HEXION

Technical Data Sheet

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EPON™ Resin 828

Product Description

EPON™ Resin 828 is an undiluted clear difunctional bisphenol A/epichlorohydrin derived liquid epoxy resin. When cross-linked or hardened with appropriate curing agents, very good mechanical, adhesive, dielectric and chemical resistance properties are obtained. Because of this versatility, EPON Resin 828 has become a standard epoxy resin used in formulation, fabrication and fusion technology.

Benefits

- Fiber reinforced pipes, tanks and composites
- Tooling, casting and molding compounds
- Construction, electrical and aerospace adhesives
- High solids/low VOC maintenance and marine coatings
- Electrical encapsulations and laminates
- Chemical resistant tank linings, flooring and grouts
- Base resin for epoxy fusion technology

Sales Specification

Property	Units	Value	Test Method/Standard
Weight per Epoxide	g/eq	185 – 192	ASTM D1652
Viscosity at 25°C	P	110 – 150	ASTM D445
Color	Gardner	1 max.	ASTM D1544

Typical Properties

Property	Units	Value	Test Method/Standard
Density at 25°C	lb/gal	9.7	ASTM D1475
Denisty at 25°C	g/ml	1.16	
Vapor pressure @ 25°C (77°F)	mm Hg	0.03	
Refractive index @ 25°C (77°F)		1.573	
Specific heat	BTU/lb/°F	0.5	

Processing/How to use

General Information

The low viscosity and cure properties of EPON Resin 828 allow its use under various application and fabrication techniques including:

• Spraying and brushing	• Pultrusion
• Filament winding	• Casting
• Pressure laminating	• Molding
• Vacuum bag laminating	• Toweling

Curing Agents

EPON Resin 828 can be cured or cross-linked with a variety of curing agents depending on properties desired in the finished product and the processing conditions employed. Some commonly used curing agents, recommended concentrations, typical cure schedules employed in major end-use applications, plus sources for these curing agents are displayed in Table 1.

Performance Properties

Perfomance Characteristics of Cured EPON Resin 828

Mechanical Properties

High performance, high strength materials are obtained when this resin is cured with a variety of curing agents. Unfilled systems in common use have tensile values greater than 10,000 psi (69 MPa) with modulus values greater than 400,000 psi (2750 MPa). Such systems are normally very rigid. If greater flexibility is needed systems can be formulated to provide up to 300% elongation.

Adhesive Properties

One of the most widely recognized properties of cured EPON Resin 828 is strong adhesion to a broad range of substrates. Such systems exhibit shear strength of up to 6,000 psi (41 Mpa). One factor which contributes to this property is the low shrinkage shown by these systems during cure. Compared to other polymers, epoxy resins have low internal stresses resulting in strong and durable finished products.

Electrical Properties

EPON Resin 828 cured systems have very good electrical insulating characteristics and dielectric properties. For example, systems can be obtained with anhydride and amine curing agents having volume resistivities up to 1 x 10E16 ohm-cm, dielectric constants of 3-5 and dissipation factors of 0.002 to 0.020 at ambient conditions. Electrical encapsulations, laminates and molding compounds are frequently based on EPON Resin 828.

Chemical Resistance

Cured EPON Resin 828 is highly resistant to a broad range of chemicals, including caustic, acids, fuels and solvents. Chemically resistant reinforced structures and linings or coatings over metal can be formulated with EPON Resin 828.

Formulating Techniques

The primary components of a thermosetting resin formula are the epoxy resin and the hardener or curing agent. However, in practice other materials are normally incorporated to achieve special properties. For example, inert fillers such as silicas, talcs, calcium silicates, micas, clays and calcium carbonate can be added to further reduce shrinkage and improve dimensional stability. Also, reactive diluents can be added to EPON Resin 828 to reduce viscosity. The effect on viscosity by adding such materials is shown in Figure 1.

Table 1 / **Curing Agents for EPON™ 828**

Curing Agent[1]	Physical State	Recommended Concentration Range, phr[2]	Typical Cure Schedule Time °C (°F)	Deflection Temperature [3]°C (°F)	Applications[4]	Suppliers[5]
Aliphatic Amines						
EPIKURE™ 3223 (DETA)	Liquid	12	7d, 25 (77)	120(250)	ABCDEFHI	5
EPIKURE 3234 (TETA)	Liquid	13	7d, 25 (77)	120(250)	ABCDEFHI	5
EPIKURE 3200 (AEP)	Liquid	22	24h, 25 (77) & 1h, 150 (300)	120(250)	BCEFGH	5
EPIKURE 3270	Liquid	75	14d, 25 (77)	56(133)	ABCDEFHI	5
EPIKURE 3271	Liquid	18	14d, 25 (77)	66(151)	ABCDEFHI	5
EPIKURE 3274	Liquid	40	14d, 25 (77)	---	ABCDEFHI	5
EPIKURE 3230	Liquid	35	7d, 25 (77)	68(155)	ABCDEFHI	1
D-400 Type PEA	Liquid	55	30 min, 115(240)	31(88)	ABCEFH	1
Cycloaliphatic Amines						
EPIKURE 3370	Liquid	38	7d, 25 (77)	56(133)	ABCDEFHI	5

EPIKURE 3382	Liquid	63	7d, 25 (77)	63(145)	ABCDEFHI	5
EPIKURE 3383	Liquid	60	24h, 25 (77) & 2h, 100 (212)	54(129)	ABCDEFHI	5

Polyamides

EPIKURE 3115	Liquid	120	1h, 100 (212)	85(185)	AB	5
EPIKURE 3125	Liquid	90	7d, 25 (77)	90(195)	ABCEFH	5
EPIKURE 3140	Liquid	75	7d, 25 (77)	115(240)	ABCEFH	5

Amindoamines

EPIKURE 3015	Liquid	50	16h, 25 (77) & 2h, 93 (200)	---	ABCDEFHI	5
EPIKURE 3055	Liquid	50	16h, 25 (77) & 2h, 93 (200)	67(153)	ABCDEFHI	5
EPIKURE 3072	Liquid	35	14d, 25 (77)	59(138)	ABCDEFHI	5

Aromatic Amines

EPIKURE W	Liquid					5
Metaphenylenediamine (MPDA)	Solid	14	2h, 80 (175) & 2h, 150 (300)	150(300)	BCDGHI	3
Methylene dianiline (MDA)	Solid	27	2h, 80 (175) & 2h, 150 (300)	160(320)	BCDEGHI	13
Diaminodiphenyl Sulfone (DADS)	Solid	25	5h, 125 (257) & 1h, 200 (392)	170(350)	BCDGHI	2, 13

Table 1 / **Curing Agents for EPON™ 828, cont.**

Curing Agent[1]	**Physical State**	**Recommended Concentration Range, phr**[2]	**Typical Cure Schedule Time °C (°F)**	**Deflection Temperature** [3]**°C (°F)**	**Applications**[4]	**Suppliers**[5]
Anhydrides						
Methyl tetrahydrophthalic Anhydride (MTHPA)	Liquid	80	2h, 120 (250) & 2h, 150 (300)	130(266)	BCDGHI	9, 11, 14
NADIC Methyl	Liquid	90	1h, 120	180(356)	BCDGHI	9, 14

Anhydride (NMA)			(250) & 2-24h, 260(500)			
Hexahydrophthalic Anhydride (HHPA)	Solid	80	1h, 80 (175) & 2h, 150 (300)	130(265)	BCDGHI	8, 12, 14
Catalysts and Miscellaneous						
2-Ethyl- 4-Methyl Imidazole (EMI-24)	Metastable Liquid	3	4h, 50 (122) & 2h, 170 (340)	170(340)	BCDGHI	15, 16
BF3-Monoethylamine (BF3-MEA)	Liquid	3	1h, 120 (250) & 2h, 170 (340)	170(340)	BCDGHI	17
Diethylaminopropylamine [6]	Solid	6	30 min, 115(240)	100(212)	ABC	6
Dicyandiamide	Solid	4	1h, 177 (350)	150(300)	BCDGHI	18, 19

[1] Cures can be effected with these curing agents over a wide range of temperatures. Higher temperatures yield shorter cure times and highest Tg.

[2] Parts of curing agent per 100 parts of resin.

[3] Systems cured at room temperature were post cured at elevated temperature to achieve deflection values.

[4] Application codes: A - Coatings; B - Adhesives; C - Castings; D - Moldings; E - Flooring; F - Paving; G - Electrical Laminates; H - Structural Laminates; I-Filament Winding.

[5] Supplier Code:

1. Huntsman Chemical

2. RSA Corporation

3. E.I. DuPont de Nemours &Co., Chemicals & Pigments Dept.

4. Harshaw Chemical Company

5. Hexion Specialty Chemical

6. BASF Corporation

7. American Cyanamid - Industrial Chemical Div.

8. Milliken & Company

9. Lindau Chemicals, Inc.

10. Anhydrides and Chemicals, Inc.

11. Dixie Chemical Co., Inc.

12. Buffalo Color Corp.

13. Air Products and Chemicals, Inc.

14. Lonza

15. Interchem

16. Polyorganix

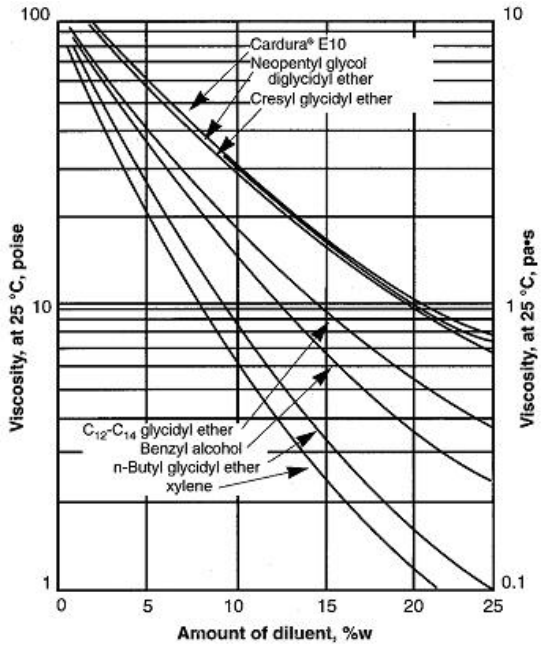
17. Atotech

18. SKW Trotsbery

19. Ashland Chemical

[6] Dimethylamino propylamine may be substituted at expense of slightly reduced pot life. Sources are 2 and 16.

Figure 1 / **Viscosity at 25 °C of EPON™ Resin 828 blends with various diluents**



Fusion Technology

EPON Resin 828 is the product of choice for a resin chemist using a specific fusion catalyst when processing proprietary solid epoxy resins or epoxy esters. Upon request, Hexion can provide EPON Resin 828 exhibiting extremely low hydrolyzable and total chlorine, two end groups that may be deleterious to resin curing and long term performance in electrical uses.

FDA Status

Provisions are made in the FDA regulations for the use of EPON Resin 828, when properly formulated, applied and cured, for food contact applications under Title 21 Code of Federal Regulations 175.300. The regulations should be consulted for complete details. In particular, we direct your attention to subparagraph (b) of 21 CFR 174.5 and the general provisions applicable to indirect food additives listed there.

Identification and Classification

Chemical Abstract Service Registry Number: 25068-38-6 (EPA/TSCA inventory designation)

Generic name: Liquid Bisphenol A Epichlorohydrin based epoxy resin.

Chemical designation: Phenol, 4,4O - (1-methylethylidene) bis-polymer with (chloromethyl) oxirane.

Figure 2 / **Viscosity - temperature profile for EPON™ Resin 828**

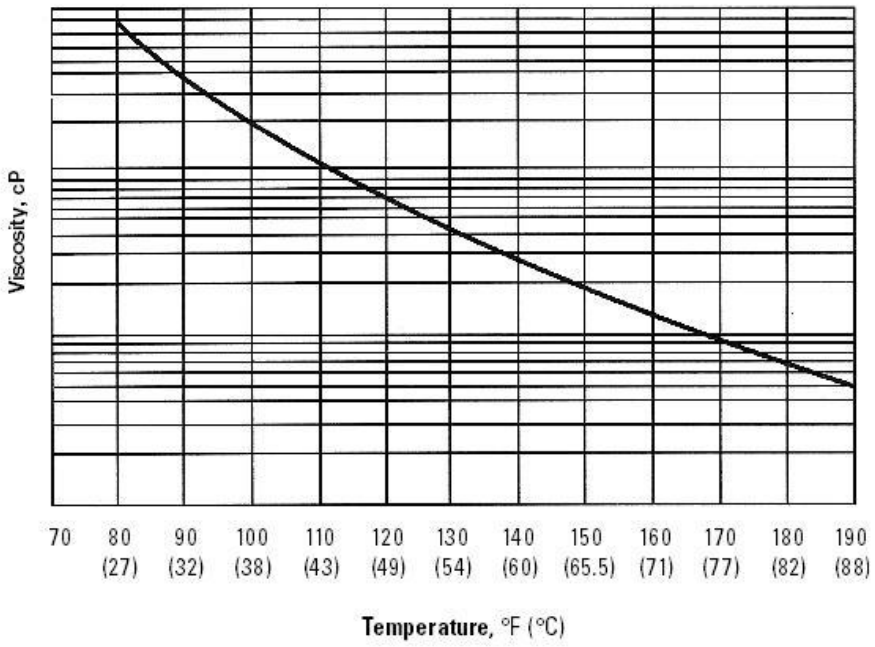
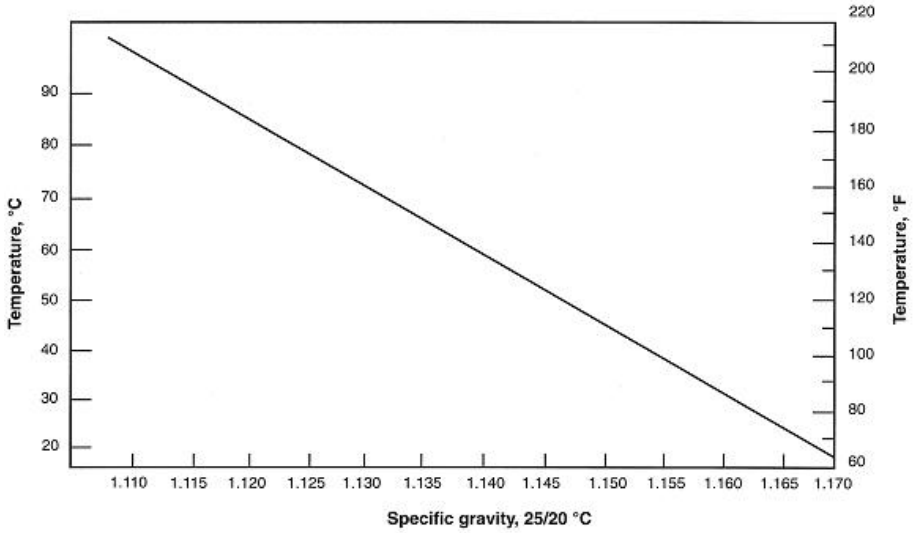


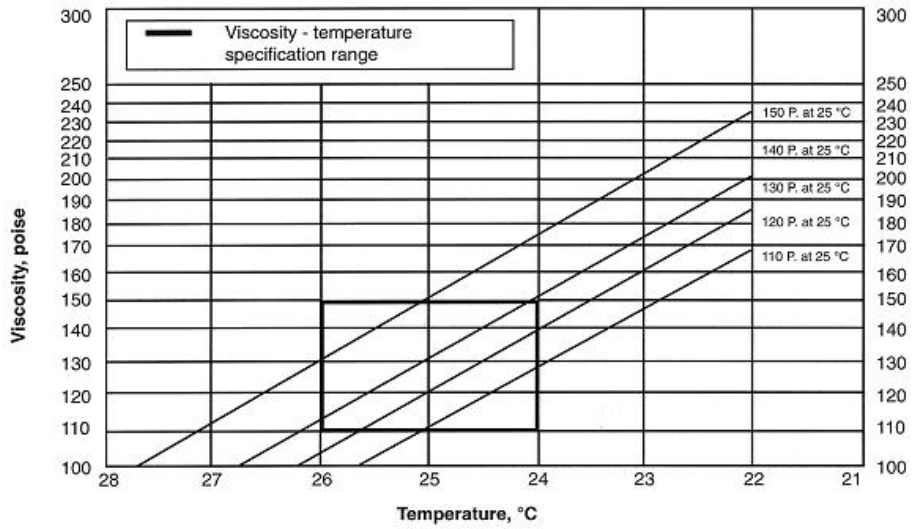
Figure 3 / **Specific gravity - temperature profile for EPON™ Resin 828**



Formulation and Application Information

For additional performance characteristics information covering adhesives, laminating, casting and molding applications, consult bulletin SC:67, entitled "EPON Resin Structural Reference Manual." For epoxy resin amine-cured coatings, consult bulletin SC:193, entitled "Formulating Amine-Cured Coatings with EPON Resin."

Figure 4 / **Viscosity - temperature profile (for 5 samples of EPON™ Resin 828 ranging in viscosity from 110-150 poise)**



Safety, Storage & Handling

Please refer to the MSDS for the most current Safety and Handling information.

Please refer to the Hexion web site for Shelf Life and recommended Storage information.

EPON Resin 828 is an undiluted liquid epoxy resin that is available in tank cars, tank trucks and 500 pound net closed head drums. EPON Resin 828 is normally shipped in bulk from 150 °F (66 °C) to 180 °F (82 °C) and can be stored at 120-140 °F (49-60 °C) for ease of handling. The viscosity/temperature profile and the specific gravity/temperature profile for EPON Resin 828 are displayed in Figures 2 and 3 respectively for your guidance.

NOTE OF CAUTION: When checking viscosity of EPON Resin 828 incoming samples, we caution you to make certain that the product is maintained at 25 +/- 0.01 °C before testing. You will note in Figure 4 that EPON Resin 828 can vary in viscosity by 10-15 poise for each degree in temperature the product varies from 25 °C.

Exposure to these materials should be minimized and avoided, if feasible, through the observance of proper precautions, use of appropriate engineering controls and proper personal protective clothing and equipment, and adherence to proper handling procedures. **None of these materials should be used, stored, or transported until the handling precautions and**

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Packaging

Available in bulk and drum quantities.

Contact Information

For product prices, availability, or order placement, please contact customer service:

www.hexion.com/Contacts/

For literature and technical assistance, visit our website at: www.hexion.com

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