D.E.R.™ 331™

Liquid Epoxy Resin

Description

D.E.R.™ 331™ Liquid Epoxy Resin is a liquid reaction product of epichlorohydrin and bisphenol A.

Introduction

D.E.R. 331 Epoxy Resin is the most widely used general purpose liquid epoxy resin. It is recognized as the standard from which many variations have been developed.

A wide variety of curing agents is available to cure liquid epoxy resins at ambient conditions. The most frequently used are aliphatic polyamines, polyamides, amidoamines, cycloaliphatic amines and modified versions of these curing agents. Curing may also be done at an elevated temperature to improve selected properties such as chemical resistance and glass transition temperature. If anhydride or catalytic curing agents are employed, elevated temperature cures are necessary and long post-cures are required to develop full end properties.

Typical Applications

This product is suitable for use in applications such as:

- Adhesives
- Casting and Tooling
- Civil Engineering
- Composites
- Automotive Coatings
- Can and Coil Coatings
- Marine and Protective Coatings
- Photocure Industrial Coatings
- Potting and Encapsulation

Typical Properties

Property(1)	Value	Method
Epoxide Equivalent Weight (g/eq)	182 – 192	ASTM D-1652
Epoxide Percentage (%)	22.4 – 23.6	ASTM D-1652
Epoxide Group Content (mmol/kg)	5200 – 5500	ASTM D-1652
Color (Platinum Cobalt)	75 Max.	ASTM D-1209
Viscosity @ 25°C (mPa•s)	11000 – 14000	ASTM D-445
Hydrolyzable Chloride Content (ppm)	500 Max.	ASTM D-1726
Water Content (ppm)	700 Max.	ASTM E-203
Density @ 25°C (g/ml)	1.16	ASTM D-4052
Epichlorohydrin Content (ppm)	5 Max.	DowM 101321
Shelf Life (Months)	24	

(1) Typical properties, not to be construed as specifications.

Safety and Handling

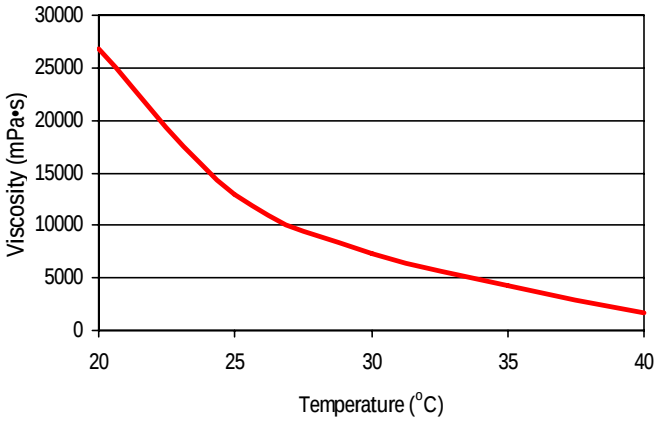
The Dow Chemical Company provides its customers with a product specific Material Safety Data Sheet (MSDS) or Safety Data Sheet (SDS) to cover potential health effects, safe handling, storage, use and disposal information. Dow strongly encourages its customers to review the MSDS or SDS on its products and other materials prior to their use.

This liquid epoxy resin is supplied in bulk, in 1000 kg intermediate bulk containers or in 240 kg tight-head drums. The resin should be stored in a dry place in its original closed packaging. This low viscosity epoxy resin should retain its chemical properties for a period of at least 24 months. For further handling information consult the Dow brochure entitled, *DOW Epoxy Resins Product Stewardship Manual, Safe Handling and Storage,* Form No. 296-00312 and the technical bulletin, *Product Coding, Shelf-life and Storage Stability,* Form No. 296-01657.

D.E.R.™ 331™ Liquid Epoxy Resin can crystallize. This reversible, physical phenomena can be greatly avoided by storing the resin at temperatures not below 25ºC. For additional information, consult the technical bulletin, *Crystallization of Liquid Epoxy Resins,* Form No. 296-01652.

Viscosity vs. Temperatrure Profile

Viscosity: D.E.R. 331 Liquid Epoxy Resin



Reactivity and Structural Properties

Typical Properties As Formulated

Formulation	A Parts By Weight	B Parts By Weight	C Parts By Weight
D.E.R. 331 Epoxy Resin	100	100	100
D.E.H.™ 24 Epoxy Curing Agent	13		
1,2-Dicyclohexane Diamine		17	
Polyamide			43
Mix-viscosity @ 25ºC (mPa•s)	2250	1020	16000
Properties			
Gel Time (min) 500 gram	25	50	56
Temperature at Gel Point (ºC)	74	113	94
Maximum Exotherm (ºC)	266	172	118
Time to Maximum Exotherm (min)	36	56	110
Heat Deflection Temperature (ºC)	111	110	101
Flexural Strength (N/mm^2)	96	106	67
Flexural Modulus (kN/mm^2)	3.0	2.9	2.4
Yield Compressive Strength (N/mm^2)	112	110	85
Tensile Strength (N/mm^2)	79	71	57
Elongation at Break (%)	4.4	4.0	3.9

Chemical Resistance

Typical Properties As Formulated

Formulation	A Parts By Weight	B Parts By Weight	C Parts By Weight
D.E.R.™ 331™ Epoxy Resin	100	100	100
D.E.H.™ 24 Epoxy Curing Agent	13		
1,2-Dicyclohexane Diamine		17	
Polyamide			43
Properties			
Gain After Immersion (wt%)	7 – 28 – 120 Days	7 – 28 – 120 Days	7 – 28 – 120 Days
Sulfuric Acid 30%	0.69 – 1.8 – 3.1	0.67 – 1.20 – 2.25	0.67 – 1.9 – 3.6
Sulfuric Acid 3%	0.61 – 1.27 – 2.66		
Hydrochloric Acid 36%	1.13 – 2.35 – 5.58	2.29 – 4.41 – 8.94	
Hydrochloric Acid 3%	0.64 – 1.45 – 3.15		
Nitric Acid 40%	1.9 – 4.1 – D	4.11 – 17.1 – D	1.7 – 3.8 – 6.6
Nitric Acid 10%	0.81 – 1.77 – 3.95		
Ammonium Hydroxide 28%	0.35 – 0.84 – 1.79		
Ammonium Hydroxide 10%	0.37 – 0.81 – 1.73		
Acetic Acid 25%	2.99 – 6.14 – 14.2		
Ethanol 95%	0.14 – 0.37 – 0.86		
Acetone	0.45 – 2.1 – 7.7	1.76 – 5.80 – 21.3	3.4 – 7.3 – 16.2
Ethylene Dichloride	0.29 – 1.14 – 6.43		
Toluene	0.04 – 0.07 – 0.16	0.32 – 0.48 – 0.57	1.5 – 3.7 – 8.0
Sodium Hydroxide 50%	0.0 – 0.04 – 0.02	0.08 - -.34 - -0.09	0.0 – 0.07 – 0.20
Sodium Hydroxide 10%	0.36 – 0.66 – 1.41		
JP 4 Fuel	0.02 – 0.01 – 0.09		0.03 – 0.05 – 0.29
Citric Acid 10%	0.39 – 0.80 – 1.65		
Chromic acid 40%	-1.53, -5.82, -17.3		
Distilled Water	0.41 – 0.88 – 1.7	0.64 – 0.95 – 1.62	0.58 – 1.3 – 2.6

Thermal Resistance

Typical Properties As Formulated

Formulation	A Parts By Weight	B Parts By Weight	C Parts By Weight
D.E.R. 331 Epoxy Resin	100	100	100
D.E.H. 24 Epoxy Curing Agent	13		
1,2-Dicyclohexane Diamine		17	
Polyamide			43
Thermal Degradation @ 160ºC (wt% loss)			
100 hours	0.71	1.4	0.73
200 hours	1.0	1.6	1.1
300 hours	1.4	1.9	1.4
500 hours	1.6	2.0	1.6
Thermal Degradation @ 210ºC (wt% loss)			
100 hours	3.4	3.8	2.9
200 hours	5.4	5.6	4.2
300 hours	6.8	7.3	5.0
500 hours	7.8	9.9	5.6

Product Stewardship

The Dow Chemical Company has a fundamental concern for all who make, distribute, and use its products, and for the environment in which we live. This concern is the basis of our Product Stewardship philosophy by which we assess the health and environmental information on our products and then take the appropriate steps to protect employee and public health and the environment. The Dow Chemical Company has enduring commitments to Responsible Care® in the management of chemicals worldwide. Our Product Stewardship program rests with every individual involved with Dow products from the initial concept and research to the manufacture, sale, distribution, and disposal of each product.

Customer Notice

Dow encourages its customers and potential users of Dow products to review their applications for such products from the standpoint of human health and environmental quality. To help ensure that Dow products are not used in ways for which they were not intended or tested, Dow personnel are available to assist customers in dealing with ecological and product safety considerations. Your Dow sales representative can arrange for the proper contacts. Dow literature, including MSDS or SDS, should be consulted prior to the use of Dow products.

Medical Application Policy

Dow will not knowingly sell or sample any product or service ("Product") into any commercial or developmental application that is intended for:

(a) permanent (long term) contact with internal body fluids or internal body tissues. Long term is a use which exceeds 72 continuous hours (except 30 days for PELLETHANE™ Polyurethane Elastomers);

(b) use in cardiac prosthetic devices regardless of the length of time involved (cardiac prosthetic devices include, but are not limited to, pacemaker leads and devices, artificial hearts, heart valves, intra-aortic balloons and control systems and ventricular bypass assisted devices);

(c) use as a critical component in medical devices that support or sustain human life; or

(d) use specifically by pregnant women or in applications designed specifically to promote or interfere with human reproduction.

Additionally, all Products intended for use in pharmaceutical applications must pass the then current Pharmaceutical Liability Guidelines. For additional information please contact your regular Dow representative.

Food Contact Applications

When properly formulated and cured for food contact applications, this resin will comply with the U.S. Food, Drugs and Cosmetics Act as amended under Food Additive Regulation 21 CFR 175.300 (b)(3)(viii)(a); "Epoxy resins, as basic polymer". This use is also subject to good manufacturing practices and any limitations specified in each regulation. Please consult the regulations for complete details.

If your applications include food contact requirements, please contact your Dow representative for further information and forthcoming EC regulations. Also consult the Dow data sheet, *Food Additive Status for Epoxy Resins, Curing Agents and Epoxy Novolac Resins,* Form No. 296-01425.

Regulatory Status

This liquid epoxy resin is regarded as a polymer according to the 6th Amendment of Council Directive 67/548/EEC and as a substance according to Council Directive 92/32/EEC of 30 April 1992; the 7th Amendment of that same directive. This product has been reported to the EC Commission as a No-Longer Polymer (NLP), is registered under NLP # 500-033-5, and is, therefore, exempt from the European Inventory of Existing Chemical Substances (EINECS). In addition, Dow confirms that the chemicals and intentional additives which form the basis of this product are listed on EINECS.

For more information on the regulatory status of this product, please refer to the MSDS or SDS for this product.

Chemical Inventory Listing

CAS Number(1)		25085-99-8 / (25068-38-6)
Europe	EINECS	NLP # 500-033-5
United States	TSCA	25085-99-8
Canada	DSL	25085-99-8
Australia	AICS	25085-99-8
Japan	ENCS	7-1279
Korea	KECI	KE-24083
Philippines	PICCS	25085-99-8
China	SEPA	25085-99-8

(1) Please refer to the MSDS or SDS for this product to ensure this CAS number is consistent with the product(s) you use.

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except Indonesia and Vietnam

http://www.dowepoxy.com

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