



April 27, 2005

EP-20

BLACK, UNFILLED, MODERATE VISCOSITY EPOXY FOR USE WITH VARIOUS HARDENERS

Description:

Lord EP-20 epoxy resin is a black, unfilled, moderate viscosity resin which may be used with several Lord hardeners to obtain a variety of handling and cured properties. This general purpose resin is used in many applications including adhesive, laminating, and electrical/electronic insulation.

Lord EP-20 Resin is also available in a clear, amber version, known as Lord 600. Its handling and physical properties are the same as EP-20 resin, except for color. Some of the more widely used hardeners are:

Lord No. 18 Hardener - Provides low viscosity, moderately fast cures, and excellent heat resistance for a room temperature curing system.

Lord No. 65 Hardener - exhibits a very low working viscosity and long working life when mixed with Lord EP-20 epoxy resin. It cures to a high gloss surface, free of "blush" or "sweat-out" even when used in very high humidity conditions.

Lord No. 66 Hardener - for high bond strength as an adhesive to a variety of surfaces. The rigidity of the bond may be varied by increasing or decreasing the EP-20 resin to No. 66 hardener mix ratio. A 1:2 (resin to hardener by weight) ratio will yield a relatively flexible bond, and a 2:1 ratio will result in a rigid one. Any intermediate ratio will yield flexibilities between these two extremes. The EP-20/No. 66 working life is over one hour and it will cure at room temperature or with mild elevated temperature. Lord 600/No. 66 has a flowable viscosity.

Lord No. 67 Hardener - offers high heat and excellent chemical resistance when mixed with Lord EP-20 epoxy resin. An elevated temperature cure schedule is required. It provides a rigid bond. See Adhesives Surface Preparation information on data sheet entitled "Lord No. 67 Hardener".

Lord No. 71 Hardener - is a semi-rigid, low exothermic, room temperature cure. The cured system has exceptional resistance to mechanical and thermal shock. This flexibility is retained even after severe heat aging.

Typical Properties:

The values listed on page 2 are averages and are not intended for specification purposes. Contact Lord when establishing specifications. In the interest of achieving optimum properties, the cured physical and electrical properties of most of the systems were developed by using a cure schedule of sixteen hours at 25°C plus two hours at 100°C. Hardener No. 65 received a two week cure at 25°C. The schedule for No. 67 is that shown under Typical Cure. The choice of cure schedule will vary with the application and users must establish their own optimum cure schedules.

***Temperature Rating Guide:** Is based on average design requirements and the guide is not intended as a guarantee of suitability for all applications operating at that temperature. The guide is based on the weight loss.

In most cases, test methods correspond with ASTM tests. Copies are available upon request.

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DS3601

Handling Properties:

	No. 18	No. 65	No. 66	No. 67	No. 71
Mix Ratio (resin to hardener)					
By weight	100:14	100:40	100:50	100:24	100:100
By volume	100:16	100:50	100:60	100:30	100:120
Mixed Viscosity @ 25°C (cps)					
STM 1	3,200	1,200	10,000	2,000	3,000
Working Life					
@ 25°C	20 min (100g)	50 min (200g)	60 min (200g)	60 min (200g)	60 min (200g)
Typical Cure Schedules					
Optional Post Cure	24 hrs @ 25°C	24 hrs @ 25°C	24 hrs @ 25°C	2 hrs @ 100°C 2 hrs @ 150°C	24 hrs @ 25°C

Physical Properties:

Hardness (Shore D) (ASTM D 2240)	88	85	85	92	60
Specific Gravity @ 25°C	1.04	1.09	1.09	1.11	1.08
Temperature Rating Guide*	130°C	130°C	155°C	155°C	130°C
Tensile Strength (psi) (ASTM D 638)	11,200	9,000	7,600	10,900	2,300
Tensile Elongation (ASTM D 638)	3.6%	4.5%	12%	5.2%	55%
Izod Impact Strength (ft lb/in of notch) (ASTM D 256)	0.38	0.55	1.0	0.32	2.50
Water Absorption (24 hours) (ASTM D 570)	0.18%	0.22%	0.35%	0.20%	0.85%

Electrical Properties:

Dielectric Constant (1 MHz @ 25°C) (ASTM D 150)	3.8	3.5	3.7	4.4	4.2
Dissipation Factor (1 MHz @ 25°C) (ASTM D 150)	0.020	0.016	0.016	0.038	0.021
Volume Resistivity (ohms/cm) (ASTM D 257)					
@ 25°C	10 ¹⁶	10 ¹⁵	10 ¹⁶	10 ¹⁶	10 ¹⁴
@ 105°C	10 ¹³	10 ¹¹	10 ¹¹	10 ¹⁴	10 ¹⁰
@ 130°C	10 ¹⁰	<10 ⁹	10 ⁹	10 ¹³	10 ⁹

Proportioning and Mixing:

Lord epoxies can be proportioned by weight or volume. These ratios are stoichiometrically calculated and should be closely followed. Automated meter-mix dispensing equipment may be used for high volume production. (A list of dispensing equipment manufacturers is available from Lord.) When mixing small amounts of epoxy, it is best to use a balance and disposable containers. The containers should be large enough to hold both resin and hardener and still have ample room for mixing. After allowing for the weight of the container, the correct amount of resin is added to the container. The scale is then set for the total weight of both resin and hardener, and the hardener is added slowly until the total weight is reached.

To insure thorough mixing, periodic scraping of the sides and bottom of the container is necessary. Even small amounts of improperly mixed material can cause soft spots or irregular curing.

FDA Compliance:

All of the ingredients contained in Lord EP-20, 600, and No. 66 are permitted for food contact under FDA food additive regulations 175.300 "Resinous and Polymeric Coatings" (Code of Federal Regulations 21 - Food and Drugs, April 1, 1981). The CFR places further restrictions on the use of epoxies in contact with food. Consult the above referenced regulations prior to use of these epoxies. Lord EP-20, 600, and No. 66 can only be considered in compliance with FDA regulations when the material is properly proportioned, mixed, applied and cured. Furthermore, Lord EP-20, 600, and No. 66 are only in compliance with FDA regulations when the following mix ratios by weight are used:

EP-20 resin and No. 66 hardener	100:67
600 resin and No. 66 hardener	100:67

Deairing and Evacuation:

The electrical properties of an epoxy are best when air bubbles and voids are minimized. Therefore, in extremely high voltage or other critical applications, vacuuming may be appropriate. Should vacuuming prove to be necessary for the application, the mixed epoxy should be deaired in a container large enough to allow for expansion from two to five times the original volume.

A vacuum of 2mm of Hg for two to five minutes is generally adequate for small (one quart or less) batches. Larger batches may require longer vacuuming, lower pressures

(<2mm Hg), or introduction of the epoxy into the chamber in thin streams. Once the epoxy has been adequately deaired, the vacuum should be slowly released.

Mold Release:

When encapsulating a unit in a nonporous mold, a mold release should be used. Most mold releases evaporate quickly and, when properly applied, leave a surface that will release easily from Lord epoxies. As with other flammable solvents appropriate precautions should be used.

Clean-Up:

It is recommended that customers use disposable containers and utensils when working with epoxies. However, when disposable materials are impractical, uncured epoxy can be removed by cleaning equipment with solvent. Observe appropriate precautions when using flammable solvents. Solvent-cleaned utensils should be thoroughly dried before reuse. Any remaining solvent can contaminate the next mixture.

Shelf Life and Storage:

Lord EP-20 resin has a shelf life of approximately twenty four months at room temperature (25°C) in closed containers. The pigment may slowly settle with time. Therefore, the resin containers should be periodically turned upside down to prevent settling. Lower temperatures will also help to reduce settling.

<u>Lord Hardeners</u>	<u>Shelf Life</u>
No. 18	24 months
No. 65	12 months
No. 66	24 months
No. 67	18 months
No. 71	18 months

(Material to be stored at room temperature (25°C) in closed containers)

Handling Precautions:

The labels on containers of Lord materials contain current information on the hazards associated with each particular product. Most epoxy resins and hardeners are skin and eye irritants. Some may be corrosive to the skin and eyes. Other problems, such as skin sensitization or serious health hazards, may exist. Further information on each product is contained in the Material Safety Data Sheet which will be sent upon request.