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TECHNICAL DATA SHEET

LINDRIDE 6 SERIES LIQUID ANHYDRIDES FOR FILAMENT WINDING APPLICATIONS

INTRODUCTION

The LINDRIDE family of anhydrides are amber colored liquids of low viscosity which find utility as curing agents for epoxy resins. **LINDRIDE 6 SERIES** are mixtures of isomeric forms of Methyltetrahydrophthalic Anhydride which have been pre-catalyzed with a quaternary amine. Members of the **LINDRIDE 6 SERIES** differ only in the level of catalyst.

FILAMENT WINDING REQUIREMENTS

Filament winding is a technique for the fabrication of structures generally having a tubular shape and which can have outstanding physical, electrical and corrosion resistant properties. In filament winding high strength to weight ratios may be obtained by utilizing the strength of the reinforcing fiber held in a matrix resin. The main requirements of the matrix resin are:

- low viscosity for proper impregnation of the fiber
- reasonable reactivity without exotherm on cure.

ADVANTAGES OF LINDRIDE 6 SERIES CURING AGENTS

The **LINDRIDE 6 SERIES** are low viscosity liquids of light color and low cost. They are low in volatility, containing no solvents or diluents. Pot life is considerably longer than with amines; in many applications this greatly reduces wasteful loss of materials. Electrical properties are excellent. Toxicity is very low. Because of their liquid nature, handling is convenient and mixing is easy. Mechanical and thermal properties of cured resins compare favorably with those based on amine hardeners. Exotherm during cure is noticeably lower, permitting the fabrication of larger structures. The LINDRIDES are decidedly less expensive than most amine hardeners.

FORMULATION

To obtain optimum thermal, chemical and physical properties with **LINDRIDE 6 SERIES** cured epoxy resin, the ratio of anhydride to epoxy (A/E ratio) should be 0.9 to 1.0. Typical formulation ratios for standard bisphenol A resins are:

	<u>Lindride 6</u>	<u>Lindride 6K</u>	<u>Lindride 6V</u>	<u>Lindride 6Y</u>
Formulation (parts per 100 Parts Resin) (EEW 180 g/eq)	87	88	90	93

(EEW 189 g/eq)

83

84

85

89

CURE

Likewise, to obtain optimum properties with a **LINDRIDE 6 SERIES** cured epoxy, a two stage cure is recommended. In the first stage, the temperature should be held at a temperature of 80°C to 90°C (180°F - 200°F) until gelation occurs; then a second stage post-cure should be applied at a temperature of approximately 150°C (300°F) for one to three hours. However, in practice a ramped cure starting at approximately 80°C (180°F) and proceeding at a reasonable rate to 150°C (300°F) is sometimes a more practical method. Lindau Technical Service can help in the design of such a curing method.

LINDRIDE 6 MEMBERS

I. Typical Product Properties

	<u>Lindride 6</u>	<u>Lindride 6K</u>	<u>Lindride 6V</u>	<u>Lindride 6Y</u>
Appearance	Clear, Amber Liquid	Clear, Amber Liquid	Clear, Amber Liquid	Clear, Amber Liquid
Color, Gardner	6	6	6	6
Brookfield Viscosity (cps @25°C)	50 - 150	75 – 200	75 – 200	150 - 250
Anhydride Equivalent Weight	160 - 175	165 – 175	165 – 175	165 - 175

II. Typical Processing Properties

	<u>Lindride 6</u>	<u>Lindride 6K</u>	<u>Lindride 6V</u>	<u>Lindride 6Y</u>
Formulation (Parts per 100 Parts Resin) (EEW 189 g/eq)	86	87	88	93
Gel Time @ 100°C (minutes)	50 - 55	15 – 18	9 – 11	5 - 6
Reactivity @ 85°C (185°F)				
Peak Exo Time (min)	175	61.0	31.0	16.0
Peak Exo Temp (°C)	87.5°	96.2°	119.7°	163.3°
Pot Life @ 25°C				
Initial Viscosity (cps)	1125	1010	1110	1430
Time (Hr.) to 5000 cps	45	17	7	1

Comments of use:

Lindride 6 - Use where long pot life is required and elevated temperatures (250°) can be used for gelation.

Lindride 6K and 6V –Use where pot lives of 7–20 hours are desired with moderate cure temperatures.

Lindride 6Y – Use where short pot lives can be tolerated such as where automatic mixing equipment is utilized and where relatively low cure temperatures are desired.

III. Typical Cured Resin Properties

Formulation - Lindride 36K @ 87 phR with an EEW 189 eq wt resin

Cure - 2 hr. @ 85°C + 3 hr. @ 150°C

<u>Property</u>	<u>Method</u>	<u>Result</u>
HDT (°C)	ASTM D-648	125°C
Tg (°C) DSC	ASTM D-3418	130°C
Tensile Strength	ASTM D-638	12,000 psi
Tensile Elongation	ASTM D-638	5%
Tensile Modulus	ASTM D-638	446,000 psi
Flexural Strength	ASTM D-790	17,800 psi
Flexural Modulus	ASTM D-790	464,000 psi
Compression Strength	ASTM D-695	18,800 psi

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