HOT CURING CASTING RESIN SYSTEM - CR 17 / EH 12 / ED 14 / EA 13

This versatile casting resin system is a system used by the hot curing process is recommended to impregnate class ' F ' motors and to cast or encapsulate other electrical components, which are rated for 155^0 C operation.

Typical usage applications include the following,
Post type insulators , Bus Bar supports , Switchgear bushings , Current & Voltage transformers , Ignition coils used in the automotive industry & also by impregnation in Motors , Generators & High Voltage choke coils.

Major Constituents of Hot Curing Resin System

1.Solvent free liquid epoxy resin of medium viscosity CR 17

Typical Properties of Liquid epoxy resin

Viscosity at 25□C(Hoeppler)	m Pa.s	11,000 - 13,500
Epoxy content	eq./kg	5.2 -5.5
Hy-Cl	ppm	500 max

2.Specially formulated liquid carboxylic acid anhydride curing agent EH 12

Typical Properties of Hardener

Viscosity at 25□C(Hoeppler)	m Pa.s	150 - 250
Glass Transition Temp	□C	105 - 120
Density at 25 □C	g/cm^3	1.15-1.25
Vapor pressure at 25□C	mbar	$0.8.10^{-3}$
at 60□C	mbar	$0.5.10^{-1}$

3.Suitable plasticizer for flexibility & resilience ED 14

Typical Properties of Plasticizer

Viscosity at 25□C (Hoeppler)	m Pa.s	50 - 110
Flash Point (DIN 51758)	□C	169
Density at 25□C	g/cm^3	0.95- 1.05
Vapor pressure at 25□C	mbar	$0.5.10^{-4}$
at 60□C	mbar	$0.5.10^{-3}$

4.Predried silica flour of very high purity is to be used as filler which helps improve the mechanical & electrical properties & also helps reduce shrinkage & exotherm in addition to reducing the cost of the mix.

Accelerator EA 13 is used to speed up the curing process as otherwise a prolonged cure time would be required.

Typical Properties of Accelerator EA 13

Viscosity at 25 □C (Hoeppler)	m Pa.s	NMT 10
Gel Time at 80 oC	Minutes	70 - 130
Storage life	One Year	minimum

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MIXING RATIO

CASTING MIX	PARTS BY WEIGHT
EPOXY RESIN CR 17	100
HARDENER EH 12	100
ACCELERATOR EA 13	0.1- 2
PLASTICIZER ED 14	0-20
FILLER	300 – 400

PROCESSING

The resin and hardener are blended at 60-80□C under a vacuum of approx. 1 mbar. The preheated filler is then stirred in over a period of 30 minutes to 3 hours depending on the type of mixer used, the size of the batch and the application envisaged. The plasticizer and accelerator are then premixed and added to the Resin-Hardener-Filler mix under a vacuum of about 5 mbar for 10-20 minutes with intensive stirring just prior to the casting operation. The filler used should be pre-dried and checked to ensure consistent quality. The plasticizer and accelerator remain storage-stable for long periods when premixed. Then the complete mix is cast in preheated moulds (containing the parts to be encapsulated) under a vacuum of 5-20 mbar and at a temperature of 70-100□C.

The addition of accelerator only slightly increases the initial viscosity of the system but reduces its pot life, gelling and cure times. This facilitates shorter cycle times and higher output, but care must be taken to keep the exothermic temperature rise within limits. The addition of plasticizer reduces the viscosity of the mix, imparts a longer pot life and necessitates the use of longer cure times. It improves resilience but reduces the glass transition temperature (Tg). The addition of powdered mineral fillers presents difficulties when preparing a casting mix. The filler must be properly wetted by the resin and the mix must be thoroughly degassed if the castings are intended for application in high voltage engineering. The use of good fillers has no significant effect on cure times, but results in slightly longer gel times. Filler impurities and high moisture content may reduce pot life and considerably increase the reactivity of the mix. This could lead to a strong exothermic reaction resulting in higher shrinkage and cracking of castings. Silica flour is the commonest filler used. However, it has an abrasive action on equipment in which it is processed. It tends to sediment in a resin mix, which is left standing without mixing. Castings made with it cannot be easily machined.

CURING SCHEDULE

Cure Temperature oC	Curing time - hrs	Curing time - hrs
	0.5 pbw of EA 13	1 pbw of EA 13
80	24 – 36	20 – 24
100	7 – 8	6
120	3	2
160	0.50	0.50

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POT LIFE

PROCESSING TEMP °C	AMOUNT OF ACCELERATOR ADDED	
	1 pbw	2 pbw
	HOURS	HOURS
25°C	48 - 96	11 - 12
40°C	14 - 20	4 - 6
60°C	5 - 7	2 - 3
80°C	-	3/4

MECHANICAL AND PHYSICAL PROPERTIES OF CURED CASTINGS

Cure Schedule	--	--	8 Hr/80 oC + 8 Hr/130 oC
Tensile Stress Max.	23 °C	N/mm^2	70 - 80
Elongation at Break (ISO/R527)	23 °C	%	0.8 - 1.1
Compressive Stress Max. (ISO/R 604)	23 °C	N/mm^2	200 - 220
Bending Stress Max (DIN 53452)	23 °C	N/mm^2	115 - 125
Surface Strain (DIN 53452)	23 °C	%	1.0 - 1.5
Impact Strength (ISO/R179)	23 °C	LJ/m^2	10 - 12
Elastic Modulus, Static Derived from Tensile Test (DIN 53457)	23 °C	N/mm^2	12000-14000
Martens Temperature (DIN 53458)		°C	80 - 90
Glass Transition Temp. (DSC)		°C	90 - 100
Thermal Conductivity (DIN 52612)		W/Mk	0.8 - 0.9
Glow Resistance (DIN 53459)		GRADE	2b
Co-efficient of Linear Thermal Expansion 20-80 °C Range (VDE0304)		K^{-1}	30 - 35 $X10^{-6}$
Water Absorption (60X10X4mm samples), 10 days at 23 °C (ISO/R62) 30 min at 100°C(ISO/R117)		 % %	 0.1 - 0.2 0.1 - 0.2

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ELECTRICAL PROPERTIES OF CURED CASTINGS

Cure Schedule	--	--	8 Hr/80 oC + 8 Hr/130 oC
Electrical Strength, 2mm Plaque, 20-S Value, 50Hz Electrodes: Plate to Plate, Ø25mm & Ø75 mm in Castor oil (IEC 243)	23 °C	KV/mm	18 - 20
Arc Resistance (ASTM D-495)		S	185 - 195
Tracking Resistance (IEC - 112)		V	475
Electrolytic Corrosion (DIN 53489)		GRADE	A - 1
Loss Factor Tan □ (DIN 53483)	23 °C	%	2 - 3
	60 °C	%	3 - 4
	100 °C	%	8 - 10
	120 °C	%	--
Dielectric Constant $□_r$ (DIN 53483)	23 °C		3.9 - 4.3
	60 °C		4.3 - 4.7
	100 °C		5.4 - 5.8
	120 °C		--
Volume Receptivity □ (DIN 53482)	23 °C	□□cm	10^{16}
	60 °C	□	10^{15}
	100 °C	□	10^{14}
	120 °C	□	--

Shelf Life

CR 17 , EH 12 , ED 14 will have a minimum shelf life of 12 months when stored in the original container & not exposed to undue heat & humidity.The accelerator EA13 will have a shelf life of 1 year under similar storage conditions

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