Vantico Ltd.

Electronic
Polymers

Heavy Electrical

®Araldite Casting Resin System

Araldite	**CY 225**	**100 pbw**
Hardener	**HY 925**	**80 pbw**
Filler	**Silica flour**	**270 pbw**

Liquid, hot-curing casting resin system with high glass transition temperature for producing castings with excellent mechanical end-properties and very high thermal shock resistance.

Applications

Indoor electrical insulators for medium and high voltage, such as switch and apparatus components.
Encapsulation of large metal parts.
Recommended for applications with long term stresses up to service temperature of 85°C.

Processing methods

Automatic pressure gelation process (APG)
(see our special brochure, Publ. No. 28160/e)
Conventional gravity casting process under vacuum

Properties

High mechanical and electrical properties at elevated temperature
Very high thermal shock resistance
Excellent toughness combined with elevated glass transition temperature

Edition: **July 2000**
Replaces Edition: December 1998

Product data

(guideline values)

Liquid, solvent-free bisphenol A epoxy resin

Araldite CY 225	Viscosity	at 25°C	DIN 53015	mPa s	8500 - 15000
	Epoxy content		ISO 3001	equiv/kg	5.10 - 5.30
	Density	at 25°C	ISO 1675	g/cm³	1.15 - 1.20
		at 60°C	ISO 1675	g/cm³	1.12 - 1.17
	Flash point		DIN 51758	°C	135
	Vapour pressure	at 20°C	(Knudsen)	Pa	< 0.01
		at 60°C	(Knudsen)	Pa	< 0.5

Liquid, modified, preaccelerated anhydride curing agent

Hardener HY 925	Viscosity	at 25°C	DIN 53015	mPa s	250 - 450
	Density	at 25°C	ISO 1675	g/cm³	1.19 - 1.22
		at 60°C	ISO 1675	g/cm³	1.16 - 1.20
	Flash point		DIN 51758	°C	115
	Vapour pressure	at 25°C	(Knudsen)	Pa	c. 0.5
		at 60°C	(Knudsen)	Pa	c. 10

Remarks

Because both products contain accelerating additives, avoid storing them for extended periods at elevated temperatures. Incorrect handling of the components can results in undesirable viscosity increases, change in reactivity and substandard cured-state properties.

Storage

Store the components dry at 18-25°C, in tightly sealed original containers. Under these conditions, the shelf life will correspond to the expiration date stated on the label. After this date, the product may be processed only following reanalysis. Partly emptied containers should be closed tightly immediately after use.
For information on waste disposal and hazardous products of decomposition in the event of fire, refer to the Material Safety Data Sheets (MSDS) for these particular products.

Processing

(guideline values)

System Preparation

General instructions for preparing liquid resin systems

Long pot life is desirable in the processing of any casting resin system. Mix all of the components together very thoroughly at room temperature or slightly above and under vacuum. Intensive wetting of the filler is extremely important. Proper mixing will result in:

- better flow properties and reduced tendency to shrinkage
- lower internal stresses and therefore improved mechanical properties on object
- improved partial discharge behaviour in high voltage applications.

For the mixing of medium- to high viscous casting resin systems and for mixing at lower temperatures, we recommend special thin film degassing mixers that may produce additional self-heating of 10-15 K as a result of friction. For low viscous casting resin systems, conventional anchor mixers are usually sufficient.

In larger plants, two premixers are used to mix the individual components (resin, hardener) with the respective quantities of fillers and additives under vacuum. Metering pumps then feed these premixes to the final mixer or a continuous mixer. The individual premixes can be stored at elevated temperature (about 60°C) for up to about 1 week, depending on formulation. Intermittent agitation during storage is advisable to prevent filler sedimentation.

Mixing time can vary from 0.5 to 3 hours, depending on mixing temperature, quantity, mixing equipment and the particular application. The required vacuum is 0.5 to 8 mbar. The vapor pressure of the individual components should be taken into account.

In the case of dielectrically highly stressed parts, we recommend checking the quality consistency and predrying of the filler. Their moisture content should be ≤ 0.2%.

Specific Instructions

The effective pot-life of the mix is about 2 days at temperatures below 25°C. Conventional batch mixers should be cleaned once a week or at the end of work. For longer interruptions of work, the pipes of the mixing and metering installations have to be cooled and cleaned with the resin component to prevent sedimentation and/or undesired viscosity increase. Interruptions over a week-end (approx. 48h) without cleaning are possible if the pipes are cooled at temperatures below 18°C.

Viscosity increase and gel time at various temperatures, refer to Fig.4.1 and Fig.4.4.

Mould temperature

APG process	130 - 160°C
Conventional vacuum casting	70 - 100°C

Demoulding times (depending on mould temperature and casting volume)

APG process	10 - 40 min
Conventional vacuum casting	5 - 8h

Cure conditions

APG process (minimal postcure)	4h at 130°C or 3h at 140°C
Conventional vacuum casting	12h at 130°C or 8h at 140°C

To determine whether crosslinking has been carried to completion and the final properties are optimal, it is necessary to carry out relevant measurements on the actual object or to measure the glass transition temperature. Different gelling and cure cycles in the manufacturing process could lead to a different crosslinking and glass transition temperature respectively.

Processing Viscosities

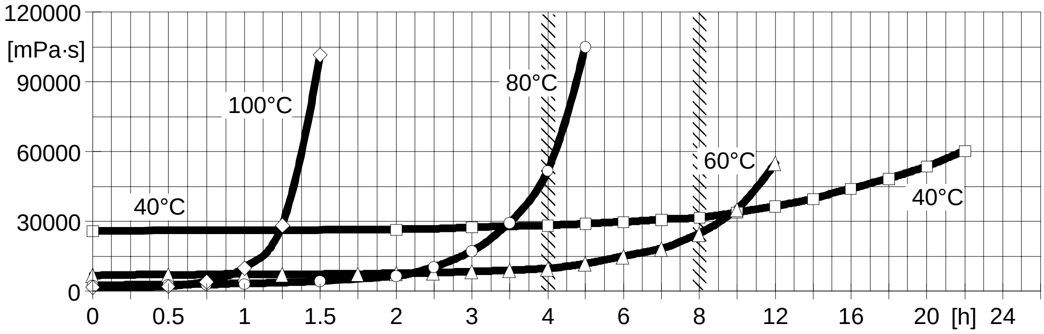

Fig.4.1: **Viscosity increase at 40, 60, 80 and 100°C** (measurements with Rheomat 115)
(Shear rate D = 10 s^{-1})

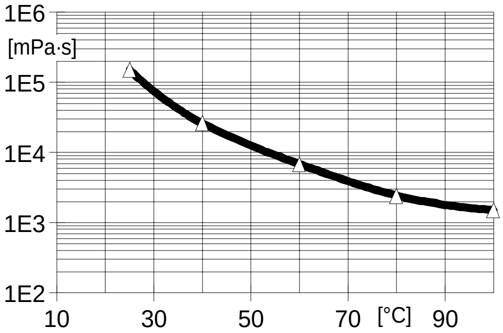

Fig.4.2: **Initial viscosity in function of temperature**
(measurements with Rheomat 115, D = 10 s^{-1})

Gelation-/Cure Times

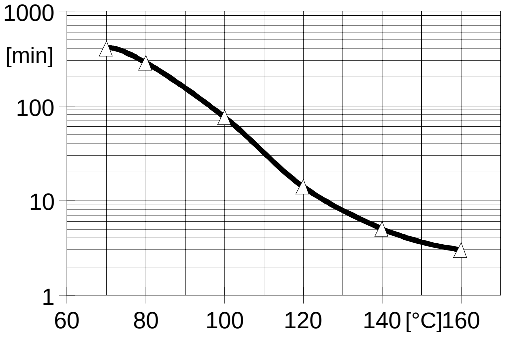

Fig.4.4: **Geltime in function of temperature**
(measured with Gelnorm Instrument,
DIN 16945/6.3.1.)

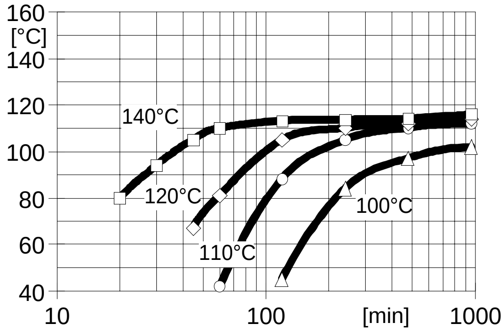

Fig.4.5: **Glass transition temperature in function of cure time**
(isothermic reaction, IEC 1006)

Mechanical and Physical Properties

(guideline values)

Determined on standard test specimen at 23°C
Cured for 6h at 80°C + 10h at 130°C

Tensile strength		ISO 527	MPa	70 - 80
Elongation at break		ISO 527	%	1.0 - 1.3
E modulus from tensile test		ISO 527	MPa	10000 - 11000
Flexural strength	at 23°C	ISO 178	MPa	110 - 125
	at 80°C	ISO 178	MPa	100 - 120
Surface strain	at 23°C	ISO 178	%	1.2 - 1.7
	at 80°C	ISO 178	%	1.8 - 2.3
Compressive strength		ISO 604	MPa	140 - 150
Compression set		ISO 604	%	6 - 7
Impact strength	at 23°C	ISO 179	kJ/m²	7 - 10
	at 80°C	ISO 179	kJ/m²	8 - 11
Double Torsion Test		CG 216-0/89		
Critical stress intensity factor (K_{IC})			MPa·m½	1.8 - 2.0
Specific energy at break (G_{IC})			J/m²	300 - 350
Martens temperature		DIN 53458	°C	100 - 115
Heat distortion temperature		ISO 75	°C	105 - 120
Glass transition temperature (DSC)		IEC 1006	°C	105 - 125
Coefficient of linear thermal expansion		DIN 53752		Fig.5.2
Mean value for temperature range: 20-60°C			K^{-1}	$35 - 37 \cdot 10^{-6}$
Thermal conductivity similar to		ISO 8894-1	W/mK	0.8 - 0.9
Glow resistance		DIN 53459	class	2b
Flammability			UL 94	
Thickness of specimen: 4 mm			class	HB
Thickness of specimen: 12 mm			class	V1
Thermal endurance profile (TEP)		DIN/ IEC 216		Fig.7.1 - 7.4
Temperature index (TI): weight loss		(20000h/ 5000h)	°C	186 / 210
Temperature index (TI): flexural strength		(20000h/ 5000h)	°C	199 / 240
Thermal ageing class (20000h)		IEC 85	class	H
Water absorption (specimen: 50x50x4 mm)		ISO 62		
10 days at 23°C			% by wt.	0.10 - 0.15
60 min at 100°C			% by wt.	0.10 - 0.15
Decomposition temperature (heating rate: 10K/min)		DTA	°C	$\geq$ 350
Density (**Filler load: 60% by wt.**)		DIN 55990	g/cm³	1.75 - 1.80

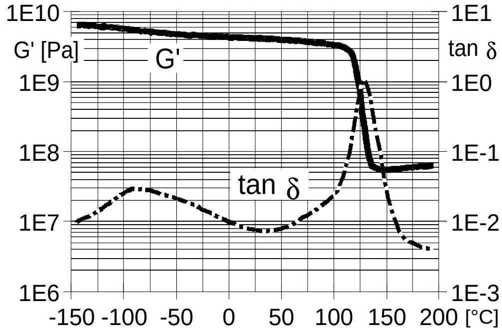

Fig.5.1: Shear modulus (G') and mechanical loss-factor (tan δ) in f (T) measured at 1 Hz ISO 6721/ DIN 53445 (Method C)

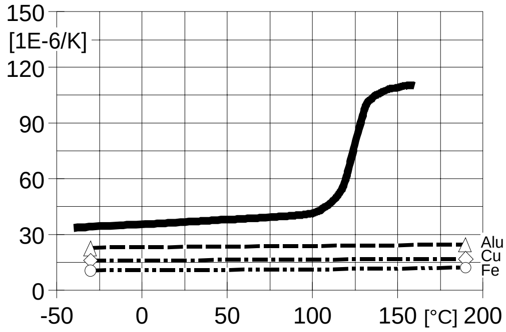

Fig.5.2: Coefficient of linear thermal expansion (α) in f (T) (reference temperature: 23°C) DIN 53752

(guideline values)

Determined on standard test specimen at 23°C
Cured for 6h at 80°C + 10h at 130°C

Breakdown strength	IEC 243-1	kV/mm	18 - 20
measured on specimen with embedded electrodes			Fig.6.3 / 6.5
Diffusion breakdown strength	DIN/ VDE 0441/1	class	HD 2
Temperature of specimen after test		°C	≤ 23
HV arc resistance	ASTM D 495	s	182 - 186
Tracking resistance	IEC 112		
with test solution A		CTI	>600-0.0
with test solution B		CTI	>600M-0.0
Electrolytic corrosion	DIN 53489	grade	A-1

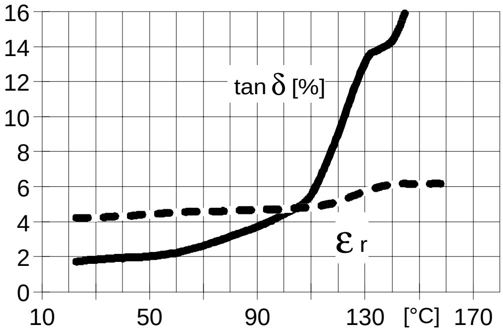

Fig.6.1: **Loss factor (tan δ) and dielectric constant (εr) in function of temperature**
(measurement frequency: 50 Hz,
IEC 250/ DIN 53483)

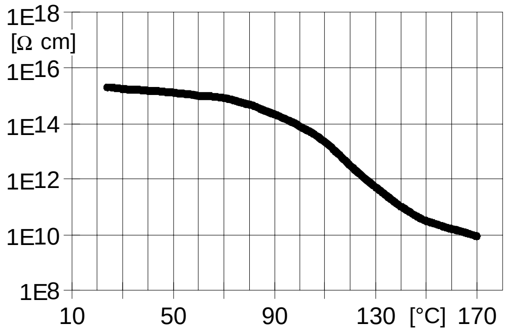

Fig.6.2: **Volume resistivity (ρ) in function of temperature**
(measurement voltage: 1000 V,
IEC 93/ DIN 53482)

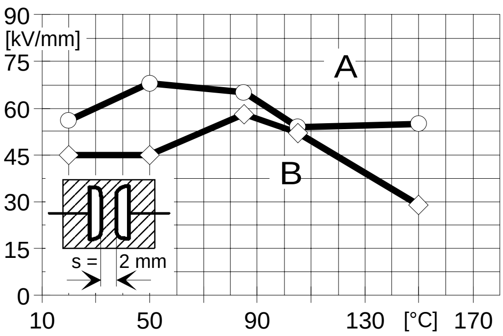

Fig.6.3: **Breakdown field strength (E_d) in function of temperature**
with embedded Rogowski electrodes
(DIN/ VDE 0303/ part 2)
A = raising test / B = 5 min step test

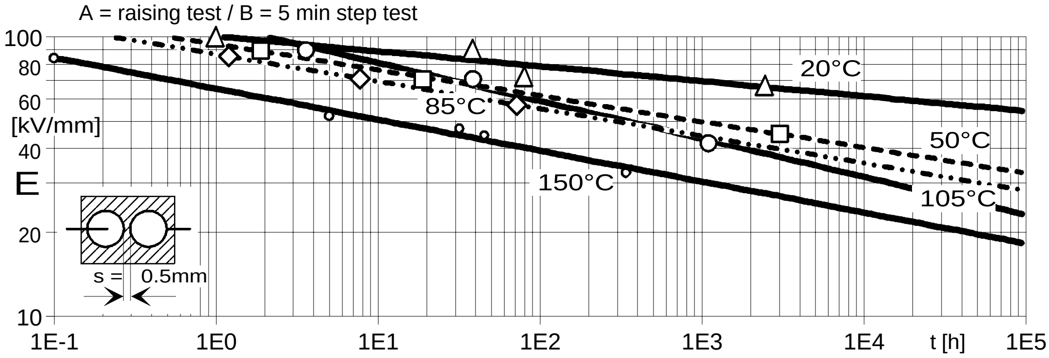

Fig.6.5: **Life time curves of the electric field stress (E) at 20, 50, 85, 105 and 150°C**
Test specimen with embedded sphere electrodes

Special Properties and Values

(guideline values)

Thermal Endurance Profile acc. IEC 216

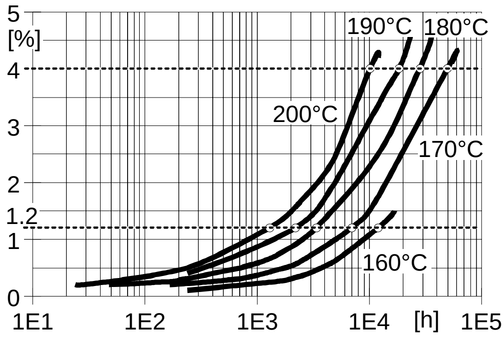

Fig.7.1: **Weight loss** (specimen: 50x50x3 mm) (limit: 4.0%)

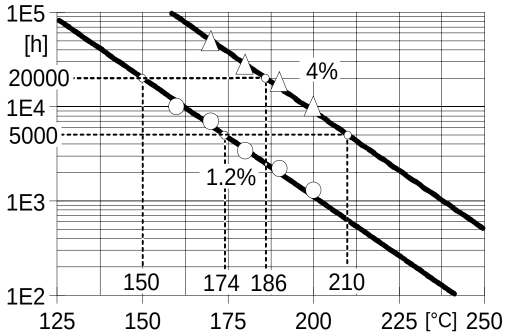

Fig.7.2: **TI 150 / 174** (weight loss 1.2%) **TI 186 / 210** (weight loss 4.0%)

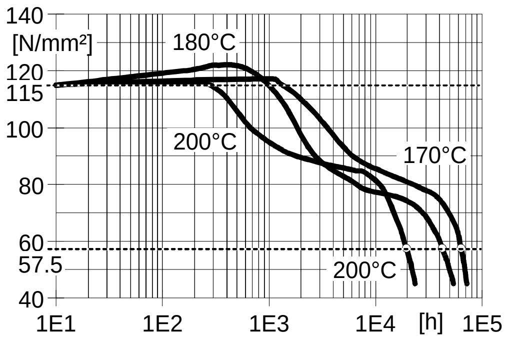

Fig.7.3: **Loss of flexural strength** (limit: 50%) ISO 178

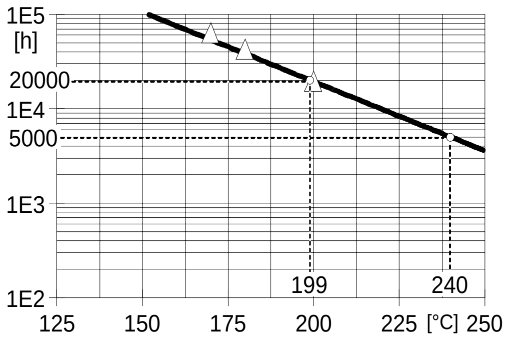

Fig.7.4: **TI 199 / 240** (flexural strength)

Tensile creep test acc. ISO 899/ DIN 53444

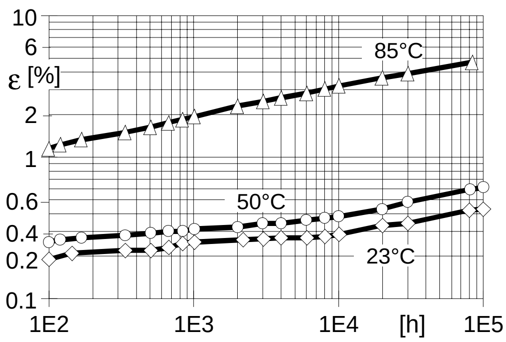

Fig.7.5: **Elongation (ε) in function of time at 23, 50 and 85°C** Tensile strain: 20 MPa

FU N CT IO

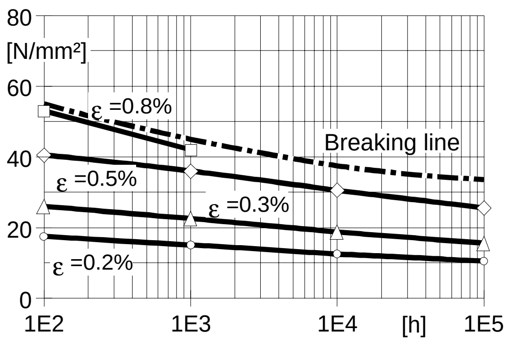

Fig.7.6: **Creep diagram at 23°C** Max. tensile strain in function of load period

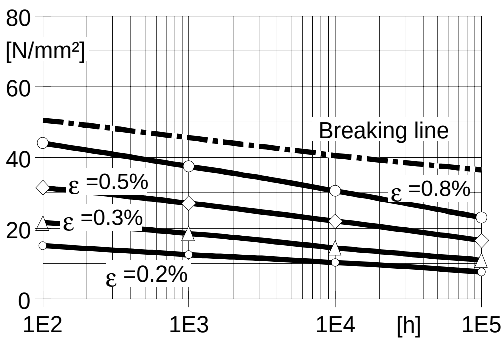

Fig.7.7: **Creep diagram at 50°C** Max. tensile strain in function of load period

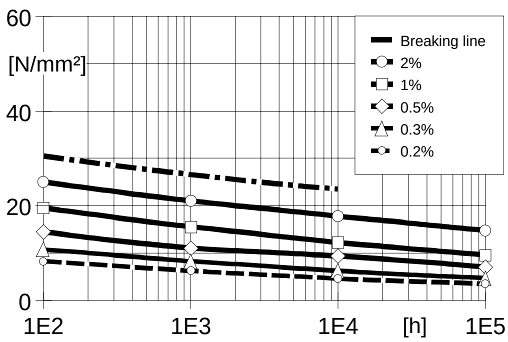

Fig.7.8: **Creep diagram at 85°C** Max. tensile strain in function of load period

Thermal shock resistance

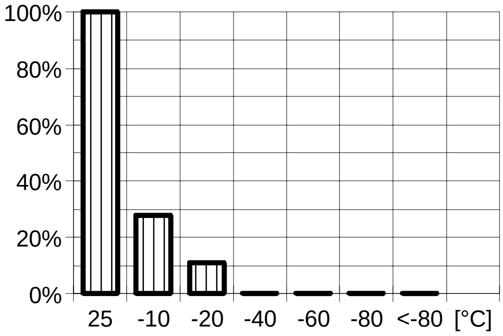

Fig.8.1: **Crack resistance / Temperature shock test**
Passed specimen (%) in function of temperature steps
Mean failure temperature: - 15°C
Embedded metal parts with 2 mm radius

Industrial hygiene

Mandatory and recommended industrial hygiene procedures should be followed whenever our products are being handled and processed. For additional information please consult the corresponding Safety Data Sheets and the brochure "Hygienic precautions for handling plastics products of Ciba Specialties Chemicals (Publ. No. 24264/e).

Handling precautions

Safety precautions at workplace:	
protective clothing	yes
gloves	essential
arm protectors	recommended when skin contact likely
goggels/safety glasses	yes
respirator/dust mask	recommended
Skin protection	
before starting work	Apply barrier cream to exposed skin
after washing	Apply barrier or nourishing cream
Cleaning of contaminated skin	Dab off with absorbent paper, wash with warm water and alkali-free soap, then dry with disposable towels. Do not use solvents
Clean shop requirements:	Cover workbenches, etc. with light coloured paper Use disposable breakers, etc.
Disposal of spillage	Soak up with sawdust or cotton waste and deposit in plastic-lined bin
Ventilation:	
of workshop	Renew air 3 to 5 times an hour
of workplace	Exhaust fans. Operatives should avoid inhaling vapours.

First Aid

Contamination of the **eyes** by resin, hardener or casting mix should be treated immediately by flushing with clean, running water for 10 to 15 minutes. A doctor should then be consulted.
Material smeared or splashed on the **skin** should be dabbed off, and the contaminated area then washed and treated with a cleansing cream (see above). A doctor should be consulted in the event of severe irritation or burns. Contaminated clothing should be changed immediately.
Anyone taken ill after **inhaling** vapours should be moved out of doors immediately. In all cases of doubt call for medical assistance.

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APPROVED TO ISO 9000 ff