Vantico Ltd.

Electronic Polymers

Heavy Electrical

®Araldite Casting Resin System

Araldite CW 229-3 100 ppw
Hardener HW 229-1 100 ppw

Liquid, hot-curing two-component epoxy casting system with excellent crack resistance.
Prefilled with slightly abrasive, mechanically reinforcing fillers.

Applications

Indoor electrical insulation material for postinsulators, equipment parts, bushings, instrument and dry type distribution transformers, switchgears, etc.

Processing methods

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

Properties

Outstanding mechanical and electrical properties combined with very high crack and thermal shock resistance due to the low coefficient of thermal expansion
Qualified for encapsulation of large metal parts

	Edition:	**June 2000**
Replaces	Edition:	October 1998

Product data

(guideline values)

Liquid, prefilled, solvent-free bisphenol A epoxy resin

Araldite CW 229-3	Viscosity	at 25°C	DIN 53015	Pas	80 - 200
		at 40°C	DIN 53015	Pas	14 - 28
	Epoxy content		ISO 3001	equiv/kg	2.20 - 2.35
	Density	at 25°C	ISO 1675	g/cm³	1.75 - 1.80
	Filler content			% by weight	55 - 58
	Flash point		DIN 51758	°C	180
	Vapour pressure	at 20°C	(Knudsen)	Pa	c. 10^{-3}
		at 60°C	(Knudsen)	Pa	c. $5 \cdot 10^{-2}$

Liquid, modified, prefilled and preaccelerated anhydride hardener

Hardener HW 229-1	Viscosity	at 25°C	DIN 53015	Pas	25 - 75
		at 40°C	DIN 53015	Pas	3 - 8
	Density	at 25°C	ISO 1675	g/cm³	1.90 - 2.0
	Filler content			% by weight	62 - 65
	Flash point		DIN 51758	°C	140
	Vapour pressure	at 20°C	(Knudsen)	Pa	c. $2 \cdot 10^{-2}$
		at 60°C	(Knudsen)	Pa	c. 5

Remarks

Prefilled liquid products always show a small filler sedimentation.
Before partial use we recommend to stir up carefully the components or to use each container as complete unit.

Storage

Store the components at 18-25°C, in tightly sealed and dry original containers. Under these conditions, the shelf life will correspond to the expiry date stated on the label. After this date, the product may be processed only following reanalyzes. Partly emptied containers should be tightly closed 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 prefilled resin systems
Long pot life is desirable in the processing of any casting resin system. Prefilled components help to shorten the mixing time considerably.
The two components will be mixed in the desired quantity under vacuum and at slightly elevated temperature (50 - 60°C). 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 °C as a result of friction.
Depending on quantity, mixer device, mixing temperature and application, the mixing time is, under a vacuum of 1 to 8 mbar, 0.5 to 2 h.
The premixed components packed according to their mixing ratio, could be used per container. In case of filler sedimentation, it is recommended to empty the container completely. Before partial use, the content must be carefully homogenized at elevated temperature. We recommend the same preheating temperature to prevent air enclosures when discharging the components.
In automatic mixing and metering installations, both components will be degased and homogenized under a vacuum of about 2 mbar in the holding tanks. When degassed, the prefilled products are stirred up from time to time to avoid any sedimentation. After dosing and mixing with a static mixer, the system is fed directly to the vacuum chamber or, in the automatic pressure gelation process, directly into the hot casting mould. By using circular feeding tubes, several casting stations can be served.

Specific Instructions

The effective pot-life of the mix is about 2 to 3 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 Figs: 4.1 and 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	4 - 8h

Cure conditions (minimal postcure)

APG process	4h at 140°C
Conventional vacuum casting	8h at 130°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 gel and postcuring cycles in the manufacturing process could influence the crosslinking and the glass transition temperature respectively.

Processing Viscosities

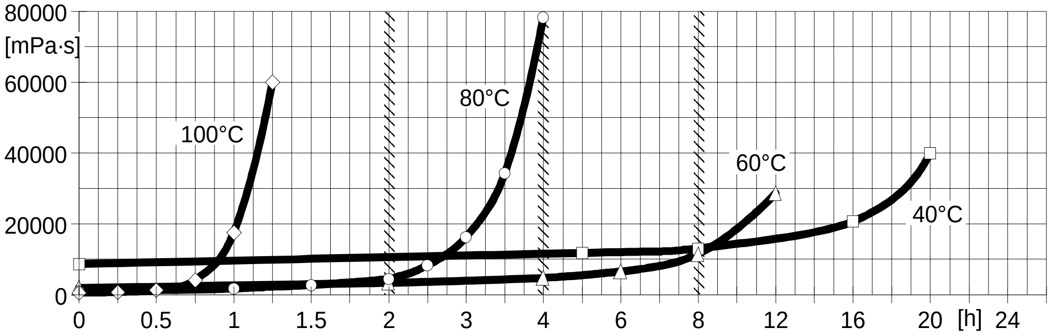

Fig.4.1: **Viscosity increase at 40, 60, 80 and 100°C** (measurements with Rheomat 115)
(Shear rate D = 10 s^{-1})

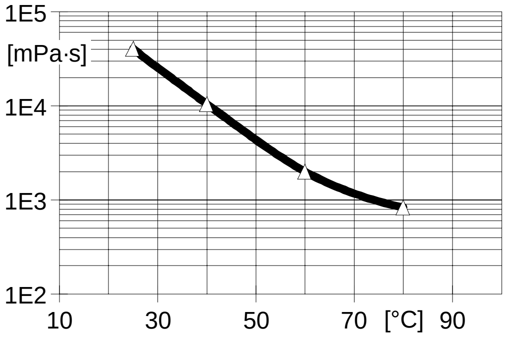

Fig.4.2: **Initial viscosity in function of temperature**
(measurements with Rheomat 115, D = 10 s^{-1})

Gelation-/Cure Times

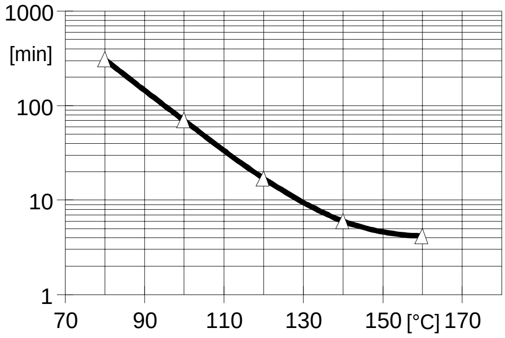

Fig.4.4: **Geltime measured in function of temperature**
(measurements with Gelnorm Instrument / DIN 16945/ 6.3.1)

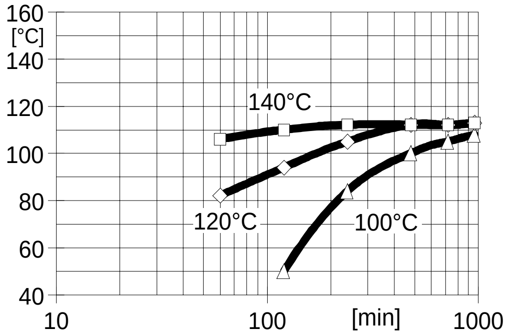

Fig.4.5: **Glass transition temperature in function of cure time**
(isothermic reaction, IEC 1006)

Mechanical and Physical Properties

(guideline values)

Determined on standard test specimen at 23°C
cured for 10h at 80°C + 10h at 140°C

Tensile strength		ISO 527	MPa	80 - 90
Elongation at break		ISO 527	%	1.3 - 1.5
E modulus from tensile test		ISO 527	MPa	10000-11000
Flexural strength	at 23°C	ISO 178	MPa	120 - 130
	at 80°C	ISO 178	MPa	100 - 110
Surface strain	at 23°C	ISO 178	%	1.4 - 1.6
	at 80°C	ISO 178	%	2.2 - 2.4
E modulus from flexural test		ISO 178	MPa	9600 - 10000
Compressive strength		ISO 604	MPa	170 - 190
Compression set		ISO 604	%	11 - 14
Impact strength		ISO 179	kJ/m²	9 - 11
Double Torsion Test		CG 216-0/89		
Critical stress intensity factor (K_{IC})			MPa·m½	2.8 - 3.0
Specific energy at break (G_{IC})			J/m²	670 - 750
Martens temperature		DIN 53458	°C	100 - 110
Heat distortion temperature		ISO 75	°C	105 - 115
Glass transition temperature (DSC)		IEC 1006	°C	110 - 120
Coefficient of linear thermal expansion		DIN 53752		Fig.5.2
Mean value for temperature range: 20-80°C			K^{-1}	27 - 30·10^{-6}
Thermal conductivity similar to		ISO 8894-1	W/mK	0.65 - 0.75
Flammability (Burningtime/-length)		ISO 1210	s / mm	57 / 11
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	TI 186 / 210
Temperature index (TI): flexural strength		(20000h/ 5000h)	°C	TI 201 / 234
Thermal ageing class (20000h)		IEC 85	class	H
Thermal endurance RTI		UL 746B	°C	200
Water absorption (specimen: 50x50x4 mm)		ISO 62		
10 days at 23°C			% by wt.	0.10 - 0.20
60 min at 100°C			% by wt.	0.10 - 0.20
Decomposition temperature (heating rate: 10K/min)				
		DTA	°C	0.4
Density (**Filler load: 60% by wt.**)		DIN 55990	g/cm³	1.80 - 1.90

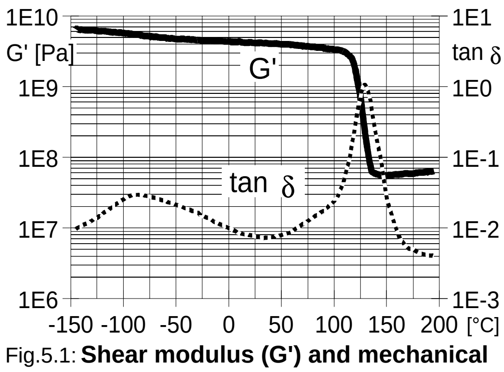

Fig.5.1: **Shear modulus (G') and mechanical loss factor (tan δ) in function of temperature**
(ISO 537/ DIN 53445,methode C, measured at 1Hz)

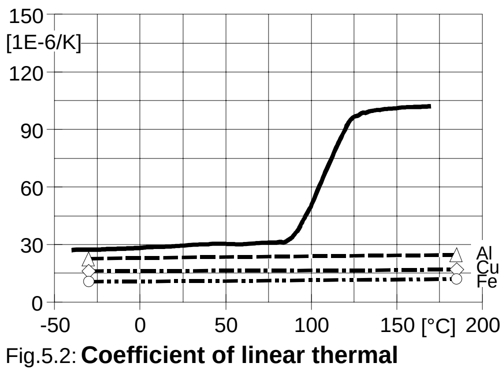

Fig.5.2: **Coefficient of linear thermal expansion (α) in function of temperature**
(DIN 53752 / reference temperature: 23°C)

(guideline values)
Determined on standard test specimen at 23°C
cured for 10h at 80°C + 10h at 140°C

If electrically stressed structural components are to be used under difficult climatic conditions (cf. IEC 932), the complete installation must be tested climatically under maximum working load.

Breakdown strength	IEC 243-1	kV/mm	18 - 22
Specimen with embedded Rogowski electrodes			
Gap: 2mm	Ciba method	kV/mm	--
Diffusion breakdown strength	DIN/ VDE 0441/1	class	HD 2
Temperature of specimen after test		°C	$\leq$ 23
HV arc resistance	ASTM D 495	s	93 - 125
Tracking resistance	IEC 112		
with test solution A		CTI	>600-0.0
with test solution B			--
Electrolytical corrosion effect	DIN 53489	grade	A-1

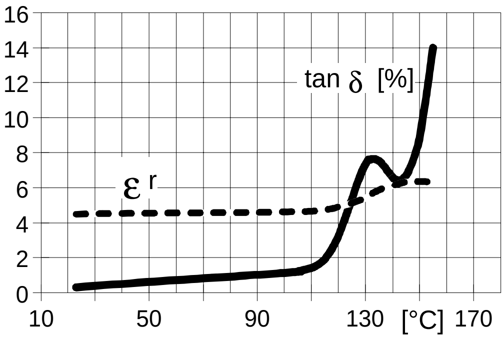

Fig.6.1: **Loss factor (tan δ) and dielectric constant (ε_r) in function of temperature**
(measurement frequency: 50 Hz / IEC 250/ DIN 53483)

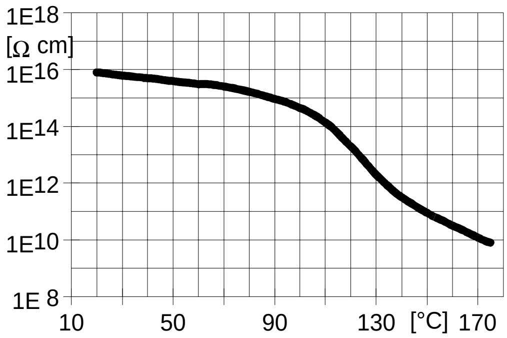

Fig.6.2: **Volume resistivity (ρ) in function of temperature**
(measurement voltage: 1000 V/ IEC 93/ DIN 53482)

Thermal endurance profile acc. IEC 216

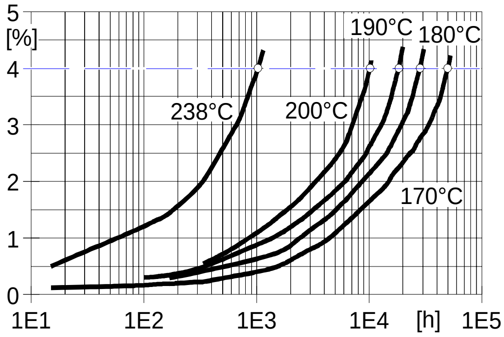

Fig.7.1: **Weight loss**
(specimen: 50x50x3 mm, limit: 4.0%)

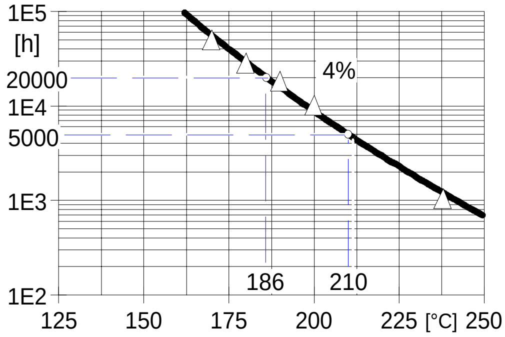

Fig.7.2: **Temperature Index 186 / 210 (weight loss)**

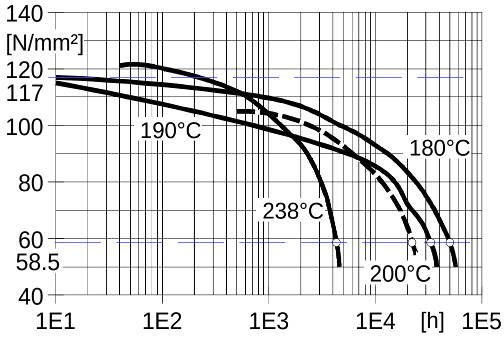

Fig.7.3: **Loss of flexural strength**
(ISO 178, limit: 50%)

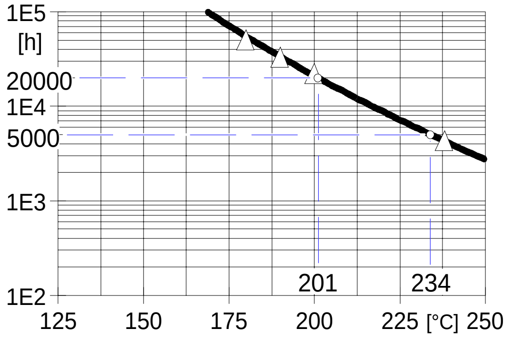

Fig.7.4: **Temperature Index 201 / 234 (flexural strength)**

Mechanical Values

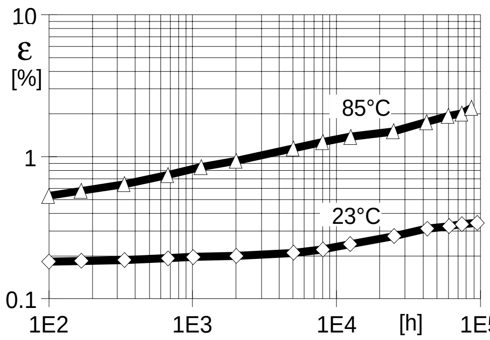

Fig.7.5: **Elongation (ε) in function of temperature at 23 and 85°C**
(Tensile strain: 20 MPa , ISO 899/ DIN 53444)

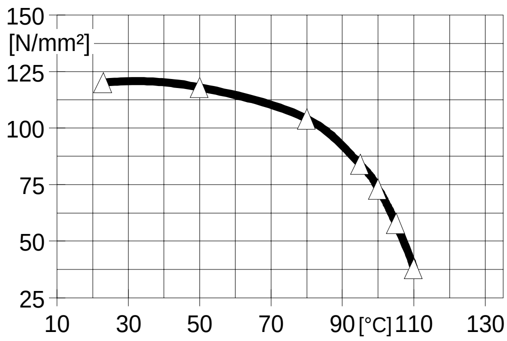

Fig.7.6: **Flexural strength in function of temperature**
(ISO 178)

Thermal Choc Resistance

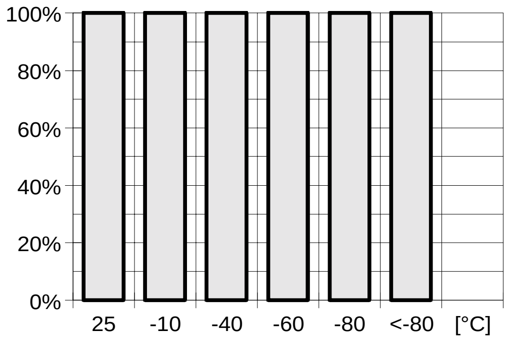

Fig.7.7: **Crack resistance/ Temperature cycling test**
Passed specimen (%) = f (temp. steps)
No crack registered till -80°C
Embedded metal part with 1mm radius

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 Specialty 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
Cleansing 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