HUNTSMAN

®Araldite Casting Resin System

Araldite®	**CY 225**	**100 pbw**
Aradur®	**HY 225**	**80 pbw**
Filler	**Silica flour**	**270 pbw**

Liquid, hot-curing casting resin system for producing castings with excellent electrical and mechanical properties and good long-term resistance

Applications

Indoor electrical insulators for medium and high voltage, such as switch and apparatus components, bushings, instrument transformers and dry type transformers.
For mechanically loaded construction parts.

Processing methods

Automatic pressure gelation process (APG)
Conventional gravity casting process under vacuum

Properties

Very high resistance to mechanical and electrical stresses
Very high resistance to thermal shock
Excellent long-term behaviour in relation to breakdown strength

Edition: **April 2008**
Replaces Edition: May 2004

(guideline values)

Modified, solvent-free, medium viscous bisphenol A epoxy resin

Araldite CY 225

Viscosity	at 25°C	ISO 12058	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		ISO 1523	°C	~135
Vapour pressure	at 20°C	(Knudsen)	Pa	< 0.01
	at 60°C	(Knudsen)	Pa	< 0.5

Liquid, modified, preaccelerated anhydride curing agent

Aradur HY 225

Viscosity	at 25°C	ISO 12058	mPa*s	1500 - 2500
Density	at 25°C	ISO 1675	g/cm³	1.20 - 1.23
	at 60°C	ISO 1675	g/cm³	1.16 - 1.19
Flash point		ISO 1523	°C	~140
Vapour pressure	at 25°C	(Knudsen)	Pa	~0.5
	at 60°C	(Knudsen)	Pa	~10

Remarks

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

Storage

The components have to be stored in tightly sealed and dry original containers according to the storage conditions on the product label. Under these conditions, the shelf life will correspond to the expiry date stated on the label. Product specific advise regarding storage can be found on product 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 vapour 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.For data on 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	5 - 8h

Cure conditions (minimal postcure)

APG process	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 curecycles in the manufacturing process could lead to a different crosslinking and glass transition temperature respectively.

Processing Viscosities

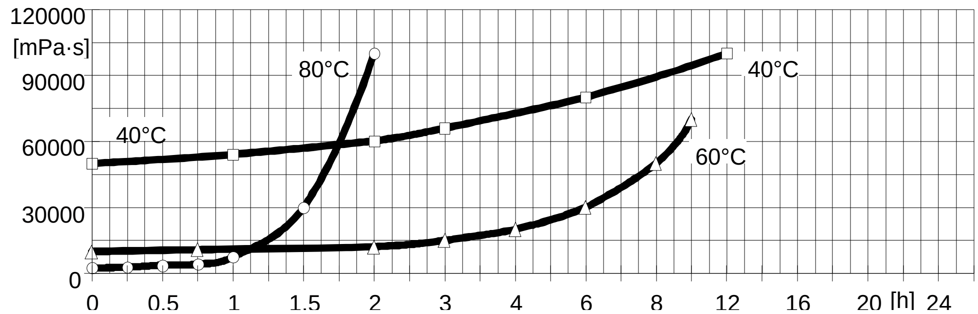

Fig.4.1: **Viscosity increase at 40, 60 and 80°C** (measurements with Rheomat 115)
(Shear rate D = 10 s^{-1})

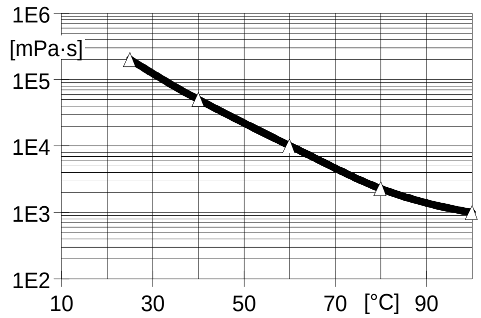

Fig.4.2: **Initial viscosity as a function of temperature**
(measurements with Rheomat 115, D =10 s^{-1})

Gelation-/Cure Times

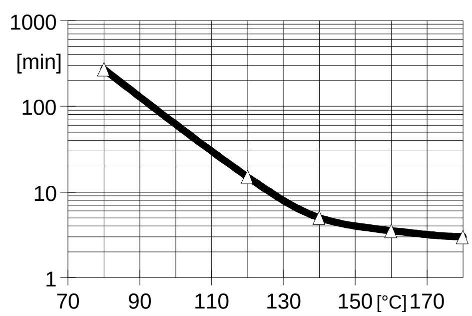

Fig.4.4: **Geltime as a function of temperature**
(measured with Gelnorm Instrument, ISO 9396)

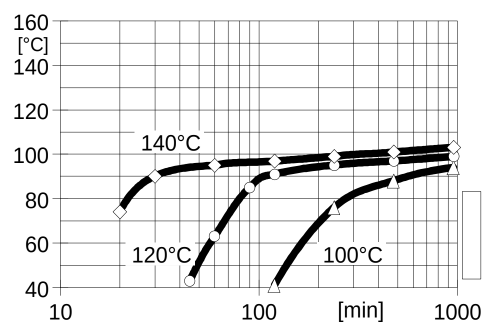

Fig.4.5: **Glass transition temperature as a function of cure time**
(isothermic reaction, ISO 11357-2)

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	75 - 85
Elongation at break	ISO 527	%	1.2 - 1.7
E modulus from tensile test	ISO 527	MPa	9600 - 10600
Flexural strength	ISO 178	MPa	120 - 130
Surface strain	ISO 178	%	1.5 - 2.0
Compressive strength	ISO 604	MPa	140 - 150
Compression set	ISO 604	%	6 - 7
Impact strength	ISO 179	kJ/m²	11 - 13
Double Torsion Test	CG 216-0/89		
Critical stress intensity factor (K_{IC})		$MPa·m^{½}$	2.3 - 2.7
Specific energy at break (G_{IC})		J/m²	550 - 650
Martens temperature	DIN 53458	°C	90 - 100
Heat distortion temperature	ISO 75	°C	95 - 105
Glass transition temperature (DSC)	ISO 11357-2	°C	90 - 105
Coefficient of linear thermal expansion	ISO 11359-2		see Fig.5.2
Mean value for temperature range: 20 - 60°C		K^{-1}	$36 - 40·10^{-6}$
Thermal conductivity similar to	ISO 8894-1	W/mK	0.8 - 0.9
Glow resistance	IEC 60707	class	2b
Flammability	UL 94		
Thickness of specimen: 4 mm		class	HB
Thickness of specimen: 12 mm		class	V1
Water absorption (specimen: 50×50×4 mm)	ISO 62		
10 days at 23°C		% by wt.	0.1 - 0.2
60 min at 100°C		% by wt.	0.1 - 0.2
Decomposition temperature (heating rate: 10K/min)			
	DTA	°C	350
Density (**Filler load: 60% by wt.**)	ISO 1183	g/cm³	1.75 - 1.80

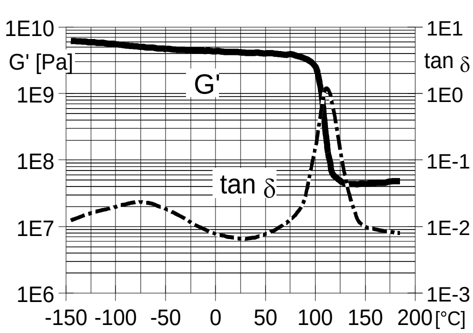

Fig.5.1: **Shear modulus (G') and mechanical loss factor (tan δ) as a function of temperature** (measured at 1 Hz.)
(ISO 6721-7, method C)

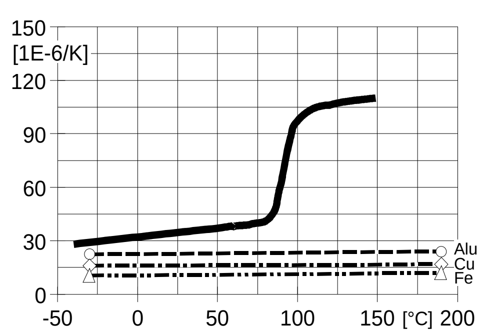

Fig.5.2: **Coefficient of linear thermal expansion (α) as a function of temperature** (reference temperature: 23°C)
(ISO 11359-2)

(guideline values)

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

Breakdown strength			
- 3mm plates	IEC 60243-1	kV/mm	18 - 20
- embedded Rogowski electrodes (Ø = 25 mm, 2 mm gap)	Huntsman		see fig.6.3
- embedded sphere electrodes (Ø = 8 mm, 0.5 mm gap)	Huntsman		see fig.6.4
Diffusion breakdown strength	DIN VDE 044-1	Class	HD 2
Temperature of specimen after test		°C	$\leq$ 25
Water diffusion Test	IEC 61109	KV	12
HV arc resistance	IEC 61621	s	182 - 186
Tracking resistance	IEC 60112		
with test solution A		CTI	>600 - <1
with test solution B		CTI	>350M - <1
Electrolytic corrosion	IEC 60426	grade	A-1

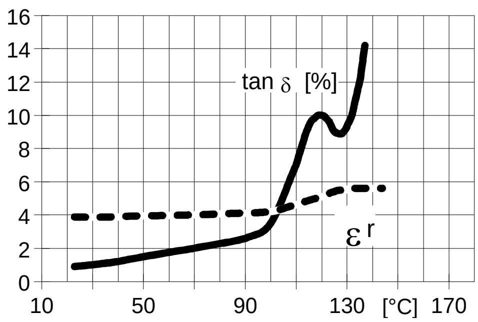

Fig.6.1: **Loss factor (tan δ) and dielectric constant (εr) as a function of temperature**
(measurement frequency: 50 Hz)
(IEC 60250)

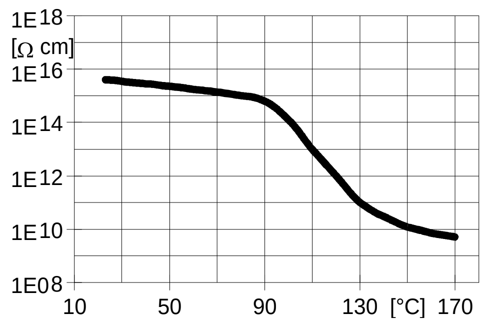

Fig.6.2: **Volume resistivity (ρ) as a function of temperature**
(measurement voltage: 1000 V)
(IEC 60093)

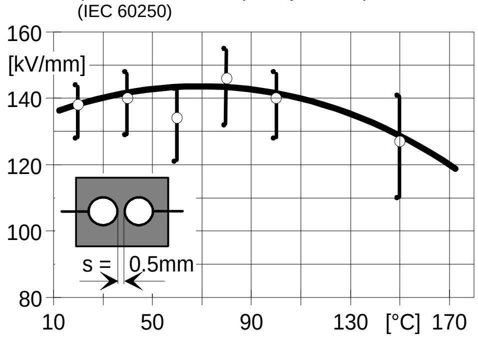

Fig.6.3: **Breakdown field strength (Ed) as a function of temperature**
(DIN/ VDE 0303 part 2, rapid voltage rise test)
Test specimen with embedded sphere electrodes
Ø 8 mm

Special Properties and Values

(guideline values)

Electrical long-term behaviour

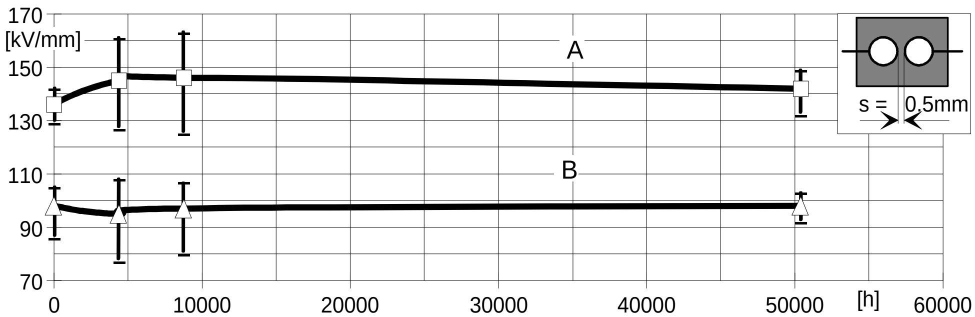

Fig.7.1: **Breakdown field strength (A) and holding field strength (B) as a function of humidity storage (55°C/ 93%rh)**
Test specimen with embedded sphere electrodes
(DIN/ VDE 0303/ part 2 A = rapid voltage rise test; B = 5 min step test)

Thermal shock resistance

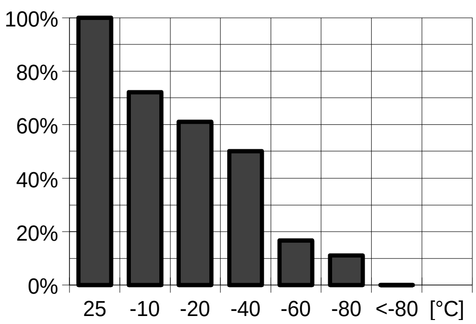

Fig.7.5: **Crack resistance / Temperature shock test**
Passed specimen (%) in function of the temperature steps
Mean failure temperature: - 45°C
Embedded metal parts with edge radius of 2 mm

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"

Handling precautions

Safety precautions at workplace:	
protective clothing	yes
gloves	essential
arm protectors	recommended when skin contact likely
goggles/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.

Note

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