
® Araldite Casting Resin System

Araldit®	CY 184	100 pbw
Aradur®	HY 1235	90 pbw
Accelerator	DY 062	0.5 pbw
Filler	Silica Flour (Silanised)	290 pbw

Liquid, hot-curing, cycloaliphatic epoxy resin system for outdoor application in difficult climatic conditions.

Outdoor electrical insulation material for medium and high voltage applications in humid conditions: apparatus components, pin/post insulators, bushings, etc.

Applications

We recommend long term tests on the parts as well as on the pieces in service.

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

Processing

Very high mechanical and dielectrical properties
Good thermal shock resistance
High resistance to erosion under UV-radiation
High tracking and arc resistance

Properties

The use of silanised silica flour insures stable dielectrical properties under outdoor humid conditions

Product data

(guideline values)

Liquid, cycloaliphatic epoxy resin (Diglycidylester)

Araldite CY 184	Viscosity	at 25°C	ISO 12058	mPa* s	700 - 900
	Epoxy content		ISO 3001	equiv/kg	5.80 - 6.10
	Density	at 25°C	ISO 1675	g/cm ³	1.20 - 1.25
	Flash point		ISO 1523	°C	169
	Vapor pressure	at 20°C	(Knudsen)	Pa	< 0.01

Liquid, modified cycloaliphatic anhydride hardener

Aradur HY 1235	Viscosity	at 25°C	ISO 12058	mPa*s	70 - 80
	Density	at 25°C	ISO 1675	g/cm ³	1.18 - 1.20
	Anhydride content			%	≥ 98
	Flash point		ISO 1523	°C	165
	Vapor pressure	at 20°C	(Knudsen)	Pa	<1
		at 60°C	(Knudsen)	Pa	<10

Liquid, tertiary amine

Accelerator DY 062	Viscosity	at 25°C	ISO 12058	mPa*s	approx. 10
	Density	at 25°C	ISO 1675	g/cm ³	0.88 - 0.92
		at 60°C	ISO 1675	g/cm ³	0.84 - 0.89
	Flash point		ISO 1523	°C	59
	Vapor pressure	at 20°C	(Knudsen)	Pa	ca. 300
		at 60°C	(Knudsen)	Pa	ca. 1600

Remarks The hardener Aradur HY 1235 is sensible to humidity. It is necessary to store this product in the sealed original containers.

Storage Store the components dry at 18-25°C, in tightly sealed 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 reanalyses. 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)

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 behavior 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 °C 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. In case of outdoor application particularly thorough wetting is essential. 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 $\leq 0.2\%$.

The system can be coloured by adding colour paste. For example:

- brown: 0.5 – 1 pbw Araldit DW 0126 per 100 pbw Araldit CY 184
- grey: 1 – 1.5 pbw Araldit DW 9134 per 100 pbw Araldit CY 184

System preparation

The effective pot-life of the mix is about 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.

Specific Instructions

Mould temperature

APG process	130 - 150°C
Conventional vacuum casting	80 - 100°C

Demoulding times (depending on mould temperature and casting volume)

APG process	10 - 30 min
Conventional vacuum casting	2 - 4 h

Cure conditions (minimum post curing)

APG process	10h at 140°C
Conventional vacuum casting	16h at 140°C

For any outdoor application, we recommend the use of silanised silica flour. Again it is essential to achieve a thorough crosslinking. 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.

Process Viscosities

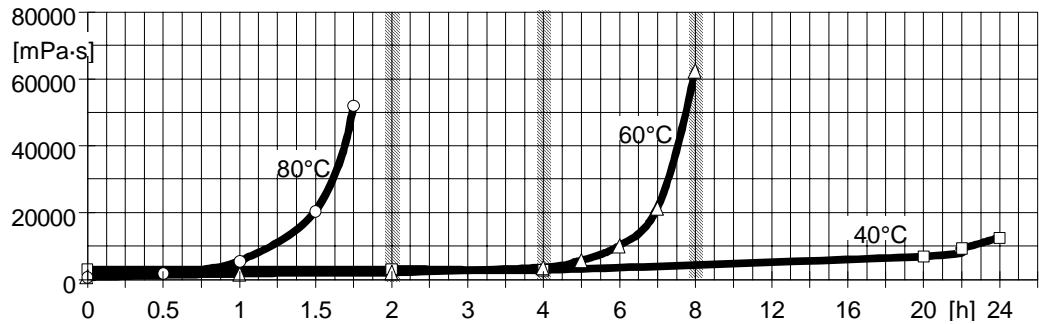


Fig.4.1: **Viscosity increase at 40, 60 and 80°C** (measurements with Rheomat 115)
(Shear rate $D = 10 \text{ s}^{-1}$)

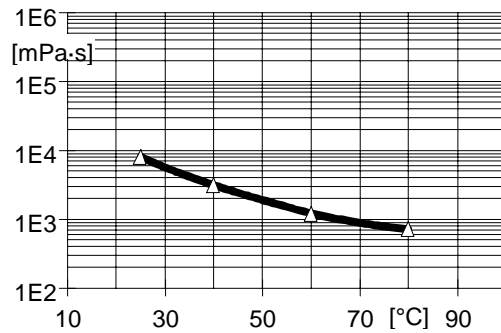


Fig.4.2: **Initial viscosity as a function of temperature**
(measurements with Rheomat 115, $D = 10 \text{ s}^{-1}$)

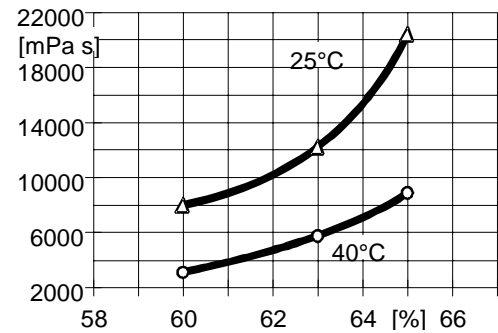


Fig.4.3: **Initial viscosities at 25°C and 40°C as a function of different filler content (% by weight)**
(measurements with Rheomat 115, $D = 10 \text{ s}^{-1}$)

Gelation and Cure Times

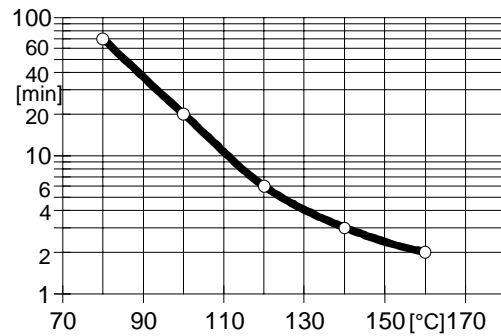


Fig.4.4: **Geltime measured as a function of temperature**
(measurements with Gelnorm Instrument / ISO9396)

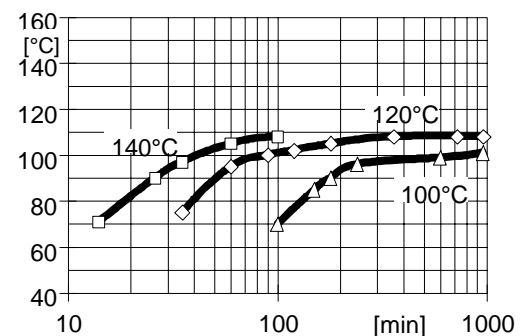


Fig.4.5: **Glass transition temperature as a function of cure time**
(isothermic reaction, IEC 61006)

Mechanical and Physical Properties

(guideline values)

Determined on standard specimen at 23°C

Cured for: 2h at 100°C + 16h at 140°C

Tensile strength	ISO 527	MPa	85 - 95
Elongation at break	ISO 527	%	1.2 - 1.6
E modulus from tensile test	ISO 527	MPa	9900 - 10300
Flexural strength	ISO 178	MPa	120 - 130
Surface strain	ISO 178	%	1.1 - 1.5
E modulus from flexural test	ISO 178	MPa	9850 - 10250
Impact strength	ISO 179-93	kJ/m ²	9 - 11
Double Torsion Test	CG 216-0/ 89		
Critical stress intensity factor (K _{IC})		MPa·m ^{1/2}	2.15 - 2.35
Specific energy at break (G _{IC})		J/m ²	470- 500
Martens temperature	DIN 53458	°C	90 - 100
Glass transition temperature (DSC)	IEC 11357-2	°C	100 - 110
Coefficient of linear thermal expansion	ISO 11359-2		Fig.5.2
Mean value for temperature range: 20 - 80°C		K ⁻¹	35 - 38·10 ⁻⁶
Thermal conductivity similar to	ISO 8894-1	W/mK	0.7 - 0.9
Combustibility	UL 94		
Thickness of specimen: 4 mm		grade	HB
Thickness of specimen: 12 mm		grade	V1
Limiting oxygen index (LOI)	ASTM D2863/95	%	24.3
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.	0.08 - 0.15
Decomposition temperature (heating rate: 10K/min.)	DTA	°C	around 350
Density (Filler load: 60 % by wt.)	ISO 1183	g/cm ³	1.6 - 1.7

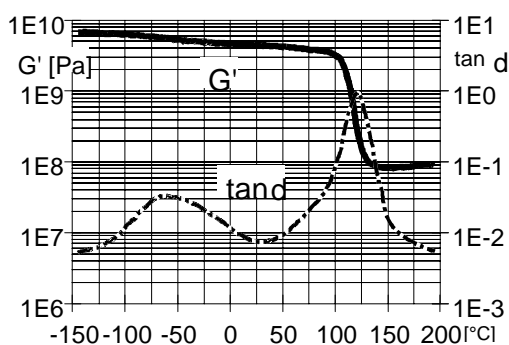


Fig.5.1: **Shear modulus (G') and mechanical loss factor (tan δ) as a function of temperature**
(ISO 6721, methode C, measured at 1Hz)

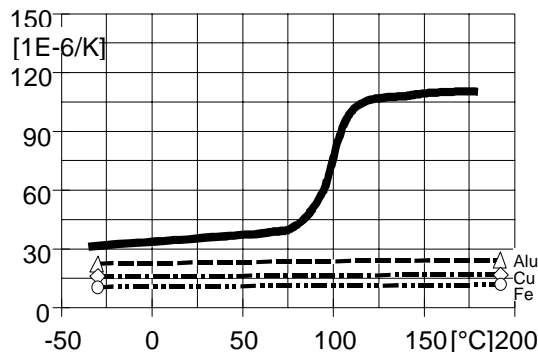


Fig.5.2: **Coefficient of linear thermal expansion (α) as a function of temperature**
(ISO 11359-2 reference temperature: 23°C)

Electrical Properties

(guideline values)

Determined on standard specimen at 23°C
Cured for 2h at 100°C + 16h at 140°C

Breakdown strength			
- 3 mm plates	IEC 60243-1	kV/mm	18 – 20
- embedded Rogowski electrodes ($\varnothing = 25$ mm, 2 mm gap)Huntsman	kV/mm		40 - 45
Diffusion breakdown strength	DIN/ VDE 0441-1	class	HD 2
Temperature of specimen after test		°C	≥ 25
HV arc resistance	IEC 61621	s	189 - 193
Tracking resistance	IEC 60112		
with test solution A		CTI	>600-0.0
with test solution B		CTI	>600M-0.0
HV tracking resistance	IEC 60587	class	1B3.5
Electrolytic corrosion	IEC 60426	grade	A1

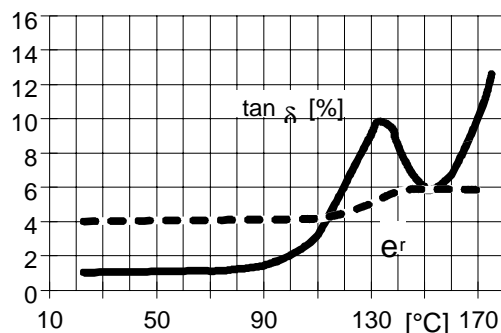


Fig.6.1: **Loss factor ($\tan \delta$) and dielectric constant (ϵ_r) as a function of temperature**
(measurement frequency: 50 Hz. IEC 60250)

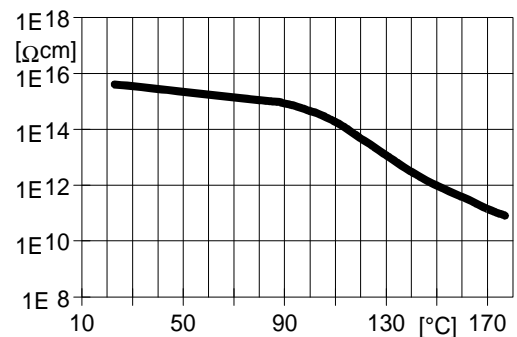


Fig.6.2: **Volume resistivity (ρ) as a function of temperature**
(measurement voltage: 1000 V. IEC 60093)

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
Treatment 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 colored 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 vapors.

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 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** vapors should be moved outdoors immediately. In any case of doubt call for medical assistance.

Note

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Advanced Materials

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