HUNTSMAN

Advanced Materials

DATA SHEET

Araldite® CY 184
Aradur® HT 907
Accelerator DY 183

Hot Cure, Cycloaliphatic Epoxy Casting System for Outdoor

General	Araldite CY 184 is a low viscosity cycloaliphatic epoxy resin, which can be readily processed and cured with Aradur HT 907 (carboxylic acid anhydride), and a small amount of Accelerator DY 183 into resilient thermosetting polymer having outstanding arc and track resistance, coupled with excellent mechanical and electrical properties. The cured product exhibits thermal endurance properties that qualify for 155°C service.
Applications	This system is recommended for use in the manufacture of medium and high voltage electrical insulating components (e.g. apparatus parts, bushings, post-type insulators, switchgear, instrument transformers, etc.) for long-term use in aggressive outdoor environments as well as for enclosed or indoor environments.
Process	Automatic pressure gelation process (APG) Conventional gravity casting process under vacuum.
Features	Very good mechanical and electrical properties Good thermal shock and crack resistance Good toughness combined with dimensional stability Very good resistance to erosion by UV radiation High tracking and arc resistance Use of silanised silica flour insures stable dielectric properties under outdoor humid conditions

Typical Properties*

Araldite CY 184: Liquid, formulated, cycloaliphatic epoxy resin (Diglycidylester)

Appearance	Grey Viscous Liquid
Specific Gravity	1.20 – 1.25
Viscosity @ 25ºC, mPas	700 – 900
Epoxy content	5.80 – 6.10
Flash Point, ºC	169
Vapor pressure @ 20ºC, Pa	< 0.01

Aradur HT 907: Room-temperature solid anhydride hardener

Appearance	Clear Liquid
Specific Gravity	
@ 25ºC	1.36 – 1.40
@ 60ºC	1.15 – 1.20
Melting point, ºC	34 - 38
Anhydride content, %	=< 1
Free acid, %	=< 0.5
Flash Point, ºF	280
Vapor pressure, mbar	
@ 40ºC	~1 x 10^{-2}
@ 60ºC	~8 x 10^{-2}

Accelerator DY 183: Liquid accelerator, tertiary amine

Appearance	Dark Brown liquid
Specific Gravity	1.00 – 1.10
Viscosity @ 25ºC, mPas	3,000 – 5,000
Vapor tension, Pa	
@ 20°C	0.05
@ 60°C	0.5
Flash Point, ºC	135

* Typical properties are based on Huntsman's test methods. Copies are available upon request.

Packaging & Storage

Store all the components at 18-25°C, in tightly sealed and dry original containers. Aradur HT 907 is moisture sensitive and packaged under a blanket of dry nitrogen. Maintain factory seal. If only part of container is used, blanket with dry nitrogen and tightly re-seal.

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.

Mix ratios

	Parts by weight
Araldite CY 184	100
Aradur HT 907	90
Accelerator DY 183	3
Silica Flour*	300

* pretreated with Gamma-Glycidoxypropyltremethoxysilane

Processing and Cure

Excellent properties are obtained with this system when processed by Automatic Pressure Gelation (APG) techniques. However, conventional processing can also produce satisfactory castings. For conventional processes, the optimum gelation temperature and cure schedule are dependent on the design of the part. General guidelines for both types of processing are given below:

APG: With mold at 140 – 160°C, fill the mold in two to five minutes with mixed material at about 50 – 60°C. Gel within mold under pressure of 1 – 3 atm for 7 – 15 minutes (dependent on part size and mixed material temperature). Then post cure 2 – 4 hours at 150°C or 6 – 10 hours at 140°C.

Conventional Casting: Pre-heat mold and material both at 60 – 80°C. Gel 4 – 6 hours, then post cure step-wise, 2 hours at 100°C, plus 2 hours at 125°C, plus 2 hours at 150°C.

Processing Guides

In preparing casting systems, the addition of powdered mineral fillers, such as silica flour, hydrated alumina, wollastonite or aluminum oxide is highly recommended when manufacturing components that will be subjected to mechanical and/or electrical stresses. Such fillers impart the following benefits:

- Enhance important mechanical and electrical properties
- Reduce shrinkage and exothermic temperature rise during cure
- Impart a lower coefficient of thermal expansion
- Improve thermal conductivity
- Reduce unit manufacturing costs

Silica flour fillers, pre-treated with organo-silanes are recommended for use in castings intended for outdoor applications. Silane treatment of the filler appreciably reduces impairment of dielectric and mechanical properties due to the absorption of moisture, and enhances the resistance to erosion by UV radiation. These improvements can be accomplished by either APG or conventional techniques.

Optimal wetting of the filler by the casting resin system is essential if products are to be electrically stressed at outdoor locations. The required results are achieved by first preparing the casting systems as separate resin and hardener components, both of which contain filler material. Colorants, if required, can be blended into the resin component. The requisite accelerator may be either added directly to the hardener component or added as a third component when preparing the mixed system. If Accelerator DY 183 is used, the level can be varied between three and six parts per 100 parts resin. Lower amounts of accelerator are recommended when processing by conventional casting techniques; whereas higher levels are normally used with the APG process. The filler is satisfactorily wetted by mixing the separate resin and hardener components described above for several hours under vacuum of 2 – 6 torr and at slightly elevated temperatures (about 60°C). Such pre-mixed separate components can be held at slightly elevated temperatures for several days prior to use. The subsequent processing of the mixed system is described below:

CONVENTIONAL CASTING

The pre-mixed resin and hardener components, with added accelerator and colorants (if required); as well as the prepared1 mold, are typically pre-heated separately at 60 – 80°C. The casting components are mixed together thoroughly for about 30 minutes under a vacuum of 2 – 6 torr, then brought to atmospheric pressure.

A very effective method for eliminating air entrapment in the casting is to place the pre-heated mold in a vacuum chamber at 2 – 6 torr vacuum. The mixed and de-aired casting system is then introduced into the mold while it is within the vacuum environment. The filled mold is then placed in an oven for cure and post cure.

AUTOMATIC PRESSURE GELATION

The pre-mixed resin and hardener components, with added accelerator and colorants (if required), are pre-heated to about 50 – 60°C. The prepared1 mold is pre-heated on a clamping machine at 140 – 160°C.

If a pressure pot is used, the casting components are mixed thoroughly in a jacketed mixer at about 60°C for approximately 30 minutes at 2 – 6 torr vacuum. The mixture is then transferred to a jacketed pressure vessel at 60°C (the mixer and pressure vessel may be the same equipment). The vessel is pressurized with dry air or nitrogen to 15 – 45 psi. If continuous metering/mixing/dispensing equipment is used, such as the Hedrich PEK-60, it is typical to set the mixed material temperature to 50 – 80°C and the dispensing pressure to the range of 15 – 45 psi.

Molds are normally filled in a range of 2 – 5 minutes and are gelled while under pressure. Typical mold close times range from 7 – 15 minutes (depending upon part size and mixed material temperature). After gelation is complete, the mold is opened and the part is placed in an oven for post cure.

Note: Molds must be released with an effective mold release agent. Mold Release Agent QZ 13 is recommended.

Processing Data

Initial viscosity, cPs (Brookfield HATDV, Spindle 21, 20 rpm)

@ 25ºC	25,000 – 35,000
@ 40ºC	10,000 – 15,000
@ 60ºC	3,000 – 5,000
@ 80ºC	1,000 – 1,500

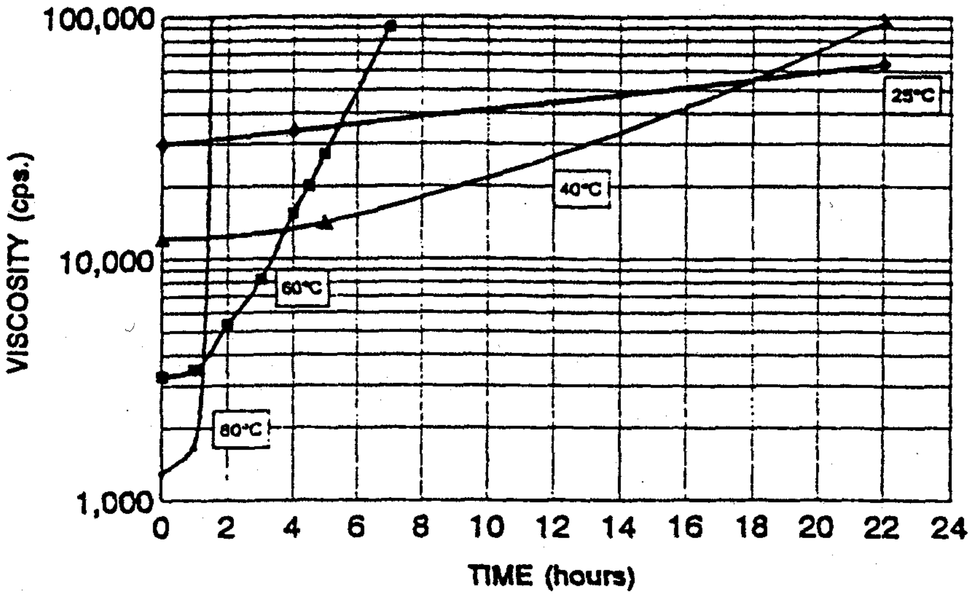
Pot life, 1 lb mass (Brookfield HATDV, Spindle 21, 20 rpm) see Figure 1

Gel time, minutes (30 grams)

@ 130ºC	7 – 8
@ 140ºC	5 – 6

Figure 1

Working Life (Viscosity vs. Time)



Physical Properties (typical values)

Tensile strength, psi	10,500 – 14,000
Tensile modulus, psi	$1.65 \times 10^6 - 1.85 \times 10^6$
Tensile elongation, %	0.9 – 1.3
Flexural strength, psi	18,300 – 22,000
Flexural modulus, psi	$1.40 \times 10^6 - 1.50 \times 10^6$
Compressive strength, psi	35,200 – 35,800
Notched izod impact, ft.lb./in.°C @ 25°C	0.3 – 0.5
Glass transition, °C	110 – 115
Coefficient of thermal expansion, in/in/°C	$30 \times 10^{-6} - 40 \times 10^{-6}$
Thermal conductivity, W/m-K	0.80 – 0.85
Water absorption, %	
30 minutes @ 100°C	0.1 – 0.2
10 days @ 23°C	0.1 – 0.2
Track resistance, minutes	
Initial tracking voltage, kV	3.5 (40)
Time to track @ 2.75 kV	2,100 – 2,700
Arc resistance, seconds	185 – 190
Dielectric constant	See Figure 2
Dissipation factor	See Figure 3
Volume resistivity, Ωcm	See Figure 4
Dielectric strength, Volt/mil.	
1/8” plaque/23°C, 60 Hz	450 – 500

Figure 2

Dielectric Constant vs. Temperature

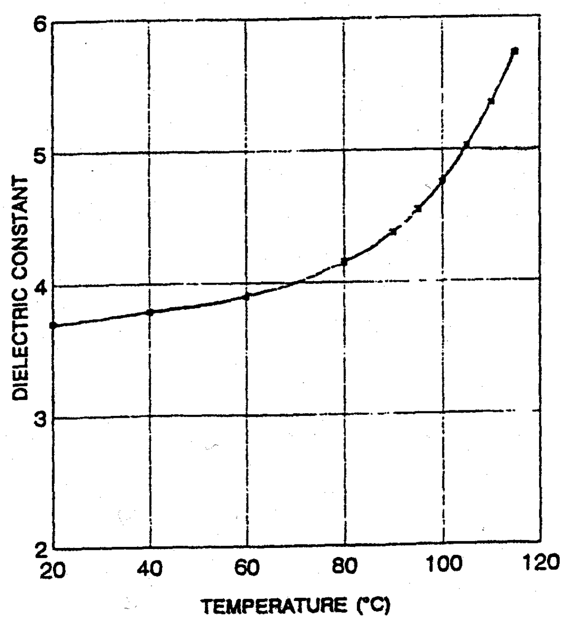


Figure 3

Dissipation Factor vs. Temperature

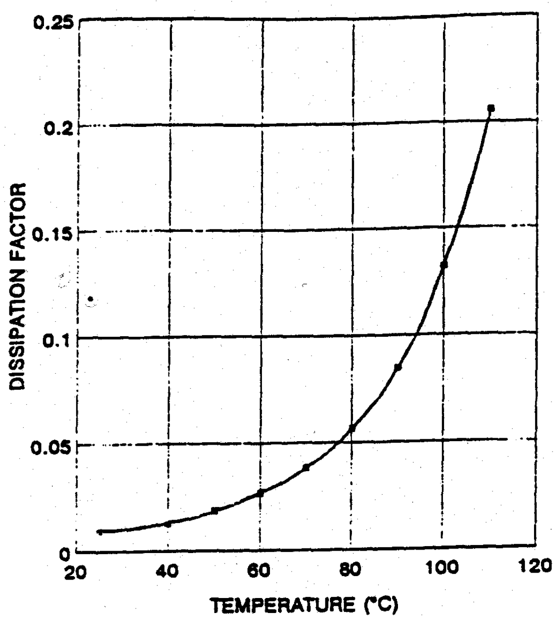
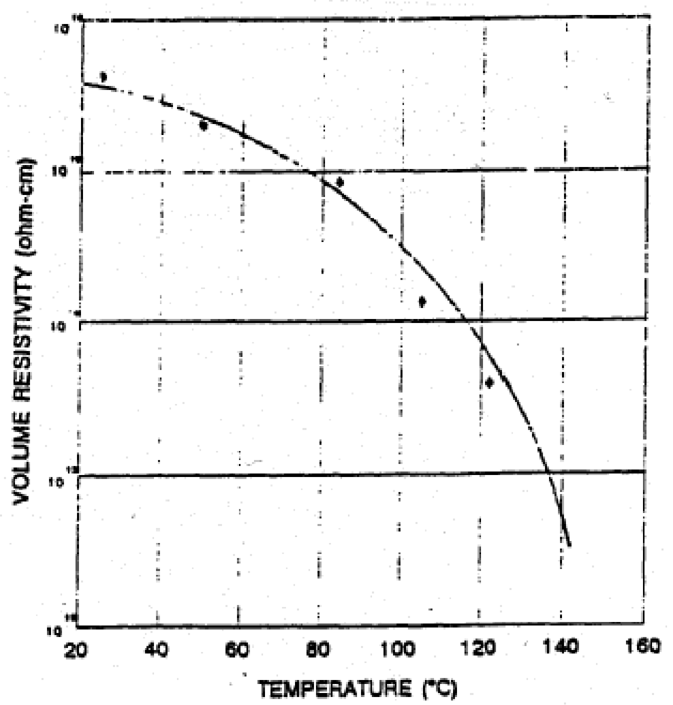


Figure 4

Volume Resistivity vs. Temperature



Thermal Endurance Characteristics

In this test program, samples of an unfilled Araldite CY 184 / Aradur HT 907 based system was tested for thermal endurance, according to IEC method. In this method, three properties are investigated. These are (1) weight loss where an endpoint of 10% is selected, (2) flexural strength where an endpoint of 50% of initial value is selected and (3) breakdown voltage where an endpoint of 50% of initial value is selected.

System	
Araldite CY 184	100 parts by weight
Hardener HT 907	80 parts by weight
Accelerator DY 183	1 part by weight

Cure schedule: 15 hours @ 60°C, plus 10 hours @ 140°C

Investigated property	**Weight loss**
Specimen size	50 x 50 x 3 mm^3
Test temperatures	160°C, 170°C, 180°C, 200°C, 220°C
Number of specimens	Seven at each temperature
Selected endpoint	10% loss in weight
Average endpoint value	See Figure 5
Regression equation	$\log_{10} t = 5849\ (1/T) - 8.927$
Thermal endurance profile	40,000 hours = 159°C
	20,000 hours = 169°C

Investigated property	**Flexural strength**
Test temperatures	160°C, 170°C, 180°C, 200°C, 220°C
Number of specimens	Seven at each measured point
Selected endpoint	50% of initial value
Average endpoint value	See Figure 7
Regression equation	$\log_{10}t = 4904\ (1/T) - 6.947$
Thermal endurance profile	40,000 hours = 151°C 20,000 hours = 163°C

Investigated property	**Breakdown voltage**
Test temperatures	160°C, 170°C, 180°C, 200°C, 220°C
Number of specimens	Seven at each measured point
Selected end point	50% of initial value
Average end point value	Determination of the thermal endurance profile with respect to breakdown voltage is not possible since no significant decrease in tested values was found over 2 years

Figure 5

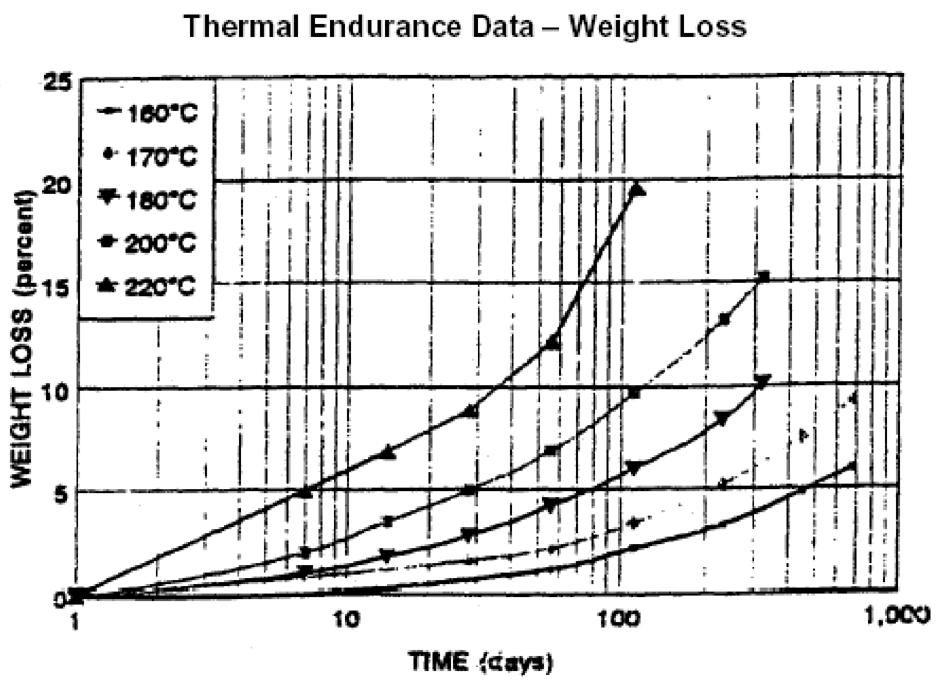


Figure 6

Thermal Endurance – 10% Weight Loss

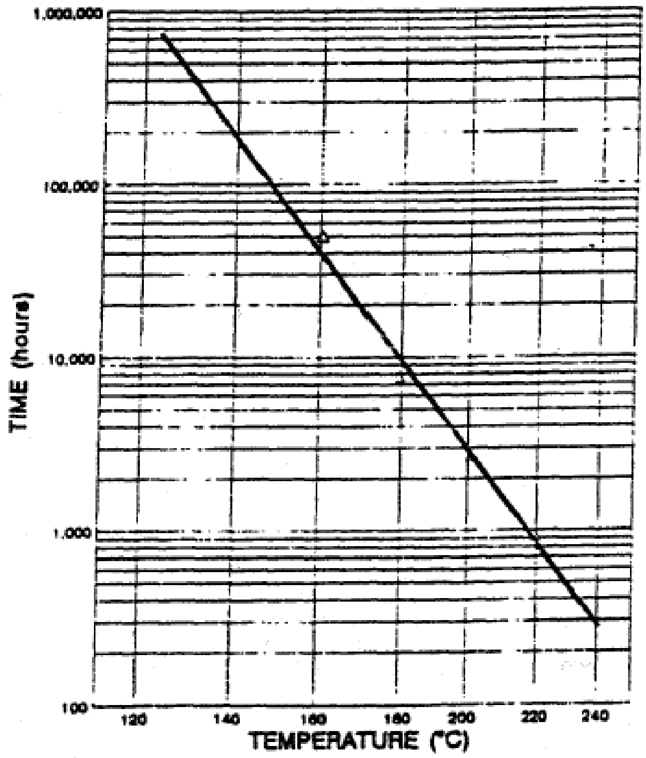
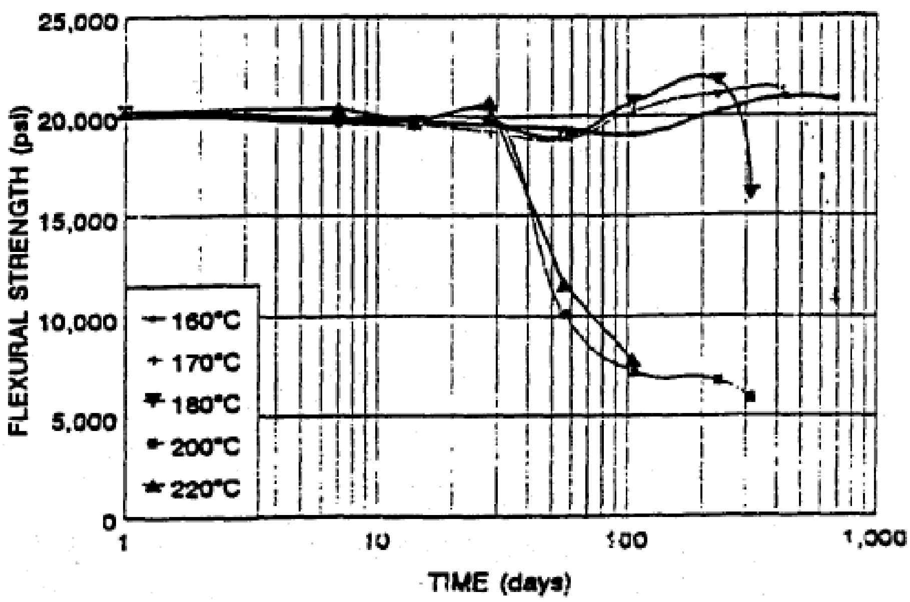


Figure 7

Thermal Endurance Data – Flexural Strength



Handling/Safety Precautions

Mandatory and recommended industrial hygiene procedures should be followed whenever our products are being handled and processed. For additional information please consult the corresponding material safety data sheets.

Araldite CY 184
Warning! Causes skin and eye irritation. May cause allergic skin reaction. Avoid contact with eyes, skin, and clothing. Avoid prolonged or repeated contact with skin. Wash thoroughly after handling.

Aradur HT 907
Warning! Corrosive - causes eye burns and severe skin irritation. Causes respiratory irritation. May cause skin burns. May cause allergic skin and respiratory reactions. Do not get in eyes, on skin, or on clothing. Avoid breathing vapor or mist. Avoid prolonged or repeated contact with skin. Keep container closed. Use with adequate ventilation. Wash thoroughly after handling.

Accelerator DY 183
Danger! Combustible. Corrosive - causes skin and eye burns. Causes severe respiratory irritation. May be fatal if inhaled. May cause allergic skin reaction. Harmful if swallowed. Keep away from heat and flame. Do not get in eyes, on skin, or on clothing. Do not breathe vapor or mist. Keep container closed. Use with adequate ventilation. Wash thoroughly after handling.

First Aid

In case of contact:

Eyes: Flush eyes with plenty of water for 15 minutes and get prompt medical attention.

Skin: Wash skin thoroughly with mild soap and water; remove contaminated clothing before reuse. Discard contaminated shoes and other articles made of leather.

Inhalation: Remove person to fresh air.

Ingestion: Do not induce vomiting. Dilute with plenty of water and contact physician immediately. Never give anything by mouth to an unconscious person.

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Note

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Araldite CY 184
with Aradur HT 907
and Accelerator DY 183
May 2004