

**Advanced Materials****Aradur® 2978-1 Hardener****Modified Cycloaliphatic Polyamine****General**

Aradur® 2978-1 Hardener is a low viscosity, non-blushing epoxy curing agent with excellent handling and surface appearance properties. Aradur 2978-1 Hardener can be formulated with modified or unmodified bisphenol A and bisphenol F based liquid epoxy resins.

**Key properties**

- **Low viscosity**
- **Low color**
- **High gloss films with good humidity resistance**
- **Optimal combination of long pot life and fast cure time**
- **Outstanding non-yellowing properties and good gloss retention**
- **Rapid development of water spotting resistance**

**Description**

Aradur® 2978-1 Hardener is designed for two-component, ambient curing coating and flooring systems that require good aesthetic properties, good blush and early water spotting resistance. Its unique combination of long pot life and fast cure offers a distinct advantage over typical curing agents based on cycloaliphatic polyamines, such as isophorone diamine. The overall improvement of performance properties gained by use of Aradur® 2978-1 Hardener makes it an ideal curing agent for many applications.

**Applications**

Solvent-free and high solids coatings for general purpose and decorative coatings, and self-leveling and broadcast floorings.

**Product data\***

	<b>Aradur® 2978-1 Hardener</b>
Visual Appearance	Clear, no contamination
Color, APHA, max.	100
H <sup>+</sup> Active Equivalent Weight (g/eq.)	115
Use Level with Araldite GY 6010 (phr)	60
Amine Value (mg KOH/g)	255 - 295
Viscosity at 25°C (cP)	125 - 425
Density at 25°C (g/cm <sup>3</sup> , lb/gal)	1.02, 8.5
Flash Point, Closed Cup (°C)	> 93

\* Product data are based on Huntsman's test methods. Copies are available upon request.

**Formulations****Clear Coating Starting Formulation (Parts by Weight)**

<b>Formulation No.</b>	<b>1</b>
Araldite® GY 6010 Epoxy Resin <sup>1</sup>	100
Aradur® 2978-1 Hardener	60
<b>Mixed Viscosity<sup>2</sup>, 25°C (cP)</b>	
	1570
<b>Gel time<sup>3</sup>, 100 g, 23°C (min)</b>	
	69
<b>Curing Properties<sup>4</sup> @ 23°C / 50% Relative Humidity</b>	
Tack-free time (hr)	5.25
Cure-through time (hr)	7.5
Film Appearance	Glossy
Gloss (20° / 60°) <sup>5</sup> (%)	105 / 108
<b>@ 5°C / 50% Relative Humidity</b>	
Tack-free time (hr)	15.5
Cure-through time (hr)	>24
Film Appearance	Glossy, slight haze
Gloss (20° / 60°) <sup>5</sup> (%)	99 / 103
<b>@ 33°C / 80% Relative Humidity</b>	
Tack-free time (hr)	2.5
Cure-through time (hr)	4
Film Appearance	Glossy, slight haze
Gloss (20° / 60°) <sup>5</sup> (%)	99 / 103

<sup>1</sup> Standard bisphenol-A liquid epoxy resin (epoxy equivalent weight: 182 - 192)

<sup>2</sup> ASTM D4440 (ICI Cone & Plate)

<sup>3</sup> Tested by Gardco® Standard gelation timer, Model GT-S

<sup>4</sup> Tested by Gardner® Circular Drying Time Recorder on a 10 mil wet coating

<sup>5</sup> ASTM D523

**Typical Cured Properties**

Unless otherwise stated, the data were determined with typical production batches using standard testing methods. They are provided solely as technical information and do not constitute a product specification.

<b>Formulation No.</b>	<b>1</b>
Araldite® GY 6010 Epoxy Resin	100
Aradur® 2978-1 Hardener	60
<b>Coating Properties 10-mil, 7 days @ 23°C / 50% Relative Humidity</b>	
Pencil Hardness <sup>6</sup>	2H
Persoz Hardness <sup>7</sup> (s)	280
X-Cut Adhesion <sup>8</sup>	5A
Impact Resistance <sup>9</sup> (Direct/Rev.) (in-lb)	30 / 16
Mandrel Bend <sup>10</sup>	Fail 1/8"
Glass Transition Temp. <sup>11</sup> , T <sub>g</sub> , (°C)	50
Shore D Hardness <sup>12</sup> , 1/8" thickness	
1 day	84
3 days	85
7 days	85
Time to Water Spot Resistance <sup>13</sup> (hr)	8.5
Taber Abrasion <sup>14</sup> (mg)	45.6
Pull-Off Adhesion <sup>15</sup> , 5-mil wet film (psi)	
Sandblasted Concrete (failure mode)	> 450 (concrete)
Sandblasted Steel (failure mode)	> 800 (glue)

<sup>6</sup> ASTM D3363

<sup>7</sup> ANSI/ISO 1522

<sup>8</sup> ASTM D3359

<sup>9</sup> ASTM D2794

<sup>10</sup> ASTM D522

<sup>11</sup> Determined by Differential Scanning Calorimetry (DSC)

<sup>12</sup> ASTM D2240

<sup>13</sup> Place a droplet of deionized water on coating periodically beginning at the tack-free time and continually throughout the cure cycle.

Record the time at which no visible defect is seen on the coating film after evaporation of the droplet.

<sup>14</sup> ASTM C1353

<sup>15</sup> ASTM D4541

**Mechanical Properties 7 days @ 23°C / 50% Relative Humidity**

Formulation No.	1
Flexural Strength <sup>16</sup> (kpsi)	13.1
Flexural Modulus, (kpsi)	475.2
Compressive Strength <sup>17</sup> (kpsi)	10.3
Compressive Modulus (kpsi)	657.7
Max. Compression Load (lb)	2254
Tensile Strength <sup>18</sup> (kpsi)	7.5
Tensile Modulus (kpsi)	407.5
Tensile Elongation (%)	2.9
Heat Deflect. Temp. <sup>19</sup> , 66 psi (°C)	45.4
Heat Deflect. Temp., 264 psi (°C)	43.8

<sup>16</sup> ASTM D790<sup>17</sup> ASTM D695<sup>18</sup> ASTM D638<sup>19</sup> ASTM D648**Yellowing Resistance (ASTM E-313)**

Cure: Araldite® GY 6010 epoxy resin; 7 days at 23°C / 50% Relative Humidity

Coating: 3-mil film on Laneta contrast panels

Exposure Conditions: QUV-A (340 nm) bulbs, 50°C

**Formulation 1**

QUV Exposure Time	Initial	3 days	7 days
- Yellow Index	-4.6	4.0	17.0
- Gloss (20°/60°), %	97 / 102	96 / 99	94 / 97

**Isophorone Diamine-based Curing Agent**

QUV Exposure Time	Initial	3 days	7 days
- Yellow Index	-4.6	10.8	32.3
- Gloss (20°/60°), %	89 / 93	Matte	42 / 43

**Chemical Resistance, Immersion (ASTM D-543)**

Specimen Dimensions: 1" x 3" x 1/8"

Cure: 7 days @ 25°C / 50% Relative Humidity

Evaluated by weight change (%) / Shore D hardness

**Formulation No. 1**

<b>Exposure Time</b>	<b>3 days</b>	<b>7 days</b>	<b>28 days</b>
Unexposed control (blank)	- / 84	- / 85	- / 86
Acetic Acid, 10%	2.2 / 80	3.2 / 79	5.5 / 75
Hydrochloric Acid, 10%	1.0 / 83	1.6 / 84	3.0 / 84
Sulfuric Acid, 55%	1.4 / 84	2.0 / 84	3.5 / 84
Nitric Acid, 10%	1.0 / 82	1.5 / 83	3.0 / 84
Sodium Hydroxide, 10%	0.3 / 84	0.4 / 84	0.7 / 85
Ammonia, 25%	0.8 / 82	1.2 / 80	2.2 / 79
Household Bleach, 100%	0.3 / 84	0.4 / 84	0.7 / 84
Ethanol, 50%	1.2 / 79	1.8 / 77	3.3 / 75
Tap Water	0.4 / 84	0.5 / 85	1.0 / 85
Mineral Spirits	0.1 / 84	0.1 / 85	0.1 / 85

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**Storage**

Aradur<sup>®</sup> 2978-1 Hardener should be stored in a dry place and in the sealed original container, at temperatures between 2°C and 40°C (36°F and 104°F). Under these storage conditions the shelf life is 2 years. The product should not be exposed to direct sunlight.

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**First Aid!**

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