

CIBA-GEIGY

**® Araldite AV 138 M
Hardener HV 998
(NO) Hardener HY 2978**

0007

Adhesive

Solvent-free, epoxy based
two-component system curing
at 5–100°C and showing
good heat resistance
at temperatures up to 120°C

Uses	The bonding of metals, ceramics, vulcanized rubber, rigid plastics and many other materials to themselves or to one another.
Application	Manually by spatula, short-bristle brush or laminating hook. Mechanically by metering, mixing and glue spreading equipment.
Features	Easy to mix and apply Gap-filling No-pressure curing Cures with negligible shrinkage and without releasing volatiles Low allergy risk if correctly handled
Properties	Good resistance to static and dynamic loading Excellent resistance to chemicals and tropical weathering Electrically insulating Does not promote corrosion Non-tainting

Araldite AV 138 M Hardener HV 998 Hardener HY 2978

General Araldite AV 138 M can be cured with either Hardener HV 998 or Hardener HY 2978, the choice of hardener being governed by the rate at which the adhesive is required to cure. Araldite AV 138 M cures without the application of pressure or heat no matter which hardener is used. But the application of heat accelerates curing and results in stronger joints.

As-supplied properties

		Araldite AV 138 M	Hardener HV 998	Hardener HY 2978
As-supplied form		thixotropic paste	thixotropic paste	liquid
Colour		pale beige	grey	pale brown
Viscosity at 25 °C	mPa s	>500,000 ¹⁾	≈380,000 ¹⁾	≈5000 ²⁾
Density at 25 °C	g/cm ³	1.65–1.70	1.65–1.75	0.94
Flash point (Pensky-Martens)	°C	110	85	93

¹⁾ Determined by Brookfield viscosimeter R 5/5 RPh

²⁾ Determined by Hoesppler falling ball test

Bonding procedure

No difficulties are normally encountered in bonding metal to metal, or metal to other materials, with an Araldite adhesive. High-performance bonds are obtained by paying close attention to the following points.

1. Correct joint design

Avoid butt joints, using socket and lap joints wherever possible.

2. Stress-free fit of the parts being bonded together

3. Proper pretreatment of the surfaces being bonded

4. Thorough blending of the resin and hardener in the recommended proportions

5. Correct curing of the adhesive

Above all, avoid letting the adhesive set at temperatures below the recommended minimum.

Pretreatment of surfaces to be bonded

To obtain completely satisfactory and durable joints, the surfaces to be bonded must be properly pretreated. All traces of dirt, oil and grease must be removed using a solvent such as acetone, trichlorethylene, perchlorethylene, etc. – alcohol, gasoline (petrol) or paint thinners should never be used.

Stabilized 1,1,1-trichlorethane is an excellent degreasing agent of low toxicity and flammability. It is readily available under the trademarks [®]Baltane (Société Rhône-Progil), [®]Chlorothene (Dow Chemical Company), and [®]Genklene (ICI). Note: Most solvents are highly flammable. The prescribed safety precautions must always be taken.

Maximum bond strength is obtained by mechanically abrading or chemically etching the surfaces to provide a better key for the adhesive. Mechanical abrading must be followed by a second, thorough degreasing treatment.

Mechanical and chemical pretreatment of a wide variety of substrates is described in detail in "Araldite adhesives – surface preparation and pretreatments."

	Parts by weight	
Araldite AV 138 M	100	100
Hardener HV 998	40	-
Hardener HY 2978	-	20

Resin/hardener mix ratio

Mixing must be thorough, and it should be continued until resin and hardener constitute a homogeneous mix.

The mixing may be done in any clean vessel. A cup made of polyethylene or plain, unwaxed cardboard is the handiest.

The homogeneous resin/hardener mix is best applied with a spatula to the dry, pretreated surfaces being bonded. If the surfaces are large, a laminating hook of the type used when laying up glassfibre laminates, may be employed.

Thick layers of adhesive may be applied with a grease gun or similar tool.

Equipment that facilitates the metering, mixing and application of large quantities of adhesive, has been developed by a number of firms. CIBA-GEIGY will gladly advise customers seeking equipment best suited to their particular needs.

When the joint surfaces are small, smooth areas, adhesive need only be applied to a single face. When the surfaces are rough, or when one part is to be inserted into another, adhesive should be applied to both surfaces to ensure complete coverage.

A joint clearance of 0.1 to 0.2 mm will, in principle, give the best shear strength. Surfaces near the joint which are not to be bonded should be coated with a thin layer of grease, soap solution, or wax or silicone based release agent (e.g. CIBA-GEIGY Release Agent QZ 13 or QZ 11 B). The parts being joined must be assembled and clamped in position as soon as the adhesive has been applied. No pressure need be applied; good, even contact throughout the joint surface will suffice to ensure proper curing and adhesion.

Application

At 25°C, the pot life of a 100 gram batch of resin/hardener mix as follows:

Pot life

Mix	Pot life min
Araldite AV 138 M/Hardener HV 998	35
Araldite AV 138 M/Hardener HY 2978	65

Initial viscosity	Mix	Initial viscosity of mix at 25°C mPa s
	Araldite AV 138 M/Hardener HV 998	80,000
	Araldite AV 138 M/Hardener HY 2978	30,000

Coating thickness To apply a medium-thick layer of adhesive, spread about 300 grams resin/hardener mix per square metre of joint surface.

Curing Cure time is dependent on the temperature in the joint. The minimum cure times shown below do **not** include the time needed to heat the joint components to cure temperature.

Cure temperature °C	Minimum cure time Araldite AV 138 M Hardener HV 998	Araldite AV 138 M Hardener HY 2978
5	3 days	–
10	24 h	48 h
23	8 h	16 h
40	2 h	4 h
80	15 min	20 min
100	10 min	15 min

The values given below should be regarded only as a general guide to performance and as a basis for making comparisons.

Unless otherwise stated, all values quoted are averages found by testing specimens made by lap-jointing flash-free strips of metal punched from sheet and each measuring 170×25×1.5 mm.

Alloy	Anticorodal-100B, a light Al-MgSi1 alloy manufactured by Schweizerische Aluminium AG.
Pretreatment	Strips degreased, joint surfaces abraded longitudinally with No.100 emery cloth and degreased again with acetone.
Overlap	Single, 12.5 mm
Resistance to water and weathering	Large-area joints generally exhibit better resistance to water and weathering than small-area joints. The decisive factor in all cases is the extent to which moisture, etc. can penetrate into the joint. In some cases it may be advisable to coat the joint all round with waterproof paint.
Conversion of SI units	9.81 N = 1 kp 9.81 N/mm ² = 1 kp/mm ² 1 mPa s = 1 cP 1 K ⁻¹ = 1/K \triangleq 1 mm/mm°C

Shear strength vs cure time and temperature

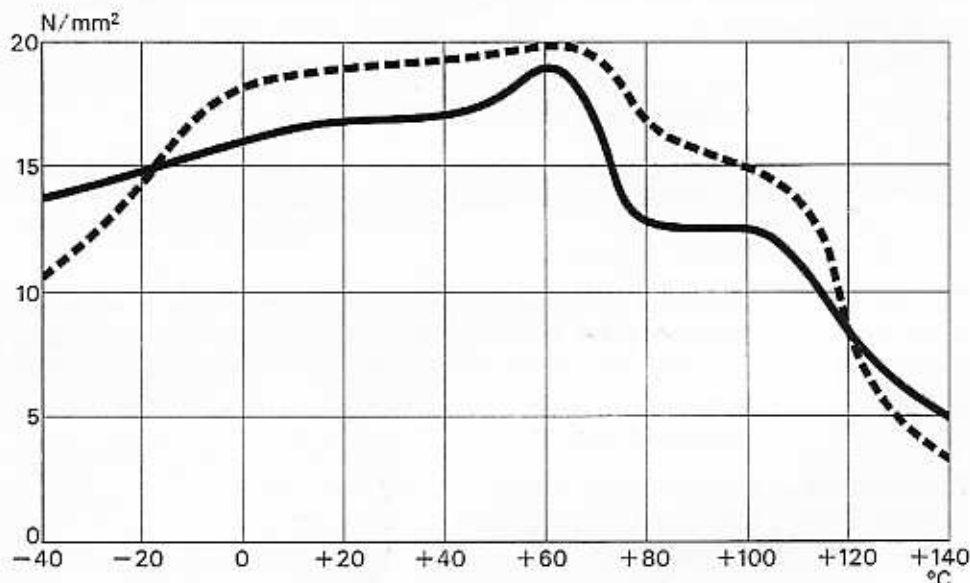
Test: On a tensometer at 23°C, 50% relative humidity, and 15 mm/min (DIN 53283)

Cure temperature °C	Cure time	Shear strength (N/mm ²) Araldite AV 138 M Hardener HV 998	Araldite AV 138 M Hardener HY 2978
5	4 days	11–13	–
15	24 h	12–14	6–7
23	24 h	15–17	14–15
40	16 h	16–18	14–15
80	15 min	19–21	14–16
100	10 min	20–21	15–16

Shear strength vs temperature

Cure: 48 hours at 23°C

Test: specimens held for 10 minutes at temperatures shown



Araldite AV 138 M/Hardener HV 998
 Araldite AV 138 M/Hardener HY 2978

Shear strength of typical metal-to-metal joints

Values determined by testing standard-size specimens made from metals listed.

Cure: 48 hours at 23°C

Test: At 23°C, 50% r.h.

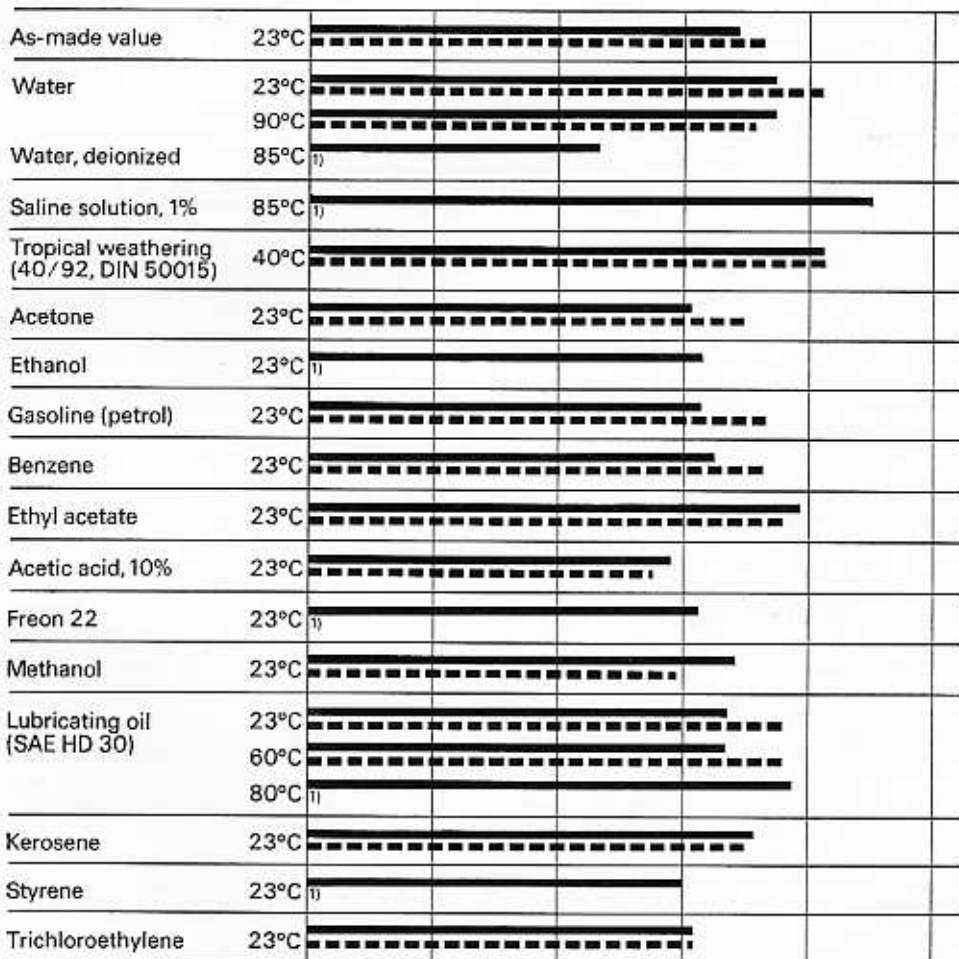
Metal	Sheet thickness mm	Shear strength (N/mm²)
Anticorodal-100B	1.5	17.0 (HV 998), 18.0 (HY 2978)
Steel 37.11	1.0	21.0 (HV 998), 17.0 (HY 2978)
Chrome steel V4A	1.0	20.0 (HV 998), 22.0 (HY 2978)
Galvanized steel*	1.5	18.0 (HV 998), 22.0 (HY 2978)
Copper	1.5	18.0 (HV 998), 17.0 (HY 2978)
Brass	1.5	15.0 (HV 998), 19.0 (HY 2978)

*Degreased but not abraded prior to bonding

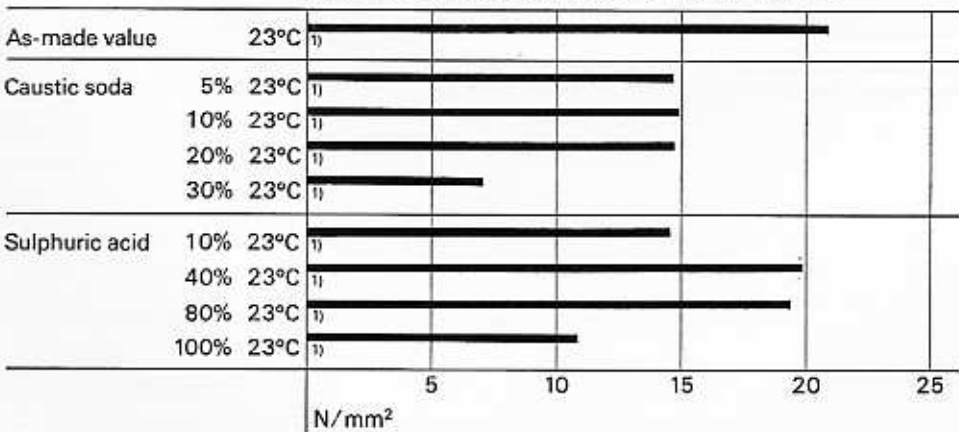
Araldite AV 138 M/Hardener HV 998
 Araldite AV 138 M/Hardener HY 2978

Shear strength vs immersion time in various media



Cure: 48 hours at 23°C
 Immersion time: 90 days
 Test: 23°C, 50% relative humidity



Standard test specimens made of chrome steel V4A



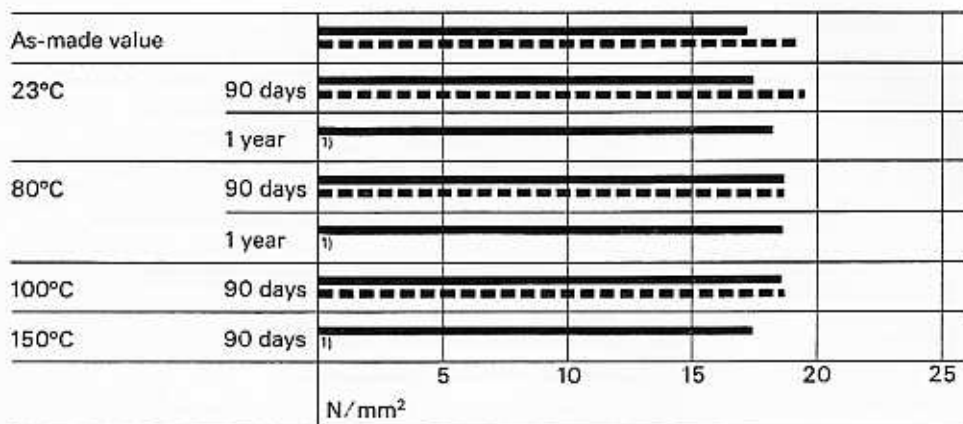
1) Values for Araldite AV 138 M/Hardener HY 2978 not determined

 Araldite AV 138 M/Hardener HV 998
 Araldite AV 138 M/Hardener HY 2978



Shear strength vs heat ageing

Cure: 48 hours at 23°C

Test: At 23°C, 50% relative humidity



¹⁾No values determined for Araldite AV 138 M/Hardener HY 2978

 Araldite AV 138 M/Hardener HV 998
 Araldite AV 138 M/Hardener HY 2978

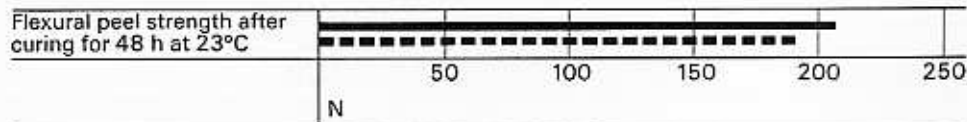
Flexural peel strength (EMPA*)

Test specimens square-section bar, 50×10×10 mm, bonded to centre of a flat-section strip measuring 90×10×2 mm


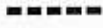
Metal Anticorodal-100B

Pretreatment pickling as described in British specification DTD 915 B

Test At room temperature on flexural test rig (distance between supports 70 mm) with knife edge in contact with flat-section strip; load increased until square-section bar began to peel off; v=10 mm/min.



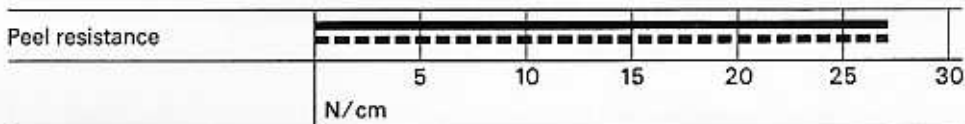
*Eidg. Materialprüfungsanstalt (Swiss Federal Materials Testing Institute)

 Araldite AV 138 M/Hardener HV 998
 Araldite AV 138 M/Hardener HY 2978

Climbing drum peel test (DIN/E 53289)

Test specimens: metal strips measuring 300×25×0.6 mm and 250×25×2.5 mm, bonded together for 200 mm of their length.

Material	0.6 mm aluminium alloy L-72 (cladding material) and 2.5 mm ALCLAD-2040 sheet (similar to Avional-150)
Pretreatment	pickling as described in British specification DTD 915 B
Cure	48 hours at 23°C
Angle of peel	90°
Rate of testing	100 mm/min
Test conditions	23°C and 50% relative humidity



— Araldite AV 138 M/Hardener HV 998
- - - Araldite AV 138 M/Hardener HY 2978

Fatigue test on simple lap joints (DIN 53285)

Test specimens	Bonded metal strips, punched, free of flash, and measuring 100×25×1.5 mm
Material	Anticorodal-100 B
Pretreatment	Strips degreased, joint surfaces abraded lengthwise with emery cloth (No. 100) and degreased with acetone
Overlap	single, 12.5 mm
Resin/hardener system	Araldite AV 138 M/Hardener HV 998
Cure	48 hours at 23°C
Mean static shear strength	13 N/mm ²
Test	Load cycle frequency 95–130 Hz

Fluctuating load as a % of static shear strength	No. of load cycles to joint failure
40	10 ⁵ –10 ⁶
30	10 ⁵ –10 ⁶
25	>10 ⁷

Elastic modulus (VSM 77103)

Araldite AV 138 M/Hardener HV 998:	4000 N/mm ²
Araldite AV 138 M/Hardener HY 2978:	3500 N/mm ²

Coefficient of linear thermal expansion (VSM 77110)

Cure: 48 hours at 23°C
Test: At 18°C to 93°C

Araldite AV 138 M/Hardener HV 998:	67.0 K ⁻¹ · 10 ⁻⁶
Araldite AV 138 M/Hardener HY 2978:	71.6 K ⁻¹ · 10 ⁻⁶

Electrolytic corrosion (DIN 53489)

Test specimens:	25×25×4 mm, cut from cast sheet and edges ground to give parallel faces
Cure:	48 hours at 23 °C
Test apparatus:	Type 1, as specified
Test:	4 days in a conditioning chamber (atmosphere 40/92, DIN 50015)

Araldite AV 138 M/Hardener HV 998: Grade AN 1

Araldite AV 138 M/Hardener HY 2978: Grade AN 1

Treatments to break down cured adhesive

Joints bonded with Araldite can only be broken down by severe heat or prolonged immersion in powerful solvents. Both treatments are harmful to a number of materials.

If an attempt has to be made to break down a joint bonded with Araldite AV 138 M with Hardener HV 998 or HY 2978, the parts should be heated to about 180 °C and then prised apart at this temperature.

Alternatively, the joint can be immersed in either dimethyl formamide or methylene chloride. These chemicals are toxic and flammable. The proper handling precautions should be ascertained and strictly followed.

“Strippers” readily available on the market will dissolve epoxy resins more rapidly, but some of them also corrode metals. Suppliers’ names and addresses can be supplied on request.

Tool and equipment maintenance

Tools and equipment should be cleaned with warm water and soap before adhesive residues have had time to set.

Storage

Araldite AV 138 M, Hardener HV 998 and Hardener HY 2978 each have a shelf life of at least one year – provided that they are stored at 18–25 °C in a dry place and in the sealed original containers.

Handling precautions

Uncured epoxy resins and hardeners are chemicals and must be handled with due care. The precautions which should always be taken are described in detail in “Workshop hygiene for users of epoxy resins.” Copies of this manual will be supplied on request.

Note Hardener HY 2978 has an irritant effect on skin and mucous membranes. Operatives should safeguard their health by wearing protective clothing, especially gloves and safety glasses or goggles. Work areas should be well ventilated, vapours being drawn off by exhaust fans.

Contaminated areas of skin should be washed immediately with soap and hot water. If hardener or resin/hardener mix is splashed into the eyes, these should be bathed without delay in clean water for about 15 minutes, after which a doctor should be consulted.

In addition to various other adhesives, CIBA-GEIGY's range of Araldite products includes:

Araldite products

Casting resins, room-temperature or heat curing, for the manufacture of high-grade insulating and structural components for electrical and mechanical applications, and of components for high voltage, low voltage, and electronic equipment.

Impregnating resins, room-temperature or heat curing, for the impregnation of coil formers and the windings of rotors, stators, high and low voltage equipment, and capacitors.

Laminating resins for the manufacture of glassfibre laminates used in electrical and mechanical engineering, in automotive and aircraft engineering, and in nuclear power and research installations.

Tooling resins for making foundry patterns, and for the construction of tools, tooling aids and fixtures used in forming plastics and sheet metal.

Araldite Engineering Plastics for the manufacture of components for application in electronic, electrical and other equipment.

Detailed literature and information on these and other synthetic resins in our range will be supplied on request.