Nagase ChemteX
NAGASE Group

TECHNICAL INFORMATION SHEET

For Industry

One-component Epoxy Adhesive

EPOXY RESIN XD911

Applications	The bonding of metals, ceramics, many types of plastics and other heat-resistant materials to themselves or to one another.
Method of application	Manually, by spatula or laminating hook, or mechanically, by metering and spreading equipment.
Features	No weighing out or mixing of resin and hardener. Cures at 120-150°C Joints need only be lightly clamped or supported while adhesive sets. Low allergy potential when Properly handled Processing characteristics: good flow and capillary action when hot.
Properties	Very good performance under static and dynamic loading. Very good peel strength. Good aging resistance even under protracted exposure to heat. Good resistance to weathering and chemicals.

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Product data

XD911 : Epoxy resin based on bisphenol A and dicyandiamide

Aspect		-	Beige paste
Viscosity	25°C	mPa·s	92,000
Flash point		°C	Not ignited (solidifies at 120°C)
Specific gravity	25°C	-	1.15
Gelation time	120°C	min	10
	150	s	120
Storage life	5°C-15°C		at least 6 months

* EPOXY RESIN XD911 is best stored dry in a refrigerator in sealed original containers.

Processing

The bonding of metal to metal or to other materials normally presents no difficulties when an EPOXY RESIN adhesive is used. The strongest joints are obtained by paying close attention to the following points.

1. Correct joint design.
   Avoid butt joints. Use socket and lap joints wherever possible.
2. Stress-free fit of the parts to be joined.
3. Pretreatment of the surfaces to be bonded.
4. Use of the appropriate amount of adhesive.
5. Correct curing of the adhesive.
   Above all. Avoid cure at a temperature below the recommended minimum.

Pretreatment of joint surfaces

To obtain strong, durable joints, the surfaces to be bonded must be properly pretreated. All traces of dirt, oil and grease should be removed using a solvent such as acetone. Alcohol, gasoline (petrol) or paint thinners should never be used as degreasing agents.

Maximum bonding strength is achieved by either mechanically abrading or chemically etching the joint surfaces to provide a better key for the adhesive. Mechanical abrading should always be followed by a second, thorough degreasing treatment.

Method of application

This adhesive may be applied with a spatula to the dry, pretreated joint surfaces. If the surfaces are large, a laminating hook of the type utilized when laying up glass fiber laminates, may be used.
A bond line 0.1 to 0.2 mm thick will usually give the best shear strength.

Surfaces adjacent to the joint which are not to be bonded should be protected by applying a thin layer of grease, soap solution, or wax or silicone-based release agent (e.g. QZ13 or QZ11).
The parts being joined should be assembled and clamped in position as soon as the adhesive has been applied. No pressure is required; good, even contact throughout the joint surfaces suffices to ensure proper cure.

Curing method (condition)

Cure temperature(°C)	Minimum cure time (min)
120	60
140	45
160	20
180	10

XD911 will not cure fully at temperatures below 120°C, no matter what cure time is used.

At temperature in the 120-160°C range cure times in excess of those shown will not induce degradation of the adhesive.

The use of cure temperatures in excess of 150°C is not advisable either when joining materials having very different coefficients of linear thermal expansion or, in particular, when joining large components subsequent cooling generates stresses in the bond line.

Properties of the cured adhesive

All figures quoted below are averages. They should be regarded primarily as being indicative of performance and as providing a means of comparison.

Unless otherwise stated, properties were determined by testing standard specimens made by lap-jointing flash-free, punched aluminum alloy strips each measuring 170x25x1.5mm.

Alloy — Anticorodal-100B, a light Al-Mg-Sil alloy made by Schweizerische Aluminum AG

Pretreatment — Strips degreased, joint surfaces abraded long longitudinally with emery cloth (100 grit) and degreased once again with acetone.

Overlap — Single, 10mm

Effect of water and weathering

Large joint surfaces generally are more resistant to water and weathering than small ones, the decisive factor in all cases being the depth to which the joint on bonded joints can be penetrated by moisture collecting on the surface. In some cases, it may be advisable to protect the bondline with a coat of waterproof paint.

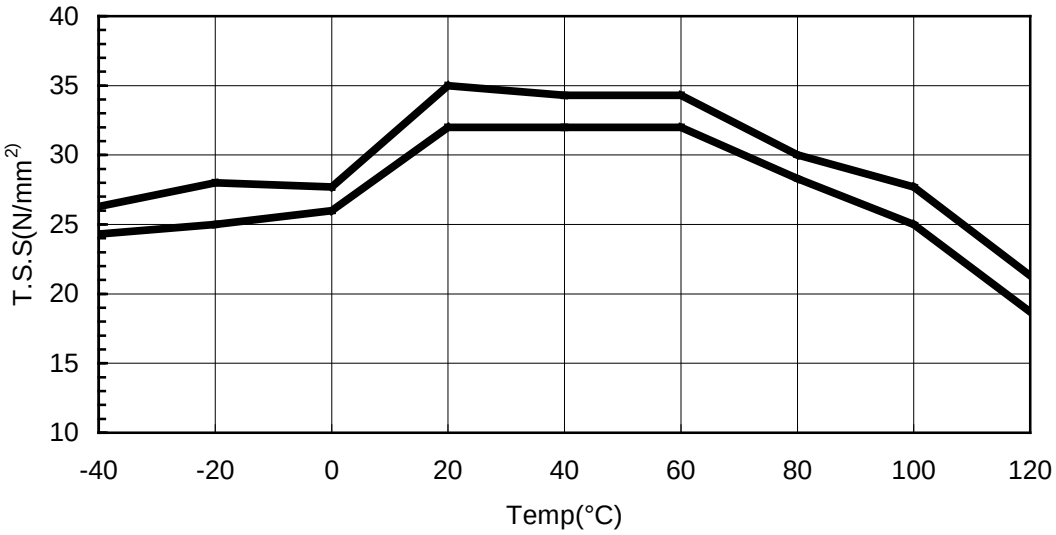
Shear strength versus curing condition

Test carried out at room temperature (23°C/50%R.H.) at a cross-head speed of 15mm/min (DIN53283)

Cure temperature(°C)	Cure time	Shear strength (N/mm^2)
120	45 min	21 - 23
	1 h	21 - 24
	2 h	23 - 24
	4 h	24 - 26
140	30 min	26 - 28
	1 h	27 - 29
	2 h	29 - 31
150	20 min	31 - 33
	30 min	32 - 35
	1 h	32 - 35
160	15 min	29 - 32
	30 min	33 - 34
	1 h	33 - 35
180	10 min	32 - 34
	20 min	33 - 34
	30 min	33 - 35

Shear strength versus temperature

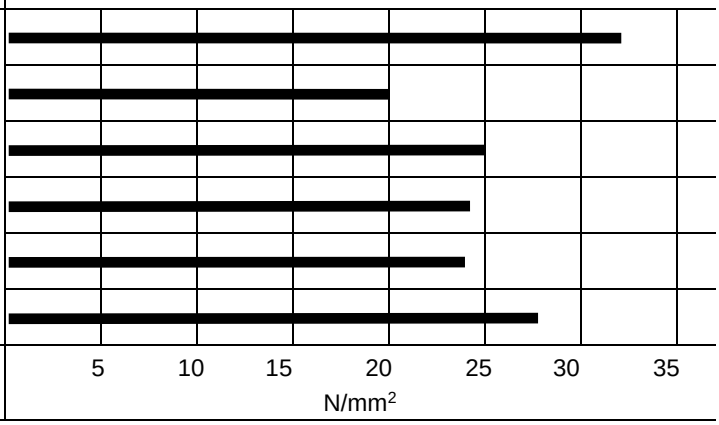
Specimen joints were cured for 30 minutes at 150°C and held for 10 minutes at the temperatures shown prior to testing.



Shear strength of typical metal-to-metal joints

Tests carried out at 23°C, 50% R.H. using lap-jointed standard-size specimens made using metal strip of the types listed. The adhesives were cured for 30 minutes at 150°C.

Metal	Sheet thickness (mm)
Anticorodal-100 B	1.5
Steel 37.11	1.0
Chrome steel V4A	1.5
Galvanized steel	1.5
Copper	1.5
Brass	1.5



Flexural peel strength (EMPA*)

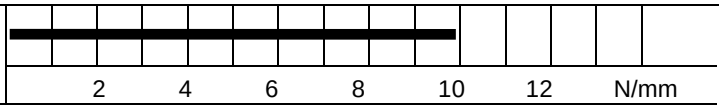
Test specimens	Square-section bar, 50x10x10mm, bonded to center of a strip of alloy measuring 90x10x2mm
Alloy	Anticorodal-100B
Pretreatment	Pickled as laid down by British Specification DTD915B
Test	On flexural test rig (distance between supports 70mm) with knife edge in contact with flat strip. Load increased until square-section bar begins to peel off, V-10mm/min

Flexural peel strength following 30min.	
Cure at 150°C	50 100 150 200 250 300 350

*Swiss Federal Materials Testing Institute

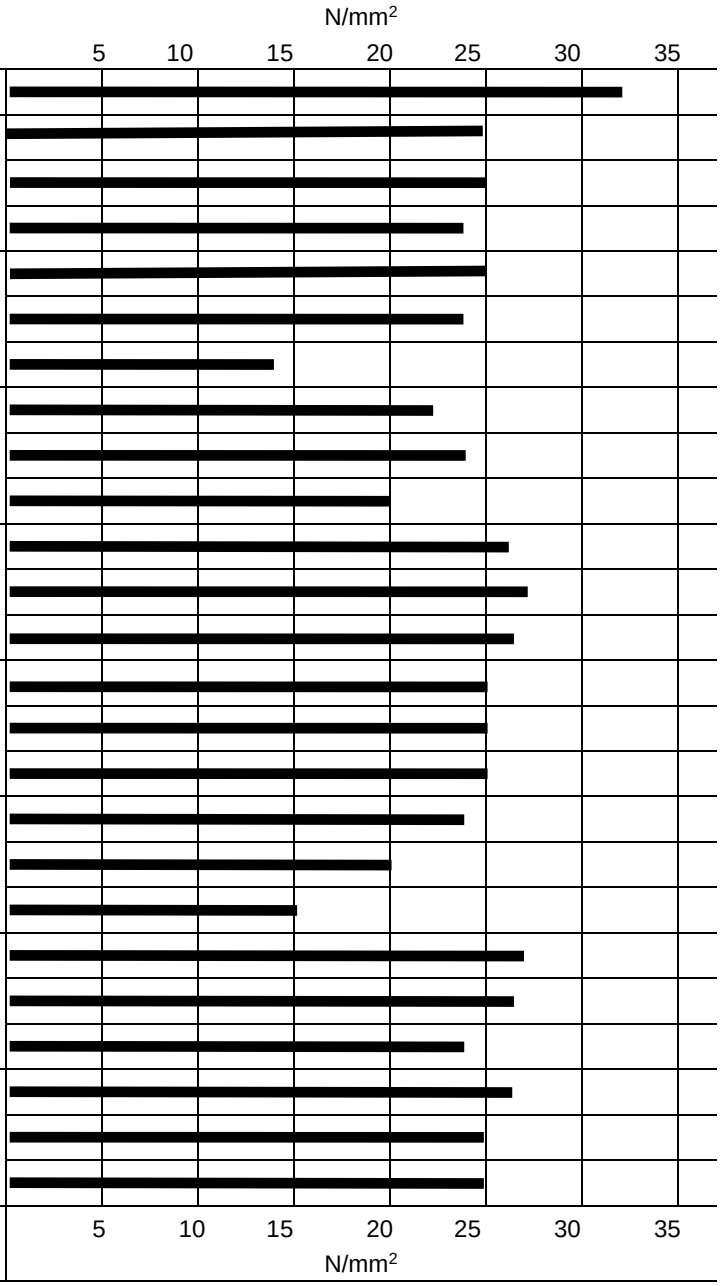
Drum peel test (90°, DTD5577)

Test specimens	Two metal strips measuring respectively 250x25x0.6mm, and 50x25x2.5mm bonded together for 170mm of their length Alloy 0.6mm L-72 aluminum alloy sheet (cladding material) and 2.5mmALCLAD-2040 sheet (similar to Avoional-150)
Pretreatment	Pickled as laid down by British Specification DTD915B
Cure	30 minutes at 150°C
Peel rate	150mm/min
Tested at	23°C, 50% R.H.



Shear strength versus immersion or exposure time in various media

Specimens cured for 30 minutes at 150°C
Test carried out at 23°C , 50% R.H.



Elastic modulus

Determined according to DIN53475 by compressive test
Specimens cured for 30 minutes at 150°C

Elastic modulus	3 GPa

Coefficient of linear thermal expansion

Determined according to VDE304
Specimens : cured for 30 minutes at 150°C

Test	Coefficient of linear thermal expansion(K^{-1})
20°C - 60°C	57×10^{-6}
20°C - 104°C	68×10^{-6}

Electrolytic corrosion

Determined according to DIN53489
Specimens : 25x25x4mm plaques cut from a cast sheet, edges ground to give parallel faces.

Grade : A1

Treatments to break down cured adhesive

Joints bonded with an epoxy adhesive can only be broken down by severe treatments that are harmful to a number of materials.

If an attempt has to be made to break down a joint bonded with XD911, the best approach is to heat the assembled parts to 170-200°C and then pries them apart at this temperature. Adhesive remaining on the joint surfaces can be ground off, burned away, or scraped off after immersion in dimethylformamide.

A joint between heat sensitive materials which are resistant to dimethyl formamide can be broken down by immersion in this solvent. Depending on the joint area it may take several days to achieve the desired effect. This solvent is toxic and flammable ; the proper handling should be strictly followed.

“Strippers” readily available on the market will break down epoxy adhesives rapidly, but some of them will also corrode metals. Suppliers’ names and addresses will be made known on request.

Tool and equipment maintenance

Tools and equipment should be cleaned with hot water and soap before adhesive residues have had time to set. The removal of cured residues is a difficult and time -consuming operation.

If a solvent such as acetone is used to clean tools the appropriate precautions should be observed.
Contamination of the skin is to be avoided.