

APM Epicol 81N

Description	
System:	2-component or 1-component freezer
Art. no.	224002
Colour:	black
Viscosity:	viscous / thixotropic
Solid bodies:	100% / solvent-free
Pot life:	45 minutes
Temp. range:	-55 °C to +85 °C, dense up to +175°C

Specifications	
NASA/ESA outgassing:	< 1% TML
	< 0.05 % CVCM
Biocompatibility:	USP Class VI biocompatible
Fungal resistance:	Class I accepted
MIL specification:	DOD-A-82720 Flexible Epoxy
Directive 2011/65/EC:	RoHS compatible
EC No. 1907/2006:	compliant with REACH

APM Epicol 81N is a flexible epoxy adhesive. The adhesive is available as a 2-component adhesive or as a deep-frozen 1-component adhesive. Typical applications for Epicol 81N include optics for low-tension plastic, metal or glass bonds. It is also known as a "black adhesive" for lenses and prisms with many customers. A thin glue line of 0.15 mm is typical. It can be varied from 0.05 to 1 mm due to its thixotropic properties depending on the dimensions of the parts to be bonded, the temperature range and the difference in thermal expansion. Epicol 81N is often used to adhere plastic or glass displays and as an adhesive and/or potting compound for electronic devices or sensors. The adhesive generally produces excellent results for bonding a wide variety of materials, such as glass, ceramics, metals, wood, concrete, rubber and most plastics.

Properties of fluid adhesive	
Colour of resin	black
Colour of resin component B:	grey
Resin component:	mod. epoxy resin
Hardener component:	mod. amine hardener
Viscosity resin (25°C):	70 - 80 Pa.s
Hardener (25°C)	45 - 50 Pa.s
Mixture (25°C):	40 - 50 Pa.s
Mixture ratio A/B:	5 : 7 part by weight
Mixture ratio A/B:	2 : 3 part by volume
Pot life at 25°C:	45 minutes

Surface pretreatment / cleaning

The surfaces to be bonded must be dry and free from dust, oil, separating agents and other impurities. The selected type of surface treatment depends on the requirements profile (cleanliness, mechanical strength, ageing resistance). Above all, mechanical pretreatment, e.g. grinding or sand-blasting, achieves an improvement in adhesion for metals and in many cases for non-ferrous surfaces as well. It is best to clean glass surfaces using the aqueous ultrasound cleaning method at raised temperature. Clean metallic surfaces with aqueous cleaners or clean solvents.

For these materials and in particular plastics, surface pretreatment using oxygen plasma has proven successful. Plasma treatment dries the surface and improves wettability. This achieves good adhesion of the adhesive. With plastics, the surface is also chemically modified. With poor adhesive plastics this produces an adhesive surface. Primers are no replacement for surface pretreatment. Adhesion and ageing resistance can also be improved by using primers.

Mixing the adhesive components

The two adhesive components are weighed in the clean mixing beakers in the specified mixing ratio. The components must be machine mixed (Speedmixer) or manually without admixing air bubbles. To obtain a perfect mixture, produce between 10 g and 50 g of the mixture and then colour it homogeneously grey after mixing.

Adhesion with deep-frozen mixtures

Remove the deep-frozen adhesive from the deep freeze and allow it to reach room temperature in the air. This requires 5 to 10 minutes depending on the cartridge size. As soon as the cartridge is no longer covered with condensation and the adhesive is fluid, work can start with dosing.

Applying the adhesive

The ideal processing temperature is between 20°C and 28°C. Viscosity falls at higher temperature and pot life shortens.

The adhesive is applied from the cartridge using a dosing device. It can also be applied with a spatula. Optimum mechanical strengths are achieved with adhesive thicknesses of 0.05 – 0.15 mm.

Optimum resistance is dependent on the temperature range and the expansion coefficients of single parts.

A uniform adhesive thickness can be ensured by a specific bond geometry or by inserting spacers, e.g. glass fibres or plastic beads.

The parts are placed together and prevented from slipping during curing by attaching clamps or fixing

Curing the adhesive

Room temperature	25 °C	18 hours
Heating cabinet	40 °C	8 hours
Heating cabinet	60 °C	90 minutes
Heating cabinet	85 °C	15 minutes

After the adhesive is cured, the parts can be further processed. However, the bond only achieves optimum strength and resistance after a few days.

Properties of cured adhesive

Colour:	black	
Shore D (25°C):	55 – 65	
Tensile strength (25°C):	24.0 N/mm ²	
Elongation at rupture (25°C):	70 %	
Modulus of elasticity (25°C):	680 N/mm ²	
Thermal conductivity:	0.40 W/mK	
Therm. Expansion (0-40°C)	± = 100 x 10 ⁻⁶ /K	
	(-40-0°C)	62 x 10 ⁻⁶ /K
	(40-85°C)	172 x 10 ⁻⁶ /K
Softening temperature	25 to 35 °C	
Decomposition temperature:	375°C	
Outgassing values:	TML	0.95 %
	CVCM	0.03%
Dielectric strength:	16.0 kV/mm	
Dielectric constant	25°C:	5.5 at 1.0 KC
	60°C	14.2 at 1.0 KC
Loss factor	25°C:	0,112 at 1.0 KC
	60°C	0,422 at 1.0 KC

Cleaning the adhesive

Residue from non-cured adhesive on the substrates and processing equipment can be removed or cleaned using a solvent such as isopropanol or acetone.

Organic solvents may lead to component destruction or stress cracking in plastics. For this reason, avoid use of aggressive solvents such as acetone, ketones and esthers. Comply with the official safety regulations when handling combustible solvents.

Cured adhesive can only be removed mechanically. The adhesive becomes very soft at temperatures over 100 °C.

Temperature stability

The typical application temperature range is from -55 °C to +85°C. Depending on the application, the adhesive can also be used below -55 °C. The adhesive becomes very hard at these temperatures and may result in cracks in the substrate or signs of the adhesive detaching from the substrate.

At temperatures of +85°C the adhesive becomes very soft, which may be an advantage depending on the load since the adhesive can compensate for a variety of thermal expansion stresses without becoming destroyed. After cooling down to room temperature, the adhesive assumes its usual properties. Thermal destruction of the adhesive only occurs at temperatures over 150 °C.

Tensile shear strength / test temperature

Aluminium, etched / at -	13.5 N/mm ²
Aluminium, etched / at -	13.8 N/mm ²
Aluminium, etched / at	17.2 N/mm ²
Aluminium, etched / at	2.5 N/mm ²

Tensile shear strength / material

Tensile shear strength according to DIN EN 1465 standard shows the excellent adhesion of the adhesive on various substrates:

Tensile shear strength at 23°C

Anodised aluminium	12.8 N/mm ²
Stainless steel	13.1 N/mm ²
Copper	7.2 N/mm ²
Brass	6.0 N/mm ²
NBR on steel	1.5 N/mm ²
ABS plastic	6.8 N/mm ²
PVC plastic	6.5 N/mm ²
Polycarbonate PC	8.0 N/mm ²
Plexiglas PMMA	7.6 N/mm ²
Glass-fibre reinforced polyester	11.4 N/mm ²
Polyphenylene oxide PPO	4.2 N/mm ²

Ageing resistance of adhesive bonds

The typical application temperature range of Epicol 81N is from -55°C to +85°C. Adhesive bonds are very resistant to ageing within this temperature range. The cured adhesive demonstrates excellent temperature stability, humidity ageing resistance and solvent resistance.

Tensile shear strength after ageing

Aluminium, etched / at 23 °C	
after 7 days cured at RT	17.2 N/mm ²
Thermal cabinet 40 days at +70°C	32.1 N/mm ²
Thermal cabinet 40 days at +150 °C	34.0 N/mm ²
50°C / 100% rel. hum. after 15 days	20.3 N/mm ²
50°C / 100% rel. hum. after 30	13.7 N/mm ²
50°C / 100% rel. hum. after 90	10.4 N/mm ²
Stored in water 25°C after 15 days	21.5 N/mm ²
Stored in water 25°C after 30 days	20.3 N/mm ²
Stored in water 25°C after 90 days	14.3 N/mm ²
Hydraulic oil 25°C after 30 days	17.2 N/mm ²
Aliphatic hydrocarbon	22.5 N/mm ²

Deep-frozen cartridges

Processing 2-component adhesives poses risks to bond quality which is not tolerated in certain applications, e.g. space, aviation, electronics or medical technology. The individual components may become crystallised during storage or might separate from the filler; the mixing ratio may be incorrect, the mixture inhomogeneous or air bubbles may become admixed with the adhesive mixture.

All the risks during the mixing process can be avoided if small quantities of adhesive (cartridges up to 55 cm³) are used and the pot life is not too short (> 30 minutes). If the deep-frozen 1-component version of the same adhesive is used, the adhesive components are decrystallized, homogenized, degassed, machine mixed and filled in cartridges without air bubbles. The cartridges can be stored below -40°C from 2 to 12 months without loss of quality.

The adhesion process with deep-frozen cartridges is simple and robust since the adhesive is processed as a 1-component adhesive. Deep-frozen adhesives are used whenever the quality of the bond must be guaranteed and the quantity of adhesive used does not justify use of a 2-component mixing machine.

Compliance

Epicol 81N and all its constituents comply with the requirements of RoHS and REACH guidelines. Always comply with the safety data sheet when handling the adhesive.

Safety instructions

Avoid contact with skin and eyes. When applying the adhesive, always wear gloves and safety goggles. If adhesive comes into contact with the skin, do not use solvents to remove. Instead wash the affected area (hands) with warm water and soap and then dry. Liquid adhesive irritates on contact with the eyes and may lead to permanent eye damage. Before use, please observe the instructions in the safety data sheet.

Storage

The adhesive has maximum shelf life at temperatures between 15°C and 25°C. The shelf life of the two components is at least 24 months under these conditions. Higher temperatures shorten the standard shelf life. Lower temperatures cause a temporary higher viscosity.

Deep-frozen 1-component adhesive (in cartridges) must always be stored at a temperature of below -40°C. At this temperature the mixture has a shelf life of at least 2 months. Never defrost the cartridges, otherwise the pot life is shorter or the adhesive is already cured. As a result the product is always delivered with dry ice at -78°C.

Procurement

The unmixed adhesive is available as a 2-component set of 600 g or as a bipack. The deep-frozen adhesive is available in cartridges of 3 / 5 / 10 / 30 or 55 cc .

Disposal

The liquid components of the adhesive must be disposed of as hazardous waste in the same way as synthetic resin or paint components. Under no circumstances mix large quantities (> 100 g) of the components for curing since the curing process is strongly exothermic and could result in the mixture heating up to a dangerous extent. Cured adhesive is disposed of as hazardous waste in the same way as thermosetting plastics depending on local legal requirements or as domestic waste.

The specifications in this data sheet are based on meticulous tests and our previous experience in everyday practice. They are non-binding instructions, in the same way as our application advisories are also non-binding, whether verbal, in writing or by trials since we cannot accept any liability due to the wide variety of possible influences during processing and application. APM Technica AG disclaims all other explicit or implicit warranties, conditions and terms, be they of real or legal nature, including those which refer to usual market quality, their suitability for a particular use, satisfactory quality or observance of third-party trademarks. APM Technica excludes all liability to the extent permitted by law – whether arising from contract, quasi contract or tort (including negligence) – for direct, indirect and consequential damages, punitive damages awarded by court, loss of business of all kinds, loss of information or data or any other financial losses which may result from the sale, installation, maintenance, use, performance, failure or interruption of operation of the product or in connection therewith, even if we were informed of the possibility of occurrence of such damages. Data and other specifications concerning the nature and suitability of our products are non-binding general conditions and specifically represent no guarantee of certain characteristics. We advise you to perform your own adequate tests to determine the suitability of our products for your specific application. The user is himself responsible for defining the suitability of production methods mentioned in the technical data sheet for his purposes and for taking precautionary measures which are suitable to protect assets and persons from any danger which may occur during the handling and usage of these products. In all other cases our General Terms and Conditions of Business shall apply.