August, 2015

APM Epicol 314015

Description	
System:	2-component or 1-component frozen adhesive
Colour:	transparent
Viscosity:	liquid
Solid bodies:	100% / solvent-free
Pot life:	60 minutes
Curing:	at room temperature or in oven
Temp. range:	-55°C to +85 °C, dense up to +125°C

Specifications	
Refractive index:	1.55
Transmission:	> 95 % above 310 nm
Biocompatibility:	good, no certificate
UL94-Class:	HB
MIL Specification:	none
Directive 2011/65/EC:	RoHS compatible
EC No. 1907/2006:	compliant with REACH

APM Epicol 314015 is a clear low viscosity epoxy adhesive. The adhesive is available as a 2-component room temperature curing adhesive or as a very reactive frozen 1-component adhesive. Epicol 314015 is typically used to bond optics not to implement tension in plastic, metal or glass bonds. Due to its flexibility, high transparency and low shrinkage Epicol 314015 is also used as an optical cement to bond large optical parts as displays and plastic filters. A typical adhesive thickness of 3 – 50 µm to bond materials with different thermal expansion coefficient. Depending on the dimensions of the parts to be bonded, the bonding line can be small, good capillary flow and low viscosity of the adhesive is given. Epicol 314015 is often used to bond plastic or glass displays. The adhesive generally shows excellent results for bonding a wide variety of materials, such as glass, ceramics, metals, and most plastics.

Properties of fluid adhesive	
Colour of resin component A:	transparent
Colour of resin component B:	transparent, yellowish
Resin component:	mod. epoxy resin
Hardener component:	mod. amine hardener
Resin viscosity (25°C):	500 mPa.s
Hardener (25°C)	500 mPa.s
Mixture (25°C):	500 mPa.s
Mixture ratio A/B:	100 : 25 GT
Mixture ratio A/B:	100 : 30 VT
Pot life at 25°C:	60 minutes

Surface pretreatment / cleaning

The surfaces to be bonded must be dry and free from dust, oil, separating agents and other impurities. 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 it must then be absolutely bubble-free 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 strength can be achieved with adhesive thicknesses of 0.03 to 0.10 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.

Curing the adhesive		
Room temperature	25°C	48 hours
Heating cabinet	40°C	12 hours
Heating cabinet	60°C	6 hours
Heating cabinet	85 °C	1 hour

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:	transparent
Shore D (25°C):	25
Tensile strength (25°C):	5.0 N/mm^2
Elongation at rupture (25°C):	60 %
Modulus of elasticity (25°C):	10 N/mm^2
Thermal conductivity:	0.20 W/mK
Therm. expansion (0-40°C)	$\alpha = 100 \times 10^{-6}$/K
(-40-0°C)	50×10^{-6} /K
(40-85°C)	192×10^{-6} /K
Softening temperature T_g:	20 … 30 °C
Decomposition temperature:	> 200 °C
Outgassing values:	> 1% TML
	< 0.1% CVCM
Dielectric strength:	21 kV/mm
Dielectric constant 25 °C:	6.5 at 1.0 KC
60 °C:	8.2 at 1.0 KC
Refractive index:	1.55
Transmission (> 95 %):	above 310 nm

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 200 °C.

Deep-frozen cartridges

Processing 2-component adhesives poses risks to adhesive 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 these risks can be avoided if the mixing process if small quantities of adhesive (up to 55 cm^3 cartridges) 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 for 2 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 314015 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.

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.

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 .