

July, 2015

## APM Epicol 412072

Description	
System:	2-component or 1-component freezer adhesive
Colour:	black
Viscosity:	viscous / thixotropic
Solid bodies:	86% / contains traces of toluene
Pot life:	60 minutes
Curing:	at room temperature or in oven
Temp. range:	-55°C to +125°C, dense up to +180°C

Specifications	
APM number:	412072
NASA/ESA outgassing:	< 6 % TML
	< 0.5 % CVCM
Fungal resistance:	Class III not accepted
MIL Specification:	MIL-S-8802 Version E
Directive 2011/65/EC:	RoHS compatible
EC No. 1907/2006:	compliant with REACH

APM Epicol 412072 is a very flexible polysulphide adhesive which cures at room temperature. The adhesive is available as a 2-component adhesive or as a deep-frozen 1-component adhesive. APM Epicol 412072 is frequently used instead of silicones if contamination with silicone oil (dimethylsiloxane) is unacceptable. Polysulphides have excellent adhesion on many materials. Good adhesion with the use of primers and enhanced moisture impermeability (compared to silicone) mean that it is suitable for use as a low tension adhesive in the optics industry. A thin glue line of 0.10 mm is typical. It can be varied from 0.05 to 0,3 mm due to its thixotropic properties depending on the dimensions of the parts to be bonded, the temperature range of the application and the difference in thermal expansion. Epicol 412072 never fogs optical devices or sealed products even if they are in close proximity and is therefore suitable as a flexible adhesive for optical modules.

Properties of fluid adhesive	
Resin component:	Polysulphide resin
Hardener component:	Manganese dioxide
Colour of resin component A:	beige
Colour of resin component B:	black
Adhesive mixture:	black
Mixture viscosity (25°C):	30 – 50 Pa.s
Mixture ratio A/B:	100 : 10 parts by wght.
Pot life at 25°C:	60 minutes
Density:	1.50 g/cm <sup>3</sup>

Surface pretreatment / cleaning
The surfaces to be bonded must be dry and free from dust, oil, separating agents and other impurities. The type of surface pretreatment depends on the requirements profile. Above all, mechanical pretreatment, e.g. grinding or sand-blasting, achieves an improvement in adhesion for metals and in many cases for non-metallic surfaces as well. Glass surfaces and metallic surfaces can be cleaned 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 is an advantage for good adhesion of the adhesive. With plastics, the surface is also chemically modified. With poor adhesive plastics this produces an adhesive surface.

### 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.

### 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. Epicol 412072 should be used as far as possible as a deep-frozen adhesive since the mixing ratio is 100:10 and the hardener dries out when the container is opened. Deep-frozen adhesive contains no air bubbles, which is a frequent cause of problems with hand-mixed adhesives.

### 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 0.05 to 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 devices.

### Curing the adhesive

Room temperature	25°C	72 hours
Heating cabinet	40°C	12 hours
Heating cabinet	60°C	3 hours
Heating cabinet	85°C	30 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 A (25°C):	35
Tensile strength (25°C):	2.0 N/mm <sup>2</sup>
Elongation at rupture (25°C):	200 %
Modulus of elasticity (25°C):	3.5 N/mm <sup>2</sup>
Softening temperature T <sub>g</sub> :	- 51°C
Therm. expansion:	50 x 10 <sup>-6</sup> /K
Decomposition temperature:	320 °C
Outgassing values:	< 6 % TML
	< 0.5% CVCM
Tensile shear strength (25°C):	1.5 N/mm <sup>2</sup>
Peel strength (25°C):	3.5 N/mm
Thermal conductivity:	0.20 W/mK
Decomposition temperature:	320 °C
Solvent resistance:	petrol / alcohols

### 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. When bonded parts are placed in acetone or xylene, the adhesive swells strongly and it can then be easily removed.

### Temperature stability

The typical application temperature range is from -55 °C to +125°C. Depending on the application, the adhesive can also be used below -55 °C. The adhesive becomes hard at these temperatures and may result in cracks in the substrate or signs of the adhesive detaching from the substrate. At temperatures of +125°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 scenarios without destroying the bond. After cooling down to room temperature, the adhesive assumes its usual properties. Thermal destruction of the adhesive only occurs at temperatures over 180°C.

### Ageing resistance of adhesive bonds

The typical application temperature range of Epicol 412072 is from -55°C to +125°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.

### 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 these risks can be avoided if the mixing process if small quantities of adhesive (up to 55 cm<sup>3</sup> 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. These cartridges can be stored for at least two months below -40°C or for at least six months below -60°C 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 412072 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 12 months under these conditions. A higher temperature shortens the shelf life.

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.

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 silicone is available as a 2-component set of 550 g. 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 should you 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.