



Plastic Bonding

Requirements,
Adhesives, Applications

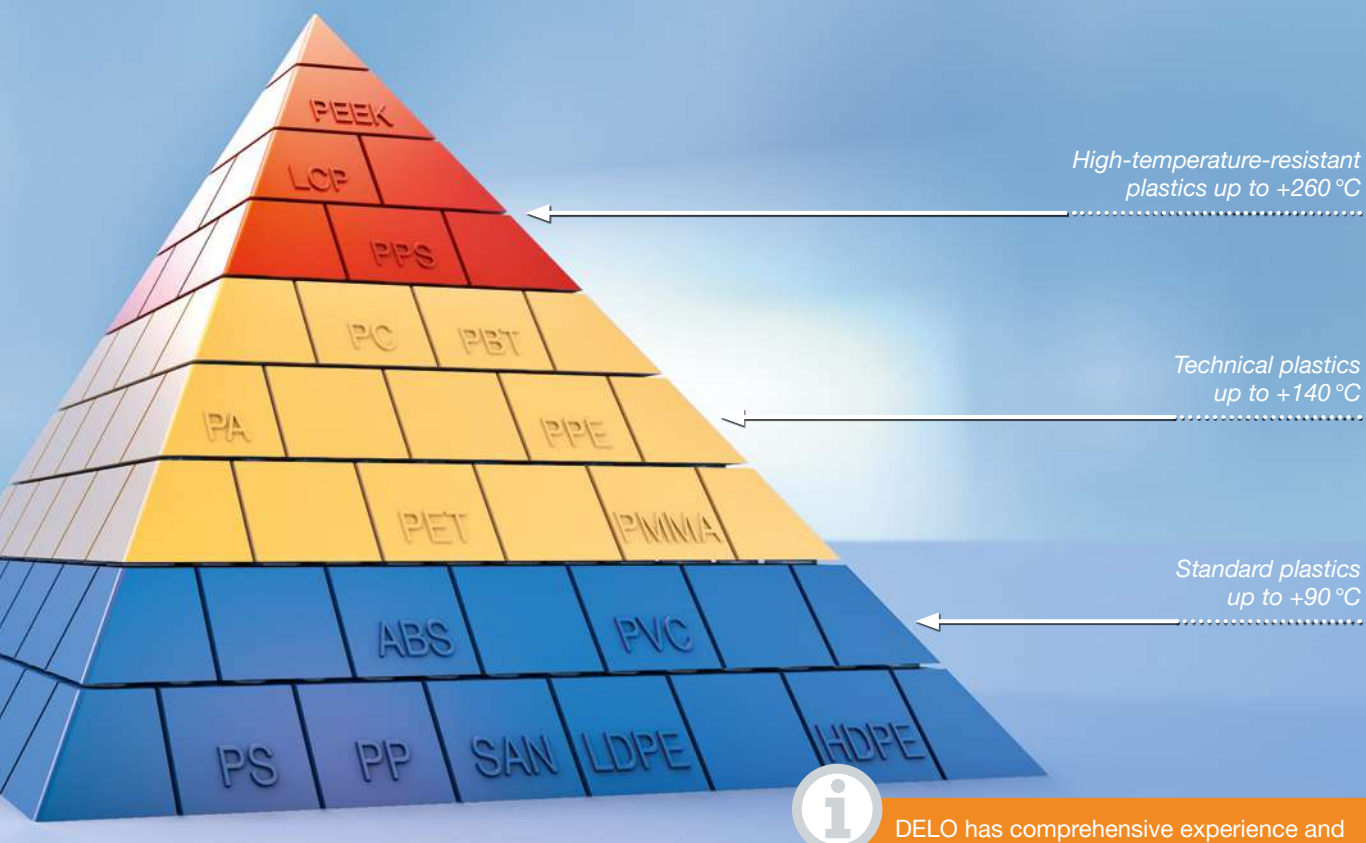
Bondability of plastics



| | DELO PHOTOBOND 1C acrylate | | | DELO KATIOBOND 1C epoxy resin | | DELO DUALBOND 1C adhesive | | | |
|---|--|-------|-------|----------------------------------|------|------------------------------|-------|-------|--------|
| | 4494 | AD494 | PB437 | 4552 | 4594 | AD4950 | AD465 | AD345 | LT2216 |
| ABS | +++ | ++ | +++ | ++ | + | +++ | ++ | +++ | +++ |
| CFRP | +++ | + | +++ | +++ | +++ | ++ | +++ | +++ | +++ |
| FR4 EGS619* | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ |
| LCP Vectra E130i* | + | + | + | ++ | ++ | + | + | + | ++ |
| PA Sustamid 6* | +++ | ++ | +++ | +++ | +++ | ++ | +++ | - | +++ |
| PBT Pocan 3235* | - | + | - | + | + | - | + | ++ | ++ |
| PC | +++ | +++ | +++ | +++ | +++ | ++ | +++ | +++ | +++ |
| PC-ABS Bayblend T65* | +++ | ++ | ++ | ++ | + | +++ | ++ | +++ | +++ |
| PET* | + | + | + | ++ | ++ | + | + | ++ | ++ |
| PMMA | ++ | ++ | + | ++ | ++ | + | ++ | - | +++ |
| PPS Fortron 6165A4* | +++ | ++ | +++ | +++ | +++ | + | ++ | ++ | +++ |
| Plastics that are difficult to bond: POM, PP, PTFE | Additional surface pretreatment (see page 6) can improve the bondability of plastics that are difficult to bond. | | | | | | | | |

Initial compression shear strength on cleaned but not pretreated surfaces

- 0 to 4 MPa
- + 5 to 9 MPa
- ++ 10 to 14 MPa
- +++ 15 MPa and up
- n. d. not determined



i DELO has comprehensive experience and expertise in plastic bonding. In tests performed by DELO's Engineering, pure plastic bonds and mixed plastic bonds achieve excellent results.

| SJ2718 | DELO-ML 1C methacrylate | | DELO MONOPOX 1C epoxy resin | | | DELO-DUOPOX 2C epoxy resin | | | | DELO-PUR 2C polyurethane | |
|--------|----------------------------|-------|--------------------------------|-------|--------|-------------------------------|-------|-------|--------|-----------------------------|-------|
| | DB133 | DB135 | GE2710 | LT204 | LT2238 | 02 rapid | AD840 | AD895 | SJ8665 | 9694 | AD948 |
| +++ | +++ | - | +++ | ++ | +++ | ++ | ++ | +++ | n.d. | ++ | ++ |
| +++ | +++ | +++ | +++ | n.d. | +++ | +++ | +++ | +++ | +++ | +++ | +++ |
| +++ | +++ | + | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ |
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| +++ | - | - | +++ | +++ | +++ | + | +++ | +++ | n.d. | +++ | +++ |
| +++ | + | - | ++ | ++ | ++ | + | ++ | +++ | n.d. | +++ | +++ |
| +++ | +++ | - | +++ | +++ | +++ | - | +++ | +++ | n.d. | ++ | +++ |
| +++ | +++ | +++ | +++ | +++ | +++ | ++ | +++ | +++ | n.d. | + | ++ |

* The compression shear strength of these plastics is greatly improved by surface pretreatment, e.g. atmospheric or low pressure plasma – see page 6/7.

AD = ADhesive
DB = Dual Bonding
GE = General Encapsulant
LT = Low Temperature
PB = PHOTOBOND
SJ = Structural Joining



DELO's adhesives for plastics...

... are ideal for various applications and requirements:

Plastic bonding enables the permanent and reliable joining of plastics that cannot be welded. In addition, it is possible to bond plastics with materials like metal, ceramic or glass. Depending on the requirements, the individual joints can be designed to be flexible, tension-equalizing, rigid or resistant to high mechanical stress. DELO has adapted its adhesive range to a variety of requirements and application areas by developing special plastic adhesives:



DELO KATIOBOND

- Fast light activation/curing within seconds
- Suitable for opaque materials
- Dry surface
- Excellent media and temperature resistance
- Low outgassing



DELO PHOTOBOND

- Fast UV/light curing within seconds
- For joins with high requirements in terms of visual appearance
- Good climatic and humidity resistance
- Available elasticities range from flexible to hard
- Universally good adhesion to many materials
- Broad range of properties



DELO DUALBOND

- Fast light curing combined with reliable curing in shadowed areas (by heat or humidity, depending on the product)
- Ideal for plastics with low temperature resistance
- Good resistance to climatic changes, humidity and salt spray test
- Available elasticities range from flexible to hard



DELO-ML DB

- Anaerobic-curing and, depending on the product, fast UV or light curing within seconds
- For mixed bonds of metal with certain plastics
- Good media and temperature resistance



DELO-DUOPOX

- Especially for very large or temperature-sensitive components
- Easy, “one-component” handling with the DELO-AUTOMIX system
- High media resistance
- Suitable for bonding components with high strength requirements



DELO MONOPOX

- For high-strength bonding
- Very good media resistance
- Wide temperature range of use: -40 to +220 °C
- Easy, one-component handling



DELO-PUR

- Easy, “one-component” handling with the DELO-AUTOMIX system
- For peel-resistant and tension-equalizing joints
- Very good strength
- Suitable for large gaps



All products are solvent-free and compliant with the RoHS Directive 2015/863/EU.



Many products are halogen-free acc. to or by the criteria of IEC 61249-2-21. Details can be found in the Technical Data Sheet.

Surface pretreatment...



The “BOND it – Reference Book on Bonding Technology” provides a comprehensive overview of pretreatment methods.

DELOTHEN cleaning agents

For degreasing the surface and the removal of contaminants. DELOTHEN cleaning agent is sprayed directly onto the surface to be cleaned from a distance of

20 – 30 cm. After thorough cleaning with a lint-free cloth, the adhesive can then be applied.

Physical-chemical pretreatment

Atmospheric pressure plasma

For fully automated in-line processes. Ionized air is generated by means of high voltage. When it contacts the surface, it reacts with the plastic, increases its polarity and improves adhesive wettability.

Low pressure plasma

Also for components with complex geometries (undercuts, boreholes, slots) and bulk materials. Reactive gases are inserted into an evacuated vacuum chamber, and ionized by energy supply. The activated gases react with the plastic surface and improves adhesive wettability.

DELO-SACO blasting technique

Simultaneous abrasion (**S**And blasting) and **CO**ating of the surface.

- For preparing difficult to bond materials
- Enables excellent bond strength and aging resistance



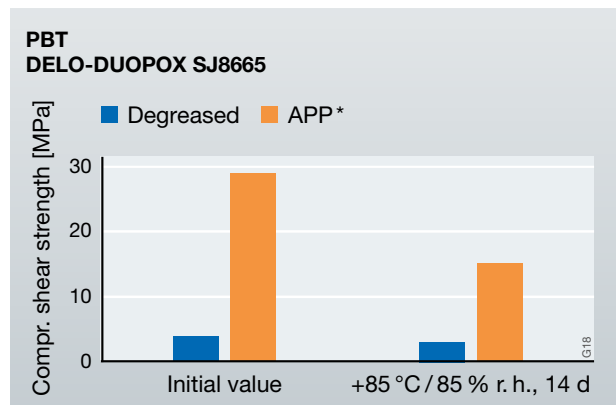
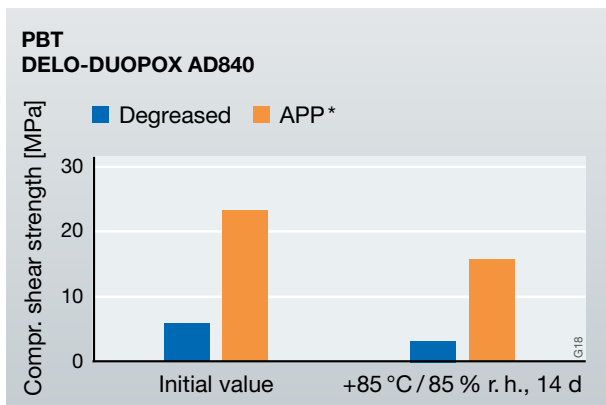
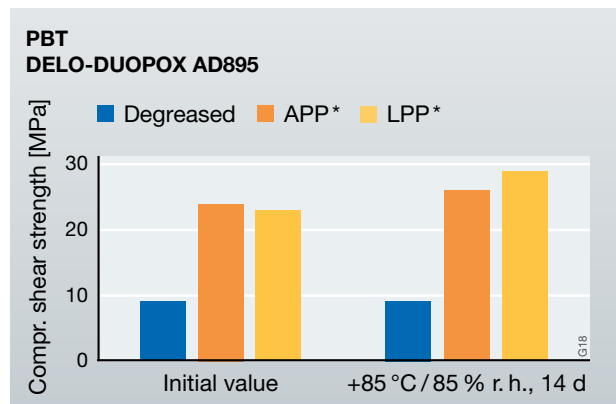
In comprehensive tests conducted in DELO's laboratories, many of our standard adhesives were tested with these pretreatment methods to determine their aging behavior. Our Engineering will be pleased to answer all of your questions!



... for improved bond strength

Influence of pretreatment on bond strength

In general, atmospheric or low pressure plasma can significantly increase bond strength, especially with semi-crystalline plastics like PBT, PA and PPS. Even after storage in humid climate, the adhesive achieves strength levels that are up to four times higher than without pretreatment.



* APP = Atmospheric pressure plasma
LPP = Low pressure plasma

DELO adhesives in use

Sensor casting

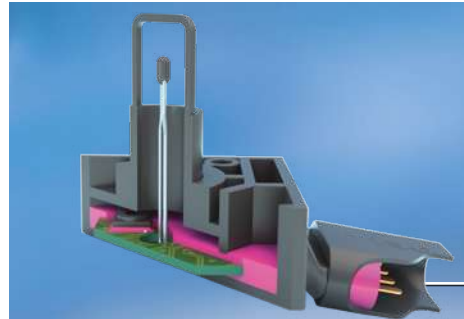
2C epoxy

20 min @ 150 °C

20 Pas viscosity

PA 6.6 GF30/FR4/Cu
DELO-DUOPOX CR8720

- High temperature resistance
- Excellent media resistance (e.g. to gasoline, diesel, oil, grease)
- Normal temperature range of use from -40 °C to +200 °C
- Universal adhesion to standard substrates (e.g. FR4, PA, PPS, Al, Cu)
- Excellent flow properties for easy dispensing and short cycle times



Casting an automotive pressure sensor



Casting a sensor PCB

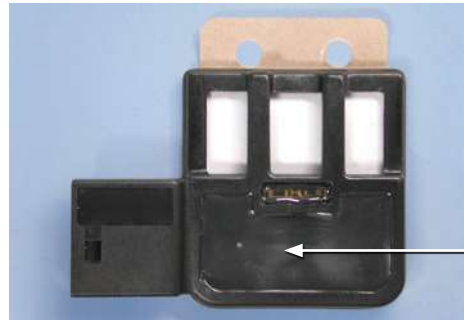
2C polyurethane

1.5 h initial strength

80 Pas viscosity

PBT/FR4
DELO-PUR 9691

- Tough-elastic
- Normal temperature range of use from -40 °C to +125 °C
- High static/dynamic loading capacity
- Flowable, suitable for small castings
- Easy processing from DELO-AUTOMIX cartridges
- Successfully tested by the criteria of UL 94 HB



Casting the PCB of a window hygrometer

Vibration protection on PCBs

2C polyurethane

5.5 h initial strength

pasty viscosity

FR4/Al lacquered
DELO-PUR 9895

- Run-resistant
- High static/dynamic loading capacity
- Functionality: Optimal vibration damping
- Multi-purpose
- Easy processing from DELO-AUTOMIX cartridges
- Successfully tested by the criteria of UL 94 HB



Vibration protection of soldered electronic components, such as capacitors

Casting electronic connectors

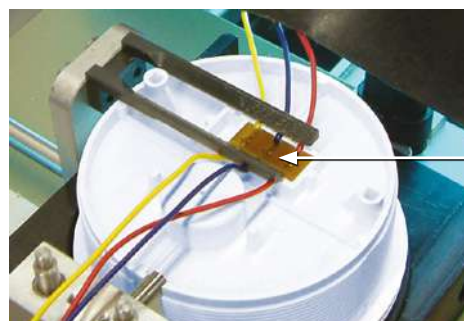
1C epoxy

15s

1.2 Pas viscosity

PBT
DELO KATIOBOND 4552

- High glass transition temperature T_g
- Good flow behavior
- Production capacity: Short cycle times thanks to very fast curing within seconds
- Suitable for rigid bonding and sealing



Casting and sealing soldered connector contacts in the cavity of indication instruments

AD = Adhesive

CR = Casting Resin

FB = Fastener Bonding

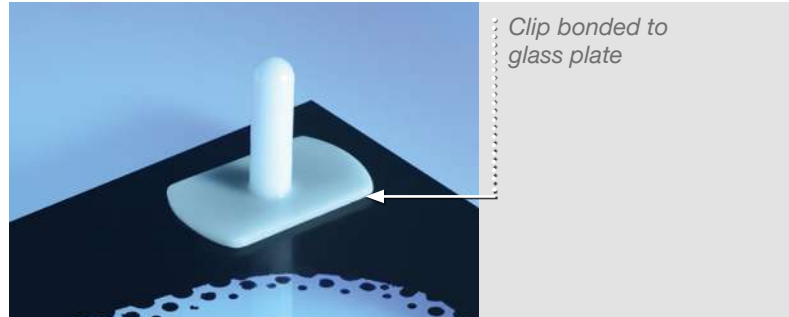
UB = Universal Bonding

Positioning clip for car windows



**PC/ABS opaque/
ceramic black screen print
DELO PHOTOBOND AD494**

- Gap-filling
- High long-term and media resistance
- Excellent equalization of tensions with an elongation at tear of 310 %
- Fast curing, even through components that are difficult to transmit through

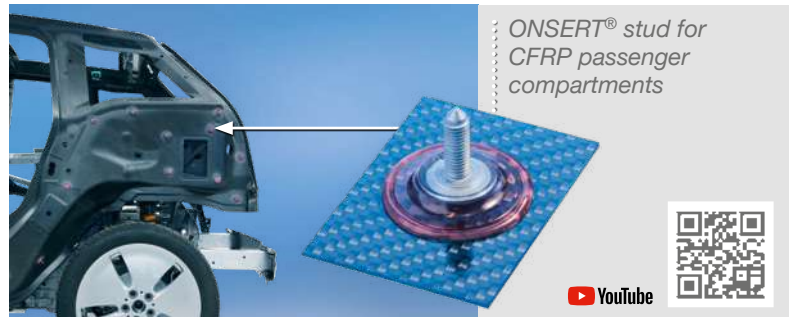


Bonding ONSERT® fasteners



**CFRP/PA/PC
DELO PHOTOBOND FB4175**

- Good peel resistance
- Good adhesion to plastics (e.g. PA), fiber-reinforced plastics (CFRP) and metals
- Longer lifetime: Excellent resistance to temperature, climatic changes and humidity
- Production capacity: Short cycle times thanks to very fast curing within seconds

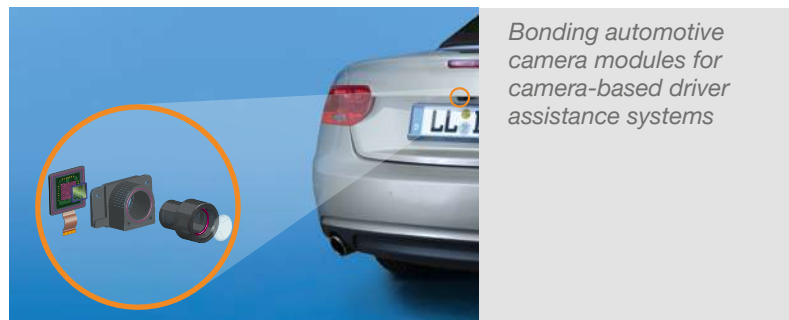


Bonding automotive cameras



**PBT
DELO DUALBOND AD345**

- Good resistance to temperature, climatic changes, humidity and in salt spray testing
- Short cycle times with light fixation in < 1 s
- Optimized process: Heat curing at just +80 °C enables the use of temperature-sensitive materials and retains the alignment of the optical system
- Process reliability: Unchanged, low shrinkage allows high yield

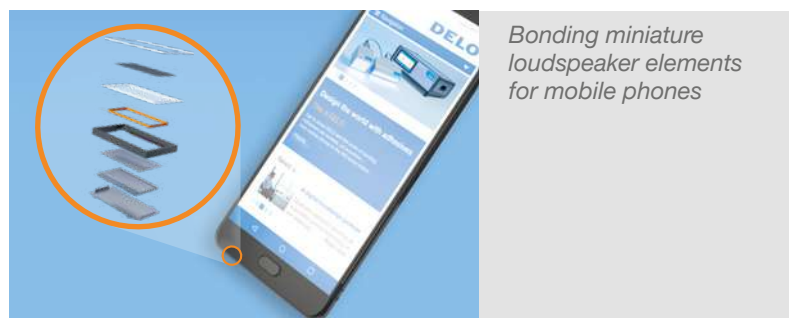


Bonding miniloudspeakers



**PC/PAR/PA/PBT/PEEK
DELO PHOTOBOND UB4086**

- Temperature range of use up to +150 °C
- High temperature stability
- High impact resistance and flexibility
- Production reliability: Application control by fluorescent adhesive
- Quality: Loudspeakers bonded with DELO PHOTOBOND are characterized by excellent acoustic quality



DELO adhesives in use

Sealing microswitches

mod. 1C
acrylate



2 Pas
viscosity

PA/metal pin (tin- or silver-plated)
DELO DUALBOND GE4910

- Excellent flow and wetting behavior
- Reliable curing in shadowed areas
- Tension-equalizing
- High flexibility, even at low temperatures
- Production capacity: Short cycle times thanks to very fast curing within seconds
- Longer lifetime: Resistance to humidity and thermal shock



Sealing switches,
e. g. for the automotive
industry



Sealing contacts of push buttons

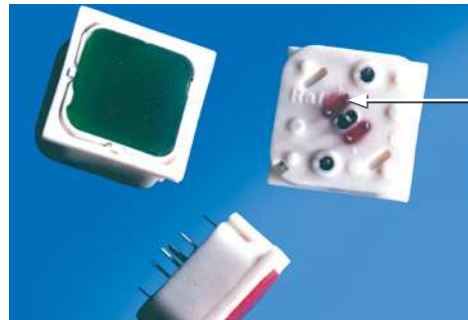
1C
epoxy



24s
1.5 Pas
viscosity

PBT/CuNi (tin-plated)
DELO KATIOBOND KB554

- Tension-equalizing, even under great temperature fluctuations
- Production capacity: Short cycle times thanks to very fast curing within seconds
- High thermal resistance during typical soldering processes



Sealing soldered
contacts for push
buttons

Bonding design light switches

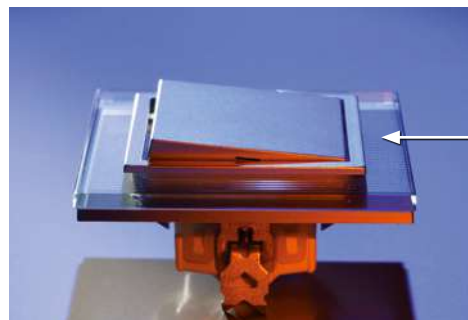
1C
acrylate



40s
0.1 Pas
viscosity

PC/glass
DELO PHOTOBOND 4302

- Excellent capillary properties
- High transparency, yellowing resistance and permanent resistance to light
- Especially developed for visible interior bondings
- High strength



Bonding the glass front
of design light switches
onto PC

Laminating organic solar cells

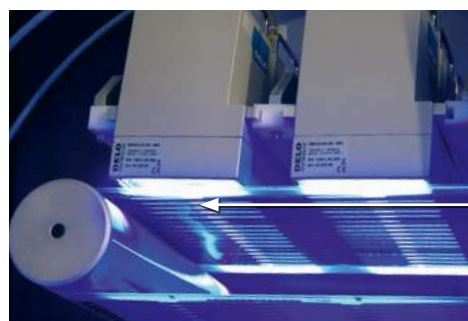
1C
epoxy



16s
10 Pas
viscosity

PET/OPV
DELO KATIOBOND LP655

- Good wet strength
- Suitable R2R applications (reel-to-reel)
- High barrier effect towards water vapor (= low WVTR)
- No interaction with the OPV layer (OPV = organic photovoltaics)



Laminating the OPV
structure between two
barrier foils,
curing by means of an
array of DELOLUX 20
LED area lamps

DB = Dual Bonding

GE = General Encapsulant

KB = KATIOBOND

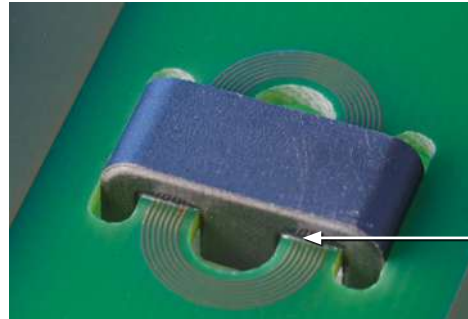
LP = Low Permeation

Ferrite bonding on a PCB



Ferrite / FR4 DELO-ML DB136

- Normal temperature range of use from -60 °C to +180 °C
- Tension-equalizing
- Immediate initial strength (after 5 s) with light fixation; anaerobic curing of the adhesive in shadowed areas
- Process reliability: Application control with fluorescent adhesives
- Successfully tested by the criteria of UL 94 HB



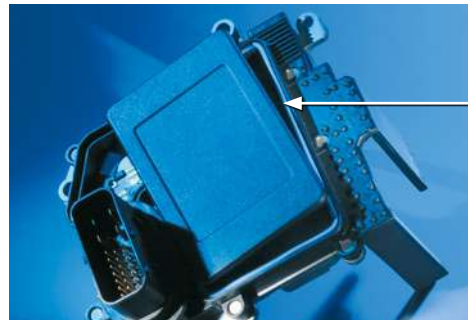
Bonding ferrite elements to an FR4 PCB

Bonding a cover and housing



PBT / PBT DELO MONOPOX GE2710

- Good media resistance (e.g. to oil, gasoline)
- Very high resistance to temperatures and temperature fluctuations
- Excellent vibration resistance
- Multi-purpose for various plastics (e.g. ABS, PA, PBT)



Bonding a cover to the housing of an automotive control unit

Bonding a display plate into a housing



PC / aluminum (lacquered) DELO-DUOPOX 02 rapid

- Very good flow properties
- Good equalization of tensions at temperature changes from -30 °C to +70 °C
- Easy processing, even at manual workstations, thanks to the DELO-AUTOMIX system
- Successfully tested by the criteria of UL 94 HB



Bonding a display plate made of PC into a powder-coated aluminum housing

Bonding camera housings



PC / PC DELO-PUR 9694

- Good resistance to climatic changes
- Reliable sealing, e.g. against water and other media
- Excellent results also with PA, ABS, PBT and PET
- Good adhesion, even without pretreatment
- Successfully tested by the criteria of UL 94 HB



*Bonding / sealing an automotive camera housing
Adhesive applied into the groove*

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