

Bonding in Electronics

Design Examples
and Product Range

Bonding and fixing

Bonding of stator to housing



DELO-ML DB135

- Very high impact resistance
- Excellent media resistance (for example to oil, gasoline, Diesel)
- Normal temperature range of use up to +180 °C
- Tension-equalizing: High-strength bonding of metals with dissimilar coefficients of expansion
- Immediate initial strength by light fixation; anaerobic curing of adhesive in shadowed areas



Bonding of a steel stator to an aluminum housing (© ebm-papst)

Bonding of magnets to stator



DELO MONOPOX AD295

- Excellent media resistance
- Very high temperature stability
- High static and dynamic loading capacity even at elevated temperatures
- Ideal for bonding metals, temperature-resistant plastics, ferrite and ceramic
- Is used in all motors produced by the DLR (German Aerospace Center)



Magnets bonded to a stator of space motors (© DLR) for the ISS International Space Station (© NASA)

Bonding of rotor to shaft



DELO-ML DB133

- High impact resistance
- Excellent media resistance
- Tension-equalizing with an elongation at tear of 130 %
- Ideal for laminar bonding
- Immediate initial strength by light fixation; anaerobic curing of adhesive in shadowed areas



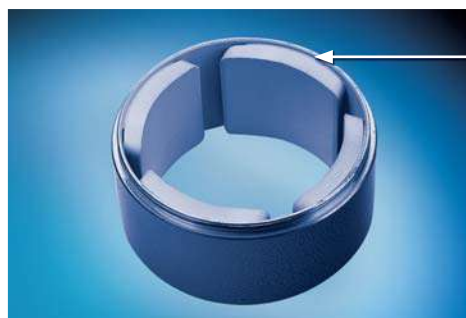
High-strength bonding of a rotor package to a shaft

Bonding of magnets into stator housing



DELO MONOPOX AD289

- High impact resistance
- Gap-filling
- Excellent media resistance (for example to oil, gasoline, brake fluid)
- Normal temperature range of use up to +200 °C
- High static and dynamic loading capacity



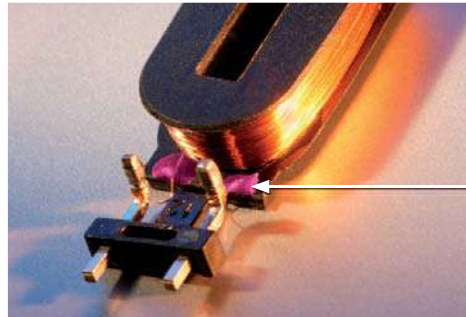
Bonding of magnets into the stator housing of an electric motor

Fixing of coil wires



DELO PHOTOBOND 4497

- Dry surface
- Tension-equalizing with an elongation at tear of 200 %
- Functionality: Additional mechanical protection, for example during vibration or subsequent molding



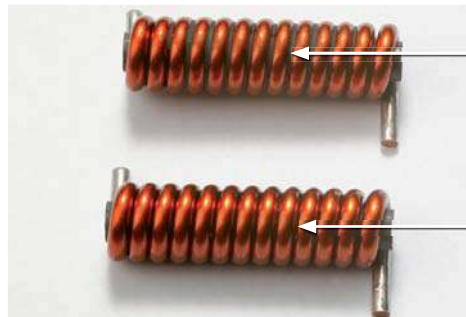
Fixing of coil wires of coil carriers (adhesive colored magenta to indicate the bonding area)

Fixing of ferrites in coils



DELO MONOPOX 6093

- Excellent flow behavior: Adhesive capillates through the windings
- Outstanding adhesion to lacquered coil wire and ferrite
- Process reliability: Reliable fixing for further processing during the assembly process
- Also suitable for potting



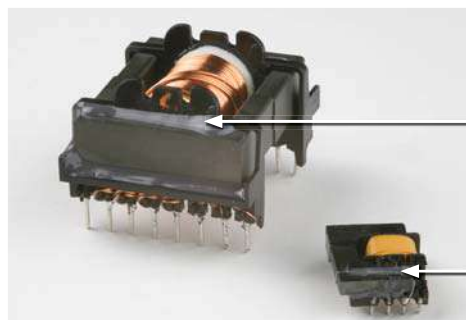
Fixing of ferrites in coils
 Top: Shorter after application, the adhesive is still visible
 Bottom: The adhesive capillates through the windings

Fixing of ferrites and coil bodies



DELO-DUOPOX FR898

- High-strength construction adhesive
- Excellent media resistance
- Quality: Good strength of the assembly during mechanical stress
- Functionality: Reduction of mechanical vibrations and associated noise development
- Multi-purpose
- Easy processing from DELO-AUTOMIX cartridges
- UL 94 V-0, E467212 (Yellow Card)



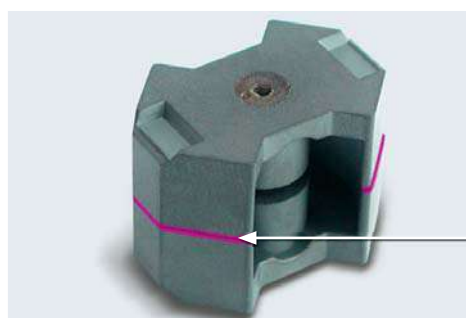
Fixing of ferrites and coil bodies

Bonding of ferrites



DELO-ML 5327

- Temperature range of use from -60 °C to +200 °C
- Accelerated initial strength in less than 20 s with DELO-QUICK activator
- High strength: Component failure in mechanical test
- Functionality: Excellent vibration resistance and damping



Fast and reliable bonding of ferrite cores (adhesive colored magenta to indicate the bonding area)

Bonding and fixing

Bonding of coils

1C epoxy

15 min @ 180 °C

pasty viscosity

DELO MONOPOX AD297

- Run-resistant
- Tough-hard
- Normal temperature range of use up to +200 °C
- Good strength on laminated copper foil and aramid foil
- High stability and strength even upon high magnetic forces



Bonding of coils for CERN high current transformers

Top: Adhesive between the copper windings and the foil

Bottom: Fixture of the coil body on the aluminum cooling plate

Vibration protection on PCBs

2C polyurethane

2h initial strength

pasty viscosity

DELO-PUR 9694

- Run-resistant
- High static and dynamic loading capacity
- Functionality: Optimal vibration damping
- Multi-purpose
- Easy processing from DELO-AUTOMIX cartridges



Vibration protection of soldered electronic components, for example capacitors

Securing of soldered contacts

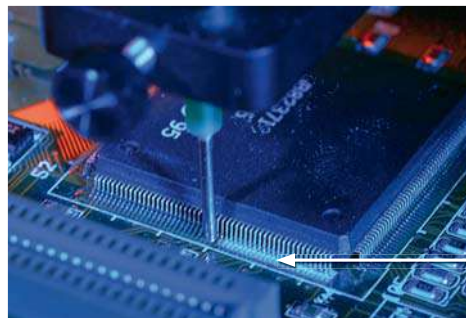
1C epoxy

22s

32 Pas viscosity

DELO KATIOBOND 45952

- High peel resistance
- High corrosion resistance
- Perfect solution: Preactivation enables bonding of opaque components
- Production reliability: Application control by fluorescent adhesive
- Prolonged lifetime: Reliable protection from desoldering and shocks



Securing of soldered contacts of electronic components, such as CSP or QFP

Fixing of SMD components

1C epoxy

15 min @ 140 °C

pasty viscosity

DELO MONOPOX MK096

- High wet strength
- Low outgassing
- High corrosion resistance
- Processing on standard systems, for example from Camalot or Asymtek: Jetting, dispensing from cartridge, stencil printing
- Suitable for high-speed processes (more than 30,000 drops/h)



Fixing of SMD components, especially of melts or glass SMD components

Bonding of PBT cover and housing

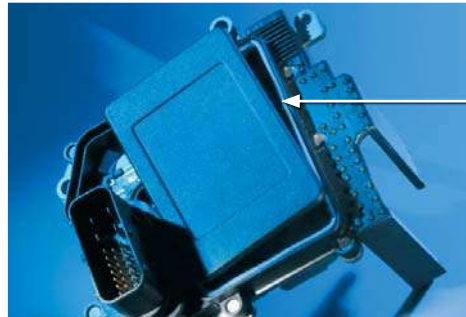
1C epoxy

30 min @ 130 °C

40 Pas viscosity

DELO MONOPOX 6093

- Good media resistance (for example to oil, gasoline)
- Excellent vibration resistance
- Very high resistance to elevated temperatures and temperature cycling
- Multi-purpose for various plastics (such as ABS, PA, PBT)



Bonding of the cover to the housing of an automotive control unit

Fixing of a diode

Cyano-acrylate

15s initial strength

2 Pas viscosity

DELO-CA 2153

- Good filling of gaps up to 0.2 mm
- Accelerated curing in combination with DELO-QUICK 2002 activator
- Multi-purpose for rubber, plastic and metal bondings
- Good adhesion to the nickel-plated surface
- Production reliability: Steady viscosity enables constant production parameters



Fast fixing of a diode in the housing of an optical converter

Bonding of miniloudspeakers

1C acrylate

UV 6s

110 Pas viscosity

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



Bonding of miniloudspeaker components for mobile phones

Bonding of automotive cameras

mod. 1C epoxy

UV

30 / 27 Pas viscosity

DELO DUALBOND AD345, OB786

- Good resistance to temperature, climatic changes, humidity and in salt spray test
- Production capacity: Short cycle times by light fixation in less than 1 s
- Optimized process flow: Heat curing at only +80 °C allows the use of temperature-sensitive materials and ensures the maintenance of the adjusted optical system
- Process reliability: Steady, low shrinkage delivers high yield



Bonding of automotive camera modules for camera-based driver assistance systems (adhesive colored magenta)

Bonding and fixing

Bonding of LED reflectors and lenses

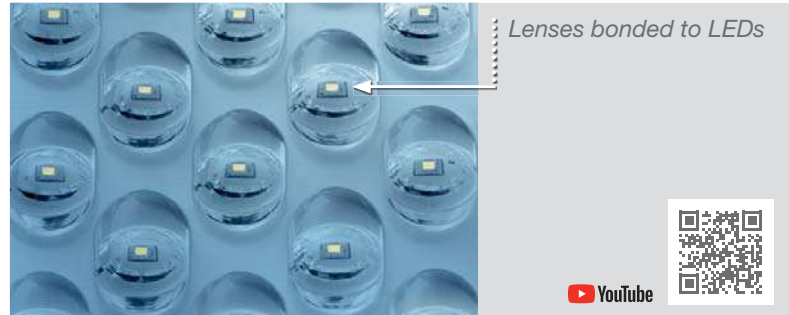
1C epoxy

UV 6s

10 Pas viscosity

DELO KATIOBOND OB642

- Optically clear
- High yellowing resistance
- High temperature stability
- Low outgassing
- Suitable for reflow processes
- High reliability: For example for the use in headlights, flash lenses and backlighting applications



Die attach

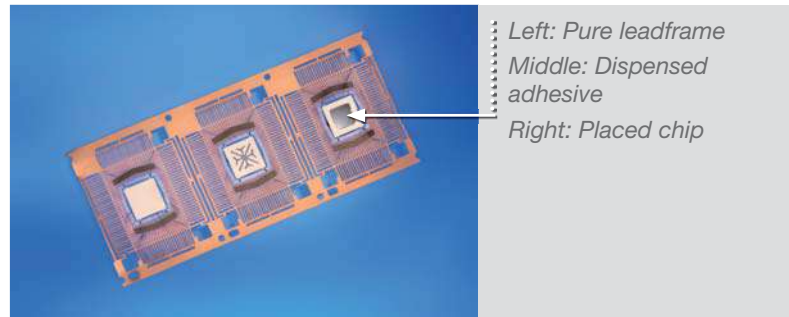
1C epoxy

2 min @ 175 °C

39 Pas viscosity

DELO MONOPOX DA375

- Good electrical and thermal properties
- High temperature resistance up to +260 °C, for lead-free soldering processes
- Fast curing in seconds with a thermode (for example 8 s @ +150 °C)
- Low-tension curing
- Products tested according to JEDEC MSL for reasonably priced storage
- Optimized products for many chip sizes



Flip-chip bonding

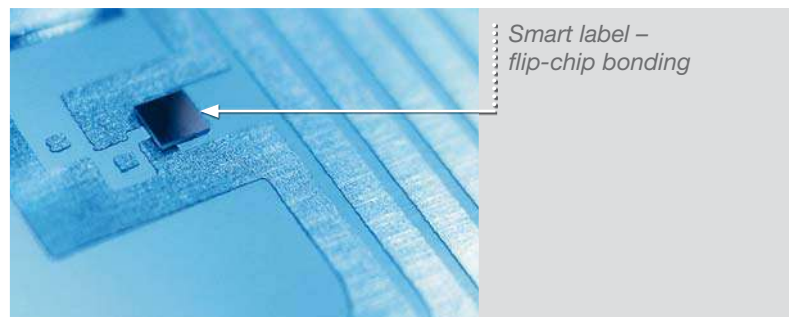
1C epoxy

6s @ 180 °C

32 Pas viscosity

DELO MONOPOX AC268

- Good humidity resistance
- High ion purity, high corrosion resistance
- Fast curing in seconds with a thermode (for example 6 s @ +180 °C)
- Multi-purpose (for example on PET, paper, FR4, PI, Cu, Al, Ag, Au)
- Anisotropic non-conductive product variants available



Bonding inkjet print heads

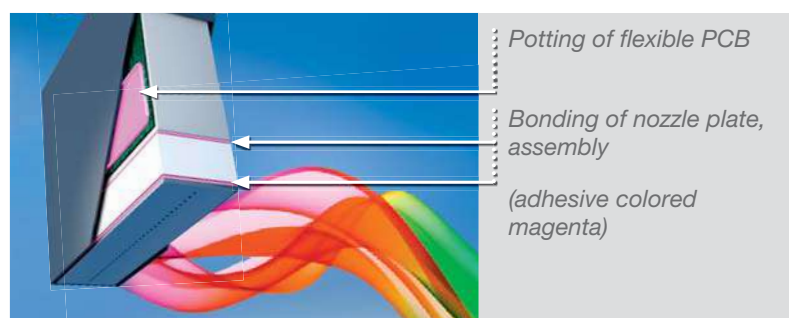
1C epoxy

UV

3 Pas viscosity

DELO MONOPOX GE785 (Dam), GE725 (Fill), DELO DUALBOND OB787

- Excellent media resistance (for example to aggressive inks)
- Minimization of tensions by low CTE and curing at +80 °C
- High bonding accuracy by light fixation
- Small fillers possible
- Viscosity can be set



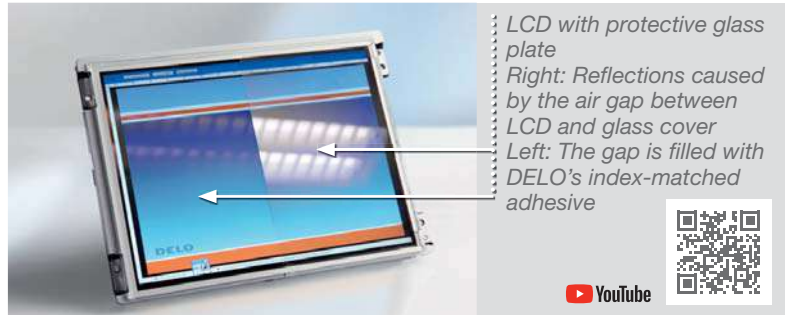
Potting and coating

Bonding of touch panel displays



DELO DUALBOND (various products)

- High transparency
- Tension-equalizing
- Low shrinkage
- Secondary curing mechanism for shadowed areas, for example under black print on the glass cover
- Quality: Increased ruggedness, impact and vibration resistance of touch panel and display

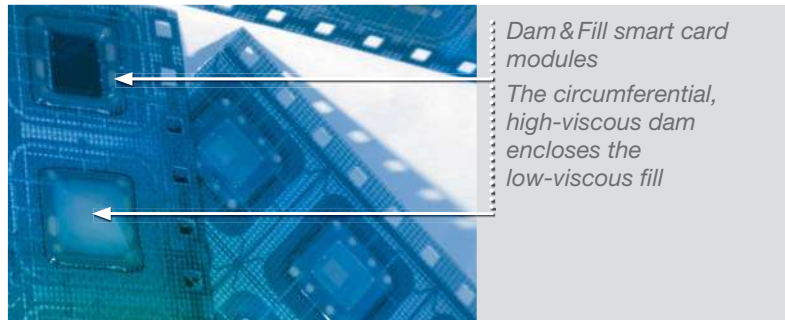


Dam & Fill chip encapsulation



DELO KATIOBOND DF698 (Dam), 4670 (Fill)

- High production capacity: Encapsulation of up to 40,000 modules/h (glob top; Dam & Fill: 20,000)
- Dam & Fill adhesives form a chemically homogeneous unit
- Functionality: High ion purity and strengths ensure the chip function over the entire lifetime
- Quality: Steady dispensing results even when using showerhead dispensers

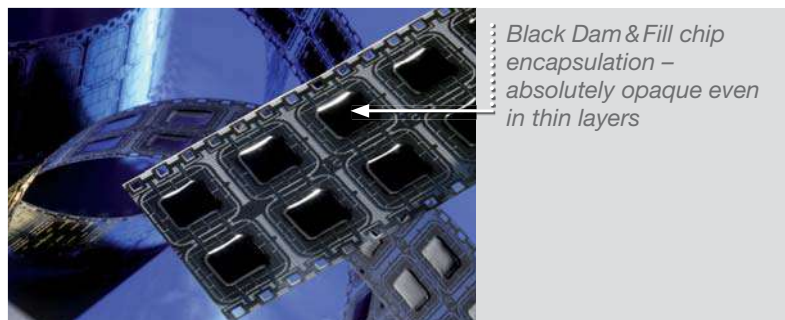


Opaque Dam & Fill chip encapsulation



DELO DAM&FILL

- Production capacity: Short cycle times thanks to very fast curing
- Absolutely opaque even in thin layers; very high mechanical protection effect → Protection of the chip from unauthorized views, chip removal and copying

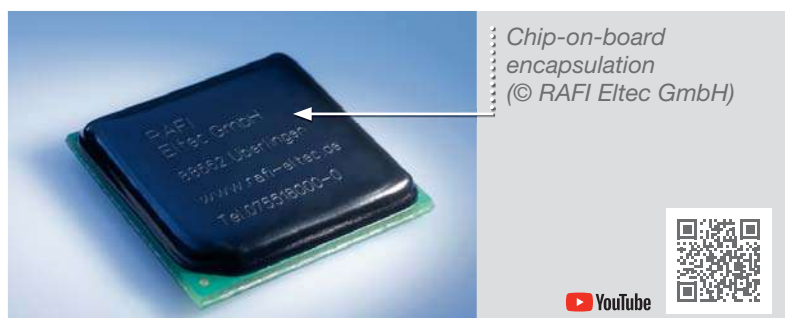


Chip-on-board encapsulation on PCB



DELO MONOPOX GE785 (Dam), GE725 (Fill)

- Excellent media resistance (for example to Diesel, oil, grease)
- Temperature range of use from -65 °C to +180 °C (modifications up to +250 °C possible)
- Resistance to lead-free soldering
- Universal adhesion to standard substrates (such as FR4, PA, PPS)
- Variable curing parameters: Fast curing or low curing temperature possible



Potting and coating

Sealing of electronic housings

1C silicone 2 mm / 24 h 17 Pas viscosity

DELO-GUM SI480

- Neutral crosslinking
- High flexibility from -50°C to $+180^{\circ}\text{C}$
- Tension-equalizing
- Low water absorption
- High corrosion resistance
- Excellent for microelectronic applications



Fixing / sealing of a PCB in a housing (© viaSonic)

Sealing of microswitch pins

mod. 1C acrylate UV 2 Pas viscosity

DELO DUALBOND GE4910

- Excellent flow and wetting behavior
- Reliable curing in shadowed areas
- Tension-equalizing
- High flexibility even at low temperatures (down to -40°C)
- Very good adhesion to metal and plastic
- Production capacity: Short cycle times thanks to very fast curing within seconds
- Longer lifetime: Resistance to humidity and temperature shocks



Sealing of switches, for example for the automotive industry



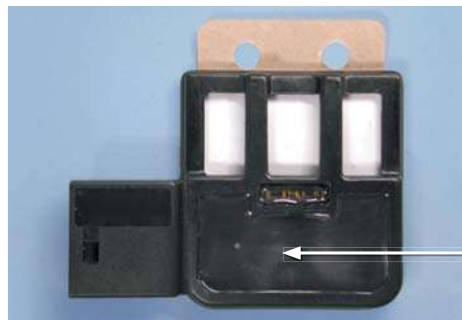
YouTube

Potting of sensor PCB

2C polyurethane A+B 1.5 h initial strength 80 Pas viscosity

DELO-PUR 9691

- Tough-elastic
- Flowable, suitable for small potting applications
- Normal temperature range of use from -40°C to $+125^{\circ}\text{C}$
- High static and dynamic loading capacity
- Easy processing from DELO-AUTOMIX cartridges



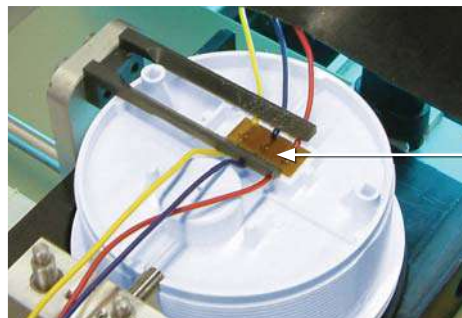
Potting of a PCB of a window hygrometer

Potting of electronic connectors

1C epoxy UV 15 s 1.2 Pas viscosity

DELO KATIOBOND 4552

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



Potting and sealing of soldered connection contacts in the cavity of indication instruments

Corrosion protection of soldered contacts

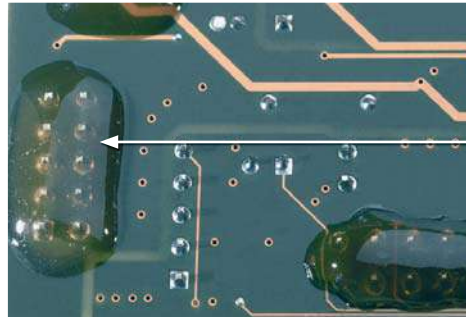
1C epoxy

UV 24s

1.5 Pas viscosity

DELO KATIOBOND KB554

- High resistance to temperature cycling
- High corrosion resistance
- Production reliability: Application control by fluorescent adhesive
- Increased operational reliability and prolonged lifetime: Excellent wetting of the soldered contact



Corrosion protection of soldered contacts, for example on PCBs

Potting of circuit carriers

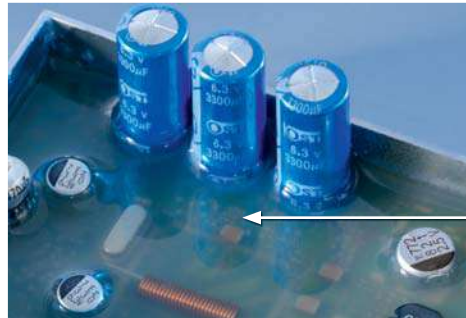
2C epoxy

A+B initial strength 5.5h

21 Pas viscosity

DELO-DUOPOX CR8021

- Good flow behavior
- Low shrinkage
- Aging-resistant, permanently flexible
- Low water absorption
- High creep resistance and dielectric strength
- Multi-purpose in mechanical engineering, electrical engineering and electronics
- Easy processing from DELO-AUTOMIX cartridges



Potting of electronic circuit carriers

Potting of electronic sensor elements

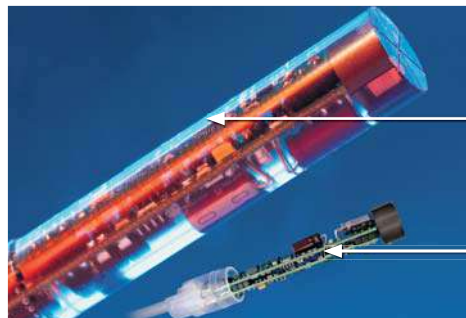
2C epoxy

A+B initial strength 7.5h

1 Pas viscosity

DELO-DUOPOX CR804

- Low-viscous for good flowing around the electronic assemblies
- Normal temperature range of use from -40°C to $+140^{\circ}\text{C}$
- Tension-equalizing
- Aging-resistant, permanently flexible
- Bubble-free potting thanks to low viscosity
- Suitable for large potting volumes



Potting of electronic elements in a safety sensor

Top: potted
Bottom: bare

Potting of PCBs in sensor heads

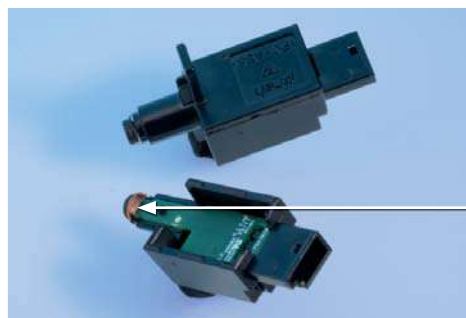
Meth-acrylate

UV 2

1.2 Pas viscosity



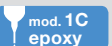
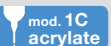
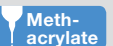




DELO-ML DB136

- Low-viscous for good flowing into the sensor head
- Normal temperature range of use from -60°C to $+180^{\circ}\text{C}$
- Tension-equalizing
- Immediate initial strength (after 5 s) by light fixation; anaerobic curing of adhesive in shadowed areas
- Production reliability: Application control by fluorescent adhesive



Potting of a PCB in a copper sensor head of a temperature sensor

DELO's adhesives for the electronics industry at a glance

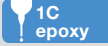









| | DELO PHOTOBOND | DELO KATIOBOND | DELO DUALBOND | DELO-ML |
|--------------------------|---|---|--|--|
| Basis |  1C acrylate |  1C epoxy |  mod. 1C epoxy  mod. 1C acrylate |  Meth-acrylate |
| Curing |  8 s UV-curing, light-curing, for example within 8 s |  9 s UV-curing, UV-/light-curing, light-activated, for example within 9 s |  Dual-curing: light-curing and heat- or humidity-curing depending on the product |  2-4 min Anaerobic-curing, for example in 2 – 4 min (accelerated curing by DELO-QUICK activator). Special product variants are dual-curing: anaerobic-curing and light- or UV-curing |
| Application areas | <ul style="list-style-type: none"> ▪ Automotive ▪ Mobile phones ▪ Displays ▪ Optoelectronics ▪ Smart labels ▪ Printed circuit boards | <ul style="list-style-type: none"> ▪ Automotive ▪ Mobile phones ▪ Displays ▪ Optoelectronics ▪ Organic electronics ▪ Smart cards ▪ Printed circuit boards | <ul style="list-style-type: none"> ▪ Automotive ▪ Mobile phones ▪ Displays ▪ Optoelectronics ▪ Photovoltaics ▪ Printed circuit boards | <ul style="list-style-type: none"> ▪ Automotive ▪ Electric motors ▪ Magnet bonding |
| Special features* | <ul style="list-style-type: none"> ▪ Extremely fast curing ▪ High equalization of tensions ▪ High peel resistance ▪ High optical clearness and UV resistance ▪ Universally good adhesion | <ul style="list-style-type: none"> ▪ High thermal and media resistance ▪ Low outgassing ▪ Optically clear and yellowing-resistant even at elevated temperatures ▪ High ion purity ▪ Low corrosion potential ▪ High water barrier effect | <ul style="list-style-type: none"> ▪ Secondary curing mechanism for reliable curing in shadowed areas ▪ Otherwise like the corresponding basic product group | <ul style="list-style-type: none"> ▪ Anaerobic- and light-curing, one-component adhesives ▪ Excellent adhesion to metal ▪ Good adhesion even to certain plastics ▪ Tension-equalizing and impact-resistant |

* The strong points show in which areas the product groups are particularly efficient. Depending on the product, these strong points may differ.

Satisfied customers

ABM Greiffenberger Antriebstechnik GmbH, Amphenol-Tuchel Electronics GmbH, Barun Electronics Co., Ltd., BSH Bosch und Siemens Hausgeräte GmbH, ContiTemic microelectronic GmbH, Daimler AG, DLR Deutsche Forschungsanstalt für Luft- und Raumfahrt, Festo KG, Goertek Electronics Co., Ltd., Honeywell AG, Infineon

Technologies AG, Knowles Electronics Austria GmbH, Leopold Kostal GmbH & Co. KG, Preh GmbH, Robert Bosch GmbH, Siemens AG A&D MC, TRW Airbag Systems GmbH, Tyco Electronics AMP GmbH, ZF Electronics GmbH, Zollner Elektronik AG, and many more...

| DELO MONOPOX | DELO-DUOPOX | DELO-PUR | DELO-GUM | DELO-CA |
|---|---|---|---|---|
|  1C epoxy |  2C epoxy |  2C polyurethane |  1C silicone |  Cyanoacrylate |
|  30 min @ 130 °C Heat curing, for example 30 min at +130 °C |  5.5 h initial strength At room temperature after mixing resin and hardener, for example initial strength after 5.5 h (products with fixing times from 15 min to 8 h available) |  1.5 h initial strength At room temperature after mixing resin and hardener, for example initial strength after 1.5 h (products with fixing times from 30 min to 8 h available) |  2 mm / 24 h By air humidity at room temperature, for example 2 mm / 24 h |  30 s initial strength By air humidity at room temperature, for example initial strength after 30 s (accelerated curing by DELO-QUICK 2002 activator) |
| <ul style="list-style-type: none"> Automotive Electric motors Magnet bonding Smart labels Smart cards Printed circuit boards Microelectronic packaging Potting | <ul style="list-style-type: none"> Automotive Electric motors Tool and plant construction Printed circuit boards Potting | <ul style="list-style-type: none"> Automotive Electric motors Tool and plant construction Printed circuit boards Potting | <ul style="list-style-type: none"> Automotive Electric motors Tool and plant construction Printed circuit boards Potting | <ul style="list-style-type: none"> Automotive Tool and plant construction Printed circuit boards |
| <ul style="list-style-type: none"> High thermal and media resistance High strength even at elevated temperatures Good adhesion to many metals and plastics Wide property variety (for example high T_g, low CTE, curing at low temperatures from +80 °C) | <ul style="list-style-type: none"> High thermal and media resistance High shear strength on metal and certain plastics Partly excellent peel resistance on smooth surfaces Products with dissimilar curing speeds available | <ul style="list-style-type: none"> High strength and good elasticity High peel resistance Products with dissimilar curing speeds available | <ul style="list-style-type: none"> Permanently flexible Very good aging resistance Very wide temperature range of use | <ul style="list-style-type: none"> Especially for fast fixing of components Universal adhesion to metals, ceramic, many plastics and elastomers |

Numeric product key

| | |
|------------------------------------|---------------------------------|
| AC = Anisotropic Conductive | GE = General Encapsulant |
| AD = ADhesive | KB = KATIOBOND |
| CR = Casting Resin | MK = MONOPOX Klebstoff |
| DA = Die Attach | OB = Optical Bonding |
| DB = Dual Bonding | SI = Silicone |
| DF = Dam & Fill | UB = Universal Bonding |
| FR = Flame-Retardant | |

All products are

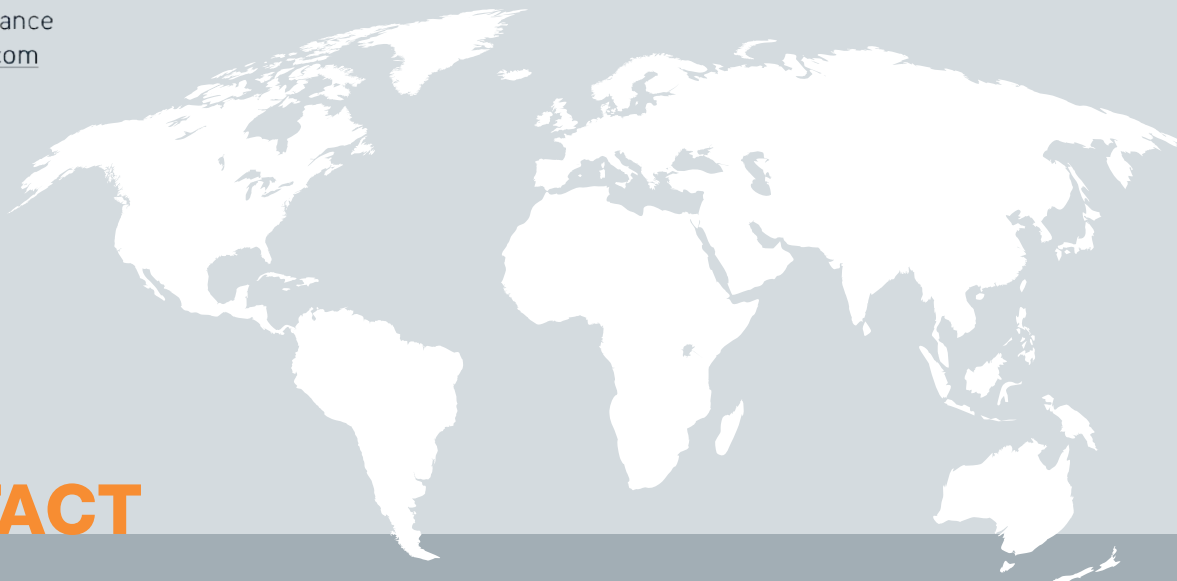
- solvent-free
- compliant with RoHS Directive 2015/863/EU



Many products are halogen-free according to or by the criteria of IEC 61249-2-21. Details can be found in the specific technical data sheet.



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