Product Safety Assessment

BETAFORCE™ Polyurethane Adhesives, BETAMATE™ Polyurethane Adhesives, and BETALINK™ Polyurethane Adhesives


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Names
- BETAFORCE™ 2850S
- BETAFORCE 9050S
- BETAFORCE 73100 Structural Adhesive
- BETAMATE™ 2810
- BETAMATE 2810LV
- BETAMATE 2810SV
- BETAMATE 2816
- BETALINK™ K2

Product Overview
- BETAFORCE™ polyurethane adhesives, BETAMATE™ polyurethane adhesives, and BETALINK™ polyurethane adhesives are two-component composite bonding adhesives containing a blend of components. These products are gray to black pastes manufactured by Dow Automotive Systems, a business unit of The Dow Chemical Company.¹²³ For further details, see Product Description.
- BETAFORCE polyurethane adhesives, BETAMATE polyurethane adhesives, and BETALINK polyurethane adhesives are used in automotive manufacturing to permanently bond coated metals such as steel to aluminum, carbon fiber panels to steel or aluminum, sheet molding compound (SMC) to aluminum, and more.⁴ For further details, see Product Uses.
- Exposure can occur either in facilities that manufacture these products or in the various industrial or manufacturing facilities that use these products. Dow Automotive Systems does not sell these products for home use. Based on their widespread use in vehicle production, it is likely that consumers will operate a vehicle manufactured with them. The cured product is not expected to present a risk to consumers.³⁵ For further details, see Exposure Potential.

Health Information
- Polyurethane component²³ – Eye contact may cause moderate irritation and slight, temporary corneal injury. A component in these products has been shown to be a skin sensitizer. Excessive inhalation may irritate the nose, throat, and lungs and cause pulmonary edema (fluid in the lungs). Decreased lung function has been associated with overexposure to isocyanates. A component in some products may cause an allergic skin or respiratory reaction. These products have low toxicity if swallowed, but contain components that have been reported to affect the kidney and liver. Lung tumors, respiratory irritation, and lung injury

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have been observed in laboratory animals exposed to aerosol droplets of products based on methylenediphenyldiisocyanate (MDI) for their lifetime.

- **Coreactant** – Eye contact may cause severe irritation with corneal injury, which may result in chemical burns, permanent vision impairment, or even blindness. Prolonged skin contact may cause irritation, even a burn. Vapor from heated product or mist may irritate the nose, throat, and lungs. These products have moderate toxicity if swallowed, but contain components that have been reported to affect the kidney, liver, central nervous system, bladder, and thymus. For further details, see Health Information or request the relevant Safety Data Sheet.

- **Environmental Information**

  - **Polyurethane component** – The polyurethane components in these products are unlikely to accumulate in the food chain. If released to water, they would react to form stable urea compounds, bind to soil, suspended solids, and sediment, and ultimately be removed as biosolids from wastewater-treatment facilities. The substances that comprise this component of the adhesive system are practically non-toxic to aquatic organisms on an acute basis.

  - **Coreactant** – The polyol substances that comprise the coreactant component of the adhesive system are highly soluble in water, non-volatile, and unlikely to accumulate in the food chain. If released to water, these polyols will remain dissolved, are readily biodegradable, and would be removed by wastewater-treatment facilities. The components in these products range from toxic to practically non-toxic to aquatic organisms on an acute basis. For further details, see Environmental Information.

- **Physical Hazard Information**

  - **Polyurethane component** – These products are stable under recommended storage and normal use conditions. Keep away from moisture and heat. Avoid contact with water, acids, alcohol, ammonia, amines, bases, metal compounds, moist air, and strong oxidizers. Avoid contact with metals such as zinc, brass, tin, copper, and galvanized metals. Avoid contact with moist organic absorbents. Avoid unintended contact with polyols.

  - **Coreactant** – These products are stable under recommended storage and normal use conditions. Keep away from heat or flame. Avoid contact with strong acids, strong bases. Avoid unintended contact with polyols. For further details, see Physical Hazard Information.

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Manufacture of Product

- **Locations** – Dow Automotive Systems manufactures BETAFORCE™ polyurethane adhesives, BETAMATE™ polyurethane adhesives, and BETALINK™ polyurethane adhesives at facilities in the U.S. and Germany.

- **Process** – BETAFORCE polyurethane adhesives, BETAMATE polyurethane adhesives, and BETALINK polyurethane adhesives are formulated using proprietary Dow Automotive Systems materials and technology.

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Product Description

BETAFORCE™ polyurethane adhesives, BETAMATE™ polyurethane adhesives, and BETALINK™ polyurethane adhesives are two-component composite bonding adhesives. The polyurethane components are gray to black pastes containing a blend of liquid prepolymer based on methylenediphenyldiisocyanate (MDI) along with fillers such as clay, carbon black, talc, and phthalate esters. The polyol coreactant component consists of a mixture of polyols along with stabilizers, catalysts, and fillers. The two components are combined just before application and chemically react to form an adhesive that solidifies within hours and fully cures in days. Formulations vary based on the vehicle production process and reflect variables such as viscosity, application temperature, conductivity, cure time, E-modulus, strength and temperature. Both components can be dispensed from bulk containers into standard meter mix equipment for application. Products are also sold in single-use kits.

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**Product Uses**

BETAFORCE™ polyurethane adhesives, BETAMATE™ polyurethane adhesives, and BETALINK™ polyurethane adhesives are used in automotive manufacturing to permanently bond coated metals such as steel to aluminum, carbon fiber panels to steel or aluminum, sheet molding compound (SMC) to aluminum, and more. They allow for consistent mechanical properties over an extremely wide temperature range and are ideal for joining composites and other dissimilar materials.

Specific applications include:
- Structural roof modules
- Lift gates
- Trunks
- Spoilers
- Claddings
- Doors
- Front end carriers
- Sunroofs
- Claddings
- Composite panels

**Exposure Potential**

BETAFORCE™ polyurethane adhesives, BETAMATE™ polyurethane adhesives, and BETALINK™ polyurethane adhesives are used in the production of vehicles and in the vehicle aftermarket industry. Based on the uses for these adhesives, individuals could be exposed through:

- **Workplace exposure** – Exposure can occur either in facilities that manufacture these products or in the various industrial or manufacturing facilities that use these products. They are produced, distributed, and stored in closed systems. Those working with these products in manufacturing operations could be exposed during maintenance, sampling, testing, application, or other procedures. Each manufacturing facility should have a thorough training program for employees and appropriate work processes, ventilation, and safety equipment in place to limit exposure. See Health Information.

- **Consumer exposure to products containing BETAFORCE polyurethane adhesives, BETAMATE polyurethane adhesives, and BETALINK polyurethane adhesives** – Dow Automotive Systems does not sell these products for home use. Based on their widespread use in vehicle production, it is likely that consumers will operate a vehicle manufactured with them. The cured product is not considered to present a risk to consumers.

- **Environmental releases** – In the event of a spill, the focus is on containing the spill to prevent contamination of soil, surface water, or groundwater. For small spills, these products should be absorbed with materials such as sand or sawdust. If released, the polyurethane component will react to form insoluble ureas that will bind to soil, suspended solids, and sediment. Each of the polyol components are readily biodegradable, while other minor components/additives are expected to slowly and ultimately biodegrade in the environment. See Environmental, Health, and Physical Hazard Information.

- **Large release** – Industrial spills or releases are infrequent and generally contained. If a large spill does occur, the product should be captured, collected, and reprocessed or disposed of according to applicable governmental requirements. Evacuate the area and keep upwind of the spill. Ventilate the area. Only trained and properly equipped personnel should be involved in clean-up operations. Prevent spilled product from entering soil, ditches, sewers, waterways, or groundwater. See Environmental, Health, and Physical Hazard Information.

- **In case of fire** – Isolate the area and deny any unnecessary entry into the area. Fight the fire from a protected location or safe distance and consider the use of unmanned hose holders. Use water spray or fog, carbon-dioxide or dry-chemical extinguishers, or foam to fight the fire. Use of a direct water stream may spread the fire and cause violent steam generation. Dense smoke is produced when the products burn, and the smoke may contain toxic and/or irritating gases. Firefighters should wear positive-pressure, self-contained breathing apparatus (SCBA) and protective firefighting clothing. These products react with water and may produce heat and/or gases. Closed containers may rupture when exposed to extreme heat in a fire. Immediately withdraw all personnel from the area in case of rising sounds from venting safety device or discolorations of the container. Keep fire water out of waterways and sewers to minimize the potential for environmental damage. Follow emergency procedures carefully. See Environmental, Health, and Physical Hazard Information.

For more information, request the relevant Safety Data Sheet.
Health Information

Health information for BETAFORCE™ polyurethane adhesives, BETAMATE™ polyurethane adhesives, and BETALINK™ polyurethane adhesives is summarized on the relevant Safety Data Sheets. It is important to note that health risks associated with individual products may vary based on their formulation or intended use. These products may also contain minor components or additives that have additional health risks. The Safety Data Sheet is the preferred source for specific health information. An overview of health information for these products appears below.

Polyurethane Component

Eye contact – Contact may cause severe eye irritation or slight, temporary corneal injury.

Skin contact – Prolonged or repeated contact may cause moderate skin irritation with local redness. Material may stick to skin causing irritation upon removal. Material may stain skin. A component in these products has been shown to be a skin sensitizer. Animal studies have shown that skin contact with isocyanates may play a role in respiratory sensitization. Prolonged skin contact is unlikely to result in absorption of harmful amounts. Hexamethylene diisocyanate, a component of some products, is a potent skin sensitizer. Severe skin rash/allergic skin reactions have been noted in people exposed to aerosols/vapors of heated product.

Inhalation – Certain operations in which the product is heated, sprayed, or otherwise mechanically dispersed may generate vapor or mist concentrations sufficient to cause respiratory irritation and other adverse effects. Excessive exposure may cause irritation to the nose, throat, and lungs and pulmonary edema (fluid in the lungs). Effects may be delayed. Decreased lung function has been associated with overexposure to isocyanates. These products may contain mineral and/or organic fillers. There is essentially no potential for inhalation exposure to these fillers incidental to industrial handling due to their physical state.

Respiratory sensitization – A component in this mixture may cause an allergic respiratory response. Methylene diphenyl diisocyanate (MDI) concentrations below the exposure guidelines may cause allergic respiratory reactions in individuals already sensitized, including asthma-like symptoms such as coughing, breathing difficulties, and a feeling of tightness in the chest. Occasionally, breathing difficulties may be life-threatening.

Ingestion – These products have low toxicity if swallowed. Swallowing may result in irritation of the mouth, throat, and gastrointestinal tract. Small amounts swallowed incidental to normal handling operations are not likely to cause injury; however, swallowing larger amounts may cause injury, including abdominal discomfort or diarrhea, nausea, and vomiting.

Repeated exposure – These products contain components that have been reported to affect the kidney and liver. Tissue injury in the upper respiratory tract and lungs has been observed in laboratory animals after repeated, excessive exposures to MDI/polymeric MDI aerosols.

Cancer information – Lung tumors have been observed in laboratory animals exposed to respirable aerosol droplets of MDI/polymeric MDI over their lifetime. Tumors occurred concurrently with respiratory irritation and lung injury. Current exposure guidelines are expected to protect against these reported effects.

Other – MDI/polymeric MDI did not cause birth defects in laboratory animals. Other fetal effects occurred only at high doses that were toxic to the mother. In laboratory testing, excessive doses of phthalate esters that were toxic to the parent animals caused decreased weight and survival of offspring.

Coreactant

Eye contact – Contact may cause severe eye irritation with corneal injury, which may result in permanent vision impairment, even blindness. Chemical burns may occur. Vapor or mist may cause eye irritation.

Skin contact – Brief contact may cause skin irritation with local redness. Prolonged contact may cause skin irritation, even burns. Prolonged skin contact is unlikely to result in absorption of harmful amounts. Repeated skin exposure to large quantities may result in absorption of harmful amounts.

Inhalation – Vapor from heated product or mist may cause irritation of the nose, throat, and lungs. These products contain mineral and/or organic fillers. There is essentially no potential for inhalation exposure to these fillers incidental to industrial handling, due to their physical state.
**Ingestion** – These products have moderate toxicity if swallowed. Small amounts swallowed incidental to normal handling operations are not likely to cause injury; however, swallowing larger amounts may cause injury resulting in burns of the mouth, throat, and gastrointestinal tract. Excessive exposure may affect the central nervous system, cardiopulmonary system (metabolic acidosis), and kidney, as well as cause abdominal discomfort or diarrhea, nausea, vomiting, headache, dizziness, and drowsiness progressing to loss of coordination and unconsciousness.

**Repeated exposure** – These products contain components that have been reported to affect the kidney, liver, central nervous system, bladder and thymus. May cause lung injury and nystagmus (involuntary eye movement).

**Other** – In animal studies, ingestion of very large amounts of ethylene glycol has been shown to interfere with reproduction and may produce birth defects.

For more information, request the relevant Safety Data Sheet from the [Dow Customer Information Group](#).

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**Environmental Information**

BETAFORCE™ polyurethane adhesives, BETAMATE™ polyurethane adhesives, and BETALINK™ polyurethane adhesives are blends of several components. An overview of environmental information for these products appears below. Detailed information for specific products and components is available on the relevant Safety Data Sheet.

**Polyurethane component** – The polyurethane components are unlikely to accumulate in the food chain (bioconcentration potential is low) because of their high molecular weight. If released to soil or water, they would form insoluble and stable polyurea compounds that would bind to soil, suspended solids, and sediment. These compounds would be removed as biosolids from wastewater-treatment facilities. The polyurethane components range from practically non-toxic (LC\(_{50}\) >100 mg/L in the most sensitive species tested) to slightly toxic (LC\(_{50}\) between 10 and 100 mg/L in the most sensitive species tested) to aquatic organisms on an acute basis.

**Coreactant** – The polyol coreactants are unlikely to accumulate in the food chain (bioconcentration potential is low) because of their high molecular weight. If released to soil or water, most polyol components are readily biodegradable (up to 90% degraded in 10 days per OECD 301A test) and would be removed by wastewater-treatment facilities. The polyol components range from practically non-toxic (LC\(_{50}\) >100 mg/L in the most sensitive species tested) to moderately toxic (LC\(_{50}\) between 1 and 10 mg/L in the most sensitive species tested) to aquatic organisms on an acute basis.

For more information, request the relevant Safety Data Sheet from the [Dow Customer Information Group](#).

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**Physical Hazard Information**

**Polyurethane component** – The polyurethane components are stable under recommended storage and normal use conditions. Keep away from moisture and heat. Elevated temperatures can cause these products to decompose and generate pressure in closed systems. These products react with water, which can generate heat/gases, cause pressure buildup, and rupture containers. Thermal decomposition may yield toxic gases and fumes. Avoid contact with water, acids, alcohol, ammonia, amines, bases, metal compounds, moist air, and strong oxidizers. Avoid contact with metals such as aluminum, zinc, brass, tin, copper, and galvanized metals. Avoid contact with moist organic absorbents. Avoid unintended contact with polyols. The reaction of polyols and isocyanates generates heat.

**Coreactant** – The polyol coreactants are stable under recommended storage and normal use conditions. Keep away from heat or flame. These products can oxidize at elevated temperatures and generate gas, causing pressure in closed systems. Avoid contact with strong acids and strong bases. Avoid unintended contact with isocyanates. The reaction of polyols and isocyanates generates heat.

For more information, request the relevant Safety Data Sheet from the [Dow Customer Information Group](#).
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Regulatory Information
Regulations may exist that govern the manufacture, sale, transportation, use, and/or disposal of BETAFORCE™ polyurethane adhesives, BETAMATE™ polyurethane adhesives, and BETALINK™ polyurethane adhesives. These regulations may vary by city, state, country, or geographic region. Information may be found by consulting the relevant Safety Data Sheet.

Additional Information
- Request the Safety Data Sheet from the Dow Customer Information Group (www.dow.com/assistance/dowcig.htm)
- Contact Us (www.dowautomotive.com/contact)

For more business information about BETAFORCE™ polyurethane adhesives, BETAMATE™ polyurethane adhesives, and BETALINK™ polyurethane adhesives, visit the Dow Automotive Systems web site at www.automotive.dow.com.

References
1 BETAFORCE™ 9050M Structural Adhesive, Technical Datasheet, Dow Automotive Systems, Form No. 299-52036-09/12
2 BETAFORCE™ 9050M Iso [Polyurethane Component], Material Safety Data Sheet, The Dow Chemical Company
3 BETAFORCE™ 2850 Iso [Polyurethane Component], Material Safety Data Sheet, The Dow Chemical Company
4 Dow Automotive website – Capabilities and Solutions: Adhesives: Composite Bonding (http://www.dowautomotive.com/capabilities/adhesives/composite-bonding/products.htm)
5 BETAFORCE™ 2850 [Coreactant], Material Safety Data Sheet, The Dow Chemical Company
6 BETAFORCE™ 9050M [Coreactant], Material Safety Data Sheet, The Dow Chemical Company
NOTICES

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