Total Solutions for Commercial Transportation

Multifunctional systems for the manufacture and repair of bus, truck, rail, recreation, industrial, emergency and agricultural vehicles

DOW Automotive Systems

Commercial Vehicle Expertise

Dow Automotive Systems provides manufacturers of commercial vehicles with total solutions that perform for interior, exterior, powertrain and under-the-hood applications. Our market areas of expertise include:

- **Buses/motor coaches**
- **Rail cars and coaches**
- **Medium- and heavy-duty truck cabs, sleepers and trailer bodies**
- **Recreational and leisure vehicles**
- **Emergency vehicles**
- **Industrial/agricultural equipment**
- **Aftermarket repair**

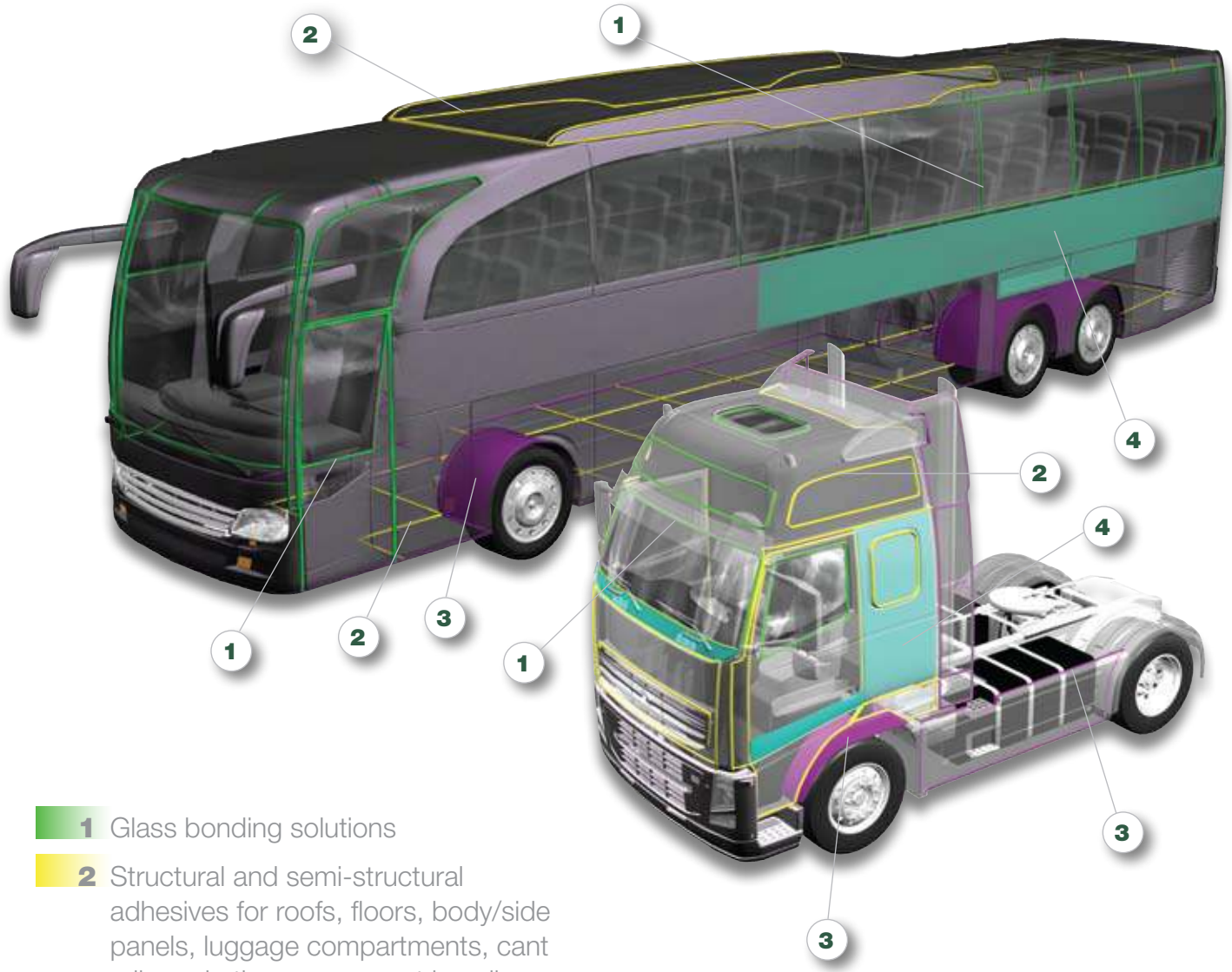
Our adhesives and sealants help increase a vehicle's structural integrity. We provide superior sealing solutions; improve acoustical performance for a quieter riding experience; or enhance thermal management for occupant comfort in all-climate environments.

Additional benefits of Dow Automotive Systems solutions are interdependent upon our variety of multifunctional systems, which generate value across the entire vehicle.

Solutions to Handle the Load

With decades of experience in body structural enhancement, Dow Automotive Systems has the experience and expertise to deliver glass and structural bonding and sealing solutions to the commercial transportation market. And with robust product performance and easy application processes, we can help you deliver strong and durable bonding to your customers.

Key Product Solutions from Dow Automotive Systems



1 Glass bonding solutions

2 Structural and semi-structural adhesives for roofs, floors, body/side panels, luggage compartments, cant rails and other component bonding

3 Sealer systems for seam sealing, gap filling and underbody coating

4 Acoustical/structural foams that provide acoustical or energy management properties

Best-in-class Innovation

Bonding technologies from Dow Automotive Systems are designed to meet the specific needs of traditional and hybrid material assembly with the ability to bond dissimilar substrates. Thick bond lines offer high strength, fatigue and crash resistance with excellent elasticity – even after weathering. The potential for reducing weight can also help enable CO_2 emission reduction through improved fuel efficiency.

Our range of adhesives and surface preparation products include:

- **BETASEAL™ glass bonding systems** - for structural and stationary glass bonding, meeting globally mandated requirements for rollover and roof crush
- **BETAMATE™ structural adhesives and BETAFORCE composite adhesives** - replace mechanical fasteners to help enable increased stiffness for improved crash resistance and reduce vibration to improve acoustical performance – all while reducing weight versus fasteners by up to 20 percent
- **BETAFILL™ seam sealants** - help prevent moisture intrusion that can lead to corrosion
- **BETATECH™ solvent-free sealants** - offer exceptional primerless performance on a variety of substrates
- **BETAPRIME™ and BETAWIPE™ cleaners and primers** - enable exceptional surface preparation while minimizing waste

Global Benefits

As a leading supplier of materials, technology and service support for vehicle bonding and sealing applications, we offer a globally consistent, reliable and secure material supply. Our offering includes adhesives, glass bonding systems, polyurethanes, sealants, films, fluids, structural enhancement and acoustical management solutions. And on the front end, our advanced engineering team can design, test and validate the right solution for each customer's unique assembly operation.

Glass Bonding Solutions

Far left: BETASEAL™ glass bonding systems are developed to provide specific advantages for the entire spectrum of commercial vehicle substrates and coatings.

Left: When applied according to manufacturer's specifications, using the complete combination of cleaners, primers, and adhesives, BETASEAL systems enable vehicles to comply with global barrier, rollover and roof crush safety regulations.

The excellent performance of Dow Automotive Systems glass bonding systems, used worldwide for structural bonding and sealing of stationary glass, helps meet globally mandated safety requirements for barrier and roof crush regulations. Our cleaners, primers and adhesives provide a wide range of mechanical properties to suit all vehicle requirements, and are compatible with all production processes, including cold- and warm-applied systems.

Above: A variety of innovative BETASEAL glass bonding systems support commercial vehicle manufacturing and after-sales repair, helping customers save costs and reduce installation time.

Technologies include:

- **Primerless to paint**
- **Non-conductive**
- **High modulus**
- **Quick fix**
- **Fast curing**
- **One- and two-part systems**
- **UV resistant**
- **One-step glass primers**
- **Different primers for various substrates, including cold-rolled galvanized steel, stainless steel, aluminum, thermoplastics, fiber-reinforced plastics and plywood**

BETASEAL™ 58402N

Primerless-to-glass, one-component, moisture-curing, high-viscosity glass bonding polyurethane (PU) adhesive provides:

- **Reduced VOCs**
- **Simplified process**
- **Reduced production costs**
- **Resistance to weathering**
- **High performance**
- **Ability to meet OEM specifications**

Application	Stationary glass bonding
Appearance	Black
Solids content, min., %	99
Density, lb/gal (kg/L)	10 (1.2)
Flash point setaflash, ˚F (˚C)	230 (110)
Viscosity (flow rate), initial at 23˚C, 50% RH, seconds, 0.157” (4 mm) orifice, 80 psi (550 kPa)	22-55
Sag	None
Tack-free time, max. minutes, at 23˚C and 50% RH	25
Shore A Hardness, durometer avg. after 7 days at 23˚C, 50% RH	55-65
Elongation at break, %	> 340
Tensile at break, psi (kPa)	> 1,000 (6.9)
Lap shear, min., psi (MPa), after 3 days at 23˚C, 50% RH	> 500 (3.4)
Packaging	55-gallon drums, cartridges, foil packs

BETASEAL™ 57302N

One-component, fast-curing, high-viscosity glass bonding PU adhesive provides:

- **Resistance to weathering**
- **High performance**
- **Ability to meets OEM specifications**

Application	Stationary glass bonding
Appearance	Black
Solids content, min., %	98
Density, lb/gal (kg/L)	10.5 (1.26)
Flash point setaflash, ˚F (˚C)	> 230 (110)
Viscosity (flow rate), initial at 23˚C, 50% RH, seconds, 0.157” (4 mm) orifice, 80 psi (550 kPa)	22-45
Sag	None
Tack-free time, max. minutes, at 23˚C and 50% RH	45
Shore A Hardness, durometer avg. after 7 days at 23˚C, 50% RH	55
Elongation at break, %	> 500
Tensile at break, psi (kPa)	> 1,015 (7000)
Lap shear, min., psi (MPa), after 3 days at 23˚C, 50% RH	> 500 (3.4)
Packaging	55-gallon drums, cartridges

BETASEAL™ 17042

One-component, advanced-curing, high-viscosity glass bonding PU adhesive:

- **Delivers fast, one-hour drive away in temperatures as low as 0˚F (-17.8˚C) at low cost**
- **Is FMVSS crash proven**
- **Provides excellent decking**
- **Meets all long-term durability requirements**
- **Provides advanced cure, Gun-n-Go™ technology**

Application	Stationary glass bonding
Appearance	Black
Solids content, min., %	99
Density, lb/gal (kg/L)	N/A
Flash point setaflash, ˚F (˚C)	> 230 (110)
Viscosity (flow rate), initial at 23˚C, 50% RH, seconds, 0.157" (4 mm) orifice, 80 psi (550 kPa)	20-50
Sag	None
Tack-free time, max. minutes, at 23˚C and 50% RH	14
Shore A Hardness, durometer avg. after 7 days at 23˚C, 50% RH	55-65
Elongation at break, %	> 400
Tensile at break, psi (kPa)	> 1,000 (6.9)
Lap shear, min., psi (MPa), after 3 days at 23˚C, 50% RH	> 500 (3.4)
Packaging	55-gallon drums, cartridges, foil packs

BETASEAL™ X2500

Two-component, high-modulus PU adhesive provides:

- **Ability to meet OEM requirements**
- **Increased shear modulus**
- **Non-conductive formulation**
- **Fast drive-away times**

Application	Stationary glass bonding
Appearance	Black
Solids content, min., %	96
Density, lb/gal (kg/L)	X2500A - 10.58 (1.27) X2500B - 10.08 (1.27)
Flash point setaflash, ˚F (˚C)	212 (100)
Viscosity (flow rate), initial at 23˚C, 50% RH, seconds, 0.157" (4 mm) orifice, 80 psi (550 kPa)	X2500A - 20-50 X2500B - 20-50
Sag	None
Tack-free time, max. minutes, at 23˚C and 50% RH	10
Shore A Hardness, durometer avg. after 7 days at 23˚C, 50% RH	50-60
Elongation at break, %	> 150
Tensile at break, psi (kPa)	> 798 (5.5)
Lap shear, min., psi (MPa), after 3 days at 23˚C, 50% RH	> 350 (2.4)
Packaging	55-gallon drums, cartridges

Seam Sealants/Adhesives

Advanced materials technologies enable Dow Automotive Systems to provide a wide range of seam sealant and adhesive solutions based on specific customer requirements.

Sealing vehicle body joints and seams provides added protection against corrosion while also protecting interior compartments from dust, dirt and moisture.

Sealants from Dow Automotive Systems also achieve bonding, acoustical and thermal improvements in commercial vehicle applications.

Customized solutions from Dow Automotive Systems for sealing, filling and bonding lightweight materials provide significant long-term advantages. Available in black, gray and white, these single-component, moisture-curing polyurethanes, like **BETAFILL**™ seam sealants and **BETATECH**™ solvent-free sealants, provide permanent elasticity and good adhesion to a wide variety of substrates. In some cases, wipes, cleaners and primers are required, but seam sealants/adhesives can be applied primerless on many substrates.

Typical commercial applications include:

- **Internal seam joints between panels**
- **Seam sealing on GRP roof panels**
- **Sealing aluminum fabrications**
- **Gap filling between panels**
- **Cosmetic finishing of internal/external joints**
- **Sealing of lightweight construction materials**
- **Bedding compounds to absorb shock and vibration**
- **Sealing of wood, metal, plastic door frames and window fittings**
- **Bulkhead sealing and door skin fixing**
- **Wheel arch sealing**

BETAFILL™ 45

One-component, moisture-curing PU adhesive and elastic adhesive/sealant offers:

- **Durable elastic seals for a variety of substrates**
- **Good primerless adhesion to a variety of substrates**
- **Low shrinkage**
- **Good sag resistance**
- **Ability to spray, over paint and sand**
- **Reactive or moisture-cured capability**

Application	Seam sealing and semi-structural bonding
Appearance	Black, gray or white
Solids content, min., %	88
Density, lb/gal (kg/L)	13.3 (1.6)
Tack-free time, max. minutes, at 23˚C and 50% RH	24
Shore A Hardness, durometer avg. after 7 days at 23˚C, 50% RH	36
Elongation at break, %	> 500
Tensile at break, psi (kPa)	> 200 (1.4)
Lap shear, min., psi (MPa), after 3 days at 23˚C, 50% RH	> 125 (0.9)
Packaging	55-gallon drums, 5-gallon pails, cartridges

BETAFILL™ 55

One-component moisture-curing PU adhesive with durable elasticity offers:

- **Primerless adhesion to a variety of substrates**
- **Excellent sealing properties with medium-strength bonding**
- **Ability to seal, fill and finish seams – and may be sanded and painted**

Application	Seam sealing and semi-structural bonding
Appearance	Black, gray or white
Solids content (EPA 24 ASTM 2369), %	95
Density, g/cm^3	1.26
Tack-free time at 23˚C and 50% RH, minutes	57
Shore A Hardness (ASTM D2240)	47
Elongation at break (ASTM D-412), %	> 800
Tensile strength at break, psi (MPa)	> 200 (1.4)
Lap shear after 3 days at 23˚C and 50% RH, min., psi	112
Packaging	55-gallon drums, 5-gallon pails, 6-mil sausage packs, cartridges

BETATECH™ Plus

Elastic adhesive and seam sealant provides:

- **Exceptional primerless performance on a variety of substrates**
- **Bonds substrates including steel, wood, aluminum, fiberglass and coatings**

Application	Substrate bonding
Appearance	Black, gray or white
Solids content, min., %	98
Density, lb/gal (kg/L)	10.1 ± 0.2 (1.21 ± 0.02)
Flash point setaflash, ˚F (˚C)	> 230 (110)
Viscosity (flow rate), initial at 23˚C, 50% RH, seconds, 0.157" (4 mm) orifice, 80 psi (550 kPa)	20-60
Non-sag properties	Good
Tack-free time, max. minutes, at 23˚C and 50% RH	60
Shore A Hardness, durometer avg. after 7 days at 23˚C, 50% RH	40 ± 4
Elongation at break, %	> 300
Tensile at break, psi (kPa)	> 200 (1379)
Lap shear, min., psi (MPa), after 3 days at 23˚C, 50% RH	> 200 (1379)
Packaging	55-gallon drums, 5-gallon pails, cartridges, foil packs

Structural Bonding Solutions

Far left: BETAMATE structural adhesives reduce vibration by stiffening overall vehicle structure.

Left: Acoustics are also improved by the use of BETAMATE structural adhesives in applications like roof and floor bonding.

Vehicle durability, structural integrity and noise, vibration and harshness (NVH) performance can be enhanced with structural and semi-structural bonding solutions from Dow Automotive Systems.

Compared to welds and mechanical fasteners, our adhesives improve vehicle stiffness and minimize metal fatigue by providing a continuous bond line between substrates. Acoustics also are improved due to reduced vibration. **BETAMATE**™ structural adhesives can bond dissimilar substrates and are used for:

- **Roof and floor bonding**
- **Body panel bonding**
- **Luggage compartment and other component bonding**

BETAMATE adhesives are available in one-part (1K) and two-part (2K) systems. 1K formulations require oven cure. For commercial transportation, 2K adhesives are recommended because no oven cure is necessary.

Semi-structural adhesives provide both bonding and sealing properties and can adhere to wood, glass, PU, sheet and coated metal. They are also paintable for a Class A finish. Typical applications include:

- **Aluminum roof sheets**
- **Painted aluminum cant rails**
- **Composite or aluminum side panels**
- **Luggage compartments**
- **Floors/carpets**

In addition, Dow Automotive Systems is introducing a new line of structural adhesives specially formulated for use with lightweight composites. Soon to be sold under the **BETAFORCE**™ trademark, these specialty adhesives exhibit high modulus, high elongation, greater shear strength and stable mechanical properties over a wide temperature range.

Above: Semi-structural adhesives from Dow Automotive Systems can be used on a variety of substrates, including sheet and coated metal, glass, PU and wood.

BETAMATE™ 73100 / 73002 / 73005 / 73010

PU structural adhesives:

- **Contain components that react quickly at room temperature to form crosslinked polymers that are stronger than many of the bonded substrates**
- **Provide high adhesion to metal and non-metal substrates**
- **Include curative available in 2-, 5- and 10-minute working times**
- **Reduce or eliminate rivets, bolts or mechanical fasteners**
- **Improve NVH**

Application	Join a variety of similar or dissimilar substrates
Appearance	Dark gray
Solids content, min., %	100
Density, lb/gal (kg/L)	N/A
Flash point setaflash, ˚F (˚C)	> 300 (150)
Viscosity, cps at 77˚F (25˚C) Brookfield, HAT Spidle #5 @ 20 RPM	1-30
Accelerate cure, ˚F (˚C), 10 minutes	200 (93)
Shore D Hardness	62
Youngs modulus, psi (MPa)	14,000 (96.5)
Elongation, %	80
Tear resistance, lb/in (N/m)	335 (58,625)
Packaging	5-gallon metal pails, 55-gallon drums

BETAMATE™ 73312 / 73313

Two-component structural adhesives:

- **Used to produce toughened structural epoxy adhesives**
- **Replace welds and mechanical fasteners in hem flanges and lap joints**
- **Bond aluminum, magnesium, cold-rolled and electro-galvanized steel**

Application	Join metal substrates
Appearance	73312 - Black 73313 - Tan
Solids content, Wt %	100
Flash point ˚F	> 230
Weight per volume, lb/gal	73312 - 10.25 73313 - 10.6
Viscosity, cps at 77˚F (25˚C) Brookfield HBT, HAT Spindle #7 at 10/100 RPM	73312 - 368,000/154,000 73313 - 64,000/37,000
Shore D Hardness	60
Elongation, %	2.1
Tensile strength, kPa	46,000
Young's modulus, kPa	3,500,000
Shear modulus, kPa	1,300,000
Packaging	5-gallon metal pails, 55-gallon drums

BETAMATE™ 73316 / 73317

Two-component structural adhesives:

- **Used to produce toughened structural epoxy adhesives**
- **Replace welds and mechanical fasteners in hem flanges and lap joints**
- **Bond aluminum, magnesium, cold-rolled and electro-galvanized steel**

Application	Join metal substrates
Appearance	73316 - Black 73317 - Tan
Solids content, Wt %	100
Flash point °F	> 230
Weight per volume, lb/gal	73316 - 8.17 73317 - 7.84
Viscosity, cps at 77°F (25°C) Brookfield HBT, HAT Spindle #7 at 10/100 RPM	73316 - 304,000/120,000 73317 - 214,000/101,000
Young's modulus, (ISO 8256 type 3 speed at 50.00 mm/min, temp. at 23°C), MPa	2,470
Strain at break (ISO 8256 type 3, speed at 50.00 mm/min, temp. at 23°C), %	2.1
Packaging	5-gallon metal pails, 55-gallon drums

BETAMATE™ 73326M / 73327M

Two-component structural adhesives:

- **Used to produce structural epoxy adhesives with added flexibility**
- **Replace welds and mechanical fasteners in lap joints**
- **Provides good adhesion to untreated aluminum and sheet-molding compounds**

Application	Joins metal substrates
Appearance	73326M - Black 73327M - Tan
Solids content, Wt %	73326M - 99.4 73327M - 93.3
Flash point °F	> 230
Weight per volume, lb/gal	73326M - 11.8 73327M - 10.1
Viscosity, cps at 77°F (25°C) Brookfield HBT, HAT Spindle #7 at 10 RPM	73326M - 624,000 73327M - 182,000
Young's modulus, (ISO 8256 type 3 speed at 50.00 mm/min, temp. at 23°C), MPa	870
Strain at break (ISO 8256 type 3, speed at 50.00 mm/min, temp. at 23°C), %	13
Packaging	5-gallon metal pails, 55-gallon drums

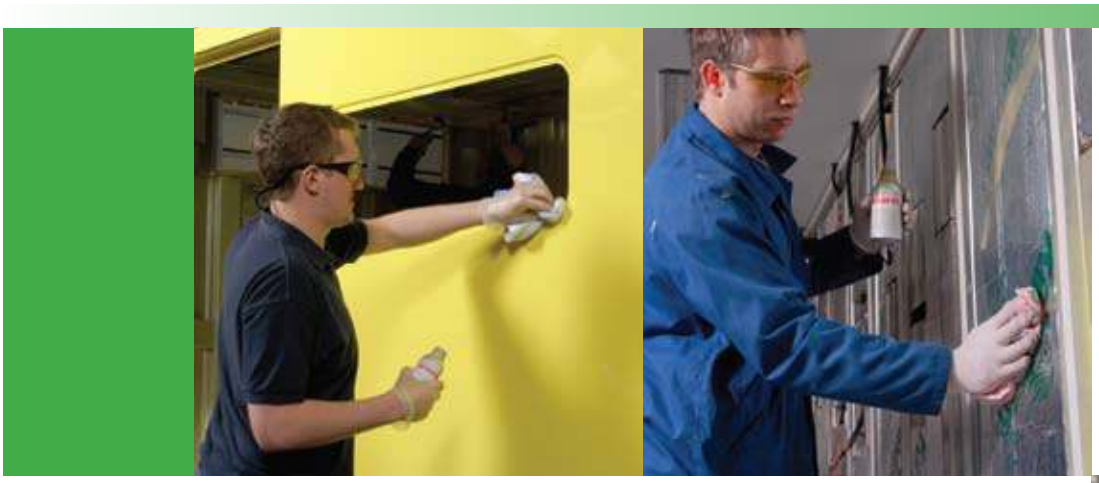
BETAFORCE™ 83100 / 83173

PU structural adhesives:

- **Cause components that react quickly at room temperature to form crosslinked polymers that are stronger than many of the bonded substrates**
- **Provide high adhesion to metal and non-metal substrates**
- **Reduce or eliminate rivets, bolts or mechanical fasteners**
- **Improve NVH**

Application	Join similar and dissimilar substrates
Appearance	Off-white
Solids content, min., %	98
Density, lb/gal (kg/L)	1.67
Flash point setaflash, ˚F (˚C)	83100 - > 200 (93) 83173 - > 230 (110)
Viscosity (flow rate), initial at 23˚C, 50% RH, seconds, 0.157” (4 mm) orifice, 80 psi (550 kPa)	15,000
Sag	None
Tack-free time, max. minutes, at 23˚C and 50% RH	15
Shore A Hardness, durometer avg. after 7 days at 23˚C, 50% RH	65-75
Elongation at break, %	45
Tensile at break, psi (kPa)	2,500 (17.2)
Lap shear, min., psi, after 3 days at 23˚C, 50% RH	621
Packaging	300-gallon totes, 55-gallon drums, 5-gallon pails, cartridges

Cleaners, Primers and Activators



Far left: Apply BETAWIPE with a continuous movement to clean and activate surfaces as part of a complete adhesive system.

To achieve optimum results from adhesives and sealers, proper surface preparation is required so that a chemical bond can form between substrates. Specific grades of **BETAPRIME**™ primers and **BETAWIPE**™ cleaners/activators from Dow Automotive Systems are recommended as parts of complete systems for commercial vehicle manufacturing and repair processes.

BETAPRIME primers from Dow Automotive Systems are used to encourage crosslinking between substrates and adhesive compounds. **BETAPRIME** also offers excellent UV stability and inhibits substrate corrosion.

BETAWIPE cleaners/activators are also recommended for specific substrates and applications. Used in the glass bonding process and also with semi-structural adhesive applications, **BETAWIPE** provides surface cleaning advantages, which help improve crosslinking and bonding.

Above: Used as part of a complete glass bonding system, BETAPRIME is also used as an adhesion promoter on body surfaces in conjunction with BETAMATE™ structural adhesives.

BETAPRIME™ Primers

BETAPRIME™ primers are available in multiple formulations to meet your specific adhesion and substrate requirements. All **BETAPRIME** primers offer:

- **Excellent UV stability**
- **Ease of use**
- **Simplified surface activation**
- **Faster primer/adhesive link-up**

Your Dow Automotive Systems representative can help you select the best **BETAPRIME** primer for your application, or visit www.dowautomotive.com for more information on the features and benefits of our complete line of primers.

Far left: BETAFILL™ seam sealants are used for seam and panel sealing, gap filling and panel bonding.

Left: BETAPRIME™ primer is applied to the roof surface prior to the application of BETAMATE™ structural adhesive.

To ensure the best results for your assembly operations, Dow Automotive Systems recommends the correct step-by-step use of its cleaners, primers, and activators with its adhesive and sealants. Please contact a Dow representative at 1-800-441-4369 for specific surface preparation guidelines and product grades for your application.

Dow Automotive Systems BETASEAL™ glass bonding systems help seal stationary glass, adding to the vehicle's structural strength and protecting the interior cabin from dirt and other environmental elements.

Product Matrix

Dow Automotive Systems provides the industry's broadest range of adhesives, sealants and acoustical, structural and thermal management solutions. Our goal is to utilize our extensive experience to exceed your requirements, meet appropriate regulations, reduce costs and accelerate time to market. Detailed product information is also available in our solutions finder located at **www.dowautomotive.com**.

Products	Applications	Benefits
BETAFILL™ seam sealants and BETATECH™ solvent-free sealants Seal lightweight construction materials	• Used as bedding compounds to absorb shocks and vibrations • Seal wood, metal, plastic door frame and window sill fittings • Used for bulkhead sealing, door-skin fixing • Seal mud guards and wheel arches	• Permanent elasticity • Paintable • Good coefficient of movement and adhesion between different substrates • Water and weather resistant • Non-corrosive • Brushable • Vibration and shock absorbent • Silicone free
BETASEAL™ glass bonding systems Used worldwide for structural bonding and sealing of stationary glass	• Windshields, taillights and quarter light glass for all commercial vehicles • Aftermarket	• Help vehicles meet globally mandated requirements for barrier, rollover and roof crush regulations • Improve crashworthiness • Enhance structural integrity • Reduce contact corrosion
BETAMATE structural adhesives Replace welds and mechanical fasteners in joining a variety of similar and dissimilar substrates	• Roof, panel and floor bonding • Hem flanges • Replace or reinforce weld joints in engine compartments, cockpits, roof panels • Reinforce rails and other load-bearing members • Bond structural headliners directly to roof • Aftermarket	• Reduce fatigue and failure commonly found around spot welds and fasteners • Seal against environmental conditions that cause corrosion • Reduce vibration by stiffening overall vehicle structure, so acoustics are also improved • Bond dissimilar substrates
BETAPRIME™ primers Glass and body primers	• Primer for glass and paint in OE applications • Aftermarket	• Excellent UV stability • Ease of use • Packaging designed to reduce waste and improve efficiency • System simplifies activation of the bonding surface • Faster primer/adhesive link-up • Conform to OEM specifications
BETAWIPE™ cleaners/activators Adhesion promoters for plastics	• Reactivate remaining "cut-back" PUR, PAAS, PUR and PVC RIM encapsulations • Aftermarket	• Flash-off time: 10 minutes

About Us

Dow Automotive Systems, a business unit of The Dow Chemical Company, provides technology- and materials-enabled solutions for interior, exterior, powertrain, vehicle structural enhancement, acoustical management, emissions control and aftermarket applications in the automotive and commercial transportation industries.

www.dowautomotive.com

Dow Automotive Systems
The Dow Chemical Company
1250 Harmon Road
Auburn Hills, Michigan 48362
USA

Phone: +1-800-441-4369 (toll free) or +1-248-391-6300
Fax: +1-248-391-6417
E-mail: dowautomotive@dow.com

DOW Automotive Systems

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