



Soluções em adesivos estruturais para aplicações automotivas

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LORD
AskUsHow™

LORD Corporation:

A global technology leader providing valuable expertise in:

- u **Vibration, motion and noise control**
- u **Magnetically responsive technologies**
- u **Adhesives and coatings**



Quick facts about LORD



- u **Founded in 1924**
- u **More than 2,600 employees**
- u **Privately-held company**
- u **\$750MM in annual sales**
- u **World headquarters in Cary, NC**
- u **17 manufacturing facilities in nine countries**
- u **90 strategically located sales and support centers worldwide**

The markets we serve include:

Aerospace and Defense

- w Commercial and Private Aircraft
- w Military Aircraft
- w Missile Systems
- w Tanks and Artillery

Transportation

- w Automotive
- w Rail
- w Truck/Bus
- w Agriculture
- w Recreational & Marine

Manufacturing

- w Industrial Assembly
- w Electronic Assembly
- w Process Industries

Construction

- w Flooring
- w Civil Engineering
- w Off-Highway Vehicles



LORD Engineered structural adhesives

Structural adhesives

A few definitions

LORD Engineered structural adhesives

u What is a structural adhesive ?

In theory: It is an adhesive making stronger bonds than the various substrates it assembles.

In practice: It is an adhesive allowing to assemble similar or different substrates while participating to the final structure integrity and robustness.

Usually a minimum bonding strength of **7 MPa** is expected

LORD Engineered structural adhesives

u Lord Structural Adhesive

- High strength and toughness.
- Replace conventional joining or alternative adhesive bonding methods
- Epoxies, Polyurethanes, Methacrylate-based acrylics

u 2-Component Adhesive

- An adhesive or coating that consists of two separate components in the unreacted state. These materials must be thoroughly mixed together at specific ratios to achieve the desired properties of the cured product.

u 1-Component Adhesive

- An adhesive or coating that consists of a single component and that cures when exposed to a specific environment or energy source.

LORD Engineered structural adhesives

Structural adhesives

How do they compares to alternative bonding methods ?

u Structural adhesive vs Mechanical fasteners:

Mechanical Fasteners	Lord structural adhesives
Design	
<ul style="list-style-type: none"> - Aesthetically unappealing - Difficult to use thin substrate 	<ul style="list-style-type: none"> + No effect on visible surfaces + Thin light substrates easy to use
Process	
<ul style="list-style-type: none"> - Require hole drilling - Difficult to paint - Requires additional sealing <p>+ Inspectable</p>	<ul style="list-style-type: none"> + Simple dry wipe (acrylics) + Bond and seal in single operation <p>- Generally requires destructive inspection</p>
Final performance	
<ul style="list-style-type: none"> - Stress concentrators - Can leak - Loosen over time - Can cause galvanic corrosion <p>+ Replaceable</p>	<ul style="list-style-type: none"> + Evenly distributes stress + Excellent durability + Helps in preventing corrosion <p>- More difficult to remove /replace</p>

u Structural adhesive vs Sealant:

Sealant	Lord structural adhesives
Design	
<ul style="list-style-type: none"> - Not valuable for structural needs - Do not participates to structure integrity - Requires more reinforcement / stiffeners + Low cost per liter 	<ul style="list-style-type: none"> + Participate to structure integrity + Allows limited stiffeners / reinforcements
Process	
<ul style="list-style-type: none"> - Require solvent cleaning - May require a primer - Usually slow cure rate + Usually no mixing required 	<ul style="list-style-type: none"> + Simple dry wipe (acrylics) + Usually no primer required + Short handling time - Mixing required
Final performance	
<ul style="list-style-type: none"> - Strength usually < to 5 MPa - Do not oppose twisting of the structure - More sensitive to ageing + 100% or more elongation 	<ul style="list-style-type: none"> + Strength usually > 12 MPa + Excellent durability

u Structural adhesive vs High Performance tapes:

High Performance tapes	Lord structural adhesives
Design	
<ul style="list-style-type: none"> - Do not participates to structure integrity - Requires more reinforcement / stiffeners - Difficult to use on complex shape - High cost per linear meter 	<ul style="list-style-type: none"> + Participate to structure integrity + Allows limited stiffeners / reinforcements + Allow complex shape
Process	
<ul style="list-style-type: none"> - Require solvent cleaning - Difficult to automatize - Difficult to handle corners - Impossible to reposition once mated - High mating pressure required + Instant bond + Dry application 	<ul style="list-style-type: none"> + Simple dry wipe (acrylics) + Automatic or manual application + Easy to handle corners + Better handle mismatch or even surfaces - Longer handling time
Final performance	
<ul style="list-style-type: none"> - Sensitive to creep - Strength < 1 MPa - Do not oppose twisting of the structure - Highly sensitive to temperature changes + 100% or more elongation 	<ul style="list-style-type: none"> + No creep + Strength usually > 12 MPa + Participate to surface integrity + Limited temperature sensitivity

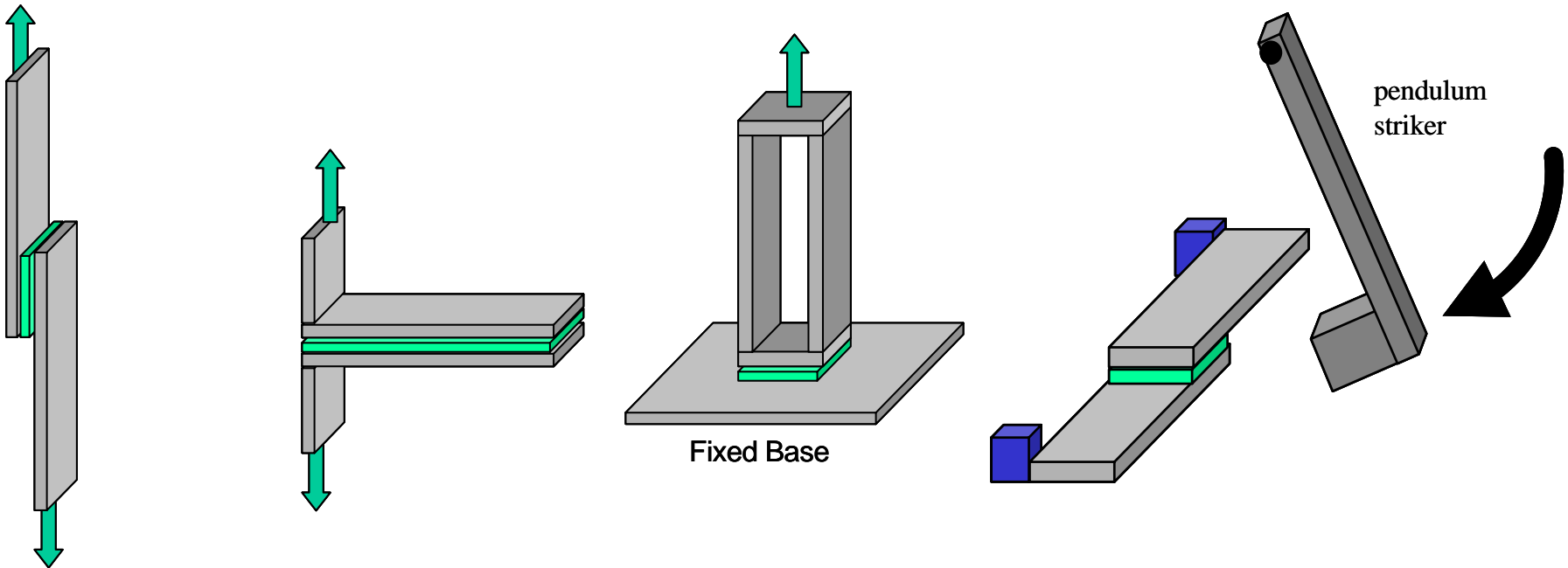
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Engineered structural adhesives

Structural adhesives
Performance measurements

LORD Engineered structural adhesives

Four test methods are commonly used to evaluate LORD adhesives on industry substrates

- Single lap shear
- T-peel
- Tensile pull-off
- Cold impact



LORD Engineered structural adhesives

u Strength

- The maximum load capacity of a given material or assembly as a function of the area the load is acting over
- Units of force per unit area or width (peel)

u Elongation

- The distance a material can stretch from its un-deformed state before failure occurs
- When quoted on a technical data sheet, it is:
 - Usually expressed as a percentage
 - Measured on neat adhesive – not a bonded part
 - Extremely dependent on test method

LORD Engineered structural adhesives

u Modulus

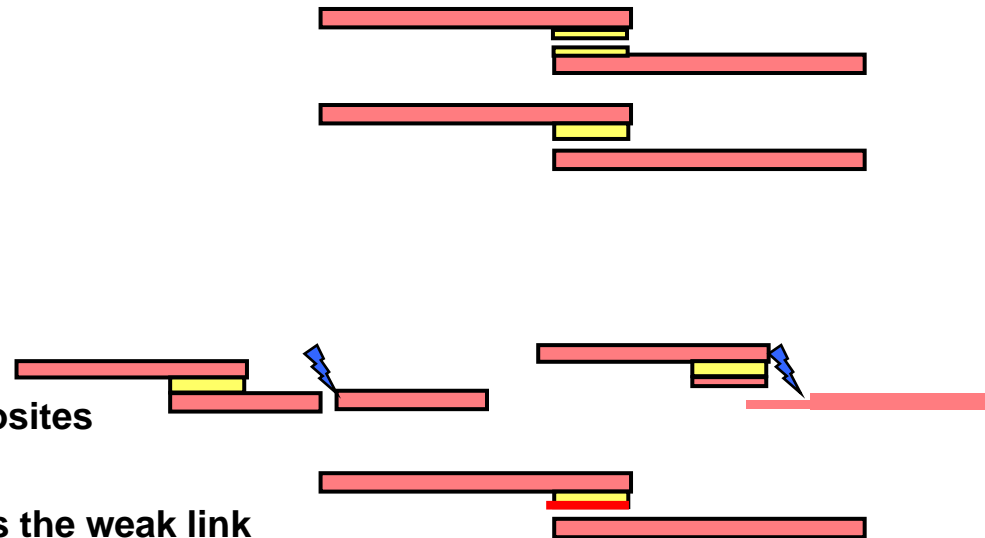
- The relationship between stress and elongation
- Expressed in units of force per unit area
- Usually used to express the rigidity of the material, but is not the same as stiffness

u Coefficient of thermal expansion

- The relationship between volume change and temperature change. Determination of the failure mode can supply a lot of information regarding the quality of adhesion.

u Failure Modes

- Cohesive failure – preferred
- Adhesive failure – not preferred
- Mixed mode failure – most common
- Stock break failure – preferred
- Fiber tearing failure – preferred for composites
- Coating failure – shows that the coating is the weak link



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Structural adhesives

Lord range

Advantages x Disadvantages of three types of Structural Adhesives

Properties	Epoxies	Acrylics	Urethanes
Mechanical resistance	★★★★★	★★★★	★★★
Chemical resistance	★★★★★	★★★	★★
Thermal resistance	★★★★★	★★★	★
Impact resistance	★★	★★★★★	★★★★★
Environmental resistance	★★★★★	★★★★	★★
RT cure	★	★★★★★	★★★★★
Surface preparation	★★	★★★★★	★★★★★
Odor	★★★★	★★	★★★★★

Adhesion proprieties

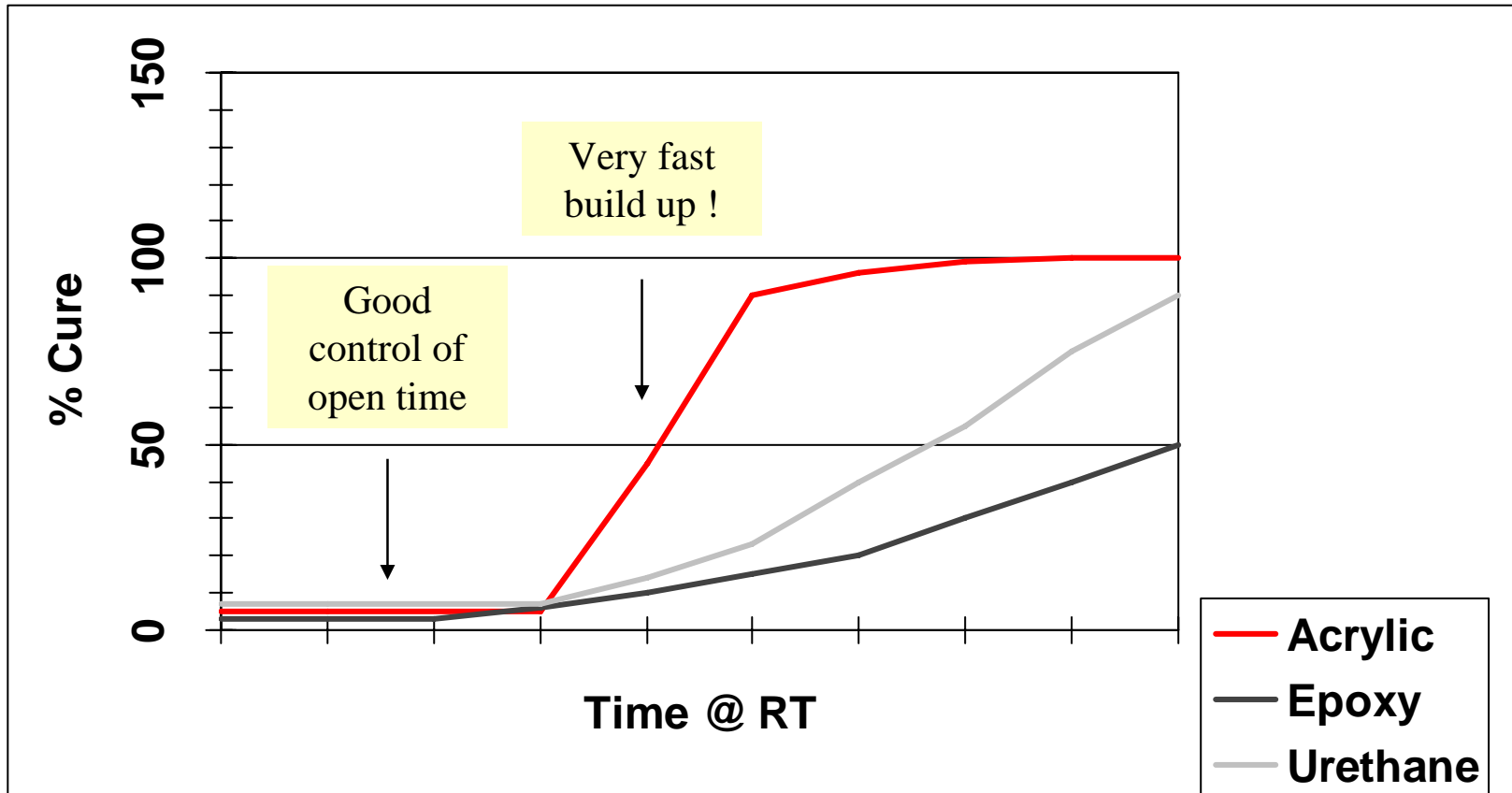
Lap shear and Cross peel – in kgf/cm²

	Epoxy		Urethanes		Acrylics	
	Lap shear	Cross peel	Lap shear	Cross peel	Lap shear	Cross peel
CRS x CRS	120 - CF	16 - CF	129 - CF	17 - CF	137 - CF	20 – CF
SMC x SMC	23 - FT	4 - AF	45 - FT	7 - SF	33 – FT	7 – SF
RTM x RTM	62 - FT	7 – FT	65 - FT	7 - SF	64 - FT	9 - SF

CF= cohesive failure AF= adhesive failure FT= fiber tear SF= substrate failure

Obs.: the values above are only referencial

Product Offering



Acrylic Product Offering

LORD Maxlok™

Acrylic Adhesives

For Maximum Performance...Make it Maxlok

[Contact Us](#) | [MSDS](#) | [LORD.com](#) | [Ask The Expert](#)



The **LORD Maxlok Series** is the next generation in metal bonding adhesives supplying superior performance across various substrates. LORD Maxlok products provide the strength and durability you need while also improving efficiencies and flexibility within the manufacturing process.

TRANSPORTATION | SHIPPING | SPECIALITY CONSTRUCTION | GREEN | SPECIALITY VEHICLE







WHY USE MAXLOK | PROCESS IMPROVEMENTS | ADVANTAGES | PACKAGED SOLUTIONS | WHERE TO BUY

Why You Should Make It Maxlok

Maxlok adhesives improve your manufacturing process and ultimately your final product. When working with Maxlok adhesives, you will gain improvements in:

- Product aesthetics
- Durability and fatigue life
- Weight reduction
- Vibration dampening
- Manufacturing costs and throughput



Advantages Over Traditional Fastening Methods

[Learn More](#)

[Contact Us](#)

LORD Maxlok™ Website – www.lordmaxlok.com

TRANSPORTATION:

Bus, Rail and Heavy Truck

The LORD Maxlok Series can be used on engine compartment doors, air conditioning and air intake components, dashboards, front bumpers, grills and other internal parts as well as carriage and frame components. Our adhesives help reduce stress points, leaks and cycle times and improve aesthetics along with dimensional accuracy, allowing design freedom to further improve your final product.



Reduction of leak points -
Reduced aftermarket service due to improved product quality

Improved appearance due to the removal of many rivets -
Easier to apply logos and advertisements



LORD Maxlok™
Acrylic Adhesives

LORD Maxlok™ Product Brochure

LORD Maxlok™ Acrylic Adhesives

Description

LORD Maxlok™ acrylic adhesives replace welding, brazing, riveting and other mechanical fastening methods especially in low-temperature environments subject to high impact or high peel loads.

Features and Benefits

Versatile – bonds a wide range of unprepared metals with minimal substrate preparation.

Temperature Resistant – performs at temperatures from -40 to +300°F (-40 to +149°C).

Environmentally resistant – resists dilute acids, alkalis, solvents, greases, oils, moisture, salt spray and weathering; provides excellent resistance to UV exposure.

Application

Surface Preparation – remove grease, loose contamination or poorly adhering oxides from metal surfaces. Normal amounts of mill oils and drawing compounds usually do not present a problem in adhesion. Most plastics require a simple cleaning before bonding. Some may require abrading for optimum performance.

Mixing – mix Maxlok T6 adhesive with the proper amount of Maxlok MX accelerator. Handheld cartridges will automatically dispense the correct volumetric ratio of each component. Even color distribution visually indicates a thorough mix. Once mixed, the adhesive cures rapidly.

Typical Properties

	MX Accelerator	T3 Adhesive	T6 Adhesive	T18 Adhesive
Appearance	Gray Paste	Off-white to Tan Paste	Off-white to Tan Paste	Off-white to Tan Paste
Viscosity, cP @ 77°F (25°C)	200,000 - 500,000	200,000 - 350,000	200,000 - 350,000	200,000 - 350,000
Density				
lb/gal 1	1.7 - 11.9	8.5 - 8.7	8.5 - 8.7	8.5 - 8.7
(kg/m³)	(1407 - 1426)	(1043 - 1061)	(1043 - 1061)	(1043 - 1061)
Flash Point, °F (°C)	201* (94*)	59* (15*)	59* (15*)	59* (15*)
Working Time, Min		3-5	6-9	18-24
Handling Time, Min @ 77°F		6-8	20-24	48-72

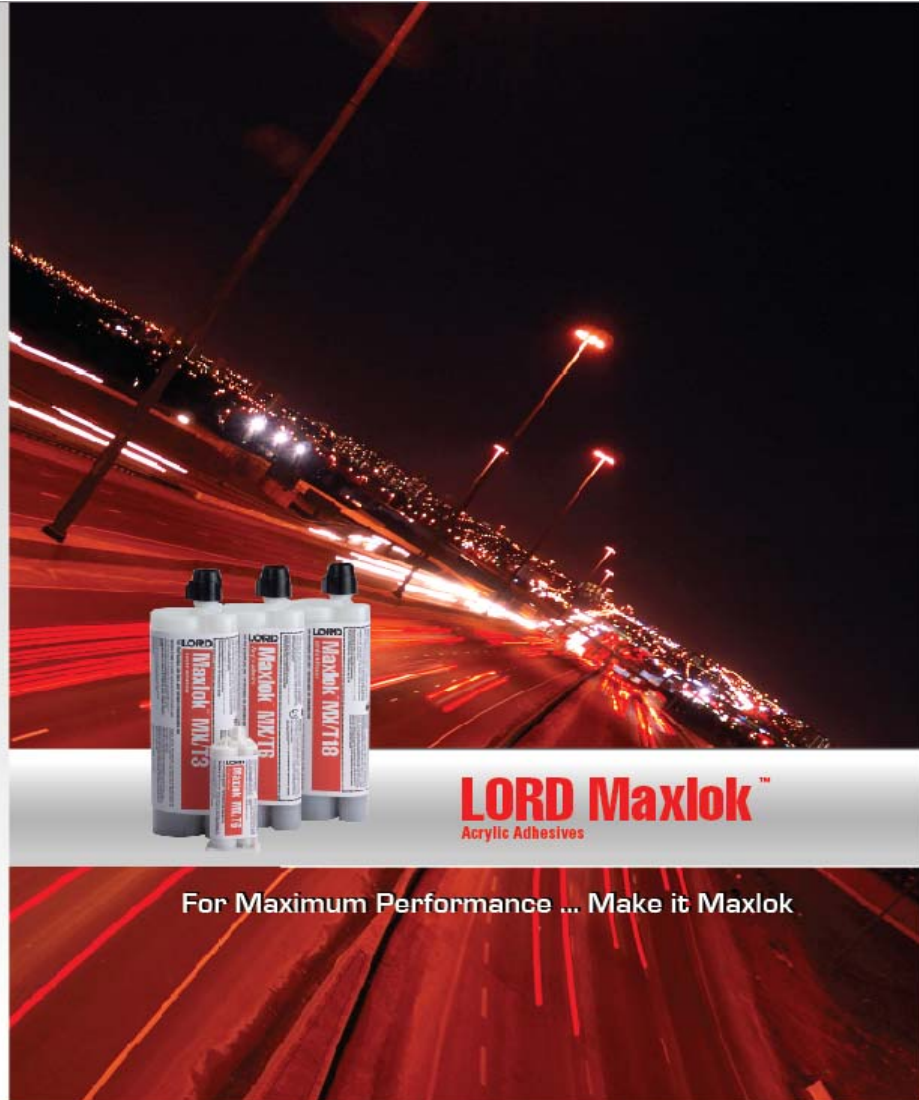
*Data is typical and not to be used for specification purposes.

Bond Performance

Substrates	Aluminum to Aluminum	HDG to HDG	EZG to EZG	Power Coated Steel to Powder Coated Steel
Lap Shear @ Room Temperature, psi (MPa)	2800 (19.3)	2400 (16.5)	2200 (15.2)	1900 (9.0)
T-Peel, pli (N/mm)	41 (7.18)	53 (9.29)	54 (9.46)	26 (4.56)
Failure Mode	C	C	C	C
Substrate	Aluminum, 0.032" thick 6061T6 Electroplated Steel (EZG), 0.032" thick Hot Dipped Galvanized Steel (HDG), 0.032" thick Powder Coated Steel, 0.035" thick, polyester on cold rolled steel		Surface Treatment Dry Rage Wipe Dry Rage Wipe Dry Rage Wipe Dry Rage Wipe	
Bonded Parameters	Bond Area	Film Thickness	Cure	Mix Ratio
Metal Lap Shears (ASTM D1002)	1.0" x 0.5"	0.010"	24 hr @ RT	4:1 by Volume
T-Peel (ASTM B1876 modified)	1.0" x 3.0"	0.010"	72 hr @ RT	4:1 by Volume
Failure Mode Definition	Abbreviation			
Cohesive Failure	C			

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Urethane Product Offering

Properties	Fusor 2001/2002	Fusor 152	Lord 7555 A/B
Open time, min	5 - 8	3 - 5	3 - 5
Handling time, min	45	12	60
Curing time, hours	24	24	24
Apearance	Black/White	Black/Brown	Translucent/White
Viscosity, cPs	3.000 – 23.000 6.000 – 14.000	3.000 – 10.000 2.000 – 9.000	45.000 – 160.000 130.000 – 230.000
Mix ratio, v/v	1:1	1:1	1:1
Shelf life, months	6	12	6

Urethane Product Offering

u **Uncured properties**

- Single component (part) and two component systems
- No odor
- Low VOC and not flammable

u **Application properties**

- Easy to dispense – some having gravity-feed viscosities
- Typically require more surface preparation than acrylics
- Non corrosive to equipment
- Cure behavior and final properties are affected by moisture in air or substrate
- Wide range of cure rates available
- Cure rate can be greatly accelerated with heat
- Gap filling properties

u **Cured properties**

- Can attain very high elongations (>100%)
- Can survive temperatures up to 150°C
- Do not form durable bonds to bare metals

Epoxy Product Offering

Properties	Fusor 305 A/S	Lord LA 017 A/B	Fusor 380/383NS
Open time, min	20 - 30	15 - 20	20 - 30
Handling time, min	150	60	120
Curing time, hours	48	24	48
Apearance	Yellowish/ translucent	White/ Beige	White/Black
Viscosity, cPs	10.000 – 18.000 19.000 – 46.000	300.000 – 600.000 300.000 – 600.000	550.000 – 1.300.000 280.000 – 950.000
Mix ratio, v/v	1:1	1:1	1:1
Shelf life, months	12	12	12

Epoxy Product Offering

u **Uncured properties**

- Tend to be very viscous liquids or pastes
- Low odor

u **Application properties**

- May have different mix ratios depending on desired final physical properties
- Relatively unaffected by humidity while curing
- Tend to have slow cure rates
 - Full-cure times of ~24 hours
 - Cure rate can be accelerated dramatically with heat

u **Cured Properties**

- Relatively low elongations
- Good hot strength - chemically stable up to 120°C and some even to 200°C
- Very good chemical resistance
- Bond well to porous substrates
- Good adhesion to a wide variety of materials, but surfaces should be very clean

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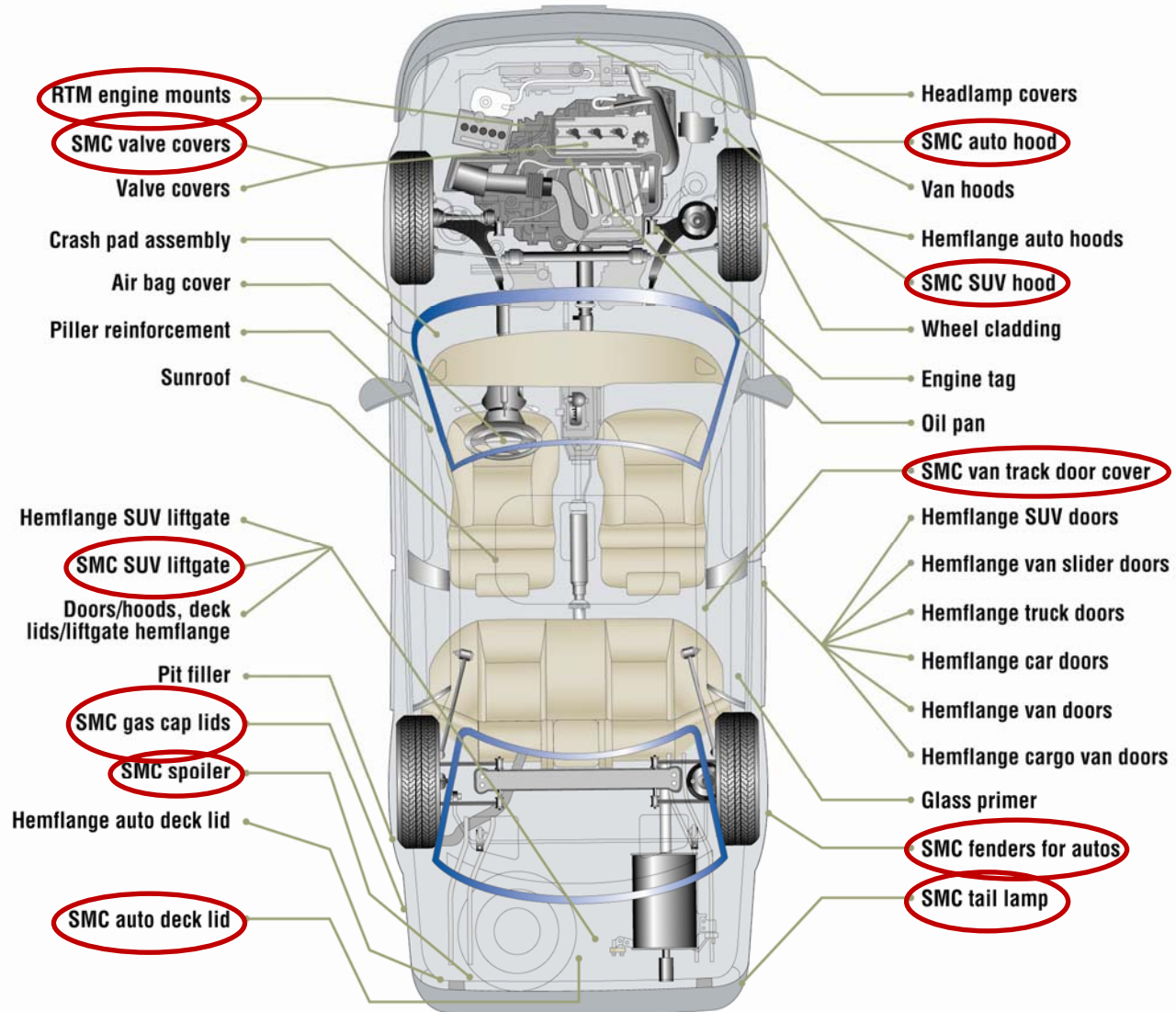
Structural adhesives
Application

Composite Bonding – Adhesive Selection

Condition	Adhesive Choice	Comments
FRP	LORD urethane or acrylic	Grind FRP bond surface if using urethane
FRP to plastics	LORD urethane or acrylic	Test adhesion to plastic, grind FRP bond surface if using urethane
FRP to bare metals	LORD metal bonding acrylic	Test adhesion to FRP
FRP to coated metals	LORD urethane or acrylic	Test adhesion to coating, grind FRP bond surface if using urethane
FRP to wood	LORD urethane	Grind FRP bond surface
FRP to masonry	LORD urethane or epoxy	Grind FRP bond surface

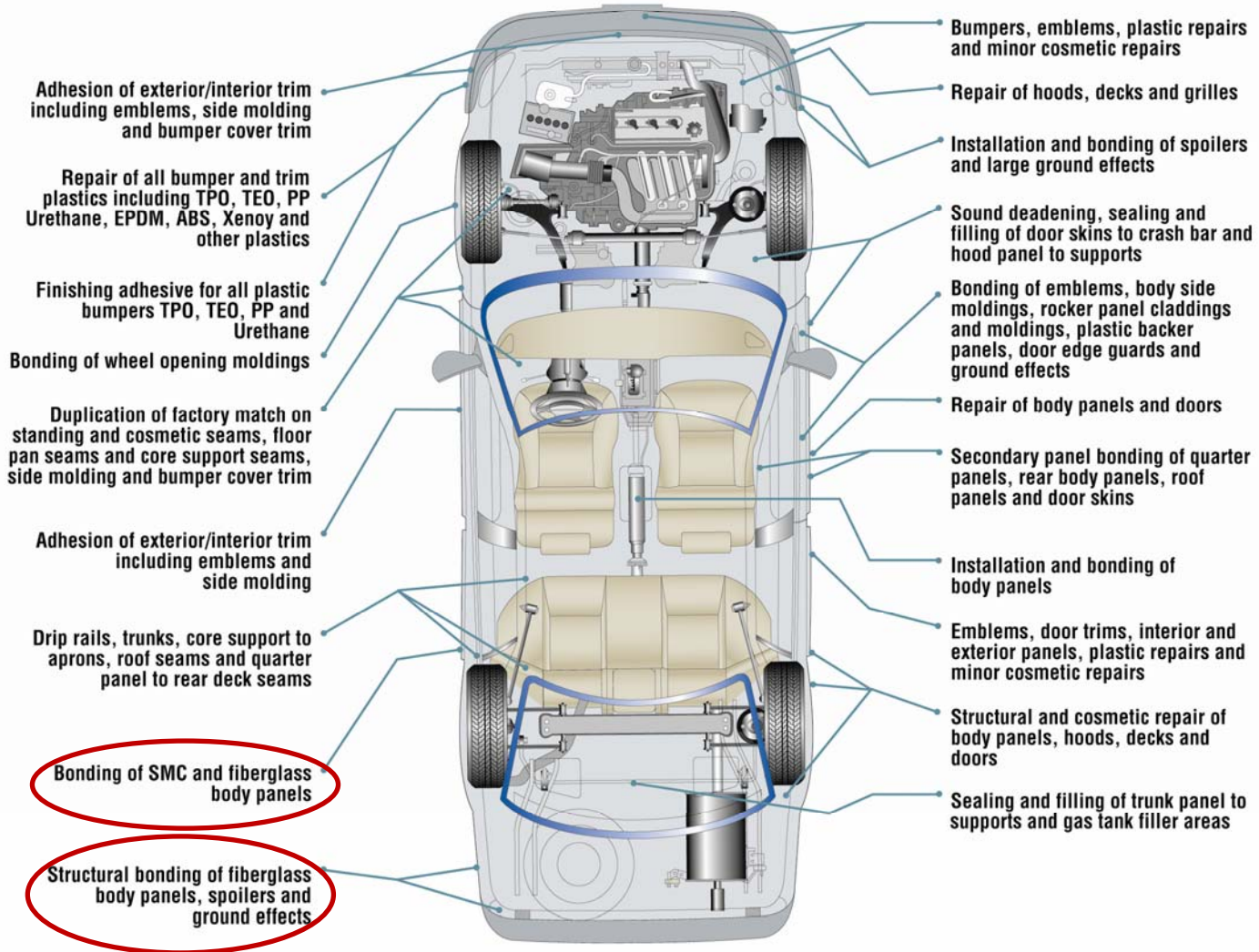
Cars...

Providing solutions for **OEM Applications**

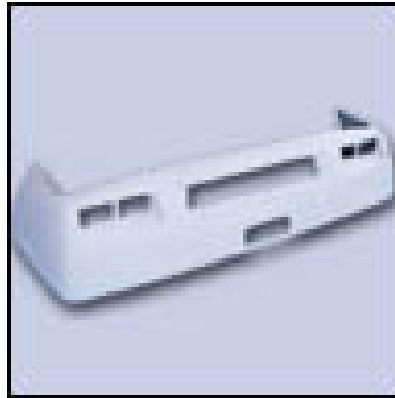


Cars...

Providing solutions for
Aftermarket Applications



Trucks...



Part: Frontal bumper

Process/material: RTM

Adhesive: LORD Acrylics



Part: Frontal grills

Process/material: RTM

Adhesive: LORD Acrylics and
Fusor 2001/2002



Part: Radiator deflectors

Process/material: RTM

Adhesive: LORD Acrylics

Trucks...

Part: Central grill

Process/material: RTM and SMC

Adhesive: Fusor 2001/2002



Trucks...

Part: Roof

Process/material: RTM

Adhesive: LORD Acrylics



Light Trucks/SUV's...



Part: Central grill and Air scoop

Process/material: RTM

Adhesive: LORD Acrylics



Part: Rear door

Process/material: RTM

Adhesive: Fusor 2001/2002

Buses...

Soluções de Adesivos Estruturais para Ônibus

Aplicação de adesivos estruturais para ônibus

01 Escotilha de ar no teto	Colagem da cúpula dianteira 07
02 Tampa do ar condicionado	Colagem do teto 08
03 Partes internas	Colagem do painel da porta 09
04 Componentes do painel	Colagem do painel lateral 10
05 Tampa traseira do motor	Portinhola do porta malas 11
06 Para-choque e grade dianteira	Colagem da cúpula traseira 12



Buses...



Part: Air conditioning shell

Process/material: RTM

Adhesive: LORD Acrylics

Part: Air intake

Process/material: RTM

Adhesive: Fusor 380/383NS

Typical Process- Screws x Adhesive

Operation	Conventional Process using screws	LORD Technology
Drill Operation for screw holes	23 min	Zero
Applying screws	30 min	-----
Applying adhesive	-----	14 min
Profile for hiding screws	16 min	-----
TOTAL	69 min (x 2 sides operation)= 138 min	14 min (x 2 sides operation)= 28 min

Typical Process- Screws x Adhesive

	Conventional Process	LORD Technology
Materials	Quantity	Quantity
Screws, units	440	0
Seam Sealer (buthilic sealer), kg	5	0
Polyurethane Sealer, kg	4	0
Structural adhesive, kg	-	4

OBRIGADO

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