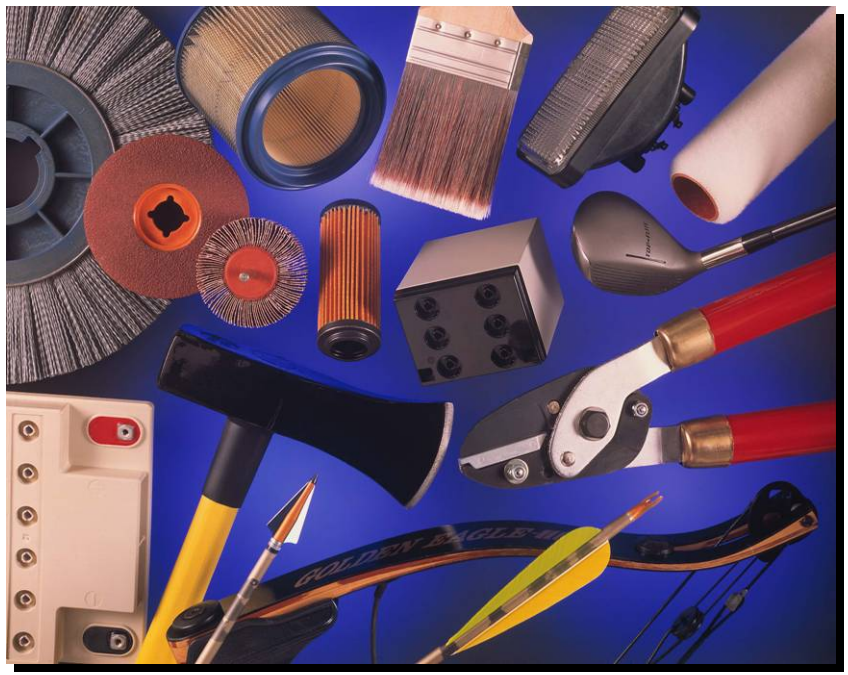
ROYAL
ADHESIVES & SEALANTS

HARDMAN

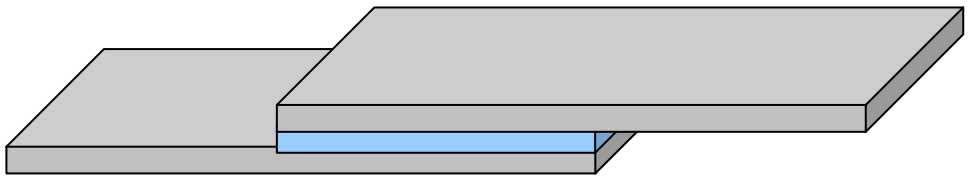
Royal Adhesives and Sealants

Hardman® Structural Adhesives

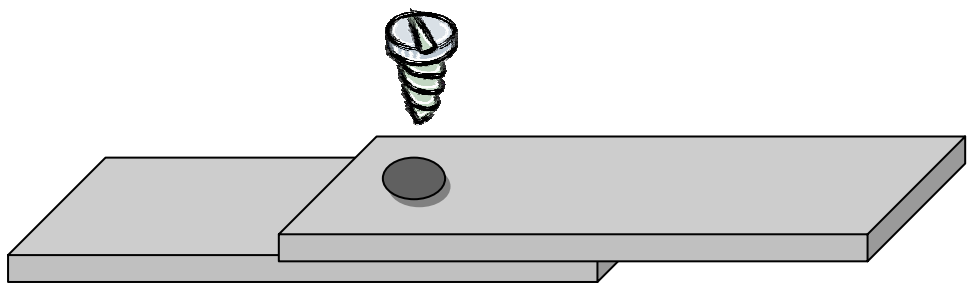


Structural Adhesives

Structural Adhesives: ***load bearing adhesives which add strength to the products being bonded by resisting stress. Typically used to replace mechanical fasteners***.



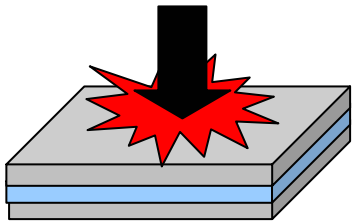
Substrates bonded with adhesive



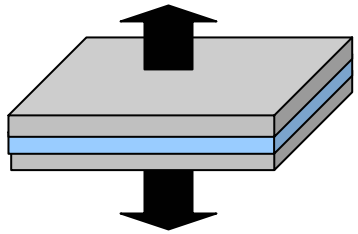
Substrates mated with mechanical fastener

Types of Stresses

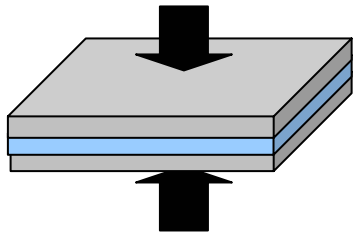
Impact Stress



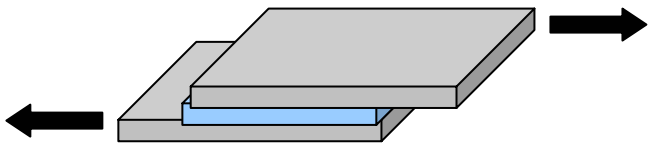
Tensile Stress



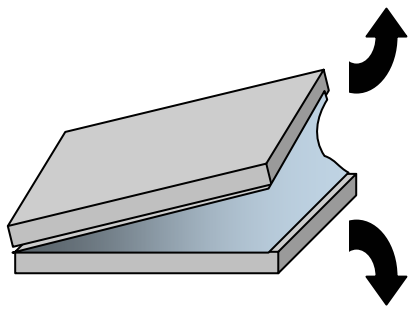
Compression Stress



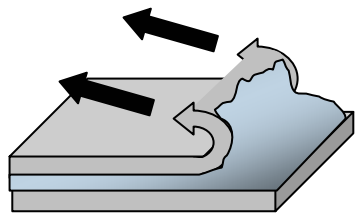
Shear Stress



Cleavage Stress

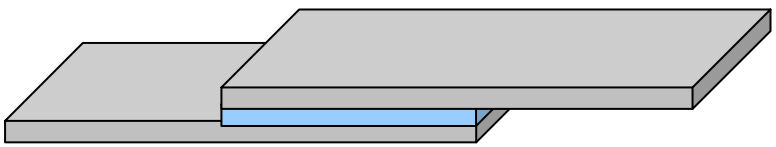


Peel Stress

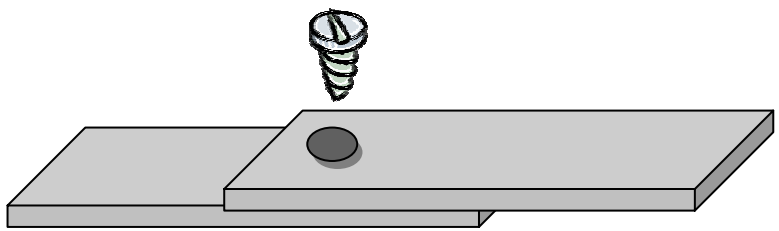


Structural Adhesives v. Mechanical Fasteners

1 **Uniform distribution of stress** can eliminate stress concentration caused by rivets, spot welds, & other mechanical fastening.	4 Holes are eliminated maintaining the integrity of bonded material – can **reduce finishing and increase design flexibility**.
2 Can bond laminates of dissimilar materials to provide **superior strength and performance** than either substrate alone.	5 **Costs can be lowered** by reducing material requirements and weight – eliminates drilling, welding, screwing, etc.
3 Adhesive flexibility compensates for differences in coefficients of expansion and **improves resistance to vibration and fatigue**.	6 Continuous contact between mating surfaces can **effectively bond and seal** against many environmental conditions.



Substrates bonded with adhesive



Substrates mated with mechanical fastener

Adhesive Key Performance Attributes

- **High Peel and Lap Shear Strength**
- **Viscosity: Good Flow**
  - Provides wetting action
- **Low Shrinkage**
  - Minimizes stress
- **Chemical Resistance Properties**
- **Temperature Range**
- **Other Chemical and Physical Properties**

} **Adhesive Strength**

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Keys to Good Adhesion

- **Joint Design**
- **Surface Preparation**
  - Chemical
  - Abrasion
  - Degreasing
  - Plasma Treatment
- **Uniform Pressure**
  - Sufficient to ensure wetting and even distribution of adhesive over the bonding area

Structural Adhesive Brands

- **EPOCAP® Two-Part Epoxy Adhesives/Encapsulants**
- **EPOWELD® Two-Part Epoxy Structural Adhesives**
- **ROLOX® Two-Part Epoxy Roller Adhesives**
- **MONOPOXY® One-Part Epoxy Adhesives**
- **KALEX® Two-Part Urethane Adhesives**

- **Custom Formulations**
  - R&D has ability to develop customized formulations in a timely manner through TSR system

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Epoxy Adhesives

Product Description	Comments
EPOCAP 3648A/25269B	Unfilled, 2:1 by volume, mild heat cure, laminate adhesive.
EPOCAP 3648A/3243B	Unfilled, 1:1 by volume, medium viscosity.
EPOWELD 3243	Excellent cohesive & pull-out strength & torque resistance. Filled, 1:1 by volume, medium viscosity.
EPOWELD 8173	D/B Red. Recommended for fast patching, fixturing and other repairs requiring quick handling strength. 5 minute cure.
EPOWELD 8200	Same as 3243, but with adhesion to plastics
EPOWELD 13230	D/B Orange. Excellent shock resistance, vibration resistance and impact strength. Recommended for bonding similar and dissimilar substrates.
EPOWELD 16562	Rubber toughened structural adhesive displays an excellent combination of shear and peel strength. 1:1 by volume & weight, excellent adhesion to thermoplastics, all SS.
EPOWELD 16756A/3243B	Less settling and crystallization than 3243A/B
EPOWELD 16756A/8200B	D/B 3243 Black. Same as 3243, but with adhesion to plastics
EPOWELD 16791	Very low viscosity, excellent penetration and air release combined with very low shrinkage and excellent impact strength. Color coded 2:1 by volume.
EPOWELD 20214	and impact strength. Recommended for bonding similar and dissimilar substrates 1:1 by volume.
EPOWELD 20327	Excellent impact and vibration resistance., 1:1 by volume, medium viscosity.
EPOWELD 20356	Fast setting, toughened ,outstanding T-peel, lap sheer strength and impact resistance. Excellent adhesion to graphite composite shafts. 2:1 by volume.
EPOWELD 20386A/16521B	Metal bonding adhesive
EPOWELD 23684A/25150B	1:1 volume, fast, unfilled.
MONPOXY 17655	One-component. Rubber toughened, metallic filled. This system is flexibilized and develops excellent cohesive strength. Retains very high shear strengths at elevated temperatures.
MONPOXY 18512	One-component. Rubber toughened, metallic filled. This system is flexibilized and develops excellent cohesive strength. Retains very high shear strengths at elevated temperatures. Also adheres to plastics.
ROLOX 19420	Good adhesion to PVC and plastic

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Urethane Adhesives

Product Description	Comments
KALEX 19440	Extra-fast setting polyurethane structural adhesive. It displays an excellent combination of shear strength and peel strength, with good impact and fatigue resistance. 1:1 by volume.
KALEX 16308	Black, D/B A-85. Fast setting, flexible, elastomeric. Excellent peel strength and low temperature flexibility.
KALEX 16666	Beige, D/B D-85. Extra fast setting. excellent combination of shear strength and peel strength, with good impact resistance.
KALEX 16668	Beige, D/B D-50. Semi–rigid, extra fast. excellent combination of shear strength and peel strength, with good impact and fatigue resistance.
KALEX 19423	Designed for reverse osmosis filters, and other sealing and bonding applications. Lower viscosity version of 19421 (300,000 cPs)
KALEX 17621A/16805B	Excellent combination of shear strength and peel strength, with good impact and fatigue resistance. Designed to tolerate the conditions in an automotive filter environment. Black, 1:2 volume, thixotropic.
KALEX 25170	1:4 volume, good chemical resistance, adhesion to metals.

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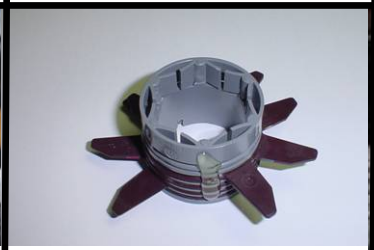
Applications

 Sports Equipment	 Aircraft/Aerospace	 Precision Tables	 Metal Windows/Doors
 Striking Tools	 Eng. Thermoplastics	 SMC's	 Automotive
 FRP's	 Filters	 Electronics	 Laminated Structures
 Ferrite Cores	 Grinding Wheels	 Rapid Repairs	 General Repairs

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Applications Selection Chart

Product Description	Sports Equipment	Aircraft/Aerospace	Precision Tables	Metal Windows/Doors	Striking Tools	Engineering Thermoplastics	SMC's	Automotive	FRP's	Filters	Electronics	Laminated Structures	Ferrite Cores	Grinding Wheels	Rapid Repairs	General Repairs
EPOCAP 3648A/25269B	●	○		●		○	○	○	●			●				
EPOCAP 3648A/3243B	●		○	●	○		○	○	○			●				●
EPOWELD 3243	●	○		●	●			○	○	○	○			●		●
EPOWELD 8173	○	●						○			○	●			●	●
EPOWELD 8200	●	●	●	○	○	●	●	○	●			●		●		●
EPOWELD 13230	●	●	●	○			○	○			●		●	●		●
EPOWELD 16562	○	○	○	○		●	●	●								
EPOWELD 16756A/3243B	●	○		●	●			○	○	○	○			●		●
EPOWELD 16756A/8200B	●	●	●	○	○	●	●	○	●			●		●		●
EPOWELD 16791	●			●	●	○		○								●
EPOWELD 20214	●	●	●	○			○	○			●		●	●		●
EPOWELD 20327	●	○		●	●			○	○	○	○			●		●
EPOWELD 20356	●	●	●	○	○	●	●	○	●			●		●	●	●
EPOWELD 20386A/16521B				●				●				●			●	●
EPOWELD 23684A/25150B	●		○	●	○		○	○	○			●			●	●
MONPOXY 17655								●								
MONPOXY 18512								●								
ROLOX 19420		○			○		○	○								●
KALEX 19440				○		●			●	●					●	●
KALEX 16308			○			●		●							●	
KALEX 16666	○					●	●	●			○				●	
KALEX 16668	○					●	●	●			○				●	
KALEX 19423						●	●	●	●	●						
KALEX 17621A/16805B						●	○		●	●					●	●
KALEX 25170						●	○		●	●					●	●

● = Strongly Recommended ○ = Recommended

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Substrate Selection Chart

Product Description	Carbon Steel	Stainless Steel	Aluminum	Copper/Brass	Tin	Zinc	Acetate	Acrylic	Epoxy	Phenolic	Polycarbonate	Polyester	PVC	Polystyrene	Urethane	ABS	Fiberglass	Nylon	Rubber	Stone	Wood	Glass	China	Leather
	Metals						Plastics											Other						
EPOCAP 3648A/25269B	●	○	●	●	○	○	○	○	●	●	●	○	○	○	●	●	●	●	●	●	●	●	●	○
EPOCAP 3648A/3243B	●	○	●	○	○	○	○	○	●	●	●			○	●	●	●		○	●	●	●	●	●
EPOWELD 3243	●	○	●	○	○	○	●	○	●	●	●	○		○	●	●	●	○	○	●	●	●	●	○
EPOWELD 8173	●	●	●	○	○	○	●	○	●	●	●	○		●	○	●	●	●	●	●	●	●	●	●
EPOWELD 8200	●	●	●	●	○	○	●	○	●	●	●	○	○	●	○	●	●	●	●	●	●	●	●	●
EPOWELD 13230	●	●	●	●	●	●		○	●	●	●	○	○	●	○	●	○	●	●	●	●	●	●	●
EPOWELD 16562	●	●	●	●	●	●	○	○	●	●	●	●	○	●	●	●	○	●	●	●	●	●	●	●
EPOWELD 16756A/3243B	●	○	●	○	○	○	●	○	●	●	●	○		○	●	●	●	○	○	●	●	●	●	○
EPOWELD 16756A/8200B	●	●	●	●	○	○	●	○	●	●	●	○	○	●	○	●	●	●	●	●	●	●	●	●
EPOWELD 16791	●	●	●	○	○	○	○	○	●	●	●	○		○	○	●	●	●	○	○	●	●	●	●
EPOWELD 20214	●	●	●	●	●	●		○	●	●	●	○	○	●	○	●	○	●	●	●	●	●	●	●
EPOWELD 20327	●	●	●	○	○	○	●	○	●	●	●	●		○	○	○	○	○	○	●	●	●	●	●
EPOWELD 20356	●	●	●	○	○	○	●	●	●	●	●	●		●	●	●	○	○	○	●	●	●	●	●
EPOWELD 20386A/16521B	●	●	●	○	○	○										○	○	○		●	●	●	●	
EPOWELD 23684A/25150B	●	●	●	○	○	○		○	●	●	●	●		●	●	●	●	●	○					
MONPOXY 17655	●	●	●	●	○	○	○		●	●	○	○				○		○				●		
MONPOXY 18512	●	●	●	●	○	○	○		●	●	○	○				○		○				●		
ROLOX 19420	○	●	●	○	○	○		○	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	○
KALEX 19440	○		●				○	○	○	●	●	●	○	●	●	●	●	●	●		●	●	●	○
KALEX 16308	●	○	●	●	●	●	○	○	●	●		●	○	○	●	○	●	○	●		●	●	●	●
KALEX 16666	●	●	●	○	●	○	○	○	●	●		●			●		○		○		●	●	●	●
KALEX 16668	●	○	●	○	○	○	○	○	●	●		○	○	○	●	○	○		●		●	●	●	●
KALEX 19423							○	○	○	●	●	●	○	●	●	●	●	●	●		●	●	●	○
KALEX 17621A/16805B	○		●				○	○	○	●	●	●	○	●	●	●	●	●	●		●	●	●	○
KALEX 25170	○		●				○	○	○	●	●	●	○	●	●	●	●	●	●		●	●	●	○

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