LOCTITE ® E32

Two-Part Toughened Epoxy

Ref.#: 062402PBE32
Replaces #: 121500PBE32

TYPICAL APPLICATIONS

Structural Metal, Glass, & Plastic Bonding
Furniture
Elevators
Automotive
Appliances
Marine
Top-hat stiffeners

Filter Assemblies
Maintenance & Repair of Equipment

Bonding Magnets to Metal & Plastic Housings
Permanent Magnet Brush-type DC motors
Permanent Magnet Brushless motors
Sensors
Antennas

FEATURES & BENEFITS

- Room Temperature Cure
- Easy to Use & Apply
- Low Shrinkage
- Adhesion to a Wide Variety of Substrates
- Environmentally Friendly – 100% Solids
- 1:1 Mix Ratio
- Excellent Impact Resistance
- Outstanding Electrical Insulation Properties
- Non-Drip Rheology

GENERAL DESCRIPTION

Loctite E32 is a two-part, 1:1 mixable, toughened epoxy adhesive. The epoxy is easy to use and provides a work life of over an hour at room temperature. The epoxy has a handling time of 6 hours and cures fully in 24 hours. Handling time is the time after part assembly when the parts will not move when subjected to moderate finger pressure. Should a faster cure be required, heat can be used to accelerate the cure of the epoxy.

Once fully cured, the E32 is an inert, toughened polymer that is resistant to a wide range of chemical and environmental conditions. The cured epoxy meets USP Class VI requirements for plastics, the highest class of safety and biocompatibility. Loctite E32 is capable of bonding a variety of substrates materials together, including most metals, glass and plastic materials. The cured adhesive bond provides a combination of excellent shear and impact strengths.

Loctite E32 may be easily used in an existing automated process line using Loctite dispensing equipment, or manually with a handheld dispense gun.

Non-Warranty: The information given and the recommendations made herein are based on our research and are believed to be accurate but no guarantee of their accuracy is made. In every case we urge and recommend that purchasers before using any product in full-scale production make their own tests to determine to their own satisfaction whether the product is of acceptable quality and is suitable for their particular purpose under their own operating conditions. THE PRODUCTS DISCLOSED HEREIN ARE SOLD WITHOUT ANY WARRANTY AS TO MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED.

No representative of ours has any authority to waive or change the foregoing provisions but, subject to such provisions, our engineers are available to assist purchasers in adapting our products to their needs and to the circumstances prevailing in their business. Nothing contained herein shall be construed to imply the non-existence of any relevant patents or to constitute a permission, inducement or recommendation to practice any invention covered by any patent, without authority from the owner of this patent. We also expect purchasers to use our products in accordance with the guiding principles of the Chemical Manufacturers Association's Responsible Care® program.

PHYSICAL PROPERTIES OF THE UNCURED ADHESIVE

PROPERTIES	PART A	PART B	MIX
Color	White	Black	Gray
Base Chemical	Resin	Hardener	----
Specific Gravity	1.14	0.980	1.06
Mean Viscosity*, cP at 25°C (77°F)	80,000	610,000	140,000
Flammability	Nonflammable	Nonflammable	Nonflammable
Flash Point, °C (°F)	> 94 (200)	> 94 (200)	> 93 (200)
Solvents	None	None	None
Solids, %	100	100	100
Mix Ratio (by volume)	1	1	1:1
Shelf Life stored at or below 27°C (80°F), months	12	12	----
Maximum Gap, in (mm)	----	----	0.2 (5.1)

*The epoxy is a thixotropic paste.

SPEED OF CURE

Cure rate of E32 @ room temperature, 25°C (77°F)

Work Life*, minutes	75
Handling Time, hours	6
Full Cure, hours	24

*The work life refers to the pot life of the epoxy after mixing.

BEHAVIOR ON DIFFERENT SUBSTRATES

The cure rate of E32 is not dependent upon the materials to be bonded. The product will cure at the same rate on all types of substrates.

EFFECT OF TEMPERATURE ON CURE RATE

Loctite E32 will cure to full strength at room temperature, but heat can be used to accelerate the cure of the epoxy. The following chart shows the time required to reach handling strength and full cure at elevated temperatures.

Cure Temperature°C, °F	Handling Time	Full Cure
25 (77)	6 hours	24 hours
45 (113)	90 minutes	6 hours
65 (149)	25 minutes	90 minutes
100 (212)	10 minutes	30 minutes

The cure rate of Bondmaster E32 can be further increased through the use of induction curing equipment.

PERFORMANCE PROPERTIES OF THE CURED ADHESIVE

SUBSTRATE BONDABILITY

Loctite E32 is an excellent metal, magnet, and glass bonding adhesive. The adhesive will bond well to almost all types of metal surfaces including painted or epoxy coated metal surfaces. The product will also bond to rigid plastic materials and some types of elastomers and wood substrates. The epoxy is not recommended to bond Delrin®, polyethylene, polypropylene or polyurethane.

LAP SHEAR STRENGTH AT ROOM TEMPERATURE, 25°C (77°F), ASTM D1002

SUBSTRATE	**SHEAR STRENGTH, psi (N/mm^2)**
Steel / Steel	3000 – 3500 (21 – 24)
Aluminum / Aluminum	2500 – 3000 (17 – 21)
Stainless Steel / Stainless Steel	3000 – 3500 (21 – 24)
Ferrite / Steel	Substrate Failure, 2000 (14)
Ferrite / Zinc Dichromate	Substrate Failure, 2000 (14)
Ferrite / Galvanized Steel	Substrate Failure, 2000 (14)
Ferrite / Zinc Plated	Substrate Failure, 2000 (14)
Glass / Glass	Substrate Failure, 250 (1.7)
Phenolic / Phenolic	200 – 300 (1.4 – 2.1)
PVC / PVC	Substrate Failure, 400 (2.8)
Polycarbonate / Polycarbonate	200 – 300, (1.4 – 2.1)
ABS / ABS	Substrate Failure, 650 (4.5)
Acrylic / Acrylic	100 – 200 (0.7 – 1.4)

PEEL STRENGTH (ASTM 1876)

Steel / Steel, lb / linear inch	15 – 20

IMPACT STRENGTH (ASTM 950)

Steel / Steel, ft-lb / in^2	15 – 18

HARDNESS (ASTM D 2240)

TEMPERATURE, °C (°F)	**SHORE D HARDNESS**
25 (77)	70
50 (122)	65

EFFECT OF MIX RATIO ON ADHESIVE PERFORMANCE

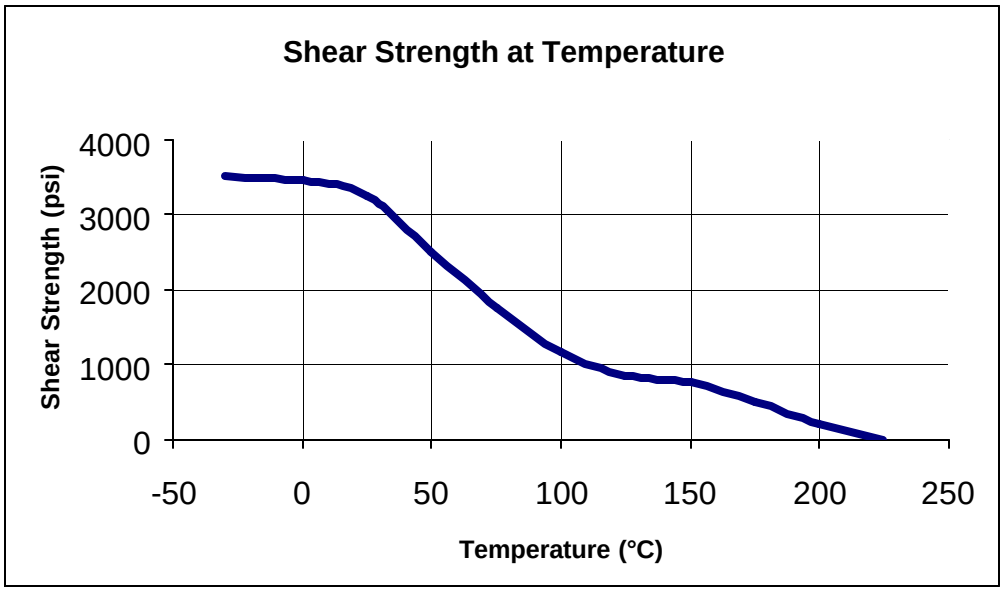
For optimum performance, E32 should be mixed in exactly a 1:1 ratio. A reduction in adhesive properties will result from an incorrect mix ratio or incomplete mixing. Static mix nozzles should have a minimum of 18 mixing elements for optimum mixing of the epoxy.

THERMAL PROPERTIES

Operating Temperature, ^{o}C (^{o}F)	-55 to 80 (-67 to 176)
Thermal Expansion Coefficient, m/m/^{o}C	20 to 65 x 10^{-6}
Thermal Conductivity, W/m^{o}C	0.2 – 2.0

Loctite E32 will retain bond strength, and will not be degraded by short-term (20 to 40 minutes) exposure to high temperatures, 232^{o}C (450^{o}F). This type of temperature cycle is typically observed in paint ovens.

Loctite E32 is suitable for use in Class H, 180^{o}C (356^{o}F) electric motors.



HEAT AGING

Temperature, ^{o}C (^{o}F)	Percent Shear Strength After Exposure to Temperature		
	1 Week	**3 Week**	**6 Week**
0 (32)	100	100	100
25 (77)	100	100	100
50 (122)	115	115	115
200 (392)	42	39	40

Bonded steel specimens were aged at various temperatures, and were tested at room temperature according to ASTM D1002.

ELECTRICAL PROPERTIES

Dielectric Strength, volts/mil (KV/cm)	300 – 450 (120 – 180)
Dielectric Constant	3.5 – 6.0
Dissipation Factor	0.002 - 0.02
Volume Resistivity, ohm-cm	$> 1 \times 10^{14}$

ENVIRONMENTAL DURABILITY

Substrates	Environmental Exposure	Percent Shear Strength Retained	
		1 Week	1 Month
Steel / Steel	38°C (100°F), 5% Salt Spray	81	86

*Shear tested in accordance to ASTM D1002

CHEMICAL RESISTANCE

Chemical	**Effect on Cured Adhesive**	
	after 1 week exposure	**after 1 month exposure**
Water	None	None
50% Water/50% Antifreeze	None	None
Motor Oil	None	None
Transmission Fluid	None	None
Gasoline	Severe Attack	Severe Attack
Freon	None	None
0.1 N HCL	Slight Attack	Moderate Attack
Heptane	None	None
0.0001 N NaOH	Moderate Attack	Severe Attack
MEK	Severe Attack	Severe Attack
Toluene	Severe Attack	Severe Attack
Acetone	Severe Attack	Severe Attack

Note: Testing was performed @ room temperature.

Shear Strength after Exposure to Chemicals

Chemical	**Exposure Length & Temperature**	**Percent Shear Strength Retained**
Motor Oil	90 hr @ 25°C (77°F)	88
ATF Oil	90 hr @ 25°C (77°F)	66
50% Water / 50% Antifreeze	90 hr @ 25°C (77°F)	83
Freon	90 hr @ 25°C (77°F)	92

SURFACE PREPARATION

For optimum bond strength on metal parts, the surface should be washed with a solvent or cleansing solution, abraded with an abrasive pad, and then rinsed with a solvent or cleansing solution. Glass surfaces should be cleaned with a commercial glass cleaner before bonding. Painted surfaces and plastic substrates should be abraded lightly and wiped clean.

APPLICATION & DISPENSING

1. Thoroughly mix the resin and the hardener in a 1:1 ratio by weight or volume, taking care not to introduce excess entrapped air into the bulk material.

    - The optimum method of mixing is accomplished via in-line static mixers with a minimum of 18 mixing elements.

2. Once mixed thoroughly, to a uniform gray color; i.e. no visible streaks, apply a bead of adhesive to one of the bonding surfaces.

3. Mate the two substrates together and clamp the assembly for 6 hours until handling strength is achieved.

4. Full cure is obtained within 24 hours of adhesive application at room temperature, 25°C (77°F).

Note: The curing temperature may be raised to increase the cure rate of the adhesive.

Loctite's Equipment Group has a complete line of dispensing equipment for all types of assembly and automated applications. Customized equipment can be designed to meet the specific application requirements. Contact your local Loctite Sales Engineer for a complete systems approach to dispensing the E32 Structural Epoxy.

STORAGE & HANDLING

Loctite E32 has a shelf life of one year when stored at or below 27°C (80°F). Do not freeze. Keep away from excessive heat, sparks, flame, and sunlight.

A note of caution: Before opening, the containers must be warmed to room temperature otherwise water might condense into the bottle and cause hardening of the adhesive.

UNCURED LIQUID ADHESIVE

Uncured E32 Part A & Part B contain reactive chemicals. The adhesive can cause skin irritation and dermatitis. The use of barrier creams, plastic gloves (nitrile rubber or Neoprene®), and an apron, in combination with good housekeeping, is usually sufficient to prevent accidental or chronic exposure. If skin contact occurs, the affected area should be washed with soap and water. Eye protection should be worn whenever the product is being used. Eye contact should be treated by thoroughly washing the affected area with water, followed by medical attention. Adequate ventilation is necessary to prevent the prolonged inhalation of vapors.

Loctite E32 Part A & Part B should not be mixed in large quantities, as a vigorous chemical reaction will occur generating a significant amount of heat and vapors.

Unreacted resin & hardener can be cleaned using acetone, isopropanol or methyl ethyl ketone (MEK).

Please read the MSDS completely before handling the uncured epoxy.

CURED (SOLID) EPOXY

The cured epoxy is a hard, inert polymer that is safe to handle. The curing reaction polymerizes all of the mixed resin & hardener (100%) into a solid plastic. No solvents are released during use as is the case with many other adhesives and adhesive/activator systems.

The cured epoxy meets USP Class VI requirements for plastics, the highest class of safety and biocompatibility.

FOR INDUSTRIAL USE ONLY. KEEP OUT OF THE REACH OF CHILDREN.