



ES-96

ONE COMPONENT EPOXY ADHESIVE

The epoxy formulation described herein was developed by our laboratory to meet a specific customer requirement. The values listed below are averages and they are not intended for specification purposes. Contact Lord when establishing specifications.

DESCRIPTION:

Lord ES-96 is a white, one component, heat cured epoxy adhesive featuring excellent thermal stability and rapid cure rates. Lord ES-96 exhibits minimal flow during cure and provides excellent resistance to acids and strong bases. This product is a modification of CK6150S with enhanced air release characteristics.

PHYSICAL PROPERTIES

Appearance:	White Thixotropic (Available in Different Colors)
Density (lb/gal):	12.9
Specific Gravity:	1.55
Viscosity:	145,000 cps.

CURE SCHEDULE

GEL at 121°C (250°F):	10 minutes	ES-96 is designed for use in masses of <5 grams. Larger masses or excessive temperatures may lead to violent exothermic reactions.
at 177°C (350°F):	1 minute	
CURE at 121°C (250°F):	30 minutes	
at 177°C (350°F):	10 minutes	

SHELF LIFE at 0°C:	3 month
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TYPICAL CURED PROPERTIES

Hardness:	90D at 25°C 70D at 125°C
Tensile Shear Strength (AL-AL):	>1,600 psi
Max Continual Temperature:	180°C
Dielectric Constant (10 ³ Hz) at 25°C:	3.9
Dissipation Factor (10 ³ Hz) at 25°C:	.01
(10 ⁶ Hz) at 25°C:	.02
(60 Hz) at 25°C:	.02
Volume Resistivity (ohm-cm) at 25°C:	>1 x 10 ¹⁵
Dielectric Strength:	>500
Thermal Conductivity (BTU/ft ² /hr/°F/in):	6.4

HANDLING PRECAUTIONS:

The labels on containers of Lord materials contain current information on the hazards associated with each particular product. Most epoxy resins and hardeners are skin and eye irritants, and some may actually be corrosive to the skin and eyes. Other problems, such as skin sensitization or serious health hazards may exist. Further information on each product is contained in the Material Safety Data Sheet, which will be sent upon request.

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IMPORTANT NOTICE TO PURCHASERS: Only those properties identified as "specifications" on Lord technical bulletins are tested by Lord's Quality Control Department prior to shipment. The results of these tests must conform to those "specifications". Other properties are "typical". Tests are not run on the "typical properties" of every batch produced. "Typical property" data is not intended for specification purposes and Lord assumes no responsibility and makes no warranty with respect to it. If any property, other than those designated as Lord "specifications", is important to the purchaser, information as to such property will be supplied only upon the basis of test procedures agreed upon between Lord and the purchaser prior to the acceptance of the purchaser order.

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SURFACE PREPARATION

Any adhesive, regardless of the type, can only be expected to perform well on a properly prepared surface. Most manufacturers will be quick to point out that such figures as "Tensile Shear Strength" were obtained on specimens tested in accordance with a certain standard. Included in the test will be preparation of the surfaces for bonding, which is usually in accordance with another standard. It would be quite possible to write a complete volume on surface preparation and still not cover every material, application or situation.

Although Lord does not purport to be an expert on all types of surface preparation, we do, nonetheless, feel an obligation to offer some suggestions to aid the user in obtaining good bond strengths.

Some surfaces require little or no preparation and epoxies will cling to them tenaciously. An example of this is clean, dry, raw wood. Some woods, however, such as Teakwood, possess a high degree of natural oils, which make bonding to it difficult to impossible. Other materials such as Teflon* or polyethylene are very resistant to bonding even with the best preparation methods known. In the middle of the spectrum, however, are materials, which can be bonded successfully with proper surface treatment. These would include all types of metals, many plastics, glass and ceramics.

In order to properly understand bond strengths, the user should be familiar with the difference between adhesive and cohesive failures. Assume that two pieces of metal are partially overlapped and joined by a thin bond of adhesive. Now the specimen is placed in a machine designed to pull it apart lengthwise. The stress applied is known as "shear". The point at which the specimen breaks across the bond line is known as its "Tensile Shear Strength" and is usually expressed in pounds per square inch. By examining the bond line on the two pieces, we should find that a roughly equal amount of cured adhesive is left on both pieces. This ideal condition is known as a "cohesive break". However, if we find no adhesive left on one of the pieces (or very little adhesive) this is known as an "adhesive break" and is indicative of either poor surface preparation, the wrong adhesive, a non-receptive surface or a combination of these factors. It is important to recognize the major hindrances to adhesion. These are: DUST, DIRT, GREASE, CORROSION, OXIDATION, SCALE

In addition, smooth, nonporous surfaces generally provide poor bonds. This is why most woods are easy to bond. The natural porosity inherent in wood allows the adhesive to "wick" into the surface and surround the fibers providing good mechanical strength. Metals, plastics and glass, on the other hand, need to be artificially roughed-up to provide a good bond. Also, materials containing polyolefins or fluorocarbons will require some type of special pre-treatment prior to bonding. For proper bonding, any adhesive must adequately wet the surfaces. Therefore, proper cleaning must also be considered.

In summary, we see that the two most important aspects of surface preparation prior to adhesive bonding are: PROPER CLEANING and PROPER PHYSICAL CONDITIONING. Following is a list of materials commonly encountered in adhesive bonding with a short general description of the preparation methods commonly employed.

WOOD - Insure that the surface is dry and free from contaminants such as grease or oil. A rough sanding will aid adhesion followed by removal of sanding dust.

PLASTICS- Most plastics to be bonded will have a smooth surface; therefore, particular attention should be paid to roughing or etching the surface in addition to a good solvent cleaning. As pointed out above, some plastics (such as polyethylene) may require special types of treatment. The plastics manufacturer or distributor should be consulted in cases where surface preparation is questionable.

METALS - Two common methods of surface preparation are generally used:

- a. degreasing followed by treatment by or grit blasting, grinding, sanding or honing.
- b. chemical cleaning by one or a combination of the following methods:
 1. degreasing with chlorinated or ketone solvents
 2. alkaline cleaning
 3. acid etching

GLASS - Solvent wiping and (where possible) sand blasting to improve mechanical bond are the preferred methods.

CERAMICS -Fired, unglazed ceramics generally require no preparation as long as they are clean. Glazed ceramics should be roughed-up by sanding.

The methods listed above are very general in nature and are not intended as specific recommendations by Lord. They are provided solely to focus the user's attention on the importance of proper surface preparation. Lord does not warrant the results of usage of the above methods nor does it assume responsibility for alleged failures of the above methods. Lord suggests that the user thoroughly familiarize himself with all available data for the particular materials he is using as well as conducting his own tests to determine the suitability of an adhesive for his particular application. There is considerable published information available covering surface preparation in detail. For example, the American Society for Testing and Materials publishes recommended practices such as:

ASTM D 2093 Preparation of Surfaces of Plastics Prior to Adhesive Bonding

ASTM D 2651 Preparation of Metal Surfaces for Adhesive Bonding

Complete publications listings are available from ASTM at 1916 Race Street, Philadelphia, PA 19103.

In summary, the possibility of achieving successful adhesive bonding may be increased by following these procedures:

1. Consider the nature of the application and understand the problems associated with adhesive bonding.
2. Conduct thorough suitability testing.
3. Select the proper adhesive.
4. Prepare the surfaces properly.