Scotch-Weld™

Toughened Epoxy Adhesives LSB60 and LSB60NS

Preliminary Technical Data Sheet **September, 2015**

Product Description

3M™ Scotch-Weld™ Toughened Epoxy Adhesives LSB60 and LSB60NS are high performance, two-part, toughened epoxy adhesives offering outstanding shear adhesion and very high levels of durability with a choice of flow characteristics. These epoxies have a 90 minute worklife and is a 1:1 mix ratio. Ideal for bulk application through meter mix dispensing equipment and the manufacture of large panel products.

Features

- Toughened
- 5 hour handling strength
- 90 minute work life
- High shear and peel
- Flame, Smoke and Toxicity Tested*
- 1:1 mix ratio and easy mixing

*LSB60 has been tested and meets surface flammability (ASTM E 162) and rate of smoke generation (ASTM E 662). This material also meets Bombardier requirements as they pertain to toxic gas production (Bombardier SMP 800-C). The adhesive was also tested to Boeing BSS 7239 requirements, although there is no specific pass criteria for this test.

NOTE: The following data is taken from tests conducted on limited production runs. 3M will continue to test samples from additional product runs and will issue a new data page if the test results change.

Typical Uncured Physical Properties

Note: the following technical information and data should be considered representative or typical only and should not be used for specification purposes.

Product		**3M™ Scotch-Weld™ Toughened Epoxy Adhesive LSB60**	**3M™ Scotch-Weld™ Toughened Epoxy Adhesive LSB60NS**
Color	Base Accelerator	White Dark Gray	White Dark Gray
Net Weight (lbs./gallon)	Base Accelerator	10.0 9.8	10.1 9.8
Viscosity[1] @ 73ºF (23ºC)	Base Accelerator	17,200 68,200	24,000 97,000
Base Resin		Epoxy/Amine	Epoxy/Amine
Mix Ratio (B:A)	By volume By weight	1:1 1:1	1:1 1:1
Work Life[2] @ 73ºF (23ºC)	Nozzle mixed	90 minutes	90 minutes
Time to Handling Strength[3]		5 hours	5 hours

1. Brookfield RVF Viscometer, #7 spindle at 20 rpm at 80°F
2. Approximate time during which material can remain in a mixer nozzle and still be expelled without undue force on the applicator.
3. Time to achieve approximate 50 psi of Overlap Shear Strength (OLS) when cured at 73ºF (23ºC).

Note: The data in this sheet were generated using the 3M™ EPX™ Applicator System equipped with an EPX static mixer, according to manufacturer's directions. Thorough hand-mixing will afford comparable results

3M™ Scotch-Weld™
Toughened Epoxy Adhesives
LSB60 and LSB60NS

Typical Cured Properties

Note: the following technical information and data should be considered representative or typical only and should not be used for specification purposes.

Product	3M™ Scotch-Weld™ Toughened Epoxy Adhesive LSB60 and LSB60NS
Color	Gray
Full Cure Time	7 days @ 73ºF (23ºC)
Shore D Hardness	60-65

Typical Adhesive Performance Characteristics

Note: the following technical information and data should be considered representative or typical only and should not be used for specification purposes.

Overlap Shear, (OLS) to Various Substrates (PSI) (ASTM D1002)

Substrate	3M™ Scotch-Weld™ Toughened Epoxy Adhesive LSB60	3M™ Scotch-Weld™ Toughened Epoxy Adhesive LSB60NS
Aluminum – MEK/abrade/MEK	3600 CF	3500 CF
CRS – MEK/abrade/MEK	3200 CF/AF	3000 CF/AF
Stainless Steel – MEK/abrade/MEK	3700 CF/AF	3500 CF/AF
Galvanized Steel– MEK/abrade/MEK	3400 CF/AF	3400 CF/AF
Polycarbonate - IPA/abrade/IPA	480 AF	400 AF
FRP (Green) – IPA/abrade/IPA	2000 CF	2100 AF/CF
FRP (Red) – IPA/abrade/IPA	2700 SF	2200 SF

AF: adhesive failure CF: cohesive failure SF: substrate failure

Aluminum, etched, Overlap Shear, at Temperature (PSI) (ASTM D1002)

Temperature	3M™ Scotch-Weld™ Toughened Epoxy Adhesive LSB60	3M™ Scotch-Weld™ Toughened Epoxy Adhesive LSB60NS
-67°F (-55°C)	3400 CF	2800 CF
73°F (23°C)	4500 CF	4500 CF
180°F (82°C); 15 minutes[1]	1200 AF	1300 AF
180°F (82°C); 4 hours[1]	900 AF	800 AF
250°F (121°C); 15 minutes[1]	400 AF	300 AF

[1] Represents time in test chamber oven before test.
AF: adhesive failure CF: cohesive failure SF: substrate failure

3M™ Scotch-Weld™
Toughened Epoxy Adhesives
LSB60 and LSB60NS

Typical Adhesive Performance Characteristics (Continued)

Aluminum, etched, Bell Peel Adhesion (PIW) at 75°F (ASTM D3167)

	3M™ Scotch-Weld™ Toughened Epoxy Adhesive LSB60	3M™ Scotch-Weld™ Toughened Epoxy Adhesive LSB60NS
-67°F (-55°C)	3.6 CF	3.2 CF
73°F (23°C)	13.3 AF	11.6 AF/CF
180°F (82°C) (4 hr)[1]	15.9 AF	11.0 AF

AF: adhesive failure CF: cohesive failure SF: substrate failure

Aluminum to Aluminum, Honeycomb Climbing Drum Peel (ASTM D1781)

	3M™ Scotch-Weld™ Toughened Epoxy Adhesive LSB60
Skins - MEK/abrade/MEK (unprimed); ¼" core cell (partial core failure)	56.5 lbf*in/in
Skins - MEK/abrade/MEK (unprimed); 3/8" core cell	15.9 lbf*in/in

Aluminum, etched, Overlap Shear Retention (PSI) (ASTM D1002)

Environmental Condition (30 day dwell in condition)	3MT(M) Scotch-Weld™ Toughened Epoxy Adhesive LSB60	3M™ Scotch-Weld™ Toughened Epoxy Adhesive LSB60NS
73°F (23°C)	4800 CF	4800CF
Water soak at 73°F (23°C)	4600 CF	4600 CF
150°F (65°C)/80% Relative Humidity	4500 CF	3500 CF
IPA soak at 73°F (23°C)	4700 CF	4700 CF
Gasoline soak at 73°F (23°C)	4100 CF	4000 CF

AF: adhesive failure CF: cohesive failure SF: substrate failure

Substrates And Testing

Overlap Shear (ASTM D1002)

Over lap Shear (ASTM D-1002, 3M Test Method C-236) strength was measured on 1" wide X ½" overlap specimen. These bonds were made individually using 1" X 4" pieces of substrates except for Aluminum. Two panels 0.063 in. thick, 4 in. x 7y in of 2024T-3 clad aluminum were bonded and cut into 1 in. wide samples after 24 hours. The thickness of the adhesive bond line was approximately 0.005". All strengths were measured at 73ºF (23ºC) except when noted,

The separation rate of the testing jaws was 0.1 in. per minute for metals, 2 in. per minute for plastics and 20 in. per minute for rubbers. The thickness of the substrates were: steel, 0.060 in.; other metals, 0.05-0.064 in.; rubbers, 0.125in.; plastics, 0.125 in.

and samples were allowed to cure at 75ºF and approximately 50% RH for 1 week before tested. The separation rate of the testing jaws was 0.1 inch per minute for metals and 2 inches per minute for plastics.

A. Bell Peel

3M™ Scotch-Weld™

Toughened Epoxy Adhesives

LSB60 and LSB60NS

Bell peel strengths were measured on 1 in. wide bonds at the temperatures noted. The testing jaw separation rate was 6 in. per minute. The bonds were made with 0.065 in. bonded to 0.020 in. thick adherends.

B. Cure Cycle

With the exception of Rate of Strength Build-Up Tests, all bonds were cured 7 days at 73°F (23°C) at 50% RH before testing or subjected to further conditioning or environmental aging.

Handling/Curing Information

Directions for Use

1. For high**est** strength structural bonds, paint, oxide films, oils, dust, mold release agents and all other surface contaminants must be completely removed. The amount of surface preparation depends on the required bond strength, environmental aging resistance desired by user. For suggested surface preparations on common substrates, see the section on surface preparation.
2. Mix thoroughly by weight or volume in the proportions specified on the product label or in the typical uncured properties section. Mix approximately 15 seconds after a uniform color is obtained.
3. For maximum bond strength, apply adhesive evenly to both surfaces to be joined.
4. Application to the substrates should be made within 60-90 minutes. Larger quantities and/or higher temperatures will reduce this working time.
5. Join the adhesive coated surfaces and allow to cure at 60°F (16°C) or above until completely firm. Heat up to 120°F - 150°F (49°C - 66°C) will speed curing.
6. Keep parts from moving during cure. Apply contact pressure if necessary. Maximum shear strength is obtained with a 3-5 mil bond line.
7. Excess **uncured** adhesive can be cleaned up with ketone type solvents*.

***Note:** when using solvents, extinguish all ignition sources, including pilot lights, and follow the manufacturer's precautions and directions for use.

Surface Preparation

3M™ Scotch-Weld™ Toughened Epoxy Adhesives LSB60 and LSB60NS is designed to be used on plastic or metal surfaces. For high strength structural bonds, paint, oxide films, oils, dust, mold release agents and all other surface contaminants must me completely removed. The amount of surface preparation depends on the required bond strength, environmental aging resistance desired by the user. The following cleaning methods are suggested for common surfaces:

Steel:

1. Wipe free of dust with oil-free solvent such as acetone or isopropyl alcohol solvents*****.
2. Sandblast or abrade using clean fine grit abrasives.
3. Wipe again with solvent to remove loose particles*****.
4. If a primer is used, it should be applied within 4 hours after surface preparation.

Aluminum:

1. Wipe free of dust with oil-free solvent such as acetone or isopropyl alcohol solvents*****.
2. Sandblast or abrade using clean fine grit abrasives
3. Wipe again with oil-free solvent such as acetone or isopropyl alcohol solvents*

Plastics/Rubber:

1. Wipe with isopropyl alcohol*****.
2. Abrade using fine grit abrasives.
3. Wipe with isopropyl alcohol*****

Glass:

1. Solvent wipe surface using acetone or MEK*****.
2. Apply a thin coating (0.0001 in. or less) of 3M™ Scotch-Weld™ Metal Primer EC3901 to the glass surfaces to be bonded and allow the primer to dry before bonding.

***Note:** When using solvents, extinguish all ignition sources, including pilot lights, and follow the manufacturer's precautions and directions for use.

3M™ Scotch-Weld™
Toughened Epoxy Adhesives
LSB60 and LSB60NS

Storage	Store products at 60-80°F (15-27°C) for maximum shelf life.
Precautionary Information	Refer to Product Label and Material Safety Data Sheet for health and safety information before using this product. For additional health and safety information, call 1-800-364-3577 or 651-737-6501.
For Additional Information	To request additional product information or to arrange for sales assistance, call toll free 1-800-362-3550 or visit www.3M.com/structuraladhesives.
Technical Information	The technical information, recommendations and other statements contained in this document are based upon tests or experience that 3M believes are reliable, but the accuracy or completeness of such information is not guaranteed.
Product Use	Many factors beyond 3M's control and uniquely within user's knowledge and control can affect the use and performance of a 3M product in a particular application Given the variety of factors that can affect the use and performance of a 3M product, user is solely responsible for evaluating the 3M product and determining whether it is fit for a particular purpose and suitable for user's method of application.
Warranty and Limited Remedy	Unless an additional warranty is specifically stated on the applicable 3M product packaging or product literature, 3M warrants that each 3M product meets the applicable 3M product specification at the time 3M ships the product. 3M MAKES NO OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY IMPLIED WARRANTY OR CONDITION ARISING OUT OF A COURSE OF DEALING, CUSTOM OR USAGE OF TRADE. If the 3M product does not conform to this warranty, then the sole and exclusive remedy is, at 3M's option, replacement of the 3M product or refund of the purchase price. price.
Limitation of Liability	Except where prohibited by law, 3M will not be liable for any loss or damage arising from the 3M product, whether direct, indirect, special, incidental or consequential, regardless of the legal theory asserted, including warranty, contract, negligence or strict liability.

Industrial Adhesives and Tapes Division
3M Center, Building 225-3S-06
St. Paul, MN 55144-1000
800-362-3550 • 877-369-2923 (Fax)
www.3M.com/structuraladhesives