

New product

WEST SYSTEM[®] launches G/flex[®] Epoxy

By Tom Pawlak

G/flex Epoxy adds a degree of flexibility to the WEST SYSTEM lineup.

G/flex Epoxy is a toughened, resilient two-part epoxy engineered for a superior grip to metals, plastics, glass, masonry, fiberglass, and wet and difficult-to-bond woods. Introduced in June 2007, G/flex Epoxy is currently available in two consistencies: G/flex 650 Epoxy, a liquid epoxy, and G/flex 655 Epoxy Adhesive, a pre-thickened epoxy. Both have an easy-to-use 1:1 mix ratio.

G/flex Epoxy gives you 46 minute pot life and a long open or working time of 75 minutes at room temperature. It will reach an initial cure in 3–4 hours and a workable cure in 7–10 hours. Wait 24 hours before subjecting joints to high loads.



G/flex is available in three convenient packages:

G/flex 650-8 Includes 4 fl oz-G/flex 650 Resin, 4 fl oz-G/flex 650 Hardener (8 fl oz of mixed epoxy), and handling and repair instructions.

G/flex 650-K Kit contains 4 fl oz-G/flex 650 Resin, 4 fl oz-G/flex 650 Hardener (8 fl oz of mixed epoxy), 2 reusable mixing stick/applicators, 2 12 cc syringes, 4 g of adhesive filler, 4 mixing cups, 1 pair of disposable neoprene gloves, 4 alcohol cleaning pads, and complete handling and repair instructions.

G/flex 655-K Kit contains 4.5 fl oz-G/flex 655 Resin, 4.5 fl oz-G/flex 655 Hardener (9 fl oz mixed epoxy), 2 reusable mixing stick/applicators, 4 alcohol cleaning pads, 1 pr disposable neoprene gloves, 10 mixing palettes, and complete handling and repair instructions.

Even as we introduce the new G/flex, we want to emphasize that our existing WEST SYSTEM 105 Resin-based epoxies can't be beat for versatility and reliability. WEST SYSTEM 105 Resin mixed with the appropriate hardeners and different additives allows you to create an epoxy for a variety of applications like gluing, sealing, fairing, and sheathing. No other epoxy is more reliable for such a huge spectrum of end uses.

However, as a marine-grade glue that can be accurately mixed in small batches, G/flex Epoxy offers important benefits.

Benefits of G/flex Epoxy

- **Toughness and flexibility** G/flex has been toughened. This gives G/flex the ability to make structural bonds that can absorb the stresses of expansion, contraction, shock, and vibration. G/flex is resilient and impact resistant. With a modulus of elasticity of 150,000 psi (WEST SYSTEM 105 Resin/205 Hardener has a modulus of elasticity of 450,000 psi), G/flex is more flexible and can deflect further before breaking than WEST SYSTEM 105/205, while being *much* stiffer than typical adhesive sealants.
- **Adhesion to wet and damp surfaces** G/flex has the ability to glue damp woods. It can be used on wet surfaces, even underwater when applied with specific techniques.
- **Excellent adhesion to hard-to-bond woods** G/flex adheres tenaciously to difficult-to-glue hardwoods, both tropical and domestic varieties. This is important since many of the exotic and tropical species now being used to replace traditional woods present bonding challenges.

- **Bonds well to a variety of materials**
G/flex® is ideal for bonding a variety of materials, including dissimilar ones. G/flex has a superior grip so that it can be used to bond to metals, plastics, glass, masonry, and fiberglass. G/flex is ideal for repairs to aluminum boats and polyethylene and ABS canoes and kayaks. It can also be used to wet out and bond fiberglass tapes and fabrics.
- **Ease of use** G/flex is a simple two-part epoxy system. Resin and hardener are mixed in a 1-to-1 mix ratio by volume. G/flex provides a relatively long open working time, yet it cures quickly and can be used in cool temperatures. Because it is simple to mix and use, G/flex is an excellent starting point for customers new to epoxy use.
- **Versatility** G/flex can be modified with WEST SYSTEM® fillers and additives if you need to meet particular bonding needs. Adding G/flex to other WEST SYSTEM epoxies can improve their toughness and flexibility.

Development of G/flex Epoxy

G/flex is the result of years of experimentation to develop a formula for a toughened epoxy. We wanted something that was simple to use, viscous enough not to drain out of a joint, and adhered tenaciously to a variety of materials under difficult conditions. As explained more fully later (see *Understanding Flexible Properties*, p. 17), material properties of an epoxy form a complicated web. When you formulate for specific end properties (like high elongation), you usually have to give up other properties in order to achieve it. Some of us thought that if you formulate an epoxy with five to six times the tensile elongation of other WEST SYSTEM epoxies, the new product would be poor at dealing with constant or long duration loads. Yet when we tested G/flex under long duration loading with our exclusive Creep Test, it performed admirably—nearly matching the 105 Resin-based epoxy.

We also wondered if an epoxy with this much elongation would perform poorly in heat resistance. Yet ASTM-D648 (Heat Deflection Under Load or HDUL) revealed G/flex performed even better than 105 Resin-based epoxies. (G/flex like all WEST SYSTEM resin/hardener combinations can handle temperatures up to 200°F repeatedly. At this temperature, it will be more flexible and less resistant to heavy durational loads than at room temperature, but it returns to

full strength as it approaches room temperature.) Well, what about through cure? Usually flexible systems take days to achieve the majority of their physical properties. Our testing revealed that G/flex's 24-hour through cure is similar to that of WEST SYSTEM 105 Resin and 205 Fast Hardener.

Adhesion Testing

How does G/flex adhere to woods and metals? Adhesion testing using the PATTI (Pneumatic Adhesion Tensile Test Instrument) on the same pieces of wood (with the wood sanded parallel to the grain with 80-grit sandpaper but no solvent wash) revealed that G/flex adheres to wood at least as well as any other WEST SYSTEM epoxy. With hardwoods and the often difficult-to-glue species such as white oak, Ipe, teak, greenheart, purpleheart and salangan batu, G/flex performed as much as 30% higher.

Adhesion testing with G/flex Epoxy on metals also yielded excellent results, typically exceeding the adhesion results achieved with 105 Resin-based epoxies (see *Figure 1*).



G/flex Epoxy has the ability to bond not only to wood and aluminum, but plastics, exotic hardwoods and wet wood.

Figure 1—Tensile adhesion results for PATTI test of G/flex and various materials.

Material	G/flex Epoxy	Surface prep / conditions	Tensile adhesion (psi)
G-10 high-density laminate	650	80-grit sand / dry surface	3459
	655	80-grit sand / wet surface	2473
		80-grit sand / underwater surface	1772
1018 steel	650	80-grit sand / dry surface	3562
	655	80-grit sand / wet surface	1175
Galvanized steel	650	100-grit wet sand	2562
	655	100-grit wet sand	2929
	655	Scotch brite™ pad wet sand	2913
Aluminum 2024 T3	650	80-grit sand, 860 etch / dry surface	2731
	650	Grit blast, 860 etch / dry surface	1856
	655	80-grit sand / wet surface	1503
	655	Grit blast, 860 etch / dry surface	2153
Copper	650	80-grit sand	2334
	655	80-grit sand	2685
Bronze	650	80-grit sand	2782
	650	Scotch brite™ pad sand	2962
	655	80-grit sand	2936
HDPE plastic	655	Alcohol wipe, flame treat	1885
ABS plastic	655	80-grit sand	1535
Lexan™	655	80-grit sand	1870
Ipe	650	60-grit sand	2134
	650	Plane, isopropyl alcohol wipe × 3	2223
Teak, vertical grain	650	80-grit sand parallel to grain	1413
	655	80-grit sand parallel to grain	1381
	655	80-grit sand, alcohol wipe × 2	1503
White oak, vert grain	650	80-grit sand	1935
	655	80-grit sand	1780
	655	Alcohol wipe × 2	2212
Purpleheart	650	60-grit sand parallel to grain	1731

We also found that G/flex® 655 Thickened Epoxy Adhesive adheres to wet and damp surfaces well. Obviously gluing to wet surfaces, especially when dealing with absorbent substrates like wood, is less than ideal because water is taking up the spaces where epoxy otherwise would find its way in; however, G/flex worked surprisingly well. Technique plays an important role in how effective a wet surface adhesion (even underwater repairs) will be. The epoxy must be thick enough to displace the water to ensure a good bond.

Pre-thickened G/flex 655 Adhesive (or G/flex 650 that has been thickened with 406 Colloidal Silica to a mayonnaise consistency) is needed.

G/flex Kit instructions include a number of short “how-to’s” on gluing to damp and wet surfaces, performing underwater repairs, and repairing plastic boats, including crack repairs and making skid plates for worn ends on plastic canoes.

Expand the versatility of other WEST SYSTEM® epoxies

Adding G/flex to WEST SYSTEM 105 Resin-based epoxy improves toughness and tensile elongation. Using it this way expands the utility and ver-

satility of the WEST SYSTEM product line even further. G/flex can also be used with WEST SYSTEM G/5 Five-Minute Adhesive to extend the working time. The more G/flex added to G/5, the slower the cure and the tougher the cure properties become.

Do I still need 105 Resin?

With all the attributes and improved properties of G/flex, you might be asking whether you still need WEST SYSTEM 105 Resin-based epoxy? The answer is that G/flex can't do some things as well as 105 epoxy. Examples include barrier coating and fiberglassing with heavier fabrics. Although G/flex flows nicely when spread out on a surface, it is less than ideal as a coating because of its higher viscosity. WEST SYSTEM 105 epoxy is better for wetting out fiberglass cloth, especially for clear finish projects like wood strip canoes and kayaks. WEST SYSTEM 105 epoxy is also a better base for creating fairing putties because its lower viscosity allows you to add more low-density filler to it. This translates into a fairing putty that sands and carves more easily because of the higher filler loading.

Several articles follow that will help you further understand our new G/flex toughened epoxy and its properties. We encourage you to read these and then experiment with G/flex as we are doing. We think you will find many projects for which the particular properties of G/flex are ideally suited. As always, our Technical Staff is available to answer your questions, and we will be eager to hear about your projects and repairs using the new G/flex Epoxy. ■

WEST SYSTEM® products

This is a good time to clarify that there are now three different epoxy types in the WEST SYSTEM product line. (see page 24.)

1. What we previously referred to as WEST SYSTEM epoxy are the four resin/hardener combinations based on 105 Resin (105 Resin mixed with 205, 206, 207 or 209 Hardener).
2. G/5 Five-Minute Adhesive is a single epoxy resin/hardener combination.
3. We have now added G/flex Epoxy to the WEST SYSTEM product line. G/flex includes 650 (liquid) Epoxy and 655 (thickened) Epoxy Adhesive.