

G/flex

655 Instructions

A guide for using G/flex 655 Epoxy Adhesive

Sample projects include repair to plastic canoes and kayaks, wooden boats, and household and sporting equipment. Also included are tips on gluing to wet surfaces and gluing underwater, joining wood, gluing in fasteners, and blending epoxies.

G/flex 655 is a high-strength epoxy designed for permanent, water-proof, structural bonding. G/flex has a modulus of elasticity of 150,000 psi, which gives G/flex the toughness to make structural bonds that can absorb the stresses of expansion, contraction, shock, and vibration.

G/flex adheres tenaciously to difficult-to-glue hardwoods, both tropical and domestic varieties—white oak, lpe, teak, greenheart, purpleheart and black walnut to name a few. G/flex can glue damp woods, be used on wet surfaces and even underwater when applied with specific techniques.

In addition to wood, G/flex is ideal for bonding a variety of materials including dissimilar ones—metals, plastics, glass, masonry, and fiberglass.

We encourage you to experiment with G/flex. We think you will find many projects for which special properties of G/flex are ideally suited. As always, our Technical Staff is available to answer your questions, and is eager to hear about your projects and repairs using G/flex Epoxy. Call 866-937-8797 (toll free).

Safety

- Avoid skin contact with resin, hardener or mixed adhesive. Wear liquid-proof gloves and protective clothing to keep the epoxy off your skin.
- Avoid eye contact with resin, hardener or mixed adhesive. Wear protective glasses. In case of contact with eyes, flush with water for 15 minutes and consult a physician.
- Avoid inhalation of vapors. Provide adequate ventilation. Wear a dust mask when sanding epoxy, especially epoxy that has not fully cured.
- Read and follow safety information on resin and hardener containers.

Starting Out

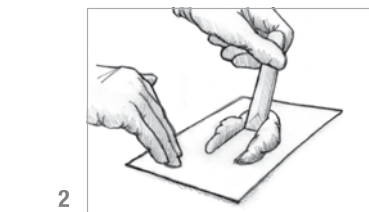
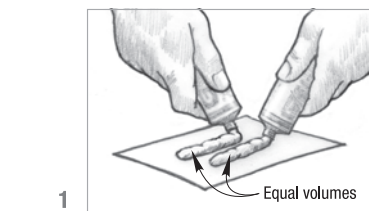
Puncture the seal in each tube with the point in the end of the cap.

Before mixing epoxy, gather all necessary application tools, clamps and equipment. Check all parts for proper fit and be sure all surfaces to be glued are properly prepared.

Mixing and Curing

Dispense equal volumes of G/flex 655 Resin and Hardener onto a mixing pallet (1). Use the square end of a mixing stick to thoroughly blend the resin and hardener (2).

After mixing the resin and hardener, you will have about 45 minutes, at 72°F (22°C), to apply the mixture before it begins to gel and up to 75 minutes to assemble and clamp parts after it is initially applied. At 72°F (22°C), the adhesive mixture will solidify in 3–4 hours and



reach a workable cure in 7–10 hours. The adhesive may be sanded, clamps can be removed, and joints can be moderately loaded. Wait 24 hours before subjecting joints to high loads.

G/flex 655 Epoxy Adhesive cures faster in warmer temperatures and slower in cooler temperatures. When a quicker cure is desired, apply moderate heat to substantially reduce cure time. Cure time is reduced by half with each 18°F (10°C) increase in temperature.

G/flex 655 will cure in temperatures as low as 40°F (4°C), but cure very slowly. When using 655 at lower temperatures, it is a good idea to warm resin and hardener to room temperature for easier dispensing and mixing.

Curing epoxy generates heat. Thicker layers of 655 generally cure a little faster than thinner layers, as this heat is concentrated in thicker layers and dissipated in thinner layers.

Cleanup

Clean uncured epoxy from skin with a waterless cleaner, followed by washing with soap and water. Remove excess epoxy from work surfaces with the flat end of a mixing stick or with paper towels. Clean up residue with an alcohol pad, citrus-based cleaner, acetone or lacquer thinner.

Basic Surface Preparation

For best adhesion, gluing surfaces should be:

CLEAN—Remove loose, chalky or flaky coatings, and contaminants such as grease, oil, wax, and mold release. Clean contaminated surfaces with an appropriate solvent applied with plain white paper towels. Wipe the surface with a clean, dry paper towel before solvent dries. Do not use laundered rags to apply or remove solvent as they may contaminate the surface with fabric softener residue.

SANDED—Sand smooth and non-porous surfaces with 80-grit sandpaper to provide good texture for the epoxy to “key” into. Brush away sanding dust.

DRY—Although G/flex 655 Epoxy Adhesive can be used to bond damp and wet surfaces (see Gluing to wet surfaces and surfaces underwater, on the reverse side), maximum adhesion will be achieved when bonding to dry surfaces.

Additional Surface Preparation Metals

Sand or grit-blast the surface to expose bright metal.

Clean the area with acetone or lacquer thinner using white paper towels. Allow the surface to dry completely.

Abrade through wet epoxy—Apply a thin coat of G/flex 655 Epoxy Adhesive and immediately scrub metal surfaces through the wet epoxy coating with a fine wire brush or sandpaper.

Plastics

Sand ABS, PVC and polycarbonate plastics with 80-grit sandpaper to provide texture for improved adhesion.

Some plastics like HDPE and LDPE (high-density and low-density polyethylene) benefit from flame treating. First wipe the bonding surface with a solvent to remove contamination and dry with a clean paper towel.

FLAME TREATING—Pass the flame of a propane torch across the surface quickly. Allow the flame to touch the surface, but keep it moving—about 12 to 16 inches per second. No obvious change takes place, but the flame oxidizes the surface and dramatically improves adhesion with adhesives and coatings applied over it.

While flame treating will improve adhesion to most plastics, it appears to provide the greatest benefit to polyethylene. If you are unsure of the type of plastic, it doesn’t hurt to flame treat.

Hardwoods, Including Tropical Woods

Bonding to dry wood (between 6 and 12% moisture content) is best for achieving long-term reliable bonds. Sand mating surfaces with 80-grit parallel to the grain. Clean oily woods with a solvent such as acetone, lacquer thinner, or

isopropyl alcohol. Apply solvent with plain white paper towels. Wipe the surface with a clean, dry paper towel before solvent dries. Do not use laundered rags to apply or remove solvent.

The extent of wood failure in tensile adhesion tests indicate that tensile adhesion achieved using G/flex 655 Epoxy Adhesive, with proper surface preparation, approached the grain strength of the wood in all of the woods we tested.

Surface Preparation for Various Dry Materials		
Material	Basic Preparation	Additional Surface Preparation
Fiberglass laminate	As necessary, Remove soft and loose surface material	Abrade with 80-grit sandpaper
Aluminum		
Steel	Remove contamination with solvent wipe	Wire brush through wet epoxy
Steel-galvanized		
Copper	Sand with medium-grit sandpaper	Isopropyl alcohol wipe
Bronze		
Lead		
lpe		
Teak	Sand with 80-grit parallel to grain	Isopropyl alcohol wipe
White oak		
Walnut		
Purpleheart		
Greenheart	Isopropyl alcohol wipe	Flame treat
ABS plastic		
PVC plastic	Sand with 80-grit	Flame treat required
HDPE, LDPE plastic		
Polycarbonate (Lexan™)	Sand with 80-grit	

Bonding

Apply the epoxy mixture to all properly prepared mating surfaces. Apply enough epoxy to fill voids and bridge gaps on uneven mating surfaces.

Clamp the components in position before the epoxy begins to gel—about 75 minutes at 72°F (22°C). Use just enough clamping pressure to squeeze a small amount of epoxy out of the joint. Leaving some glue in the joint increases

bonding strength. Allow the epoxy to cure thoroughly before stressing the joint.

Use a spreader or notched trowel to apply G/flex 655 to larger surfaces prior to clamping. Use a pipe cleaner or syringe to apply adhesive to hard to reach areas such as cracks and fastener holes when bonding hardware.

Bonding to wet surfaces and surfaces underwater

While gluing to a dry and properly prepared surface is best for producing reliable long-term bonds, gluing to damp, wet, and even under water surfaces is possible.

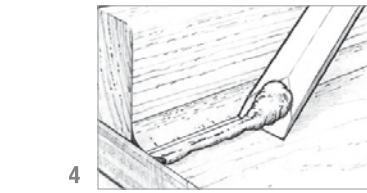
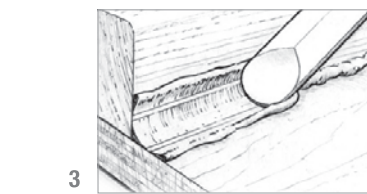
Abrade bonding surfaces with 80-grit sandpaper.

Mix an appropriately sized batch of G/flex 655 Epoxy Adhesive. Forcefully apply the 655 on to the bonding surfaces with a plastic spreader or stiff brush to displace water in the scratches and pores at the bonding surface.

Bring the mating surfaces together and apply just enough clamping pressure to squeeze out excess 655 and moisture. Allow to cure 7–10 hours before removing clamps and 24 hours before stressing the joint.

Making Fillets

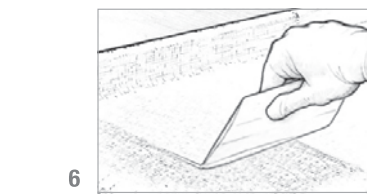
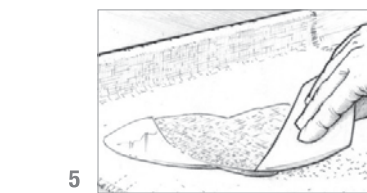
When parts are joined at or near right angles, fillets can be used to add considerable strength to the joint by increasing the surface area of the bond. Make fillets by applying a bead of G/flex 655 along the inside corner of the joint. Form the epoxy into a cove section using the round end of a mixing stick (3).



Clean off the excess epoxy with the beveled end of the mixing stick before the epoxy gels (4).

Fiberglassing

Light weight fiberglass fabrics and tapes (4–9 oz/sq yd range) can be used with G/flex 655 Epoxy Adhesive when fiber reinforcement is desired to add stiffness



or abrasion resistance, or to patch a damaged area.

Cut the fabric to fit the area. If heavier reinforcing is desired, use multiple thin layers rather than a single thick layer. Properly prepare the surface before applying fabric.

Reliable WEST SYSTEM® Epoxies

While G/flex offers physical properties and applications that are different than WEST SYSTEM 105 Resin-based epoxies, they share the same high standards for performance and reliability.

Since 1969, reliability has been the hallmark of WEST SYSTEM. We adhere to the highest standards of quality assurance in our formulating and manufacturing practices, from raw material qualification to testing and certification of finished resins and hardeners. This means that every properly mixed batch of WEST SYSTEM resin and hardener, including G/flex resin and hardener, will cure as it is supposed to, every time. This commitment to quality has earned certification to the ISO 9001:2008 standard. WEST SYSTEM is your reliable solution.

Technical Staff and comprehensive instructional publications will help ensure the success of your building and repair project. WEST SYSTEM is renowned for its outstanding customer service.

WEST SYSTEM technical publications and DVD provide detailed procedures and instructions for specific repair and construction applications.

The WEST SYSTEM website provides basic product information, dealer locations and links, project articles and galleries, and safety information. Visit westsystem.com.

Further assistance can be obtained by contacting the friendly and knowledgeable **Technical Staff**. Call 866-937-8797 (toll free).

Coat the substrate with 655. Lay the fabric in position on the wet adhesive. Spread mixed adhesive onto the fabric using a plastic spreader (5). When the fabric and substrate have been saturated, use the spreader to smooth and remove excess epoxy (6). Repeat the process with additional layers. ■

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Sample Projects

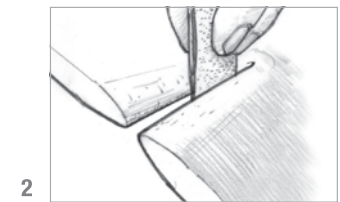
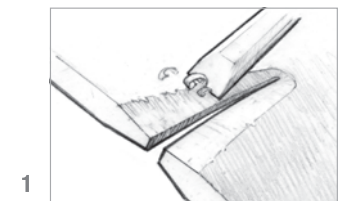
The repairs described on this page are just a sample of the potential uses for G/flex® 655 Epoxy Adhesive. Products not included in the kit can be found in the WEST SYSTEM® *User Manual & Product Guide* and are available at WEST SYSTEM dealers. Be sure to read *Handling Epoxy* and *Basic Techniques* on the reverse side of this guide before beginning these repairs. For additional information on WEST SYSTEM products or techniques, visit westsystem.com or call 866-937-8797 (toll free).

Plastic Canoe & Kayak Repairs

Plastic canoes and kayaks are often made with thermoformed plastics like HDPE (high-density polyethylene), ABS, and occasionally PVC. G/flex adheres to these materials with specific surface preparations. Refer to the Surface Preparation chart on the reverse of this page.

Split and Crack Repair

Open up cracks and splits with a sabre saw or hack saw blade to create a slight gap in the break. Bevel the edges of the crack with the end of a sharp chisel or with a cabinet scraper to create a $\frac{3}{8}$ " to $\frac{1}{2}$ " long bevel



on both sides of the split and on both sides of the hull (1). Sand the beveled surfaces to round the edges and create more taper with 80-grit sandpaper (2).

Flame treat HDPE and LDPE (high-density and low-density polyethylene) plastic with a propane torch to oxidize the repair surfaces. See *Additional Surface Preparation* on the reverse of this page.

Mix an appropriately sized batch of G/flex 655 Epoxy Adhesive. Apply a bead of the adhesive to the beveled joint, overfilling it slightly.

Cover the adhesive filled joint with 2" wide cellophane packaging tape while forcing the excess epoxy through to the other side of the joint. Avoid using too much force, which could leave the taped side under filled.

Spread out the adhesive on the opposite side to fill in the beveled seam. Add or remove epoxy to fill the bevel flush.

Allow to cure 7–10 hours before removing tape. Use a scraper or sandpaper to remove high spots and smooth the surface. Paint the area with plastic-compatible paint like Krylon® Fusion.

Small Hole Repair

Canoes and kayaks are often dragged over sand and rocks, resulting in worn off ends and eventual leaks near the bow and stern.

Clean the area being repaired with a mild solvent like rubbing alcohol and paper towels. Sand with 80-grit sandpaper to create a slight taper around the perimeter of the repair. Flame treat the repair surfaces of HDPE and LDPE plastics.

If the worn section has a gap that is too wide to bridge with G/flex 655 Epoxy Adhesive, say $\frac{1}{4}$ " to $\frac{3}{8}$ " across, cover the back of the hole with a temporary backer to support the epoxy while it cures. The backer can be a wad of plastic wrap, piece of polystyrene foam, or any appropriately shaped material covered with plastic wrap. The plastic wrap will allow for easy removal after the epoxy cures.

Mix an appropriately sized batch of G/flex 655 Epoxy Adhesive.

Apply the adhesive to the area with a mixing stick or plastic spreader. Apply enough epoxy to fill the hole and build up low areas to match the original thickness. Apply additional epoxy, if necessary, while previous applications are still tacky.

Allow to cure 7–10 hours before removing excess cured epoxy and shaping the surface with a cabinet scraper, file, or sandpaper. Paint the area with a plastic-compatible paint like Krylon Fusion.

Create Skid Plates/Repair Larger Holes

Avoid wearing holes on the keels and ends of canoes and kayaks by applying an abrasion resistant fiberglass strip on the wear areas. Fiberglass or Kevlar® reinforcement can also be used to patch larger holes (over $\frac{3}{8}$ ").

Clean the surface with a mild solvent like rubbing alcohol and paper towels. Sand the end of the canoe along the bottom and up the sides a few inches with 80-grit (3). This area will define the size of the skid plate. Flame treat HDPE or LDPE plastics. If you are patching a hole, cover the back with a temporary backer as described earlier.



Cut three or four layers of light fiberglass cloth (4–6 oz fabric) to cover the sanded area. Cut the bottom piece of fiberglass to fit to the sanded/flame-treated boundary. Trim each successive layer an inch or two narrower and shorter than the previous. This tapers the thickness of the fiberglass skid plate/patch toward the edges so it will easily deflect and cling to the hull as it flexes.

Mix enough G/flex 655 Epoxy Adhesive to wet out and apply one or two layers of fabric.



Apply a coat of epoxy to the sanded/treated area. Lay the largest piece of fiberglass onto the adhesive. Apply more adhesive to wet out the fiberglass cloth. If necessary, a heat gun can be used to warm the epoxy and improve wet out in cooler temperatures. Use a spreader to smooth the fabric and remove excess epoxy (4).

Repeat the fiberglass application with the remaining piece(s). Center each smaller layer on the one before it. Wet out the fabric, and then use a spreader to smooth the fabric and remove excess epoxy.

Apply a coat of adhesive to fill and smooth the edges of the fabric if desired while the fiberglass application is still tacky.

Allow to cure 7–10 hours before removing any rough edges or excess cured epoxy with a cabinet scraper, file or sandpaper. Paint the area with a plastic compatible paint like Krylon Fusion. ■

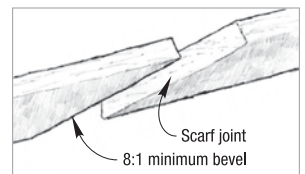
Wood Construction and Repair

G/flex 655 is an excellent adhesive for wood. It is especially good for gluing hardwoods like white oak and for tropical woods like teak and purple heart. There are many uses for G/flex Epoxy Adhesive in building and repairing boats, indoor and outdoor furniture, cabinetry, and trim. Refer to *Special Surface Preparation* and *Bonding* on the reverse page for basic gluing information. Here are some additional wood bonding applications that extend the uses of G/flex 655 Epoxy Adhesive.

Joining Wood

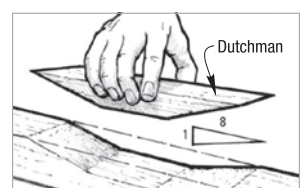
BUTT JOINTS are used to edge glue lumber to create wider boards. Edges are typically square cut at 90° and simply butted up to one another when gluing. This joint is used for edge gluing lumber; it is not recommended for end gluing, or lengthening boards parallel to the grain. Avoid excess clamping pressure.

SCARF JOINTS are used to join two pieces of wood together along their length. The ends of lumber are ma-

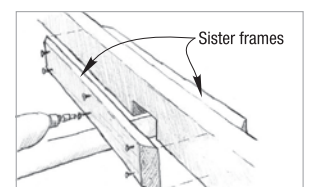
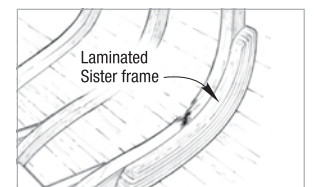


chined with an 8:1 to 12:1 bevel angle (5). Longer bevels create more gluing surface and potentially stronger joints. Scarf joints are often used to replace damaged sections of frames and ribs in traditionally built wooden boats.

A DUTCHMAN is a wood splice used to repair damaged sections of wood timbers. We recommend creating an 8:1 bevel (6) on each end of the joint to provide adequate gluing area to maintain structural integrity.

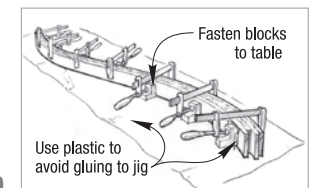


SISTER PLANKS are used to build up the strength of the lumber by gluing additional pieces or sister planks on one or both sides.



Bond sister planks where structural members have been damaged by rot (7) or weakened by cutouts for plumbing or drain holes (8). They are useful where weight or appearance is not a factor.

LAMINATING multiple layers of wood strips is a great way to create custom-shaped lumber for frames, sister frames, legs, arches, railings, and trim. Laminated lumber is stronger and more stable than steam bent or sawn lumber. Glue strips using the preparation and



bonding techniques on the reverse page. Use a jig or mold to clamp strips to the desired shape (9). Jigs should be strong enough to provide even clamping pressure and prevent spring back until the epoxy cures. ■

Repairing Splits, Cracks and Delaminations

Paddles, oars, garden tool handles, and sports equipment made with wood or laminated materials can split or crack under normal use or abuse. G/flex 655 Epoxy Adhesive's tenacious adhesion and ability to resist shock loads make it a good choice for these kinds of repairs.

Insert a wedge into the crack(s) to expose as much bonding area as possible without increasing the damage. Mix a small batch of G/flex 655. Work epoxy into the crack with the mixing stick or a small brush, or inject epoxy with an 807 Syringe. Use a fine blade or stick to push epoxy as far down into the crack as possible. Wait a few minutes for absorption to take place before removing wedge and clamping the crack(s) closed. Allow to cure 7–10 hours before removing clamps and sanding away epoxy squeeze-out. Wait 24 hours before using.

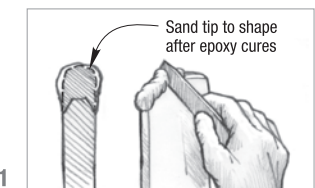
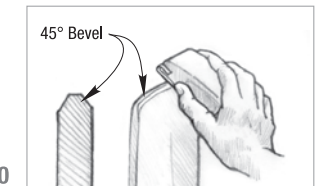
A layer or two of light-weight fiberglass fabric (4–6 oz) can be applied for additional reinforcing. Refer to *Fiberglassing* on the reverse page.

Use G/flex 655 Epoxy Adhesive to fill cracks and voids in masonry and tile. Fill cracks in damp and wet basement walls. Scrape out loose material and force 655 into cracks with a plastic spreader. ■

Create Durable Tips on Wooden Paddles and Oars

The tips of canoe and kayak paddles take lots of abuse from scraping bottom, pushing off rocks, and fending off debris. Use G/flex 655 Epoxy Adhesive to produce a durable edge to protect tips from damage.

Sand varnish or paint from the tip of the paddle to expose fresh wood. Use sandpaper on a hard sanding block to create a slight bevel around the edge of the paddle tip (10).



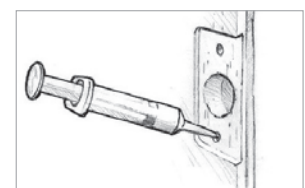
Mix an appropriate amount of G/flex 655. Apply a thick bead of the mixture around the edge of the paddle blade (11). Apply additional 655 to extend the tip, if desired, after the initial application has gelled and will support the additional weight.

Allow to cure 7–10 hours. Wash with water before shaping the tip with a file or sandpaper. Apply paint or varnish if desired. ■

Bonding Fasteners

Installing screws and other threaded fasteners with G/flex 655 dramatically improves load carrying capacity and is especially useful when fasteners are subject to shock or vibration.

Use G/flex 655 Epoxy Adhesive to install new fasteners and hardware, repair stripped screw holes and replace missing wood around fasteners. When cured, G/flex 655 can be sanded, sawn, nailed and screwed. Small screws, nails, and tacks can be driven into it without pre-drilling. Larger fasteners may require a pilot hole. Experiment for best results.



The easiest method is to fill pilot holes (or stripped fastener holes) (12) with G/flex 655 Epoxy Adhesive prior to installing the screws. The epoxy will bond to the exposed end grain on the inside of the hole, effectively increasing fastener diameter. This results in more holding power, and seals water out so the wood stays drier. Drier wood is stronger than damp wood.

For even greater strength and stability, drill oversized holes $\frac{2}{3}$ the depth of the fastener, then fill the hole with G/flex 655. Install the fasteners with just enough force to hold the hardware in place until the epoxy cures. ■

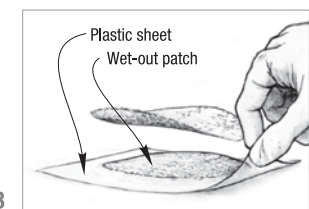
Underwater Fiberglass Patching

Intended for small repairs, fiberglass patches should be small enough for one person to carry and apply under water, limiting the size to about 12 inches square. The water must be fairly still so the patch is undisturbed during the cure.

Clean the surface to be patched and abrade the area of the patch with sandpaper to remove bottom paint.

Cut multiple layers of fiberglass cloth, with the first layer sized to fit the abraded area and successive layers $\frac{1}{2}$ " smaller on each side than the previous one.

Apply G/flex 655 to a piece of sturdy plastic film (like freezer bag plastic), cut larger than the patch. One by one, wet out the fiberglass plies onto the plastic starting with the smallest piece and ending with the largest (13). Compress the patch by squeezing out excess epoxy between layers with a spreader. Spread a uniform $\frac{1}{16}$ " thick layer of 655 to the compressed fiberglass stack.



Position the fiberglass patch over the abraded area underwater, making sure that the plastic covering stays in position on the outside of the patch. (Be sure to wear protective gloves.)

Apply pressure with a plastic spreader starting in the middle of the patch and work toward the edges to squeegee the 655/fiberglass patch against the hull and to displace water at the repair surface. Repeat the process in all directions to displace all of the water under the patch and push excess 655 Adhesive toward the edges of the patch.

Allow 24 hours to cure before removing plastic. Inspect repair at first opportunity (preferably with the hull out of the water) and rework as needed for structural integrity.

Blending Epoxies

Advanced users can blend G/flex 655 Epoxy Adhesive with WEST SYSTEM 105 Resin-based epoxy combinations to modify toughness, flexibility, cure speed, viscosity, strength, and elongation. The epoxy blend will have properties/characteristics derived from both epoxy systems, roughly in proportion to the percentage of each epoxy in the blend.

Blending WEST SYSTEM 105/205 with G/flex 655 will speed up the cure of G/flex, lower its mixed viscosity and increase rigidity of the cured epoxy, compared to using G/flex 655 alone.

To blend G/flex 655 Epoxy Adhesive with 105 Resin-based epoxies, you must meter the appropriate resin to hardener mix ratio of each epoxy prior to blending the two combinations together.

For more information call the WEST SYSTEM Technical Staff at 866-937-8797 (toll free) or visit westsystem.com ■