

# 650 Epoxy General Use

## Safety

- Avoid skin contact with resin, hardener or mixed epoxy. Wear liquid-proof gloves and adequate protective clothing to keep the epoxy off your skin.
- Avoid eye contact with resin, hardener or mixed epoxy. 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

Remove and discard the red inner seal from both containers. Trim the tip of each spout about 1/4" from the end.

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

## Mixing and curing

Dispense equal volumes of G/flex 650



Resin and Hardener into a small mixing cup (1). Use a mixing stick to thoroughly blend the resin and hardener, while scraping the sides and bottom of the mixing cup (2). Small quantities can be mixed on a paper or plastic palette.



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 the epoxy is initially applied. At 72°F (22°C), the epoxy mixture will solidify in 3–4 hours. It will reach a workable cure in 7–10 hours and may then be sanded,

clamps can be removed, and joints can be moderately loaded. Wait 24 hours before subjecting joints to high loads.

Epoxy 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 increase in temperature. G/flex 650 Epoxy will cure in temperatures as low as 40°F (5°C), but will cure very slowly. When using G/flex at lower temperatures, it is a good idea to warm resin and hardener to room temperature while dispensing and mixing.

Curing epoxy also generates heat. Thicker layers of epoxy generally cure faster than thinner layers, as this heat is concentrated in thicker layers and dissipated in thinner layers. Use caution when mixing large batches of G/flex 650 Epoxy. A large, confined quantity of curing epoxy (10 fl oz or more) may generate enough heat to burn your skin or melt a plastic mixing cup.

## Cleanup

Clean uncured epoxy from skin and clothes with alcohol, 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 alcohol, citrus-based cleaner or a solvent such as lacquer thinner or acetone.

## Basic surface preparation

G/flex 650 Epoxy will bond to many different materials. For best adhesion to most materials, bonding 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 non-porous and smooth surfaces with 80-grit aluminum oxide sandpaper to provide good texture for the epoxy to “key” into. Brush away sanding dust. Refer to the chart (*right*) for recommendations.

**DRY**—Although G/flex 650 Epoxy can be used to bond damp and wet surfaces, 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 650 Epoxy and immediately scrub metal surfaces through the wet epoxy coating with a fine wire brush or sandpaper.

Adhesion to aluminum can best be improved by treating it with the two-part WEST SYSTEM 860 Aluminum Etch prior to applying the epoxy. Aluminum can be prepared using the “abrade through wet epoxy” method with good results if an Aluminum Etch kit is not available.

### 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 isopropyl alcohol or acetone. Apply solvent with plain white paper towels. Wipe the sur-

face 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 G/flex 650 Epoxy, with proper surface preparation, approached or exceeded the grain strength of the wood in all of the woods we tested.

### Plastics

Clean plastics, except for polycarbonate, with isopropyl alcohol to remove contamination. Sand all plastics including polycarbonate with 80-grit sandpaper to provide texture for good adhesion. Flame treat ABS and PVC for additional benefit.

HDPE (high-density polyethylene) and LDPE (low-density polyethylene) must be flame treated for good adhesion.

**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 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 (HDPE and LDPE). If you are unsure of the type of plastic, it doesn't hurt to flame treat. ■

Surface preparation for various dry materials		
Material	Basic surface preparation	Additional surface preparation
Fiberglass laminate	As necessary,	
Aluminum	Remove soft and loose surface material	860 Aluminum Etch, two part
Steel		
Steel-galvanized	Remove contamination with solvent wipe	Wire brush through wet epoxy
Copper		
Bronze	Sand with 80-grit sandpaper	
Lead		
Ipe	Sand with 80-grit sandpaper parallel to grain	Isopropyl Alcohol wipe
Teak		
White oak		
Walnut		
Purpleheart		
Greenheart	Isopropyl Alcohol wipe Sand with 80-grit	Flame treat
ABS		
PVC	Flame treat required	
HDPE, LDPE plastic		
Polycarbonate (Lexan™)	Sand with 80-grit	

# G/flex 650—a WEST SYSTEM® Epoxy

G/flex 650 Epoxy is the result of years of experimentation to develop a toughened epoxy that was simple to use, viscous enough not to drain out of a joint, and would adhere tenaciously to a variety of materials under difficult conditions.

G/flex 650 is all that, and more. It is a marine-grade glue that can be accurately mixed in small batches with a simple 1:1 mix ratio. It has the advantage of a long open working time and a relatively short cure time.

G/flex 650 is, first of all, a high-strength epoxy—designed for permanent, waterproof, structural bonding. Furthermore, G/flex has a modulus of elasticity of 150,000 psi, giving 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 and even has the ability to glue damp woods.

G/flex is ideal for bonding a variety of other materials, including dissimilar ones—metals, plastics, glass, masonry, and fiberglass. It can be used to wet out and bond fiberglass tapes and fabrics.

We encourage you to read these instruction and then experiment with G/flex. 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 G/flex Epoxy. Call 866-937-8797 (toll free).

**WEST SYSTEM reliability**  
G/flex 650 Epoxy is the latest addition to the WEST SYSTEM line of epoxy products. 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.

WEST SYSTEM is the worlds leading brand of marine epoxy, created by Gougeon Brothers—sailors, boatbuilders, and formulators who literally wrote the book on wood/epoxy boat building. We know the engineering and chemistry required to formulate epoxies for high-performance composite structures. It requires thorough research,

rigorous test programs, skillful shop work and direct experience with today's high-performance boats and other engineered structures. This experience and dedication to performance have given WEST SYSTEM another quality that sets it apart from other brands of epoxy.

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.

## Outstanding customer service

WEST SYSTEM provides you with something else as reliable as our epoxy—knowledge. Whether your project is large or small, the WEST SYSTEM Technical Staff and comprehensive instructional publications will help assure the success of your building and repair project. WEST SYSTEM is renowned for its outstanding customer service.

**The WEST SYSTEM website** provides basic product information, how-to videos, dealer locations and links, project articles and galleries, and safety information. Visit [westsystem.com](http://westsystem.com).

Further assistance can be obtained by contacting the friendly and knowledgeable Technical Staff. Send e-mail to [tech-support@westsystem.com](mailto:tech-support@westsystem.com) or call 866-937-8797 (toll free).

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# 650-K ALUMINUM BOAT Repair Kit



## Repair leaking seams and rivets

Step-by-step instructions show you how to use the materials in this kit to repair the most common problem with aluminum boats and canoes—leaking seams and rivets.

## Tools required

In addition to the materials in this kit, you will need a propane torch or heat gun, a wire brush, a putty knife, paper towels and laquer thinner or acetone as necessary for cleanup.

## Repairs requiring additional materials

With the addition of 745-30 12 oz (30"×30") Fiberglass Fabric and 808 Plastic Spreaders or the equivalents, you can REPAIR TEAR OR PUNCTURE DAMAGE up to 36 square inches (6"×6"). You will also need a 1/8" drill, a sabre saw with metal cutting blade, a hammer and 80-grit sandpaper. Though not required, WEST SYSTEM 860 Aluminum Etch Kit will improve adhesion of the patch and is recommended for the repair of pitted and pin-holed surfaces. Instructions for these repairs are included.

## Finishing

G/flex Epoxy is compatible with most primers and paints to match existing finishes.

## Kit contents

4 fl oz G/flex 650-A Resin, 4 fl oz G/flex 650-B Hardener (8 fl oz mixed epoxy), 406 Adhesive Filler, 2 reusable mixing sticks, 2-12 cc syringes, 2 mixing cups, 2 pair disposable neoprene gloves and handling and repair instructions.

**WARNING IRRITANT. POSSIBLE SKIN SENSITIZER.** May cause irritation to eyes and skin. May cause allergic reaction. Avoid skin and eye contact. Do not ingest. Use with adequate ventilation. Use with liquid-proof gloves, eye protection and protective clothing.

**FIRST AID: SKIN CONTACT**—Immediately wash with soap and water. **EYE CONTACT**—Immediately flush with water for at least 15 minutes. Consult physician. **INHALATION**—Remove to fresh air. Consult physician if coughing or irritation develops. **INGESTION**—Do not induce vomiting. If conscious, give 2 glasses of water. Get immediate medical attention. **KEEP OUT OF REACH OF CHILDREN**

**650-A RESIN CONTAINS:** bisphenol-a epoxy resin, bisphenol-f epoxy resin. **650-B HARDENER CONTAINS:** ATBN polymer, aminoethylpiperazine, tris-2,4,6-(dimethylaminomethyl)phenol, triethylenetetramine, phenol 2,4,6-tris[(dimethylamino)methyl] reaction products with triethylenetetramine, phenalkamine curing agent, cashew nutshell liquid, 1,3-benzenedimethanamine. **406 ADHESIVE FILLER CONTAINS:** amorphous silica.



SCAN FOR VIDEO

Manufactured for West System by:



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8 1 1 3 4 3 1 0 1 2 1 6 8

# Fix leaking seams and rivets

As aluminum boats age the accumulated wear and tear on its riveted joints can take a toll on the rivets themselves. Rivets can stretch and eventually loosen, leaving gaps and leaks. Severely damaged seams may require new rivets in combination with G/flex Epoxy. Most leaks can be easily repaired with this kit and the following:

- Wire brush
- Propane torch or heat gun

1. Determine the exact locations of leaks by putting the boat in the water or by filling the boat part way with water to see where it leaks.
2. Mark the leak locations with an indelible pen.
3. Allow the boat to dry.
4. Roll the hull over if possible for easy access to leaking sections.
5. Abrade along the seams and rivets with a wire brush to remove any debris and expose bright metal. A wire brush attachment on drill will make the job easier.

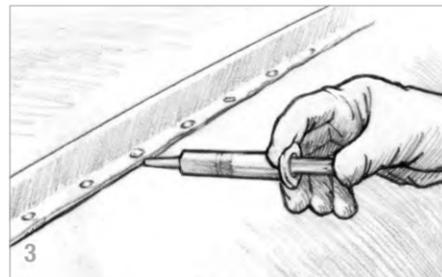


6. Dispense equal volumes of G/flex 650 resin and hardener into a mixing cup and stir thoroughly with the mixing stick (1). Transfer the mixed G/flex epoxy to the plastic syringe. (It is quicker to fill the syringe by removing the plunger and pouring the epoxy into top, especially in cooler temperatures. You should also find it easier to



extrude the epoxy in cooler temperatures if you trim the syringe tip back to about a 1/16" opening.)

7. Use a propane torch or heat gun to boil off any remaining water under the rivets and in the seams in 12" to 18"-long sections or areas (2).



8. Apply a continuous bead of G/flex, using the syringe, along the heated seam and around rivet heads. The epoxy should thin out and flow into the smallest crevices (3). 9. Heat the metal with a torch or heat gun as necessary to thin the epoxy to a water-like consistency and to move it along and penetrate deeply into seams and under rivets. Continued moderate heating will cause the epoxy to gel and cure quickly. Do not heat the epoxy to the point where it discolors or begins to smoke.

When you are satisfied that epoxy has penetrated all of the gaps move on to the next section. Repeat steps 6 through 9 until all leaks are repaired.

## Filling larger gaps in seams and rivets

If new rivets are not available to draw together large gaps, it is possible to successfully repair larger gaps in seams and loose rivets by completing the previous 8 steps and following with these additional steps:

1. Mix a batch of G/flex 650 Epoxy as described earlier. Stir in 406 Adhesive Filler to thicken the mixture to a "mayonnaise" consistency.

2. Force the thickened epoxy mixture into the seam gaps or under the leaky rivets with a putty knife or mixing stick while the initial coat of G/flex 650 is still uncured (4). You may also use the syringe filled with the thickened mixture to force epoxy into the gaps. Trim the tip back as necessary for the thicker material.



3. Keep forcing the mixture through the seam until you see epoxy on the other side of the hull. Thickened epoxy bridges gaps and stays in the seams while it cures.

# Patch holes in aluminum hulls

It is not uncommon for a thin-gauged aluminum hull skin to be punctured or torn by some unseen underwater object or unforeseen trailering mishap. If you don't have skills or the patience for welding or riveting aluminum you can still effect a sturdy repair with G/flex 650 epoxy and the following items not included in the kit:

- WEST SYSTEM 745-30 12 oz (30" x 30") Fiberglass Fabric.
- WEST SYSTEM 808 Flexible Plastic Spreader.
- WEST SYSTEM 803 Glue Brush
- 80-grit sandpaper
- WEST SYSTEM 860 Aluminum Etch Kit (recommended)

These items along with the kit materials will allow you to repair a damaged area up to 6" x 6" as follows:

1. Hammer the torn aluminum back as close as possible to the original hull shape. Cut away torn edges as necessary for the metal to lie smooth.

2. Drill a 1/8" diameter hole at the ends of each crack to prevent further cracking (5).

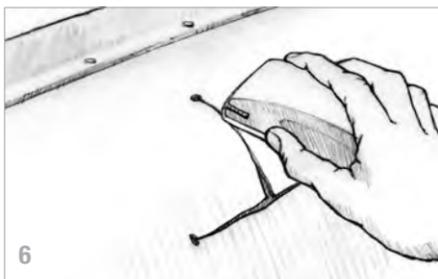


4. Wipe uncured excess epoxy from both sides while uncured with paper towel. Use solvent (laquer thinner or acetone) sparingly if needed to remove stubborn epoxy. Avoid washing epoxy out of the seams or dissolving paint.

5. Allow the epoxy to cure overnight at 65°F (18°C) or warmer before using the boat. You can speed curing by applying moderate heat.

6. Apply a spray paint like Rustoleum® All Finishes to match the aluminum or the existing paint if desired. ■

3. Smooth edges and rough areas with 80-grit sandpaper.



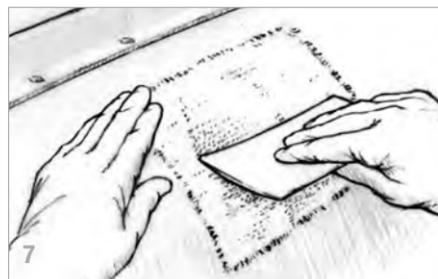
4. Abrade away any remaining paint in the area at least 2" larger than the hole on the inside and outside of the hull (6). (You can improve adhesion to aluminum by treating with an aluminum etch, such as the two-part WEST SYSTEM 860 Aluminum Etch. Follow the etch kit instructions.)

5. Cut a piece of 12 oz fiberglass cloth 2" larger on all sides than the hole to match the abraded or treated area.

6. Dispense equal volumes of G/flex 650 Resin and Hardener into the mixing cup and stir thoroughly with the mixing stick.

7. Place the fiberglass on a piece of plastic. Using a disposable brush, apply the mixed epoxy to the fabric until it is saturated.

8. Position the wet fiberglass over the hole on the outside of the hull with 2" of fabric extending beyond all sides of the hole. Use a plastic spreader to smooth the fabric against the surface while wiping off excess epoxy (7).

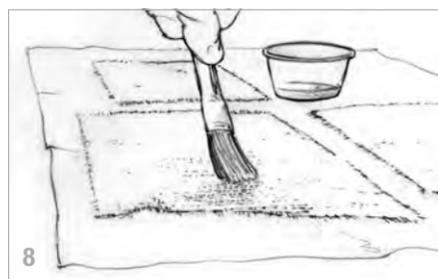


9. Mix a batch of G/flex 650 and stir in enough 406 Adhesive Filler to thicken the mixture to a "mayonnaise" consistency.

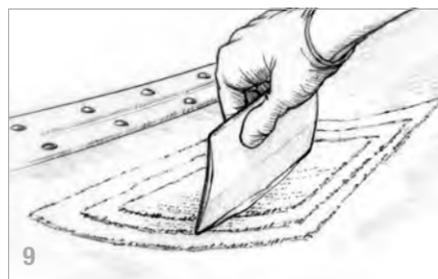
10. Apply the thickened mixture to the repair area on the inside of the hull, filling the gaps in the metal and leaving a thin layer of the thickened mixture over the entire repair area.

11. Cut a piece of 12 oz fiberglass cloth 2" larger on all sides than the hole. Cut a second piece 1" larger on each side than the hole. Then cut a third piece 1/4" larger on each side than the hole.

12. Dispense equal volumes of G/flex 650 Resin and Hardener into the mixing cup and stir thoroughly with the mixing stick.

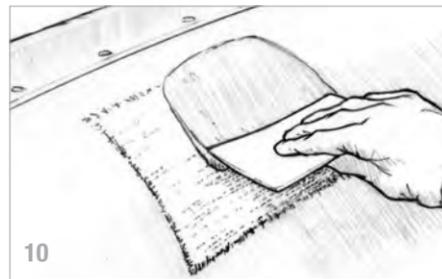


13. Place the three pieces of fiberglass on a piece of plastic. Using a disposable brush, apply the mixed epoxy to the pieces of fabric until they are saturated (8).



14. Position the largest piece of wet fiberglass over the hole on the inside of the hull with 2" of fabric extending beyond all sides

of the hole. Position the next biggest piece centered over the first. Then position the smallest piece centered over the previous piece. Using a plastic spreader, smooth all of the fabric against the surface, eliminate trapped air and wipe off excess epoxy (9). Check the outside of the hull to make sure the patch was not pushed away from the surface. Smooth it with the spreader as necessary.



15. When both sides of the patch have cured to a duct tape-like tackiness, mix a batch of G/flex 650 and stir in enough 406 Adhesive Filler to thicken the mixture to a "mayonnaise" consistency. Using a plastic spreader, apply this mixture over the patch, filling and smoothing the uneven edges and blending both sides of the patch into the undamaged area around it (10). Allow the patch to cure overnight.

16. Wipe the area with water and sand the epoxy smooth and dull before applying a final finish. (If you are not satisfied with the smoothness of the patch repeat steps 15 and 16 before continuing with the final finish.)

17. Apply a finish coating to protect the epoxy from the effects of sunlight. You can apply a spray paint like Rustoleum® All Finishes to match the aluminum or the existing paint. Or, you may apply another coat of G/flex 650, modified with WEST SYSTEM 420 Aluminum Powder to create a UV resistant coating with an aluminum-like metallic grey color. If the hull is painted, you can coat the repaired area with a marine or automotive primer and matching paint. Follow paint manufacturers recommendations. ■

**Note:** Wherever fiberglass fabric is called for, you may use more layers of lighter weight fabric that totals the same weight. For example, to equal 3 layers of 12 oz fabric, you may use 6 layers of 6 oz, or 9 layers of 4 oz fabric to total 36 ounces. Always make top layers progressively smaller than the bottom layer. Center each layer over the previous layer with the edge of each layer stepped back from the edge of layer below it.

# Repair pitted or pin holed surfaces

Extensive corrosion or pinhole damage should be cut away with and replaced with new material by a repair professional. But as long as the damage is not too severe, you may reinforce the area with G/flex 650 epoxy and the following items not included in the kit:

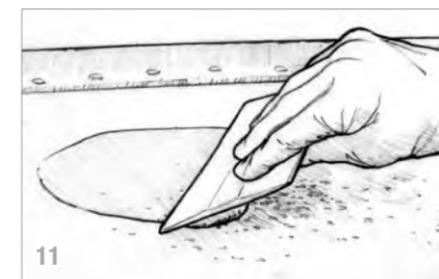
- WEST SYSTEM 745-30 12 oz (30" x 30") Fiberglass Fabric.
- WEST SYSTEM 808 Flexible Plastic Spreader.
- WEST SYSTEM 803 Glue Brush
- 80-grit sandpaper
- WEST SYSTEM 860 Aluminum Etch Kit

These items along with the kit materials will allow you to repair a damaged area up to 12" x 12" as follows:

1. Remove loose material with a wire brush and abrade the area with 80-grit sandpaper.

2. Treat the surface of the damaged area with WEST SYSTEM 860 Aluminum Etch (sold separately) or a similar 2-step etching product. (If a two-step etch is not available, abrade with 80-grit sandpaper immediately after applying a coat of G/flex 650 Epoxy. This removes the weak oxidation layer and exposes clean metal to improve adhesion.)

3. Dispense equal volumes of G/flex 650 Resin and Hardener into the mixing cup and stir thoroughly with the mixing stick. Then stir in enough 406 Adhesive Filler to



thicken the mixture to a "mayonnaise" consistency.

4. Force this thickened G/flex 650 into the pinholes, filling the pores, using a plastic spreader or putty knife (11). Spread it smoothly to leave a thin, even layer. Allow to cure overnight.

Proceed to step 12 if damage is minimal. If the damage area appears to be thin or porous, apply a layer of fiberglass fabric for reinforcing as follows:

7. Cut a piece of 12 oz fiberglass fabric slightly larger than the damaged area.

8. Dispense equal volumes of G/flex 650 Resin and Hardener into the mixing cup and stir thoroughly with the mixing stick.

9. Place the fabric on a piece of plastic. Using a disposable brush, apply the mixed epoxy to the fabric until it is saturated.

10. Position the wet fiberglass over the damaged area. Use a plastic spreader to smooth the fabric against the surface while wiping off excess epoxy.

11. When the fiberglass patch has cured to a duct tape-like tackiness, mix a batch of G/flex 650 and stir in enough 406 Adhesive Filler to thicken the mixture to a "mayonnaise" consistency. Use a plastic spreader to apply this mixture over the patch and smooth out the edges of the fabric and blend the patch into the undamaged area around it.

12. Wipe the area with water and sand the epoxy smooth and dull before applying a final finish.

If you are not satisfied with the smoothness of the patch repeat steps 11 and 12 before continuing as follows:

13. Apply a finish coating to protect the epoxy from the UV effects of sunlight. You can apply a spray paint like Rustoleum® All Finishes to match the aluminum or the existing paint. If the hull is painted, you can coat the repaired area with a marine primer and matching paint or an automotive primer and paint. Follow paint manufacturers recommendations. ■