

LOCTITE®

LOCTITE® Fixmaster® Metal Rebuilding

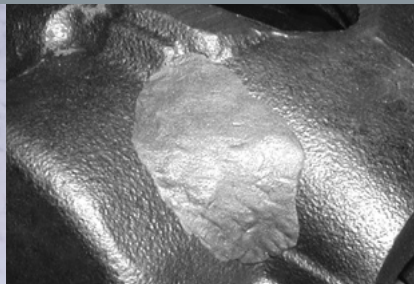
Rebuild, Repair and Restore

Industrial Equipment Catalog and Technical Guide



Excellence is our Passion





When you choose the LOCTITE® brand, you receive much more than a reliable assembly, you obtain a comprehensive solutions package:

- Wide product range
- Advanced training programs
- Engineering services
- Research and development
- Agency certification and approvals
- Local application assistance
- Global availability
- Online resources at www.henkelna.com



Visit the Web for an all-access pass to distributors, safety and technical data sheets, literature, and product application assistance

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Introduction

LOCTITE® Fixmaster® composites REBUILD, REPAIR and RESTORE industrial equipment and surfaces, while extending equipment life, improving efficiency, and minimizing downtime.

Providing Maintenance Solutions

LOCTITE® Fixmaster® composites offer proven maintenance solutions to the problems caused by wear, abrasion, chemical attack, erosion, vibration, corrosion, fatigue, and mechanical damage. With metal reinforcement fillers, these products are machinable and have superior adhesion. They are designed to protect and extend the service life of a wide range of plant equipment.



Creating Partnerships

LOCTITE® branded products are foremost in the business of solving and preventing customers' problems. With Fixmaster® composites technology providing the foundation, customers get more than a product – they get a partner who will work side-by-side with them to create and implement innovative solutions.



Focusing on Customer Support

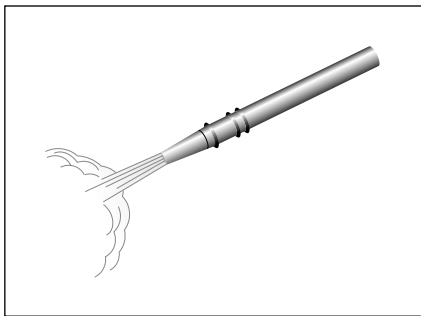
Our highly experienced Fixmaster® composite Application Engineers are committed to providing the highest level of technical support and assistance in the industry. Working closely with local industrial suppliers, our Application Engineers provide full process support, from maintenance assessment to implementation of solutions.

This manual is designed to assist maintenance personnel through many common everyday repairs.

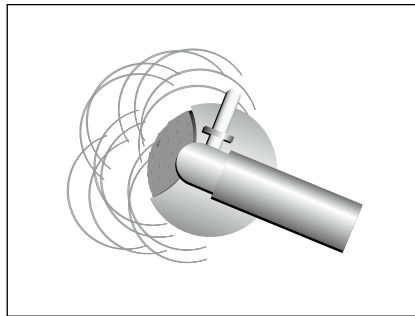
Surface Preparation

Refer to page 16

Abrasive Blasting



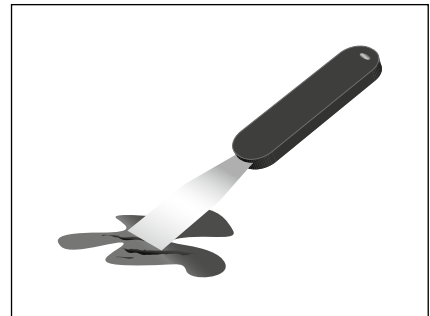
Course Grinding



Mixing Tips

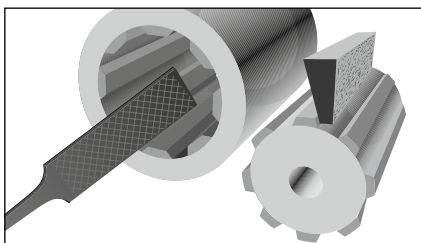
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Proper Mixing

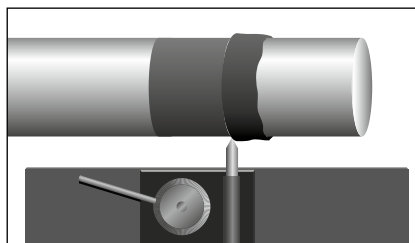


Application Examples

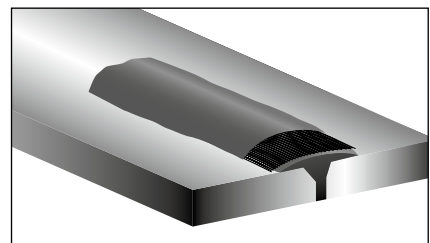
Spline Repairs



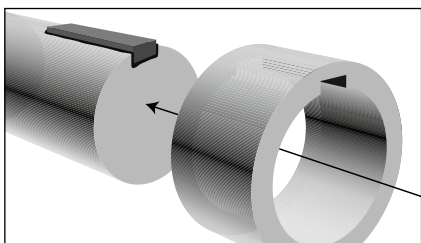
Shaft Repairs



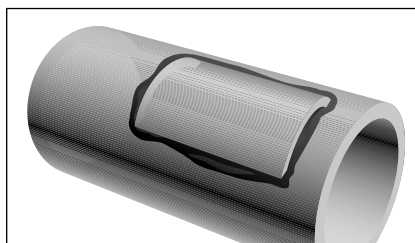
Metal Surface Repairs



Keyway Repairs



Pipe and Ducting Repairs



Not all repair procedures are listed. However, with the techniques shown here, combined with the versatility of LOCTITE® products and the ingenuity of the user, many hundreds more are possible.

Loctite® Fixmaster® Selector Guide

WHAT TYPE OF APPLICATION IS NEEDED?

PUTTY

Steel

Aluminum

**Loctite® Fixmaster®
Steel Putty**
Page 8

**Loctite® Fixmaster®
Fast Set Steel Putty**
Page 8

**Loctite® Fixmaster®
Aluminum Putty**
Page 9

Color	Grey	Grey	Light Grey
Maximum Temperature	225°F (107°C)	200°F (93°C)	200°F (93°C)
Working Time*	30 min.	3 min.	20 min.
Cure Time*	6 hrs.	10 min.	6 hrs.
Compressive Strength	11,100 psi	10,800 psi	11,300 psi
Common Sizes / Part Number	1 lb. kit – 99913 4 lb. kit – 99914 25 lb. kit – 99912	1 lb. kit – 39917	1 lb. kit – 97463

Stainless Steel

High Performance

**Loctite® Fixmaster®
Stainless Steel Putty**
Page 10

**Loctite® Fixmaster®
Superior Metal**
Page 9

Color	Grey	Grey
Maximum Temperature	225°F (107°C)	250°F (121°C)
Working Time*	20 min.	20 min.
Cure Time*	6 hrs.	6 hrs.
Compressive Strength	12,000 psi	18,000 psi
Common Sizes / Part Number	1 lb. kit – 97443	1 lb. kit – 97473 4 kg kit – 40900

- High compressive strength
- Choice of mild steel aluminum or non-metallic fillers
- Can be machined, drilled, or tapped after cure
- Excellent resistance to aggressive chemicals



POURABLE

Steel

**Loctite® Fixmaster®
Steel Liquid**
Page 11

Aluminum

**Loctite® Fixmaster®
Aluminum Liquid**
Page 11

Color	Light Grey	Light Grey
Maximum Temperature	225°F (107°C)	200°F (93°C)
Working Time*	25 min.	20 min.
Cure Time*	6 hrs.	6 hrs.
Compressive Strength	13,500 psi	17,000 psi
Common Sizes / Part Number	1 lb. kit – 97483 4 lb. kit – 97484	1 lb. kit – 97453

KNEADABLE STICK

**Loctite® Fixmaster®
Metal Magic Steel™**
Page 12

**Loctite® Fixmaster®
Underwater Repair
Epoxy**
Page 12

SPECIALTY

Fast Setting

**Loctite® Fixmaster®
Fast Set Steel
Epoxy**
Page 13

Putty

**Loctite® Fixmaster®
2000° Putty**
Page 13

Color	Dark Grey	White	Grey	Grey
Maximum Temperature	250°F (121°C)	300°F (149°C)	200°F (93°C)	2000°F (1093°C)
Working Time*	3 min.	15 min.	3 min.	30 min.
Cure Time*	10 min.	30 min.	6 to 8 min.	1 hr.
Compressive Strength	12,000 psi	12,000 psi	2,600 psi	675 psi
Common Sizes / Part Number	4 oz. stick – 98853	4 oz. stick – 82093	50 ml cart. – 96604	8 oz. can. – 95724

Repair, Rebuild and Restore Damaged Parts

Different fillers provide a range of performance characteristics, making LOCTITE® Fixmaster® composites suitable for specific applications. Putty, liquid and stick forms give you the flexibility to fix equipment throughout the plant.

FIXMASTER® PUTTIES

LOCTITE® Fixmaster® Steel Putty

Versatile Repair Compound for Steel

Non-slumping, two-part, steel-filled putty. Recommended for repairing and rebuilding worn steel components, such as bearing and fan housings. Can be machined when cured. ABS Approved. Sets in 30 minutes.

- 1 lb. kit – 99913
- 4 lb. kit – 99914
- 25 lb. kit – 99912



LOCTITE® Fixmaster® Fast Set Steel Putty

Faster Version of LOCTITE® Fixmaster® Steel Putty

Faster setting version of the LOCTITE® Fixmaster® Steel Putty. Recommended for repairing pipes and other emergency repairs. ABS Approved. Sets in 3 minutes.

- 1 lb. kit – 39917



Type	Working Time	Functional Cure	Maximum Operating Temperature
Loctite® Fixmaster® Steel Putty	30 minutes @ 77°F (25°C)	6 hours @ 77°F (25°C)	225°F (107°C)
Loctite® Fixmaster® Fast Set Steel Putty	3 minutes @ 77°F (25°C)	10 minutes @ 77°F (25°C)	200°F (93°C)



FIXMASTER® PUTTIES

LOCTITE® Fixmaster® Superior Metal

Non-Rusting, Ferro-Silicone-Filled Composite

Extremely high compressive strength and wear resistance. Ideal for rebuilding worn surfaces exposed to harsh environments. Recommended for use on all metals. Can be machined, drilled and tapped in 6 to 8 hours. For final finish cuts, let the product cure for 24 hours and use carbide tooling. Spreadable putty. Sets in 20 minutes.

1 lb. kit – 97473

4 kg kit – 40900

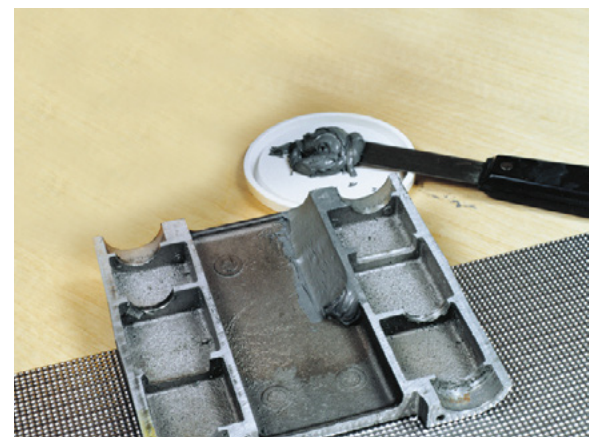


LOCTITE® Fixmaster® Aluminum Putty

Aluminum Repairs

Similar to LOCTITE® Fixmaster® Steel Putty, but aluminum filled to better match the coefficient of thermal expansion of aluminum. General purpose putty for repair of all aluminum alloy components. ABS Approved. Sets in 20 minutes.

1 lb. kit – 97463



Type	Working Time	Functional Cure	Maximum Operating Temperature
Loctite® Fixmaster® Superior Metal	20 minutes @ 77°F (25°C)	6 hours @ 77°F (25°C)	250°F (121°C)
Loctite® Fixmaster® Aluminum Putty	20 minutes @ 77°F (25°C)	6 hours @ 77°F (25°C)	200°F (93°C)

Repair, Rebuild and Restore Damaged Parts

TIPS & TRICKS

Loctite® Fixmaster® Curing Times

Working time and cure depends on temperature and mass.

- The higher the temperature, the faster the cure
- The larger the mass of material mixed, the faster the cure

To speed the cure of composites at low temperature:

- Store composite at room temperature
- Pre-heat repair surface until warm to the touch

To slow the cure of composites at high temperature:

- Mix composites in small masses to prevent rapid curing
- Cool resin/hardener components



FIXMASTER® PUTTIES

LOCTITE® Fixmaster® Stainless Steel Putty

Stainless Steel Repairs

Similar to LOCTITE® Fixmaster® Steel Putty, but stainless steel filled to better match the coefficient of thermal expansion of stainless steel. Sets in 20 minutes.

1 lb. kit – 97443

Type	Working Time	Functional Cure	Maximum Operating Temperature
Loctite® Fixmaster® Stainless Steel Putty	20 minutes @ 77°F (25°C)	6 Hours @ 77°F (25°C)	225°F (107°C)



FIXMASTER® POURABLE LIQUIDS

LOCTITE® Fixmaster® Steel Liquid

Steel Casting or Molding

Pourable and self-leveling, steel-filled epoxy. Ideal for casting or making molds. Works well to fill hard-to-reach areas. Can be machined when cured. ABS Approved. Sets in 25 minutes.

1 lb. kit – 97483

4 lb. kit – 97484



LOCTITE® Fixmaster® Aluminum Liquid

Aluminum Casting or Molding

Self-leveling aluminum liquid. Can be poured into molds and cavities. Recommended for casting aluminum replacement parts and for making molds. ABS Approved. Sets in 20 minutes.

1 lb. kit – 97453



Type	Working Time	Functional Cure	Maximum Operating Temperature
Loctite® Fixmaster® Steel Liquid	25 minutes @ 77°F (25°C)	6 hours @ 77°F (25°C)	225°F (107°C)
Loctite® Fixmaster® Aluminum Liquid	20 minutes @ 77°F (25°C)	6 hours @ 77°F (25°C)	200°F (93°C)

DID YOU KNOW?

100% SOLIDS

LOCTITE® Fixmaster® composites are formulated with 100% solids. This means that unlike solvent-based systems, LOCTITE® Fixmaster® composites will not shrink when cured.



FIXMASTER® KNEADABLE STICKS

LOCTITE® Fixmaster® Metal Magic Steel™

Steel Epoxy in Stick Form

Kneadable, two-part paste. Working time is 3 minutes – sets in 10 minutes. Adheres to damp surfaces. Can be drilled, filed, and painted. Ideal for emergency sealing of leaking tanks and pipes. Smooths welds, repairs small cracks in castings, and fills oversized bolt holes.

4 oz. stick – 98853



LOCTITE® Fixmaster® Underwater Repair Epoxy

Wet or Underwater Repair in Stick Form

This putty-like material is ideal for plumbing, irrigation and marine applications because it is unaffected by chlorinated or salt water. Will stick to wet surfaces. Ideally suited for underwater repairs. Sets in 15 minutes.

4 oz. stick – 82093

Type	Working Time	Functional Cure	Maximum Operating Temperature
Loctite® Fixmaster® Metal Magic Steel™	3 minutes @ 77°F (25°C)	10 minutes @ 77°F (25°C)	250°F (121°C)
Loctite® Fixmaster® Underwater Repair Epoxy	15 minutes @ 77°F (25°C)	30 minutes @ 77°F (25°C)	300°F (149°C)



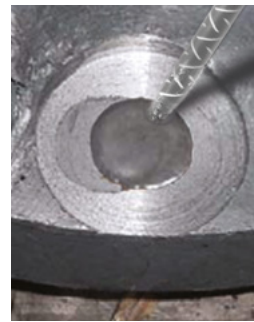
FIXMASTER® SPECIALTY PRODUCTS

LOCTITE® Fixmaster® Fast Set Steel Epoxy

Cartridge-Based, Steel-Filled Epoxy

Cartridge-based, steel-filled epoxy. Makes fast, cost-effective repairs. Easy-to-use and easy-to-apply. Ideal for metal parts that must be back in service quickly. Can be machined when cured. Requires the handheld dispenser (P/N 98472). One mix nozzle comes included with the cartridge. Sets in 3 minutes.

50 ml cartridge – 96604



Damaged metal part filled with epoxy.



Metal part drilled to original size.

LOCTITE® Fixmaster® 2000° Putty

Extreme Temperature Repair

Single component putty designed to fill and restore damaged metal and fill cracks in environments that will see 2000°F. Water-based and non-toxic. Typical applications include header, manifold and cast iron repair.

8 oz. can – 95724



Type	Working Time	Functional Cure	Maximum Operating Temperature
Loctite® Fixmaster® Fast Set Steel Epoxy	3 minutes @ 77°F (25°C)	10 minutes @ 77°F (25°C)	200°F (93°C)
Loctite® Fixmaster® 2000° Putty	30 minutes @ 77°F (25°C)	1 hour @ 77°F (25°C)	2000°F (1093°C)

Technical References - Surface Preparation Tips

The successful application of any LOCTITE® Fixmaster® polymer composite product is largely dependent on correct surface preparation. For this reason, it is critical that all applications begin with a thorough preparation of the repair surface in keeping with the instructions in this section.

General Surface Preparation

Ensure that the surface is dry and stop all liquid leakage. Remove all dirt, paint, rust, and other contaminants by abrasive blasting or other suitable mechanical techniques.

Degrease thoroughly using LOCTITE® ODC-Free Cleaner & Degreaser or LOCTITE® Natural Blue® Biodegradable Cleaner and Degreaser.

Provide a profile by abrasive blasting or other mechanical means.

To bond a composite to a badly degraded surface or to fill large voids, first tack weld wire mesh over the damaged area, then fill the prepared area with the composite.

To prevent adhesion to a surface, as when casting parts or in tooling applications, coat the surface with LOCTITE® Silicone Lubricant (Product No. 51360) or other release agent.



The wire mesh reinforces the repair area and forms a mechanical backing for the epoxy.

Cleaning the Surface

Clean the surface with LOCTITE® ODC-Free Cleaner & Degreaser or LOCTITE® Natural Blue® Biodegradable Cleaner & Degreaser.

Areas immersed in oil must be cleaned repeatedly to draw the oil out of the surface. Use a heat gun to force oil out of the pores. Allow the surface to cool, then degrease again.

After cleaning, roughen the surface to produce a good profile. The following methods may be used, but in all cases the objective is to obtain an anchor profile of 0.003 to 0.005 inches (75 to 125 microns).

Abrasive blast using an angular grit such as aluminum oxide, silicon carbide, or coal slag 1240 medium grade. Round abrasive grit should not be used. High velocity water blasting with an abrasive medium is also recommended. (See *Figure 1*)

If grit blasting is not possible, roughen the surface using a coarse grinding wheel (60 grit or coarser) or a needle gun to achieve the desired profile. (See *Figure 2*)

Using coarse sandpaper or a file is acceptable only if the first two methods cannot be utilized.

After roughening, the surface must again be thoroughly cleaned with LOCTITE® ODC-Free Cleaner & Degreaser or LOCTITE® Natural Blue® Biodegradable Cleaner and Degreaser. Repairs should be made as soon as possible to avoid rusting.

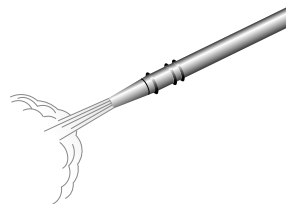


Figure 1. For best results, abrasive blast the application surface.

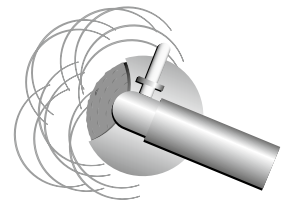


Figure 2. Coarse grinding of the surface is also recommended for surface preparation.

Wet surfaces

Exceptions to having a dry surface are when using LOCTITE® Fixmaster® Wet Surface Repair Putty, Fixmaster® Underwater Repair Epoxy, or Fixmaster® Metal Magic Steel™. These products will cure in the presence of water.

Stop all leakage or seepage by:

- Turning off the water flow.
- Fitting a wooden peg or sheet metal screw.
- Stuffing with cork, wax, rags, or any other suitable material. (See *Figure 3*)

If the leak is caused by corrosion, the side wall may be weak. Open the hole to a point where the wall is close to its original thickness. Then plug the opening using a suitable material. All surface condensation, wetness, or dampness must be wiped clean and dried off using a hot air gun or similar device. Continue surface preparation in accordance with the preceding section on Surface Cleaning.

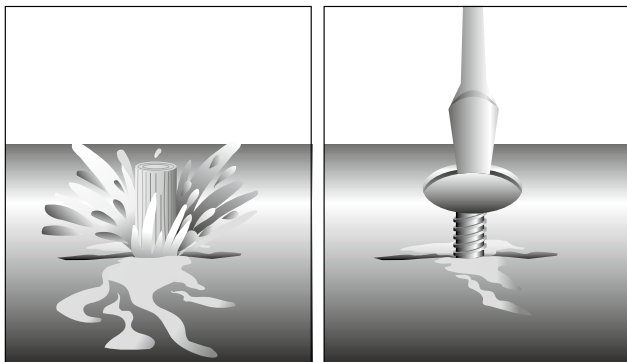


Figure 3. Stop leaks with a wooden plug or screw inserted in area of seepage.

Did You Know?

Surface Profile

Abrasive blasting not only removes visible surface rust and contaminates, but also creates a rugged, miniature mountain and valley finish. This surface roughness is known as Surface Profile. Surface Profile is critical to coating performance as it improves adhesion by increasing surface area and providing a keyed anchor pattern.

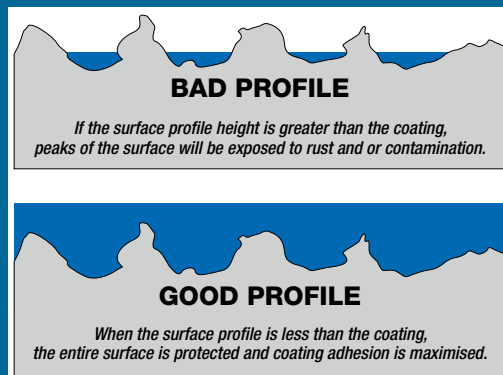
Surface Profiles will vary depending on the type of abrasive particles, equipment and technique utilized. It is critical to achieve the correct profile depth specified for a particular coating.

Inadequate quality control and lack of restriction of large abrasive particle sizes for thin coats can lead to peaks of the surface not being adequately covered. In addition, more profile means using more product to cover the surface!

The diagrams below illustrate how profile must be matched to the product specification.

Surface Profile

Chemical contaminants that are not readily visible, such as chlorides and sulphates, attract moisture through coating systems, resulting in premature failure. Therefore it is fundamentally important to chemically clean all substrates with an industrial strength cleaner and degreaser such as LOCTITE® Natural Blue®.



Loctite® Composites applications require a minimum 75 micron surface profile.

Surface Preparation Grades of Blast

Rust Grade

- A Steel with mill scale layer intact and very minor, or no rusting
- B Steel with spreading surface rust and the mill scale commenced flaking
- C Rusty steel with mill scale layer flaked and loose or lost but only minor occurrence of pitting
- D Very rusty steel with mill scale layer all rusted and extensive occurrence of pitting

Blast Class

- 1 (SP-7/N4) Very light over clean with removal of loose surface contaminants
- 2 (SP-6/N3) Substantial blast clean with widespread, visible contaminate removal and base metal color appearing
- 2.5 (SP-10/N2) Intensive blast clean leaving shading grey metal with only contaminates
- 3 (SP-5/N1) Complete blast clean with consistent metal color all over and no visible contaminates



Mixing Tips

The following tips are designed to facilitate the process of working with LOCTITE® polymer composite products under a variety of conditions.

Mixing

Thorough mixing, in proper ratio, is critical to the performance of the material. Whenever possible, the complete container should be mixed at one time. If the material is to be mixed in separate batches, the user must be careful to adhere to the mix ratios that appear on the product label.

The material is mixed by adding hardener to resin. The mixing process is complete when the product is free from streaks or other variances. Failure to thoroughly mix the material will cause soft spots or overall failure of the product. Mixing should take 3 to 5 minutes.

Large masses (over one pound) can be mixed more easily by turning out the resin and hardener onto a clean, disposable surface. Mix and knead material with a putty knife or other flat tool until the product is thoroughly mixed. Do not fold material into the mix as this process can cause air entrapment that will weaken the cured product.



Composite is turned out onto a disposable surface to ensure proper mixing.

Cure

Polymer composite compounds begin to cure, or harden, when the hardener is added to the resin. Curing is by a chemical reaction that causes exotherming, or the process of giving off heat. There are some basic principles of working with composite compounds that every user should understand.

Cure Times are Mass Dependent. The larger the mass mixed, the faster it will cure. If the mixed material cannot be applied during the working time specified on the product label, mix it in smaller batches.

Cure Times are Temperature Dependent. The higher the temperature, the faster the product will cure. Ideal mixing temperature is between 55°F and 80°F.

If the application is to occur at higher temperatures, the product should be stored at room temperature or slightly below to slow down the chemical reaction between resin and hardener.

At lower temperatures, the epoxy will cure very slowly or may fail to cure at all. To speed up the cure at low temperatures, store product at room temperature and heat parts to be repaired prior to application. The repaired area can also be heated with a heat gun upon completion of the application.

Most polymer composite compounds are skin and eye irritants, and many hardeners are corrosive. Always wear appropriate gloves and goggles or face shield during mixing and handling. Observe good industrial safety practices, and review product Material Safety Data Sheet (MSDS) prior to use for complete precautionary information.

Application Tips and Case Histories

For Maximum Bond

Pre-coat the application surface by rubbing the mixed composite into the substrate. This technique, called “wetting out the surface,” helps the repair material fill all the crevices in the application surface, creating a superior bond between the composite and substrate. The rest of the mixed product can then be applied over the pre-coat to finish the application.



Eliminating Air Entrapment

Use a heat gun (do not use an open flame) to pull air bubbles out of cast composite. Heat will cause bubbles to rise to the top and dissipate.



Pouring Liquid Composites

Avoid air entrapment in cured composite by pouring close to the mold in a steady, even stream.



Creating a Smooth Finish

Smooth out the uncured product with a warm trowel for a smooth, glossy finish. A heat gun can also be used to create a smooth finish.

APPLICATION CASE HISTORIES

- PROBLEM:** Leaking flange
EQUIPMENT: Flange face on a chemical pump
SOLUTION: LOCTITE® Fixmaster® Aluminum Putty

Flange faces, eroded by chemical exposure, were previously repaired by welding and machining. Loctite® Fixmaster® Aluminum Putty repairs aluminum faces at a lower cost and with far less downtime than conventional methods.



- PROBLEM:** Severely damaged pipe
EQUIPMENT: Slurry transport pipe
SOLUTION: Fixmaster® Metal Magic Steel™

Damage to this pipe was so severe that expanded mesh was welded over the opening to provide reinforcement for the epoxy application. Fixmaster® Metal Magic Steel™ was pressed over the mesh to fill and seal the application area. The pipe was ready for service in just minutes.



Typical Repair Applications

PIPE AND DUCTING REPAIRS:

Pipes are used for transporting all compositions of fluids, slurries, gases and solids. Wear, corrosion, abrasion and chemical attack can lead to progressive damage to pipe walls, leading to eventual piping failure.

Industries such as coal-fired power plants, sewage treatment plants, pulp and paper processors, and aggregate sites are particularly vulnerable to pipe abrasion due to caustic and abrasive media carried in the piping system.

The areas of piping most subject to wear and damage are elbows, t-junctions, reduction fittings and weld spots in both seams and joints. Flange faces can also suffer erosion, preventing effective gasket sealing.

The problem of pipe damage can be as simple as a leaky pipe or as severe as a total plant shutdown, service contamination, or fire damage; but good plant maintenance depends on keeping equipment, such as piping systems, running smoothly and efficiently. The following information is intended to identify possible problem areas that can be successfully protected or repaired with LOCTITE® epoxies in order to reduce downtime and equipment failure.

NOTE: Before starting any pipe repair, the line pressure must be removed.

Exterior Repair – Fractures and Pinholes

1. PREPARE APPLICATION: To prepare the application, plug the hole or fracture with LOCTITE® Fixmaster® Metal Magic Steel™, an epoxy in stick form that hardens in just 10 minutes. Or use a wooden dowel, putty or plasticine. If the wall thickness is insufficient to support a mechanical plug, use a rubber patch and an adhesive such as LOCTITE® Fixmaster® 4-Minute Epoxy.

Abrasive blast, grind, or file off all deposits, paint, rust, and mill scale. The area must be prepared with an extension border of 3" (7.6 cm) around the damaged area. Degrease the application area completely with LOCTITE® ODC-Free Cleaner & Degreaser.

2. REPAIRS TO LARGE DIAMETER PIPES, WEEPING PIPEWORK, AND HIGH-PRESSURE PIPES: Use a half section of pipe with a slightly larger diameter than the pipe to be repaired. A curved aluminum or steel backing plate that extends 2" (5 cm) radially and axially beyond the damaged area will also work to reinforce the repair.

Abrade the inside and outside of the backing plate and degrease thoroughly with LOCTITE® ODC-Free Cleaner & Degreaser.

3. REPAIRS TO LARGE, LOW PRESSURE PIPES

(DIAMETER > 3" OR 7.6 CM AND PRESSURE LESS THAN

100 PSI OR 0.70 MPA): Prepare the pipe as above. Inspect the damaged area to see if the fracture or crack is under stress. If so, relieve by drilling the ends and "V"-ing out the crack.

Apply the epoxy to the prepared area, forcing the product into the crack. Also apply epoxy to the inside radius of the backing plate. Press the backing plate firmly over the repair area. (See *Figures 4 & 5*) Force out any air, and remove excess epoxy. Use ties, clamps, or wire to hold the repair firmly in place. After the epoxy has cured, the clamps may be removed and the patch coated with more product for reinforcement of the repair. (See *Figure 6*)

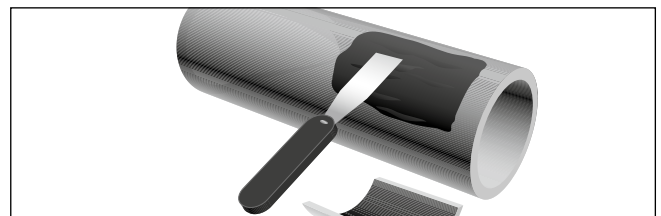


Figure 4. Force Epoxy into damaged area.

Typical Repair Applications

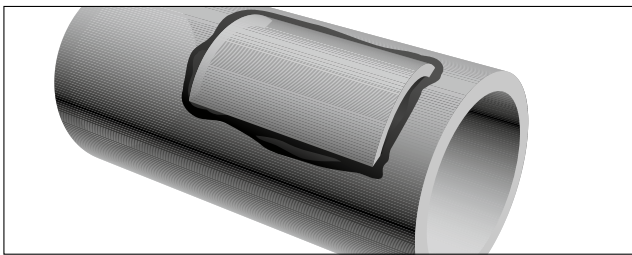


Figure 5. Press backing plate over the damaged repair area.

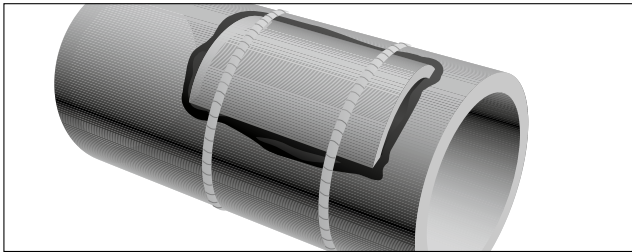


Figure 6. Reinforce repair area by tying or clamping the repair until epoxy is cured.

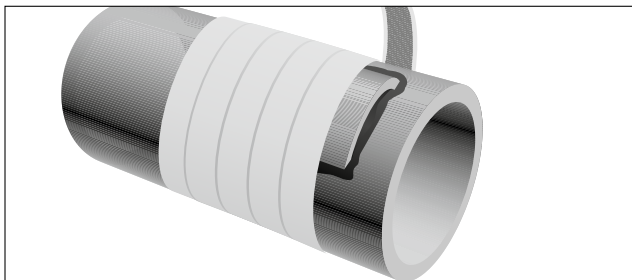


Figure 7. Reinforce repair area with reinforcing mesh when repairing small pipes.

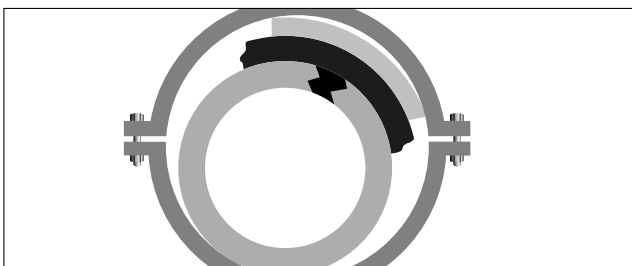


Figure 8. Use steel clamps to reinforce repairs to large diameter pipes

PIPE AND DUCTING REPAIRS (Continued):

4. REPAIRS TO HIGH-PRESSURE PIPES

(**> 100 PSI OR 0.70 MPA**): Prepare the pipe as above.

REPAIRS TO SMALL DIAMETER PIPES: Wrap the repair firmly with reinforcing mesh impregnated with epoxy. Before the epoxy hardens, over-coat and shape the repair with a final application of epoxy. (See *Figure 7*)

REPAIRS TO LARGE DIAMETER PIPES: Once patched, clamp into position using steel clamps 2" (5 cm) apart. Do not remove the clamps. (See *Figure 8*)

5. REPAIRS TO LOW PRESSURE, SMALL DIAMETER PIPES

(**<100 PSI OR 0.70 MPA AND < 3" OR 7.6 CM DIAMETER**):

Prepare as in **Step 1** above. Apply 1/8" or 3 mm layer of epoxy, working it well into the anchor pattern and into the hole. Wrap reinforcement mesh treated with repair compound at least twice around the pipe. Remove excess product. As epoxy starts to cure, over-coat the repair with a final application of epoxy.

Internal Repair

Internal repair of pipes, elbows, and fittings is sometimes possible and necessary. This procedure should include exterior patching according to **Step 3** above.

- 1. PREPARE SURFACE:** To prepare the surface, flush the interior of the pipe liberally with high-pressure water, if available. Abrasive blast to achieve 0.003 - 0.005" (75 - 125 microns) profile. Blast inside and outside, as well as the backing plate, for the exterior patching. Degrease thoroughly.
- 2. EXTERIOR PATCHING:** Exterior patching must be done prior to internal lining. If backing plate is not suitable, tack weld a heavy metal mesh and apply 1/8 to 1/4" (3 - 6 mm) of epoxy.
- 3. COAT INTERIOR:** Coat the interior by applying a series of thin coats of epoxy pressed into the abraded profile. Continue to build up the original profile. As the epoxy begins to cure, apply a 1/4" (6 mm) over-coat of epoxy to the repair area.

CAUTION: PRESSURIZED LINES SHOULD BE REPLACED WHEN TIME AND MANPOWER PERMITS.

METAL SURFACE REPAIRS:

The following procedures are developed for surface repairs that call for filling or rebuilding a damaged metal surface. Damage caused by metal fatigue or stress cracks should be replaced.

LOCTITE® Repair Epoxies are recommended for making surface repairs to restore the integrity of cracked or damaged metal. In general, epoxies are not recommended for heavy load bearing applications or for making structural repairs; however, experience has shown that successful temporary or emergency repairs can be made to seriously damaged equipment using skillful and imaginative techniques.

Non-stress cracking problems are common to pump casings, bearing housings, valve bodies, tanks and gearboxes.

NOTE: WHEN THE EQUIPMENT TO BE REPAIRED MAY HAVE CONTAINED FLAMMABLE OR EXPLOSIVE MATERIAL, PROPER SAFEGUARDS MUST BE TAKEN TO CLEAN THE AREA THOROUGHLY TO REMOVE ALL FLAMMABLE MATERIAL. IF IN DOUBT, CONTACT A LOCTITE® BRAND PRODUCTS REPRESENTATIVE.

- 1. PREPARE SURFACE:** To prepare the surface of the damaged metal, refer to the Surface Preparation Section in this manual.
- 2. DRILL HOLES:** Drill holes 1/8" (3 mm) larger than the crack at either end of the crack. Use detecting dye if necessary to determine the actual area of the crack. If the crack is over 5" (12.5 cm) long, drill multiple holes along the length of the crack. (See Figure 9)
- 3. CREATE BETTER BOND:** To create a better bond drill, or edge grind the cracked area with an abrasive wheel to "V" out the cracked area. After the area has been opened up, clean the area of any residue using LOCTITE® ODC-Free Cleaner & Degreaser. (See Figure 10)
- 4. APPLY EPOXY:** Apply the epoxy with a putty knife, forcing the epoxy material into the crack. Fill the "V" thoroughly and overlap approximately 1" on each side of the application area. (See Figure 11)

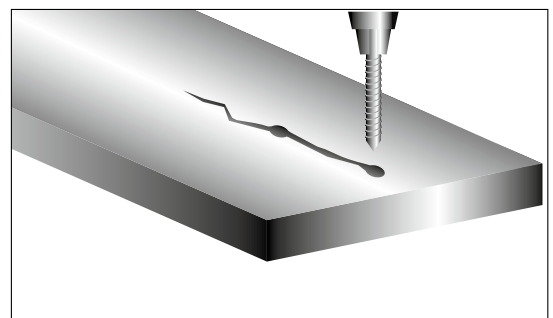


Figure 9. Drill holes at either end of crack.

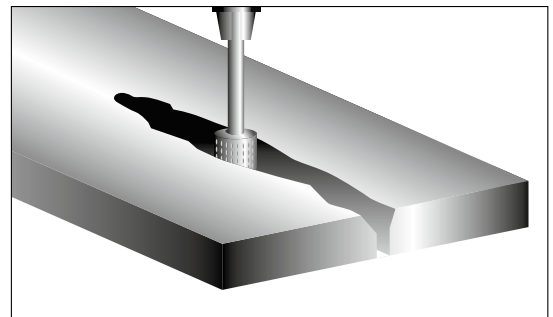


Figure 10. Grind out the repair area for maximum adhesion.

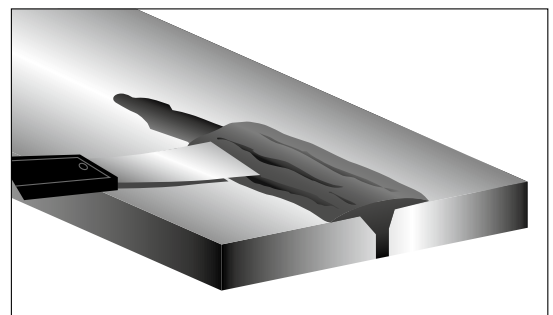


Figure 11. Fill repair area with epoxy.

Typical Repair Applications

METAL SURFACE REPAIRS (Continued):

5. **REINFORCING MESH:** Use a reinforcing mesh, such as fiberglass or wire screening, to lay a strip of the reinforcement material over the application and imbed the tape into the epoxy. (See Figure 12)
6. **APPLY EPOXY:** Apply another 1/16" to 1/4" (1.5 – 6 mm) of epoxy over the reinforced mesh and smooth out the epoxy. To prevent lifting of the repair, be sure to feather the edges in keeping with the contour of the repaired equipment. (See Figure 13)
7. **SPEED CURE:** To speed the cure, heat the area with a heat gun or heat lamp. Never expose epoxy to open flame.

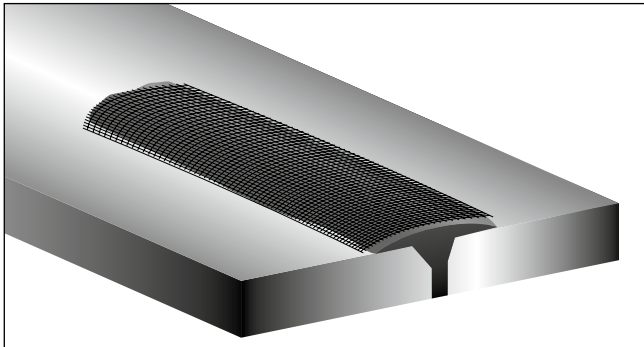


Figure 12. Reinforce the repair by applying tape over the epoxy.

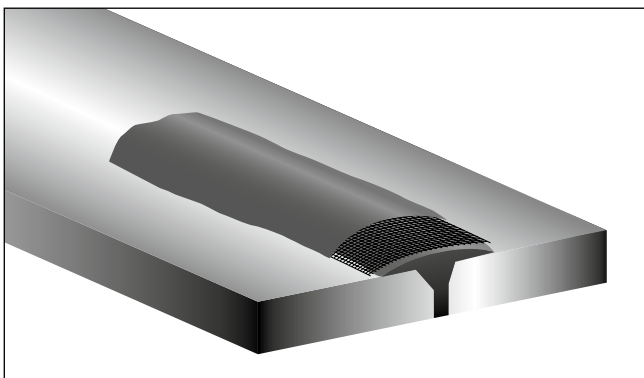


Figure 13. Over-coat the epoxy/tape application with another coating of epoxy.

SHAFT REPAIRS:

LOCTITE® epoxies can often be used to repair damaged or scored shafts. In some cases, however, the repair may not provide long-term service and should not be made.

Repairs are **not recommended** to the following shafts:

- Any repair on an area subject to frictional heat such as on a shaft worn by mechanical packing.
- The worn area under a bearing, bushing or mechanical seal that exceeds its width.
- Shafts under 1/2" (13 mm).

The Shaft

Since the area to be repaired needs to be machined, the standard preparation procedures are not used. (See Figure 14)

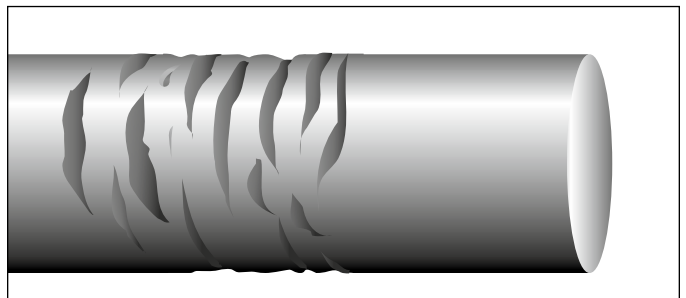


Figure 14.

Undercut the worn area according to the following guidelines:

Shaft Diameter	Desired Undercut
1/2 to 1" (13 – 25 mm)	1/16" (1.5 mm)
1 to 3" (25 – 75 mm)	1/8" (3 mm)

1. **UNDERCUT:** Using a lathe, undercut to the desired depth. If the shaft is already worn to the recommended depth, go to the next step.

Dovetail the ends of the worn area to lock the application into place and to serve as a guide when repairing. (See Figure 15)

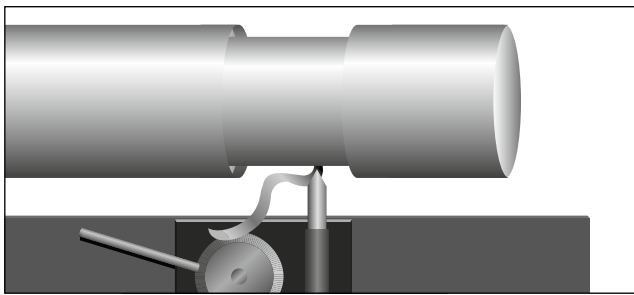


Figure 15. Dovetailing provides mechanical lock for epoxy.

2. FINISH UNDERCUTTING: Finish undercutting by machining a rough cut surface or gramophone pattern; the larger the shaft diameter, the deeper the threads. Degrease thoroughly. (See Figure 16)

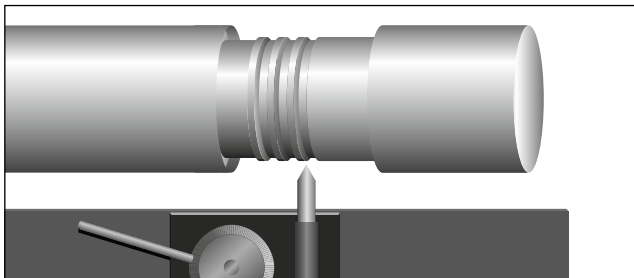


Figure 16. Roughen shaft for better adhesion.

3. APPLY EPOXY: Apply a very thin layer of the recommended repair epoxy and force into the bottom of the threads. Turn the shaft at a very low speed and continue to apply more material by using a tool, such as a putty knife, that can be bent. (See Figure 17)

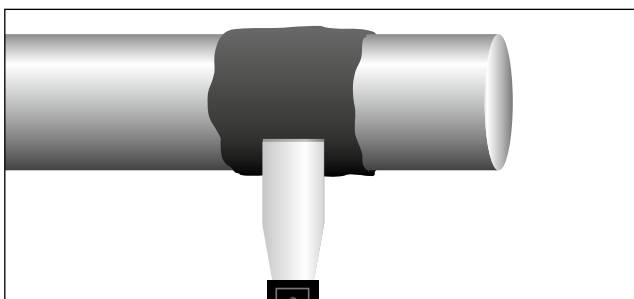


Figure 17. Fill repair area with epoxy.

4. MACHINE REPAIR: Machine repair to required dimensions using the guidelines below. (See Figure 18)

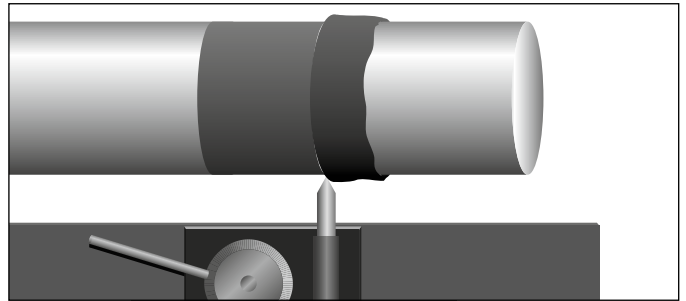


Figure 18. Machine epoxy to the original dimensions of the shaft.

Lathe Speed:	150 ft./min.	46 m/min.	
Feed Rate:	Roughing	.025 in./rev	0.64 mm/rev
	Finishing:	0.010 in./rev	0.25 mm/rev

Top Rake:	3°
Side Clearance:	3°
Front Clearance:	3°

Comments: Cut dry; use carbide or high speed steel bits. If polishing is required, use only wet 400 to 600 grit emery paper. (See Figure 19)

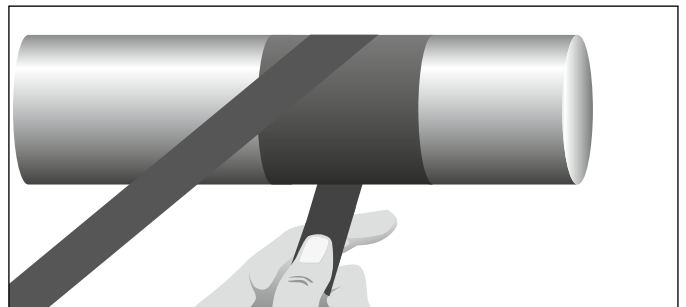


Figure 19. If necessary, polish repair with emery paper.

Typical Repair Applications

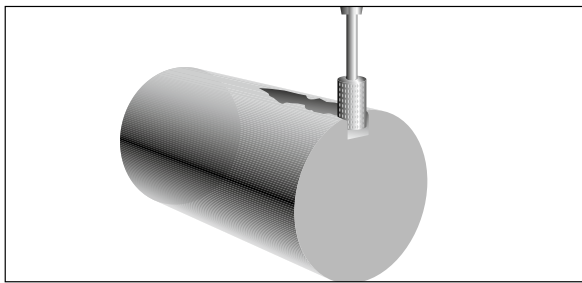


Figure 20. Roughen the damaged surface.

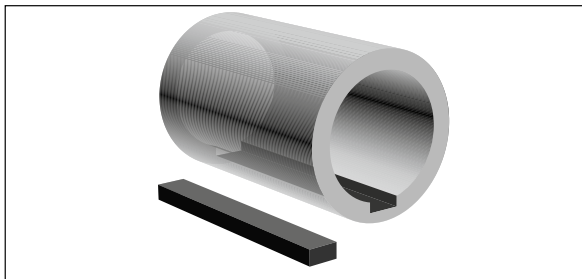


Figure 21. Coat with release agent.

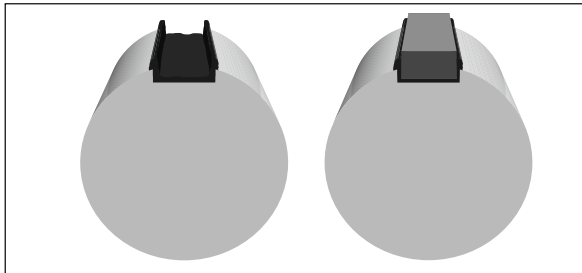


Figure 22. Fill keyway with epoxy and install coated key.

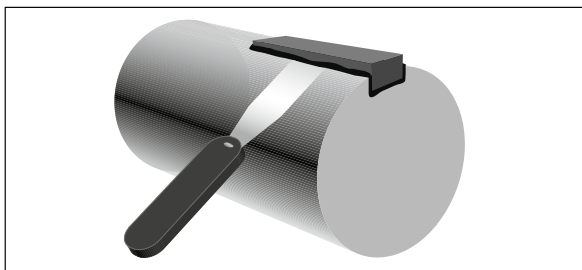


Figure 23. Immediately scrape excess epoxy away from repair area

KEYWAYS:

A keyway becomes worn through constant pressure from starting and stopping.

1. **PREPARE SURFACE:** To prepare the surface, follow the Surface Preparation Section. Roughen the surface with a file or rotary cutting/grinding tool and degrease again. (See *Figure 20*)
2. **APPLY RELEASING AGENT:** Apply a thin layer of LOCTITE® Silicone Lubricant release agent to the key and to any area where you do not want the product to stick. (See *Figure 21*)
3. **APPLY EPOXY:** Apply the recommended epoxy using a spatula or putty knife. Use a thin coat on the bottom and a thicker layer on the side walls to ensure the key will not be raised and also to ensure a close tolerance fit. (See *Figure 22*)
4. **SCRAPE:** Scrape away excess epoxy from the side of the keyway. (See *Figure 23*)
5. **IMMEDIATELY REPOSITION:** Immediately reposition the shaft on the hub to properly align the key, shaft and hub. Leave assembled. (See *Figure 24*)

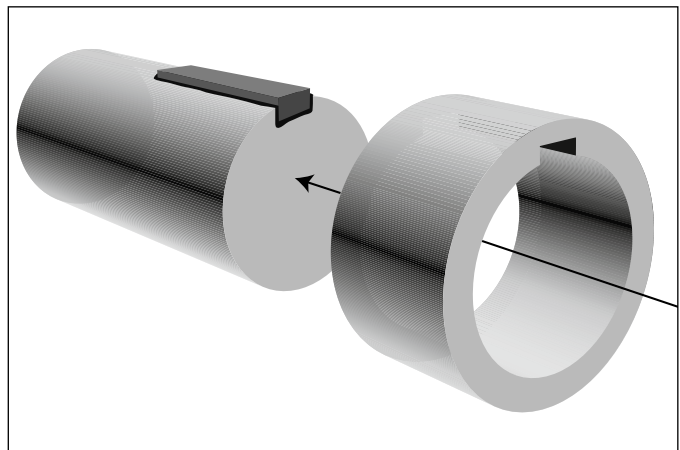


Figure 24. Immediately align key, shaft and hub.

SPLINES:

1. **REMOVE SPLINE:** Remove spline shaft from the socket and chamfer the edges of the sockets to a 45° angle using a file. (See *Figure 25*)
2. **PREPARE SURFACE:** Prepare the application surface by degreasing surface thoroughly. Check the spline shaft for evenness and remove any high spots or rough areas by filing or sanding. Degrease again.
3. **APPLY RELEASE AGENT:** Apply a thin layer of LOCTITE® Silicone Lubricant release agent to the spline shaft, ensuring that the entire surface is coated.
4. **MIX AND APPLY REPAIR COMPOUND:** Mix and apply the recommended repair compound to the spline shaft. Do not apply product into the socket. Immediately push the spline shaft into the socket and remove excess material. (See *Figure 26*)

Allow the epoxy to cure according to the application instructions before putting the equipment back into service.

If it will be necessary to dismantle the assembly in the future, mark the position of the spline and socket in order to be able to reposition the assembly in exactly the same position. (See *Figure 27*)

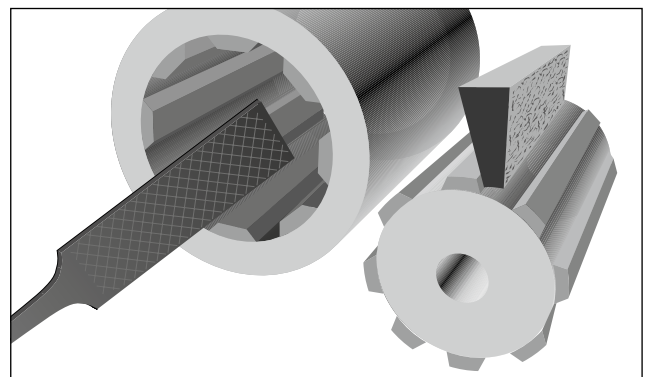


Figure 25. File socket to 45° angle.

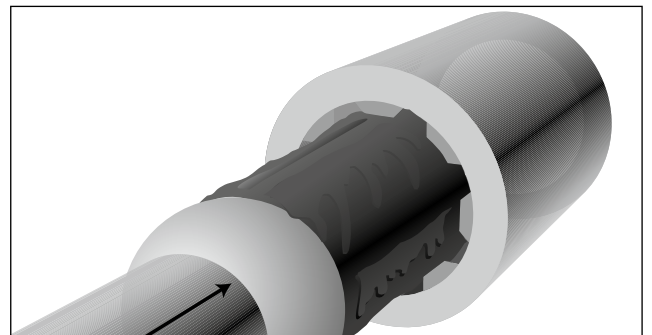


Figure 26. Install coated spline into shaft and remove excess epoxy.

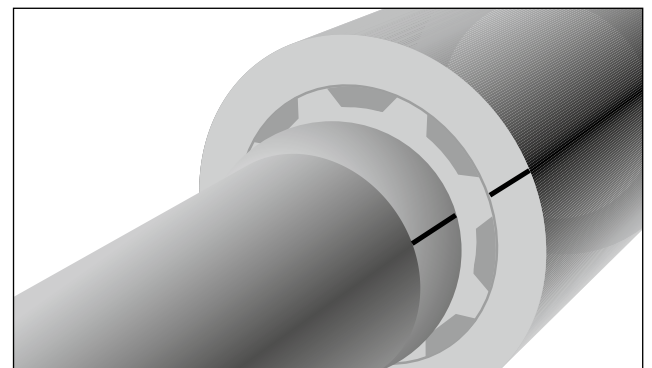


Figure 27. Mark the position of the spline in the socket for future assembly.

Metal Rebuilding Composites Properties Chart

LOCTITE® FIXMASTER® COMPOSITES PROPERTIES CHARTS

PRODUCT		Item Number	Package Type & Size	COLOR	COVERAGE (FT. ² AT 1/4" THICKNESS)	MAXIMUM TEMPERATURE (°F)	COMPRESSIVE STRENGTH [†] (psi)	TENSILE SHEAR STRENGTH [†] (psi)	HARDNESS (SHORE D)	WORKING TIME	FUNCTIONAL CURE	MIX RATIO BY VOLUME	MIX RATIO BY WEIGHT	AGENCY APPROVALS
KNEADABLE STICKS	Fixmaster® Metal Magic Steel™*	98853	4 oz. stick	Grey	16 in. ²	250	12,000	2,500	80	3 minutes	10 minutes	N/A	N/A	NSF 61
	Fixmaster® Underwater Repair Epoxy [§]	82093	4 oz. stick	White	16 in. ²	300	12,000	900	70	15 minutes	30 minutes	N/A	N/A	CFIA
POURABLE	Fixmaster® Steel Liquid*	97483 97484	1 lb. kit 4 lb. kit	Grey	13 in. ³ 52 in. ³	225	13,500	6,000	86	25 minutes	6 hours	4:1	9.5:1	ABS, CFIA, NEHC, NAVSEA
	Fixmaster® Aluminum Liquid*	97453	1 lb. kit	Aluminum	17 in. ³	200	17,000	6,000	85	20 minutes	6 hours	5:1	9:1	ABS, CFIA, NEHC, NAVSEA
TROWELABLE	Fixmaster® Superior Metal*	97473 40900	1 lb. kit 4 kg kit	Dark Grey	0.25 2.2	250	18,000	5,500	90	20 minutes	6 hours	4:1	7.25:1	CFIA
	Fixmaster® Steel Putty*	99913 99914 99912	1 lb. kit 4 lb. kit 25 lb. kit	Grey	0.3 1.2 7.5	225	11,100	4,900	85	30 minutes	6 hours	2.5:1	6.25:1	ABS, CFIA, NEHC, NAVSEA
	Fixmaster® Aluminum Putty*	97463	1 lb. kit	Aluminum	0.5	200	11,300	4,000	87	20 minutes	6 hours	4:1	6.3:1	ABS, CFIA, NEHC, NAVSEA
	Fixmaster® Stainless Steel Putty*	97443	1 lb. kit	Grey	0.25	225	12,000	4,600	85	20 minutes	6 hours	4:1	9:1	ABS, CFIA, NEHC, NAVSEA
	Fixmaster® Fast Set Steel Putty*	39917	1 lb. kit	Grey	0.4	200	10,800	4,600	80	3 minutes	10 minutes	1:1	1.8:1	ABS, CFIA, NEHC, NAVSEA

TROWELABLE	PRODUCT	Item Number	Package Type & Size	COLOR (CURED)	TEMPERATURE RESISTANCE (°F)	TENSILE SHEAR STRENGTH (psi)	WORKLIFE	FIXTURE TIME [‡]	FULL CURE (HOURS)	AGENCY APPROVALS
				Fixmaster® Fast Set Steel Epoxy*	96604	50 ml cartridge	Grey	200	2,600	3 minutes
Fixmaster® 2000° Putty*	95724	8 oz. can	Grey	2000	675	30 minutes	1 hour	7	N/A	

[§] Properties based on ultimate cure. Epoxy properties based on mixing 20g mass at 77°F. * Properties based on mixing one lb. mass at 77°F, 7 days cure.

[†] Ultimate cure. [‡] Time to reach handling strength

Application Selector Guide

LOCTITE® FIXMASTER® COMPOSITES APPLICATION CHART

PRODUCT		EMERGENCY METAL REPAIRS	CORROSION PROTECTION	REPAIRING PIPES AND TANKS	REBUILDING SHAFTS, KEYWAYS AND BEARINGS	REPAIRING THREADED PARTS	RESTORING TUBE SHEETS	PUMP REPAIR	REPAIRING ENGINE BLOCKS	FIXTURES AND PROTOTYPES	REBUILDING IMPELLERS AND VALVES	REPAIRING ALUMINUM AND PARTS	REPAIRING STAINLESS STEEL FIXTURES	WET SURFACE REPAIRS
KNEADABLE	Fixmaster® Metal Magic Steel™	●	○						●			●	○	
	Fixmaster® Underwater Repair Epoxy	○	○											●
POURABLE	Fixmaster® Steel Liquid		●		●				○			●		
	Fixmaster® Aluminum Liquid								●		●	○	●	
TROWELABLE	Fixmaster® Superior Metal	●		●	●	●	●	●		●				
	Fixmaster® Steel Putty		●					●		○		●		
	Fixmaster® Aluminum Putty		○							●	●	○		
	Fixmaster® Stainless Steel Putty		○							●	○	●		
	Fixmaster® Fast Set Steel Putty	●		●				○						

LOCTITE® FIXMASTER® COMPOSITES BONDING CHARACTERISTICS

SPECIALTY	PRODUCT	GAP FILLING	FAST CURE TIME	FERROUS METAL REPAIR	TEMPERATURE RESISTANT	METAL BONDING	SANDABLE FINISH	PRINTABLE FINISH
		Fixmaster® Fast Set Steel Epoxy	○	●	●		○	●
	Fixmaster® 2000° Putty	●		●	●		○	○

● Preferred Choice ○ Good Choice ○ Acceptable Choice

Loctite® Fixmaster™ Chemical Compatibility

LEGEND:

- 1 Compatible
- 2 Intermittent Exposure
- 3 Not Compatible

Acetic Acid, 10%3	Acetic Acid, Glacial3	Acetic Anhydride3	Acetone3	Acetyl Chloride1	Acetylene, Liquid Phase1	Acid Clay1	Acrylic Acid1	Acrylonitrile1	Activated Alumina1	Activated Carbon1	Activated Silica1	Alcohol, Allyl2	Alcohol, Amyl2	Alcohol, Benzyl2	Alcohol, Butyl2	Alcohol, Ethyl2	Alcohol, Furfuryl2	Alcohol, Hexyl2	Alcohol, Isopropyl1	Alcohol, Methyl3	Alcohol, Propyl1	Alum, Ammonium1	Alum, Chrome1	Alum, Potassium1	Alum, Sodium1	Alumina1	Aluminum Acetate1	Aluminum Bicarbonate1	Aluminum Bifluoride1	Aluminum Chloride1	Aluminum Sulfate1	Ammonia, Anhydrous3	Ammonia Solutions, 20%1	Ammonium Bisulfite, 20%1	Ammonium Borate1	Ammonium Bromide1	Ammonium Carbonate1	Ammonium Chloride1	Ammonium Chromate1	Ammonium Fluoride1	Ammonium Fluorosilicate1	Ammonium Formate1	Ammonium Hydroxide, 20%1	Ammonium Hyposulfite1	Ammonium Iodide1	Ammonium Molybdate1	Ammonium Nitrate1	Ammonium Oxalate1	Ammonium Persulfate1	Ammonium Phosphate1	Ammonium Picrate1	Ammonium Sulfate, 10%1	Ammonium Sulfate Scrubber1	Ammonium Sulfide1	Ammonium Thiocyanate1	Amyl Acetate2	Amyl Amine1	Amyl Chloride1	Aniline2	Aniline Dyes1	Anodizing Bath2	Antichlor Solution1	Antimony Acid Salts1	Antimony Oxide1	Antioxidant Gasoline1	Aqua Regia, 20%1	Argon1	Armeen §1	Arochlor §1	Aromatic Gasoline1	Aromatic Solvents2	Arsenic Acid1	Asbestos Slurry1	Ash Slurry1	Asphalt Emulsions1	Asphalt, Molten1	Bagasse Fibers1	Barium Acetate1	Barium Carbonate1	Barium Chloride1	Barium Hydroxide1	Barium Sulfate1	Battery Acid1	Battery Diffuser Juice1	Bauxite (See Alumina)1	Bentonite1	Benzaldehyde1	Benzene2	Benzene Hexachloride1	Benzene in Hydrochloric Acid, 20%1	Benzoic Acid1	Benzotriazole1	Beryllium Sulfate1	Bicarbonate Liquor1	Bilge Lines1	Bleach Liquor1	Bleached Pulps3	Borax § Liquors3	Boric Acid1	Brake Fluids1	Brine, Chlorinated1	Brine, Cold1	Bromine Solution3	Butadiene1	Butyl Acetate2	Butyl Alcohol2	Butyl Amine2	Butyl Cellulosolve §2	Butyl Chloride1	Butyl Ether, Dry1	Butyl Lactate1	Butyral Resin1	Butyraldehyde1	Butyric Acid1	Cadmium Chloride1	Cadmium Plating Bath1	Cadmium Sulfate1	Calcium Acetate1	Calcium Bisulfate1	Calcium Carbonate1	Calcium Chlorate1	Calcium Chloride1	Calcium Chloride Brine1	Calcium Citrate1	Calcium Ferrocyanide1	Calcium Formate1	Calcium Hydroxide1	Calcium Lactate1	Calcium Nitrate1	Calcium Phosphate1	Calcium Silicate1	Calcium Sulfamate1	Calcium Sulfate1	Calcium Sulfite1	Camphor1	Carbitol1	Carbolic Acid, Phenol1	Carbon Bisulfide1	Carbon Black1	Carbon Tetrachloride1	Carbolic Acid1	Carbowax §1	Carboxymethyl Cellulose1	Casein1	Casein, Water Paint1	Casein1	Carnauba Wax1	Cerium1	Cerium Oxide1	Chalk1	Chemical Pulp1	Chestnut Tanning1	China Clay1	Chloral Alcoholate1	Chloramine1	Chlorinated Hydrocarbons2	Chlorinated Paperstock1	Chlorinated Solvents2	Chlorinated Sulphuric Acids2	Chlorinated Wax1	Chlorine Dioxide1	Chlorine, Liquid1	Chlorine, Dry1	Chloroacetic Acid2	Chlorobenzene, Dry1	Chloroform, Dry1	Chloroformate Methyl1	Chlorosulfonic Acid1	Chrome Acid Cleaning, 20%1	Chrome Liquor, 20%1	Chrome Plating Bath, 20%1	Chromic Acid, 10%2	Chromic Acid, 50% Cold3	Chromic Acid, 50% Hot3	Chromium Acetate1	Chromium Chloride1	Chromium Sulfate1	Classifier1	Clay1	Coal Slurry1	Coal Tar1	Cobalt Chloride1	Copper Ammonium Formate1	Copper Chloride1	Copper Cyanide1	Copper Liquor1	Copper Naphthenate1	Copper Plating, Acid Process1	Copper Plating, Alk. Process1	Copper Sulfate1	Core Oil1	Corundum1	Creosote1	Creosote, Cresylic Acid1	Cyanide Solution1	Cyanuric Chloride1	Cyclohexane1	Cylinder Oils1	De-Ionized Water1	De-Ionized Water, Low Conductivity1	Detergents1	Developer, Photographic1	Dextrin1	Diacetone Alcohol3	Diammonium Phosphate1	Diamylamine1	Diatomaceous Earth Slurry1	Diazo Acetate1	Dibutyl Phthalate1	Dichlorophenol1	Dichloro Ethyl Ether1	Dicyandamide1	Dielectric Fluid1	Diester Lubricants1	Diethyl Ether, Dry1	Diethyl Sulfate1	Diethylamine1	Diethylene Glycol1	Diglycolic Acid1	Dimethyl Formamide1	Dimethyl Sulfoxide1	Dioxane, Dry1	Dioxidene1	Dipentene, Pinene1	Diphenyl1	Distilled Water, Industrial1	Dowtherm §1	Drying Oil1	Dust, Flue (Dry)1	Dye Liquors1	Emery Slurry1	Emulsified Oils1	Enamel Frit Slip1	Esters General1	Ethyl Acetate2	Ethyl Alcohol2	Ethyl Amine1	Ethyl Bromide1	Ethyl Cellulosolve §2	Ethyl Cellulosolve § Slurry2	Ethyl Formate1	Ethyl Silicate1	Ethylene Diamine1	Ethylene Dibromide1	Ethylene Dichloride1	Ethylene Glycol1	Ethylenediamine Tetramine1	Fatty Acids1	Fatty Acids, Amine1	Fatty Alcohol1	Ferric Flocc1	Ferric Chloride1	Ferric Nitrate1	Ferric Sulfate1	Ferrocene, Oil Sol1	Ferrous Chloride1	Ferrous Oxalate1	Ferrous Sulfate, 10%1	Ferrous Sulfate, Sat1	Fertilizer Sol1	Flotation Concentrates1	Fluoride Salts1	Fluorine, Gaseous or Liquid1	Fluorolube1	Fluosilic Acid1	Flux, Soldering1	Fly Ash, Dry1	Foam Latex Mix1	Foamite1	Formaldehyde, Cold2	Formaldehyde, Hot3	Formic Acid, Dil. Cold2	Formic Acid, Dil. Hot3	Formic Acid, Cold2	Formic Acid, Hot3	Freon §1	Fuel Oil1	Fuming Nitric, Red, 20%1	Fuming Sulfuric, 20%1	Fuming Oleum2	Furfural1	Gallic Acid1	Gallium Sulfate1	Gasoline, Acid Wash1	Gasoline, Alk. Wash1	Gasoline, Aviation1	Gasoline, Copper Chloride1	Gasoline, Ethyl1	Gasoline, Motor1	Gasoline, Sour1	Gasoline, White1	Gluconic Acid1	Glue, Animal Gelatin1	Glue, Plywood1	Glutamic Acid1	Glycerine Lye, Brine1	Glycerol1	Glycine1	Glycine Hydrochloride1	Glycol Amine1	Glycolic Acid1	Glyoxal1	Gold Chloride1	Gold Cyanide1	Granodine1	Grape Pomace Graphite1	Grease, Lubricating1	Green Soap1	Grinding Lubricant1	Grit, Steel1	Gritty Water1	Groundwood Stock1	GRS Latex1	Gum Paste1	Gum Turpentine1	Gypsum1	Halane Sol1	Halogen, Tin Plating1	Halowax §1	Harvel, Trans. Oil1	Heptane1	Hexachlorobenzene2	Hexadiene1	Hexamethylene Tetramine1	Hexane1	Hydrazine1	Hydrazine Hydrate1	Hydrobromic Acid3	Hydrochloric Acid, 20%1	Hydrocyanic Acid1	Hydrofluoric Acid3	Hydrogen Peroxide, Dil1	Hydrogen Peroxide, Con. 20%1	Hydroponic Sol1	Hydroquinone1	Hydroxyacetic Acid1	Hypo1	Hypochlorous Acid1	Ink20%	Ink in Solvent, Printing2	Iodine in Alcohol2	Iodine, Potassium Iodide1	Iodine Solutions1	Ion Exchange, Service1	Ion Exclusion, Glycol1	Irish Moss Slurry1	Iron Ore, Taconite1	Iron Oxide1	Isobutyl Alcohol1	Isobutyraldehyde1	Isocetane1	Isopropyl Alcohol1	Isocyanate Resin1	Isopropyl Acetate2	Isopropyl Ether2	Itaconic Acid1	Jet Fuels2	Jeweler's Rouge1	Jig Table Slurry1	Kaolin §, China Clay1	Kelp Slurry1	Kerosene1	Kerosene, Chlorinated1	Ketone3	Lacquer Thinner1	Lactic Acid1	Lapping Compound1	Latex, Natural1	Latex, Synthetic1	Latex, Synthetic Raw1	Laundry Wash Water1	Laundry Bleach3	Laundry Blue1	Laundry Soda1	Lead Arsenate1	Lead Oxide1	Lead Sulfate1	Lignin Extract1	Lime, Slaked1	Lime Sulfur Mix1	Liquid Ion Exchange1	Lithium Chloride1	LOX, Liquid O1	Ludox1	Lye, 20%1	Magnesium Bisulfite1	Magnesium Carbonate1	Magnesium Chloride1	Magnesium Hydroxide1	Magnesium Sulfate1	Maleic Acid1	Maleic Anhydride1	Manganese Chloride1	Manganese Sulfate1	Melamine Resin1	Menthyl Chloride3	Mercaptans1	Mercuric Chloride1	Mercuric Nitrate1	Mercury1	Mercury, Dry1	Methane1	Methyl Alcohol1	Methyl Acetate1	Methyl Bromide1	Methyl Carbitol1	Methyl Cellulosolve §1	Methyl Chloride3	Methyl Ethyl Ketone3	Methyl Isobutyl Ketone3	Methyl Lactate1	Methyl Orange1	Methylamine1	Methylene Chloride3	Mineral Spirits1	Mixed Acid, Nitric/Sulfuric, 20%1	Monochloroacetic Acid, 10%1	Morpholine1	Mud1	Nalco Sol.1	Naphtha1	Naphthalene1	Naval Stores Solvent1	Nematocide1	Neoprene Emulsion1	Neoprene, Latex1	Nickel Acetate1	Nickel Ammonium Sulfate1	Nickel Chloride1	Nickel Cyanide1	Nickel Fluoborate1	Nickel Ore Fines1	Nickel Plating Bright1	Nickel Sulfate1	Nicotinic Acid1	Nitrate Sol.1	Nitration Acid(s)1	Nitric Acid, 10%2	Nitric Acid, 20%3	Nitric Acid, Anhydrous2	Nitric Acid, Fuming3	Nitro Aryl Sulfonic Acid2	Nitrobenzene, Dry2	Nitrocellulose1	Nitrofurane1	Nitroguanidine1	Nitroparaffins, Dry1	Nitrosyl Chloride1	Norite Carbon1	Nuchar1	Oakite § Compound1	Oil, Creosote1	Oil, Emulsified1	Oil, Fuel1	Oil, Lubricating1	Oil, Soluble1	Oleic Acid, Cold1	Oleic Acid, Hot1	Oleic Acid, Cold1	Ore Fines, Flotation1	Ore Pulp1	Organic Dyes1	Oxalic Acid, Cold1	Ozone, Wet1	Paint, Linseed Base1	Paint, Water Base1	Paint Remover, Sol. Type1	Paint, Vehicle1
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Palmitic Acid1	Zinc Acid, 20%1	Shellac1	Sour Gasoline1	Trichlorethylene2
Paper Board, Mill Waste1	Zinc Alk. Cyanide1	Shower Water1	Soybean Sludge Acid1	Trichlorethylene, Dry2
Paper Coating Slurry.....1		Silica Gel1	Spensol Solution1	Tricresyl Phosphate1
Paper Pulp1	Polyacrylonitrile Slurry1	Silica, Ground1	Stannic Chloride1	Triethanolamine1
Paper Pulp with Amun.1	Polybutene1	Silicone Tetrachloride1	Starch1	Triethylene Glycol1
Paper Pulp with Dye1	Polysulfide Liquor1	Silicone Fluids1	Starch Base1	Trioxane1
Paper Pulp, Bleached3	Polyvinyl Acetate Slurry1	Silver Cyanide1	Stearic Acid1	Tungstic Acid1
Paper Pulp, Bleached, washed3	Polyvinyl Chloride1	Silver Iodide, Aqu.1	Steep Water1	Turpentine1
Paper Pulp, Chlorinated2	Porcelain Frit1	Silver Nitrate1	Sterilization Steam1	
Paper Groundwood1	Potash1	Size Emulsion1	Stillage Distillers1	UCON § Lube1
Paper Rag.....1	Potassium Acetate1	Skelly Solve E, L1	Stoddard Solvent1	Udylite Bath, Nickel1
Paper Stocks, Fine1	Potassium Alum. Sulfate1	Slate to 400 Mesh1	Styrene1	Undecylenic Acid1
Paradichlorobenzene2	Potassium Bromide1	Soap, Lye1	Styrene Butadiene, Latex ...1	Unichrome Sol., Alk.1
Paraffin, Molten1	Potassium Carbonate1	Soap Solutions, Stearates .1	Sulfamic Acid, 20%1	Uranium Salts1
Paraffin Oil1	Potassium Chlorate1	Soap Stone, Air Blown1	Sulfanilic Acid, 20%1	Uranyl Nitrate1
Paraformaldehyde1	Potassium Chloride Sol.1	Soda Pulp1	Sulfathiazole1	Uranyl Sulfate1
Pectin Solution Acid1	Potassium Chromate1	Sodium Acetate1	Sulfite Liquor1	Urea Ammonia Liquor, 20% 1
Pentachlorethane2	Potassium Cyanide Sol.1	Sodium Acid Fluoride, 20% 1	Sulfite Stock1	
Pentaerythritol Sol.1	Potassium Dichromate1	Sodium Aluminate1	Sulfonated Oils1	
Perchloroethylene, Dry2	Potassium Ferricyanide1	Sodium Arsenate1	Sulfones1	Vacuum Oil1
Perchloric Acid, 10%3	Potassium Hydroxide, 40%1	Sodium Benzene Sulfonate 1	Sulfonic Acids2	Vanadium Pentoxide1
Perchloromethyl Mercaptan .1	Potassium Iodide1	Sodium Bichromate1	Sulfonyl Chloride1	Slurry1
Permanganic Acid2	Potassium Nitrate1	Sodium Bisulfite1	Sulfur Slurry1	Varnish1
Persulfuric Acid, 10%3	Potassium Persulfate1	Sodium Bromide1	Sulfur Solution1	Varsol, Naptha Solv.1
Petroleum Ether, 10%3	Potassium Perchlorate1	Sodium Carbonate1	in Carbon Disulfide1	Versene §1
Petroleum Jelly1	Potassium Permanganate .1	Sodium Chlorate1	Sulphuric Acid, 0-7%2	Vinyl Acetate, Dry or Chloride Monomer1
Phenol Formaldehyde Resins.1	Potassium Phosphate1	Sodium Chlorite1	Sulphuric Acid, 7-40%3	Vinyl Chloride, Latex Emul .1
Phenol Sulfonic Acid1	Potassium Silicate1	Sodium Cyanide1	Sulphuric Acid, 40-75%3	Vinyl Resin Slurry1
Phenolic Glue1	Potassium Sulfate1	Sodium Ferricyanide1	Sulphuric Acid, 75-95%3	Viscose1
Phloroglucinol1	Potassium Xanthate1	Sodium Formate1	Sulphuric Acid, 95-100%3	Vortex, Hydroclone.....1
Phosphate Ester1	Press Board Waste1	Sodium Glutamate1	Sulphurous Acid2	
Phosphatic Sand1	Propionic Acid1	Sodium Hydrogen Sulfate .1	Sulfuryl Chloride1	Water, Acid Below pH 72
Phosphoric Acid, 85% Hot 3	Propyl Alcohol1	Sodium Hydrosulfite1	Surfactants1	Water, pH 7 to 82
Phosphoric Acid, 85% Cold 3	Propyl Bromide1	Sodium Hydroxide1	Synthetic Latex1	Water, Alkaline Over pH 8, 20%1
Phosphoric Acid, 50% Cold 3	Propylene Glycol1	Sodium Hydrochloride2	Taconite, Fines1	Water, Mine Water1
Phosphoric Acid, 10% Cold 1	Pumice1	Sodium Hydroxide, 20%2	Talc Slurry1	Water, Potable1
Phosphoric Acid, 10% Hot 3	Pyranol1	Sodium Hydro., 20% Cold .2	Tankage Slurry1	Water, River1
Phosphorous, Molten1	Pyridine1	Sodium Hydro., 50% Cold .3	Tannic Acid, Cold1	Water, Sandy1
Phosphotungstic Acid, 20%. 1	Pyrogallic Acid1	Sodium Hydro., 50% Hot .3	Tamin1	Water, "White" low pH, 20%1
Photographic Sol.1	Pyrogen, Free Water1	Sodium Hydro., 70% Cold .3	Tar and Tar Oil1	Water, "White" high pH, 20%1
Phthalic Acid1	Pyrole1	Sodium Hydro., 70% Hot .3	Tartaric Acid1	Wax1
Phytate1	Pyromellitic Acid1	Sodium Hypochlorite3	Television Chemicals1	Wax, Chlorinated1
Phytate Salts1	Quebracho Tannin1	Sodium Lignosulfonate1	Tergitol §1	Wax Emulsions1
Pickling Acid, Sulfuric3	Rag Stock, Bleached2	Sodium Metasilicate1	Terpineol1	Weed Killer, Dibromide1
Picric Acid Solutions1	Rare Earth Salts1	Sodium Molten1	Tetraethyl Lead1	Weisberg Sulfate Plating ...1
Pine Oil Finish1	Rayon Acid Water1	Sodium Nitrate1	Tetrahydrofuran1	Wood, Ground Pulp1
Plating Sol. as follows:	Rayon Spin Bath1	Sodium Nitrite, Nitrate1	Tetranitromethane1	Wort Lines1
Brass Cyanide1	Rayon Spin Bath, Spent1	Sodium Perborate1	Textile Dyeing1	
Bronze, Cyanide1	Resorcinol1	Sodium Peroxide1	Textile Finishing Oil1	X-Ray Developing Bath1
Chromium and Cadmium 1	River Water1	Sodium Persulfate1	Textile Printing Oil1	Xylene3
Cyanide1	Road Oil1	Sodium Phosphate, Mono .1	Thiocyanic Acid1	
Cobalt Acid, 20%1	Roccal1	Sodium Phosphate, Tri1	Thionyl Chloride1	Zelan1
Copper Acid, 20%1	Rosin, Wood1	Sodium Potassium Chloride .1	Thiophosphoryl Chloride ...1	Zeolite Water1
Copper Alk., 20%1	Rosin in Alcohol1	Sodium Salicylate1	Thiourea1	Zinc Acetate1
Gold Cyanide1	Rosin Size1	Sodium Sesquicarbonate ...1	Thorium Nitrate1	Zinc Bromide1
Iron Acid, 20%1	Rubber Latex1	Sodium Silicate1	Thymol1	Zinc Chloride1
Lead, Fluoro1	Safrol1	Sodium Silcofluoride1	Tin Tetrachlorida1	Zinc Cyanide, Alk.1
Nickel, Bright1	Salt, Alkaline1	Sodium Stannate1	Tin Tinning Sol., DuPont1	Zinc Flux Slurry1
Nickel, Sulfuric1	Salt, Electrolytic1	Sodium Sulfate1	Titanium Paper Coating1	Zinc Flux Paste1
Platinum1	Salt, Refrig.1	Sodium Sulfide1	Titanium Oxide Slurry1	Zinc Galvanizing1
Silver Cyanide1	Sand, Air Blown Slurry1	Sodium Sulfite1	Titanium Oxide Sulfate1	Zinc Hydroxysulfite1
Tin Acid, 20%1	Sand, Air Phosphatic1	Sodium Sulphydrate1	Titanium Sulfate1	Zinc Oxide in Water1
Tin Alk. Barrel, 20%1	Sea Coal1	Sodium Thiocyanate1	Titanium Tetrachloride1	Zinc Oxide in Oil1
	Sea Water1	Sodium Thiosulfate1	Toluol3	Zinc Sulfate1
	Selenium Chloride1	Sodium Tungstate1	Toluene3	Zinc Sulfate1
	Sequestrene1	Sodium Xanthate1	p-Toluene Sulfonic Acid2	Zinccolate1
	Sewage1	Soluble Oil1	Trichloroacetic Acid, 10%1	Zirconyl Nitrate1
		Solvent Naphthas1	Trichlorethane, 1,1,12	Zirconyl Sulfate1
		Sorbic Acid1		

Gases

Acetylene1	Carbon Dioxide1
Acid and Alkali Vapors2	Carbon Disulfide1
Air1	Carbon Monoxide1
Amine1	Chloride, Dry1
Ammonia1	Chlorine, Dry1
	Chlorine, Wet2
Butane1	Coke Oven Gas, Cold1
Butadiene, Gas/Liquid1	Coke Oven Gas, Hot3
Butylene, Gas/Liquid1	Cyanogen Chloride1
By-Product Gas, Dry1	Cyanogen Gas1
	Ethane1
	Ether, see Diethyl Ether1
	Ethylene1
	Ethylene Oxide1
	Freon § (11-12-21-22)3
	Furnace Gas, Cold1
	Furnace Gas, Hot3
	Gas, Drip Oil1
	Gas, Flue3
	Gas, Natural1
	Helium1
	Hydrogen Gas, Cold1
	Hydrogen Chloride1
	Hydrogen Cyanide1
	Hydrogen Sulfide, Wet and Dry1
	Isobutane.....1
	Methane1
	Methyl Chloride3
	Natural Gas, Dry1
	Nitrogen Gas1
	Nitrous Oxide1
	Oil, Solvent Vapor1
	Oxygen3
	Ozone3
	Propane1
	Propylene1
	Steam, High Pressure (> 70 psi)1
	Steam, Low Pressure (< 70 psi)1
	Sulfur Dioxide1
	Sulfur Dioxide, Dry1
	Sulfur Trioxide Gas1
	Sulfuric Acid Vapor, 20% ...1

NOTE:

1. The above information does not constitute a recommendation of product use. It is intended only as a guide for consideration by the purchaser with the expectation of favorable confirming test results. It is impossible to test product reaction with the multitude of chemicals in existence, therefore, compatibility has been estimated based on a wide variety of customer experience.

2. With the stringent action of such chemicals as Freon§, strong cold acids and caustics, thorough evaluation is suggested.

3. Contact Henkel Corporation for use with chemicals not covered by this information.

§Listing(s) may be Brand Name(s) or Trademarks for chemicals of Corporations other than Henkel.

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Frequently Asked Questions and Troubleshooting Guide

FREQUENTLY ASKED QUESTIONS

Q: What is a polymer composite?

A: An epoxy system that contains a reinforcement component such as fibers, beads, powders, etc. These added composites increase performance.

Q: Why is surface preparation so important?

A: A successful application is largely dependent on surface preparation. The application surface must be free from all contamination. Removal of oil, grease, dust, rust and, for most products, moisture* will greatly enhance application success. For more detailed surface preparation techniques, refer to Product Description Sheets.

* NOTE: Products such as LOCTITE® Fixmaster® Metal Magic Steel™ and Fixmaster® Wet Surface Repair Putty contain hardener systems that can be applied to damp and underwater surfaces.

Q: Can I add solvents to make them thinner (easier to work with)?

A: The use of solvent is not recommended due to the possibility of trapping the solvent in the cured systems, causing voids or soft spots.

Q: Can I mix just the amount I need instead of the entire amount of the composite?

A: Yes, Polymer Composites are packaged as kits with exact ratio, however, partial kits can be mixed if measured precisely.

Q: Can I remove a polymer composite after it has cured?

A: Polymer composites have great adhesive properties and are designed not to be removed. If removal is necessary, LOCTITE® Chisel® Gasket Remover may be used.

Q: Will my cure time be affected if I bring in a cold part from outdoors into a warm room?

A: If a part is cold and the ambient air is warm, cure time will be extended. Both the air and the part should be room temperature to get the prescribed cure time and strength.

Q: If I add more hardener will that make it cure faster?

A: No, epoxy systems have been formulated to contain an exact amount of resin to react with an exact amount of hardener. If excess hardener is added, it will remain unreacted and the physical properties will be negatively affected.

Q: When can I put my equipment back in service?

A: Functional cure time varies with product type and application temperature; refer to the Product Description Sheets for individual product information.

Q: How long will the products last?

A: Durability of a product will depend on the surface preparation, applicator skill, environmental conditions, chemical exposure, etc.

TROUBLESHOOTING GUIDE

PROBLEM	POSSIBLE CAUSES	SUGGESTED SOLUTION
Curing too fast	<ul style="list-style-type: none"> Air temperature too high Application surface too hot Composite temperature too hot Too much material being mixed 	Working time and cure time depend on temperature and the amount of material being mixed; the higher the temperature, the faster the cure. The larger the amount of material mixed, the faster the cure. To slow the cure at high temperatures, mix in smaller amounts to prevent rapid curing and/or cool resin/hardener components and application surface.
Curing too slow	<ul style="list-style-type: none"> Air temperature too cold Composite temperature too cold Application surface too cold 	To speed the cure at low temperatures (<60°F), store at room temperature (70°F ± 5°F) and/or preheat application surface until warm to the touch.
Loss of adhesion	<ul style="list-style-type: none"> Surface contamination Surface too smooth 	Prepare surface by grit blasting, if possible. For less severe applications, roughening the surface with hand tools is suitable. Solvent clean with a residue-free cleaner such as Loctite® ODC-Free Cleaner & Degreaser or Loctite® Natural Blue® Biodegradable Cleaner and Degreaser. Product should be applied as soon as possible after surface preparation to avoid surface rust or contamination.
Excessive shrinking and cracking	<ul style="list-style-type: none"> Too much product being applied or poured resulting in high heat buildup 	Applying too much material at one time will cause excessive heat buildup, which will cause shrinking and cracking. Apply material in layers of one inch at a time, allowing the layer to cool before applying the next layer.



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