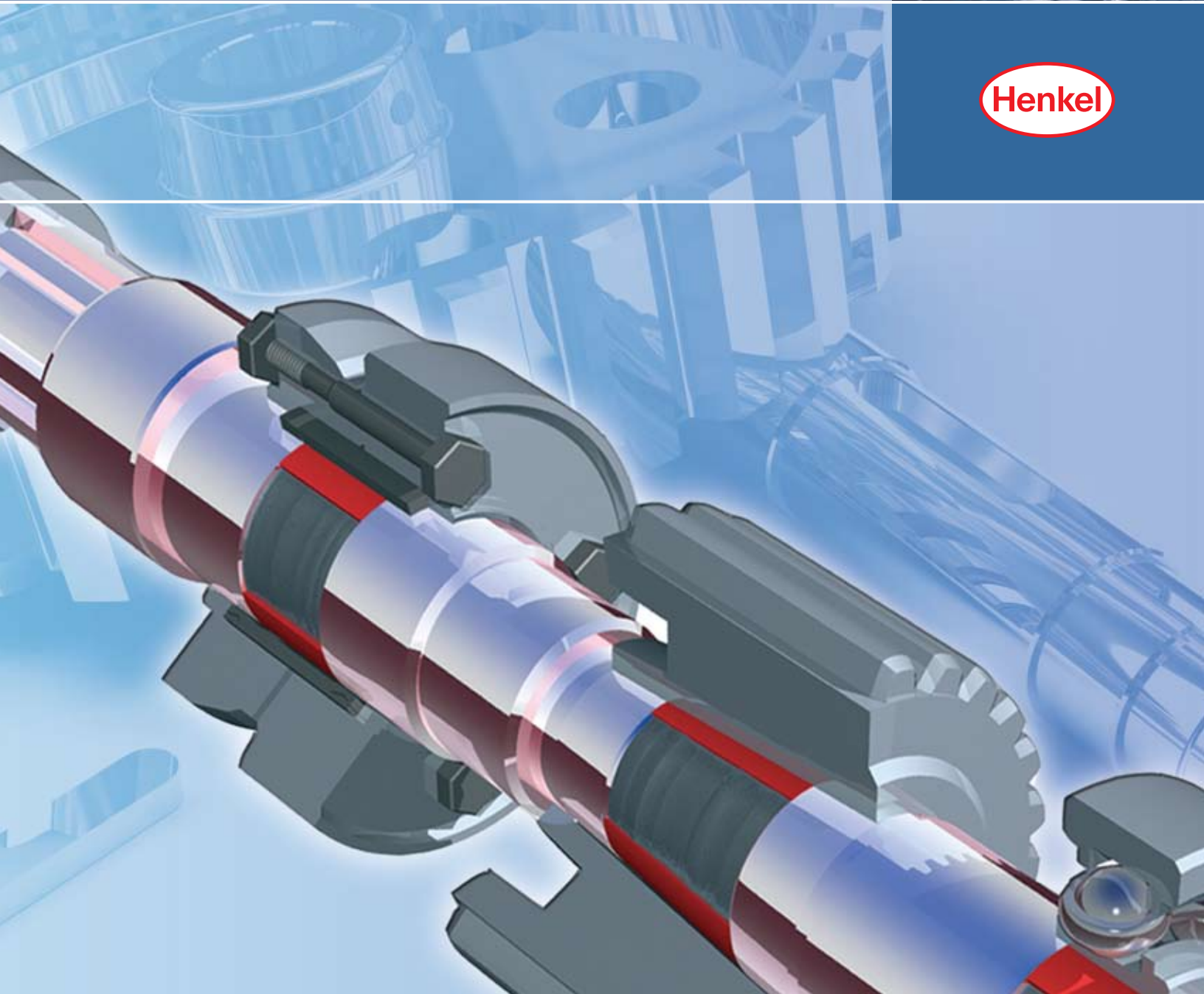


LOCTITE®

Shaft Repair Service Manual



Henkel



Introduction

This guide has been designed to provide quick and easy assistance to the professionals responsible for the maintenance and repair of shaft assemblies. With the help of this guide, you can:

- Easily select the right way to repair a variety of shaft assemblies
- Pinpoint the most suitable repair method for worn parts, or prevent wear proactively
- Determine the best Loctite® product for your particular maintenance or repair problem

Most shaft assemblies are incorporated into systems carrying a significant capital equipment value. It is therefore vital to maximize their useful lives and ensure reliable performance. Proactive maintenance can reduce downtime, enhance reliability, and dramatically cut costs.

There is a comprehensive range of Loctite® products to:

- Repair and prevent common failures to extend end-product life and minimize downtime
- Reclaim worn or damaged assemblies to avoid scrap and replacement costs
- Assist in assembly, installation and disassembly
- Help ensure reliability and smooth running by restoring performance to “as new” condition

Profit from reliability

At Henkel, we understand the problems you face in ensuring reliability, safety, and durability. We provide a wide range of industry-leading products for cost-efficient, easy and effective shaft maintenance and repair. When equipment fails, the greatest concern is getting it running again. Loctite® products not only provide reliable on-site repair capability, but emergency repair and service solutions that last or even extend the lifetime of your equipment.

Our focus on increasing reliability, through the protection of our customers equipment, facilities and people, delivers maximum value to the maintenance process.

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To speak with someone in our technical service department
or to contact your local Loctite® product specialist, call
1-800-LOCTITE (562-8483) or 1-800-263-5043 in Canada.



Rebuild Worn Shafts

Loctite® Fixmaster® Superior Metal

- Rebuild worn surfaces with metal-filled epoxy
- Machine the shaft after repair to the original diameter
- Return to service quickly without major overhaul



Prevent Keyway Wear

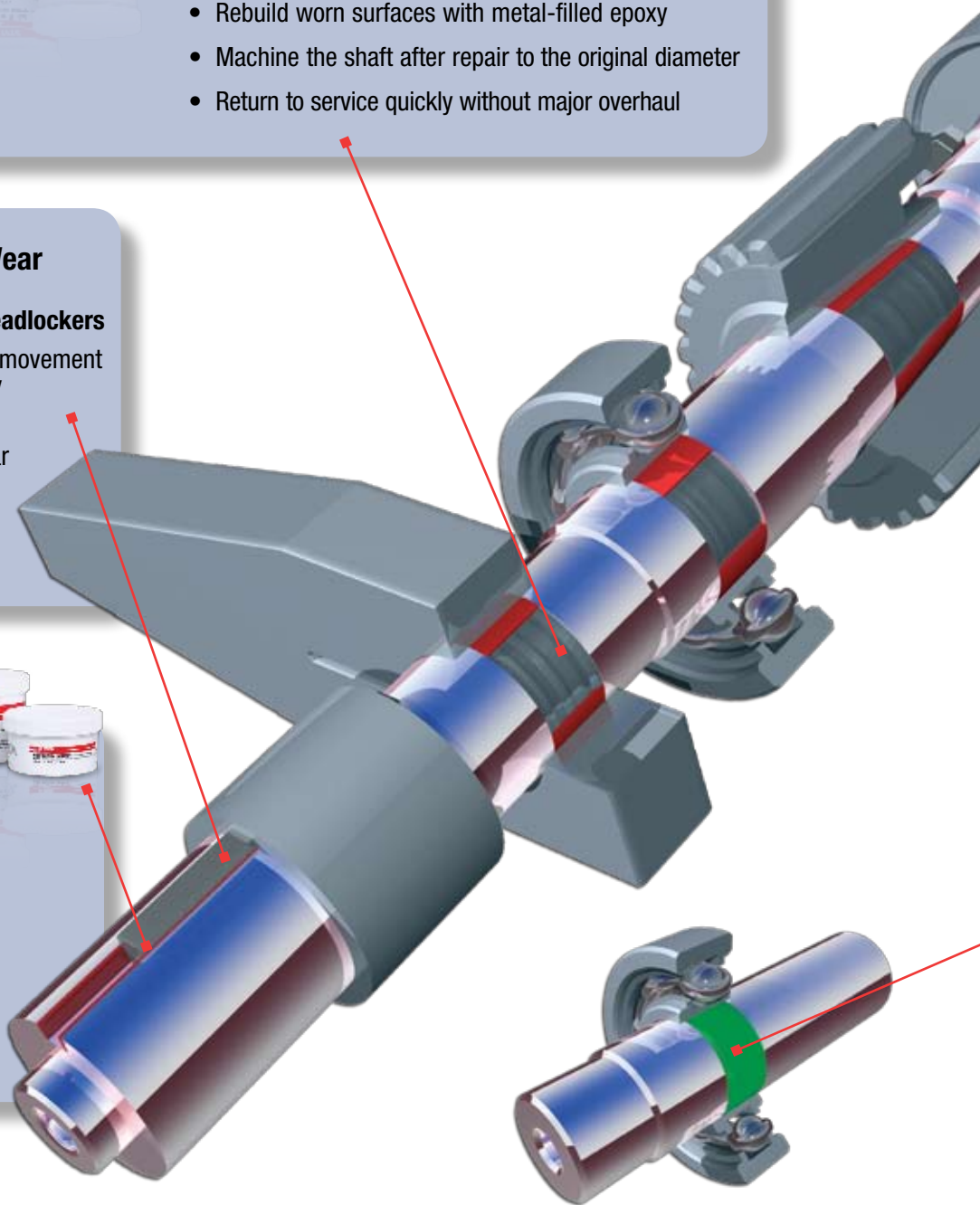
Loctite® 243™ and QuickStix™ 248™ Threadlockers

- Eliminate the micro-movement that leads to keyway wallow and fretting
- Prevent keyway wear
- Prevent corrosion
- Ease disassembly

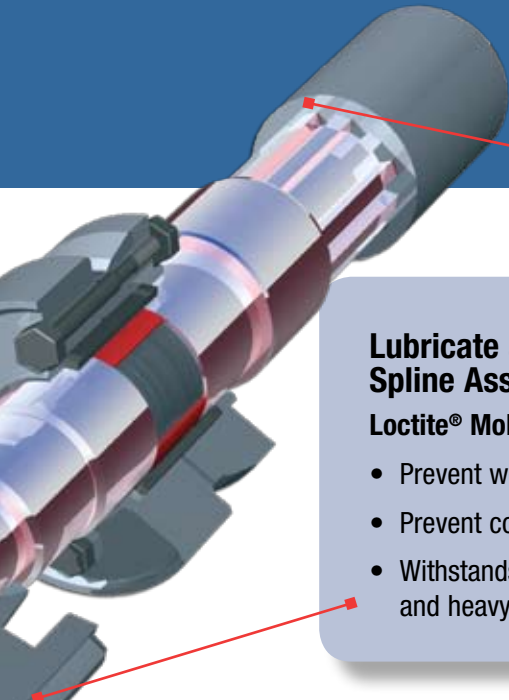
Repair Worn Keyways

Loctite® 660™ Quick Metal® and Loctite® Fixmaster® Superior Metal

- Repair and restore wallowed keyways without a major overhaul
- Prevent corrosion
- Eliminate the micro-movement that leads to fretting



Shaft Repair Application Diagram



Lubricate and Protect Spline Assemblies

Loctite® Moly Paste

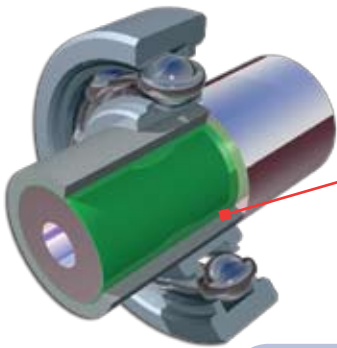
- Prevent wear caused by friction
- Prevent corrosion
- Withstands extreme pressure and heavy loads



Secure Fixed Spline Assemblies

Loctite® 660™ Quick Metal®

- Eliminate micro-movement that leads to wear
- Prevent corrosion



Sleeving a Worn Shaft

Loctite® 609™ Retaining Compound

- For badly worn shafts
- High load applications



Secure Cylindrical & Taper Joints

Loctite® Retaining Compounds

- Recover worn or incorrectly machined components
- Prevent corrosion
- Create 100% contact – load and stress distributed evenly over the joint
- High and moderate strength products can carry high loads
- Eliminate fretting
- Prevent bearing spinout

Additional Loctite® Products:

Loctite® ODC-Free Cleaner & Degreaser

- Use with all repair methods for cleaning parts prior to adhesive bonding

Loctite® 7649™ Primer N™

- Use in combination with Loctite® Retaining Compounds
- Increase cure speed on passive surfaces such as stainless steel, aluminium, and plated metals



? CHALLENGE

Repairing a badly worn shaft

CAUSE

- Out-of-tolerance machining results in loose components; this leads to micro-movement and wear
- Load produces axial forces that are higher than original calculations
- Insufficient interference or inappropriate loads lead to spun bearings
- Use of components in aggressive environments and at elevated operating temperatures

i SOLUTION #1

Rebuilding the damaged shaft with Loctite® Fixmaster® Superior Metal

STEPS

1. Using a lathe, undercut the shaft in the worn area as follows:
Shaft diameter: 13 mm–25 mm; desired undercut: 1.5 mm
Shaft diameter: 25 mm–75 mm; desired undercut: 3 mm
2. Dovetail the ends of the worn area to anchor the application into place.
3. Finish undercutting by machining a rough cut surface (e.g., $R_z := 100 \mu\text{m}$). The larger the shaft diameter, the coarser the cut.
4. Clean parts with Loctite® ODC Free Cleaner & Degreaser.
5. Apply a very thin layer of Loctite® Fixmaster® Superior Metal and force it into the rough surface finish. Turn the shaft at a very low speed and continue to apply adhesive using a putty knife or similar. Build the surface above the final desired level.
6. Allow the adhesive to cure for 12 hours at room temperature. If necessary, apply dry heat to the repair area to speed the cure.
7. Machine the repair to the required dimensions.
8. Cut the material with the component dry, using carbide or high speed steel. If polishing is required, use an abrasive paper.



✓ RESULTS

- Prevent downtime and scrap costs by repairing worn shaft
- Epoxy solution uses standard machine tools, no special equipment or training required

Note:

When mounting components to the rebuilt surface with Loctite® Retaining Compounds, Loctite® 7649™ Primer N™ is required.

Shaft Repair



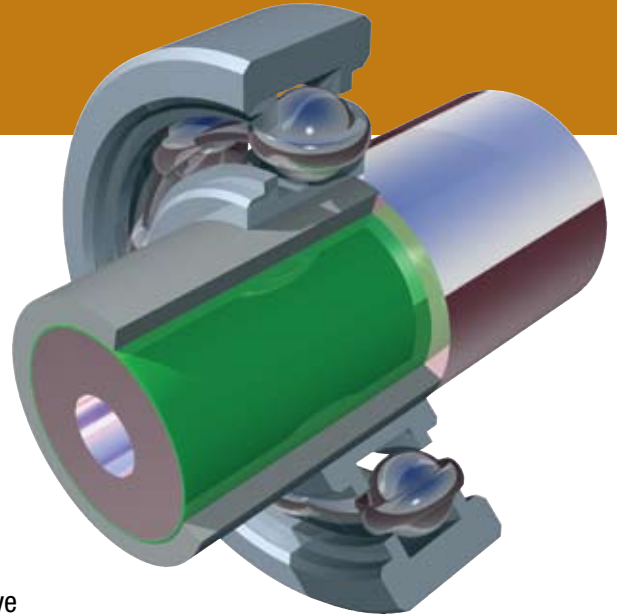
SOLUTION #2



Sleeving Reliably with Loctite® Retaining Compounds

STEPS

1. Determine appropriate size of sleeve.
2. Create a transition fit joint between shaft and sleeve (for tapered joints, create a press fit).
3. Ensure the outside diameter is the specified shaft diameter (for a taper joint, the outside diameter should be the nominal diameter of the original cone).
4. Roughen the surface.
5. Clean parts with Loctite® ODC-Free Cleaner & Degreaser.
6. Apply a bead of Loctite® 609™ Retaining Compound to the circumference of the shaft at the leading edge of the component to be inserted. Apply the adhesive to both parts of the assembly. In the case of a shrink fit (using thermal energy for assembling), apply the adhesive onto the cold part, coating the complete engagement area.
7. Assemble sleeve; in some cases, heat should be applied to the fit.
8. Wipe off excess adhesive.
9. Allow adhesive to cure.
10. Follow the same procedure for press-fit joints between the sleeve and bearing.



RESULTS



- Repair worn shaft
- Unitize assembly, distributing load evenly
- Prevent downtime and scrap costs
- Protect new components against wear, abrasion, and chemical attack



CHALLENGE

Reliably secure components to shaft

CAUSE

- Out-of-tolerance machining results in loose components; this leads to micro-movement and wear
- Load produces axial forces that are higher than original calculations
- Insufficient interference or inappropriate loads lead to spun bearings
- Use of components in aggressive environments and at elevated operating temperatures



SOLUTION

Mount components to shaft using Loctite® Retaining Compounds

STEPS

Select the proper repair adhesive according to the extent of component wear or gap fill required

Type of Fit	Loctite® Retaining Compound	Benefit	Maximum Repair Gap	Cure Time (Setup/Full Strength)
Press Fit	Loctite® 603™	Oil Tolerant	up to 0.005" (0.1 mm)	10 min/24 hrs
	Loctite® QuickStix™ 668™	Semisolid	up to 0.005" (0.1 mm)	30 min/24 hrs
	Loctite® 609™	General Purpose	up to 0.005" (0.1 mm)	10 min/24 hrs
Slip Fit	Loctite® 620™	High Temp	up to 0.015" (0.4 mm)	30 min/24 hrs
	Loctite® 680™	High Strength	up to 0.015" (0.4 mm)	10 min/24 hrs
Medium to Large Gaps	Loctite® 660™ Quick Metal®	Restore Worn Parts	up to 0.020" (0.5 mm)	20 min/24 hrs

1. Clean parts with Loctite® ODC-Free Cleaner & Degreaser.
2. Roughen the shaft-mounted component and shaft with abrasive paper at the bonding area.
3. Re-clean parts.
4. Apply a bead of the repair adhesive to the circumference of the shaft at the leading edge of the component. Apply the adhesive to both parts of the assembly. In the case of a shrink fit (using thermal energy for assembling), apply the adhesive onto the cold part, coating the complete engagement area.
5. Assemble shaft-mounted component; in some cases, heat should be applied to the transition fit.
6. Wipe off excess.
7. Allow to cure.

RESULTS

- Adhesive fills airspace – sealing from leaks, rust, and corrosion
- Eliminates micro-movement between component and shaft
- Provides 100% contact, distributing loads and stress evenly

Securing Cylindrical & Taper Joints

? CHALLENGE

Prevent bearing spinout, corrosion, and component damage

CAUSE

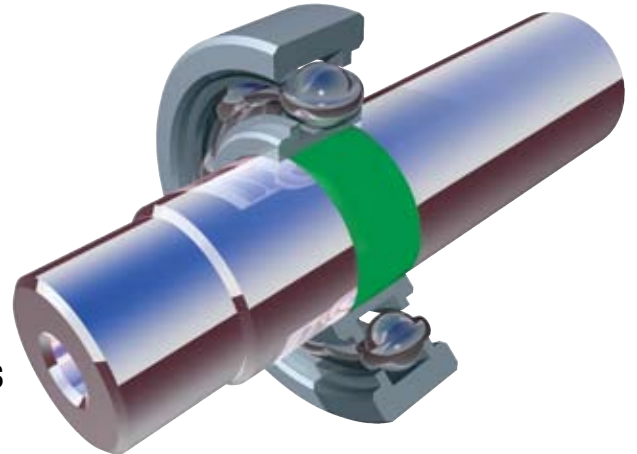
- Bearings are prone to spinning either on their shafts or within their housings. This results in damage to these parts regardless of whether or not they are a press, shrink, or slip fit.
- The airspace that exists between a bearing and shaft is an area where rust can form and cause damage to the parts and can also be a leak path for fluids.
- Airspace allows micro-movement leading to fretting and corrosion.

i SOLUTION

Retain joints using Loctite® 609™ General Purpose or Loctite® 603™ High Strength Retaining Compounds

STEPS

1. Clean parts with Loctite® ODC-Free Cleaner & Degreaser.
2. Apply a bead of Loctite® Retaining Compound to the circumference of the shaft at the leading area of the component.
3. Press the bearing onto the shaft using normal techniques.
4. Wipe off excess material.



✓ RESULTS

- Reduces shaft and/or bearing housing damaged
- Fills airspace – sealing from leaks, rust, and corrosion
- Eliminates micro-movement between bearing and shaft that could lead to fretting damage
- Provides 100% contact, distributing loads and stress evenly



CHALLENGE



Preventing keyway wear

CAUSE

In a new assembly the fit between the key and keyway is usually tight; however, over time wear can cause this fit to loosen, leading to damage to the keyway.



SOLUTION



Loctite® Medium Strength Threadlocker is appropriate for the gap fill and will provide the needed strength while allowing easy removal for servicing.

STEPS

1. Clean the keyway and key with Loctite® ODC-Free Cleaner & Degreaser.
2. Apply several drops of Loctite® 243™ Medium Strength Threadlocker into the keyway or apply Loctite® QuickStix™ 248™ to the key.
3. Insert the key into the keyway.
4. Wipe off excess adhesive.
5. Allow to cure before assembling the shaft-mounted component.



RESULTS



- Eliminates micro-movements that can lead to fretting
- Prevents keyway wear
- Prevents corrosion
- Eases disassembly

Keyed Assemblies

? CHALLENGE

Repairing worn keyed assemblies

CAUSE

- Alternating loads and combined loading results in micro-movement wear and loose parts
- Over time wear can cause keys to loosen – leading to damage of the keyway.
- Out-of-tolerance machining



i SOLUTION #1

Loctite® 660™ Quick Metal® Retaining Compound is a very thick product, allowing it to fill large gaps.

STEPS

1. Clean shaft, keyway, and key stock with Loctite® ODC-Free Cleaner & Degreaser.
2. Apply Loctite® 660™ Quick Metal® Retaining Compound into the worn keyway.
3. Insert the key into the keyway, wipe off excess, and allow to cure.
4. Assemble component as usual.

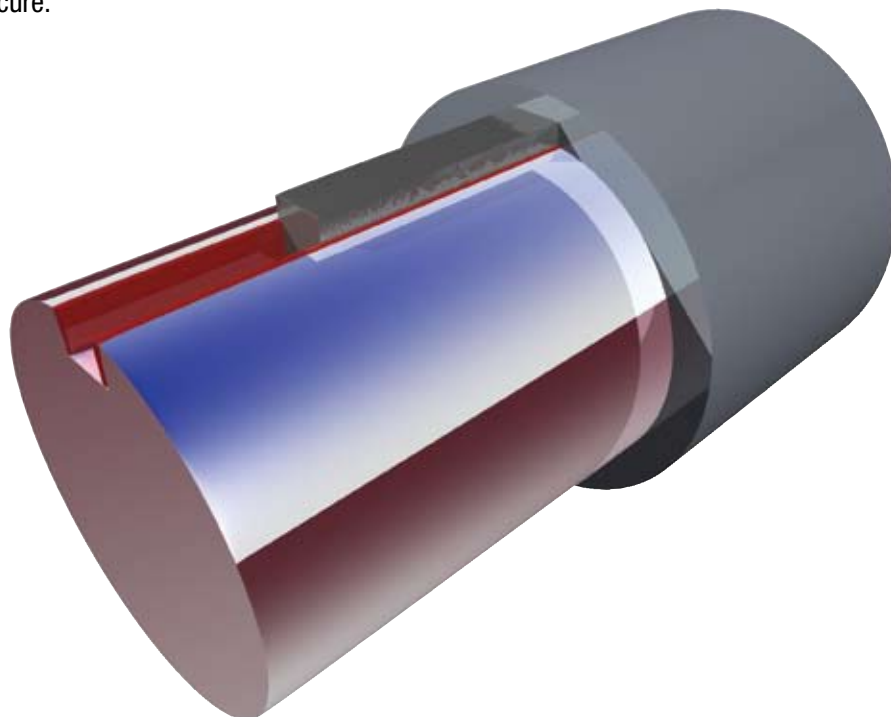


SOLUTION #2

Repairing badly worn keyed assemblies by resizing the existing keyway

STEPS

1. Resize the worn keyway.
2. Select proper keystock to fit the new keyway.
3. Machine a step in the new key to fit the female component.
4. Clean parts with Loctite® ODC-Free Cleaner & Degreaser.
5. Apply Loctite® 609™ retaining compound to the keyway of the shaft (where there is a high power application, apply Loctite® 609™ onto the whole shaft at the engagement area).
6. Assemble the key into the shaft.
7. Wipe off excess adhesive.
8. Allow product to cure.



Keyed Assemblies

SOLUTION #3



Alternate solution for badly worn keyway: fill in worn keyway and cut new keyway

If parts are very badly worn, it may be necessary to cut new keyways. In this situation the old keyways can be filled as described below.

STEPS

1. Clean parts with Loctite® ODC-Free Cleaner & Degreaser.
2. Apply Loctite® Fixmaster® Superior Metal into the keyway of both the shaft and collar. Fill all the available space. Allow to cure.
3. If a rounded surface is required, machine the repair to the original dimensions of the shaft and bore of the collar.
4. Machine a new keyway in the shaft and collar, opposite the original keyway.
5. Re-clean parts with Loctite® ODC-Free Cleaner & Degreaser.
6. Apply several drops of Loctite® 243™ Threadlocker directly into the new keyway and insert key.
7. Wipe off any excess adhesive.
8. Assemble the components.
9. Allow to cure.



RESULTS



- Restores assembly, so it is ready for service without a major overhaul
- Secures the key in the keyway
- Eliminates micro-movements that lead to fretting
- Prevents corrosion

? CHALLENGE

Reliably securing fixed spline assemblies

CAUSE

- Out-of-tolerance machining of components leads to micro-movement and wear
- Alternating loads
- Worst case combined loading
- Damage during assembly
- Incorrect assembly due to contamination of the parts
- Incorrectly specified spline drive – producing overload during operations



i SOLUTION

Secure fixed spline assembly with Loctite® 660™ Quick Metal®

STEPS

1. Create a chamfer on the leading edges of the socket if there isn't one, using a file or grinding wheel.
2. Abrasive-blast the surface of the splines.
3. Clean parts with Loctite® ODC-Free Cleaner & Degreaser.
4. Apply Loctite® 660™ Quick Metal® to the shaft. Do not apply product into the socket.
5. Immediately push the spline/toothed shaft into the socket and remove excess adhesive.
6. Allow the adhesive to cure before returning to service.



✓ RESULTS

- Restores assembly, so it is ready for service without a major overhaul
- Reduces scrap and costs by salvaging components
- Reduces downtime

Spline Assemblies

? CHALLENGE



Lubricate and protect sliding spline assemblies from unnecessary fretting and wear

CAUSE

- Wear will occur where there is friction and movement in the spline coupling
- Contamination between shaft and socket



i SOLUTION



Apply Loctite® Moly Paste to splines during assembly to reduce friction

STEPS

1. Clean mating surfaces before application with Loctite® ODC-Free Cleaner & Degreaser.
2. Coat mating surfaces with Loctite® Moly Paste.
3. Assemble parts.



RESULTS



- Withstands extreme pressure and heavy loads
- Prevents wear caused by friction for long-lasting assemblies
- Prevents corrosion

Shaft Application Product Table

Application	Loctite® Solution	Benefits	Sizes	Part No.	Page
SHAFT REPAIR					
Repairing badly worn shaft	Loctite® Fixmaster® Superior Metal	Non-rusting, ferro-silicone-filled epoxy. Extremely high compressive strength and wear resistance. Sets in 20 minutes.	1 lb. Kit	97473	4
			4 kg Kit	40900	
Sleeving	Loctite® 609™ Retaining Compound	General purpose, low viscosity adhesive for bonding cylindrical assemblies. Ideal for gap distances up to 0.005" diametral clearance. Fixtures in 10 minutes.	50 ml	60931	5
SECURING CYLINDRICAL & TAPER JOINTS					
Press Fit – Mounting components to shaft	Loctite® 603™ Retaining Compound	A retaining compound tolerant of oil and other contamination. Seals and secures gaps up to 0.005" diametral clearance. Fixtures in 10 minutes.	50 ml	21441	6
	Loctite® QuickStix™ 668™ Retaining Compound	Convenient semisolid formula. Withstands temperatures to 400°F (204°C). Ideal for gaps up to 0.005" in diameter.	19 g stick	39148	6
	Loctite® 609™ Retaining Compound	Low viscosity adhesive for bonding cylindrical assemblies. Ideal for gap distances up to 0.005" diametral clearance. Fixtures in 10 minutes.	50 ml	60931	6
Slip Fit – Mounting components to shaft	Loctite® 620™ Retaining Compound	High temperature resistance up to 450°F. High viscosity securing cylindrical assemblies up to 0.015" diametral clearance.	50 ml	62040	6
	Loctite® 680™ Retaining Compound	A high strength retaining compound capable of filling diametral gaps up to 0.015". Allows for more relaxed machining tolerances.	50 ml	68035	6
Mount components requiring medium to large gap fill	Loctite® 660™ Quick Metal® Retaining Compound	A creamy, non-running gel ideal for filling surface imperfections and worn areas. Ideal for gaps up to 0.020".	50 ml	66040	6
Prevent bearing spinout, corrosion and component damage	Loctite® 609™ Retaining Compound	Low viscosity adhesive for bonding cylindrical assemblies. Ideal for gap distances up to 0.005" diametral clearance. Fixtures in 10 minutes.	50 ml	60931	7
	Loctite® 603™ Retaining Compound	A retaining compound tolerant of oil and other contamination. Seals and secures gaps up to 0.005" diametral clearance. Fixtures in 10 minutes.	50 ml	21441	7

Application	Loctite® Solution	Benefits	Sizes	Part No.	Page
KEYED ASSEMBLIES					
Prevent keyway wear	Loctite® 243™ Threadlocker	Anaerobic adhesive fills airspace, eliminating any micro-movement between the parts. Oil resistant, removable strength.	50 ml	24078	8
	Loctite® QuickStix™ 248™ Medium Strength Threadlocker	Convenient semisolid anaerobic adhesive fills airspace, eliminating any micro-movement between the parts. Removable strength.	19 g stick	37087	
Repair worn keyways	Loctite® 660™ Quick Metal® Retaining Compound	A creamy, non-running gel ideal for filling surface imperfections and worn areas. Ideal for gaps up to 0.020".	50 ml	66040	9
	Loctite® 609™ Retaining Compound	Low viscosity adhesive for bonding cylindrical assemblies. Ideal for gap distances up to 0.005" diametral clearance. Fixtures in 10 minutes.	50 ml	60931	10
	Loctite® 243™ Threadlocker	Anaerobic adhesive fills airspace eliminating, any micro-movement between the parts. Oil resistant, removable strength.	50 ml	24078	8, 11
	Loctite® Fixmaster® Superior Metal	Non-rusting, ferro-silicone-filled epoxy. Extremely high compressive strength and wear resistance. Sets in 20 minutes.	1 lb. Kit 4 kg Kit	97473 40900	11
SPLINE ASSEMBLIES					
Securing fixed spline assemblies	Loctite® 660™ Quick Metal® Retaining Compound	A creamy, non-running gel ideal for filling surface imperfections and worn areas. Ideal for gaps up to 0.020".	50 ml	66040	12
Protect sliding spline assemblies from fretting and wear	Loctite® Moly Paste	Metal-free, general purpose lubricant. Lubricates and protects especially well during break-in and under high loads up to 750°F (400°C).	8 oz. brush-top can	51048	13
			1 lb. brush-top can	51049	
CLEANER AND PRIMER					
Cleaning and degreasing prior to bonding	Loctite® ODC-Free Cleaner & Degreaser	Non-aqueous, hydrocarbon-based solvent for cleaning and degreasing surfaces to be bonded with adhesives, as well as any general purpose industrial cleaning.	15 oz. net wt. aerosol	22355	—
Priming components	Loctite® 7649™ Primer N™	Use with Loctite® Retaining and Threadlocking products to speed the cure on active metals or to ensure cure on inactive metals (stainless steel, aluminum, plated parts, etc.).	1.75 fl. oz. bottle	38402	—
			25 g net wt. aerosol can	21347	—

At Henkel Corporation we invent more than just quality Loctite® brand products, we provide solutions to industries' biggest challenges. Whether looking to reduce costs, increase the reliability of equipment, or assist in product application, Henkel is dedicated to earning and keeping the trust of our customers.

Here are just a few Loctite® tools and services you may be interested in:



Loctite® Maintenance Workshop

Two hours of on-site training reviewing common maintenance challenges and the appropriate Loctite® product solution customized to the needs of your plant. Visit our website to learn more, download Literature “LT-3690”, or contact your local Loctite® Specialist to schedule a workshop.

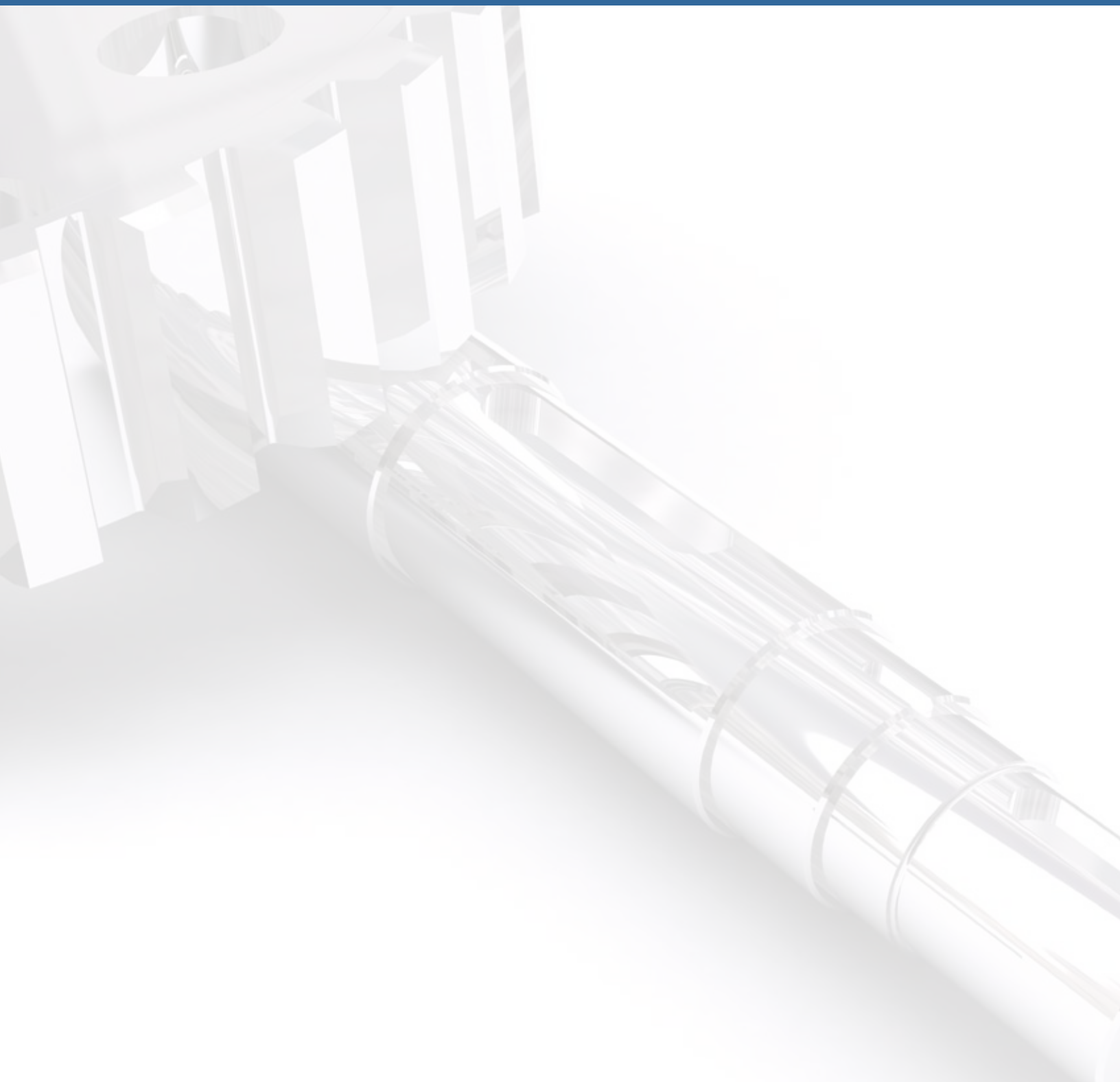
Loctite® Industrial Pump Rebuild and Maintenance Guide

This comprehensive guide details the assembly and repair steps that can be taken to increase efficiency and reduce or even eliminate common failures with centrifugal pumps. To get a copy of this guide, visit our website or call us and reference “LT-4047”.



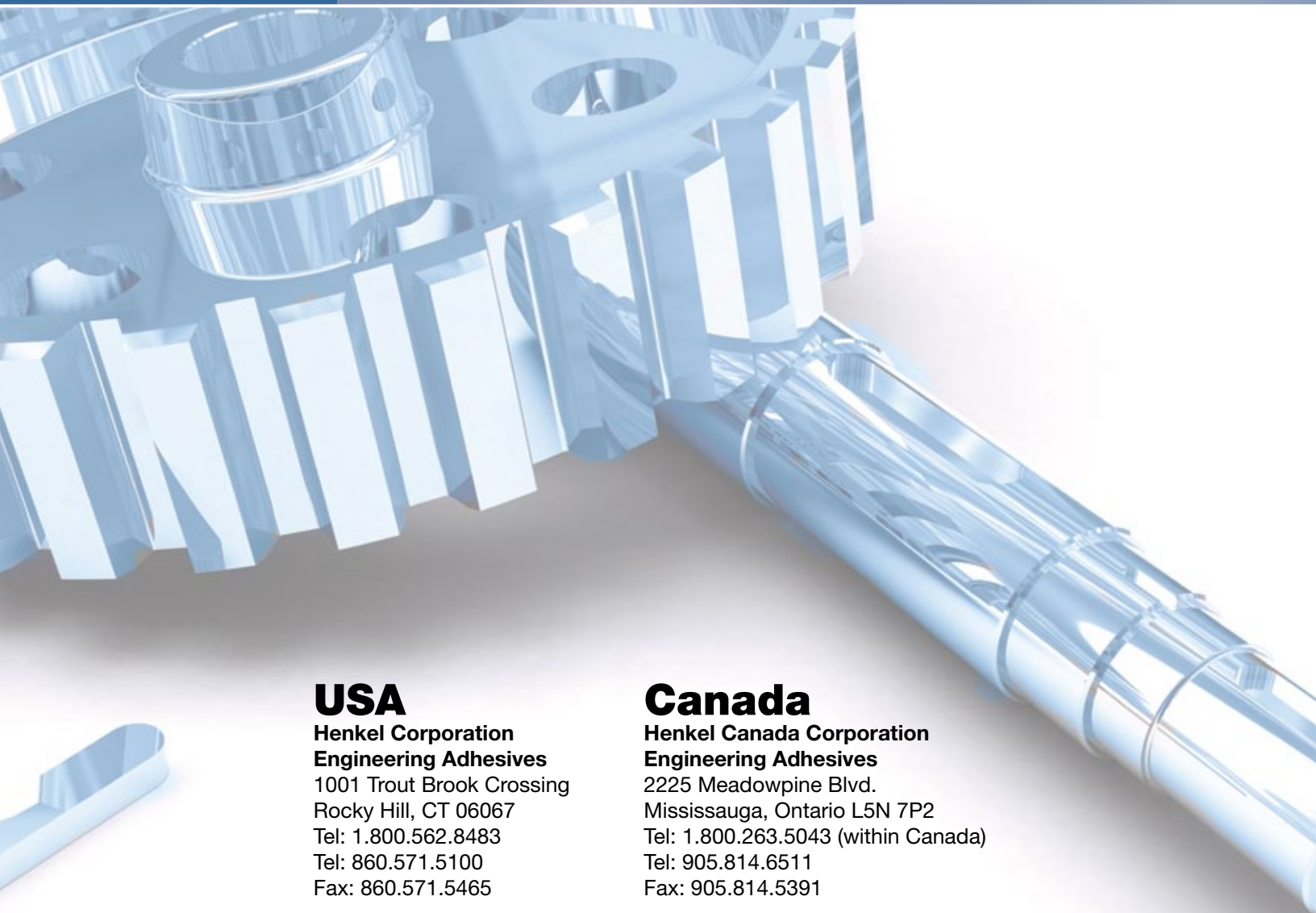
Loctite® Industrial Gearbox Service Manual

This guide is designed to provide quick and easy assistance to professionals who service industrial gearboxes and look for reliability, longevity, and cost reduction. To get a copy of this guide, visit our website or call us and reference “LT-4872”.





**Henkel –
Your worldwide partner**



USA

**Henkel Corporation
Engineering Adhesives**
1001 Trout Brook Crossing
Rocky Hill, CT 06067
Tel: 1.800.562.8483
Tel: 860.571.5100
Fax: 860.571.5465

Canada

**Henkel Canada Corporation
Engineering Adhesives**
2225 Meadowpine Blvd.
Mississauga, Ontario L5N 7P2
Tel: 1.800.263.5043 (within Canada)
Tel: 905.814.6511
Fax: 905.814.5391

**Henkel Corporation
Engineering Adhesives
1001 Trout Brook Crossing
Rocky Hill, CT 06067
U.S.A.
www.henkelna.com/mro
www.loctite.com**

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