

# Increasing Harsh-Environment Equipment Life through Proper Coating Selection.

Loren Nauss, September 12, 2019  
Pumps and Systems Magazine, and Loctite



# Who I am:



- Loren Nauss, Business Development Manager, Maintenance Chemicals, Henkel
- Focusing on Protective Coatings
- Bachelor's Degree in Business, Eastern Connecticut State University
- 28 years of experience supporting:
  - Rebuilding, repairing and fabricating industrial equipment and incorporating the use of Loctite adhesive, Sealing, and Coating solutions.
  - Industry experience includes products, projects and applications in mines, quarries, pulp and paper industry, power gen, oil and gas, as well as many other general industrial areas.
  - 6 years machinist

# | AGENDA

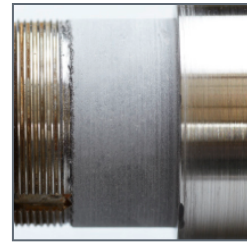
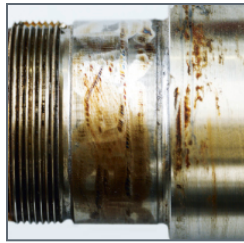
1. What is this webinar going to be about?
2. Webinar Description
3. Webinar Goals
4. Definitions
5. Proper Surface Preparation
6. Metal Repair/Rebuild Compounds
7. Protective Coatings and Compounds
8. Concrete Repair and Protective Coating
9. Questions



# | Webinar Descriptor

- This webinar will take a look at the conditions that cause premature wear, fatigue and eventual failure of equipment and will help you understand the parameters around an application that can be used to help select a coating solution to ensure your equipment assets are protected and life extended as long as possible.





# | Webinar Goals

- Understand the features and benefits of Wear, Abrasion, and Chemical Resistant Coating solutions
- Know how to select the right product/products needed for your application
- Methods of application
  - Proper surface preparation (Touch-on)
- Provide a guideline for choosing products for a specific applications
  - For rebuilding & protective coatings and compounds
  - On metal and concrete structures (Touch-on)
- Information on repair systems and how to use them on selected industrial equipment or components to increase life and improve efficiency

# | Definitions

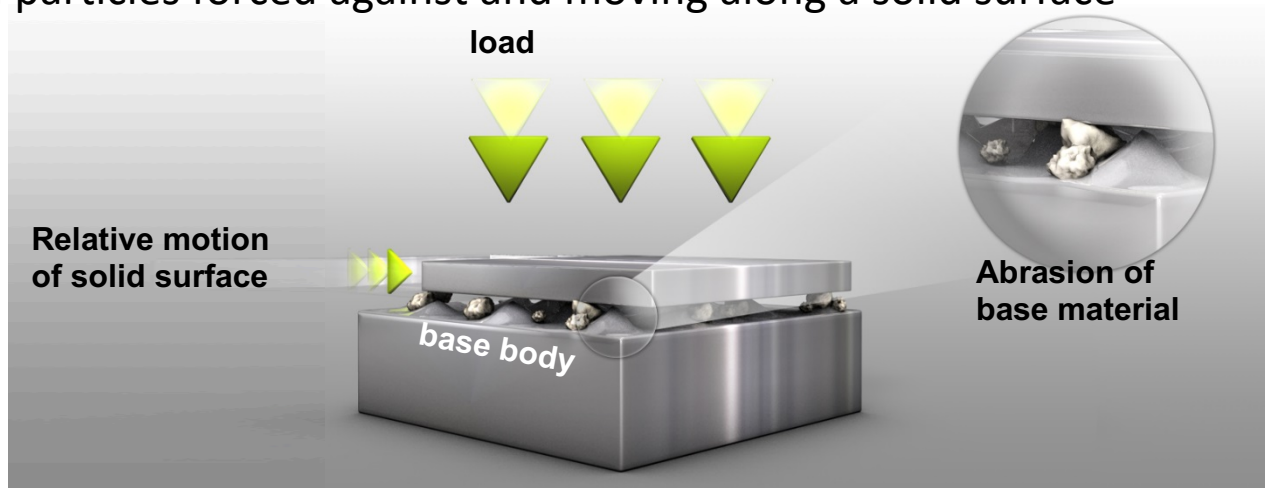
## Wear

- **Definition of Wear**
  - Wear is the loss of material of the surface of a solid body by means of contact and movement of a solid, liquid or gaseous opposing body
  
- **Most important wear mechanisms**
  1. Abrasion
  2. Erosion
  3. Cavitation
  
- **Corrosion and chemical attack** on metal surfaces accelerate the effect of the wear mechanism

# | Definitions

## Wear

- **Abrasion**
  - Can be two or three component wear,
  - Solid surfaces act against each other with a load and a relative motion
  - Hard particles forced against and moving along a solid surface

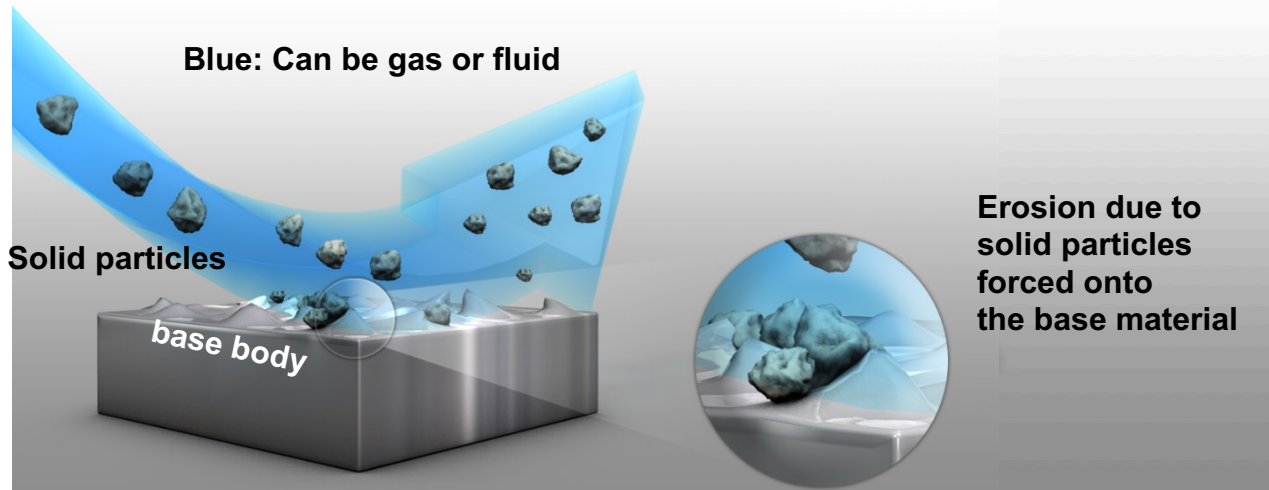


# | Definitions

## Wear

- **Erosion**

- Is wear due to mechanical interaction between the surface and a gas or fluid (water – seawater – wastewater etc.) loaded with solid particles
- Wear of the base material by solid particles forced onto the surface

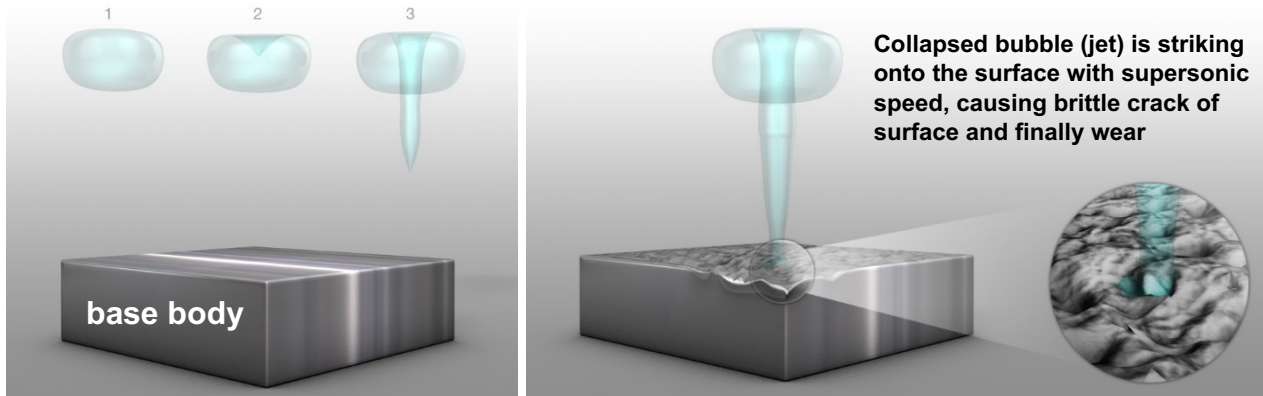


# Definitions

## Wear

### ■ Cavitation

- Is a form of erosion causing material to wear by the action of vapor bubbles in a very **turbulent liquid** and rapid changes in pressure (e.g. high speed impeller)

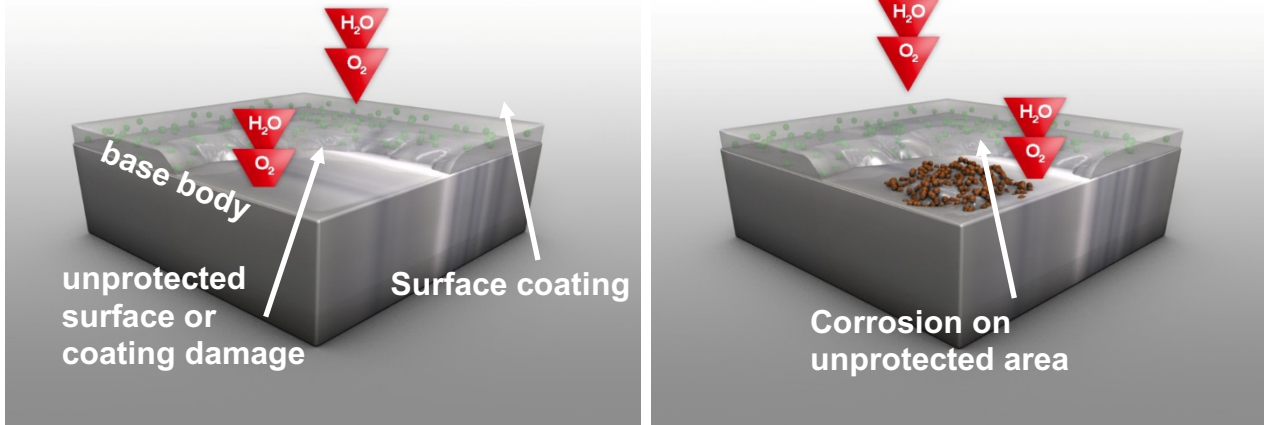


- (1) Formation of vapour or gas bubbles from changes in pressure in the liquid
- (2) Collapse of bubbles or cavities by pressure rise
- (3) Formation of a jet towards the surface

# Definitions

## Corrosion

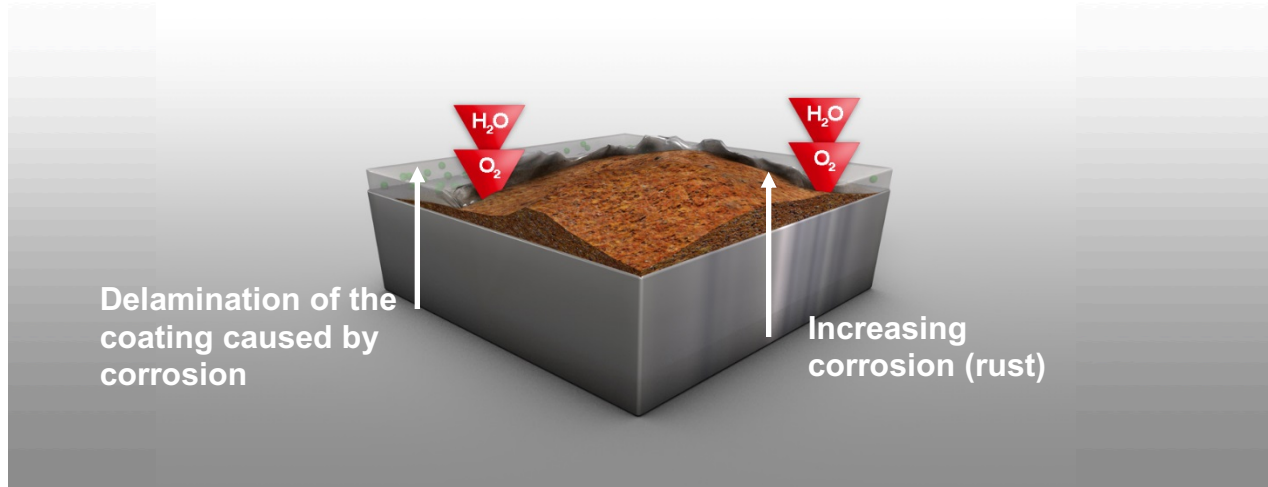
- Corrosion is caused by water ( $H_2O$ ) acting as an electrolyte, oxygen ( $O_2$ ) and a difference in potential at the metal surface (building of an electrochemical cell)
- Corrosion can happen on unprotected areas of metal surfaces or where coating is damaged (e.g. cracks or worn coatings)



# Definitions

## Corrosion

- Corrosion increases and continues to progress along the metal surface
- Eventually creeping under the coating which leads to delamination





## Surface Preparation



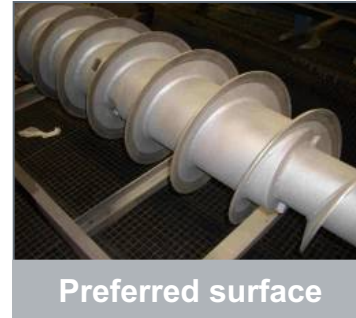
# | Cleaning & Pre-Treatment

To achieve a properly prepared surface for durable repair and coating

- **Preferred surface cleanliness**
  - Free of contaminations (oil, grease)
  - Free of loose particles (rust, dust)
  - Free of critical residues (rust, salt)
- **Preferred surface profile**



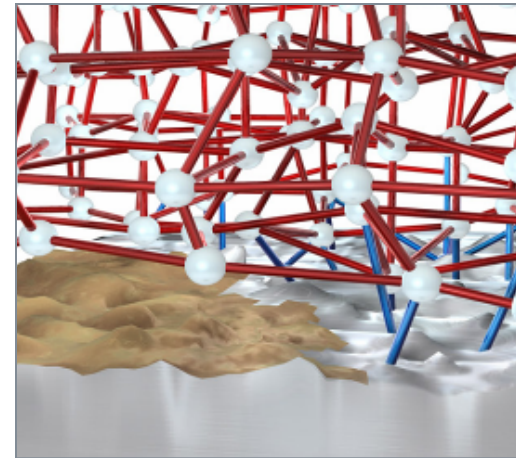
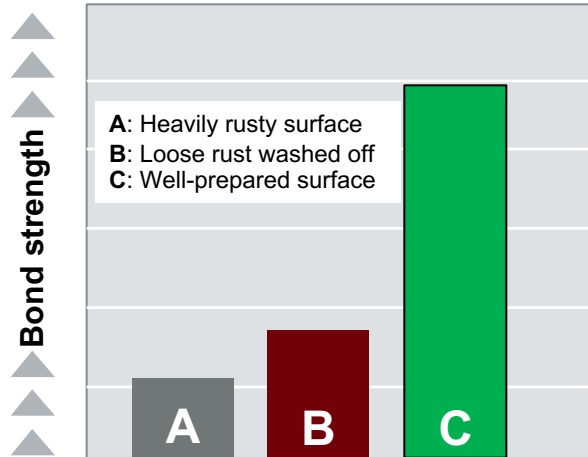
Cleaning & Pre-Treatment



# | Cleaning & Pre-Treatment

## A surface conducive to bonding must be achieved

- For best adhesion
- For best strength
- Contamination = barrier between part and coating product



- Contaminant
- Cohesion
- Adhesion

# | Cleaning & Pre-Treatment Target

**A surface conducive to bonding must be achieved**

- For long term durability



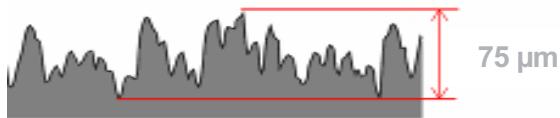
Corrosion underneath the coating  
caused by salt contamination

# Cleaning & Pre-Treatment

## Abrasive Blasting

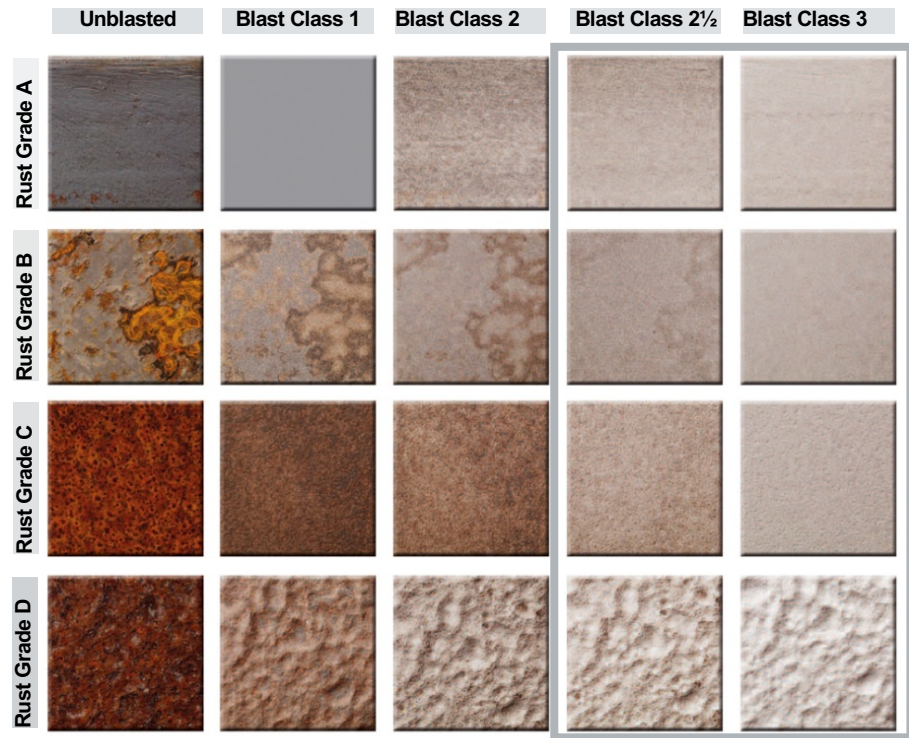
### Target:

- SA 2½ class (SSPC - SP10)
- 75 µm profile



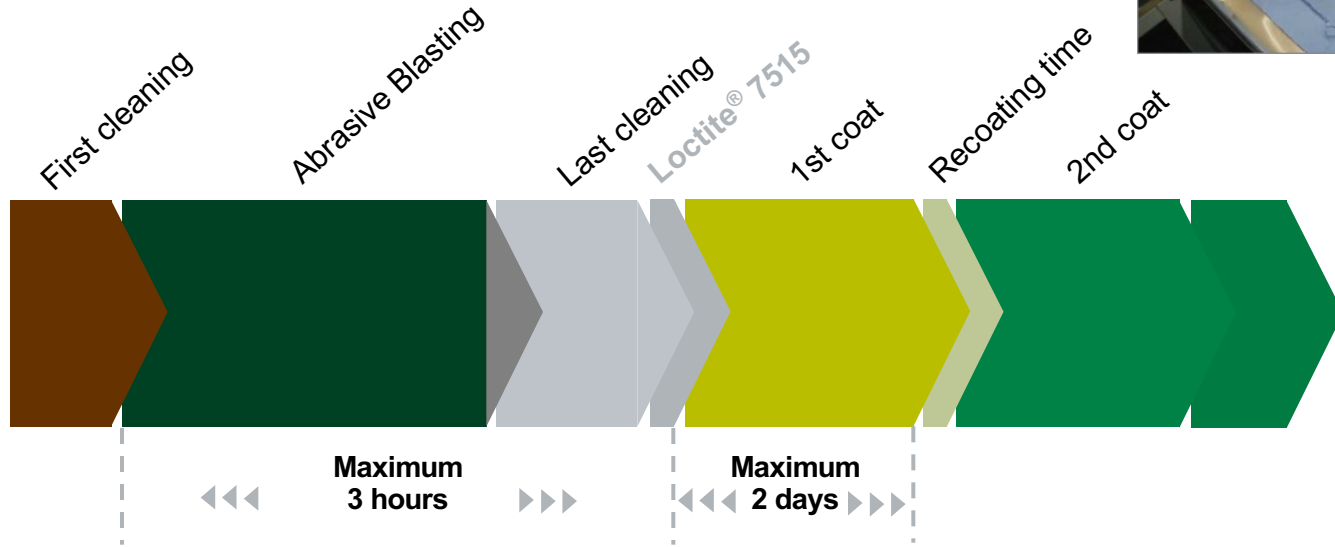
### When viewed without magnification:

- Free from visible oil, grease and dirt
- Free from most of mill scale, rust
- Free from paint coatings, foreign matter
- Only remaining of slight stains in form of **spots** or **stripes**



# Cleaning & Pre-Treatment

## Rebuilding Cycle – Extended Process Window



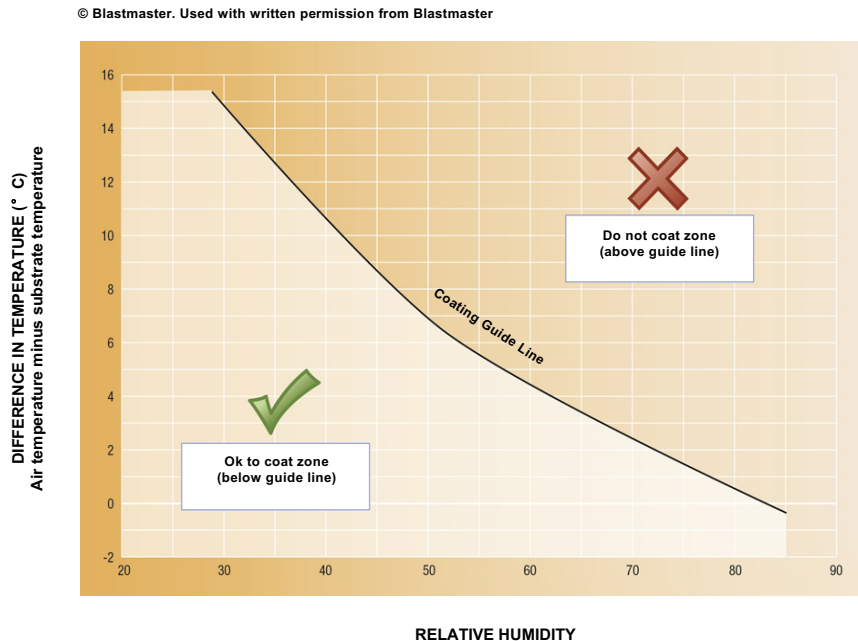
# Cleaning & Pre-Treatment

## Avoid Condensing Humidity

### Coating Guide Line:

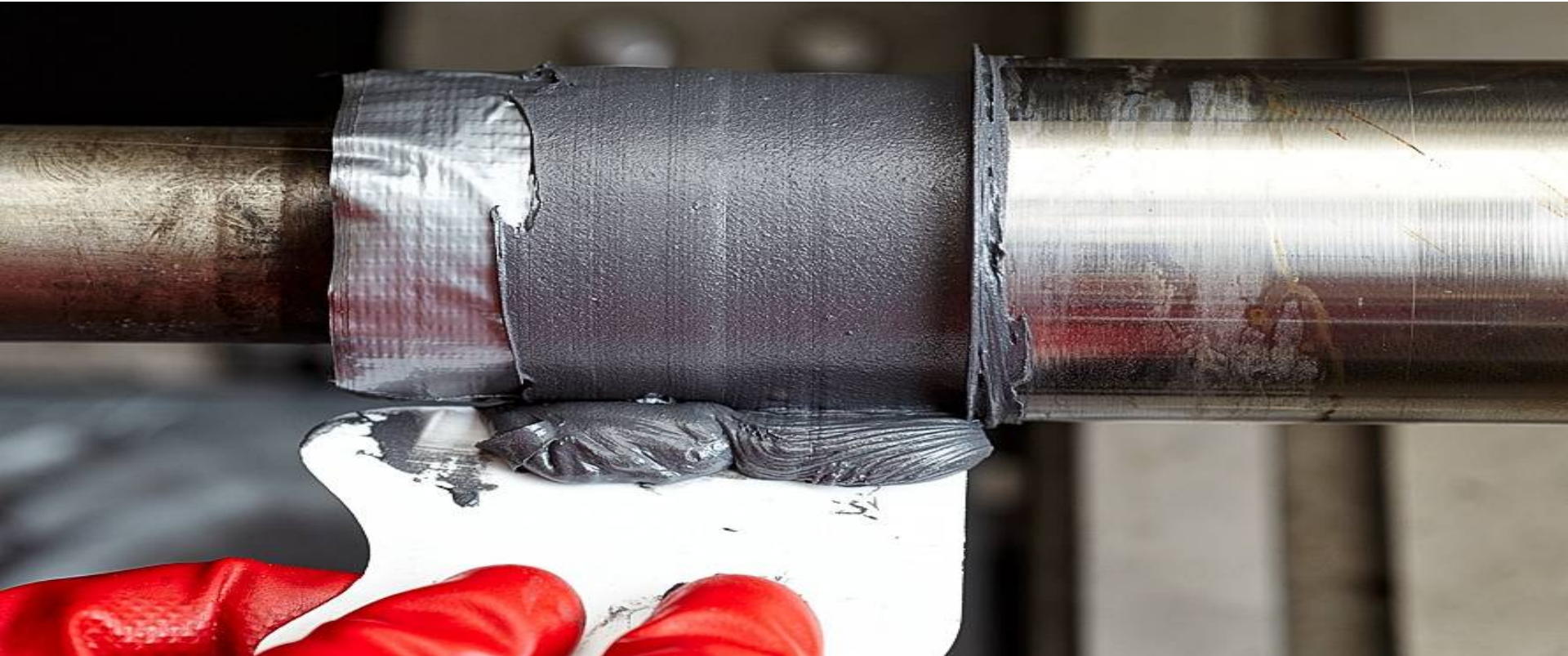
This guideline considers

- Part surface temperature
- Air temperature
- Relative humidity
- Recommendation to stay 7°F (3°C) above dew point





# Metal Repair and Rebuilding Compounds





# | Rebuilding Compounds

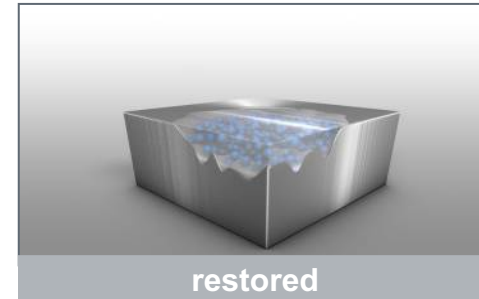
Repair and rebuild worn/damaged parts back to a serviceable condition

- **Damaged parts**



▶ ▶ ▶  
High Performance  
Compounds

- **Repaired**
  - **Easy**
  - **Fast**
  - **Durable**



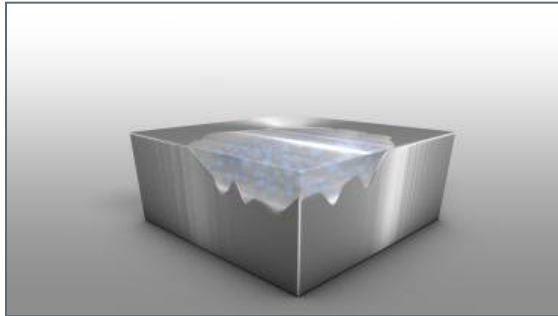
# | Rebuilding Compounds

## Product Features

Rebuilding compounds combine the features of Matrix and Fillers

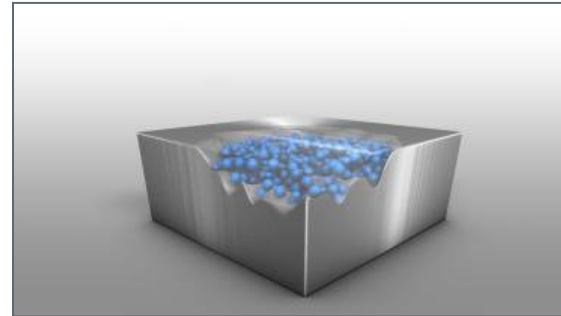
- **Epoxy - Matrix**

- Easy application (liquid, pasty)
- Versatility (surface, dimensions etc.)
- Cure properties
- Adhesion to surface



- **Fillers**

- High mechanical performance
- High compression strength
- Low shrinkage
- Machineability

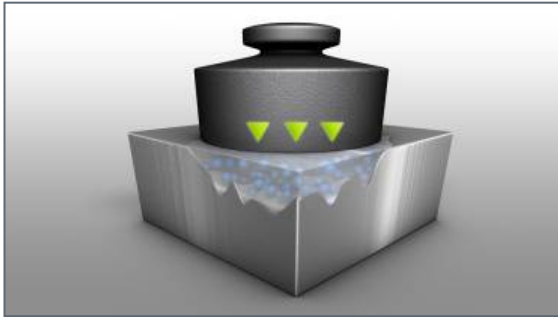


# | Rebuilding Compounds

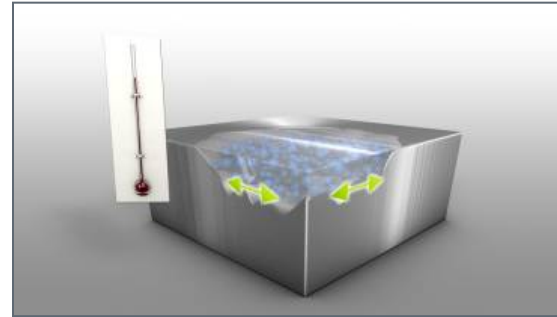
## Product Features

Most important features

- **High compression strength**



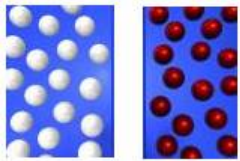
- **Controlled thermal expansion**



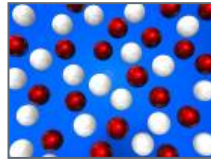
# | Rebuilding Compounds

## Epoxy Matrix - Cure

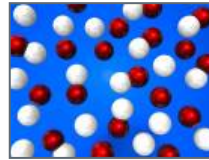
- **Resin and hardener need to be mixed**
  - Right mixing ratio
  - Thorough mixing process
- **With mixing the cure starts (working life)**



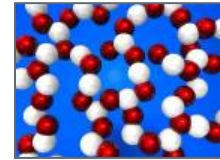
Components  
A&B




Mixed



Cure starts



Thermoset  
Polymer

 = Hardener

 = Epoxy resin

# Rebuilding Compounds Forms

Putty i.e. Loctite® Metal Magic™  
(EA 3463)



Mixing of liquid products i.e.  
Loctite® Fixmaster® Steel Liquid™  
(EA 3472)



Mixing of paste products i.e.  
Loctite® Superior Metal™ (EA 3478)



# | Rebuilding Compounds

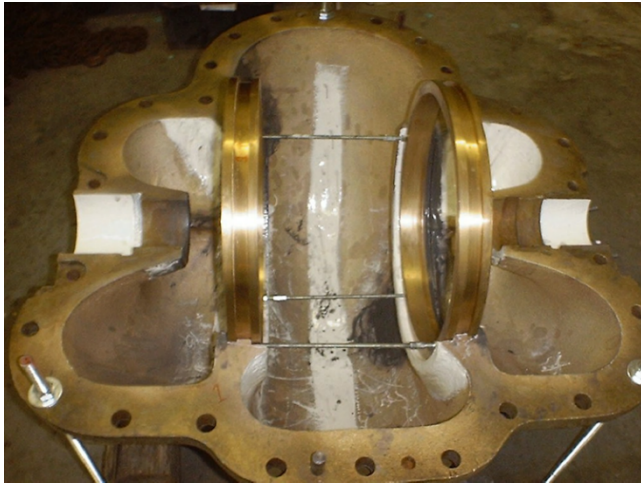
## Product Application

How to apply the product?



# | Rebuilding Compounds Product Application

- Rebuilding / Resurfacing Pumps





# | Rebuilding Compounds

## Application Example

**Repair of a shaft worn by movement of a ball bearing**





# | Rebuilding Compounds

## Application Steps to Repair a Worn Shaft

### Filling with Loctite® Superior Metal™ (EA 3478)

- Mask off repair area with tape
- Mix appropriate amount (+) of Loctite® EA 3478
- First apply thin layer of Loctite® EA 3478 on whole repair area building thickness gradually (to avoid bubbles)
- Final applied diameter must be a bit bigger than nominal shaft diameter
- Cure -24 hrs at 70°F or 12 hrs at 100°F
- Machine repair area to nominal diameter
- Clean and bond new bearing upon install with Loctite retaining compound



# | Rebuilding Compounds

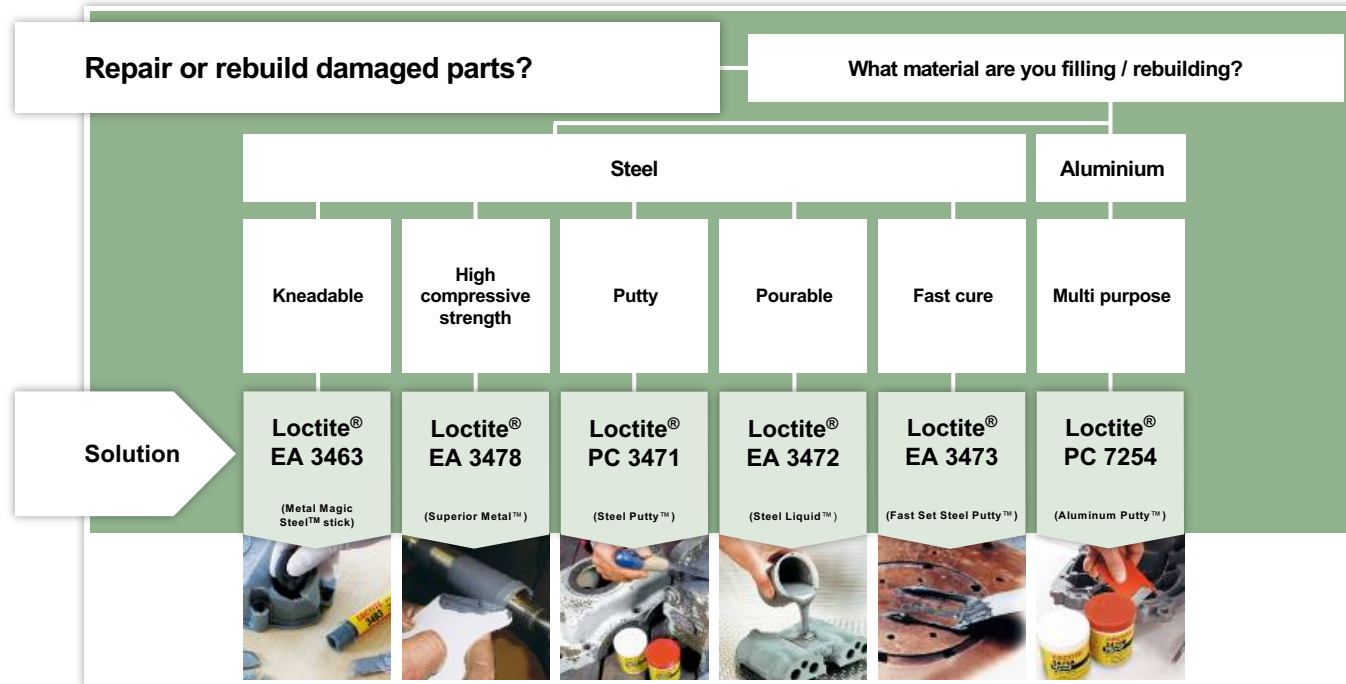
## Summary

Repair and rebuild metal parts back to a serviceable condition

- For damaged parts
- Easy
- Fast
- Durable
- Can be drilled, tapped or machined
- Superior adhesion to metal
- Excellent resistance against chemicals

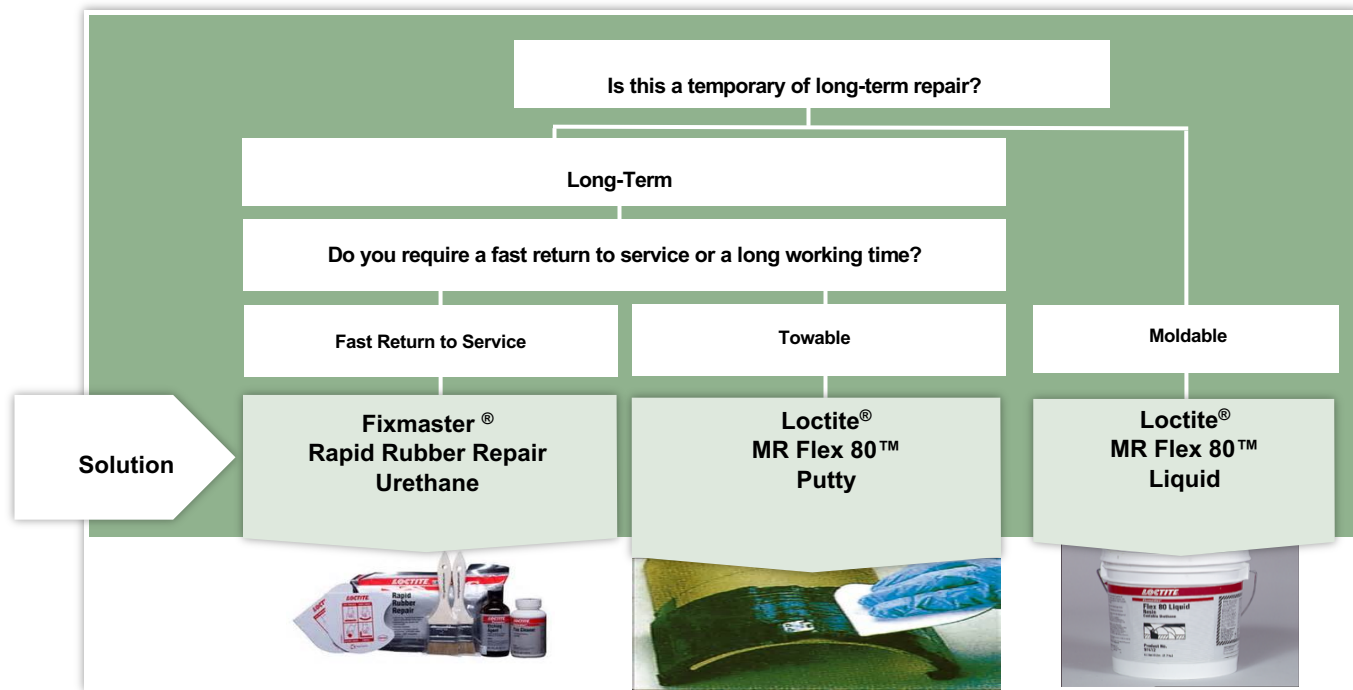
# Rebuilding Compounds

## Product Selection



# Rebuilding Compounds

## Product Selection



## Protective Coatings & Compounds



# | Protective Coatings & Compounds

**Resurface and protect metal parts and surfaces from damage caused by wear, abrasion, erosion, chemical attack or corrosion**

- Protective Coating: Rebuilding of and protection against damages **caused by wear** from fluids, gases etc
- Metal-filled Compounds: Rebuilding of (and protection against) damages **caused by compression loads** (=mechanical loads), often from connected metal devices, e.g. shaft and bearing or bearing and bearing seat.

# | Protective Coatings & Compounds

## Product Application Example

Repair of a pump housing

- **Loctite® PC 7227 GY Brushable Ceramic**



Disassembled  
corroded housing



Protected housing  
before reassembly

# Protective Coatings & Compounds

## Product Application Example

Repair of worn pump

- **Loctite® PC 7255 Sprayable Ceramic (inside)**
- **Loctite® PC 7227 BL Brushable Coating (outside)**



Worn pump



Restored pump



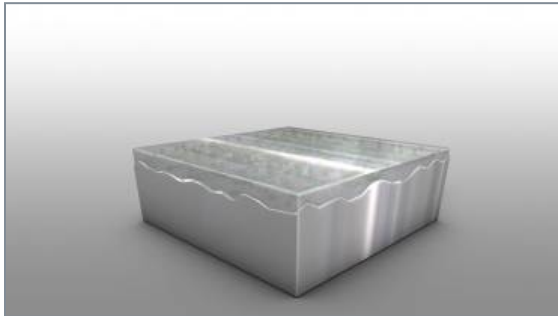
# | Protective Coatings & Compounds

## Product Features

Protective Coatings & Compounds combine features of the Matrix and Fillers

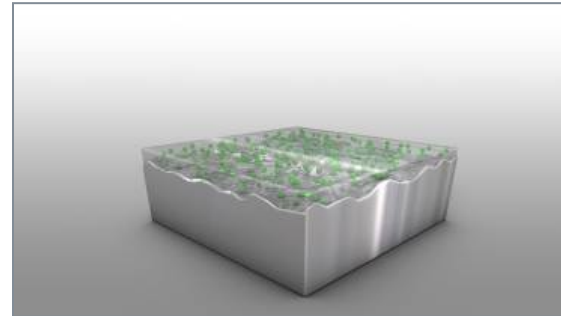
### ▪ **Epoxy – Matrix**

- Easy application (liquid, paste)
- Versatility (surface, dimensions etc.)
- Cure properties
- Adhesion to surface
- Corrosion protection



### ▪ **Fillers**

- Wear resistance
- Low shrinkage
- Adapted for abrasive particle sizes

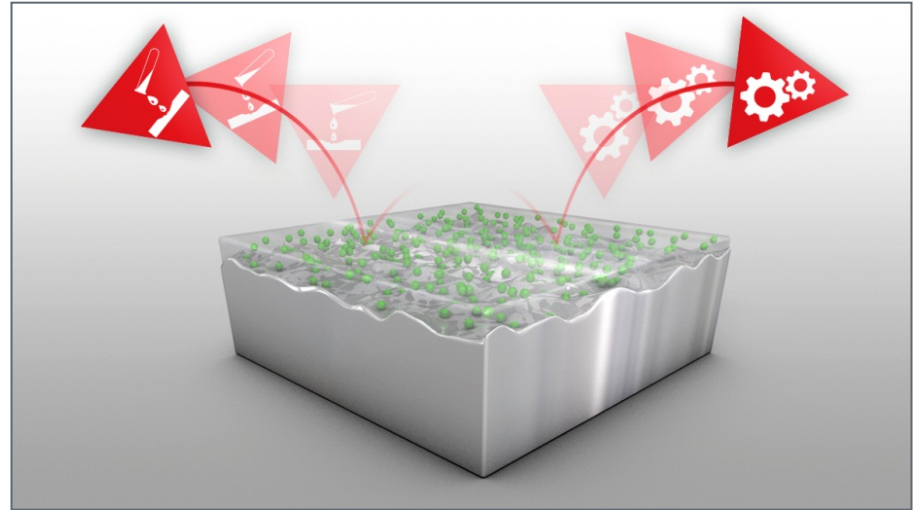


# Protective Coatings & Compounds

## Product Features

Most important features

- **Wear protection against:**
  - Erosion
  - Abrasion
- **Corrosion protection against:**
  - Water / sea water
  - Acids / alkaline

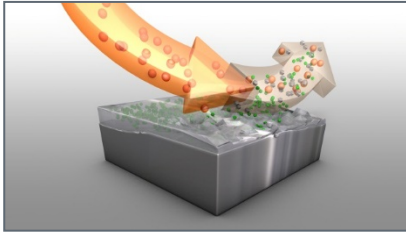


# Protective Coatings & Compounds

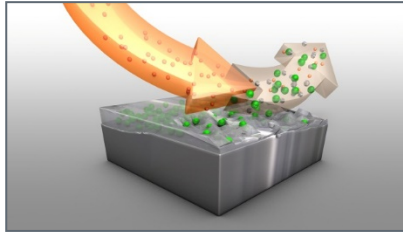
## Filler Size

Different fillers size adapted for abrasive particle size:

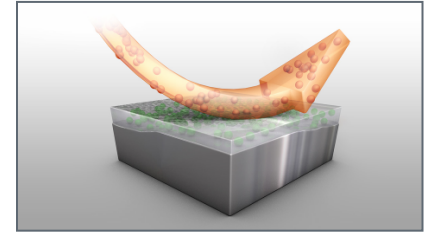
**Small fillers knocked out by large particles**



**Large fillers undermined by small particles**

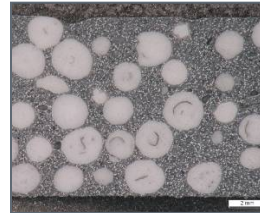


**Fillers of similar size to wear media provide best protection**

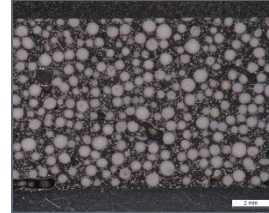


Different fillers size available, examples:

**Loctite® PC 7218**



**Loctite® PC 7226**



# Protective Coatings & Compounds

## Product Application

How to apply the product?

Brush



Spray



Roller



Spatula



# Protective Coatings & Compounds

## Application by Spatula



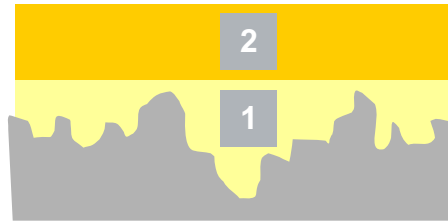
### Recommendation:

- Best use a brushable grade as primary coat for good surface contact

Non-perfect contact



Perfect contact



- 1 Primary coat of brushable grade
- 2 Large particle size coating

# | Protective Coatings & Compounds

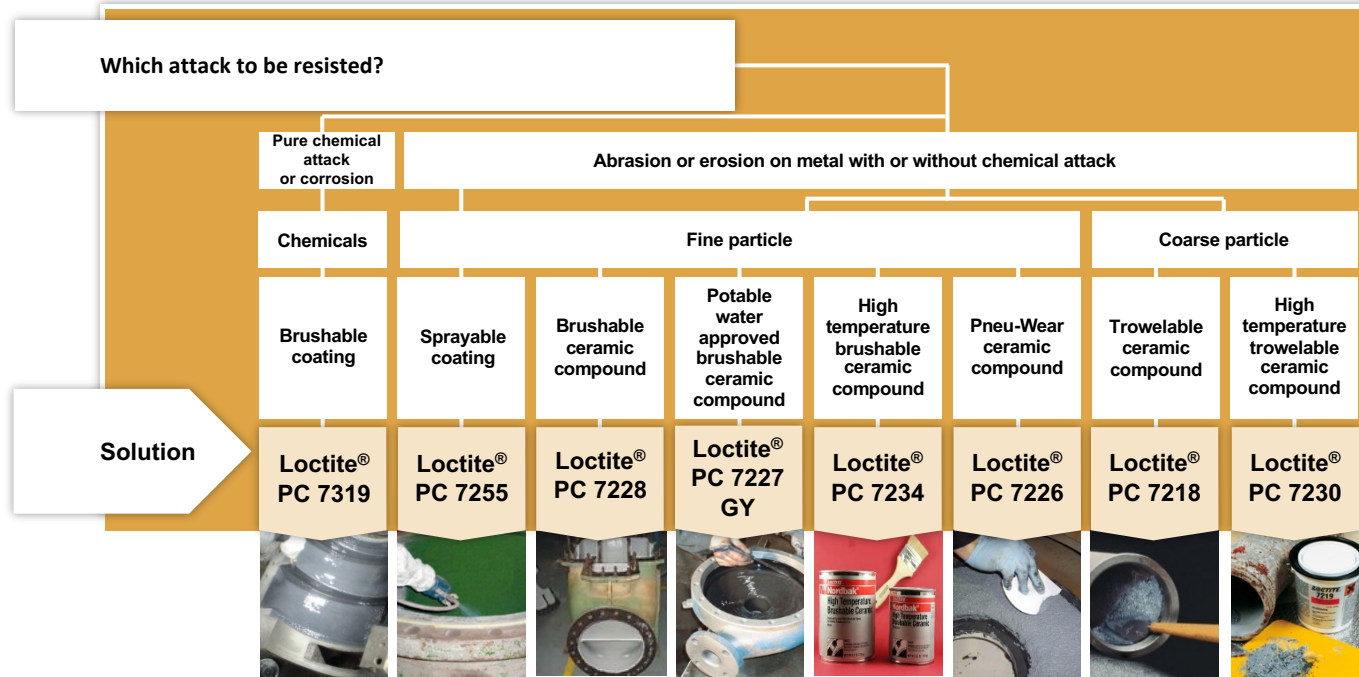
## Product Selection

Wide range of products to provide the right solution for your specific surface engineering needs!



# Protective Coatings & Compounds

## Product Selection



# Protective Coatings & Compounds

## Application Example & Benefits



### Increase reliability

of worn parts by restoring them to a serviceable condition

#### Challenge:

- Low pump efficiency due to worn waste water pump housing
- Strong chemical and mechanical aggression leads to low mean time between overhaul

#### Solution:

- Rebuild pump and protect it against chemical attack & abrasion
- Coat pump housing with two coats of Loctite 7255 sprayable ceramic coating
- After first coat, fill any large worn areas with Loctite 7219 High Impact Wearing Compound

#### Benefit:

- Increase efficiency factor and flow rate by up to 12 %
- Higher reliability of device results in an increase in mean time between failure from 4 to 6 years





# | Protective Coatings & Compounds

## Application Example & Benefits



### Save time

by minimizing downtime and extending part life

#### Challenge:

- Conveyor of industrial waste water plant exposed to aggressive media and solid particles
- Large surface to coat (diameter 2m, length 8m)
- New spare part has a long lead time of 2-3 months

#### Solution:

- Maintain device instead of replacing
- Coat with Loctite 7255 sprayable ceramic for a fast solution

#### Benefit:

- Short downtime by repairing instead of replacement
- Fast solution due to spray technology
- No complex equipment needed (only dual cartridge and a pneumatic gun)
- Extended part life with excellent corrosion and wear protection



# | Protective Coatings & Compounds

## Application Example & Benefits



### **Reduce cost**

by avoiding part replacement and increasing equipment efficiency

#### **Challenge:**

- Tube sheets of heat exchanger are prone to corrode and need an overhaul and corrosion protection
- Replacement of heat exchanger not cost-efficient

#### **Solution:**

- Maintain device instead of replacing
- Rebuild tube sheets with Loctite 3472 Metal A&B and apply a final coat of Loctite 7227 brushable ceramic

#### **Benefit:**

- Increase of mean time between failure due to higher chemical resistance than original base material
- Repair method without applying heat (welding)
- €4600 cost saving due to repair solution instead of part replacement



# Concrete Repair and Protective Coating



# | Concrete Repair and Coating

## Rebuild, repair and protect concrete

- Rebuild, repair and protect concrete structures and floors from mechanical damages and chemical attack



# | Concrete Repair and Coating Product Application Example

Repair of concrete column

- **Loctite® PC 9410 (Magna-Crete®)**



Damaged bridge column



Restored column

# | Concrete Repair and Coating

## Product Application Example

Rebuild and protection of concrete at tank area

- **Loctite® PC 7204 (High Performance Quartz)**



Concrete damaged by chemical attack



Rebuilt and protected floor

- Quartz filled epoxy for repairing and protecting concrete floors and surfaces exposed to chemical and mechanical attacks

- **Typical application areas include:**

- Floor protection in chemical containment areas
- Protection of concrete support areas against high dynamic loads
- Resurfacing ramps and stairs



# | Concrete Repair and Coating

## Product Features and Benefits – Loctite® PC 7204

### Loctite® PC 7204

- High chemical resistance
- High compression strength
- Good abrasion resistance



Reconditioning surface of channel in water treatment works

# | Concrete Repair and Coating

## Product Application Example

Concrete protection at a storage area

- **Loctite® PC 7319 Chemical Resistant Coating**



Unprotected storage area



Protected concrete

- Epoxy coating to protect concrete surfaces against chemical attacks



- **Typical application areas include:**

- Floor protection in chemical containment areas
- Tanks, reservoirs and pipes



# | Concrete Repair and Coating

## Product Features and Benefits – Loctite® PC 7319

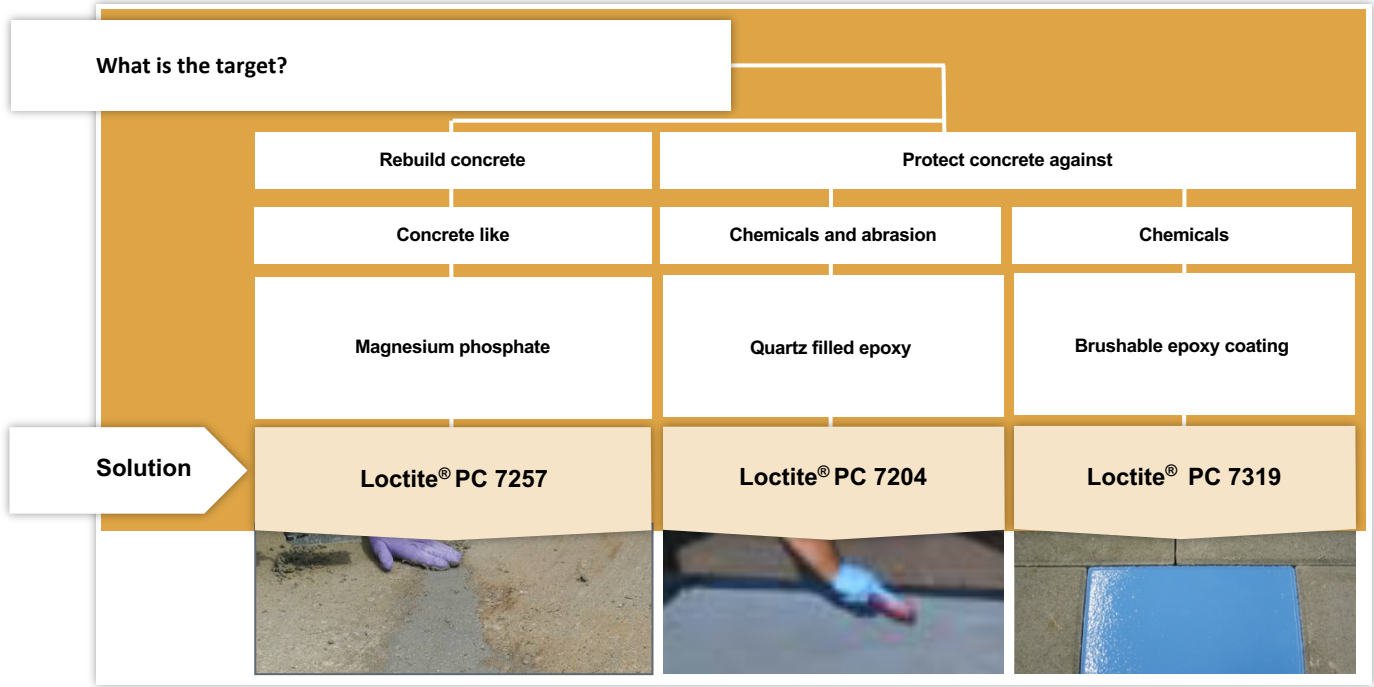
### Loctite® PC 7319

- Highly efficient coating against chemical attack
- Resistance against most acids and bases
- Easy to apply (roller, brush or spray)



Chemical attack on concrete,  
protected vs. unprotected

# Concrete Repair and Grouting Product Selection

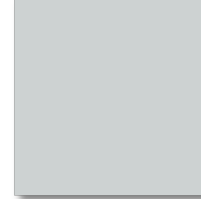
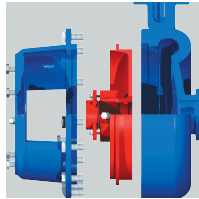
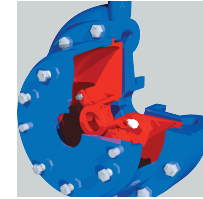
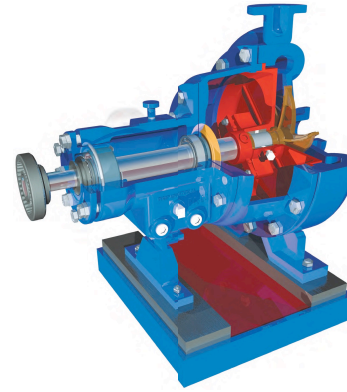


# | Increasing Harsh-Environment Equipment Life through Proper Coating Selection.

- Increase the longevity and efficiency of your equipment.
- Save and increase your profits \$\$
- Solutions that can be used in everyday maintenance practices to reduce and eliminate downtime.



Thank You!



# | Increasing Harsh-Environment Equipment Life through Proper Coating Selection.

## Contact Information



**Loren Nauss**

Business Development Manager, Polymer Composites

Office: (860) 571-2430

Mobile: (860) 424-1458

E- Email: [Loren.Nauss@Henkel.com](mailto:Loren.Nauss@Henkel.com)

**Henkel Corporation**

One Henkel Way  
Rocky Hill, CT 06067

**> Any questions or clarifications, please feel free to contact me**