# Technology Day

## Washdown Considerations for Mechanical Power Transmission

October 17th, 2013

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# Outline

- **General Concerns for Washdown Applications**
- **Example Bearing Applications**
  - Bearing Technology & Solutions
- **Example Reducer Applications**
  - Reducer Technology & Solutions

# Top Concerns for Washdown Applications

- **Water / Caustics / Contamination**
  - High pressure washdown fills reducers & bearings with water causing premature failure.
  - Caustics or chemicals degrade finishes and seals.
- **Corrosion / Paint Chipping**
  - Reducers or bearings bores corrode and seize to shafts, causing a maintenance nightmare.
  - Rusted housings potentially contaminate the product.
- **Compromised Seals / Leaking Oil**
  - Grease / oil from bearings or reducers potentially contaminate food product.
  - Lack of lubrication leads to breakdowns, which are expensive!
- **Discontinued / Non-standard Products**
  - Legacy products are expensive with long lead times.
  - Lack power density - lack washdown provisions / options

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# Food and Drug Administration (FDA)

- **What FDA Regulates**
  - All Food products (except meat and poultry)
  - Drugs (legal)
  - Human Blood Supply
  - Medical Devises
  - Radiation emitting products
  - Veterinary feeds and pet foods
  - Cosmetics

- **What FDA Does not regulate**
  - Alcohol (ATF does)
  - Food advertising
  - Illicit drugs
  - Meat and Poultry
  - Pesticides (EPA)
  - Restaurants and Grocery Stores (local county health dept)
  - Water (EPA)
  - Approval of Gearboxes and bearings

# Evolution to HACCP

- **Definition- Hazard Analysis and Critical Control Points.**
  - A systematic preventive approach to food safety that addresses physical, chemical, and biological hazards as a means of prevention rather than finished product inspection.
- **Prior to HACCP- "product and test" procedures were widely used- reactive in nature**
- **Accountability for systematic prevention was delegated back to the Food Processors**
- **Food Processors must establish, implement and be accountable for their own HACCP plans-**
  - Example - Identifying potential bacterial harbor points in a process and implementing measures to prevent, measure, and develop a corrective action plan in case of system failure.

# Washdown Bearings - Objectives

- **Protect the bearing element from contaminants**
- **Eliminate potential for rust**
- **Produce longer bearing life**

# Rusted bearings are easy to find in washdown applications

- Does not conform with HCCAP approach
- Potential for contamination in product
- Significantly decreased bearing life
- Increased maintenance costs and down time

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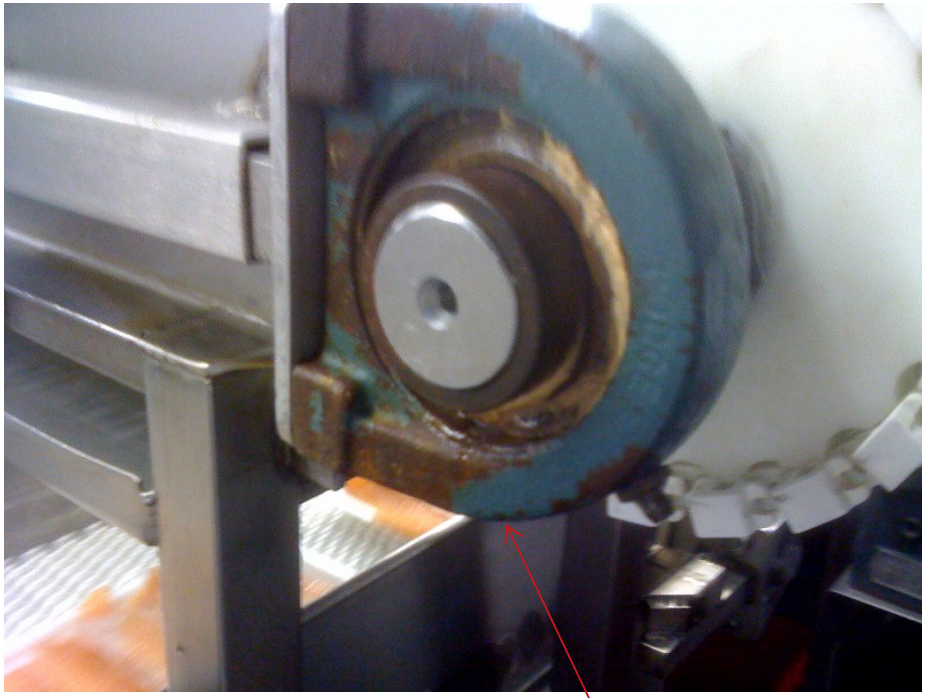
# Standard and Coated Bearings Perform Poorly in Washdown Applications



Note Rust

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# Standard and Coated Bearings are Inferior to Stainless Bearings

- Stainless will out-perform any coated product.
- Zinc coating does not perform well in caustic washdown environments
- Stainless product will reduce maintenance costs and avoid contamination from rust and paint

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# Bearing Inserts

## *Accelerated washdown test results*

Nickel Alloy CR

Zinc Coat

Black Oxide

Thin Dense Chrome

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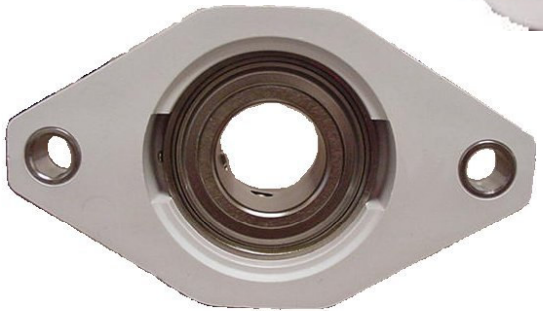
# Washdown Housings

- **Polymer**
  - **Glass reinforced**
  - **Molded-in SS hardware**
  - **Solid, one piece construction**
  - **Anti-microbial agent**
  - **Grease fitting**
  - **Loading slots in back**
  - **Accepts End-Cover**



- **Stainless**
  - **300 series stainless**
  - **Investment cast**
  - **Glass bead finish**
  - **Grease fitting**
  - **Loading slots in back**
  - **Accepts End-Cover**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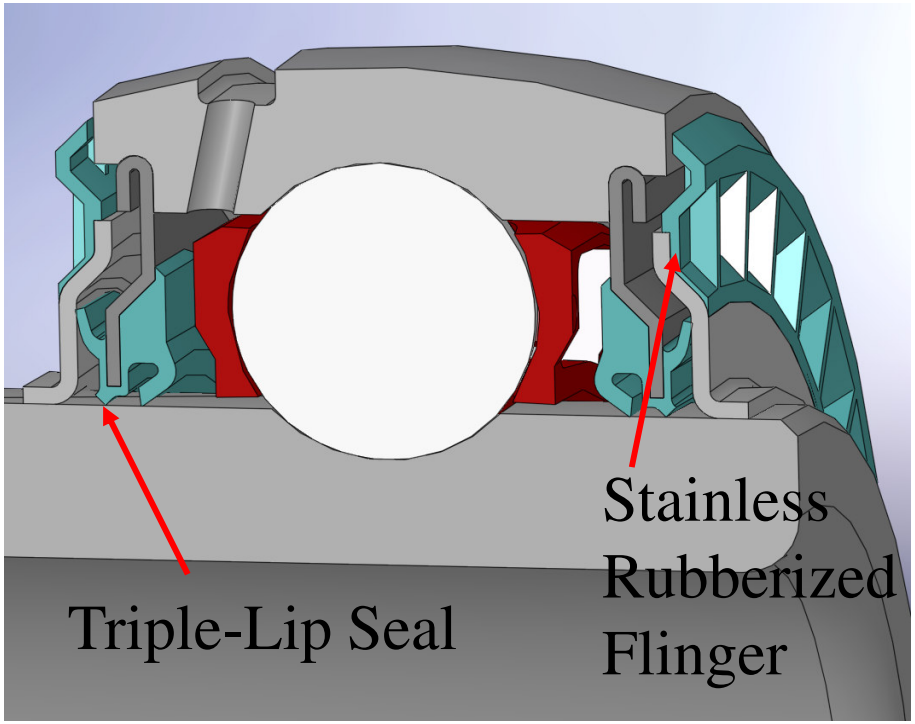
# Sealing

Over 90% of all bearing failures are caused by contamination

- **Triple-Lip seal provides 3 points of contact to keep out contaminants and keep in grease**
- **Mechanically retained seal for added strength-allows grease to purge without blowing seals**
- **Rubberized flinger provides external protection and discards contaminants as it rotates**
- **Rubber molding on the flinger is extended to the outer race of the bearing providing better protection than non-rubberized versions**

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# Cage Design

## Improved Cage Design

- **Creates Compartments that Keep Grease in Close Contact to Balls**
- **Compartments Help Prevent Grease from Being Washed Out During High Pressure Cleaning**
- **Extends the Time In Between Lubrication**
- **Cooler Operating Temperatures Extend Life of Grease**
- **Washdown Bearings 100% Filled with H1 Food Grade Grease**


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# End Caps

- Homemade end caps cost more, and do not always protect against incidental contact
- Open and closed polymer end-caps guard against contact with the end of the shaft / bearing
- Snaps in to groove on housing
- Provides additional protection from washdown
- Helps Meet OSHA Requirements


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# Washdown Bearings - Summary

- **Protect the bearing element from contaminants**
  - Multiple lip seal with rubberized flinger
- **Eliminate potential for rust**
  - Use polymer or stainless steel housings
  - CR or stainless steel bearing inserts
- **Produce longer bearing life**
  - 100% Fill of food grade synthetic grease
  - Improved cage design




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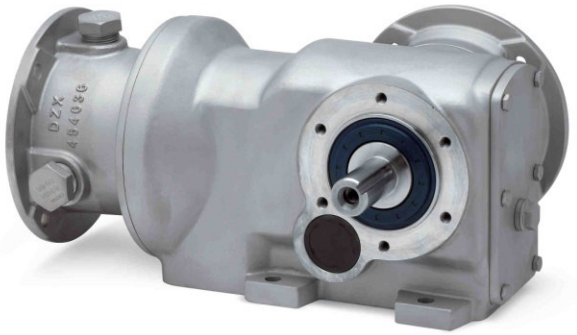
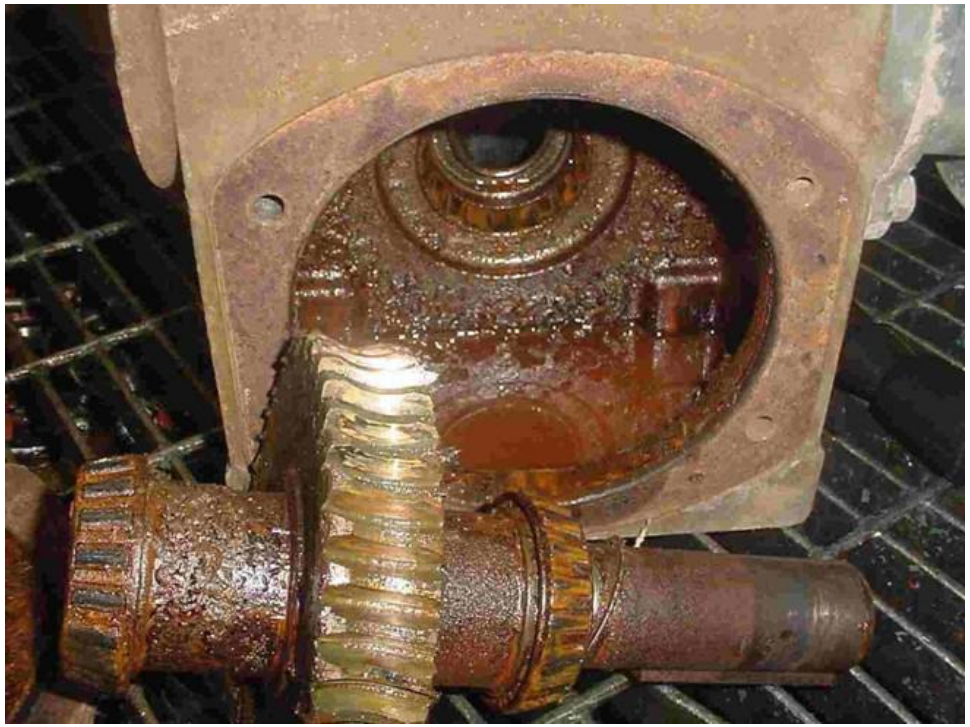
# Washdown Reducers - Objectives



- Maintain a Rust Free Surface
- Eliminate Contamination Points
- Effective Sealing
- Easy Motor Instillation and Removal
- Easy Shaft Installation and Removal

# Non-Washdown Reducers Perform Poorly in Washdown Applications

- Rusted hardware
- Chipping Paint
- Rusted shafts at seal journal
- Damaged nameplates
- Bacteria harbor points
- Leaking oil

# Painted Reducers are not Washdown Duty

- High pressure caustic washdown application
- Common problem with paint
- Brand new installation
- Plant had only ran test production and a couple of cleaning cycles
- The future is stainless

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# True Washdown Reducers

- **Coated Washdown Recuers**
  - EZ Kleen - Stainless Steel Paint & Epoxy Coatings

- **Full Stainless Steel**

# Coated Washdown Reducers

- **EZ Kleen Coating**
  - A 13-step coating system that provides greater than three times the corrosion resistance of standard epoxy painted units.
  - Stainless or white top coat
- **Fully sealed (non-vent) housing**
- **Factory filled H1 Food Grade synthetic lubrication**
- **Stainless steel solid or hollow output shafts**
- **Two-piece Harsh Duty output seals**
- **Stainless steel hardware**

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# Stainless Reducers

- **316 Series stainless steel housing**
  - Smooth outer surfaces eliminate bacteria harbor points
- **300 Series stainless steel shafts**
- **Fully sealed (non-vent) housing**
- **Factory filled H1 Food Grade synthetic lubrication**
- **Stainless steel hardware**
- **Two-piece Harsh Duty output seals**
- **Heavy-duty mylar nameplate**

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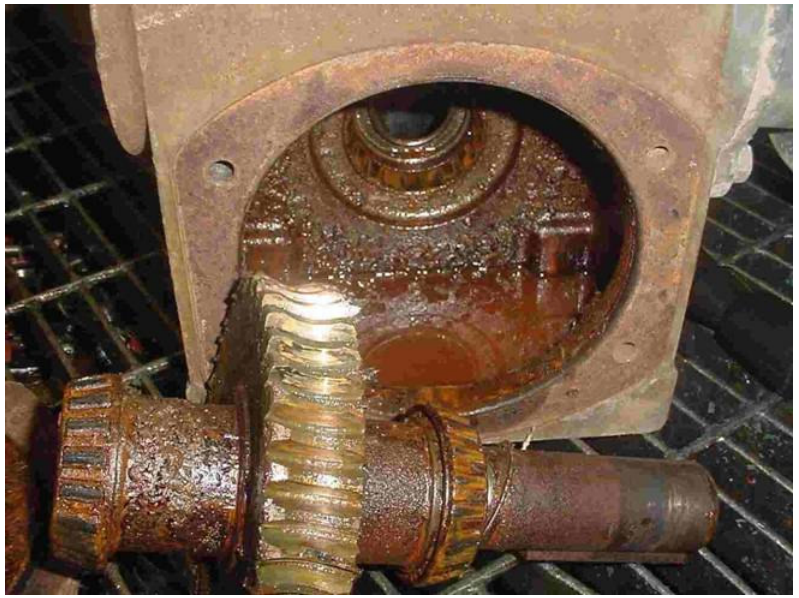
# Standard Seals Perform Poorly in Washdown Environment

Standard Oil Seal

Poor sealing leads to premature reducer failure



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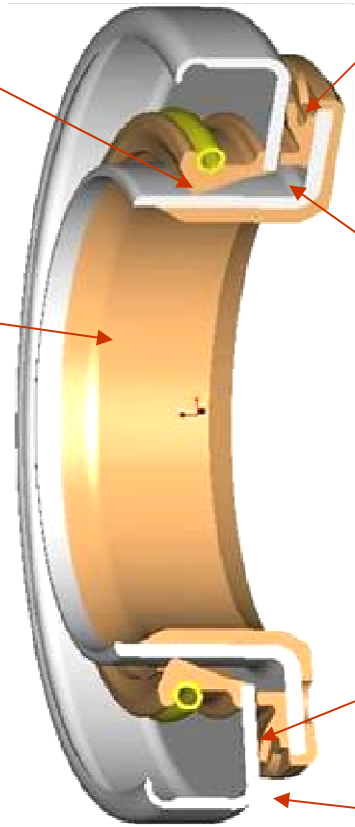
# Industry Leading Seal Technology

Wave seal with optimized contact pressure for reduced heat generation & wear

Axial sealing lip for superior water and contamination exclusion

Rubber ID sleeve for ease of installation and corrosion protection



Axial bumper to insure proper loading on axial lip

- Ensures interior of reducer is as protected as exterior
- Keeps out high pressure sprays and sanitizing solutions

Grease packed for extended life

Stainless o.d. seal case

2-Piece “Harsh Duty” Seal

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# Fully Sealed Housing

- **Cast-in output shaft housing**
  - Eliminates potential leak point
- **Cast-in worm bore plug**
  - Eliminates potential leak point
  - “Ship in a bottle” assembly
- **Totally enclosed vent-less design**
  - No vents or breathers
  - No bladders



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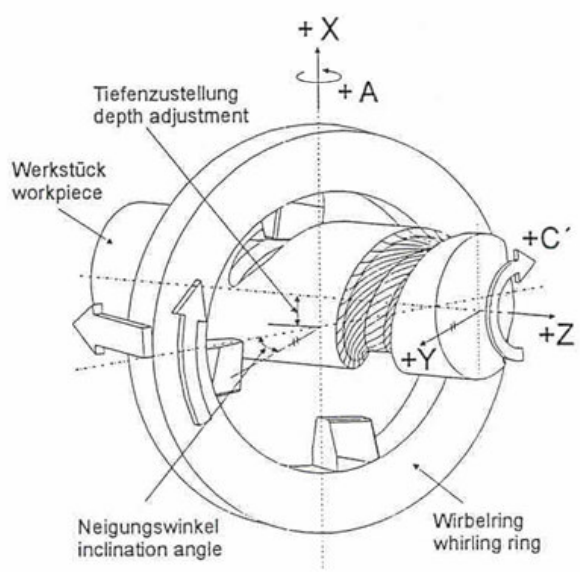
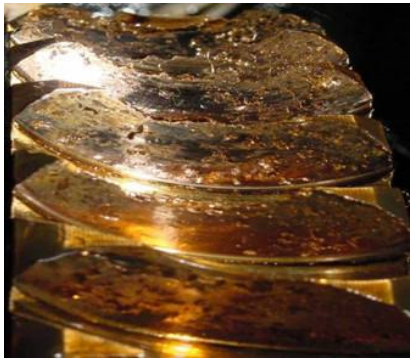
# Fully Sealed Housing – Internal Technology

- **Whirling operation delivers optimized gear geometry**
  - Delivers 30% more torque than same sized rolled worms
  - Reduces friction and overall temperature
- **New synthetic lubricant reduces wear & operating temps**
  - Increases overall efficiency & seal life
  - Comes standard as H1 food grade




**OLD Lube**



**High Wear**

**NEW Lube**

**Low Wear**

**Identical gear sets run for 4,000 hours at new class 1 load ratings**

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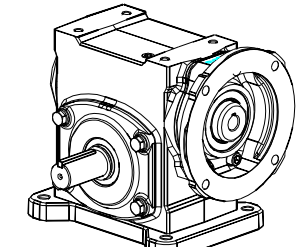
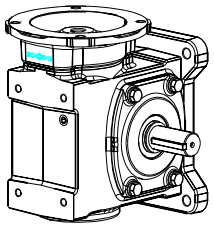
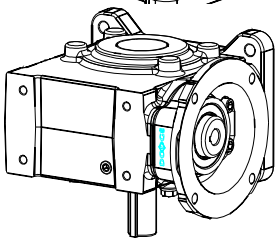
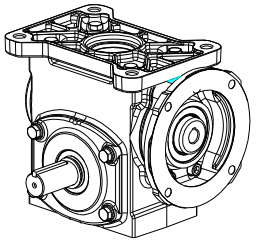
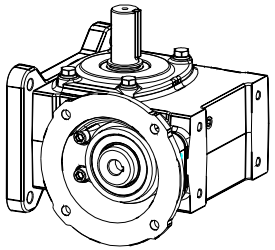
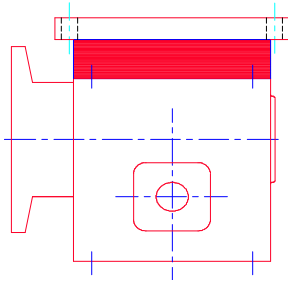
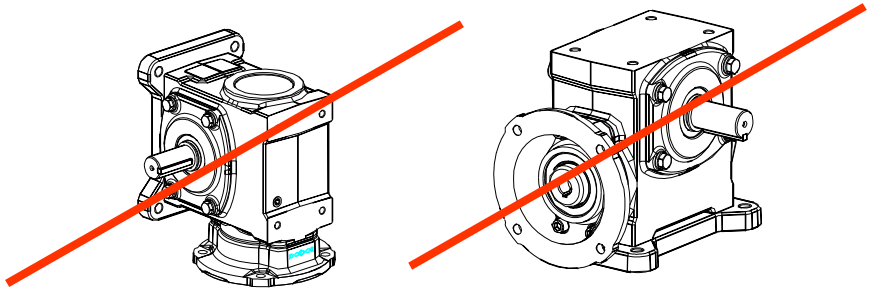
# Application Concerns

- Avoid worm under mounting positions
- Riser Blocks are available



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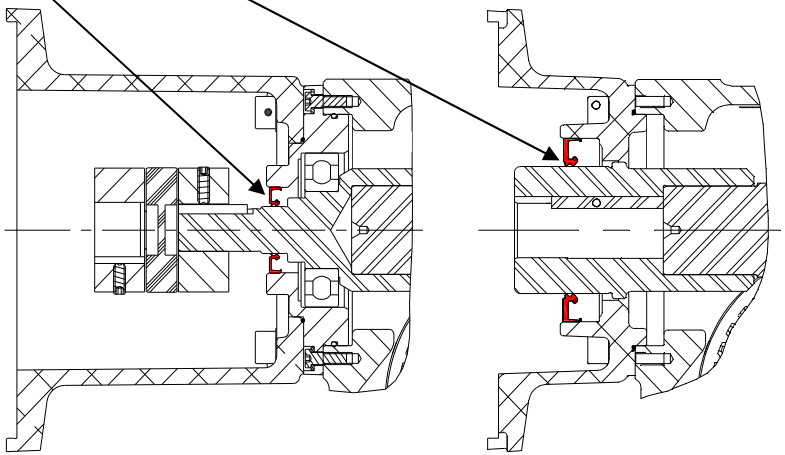
# Motor Attachment: Quill vs. 3 Piece Coupling

- **The seal lip diameter on the coupled unit is substantially smaller than Quill input**
  - 3-Piece Coupled reducer has a seal sliding velocity that is 63% lower than the Quill seal
  - This lower velocity equates to lower temperatures under the lip which is a critical item when dealing with seal life
  - The shaft “travels” a shorter distance and thus less seal friction and wear every revolution
  - Ensures easy motor assembly and removal
- **Always use 3-piece coupled for:**
  - Cycling applications of more than 2 or 3 start/stops per hour
  - When using single phase or DC motors

Coupled attachment eliminates possibility of fretting corrosion between motor and reducer



3-Piece Coupled  Quill

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# Fretting Corrosion on Motor Shaft

- **Fretting corrosion is common among quill inputs**
  - Typical on worm reducers – regardless of brand
- **Severe fretting corrosion**
  - Common on quill reducers with: shock loads, excessive starts & stops, brake motor with frequent stops, single phase motors
- **Easily corrected with 3-Piece Coupled input**



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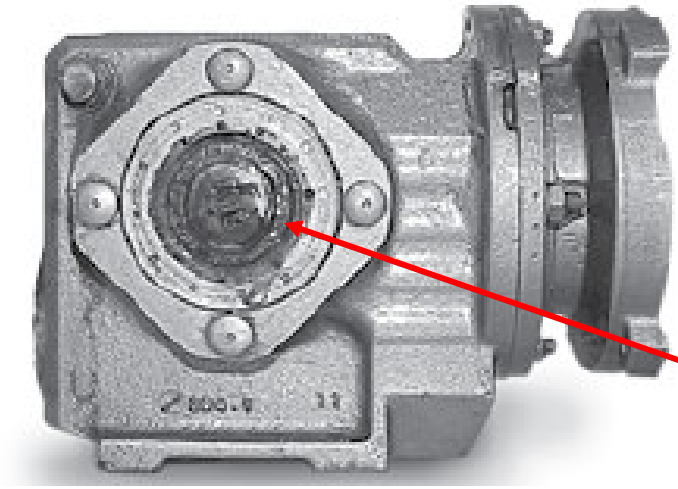
# Use of Bushings on Hollow Output

- **Twin Tapered bushings ensure easy installation / removal**
  - Not currently common in food / washdown industries
  - Widely used in heavy industry – shaft mount reducers
- **Twin Tapered Bushings work similar to QD Bushings**
  - Bushing acts as “gear puller” when removing
  - No damage to shaft



No Bushing
Shows signs of extensive fretting corrosion

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# Washdown Reducers - Summary

- **Maintain a Rust Free Surface**
  - Specify Stainless Steel or a true washdown coated reducers
  - Ensure washdown reducers have stainless or C.R. shafts
- **Eliminate Contamination Points**
  - Choose a reducer designed with a smooth outer surface
- **Effective Sealing**
  - Double check to make sure a harsh duty 2-piece seal is present
- **Easy Motor Installation and Removal**
  - Choose 3-piece coupled input over quill whenever possible
- **Easy Shaft Installation and Removal**
  - Utilize Twin Tapered Bushing system on hollow bore reducers