



Gear Pump Failure Analysis

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Excessive Pressure

- *Excessive pressure not only can twist off drive shafts, but also split housings, and cause bearing failure.*
- *Excess pressure can also cause indentations in the side of wear plates due to housing shifting from pressure or pressure pushing wear plate into housing.*



Pressure signs

- *Bearing Failure*
- *Thrust plate indentation*
- *Gear housing lines*
- *Twisted off drive shaft/Key*
- *Fatigue failure break*
- *Gear housing wipe*
- *Spline wear*
- *Cracked port*



Bearing Life

L_{10} life:

*the number of hours (or revolutions)
90% of a group of bearings will
exceed, under a given set of
conditions, before fatigue failure.*



Bearing Failure

- *Check both rollers, as well as hubs for pitting.*
- *Idler bearing rollers and/or hubs should start to break down first.*
- *Normal bearing failure is a normal failure based on operating conditions: loads, speed, fluid conditions.*



Beginning Bearing Failure

(1)



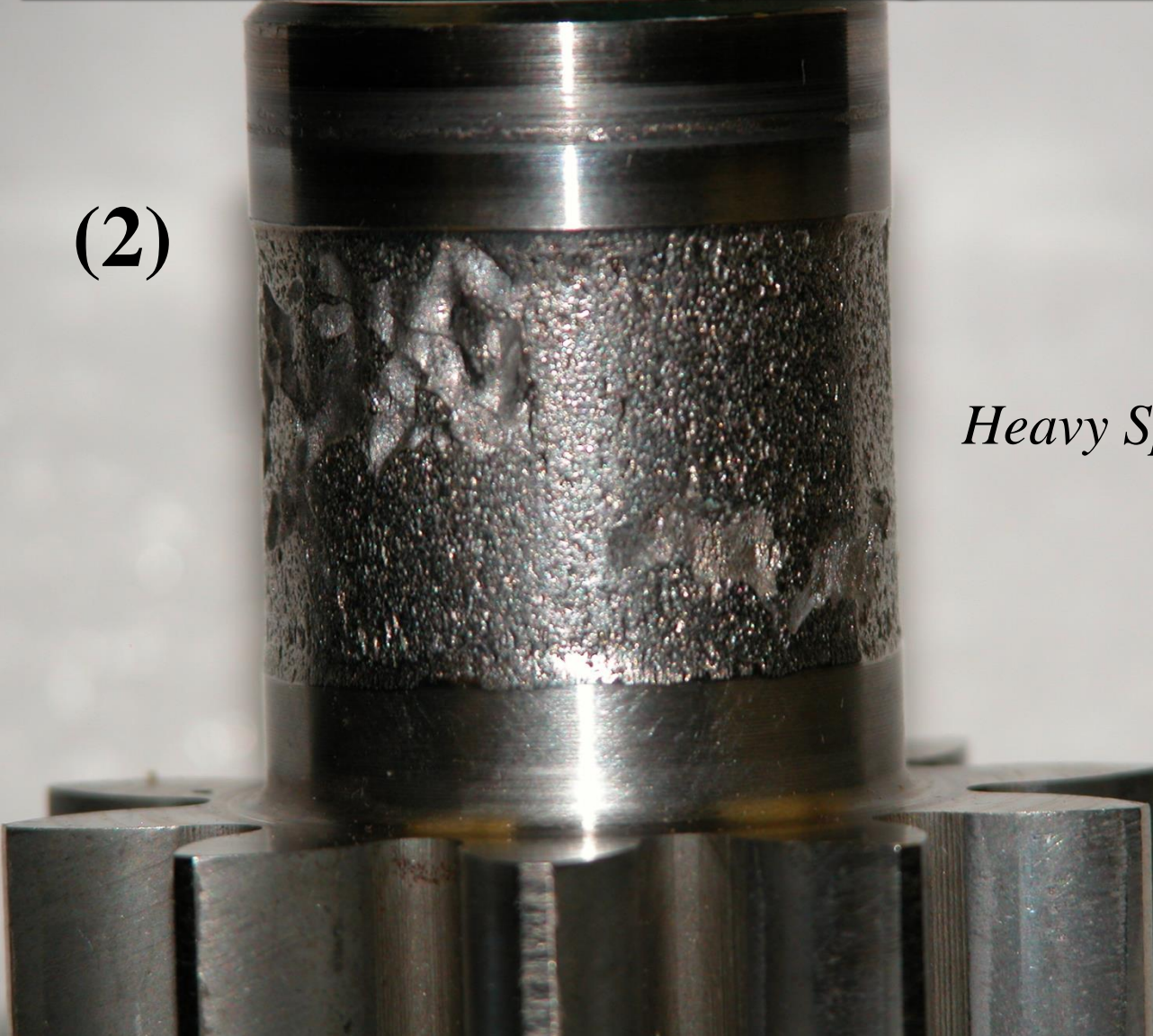
Start spalling



Advanced Bearing Failure

(2)

Heavy Spalling



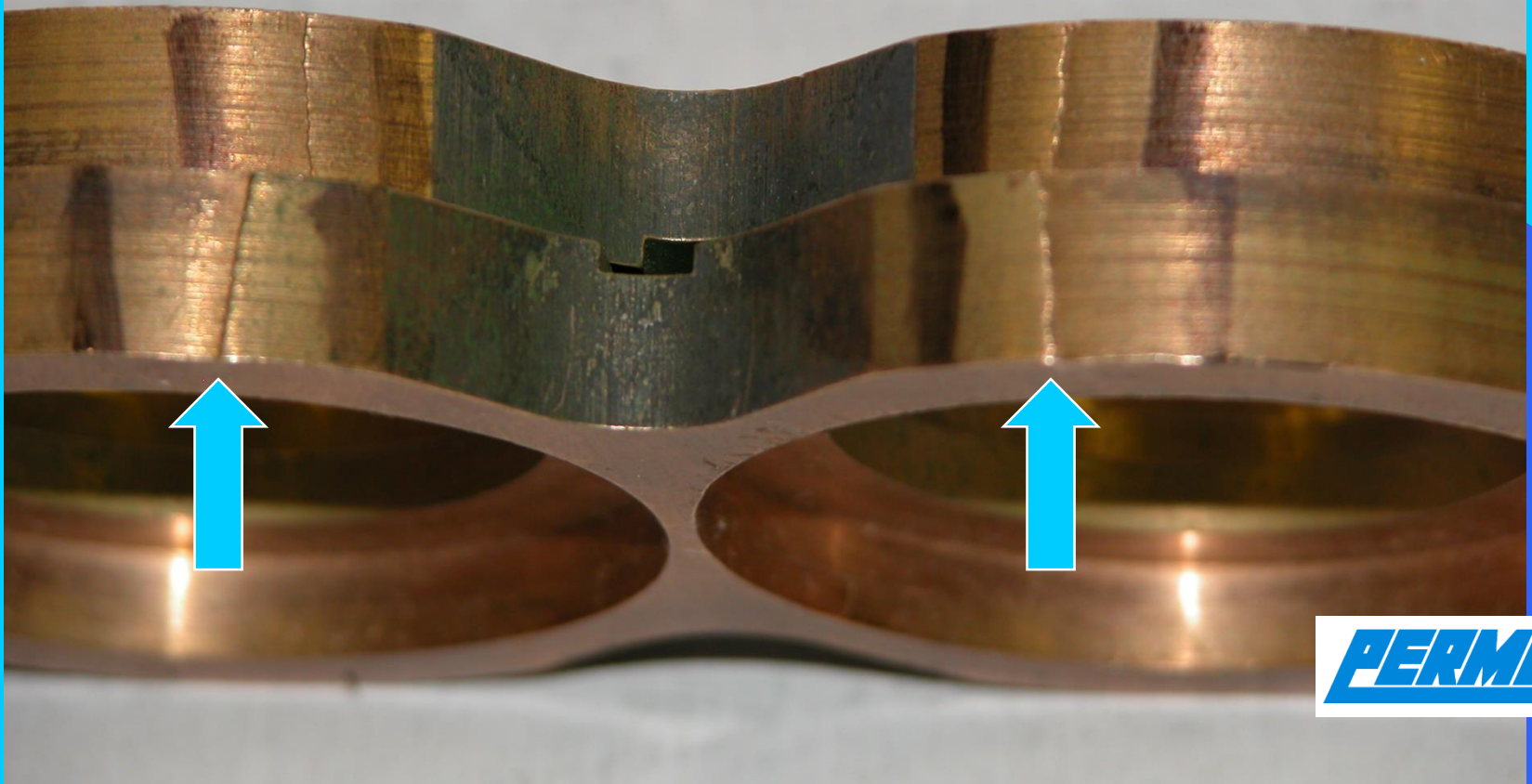
Drive Bearing Fails First

- *If the drive bearings show to have failed first, check for the following.*
- *Too much tension on drive belts.
(keyed shaft units)*
- *Misalignment (splined pumps)*



Housing Shift From Pressure

(3)



Lines in gear bores

- *Most likely cause: Pump dead head*
- *Relief valve bottomed out*
- *Valve shut off at outlet*
- *Quick disconnect not on properly*



(4)

Pressure Spike

Lines from gears digging in



Shaft Twisted Off

- *Excessive pressure spike*
- *Contamination locking up gears*
- *Pump dead headed*
- *Misalignment*
- *Fatigue failure*
- *Spike driving gears into housing*



Torsional spike

(5)

Flat shear (overload)

Note roller crushed
Between teeth



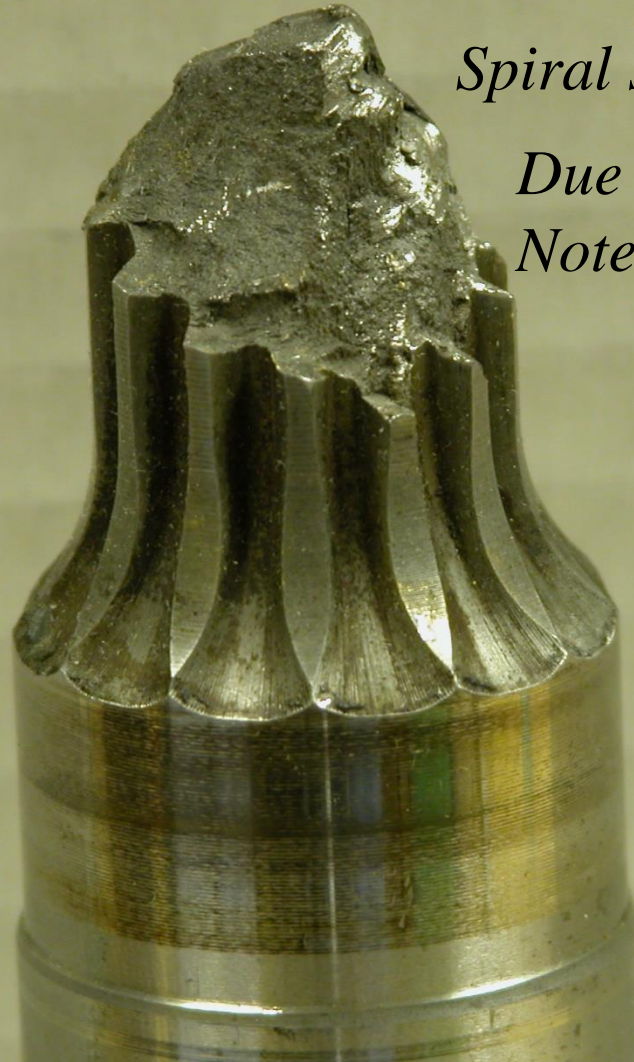
Fatigue Failure

(6)

Spiral shear

Due to stresses

Note: On a 45° angle



Cracked Port

- *Check wipe in gear housing (PSI indicator)*
- *Check relief valve setting (Verify PSI setting)*
- *Check type of port (NPT adds stress when torqued)*
- *Check wall thickness (Port too large for body)*
- *Check to see if customer using the correct fitting (NPT fitting in straight thread port)*
- *Check for cast iron shavings in pump (Customer dead head pump)*
- *Teflon tape in threads*



Contamination

- *Gear housing inlet (large)*
- *Thrust plate faces (large)*
- *Thrust plate faces (fine)*
- *Gear profile (fine)*
- *Pump seal (fine)*
- *Motor seal (fine)*

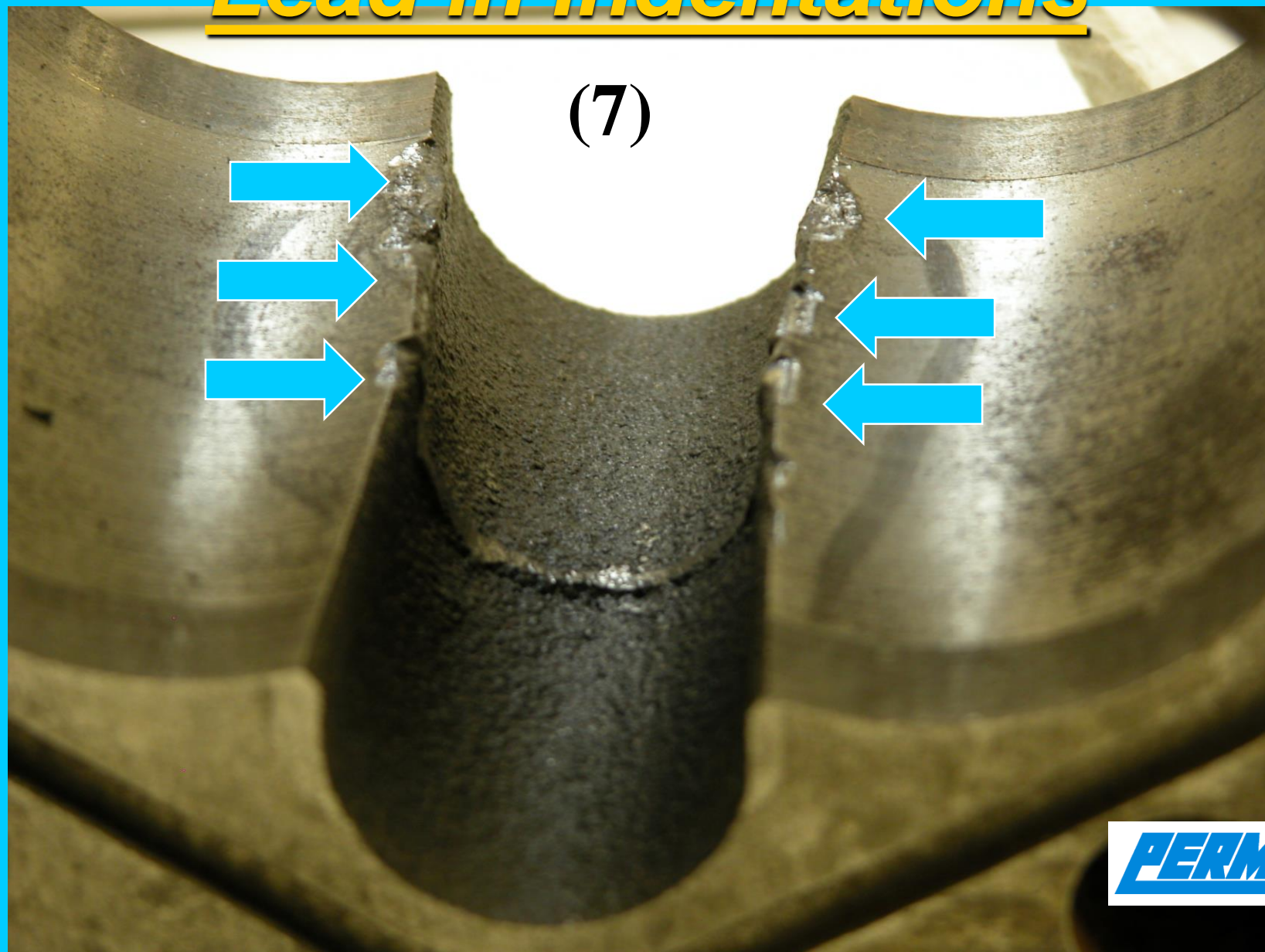


Large Contamination

- *Large/hard contamination will be crushed between teeth and “lead in” on housing bore (see next slide)*
- *Will cause grooves in wear plates looking like a record*
- *Could cause gears to lock up and twist off drive shaft*



Lead in Indentations



(8)

Metal Contamination



Fine Contamination

- *Diagonal line from trapped dirt near trapping pockets (see next slide)*
- *Sand blasted appearance on gears and wear plates, profile flat spots*
- *Wear at shaft seal area pump and motor*
- *Wear at ring seal area*



Fine Contamination

(9)

Diagonal Line from trapped dirt



(10)

Fine Contamination

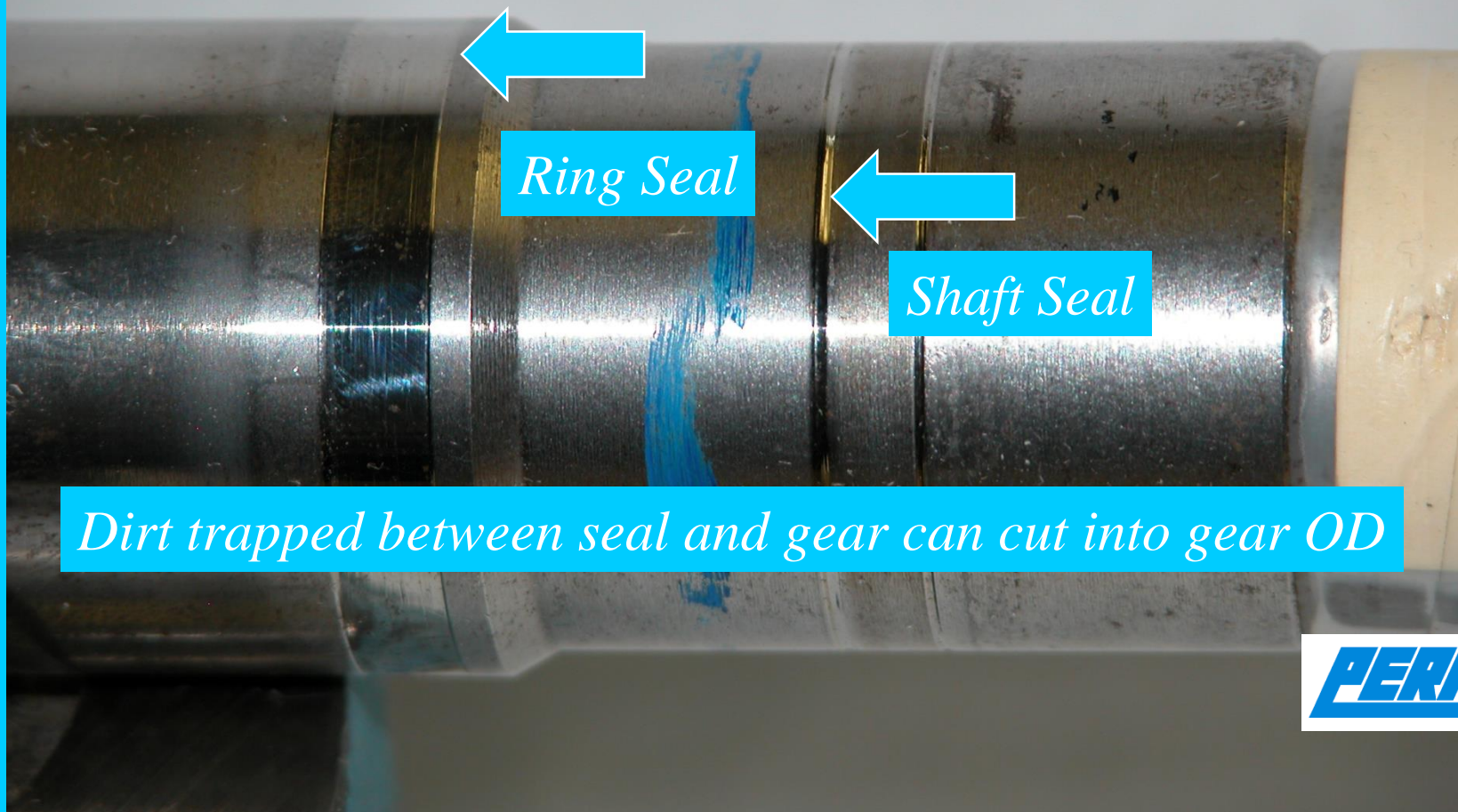


*Dull sandblasted appearance on hub
And profile wear*



(11)

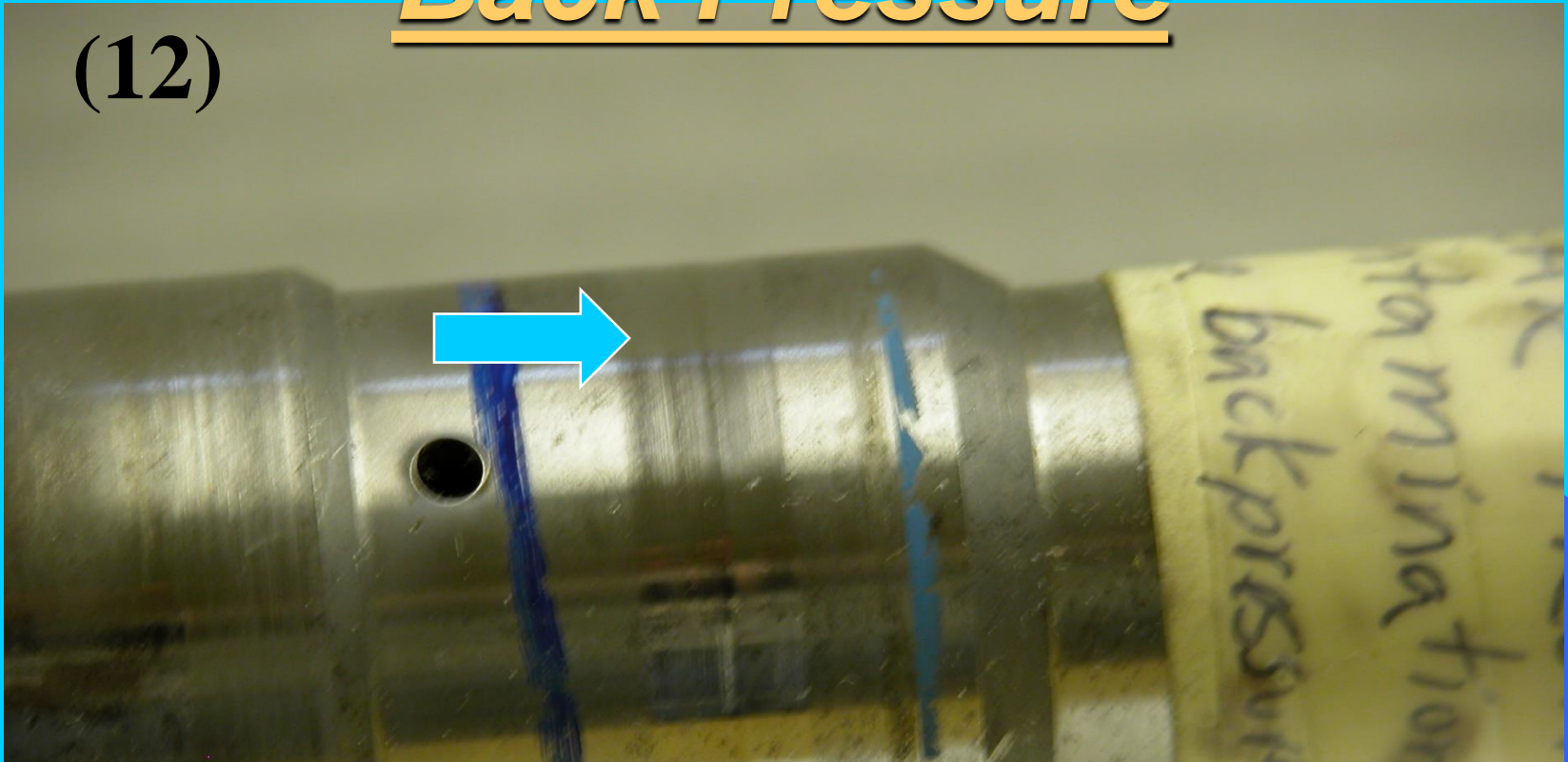
Dirt in Seal Area



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Back Pressure

(12)



Dirt and back pressure will cause grooves in seal area on motors

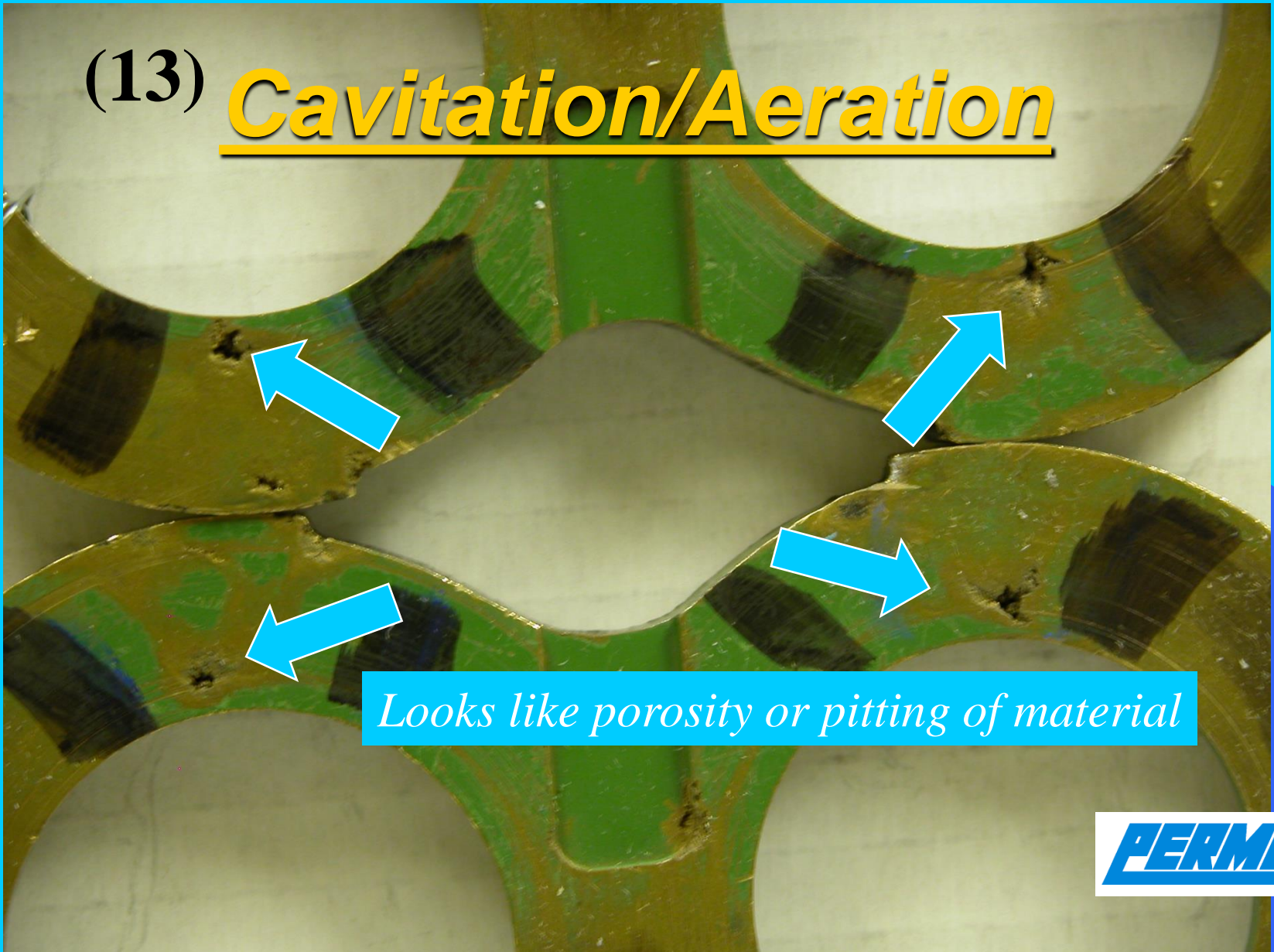


Cavitation

- *Cavitation or Aeration will cause localized heat and pitting at area of pressurization of gas, air or vapor.*
- *This pitting is generally most noticeable at the output side, on the wear plates.*
- *This may show up in gear housing as well.*



(13) Cavitation/Aeration



Looks like porosity or pitting of material



(14) Cavitation/Aeration



Assembly/Installation/Operation

- *Pump not torqued properly*
- *Thrust plate upside down*
- *Drive gear driven into plate*
 - Dropped on shaft*
 - Bottomed out in PTO*
 - Coupler driven onto shaft*
- *NPT over tightened*
- *Gemini return core pressurized*
- *PTO left engaged (Dump Pump)*



Improper Torqued unit

- *An improperly torqued unit (bolt or stud torque) will also cause housing to shift.*
- *Always check for proper torque before tear down and upon assembly.*



Not Torqued Properly

(15)



Notice severe deformation



Plate upside down

(16)



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Drive gear forced into plate

(17)

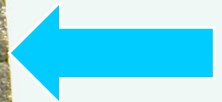


Gear Teeth indentation



Excessive Fitting Torque

(18)



Port large for pressure side
Over torqued fitting



Return Core Pressurized

(19)



Plate bowed out from pressure pushing
O ring out of bore



Dump Pump Burned Up

- *PTO left engaged/ In neutral too long (Look for heat discoloration all around bore)*
- *Pump ran over relief for too long (Look for local intense heat on wear plates and gears)*
- *Lack of oil (Look for heat on parts of housing bore as well as plates and gears)*



(20)

PTO Engaged

Notice heat on outlet side as well as inlet side

Inlet



Lack of Lubrication (No Oil?)



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