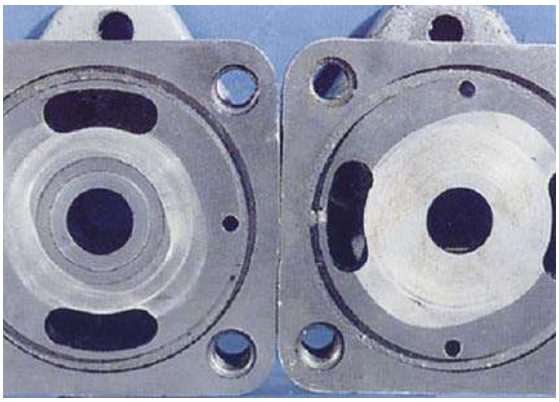
SQUARE PUMP BODY

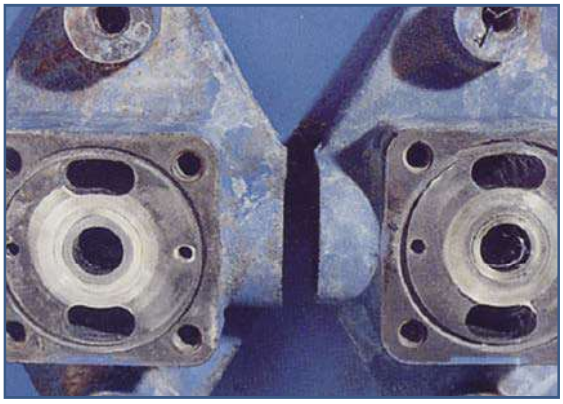
SURFACE SCORING

This pump body surface is phosphate coated. It can be scored from pump seizure or severe contamination trapped between the rotor and body surface. The pump body on the left shows typical scoring. Such scored bodies can undergo minor resurfacing (.005" to .010"), but must be retreated (phostphated) before being returned to service. If major resurfacing is performed (.010" to .020" maximum), the O-ring groove must deepened by an equal amount.



RESURFACING REQUIREMENTS

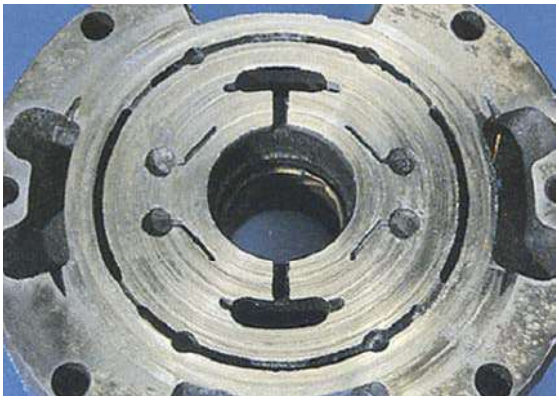
The body on the left (refer to photo to right) is scored badly enough to require resurfacing. The pump body surface on the right, however, has no depth of scoring-only the treatment colour has worm off. Bodies in this condition can be used "as is".



INTRA-VANE PUMP SUPPORT PLATE

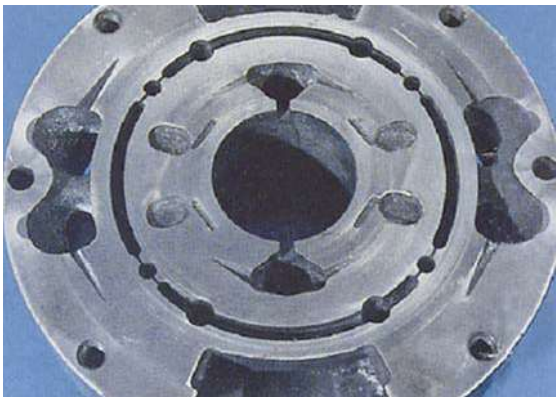
INLET SUPPORT PLATES DAMAGES BY AERATION

The effects of aeration are similar on booth inlet and outlet support plates. Here we see obvious damage caused by collapsed air bubbles. The plate surface is also badly scored. It can be resurfaced up to .010" without renotching or deepening the grooves. Resurfacing between .010" and .020" will require re-machining the groove depth an metering notches correspondingly. The resurfaced plates must be phosphate coated.



NO SIGNIFICANT DAMAGE

This outlet support plate shows no significant wear. After stoning to remove burrs, it can be reused.



VQ PUMP FLEX PLATES

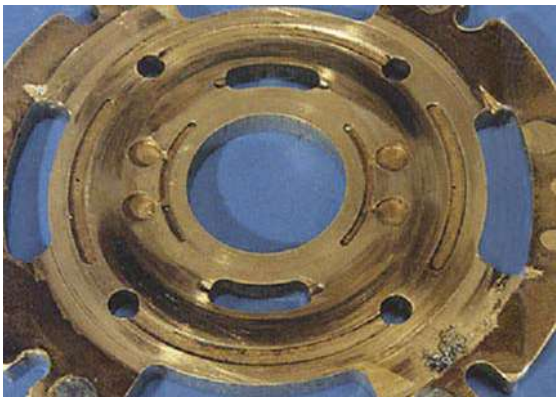
NORMAL DISCOLORATION

Flex plates play a key role in VQ pump operation. The bronze surface of these plates is critical to proper performance.

This flex plate displays a typical amount of discoloration. The discoloration alone should have no effect on pump operation.

SEVERE AERATION DAMAGE

The erosion on the VQ flex plate was caused by collapsed air bubbles (aeration) near the outlet port metering notches. If the damage isn't too severe, the plate can be resurfaced to a maximum .005". The flex plate to the right is damaged beyond repair.



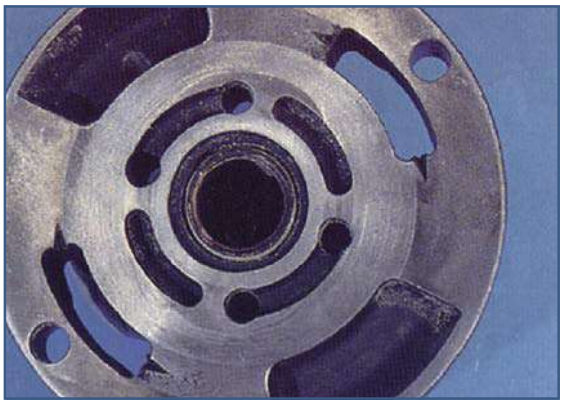
DARKENING AND EROSION

Damage as shown here is the result of excessive system temperature. After this problem in the system has been corrected, the entire cartridge must be replaced.

SQUARE PUMP PRESSURE PLATE

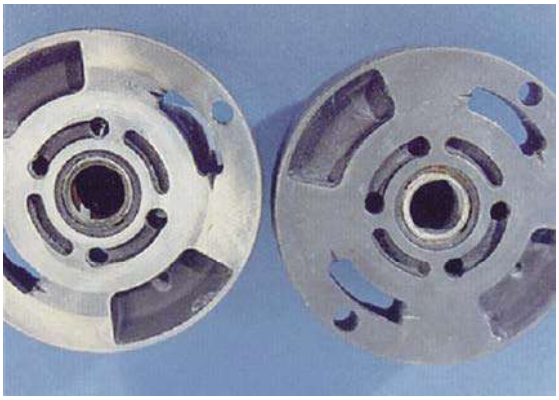
SIGNS OF PUMP AERATION

Because air is compressible, any bubbles trapped between the vanes of a pump are violently imploded when subjected to outlet pressure. If an imploded air bubble is near a pump surface, the energy teleased can remove material. This leaves cavitation-type pock marks (as seen here at the outlet metering notches). The particles of metal blasted away become fine contamination that can cause wear and scoring of the pressure plate and mating rotor facture. Pumps surfaces with mild aeration and cavitation marks can be resurfaced up to .010". If more than .010" is removed during resurfacing, the metering notches must be renotched by the same amount. Any bearing or guide surfaces that are ground should always be lapped or polished to improve surface texture. After resurfacing, a phosphate coating must be applied.



SEVERE AERATION DAMAGE

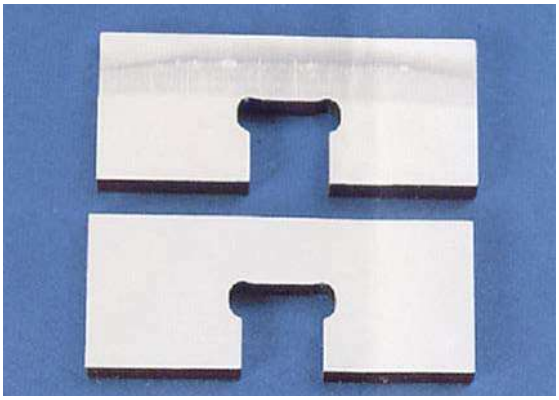
The pressure plate on the left has suffered severe damage from aeration and is beyond repair. Resurfacing would fail to restore the material that's been chipped away near the metering notches. (The plate on the right is in good condition and is shown for comparison).



VANE PUMP VANES

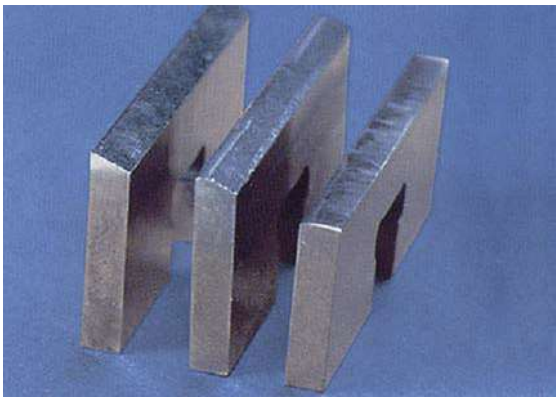
VANE FROSTING

Compare the appearance of the vane (bottom) with the frostes look of a vane that's been subjected to fluid contamination (top). The cartridge this vane came from must be replaced.



TIP WEAR

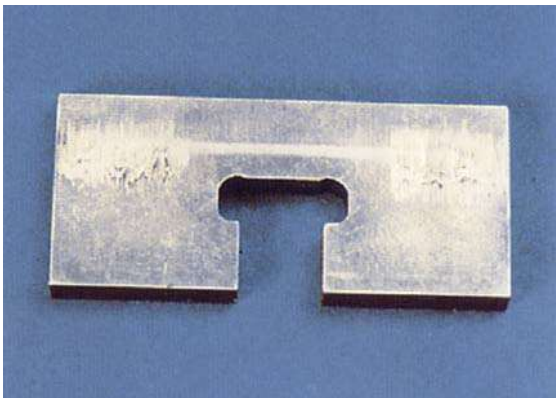
The vane on the left is new. The vane in the middle is worn down from the fluid contamination. The extreme wear seen on the vane to the right was caused by aeration. Similar damage can also be caused by fluid in poor or marginal condition. The associated cartridge must be replaced.



VANE PUMP VANES

GALLED VANE

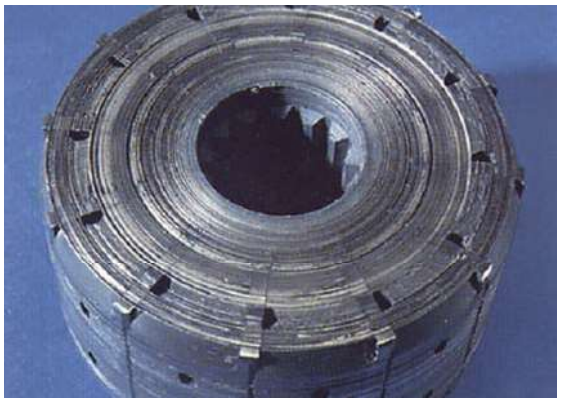
This type of galling damage is symptomatic of over-pressure or over-temperature. This indicates a cartridge damaged beyond repair.



ROTOR PUMP VANES

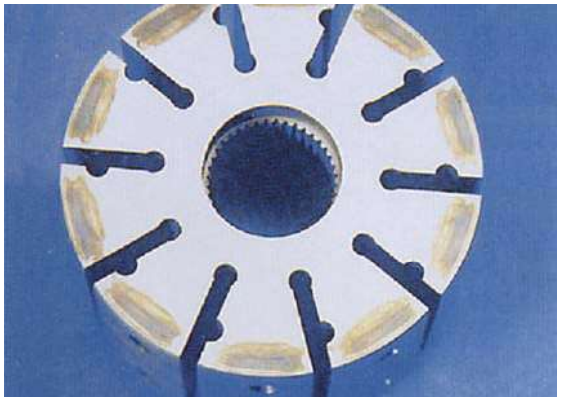
TYPICAL SEIZURE DAMAGE

Seizure type failures can be due to fluid contamination, dry run, lack of lubricity in the fluid, high system temperature, or improper clearance between cam ring and rotor thicknesses. Rotors with vane slots worn more than .0002" cannot be reused. Rotors with scored surface like the one shown here cannot be reworked and must be replaced.



ROTOR SMEAR

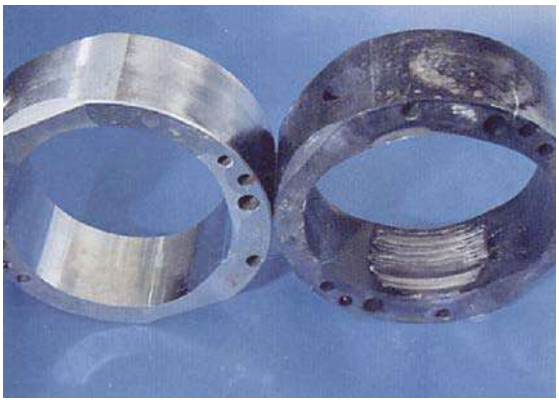
Rotor surfaces can be badly scored by contamination and/or seizure. Vane slots can also become worn or scored by fluid contamination.



VANE PUMP CAM RING

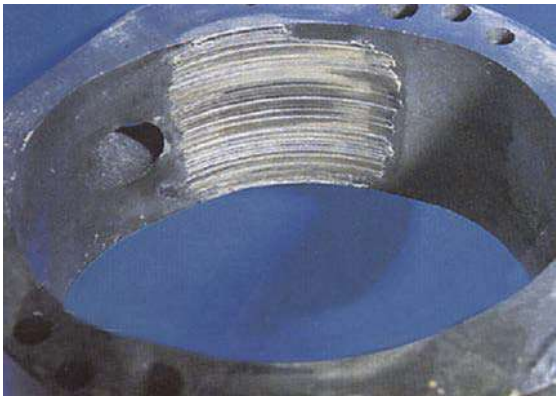
COMPARISON OF TWO FAILED CAM RINGS

The ring on the left has mild rippling and can be used again. He one on the right, however has decomposed badly from extreme heat and shows evidence of pump seizure. It must be replaced.



SEIZURE DAMAGE

Pump seizures (as evidenced by galling or metal transfer) can make local temperatures rise dramatically. These high temperatures cause discoloration of the cam ring, as seen here. The local temperature was so high that the vane tips literally fused into the ring contour. A ring in this condition cannot, and should not, be reworked).



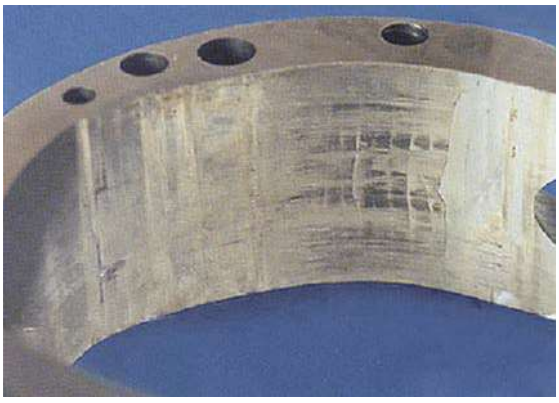
RIPPLE MARKS

Vane pump cam ring will have a shiny inner surface due to normal operation. Some rings (as seen here) may also exhibit ripples marks caused by cavitation, aeration or contamination. These marks can vary from minor to severe. Mild ripples can be polished out and the ring reused. Always polish the cam ring in the indicated direction of rotation. Heavy rippling requires expert examination to determine whether geometrical grinding can be used to salvage the ring. Nital etching should also be performed to ensure that the surface is not softened.

HEAT CHECKED SURFACE

This appearance indicates one or more system problems including excessive temperature, marginal fluid quality or an aerated inlet. Heat checked cam rings must be replaced.

Cam rings can crack or break completely at their weakest cross sectional point. This type of failure is caused by pressure surges beyond the pump's design specification.



VANE AND PISTONS PUMP SHAFTS

Pump shaft failures are generally caused by repeated stress. Like a chaint that is only as strong as its weakest link, shaft damage will occur when the stresses encountered at the weakest link, shaft damage will occur when the stresses encountered at the weakest point of the shaft finally exceeds its strength.

ROTATIONAL BENDING FATIGUE

The shaft above broke cleanly at a 90 angle to its axis of rotation.
This type of failure is due to rotational bending fatigue. A likely cause is misalignment between the pump and its "prime mover" that makes the shaft flex slightly with each revolution. Fractures like this usually start in some area of concentrated stress that is at least partially perpendicular to the shaft axis. Theses weak points in the shaft can include grooves, fillets, and holes. The shaft shown here has the ripple marks typically found with rotational bending fatigue failures. These marks indicate that the shaft was unevenly loaded or unbalanced. The smoother area near the edge is where the fracture started. The curved ripples get gradually courser, with a rough, shell-like spot where the shaft finally ruptured.

TORSIONAL FATIGUE

Seizure type failures can be due to fluid contamination, dry run, lack of lubricity in the fluid, high system temperature, or improper clearance between cam ring and rotor thicknesses. Rotors with vane slots worn more than .0002" cannot be reused. Rotors with scored surface like the one shown here cannot be reworked and must be replaced.