



## Wear Rings

*Contributed by Zoeller Engineering Department*

When paging through a competitors catalog or looking at a request for quote the subject of wear rings is almost always mentioned. What are these mysterious wear rings? Why do some pumps use them and others do not? Why do maintenance people not want pumps with wear rings? Hopefully, we can answer these questions with this article that will take a deeper look at wear rings.

Wear rings can be defined as a device used to seal the pressure leakage of the liquid between the inlet of the impeller and the pump casing. Wear rings are typically found on sewage pumps with closed impellers. A similar device that serves the same function called a wear plate can be found on some pumps with a semi-open impeller.

The typical reason for using a wear ring is to decrease the amount of leakage loss around the impeller. Due to more work available to push the pumped liquid out the discharge there is a slight improvement in pump efficiency. This becomes important as the pump size and pressure is increased but not as important on small pumps up to 15 brake horsepower. This can be demonstrated by looking at a Zoeller Model 6223 pump that uses a close running clearance and a semi-open impeller. Let us say that this is a typical sewage station running on a 25% duty cycle (25% on, 75% off) and operating on the curve at 400 GPM @ 59'. Then the power input to the pump will be 9.3 kW. The pump efficiency will be about 61%. Assuming a kW/hour cost of \$0.10 then the yearly energy cost will be \$2,037. Now, we will take a look at a similar pump that uses a wear ring and a closed impeller. The pump efficiency will increase about 2% at the most (demonstrated from testing performed in our lab). Operating at the same conditions the pump with wear rings will cost about \$1,971 per year to operate. A difference of \$66 per year. The difference decreases as the horsepower size is lowered. Therefore, this is the worst case for a semi-open design versus a conventional closed design.

From our shop tests on returned units and competitor units we have found that wear rings tend to wear to the largest particulate size found in the liquid. The same holds true for a semi-open impeller. Whenever a performance test has been performed on a returned unit the efficiency for a semi-open impeller holds closer to a new pump than a wear ring type impeller. This is due to the way the hydraulic seal is designed on the inlet of the pump. A semi-open impeller is sealed by the entire clearance between the vanes and the volute. A wear ring impeller is only sealed at the wear ring. The semi-open design, therefore, gives a very long sealing surface that the liquid must travel to by-pass the impeller whereas the wear ring design has a much shorter sealing surface. If both pumps were installed in the same application and wore to the same clearance distance, then the wear ring design would have much more leakage than the semi-open design. When this happens any initial energy savings of the wear ring design will be eliminated.

A common problem with wear rings is their ability to lock up or wear out which causes maintenance headaches. Due to the design of most closed impellers and wear rings, particulate tends to build up between the impeller shroud and the volute. After a while the particulate will lock up the impeller and require maintenance. A semi-open design provides a scouring action along the sealing surface to continually clean and help prevent jams.

Another common problem with wear rings is galling. Galling happens whenever two metals are in close running clearance and get a burr either due to abrasives in the pump media or rubbing. This burr will tend to cause the metals to rub and create a localized hot spot that will weld the two pieces together.

Because of a gall the pump will often lock up. Stainless steel, a common wear ring material, is especially bad about galling. This is not a common problem with a semi-open impeller because of the materials involved. Galls can be avoided on semi-open designs by using all cast iron components or bronze running on cast iron.

In conclusion, many of our competitors preach of the operating cost advantages of the closed impeller design, but it only takes one maintenance call to wipe out any benefit. Zoeller Company has decided to use a semi-open design for all impellers up to our 20 HP Model 6224 Sewage/Waste pumps and Model X6224 Hazardous Location pumps. On higher capacity models the operating cost advantage begins to outweigh the maintenance cost advantage, therefore, a closed impeller design becomes mandatory.