Mechanical Seal Wear and Leakage

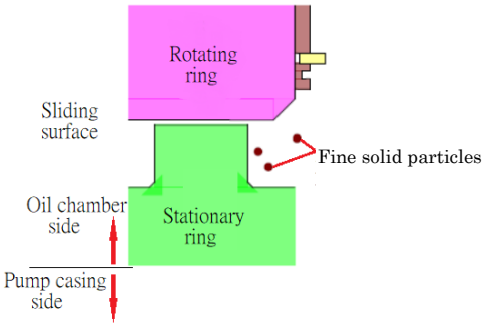
Mechanical seal is an important component of submersible pumps to prevent leakage of water into the motor chamber. However, even in normal operation in liquids containing fine solid particles, there could be gradual progressive wear in mechanical seals causing leakage.

Fig. Mechanical seal arrangements

Phenomenon of occurrence of leakage through mechanical seal sliding surfaces is as follow:

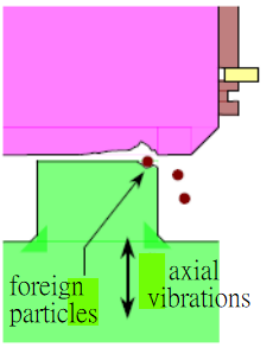
Stage 1: Normal condition

During normal condition, sliding surface of stationary and rotating ring is in close contact thereby preventing leakage through the gap. Slight gap is present which is sealed by lubricating oil.



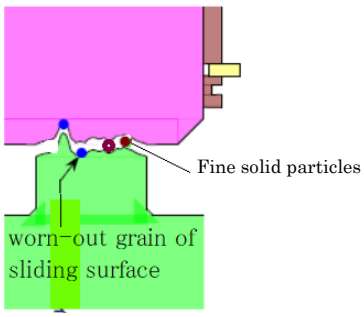
Stage 2: Piling up of solid waste particles

Occurrence of axial vibration even during normal pump operation widens the gap between stationary and rotating ring which allows fine solid particles (in sub-micron sizes) in the liquid to get between the sliding surfaces and wearing of the mechanical seal surfaces begin.



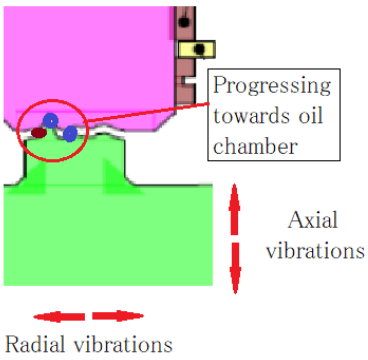
Stage 3: Wearing of sliding surfaces

As pump continues operating in the presence of such particles between the sliding surfaces, wear debris of sliding surfaces will be formed due to friction further increasing the gap.



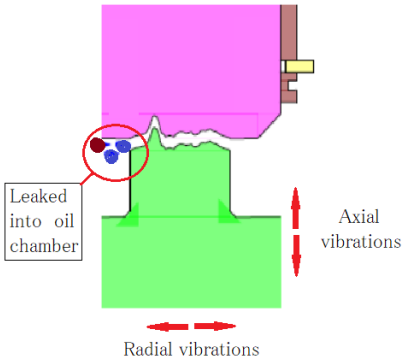
Stage 4: Progression in wearing

As gap increases, larger foreign particles will get in causing aggressive wear due to which surfaces become rough and jagged. And as roughness increases, radial vibration will be exerted on the surfaces due to which wearing phenomenon progresses towards the oil chamber along with finer particles.



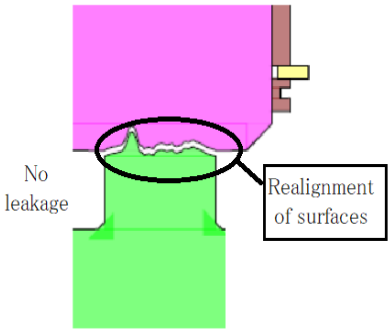
Stage 5: Leakage occurrence

As the pump continues to operate under such conditions for extended period, misalignment and wearing of sliding surfaces occur simultaneously resulting in leakage through towards the oil chamber.



Stage 6: Surface realignment and leakage prevention

Depending upon the nature of wearing surfaces, leakage could be restricted significantly without any external interference when the pump is stopped. As the pump stops, the sliding surfaces realign itself into original position with no vibration and pressure from pump operation. Due to this phenomenon, even air-tightness test may be unable to detect the leakage.



Hence, liquid containing fine solid particles has greater adverse effects on mechanical seal than liquid containing coarse solid particles. The progressive wear of mechanical seal also signifies the importance of regular inspection and maintenance of lubrication oil to detect leakage at early stage.