Advantages of Three Idler Imo Pumps in Shipboard Lubrication Systems

By: George E. Ponton, Imo Pump, Monroe, NC, USA

Lube oil service for engines and reduction gear assemblies frequently is thought to be an easy application. The opposite is true in many instances, particularly aboard ship. The cause is air entrainment, a natural condition for fluids undergoing continuous recycling from sump through bearings, jet sprays and gear meshes and draining back into the sump.

Several contributing factors are known which make this condition more pronounced in shipboard systems than is normally found in shore-based systems. Limited machinery space usually dictates smaller sumps resulting in shorter residency (deareation) time. Due to structural limitations, sump baffles and oil return lines may not be arranged to ensure adequate deareation. In severe weather, random ship motions cause sloshing in addition to the fluid distribution variations caused by pitch and roll motion. Ensuring that the suction bell mouth has adequate depth of immersion in neutral trim condition is no insurance that air ingestion will not occur due to vortexing (shallow immersion) or even total exposure of the bell mouth while the ship is at sea. It becomes apparent that the amount of air entrained in the system is highly unpredictable in spite of the frequently encountered specification boilerplate which requires pumps to pull 15 inches of mercury with 2% entrainment.

Air entrainment becomes a serious concern when machinery is not placed in optimum locations and long suction piping causes high pressure loss. These conditions can cause excessive noise and vibration when the fluid contains entrained air.

Centrifugal pumps operating under these conditions may loose prime completely as the quantity of air collected at the eye of the impeller exceeds practical operating limits. Re-priming may be difficult at best. (This is one of several centrifugal pump problems; others include unreliable flow rate prediction against varying discharge heads and fluid viscosities and deteriorating suction lift capacity with increasing flows and decreasing heads.)

The Imo 2-idler pump (one power rotor and two idler rotors), and other types of positive displacement pumps in general, can be primed with relative ease. However, where air is entrained, another problem may arise; specifically that of noise generation.

Noise is generated by the enlargement of air bubbles in the suction piping and pump inlet and their subsequent rapid collapse in the pump as fluid pressure is increased. The noise may be only an annoyance to personnel in mild cases. In more severe instances, the resultant vibration may cause failure of pipe hangers, flanges and other equipment.

The intermeshing rotors of a screw type pump form multiple, separate cavities on their perimeters by the walls of the housing bores. Turning the rotors moves the cavities and their contents from suction to discharge. Normally, with no air present, the pressure increases gradually as the fluid is carried through the pump. With air present, however, the pressure rise is not gradual, incurring instead as a sudden increase from near suction pressure as the cavity opens to the discharge port. The enlarged air bubbles then collapse very rapidly and noisily, in the same manner as a marine propeller cavitation. The effects are also the same: noise, vibration and pitting erosion of metal surfaces adjacent to the collapsing (imploding) bubble. It has been calculated that the implosion of cavitation bubbles can create momentary pressure spikes exceeding 50,000 psi.

Incorporating a third idler rotor in the Imo design (one power rotor and three idler rotors) automatically creates a complex internal leakage path, providing a restricted interconnection among cavities. Pressure rise therefore is more constant and gradual. Bubble implosion is less abrupt

and pump operation is much quieter. The effectiveness of this design in air-entrained systems has been demonstrated in test programs and ship installations.

Sixty years of marine experience have shown that the three idler Imo pump design is significantly superior to all types of pumps, either centrifugal or positive displacement, for engine, turbine and reduction gear lube oil systems. It cannot, of course, compensate for a poorly designed system. It can make the system more tolerant of air entrainment, thus reducing cavitation. Therefore, this pump type is strongly recommended for any application involving air entrained fluids, particularly shipboard systems.

~

Imo™ Pump

Imo Pump
1710 Airport Road
PO Box 5020
Monroe, NC
28110.5020

tel 704.289.6511
fax 704.289.9273
email IMOPUMP@VNET.NET
web WWW.IMO-PUMP.COM