



Application Note to the Field

Limitations of Teflon as a Gear Pump Engineering Material

Application Note Number: 1603-1

Date: March 28, 2016

Teflon: Why it is Liquiflo's least favorite material for gears, bearings and mechanical seal faces

The fluoropolymer *polytetrafluoroethylene* (PTFE) is commonly known by its generic name, Teflon. In the world of chemical processing, Teflon is widely known for its excellent chemical resistance. However, in the world of gear pumps, Teflon possesses several undesirable properties. First, the mechanical strength of Teflon is the lowest of all available materials from Liquiflo. The strength is so low and deforms so easily, we suggest using it only up to 50 PSI for gears, bearings and seal faces. On top of that, the standard grade of Teflon is glass-filled (except for seal faces), which makes the material very abrasive against a metal drive gear, shaft or housing, causing undesirably short pump life. Finally, the coefficient of thermal expansion of Teflon is extremely high, making it a very thermally unstable material for maintaining close clearances required inside a gear pump. Also, at elevated temperatures, the already weak material loses even more strength.

So what are we do to when the application conditions preclude the use of Teflon or another standard non-metallic material, but require the use of a chemically-resistant fluoropolymer, such as when pumping a highly corrosive chemical? Fortunately, there is another fluoropolymer available that is becoming very well known in the industry: *polyvinylidene fluoride* (PVDF), which is commonly known as Kynar. Kynar is mechanically superior to Teflon (having twice the strength and a lower thermal expansion coefficient) and is compatible with a wide range of chemicals, including highly corrosive *sulfuric acid* (H₂SO₄) and *hydrochloric acid* (HCl). Kynar gears are available as a standard offering in the Poly-Guard[®] Series pumps and Liquiflo now offers Kynar gears in the most common H-Series models (H3F thru H9F).

For the bearings – critical components of a gear pump – Carbon or Silicon Carbide are the best materials to use because they are rigid and will not deform under load. In addition, Carbon is self-lubricating and Silicon Carbide is extremely hard and wear-resistant. These properties allow these materials to far surpass Teflon in durability and pump performance.

In mechanically-sealed pumps, the critical component of the seal is the rotating seal face. Carbon is the best choice for the seal face due to its good chemical resistance, self-lubricating property and high pressure and temperature capability. At similar conditions, Carbon seals will last significantly longer than Teflon seals. Teflon seal faces should only be considered when Carbon is not acceptable and where differential pressures are limited to 50 PSI. At higher pressures, and where Carbon is not an option, a mag-drive pump using Silicon Carbide bearings against Tungsten Carbide-coated shafts, should be considered.

In non-mechanically-stressed applications, such as O-rings, bearing pins and sometimes wear plates (unless the application is at elevated temperature), Teflon does find a satisfactory home and can be applied with confidence.