

Development of Unitized Mechanical Seal for PTO Shafts



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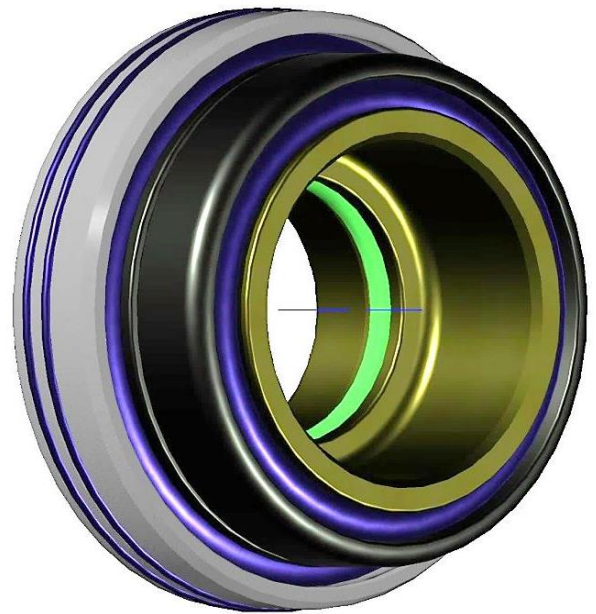
The growing demand for advanced and reliable sealing solutions on even the heaviest of slurry applications and higher surface speed applications has resulted in the development of a new and improved design of single Unitized Mechanical seals – for PTO Shaft application for Tractors, while the various customized and unique design solutions offered by SAP Parts have already provided excellent results in all light to medium mud slurry applications. The new design PTO seals are of complete “ready to fit” cartridge type and can replace the standard shaft sealing arrangement. The Unitized seal is a pre-adjusted “slide on unit” and require no further settings.

Keywords: PTO Seal, Unitized PTO seal, SAP Seal, contamination, tractor PTO seal, bearing, premature failure.

1. Introduction :

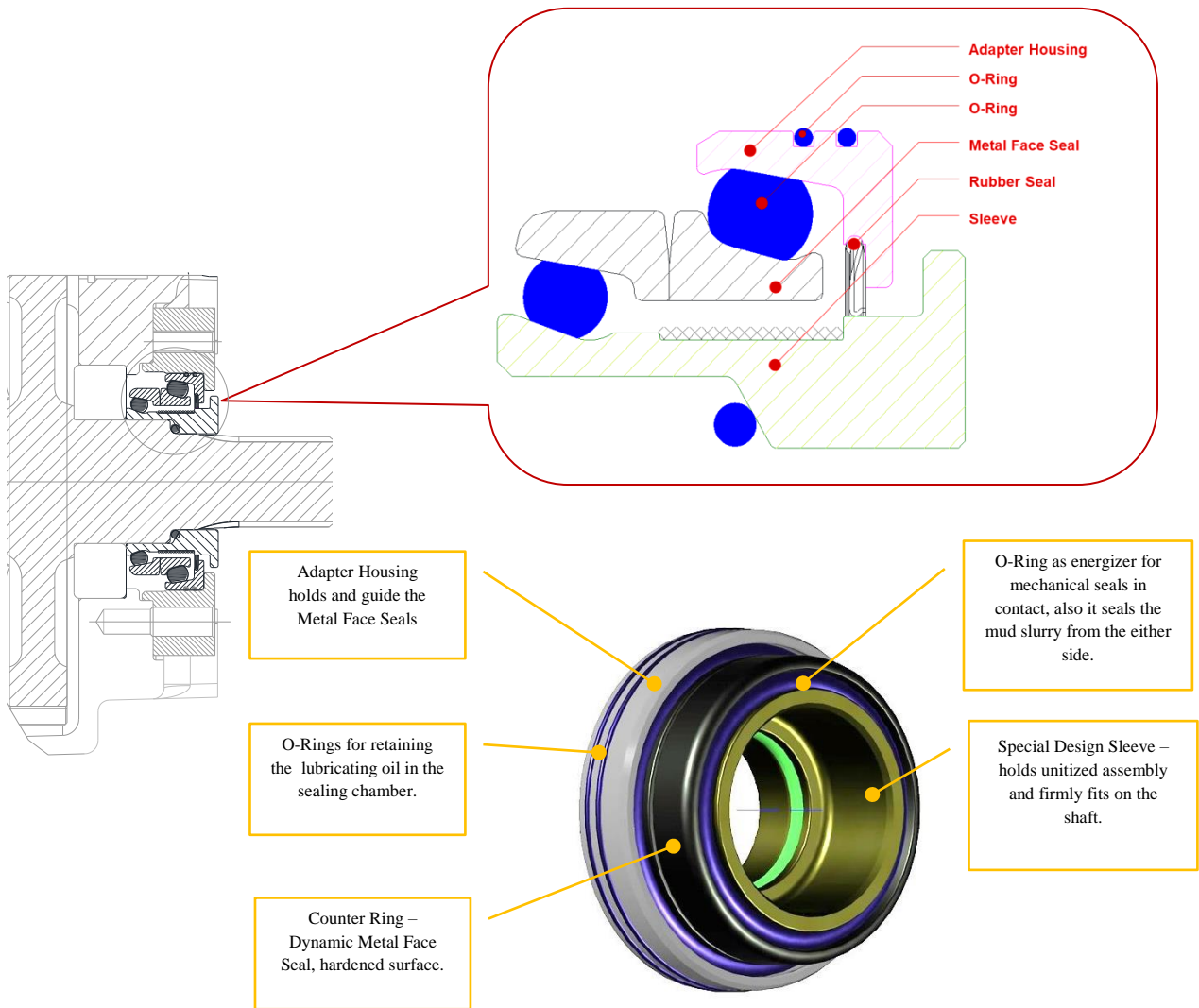
A very common combination of Cassette Seal & Multi Lip Seal is employed in the Power Transmission Output (PTO) Shaft assembly to protect the mud entry in the gearbox, however this sealing systems does not fully satisfy the intended purpose due its limitations in handling extreme working conditions in and around the PTO system. Also use of multi lip seal is restricted by the temperature limitations of the sealing element material. These seals have sensitivity to radial shaft motion and shaft-to-housing eccentricity. These cannot be ideally used in highly abrasive applications and do not work well with light hydrocarbons, fertilizers, organic residues in in the paddy mud environment. On account of extreme application conditions, in PTO systems conventional sealing arrangements observed to be failing with higher frequency and increased service demands.

Now SAP Parts™ proposed a new type of unitized arrangement of metal face seals, with flexible fixing system which allows it to tolerate both vibration and excessive shaft deflection. Static and rotating seal parts exposed to mud, slurry have been geometrically harmonized to minimize turbulence and secondary flow streams, thus reducing wear in high RPM applications. Patented design with the elastomers located on the atmospheric side, protected from both mud and barrier liquid, eliminates hang-up problems or clogging of the O-Rings. The design also accepts axial variations up to 85% higher than that of conventional lip seal designs enabling operators to take advantage of SAP Parts axial adjustment features without resetting the assembly. Unitized Mechanical Seals for Tractor applications are supplied with metal parts in alloy steel and the loader Rings of elastomers, that can withstand temperature as high up to 150 °C and seal faces in a unique proprietary   Cast alloy Iron grades and hardened to 62Hrc.



2. Unitized Mechanical Seal – Features :

The unitized mechanical seal type design makes the seal for the toughest mud & slurry applications. The basic principle of this mechanical seal is that lubricating Oil inside the seal is provided. This oil lubricates and cools the seal faces. The lubricating function becomes more efficient when the sealing liquid is kept at a higher pressure than the mud slurry entering in the housing chamber.



3. Assembly :

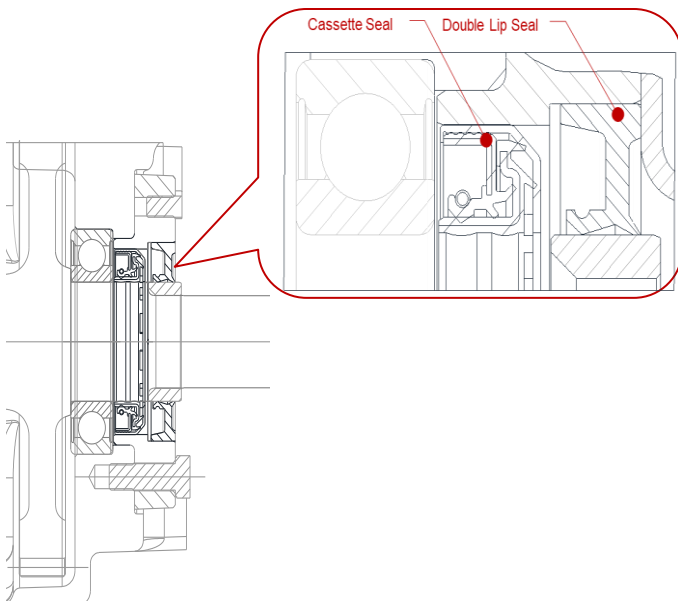
In the un-mounted condition of the Unitized metal face Seal assembly, there exists an axial clearance between the sleeve and adapter housing faces. While assembling, an appropriate tool and correct installation method be followed. The assembly is press fitted on the shaft and as the sleeve progress till bearing Inner race face the gap between adapter housing and sleeve face reduces to zero. This is the condition when seal assembly perfectly fits on the shaft. As this seal is designed for high RPM, the cover is to be fitted firmly. Since the assembly is unitized and a special grease is filled in for life time, it do not require frequent lubrication.

4. Function :

At high RPM, to compensate the radial displacement of Metal face Seal, which is in floating condition, a clearance is maintained between the sleeve and inside diameter of the Mechanical Face Seal. The leakage of oil in the system is collectively controlled by the arrangement of O Ring, adaptor housing, flatness of the Metal Face Seal and Counter Seal faces. The Possible mud entry from the outside of system is prevented by the sealing arrangement governed by O-Ring adaptor, Housing and the Sleeve.

5. Cassette Seal & Multi Lip Seal arrangement in PTO shaft :

The sealing arrangement using combination of cassette seal & double lip seal as explained below is intended to arrest external dust and mud outside the PTO shaft. Lip seal is a secondary sealing which wears out mainly due to frictional contact with rotating shaft. Lip seals add life to the sealing system by keeping cassette seal away from mud till the time it fails. Both the seals are mounted on rotating shaft and hence frictional wear due to contact surface is determinant apart from the abrasive wear from environment. This arrangement also requires frequent lubrication- greasing as to ensure the smooth function.

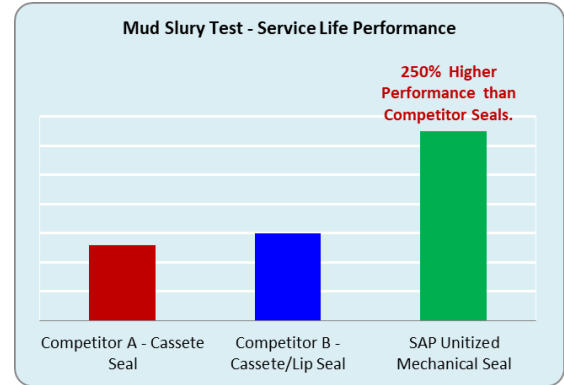


6. Competitive Advantage of - Unitized Mechanical Face Seal

SAP Parts Unitized Seal design offers competitive advantage over the functional limitations of conventional sealing system in PTO applications, in terms of reduced service life, higher sealing performance, life time arrangement, easy installations without changes in housing of Tractor Transmission system, no re-lubrication as well as overall cost reliability.

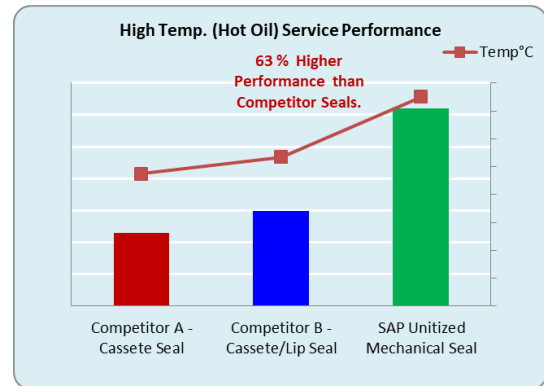
Service Performance: Mud Slurry Service Test


SAP Parts mud slurry tests on Tractors simulate thousands of hours of exposure to the most abrasive mud containing liquid and solid contaminants. As this graph indicates, Sap unitized Mechanical Seal seals can withstand the competitor's seals by up to 250% higher service life performance.



High Temp. (Hot Oil) Service Performance of O-Rings

Withstanding lubricating oil in transmission system at elevated temperature indicates the effectiveness of a seal's performance. Featuring Special- high temperature compatible compounds elastomers, O- Ring arrangement in the unitized seal profile of SAP seals help extend oil durability, thereby reducing wear and contributing to significantly longer service to the extent of 63% as tested in the field life against the competitor's seals.



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