

SAP- METAL FACE SEALS FOR HAUL TRUCKS

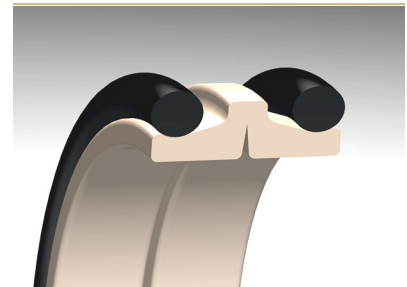
Wet Brake System Sealing Solution

2020

Advantages of SAP Parts MFS

SAP Parts Metal Face Seals are designed to offer the highest dependable performance in the tough mining environments for the wet brake applications of Haul trucks & dumpers, comes with the engineered and proprietary materials elastomers

- Materials** — SAP MFS ensure an adequate resistance to the metal seal abrasion, corrosion during the work and offers the highest heat dissipation ability which is achieved by unique metallurgical understanding and patented processes that transforms precipitation of the graphite in the secondary matrix of carbides in the microstructure of Ni-Hard alloy rings using Centrifugal Casting process. The elastomers as well, are specially developed to suit the specific working environments, especially compatible to different lubrication fluids available in the wet brake system and to offer the adequate resistance to a wide range of temperature range and harsh external contaminants.
- Design** — SAP MFS are truly engineered solutions and offers the design choice based on the extensive study of running conditions of haul trucks with regards to higher speed, higher torque, differential pressure built inside the system, and various load profiles to which the system is put for to warrant the most effective sealing over a time.



“Haul trucks employed at the mining sites are put to one of the most hostile working environments and protection of the transmission as well as the wet - brake systems is a challenging task. Only the reliable sealing can warrant the best performance of the equipment.”

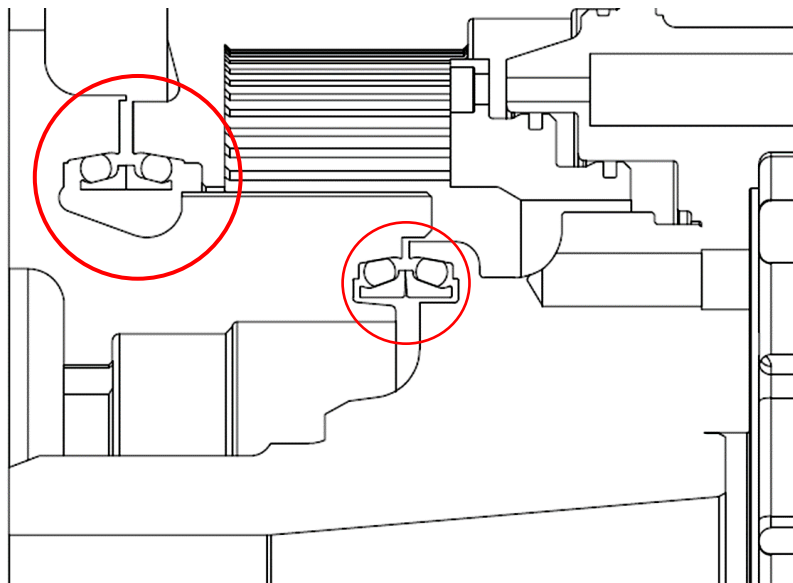


Haul Truck

INSIDE READ :

- Haul truck Wet Brake Sealing System Construction.
- SAP Seal Features.
- Processes
- Working Conditions.

(Illustrative image only, the rights hold by the OEM)



Wet Brake System & MFS

Wet Brake System Sealing

The wet braking system is designed as a closed system: unless there is a leak in the system, none of the brake fluid enters or leaves it, nor does the fluid get consumed through use.

Leakage may happen, however, from cracks in the O-rings or from a puncture in the braking system on account of various reasons. Cracks can form if two types of brake fluid are mixed or if the brake fluid becomes contaminated with water, mud, antifreeze, or any number of other liquids.

This system is deal for high torque and heavy load capacities in extreme environments. Oil cooled; provides better heat dissipation. Brakes work in a protected environment in a bath of oil, preventing rust of components. Requires less adjustment and maintenance over the time.

SAP Sealing System Features

Inner Metal Face Seal (*Small MFS*)

- Designed for pressure difference. (*Up to 5 Bar*)
- Inner seal has less surface speed than the outer seal.
- Face pressure / Load is more as compared to outer seal. (*Withstand the fluid pressure difference*)

Outer Metal Face Seal (*Big MFS*)

- Outer seal is open to the environment and it doesn't require specific pressure difference capability.
- The surface speed of Outer seal is more as compared with the Inner Seal.
- As outer seal is open to the environment (*mine conditions*) it requires to have a more abrasion resistance properties.
- Outer seals are designed to dissipate heat at larger rate. (*SAP proprietary Ni-Hard Cast Metal Seals Microstructure shows precipitated Graphite*)

Elastomeric O - Rings

- For Dump truck axle applications, considering the temperature requirement, SAP Parts developed a special HNBR compound which is capable to withstand the High ($>100^{\circ}\text{C}$) as well as Low (*up to - 40°C*) temperature. (*some times in the mines at cold geographical locations, the evening and early morning temperature goes below 0°C*)
- SAP HNBR compound offers excellent **CTE** (*Coefficient of thermal expansion*)
- SAP Elastomeric O - rings exhibit superior Compression Set. (*In both High as well as Low temperature working conditions.*)

Product Testing & Validation

- SAP MFS for Wet brake system are validated for the life and the leakage performance at its state of the art Seal Endurance Test facility, which is completely automated and controlled by SCADA Program system, simulates the actual application working conditions in the test set-up and it can run the designated duty cycles several hundreds of hours, closely monitoring the oil leakage & wear performance using a combination of highly precise electronic transducers, load cells and thermocouples. Collectively they predict the reliability & service life of the seals as expected.



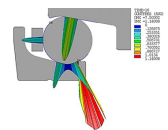
Seal Life Test & Validation Set-up

Centrifugal Casting Process

All SAP Parts Metal Face / Floating Seals are produced using centrifugal casting process that offers SAP Parts' proprietary developed alloys poured into the rotating molds at very high speed, and due to the centrifugal force, the liquefied alloy comes into contact with the rotating mold under significant pressure thereby yields a highly sound & integrated castings.

Specialty Elastomers

SAP elastomeric O rings are flash-less compression molded, adequately vulcanized, owing to the results derived from FTIR, TGA and MDR analysis, gives the predictable compression set and load profile. These elastomers are designed using high end simulation technologies like nonlinear FEA analysis and validation of Load V/s deflection carried out on the dedicated test rigs.



***Note** — SAP Parts MFS are also offered in Silicone Elastomer versions, based on the specific customer requirements; however certain things need to be specially considered before such selection, in view of the compatibility with the application conditions.

- Oil compatibility with Silicone O-rings need to be ensured. Hence Oil grade & make needs to be known. Also the compatibility of Silicone O-ring has limitations w.r.t. working temperature as compared to HNBR.