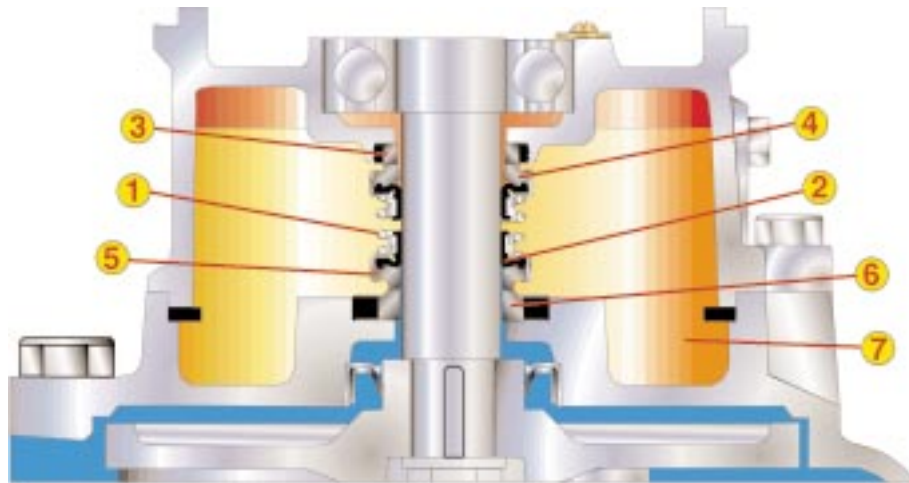


Mechanical Seal

A. Dual Inside Mechanical Seal

After many years of severe testing all types of seal arrangements and seal face materials, the design and face material that has proven to be the most durable is the dual inside mechanical seal with silicon carbide faces.



The spring mechanism **1**, seal bellows **2** and all seal faces **3,4,5**, and **6**, are located inside the oil chamber **7**, (a clean, non-corrosive, abrasion free and lubricating environment).

The seal seats **3** and **6** are in direct contact with the cast iron oil chamber. This allows heat transfer directly to the casing and thereby utilizing the whole pump as a heat sink.

The following problems encountered with seals located in the pumpage are eliminated:

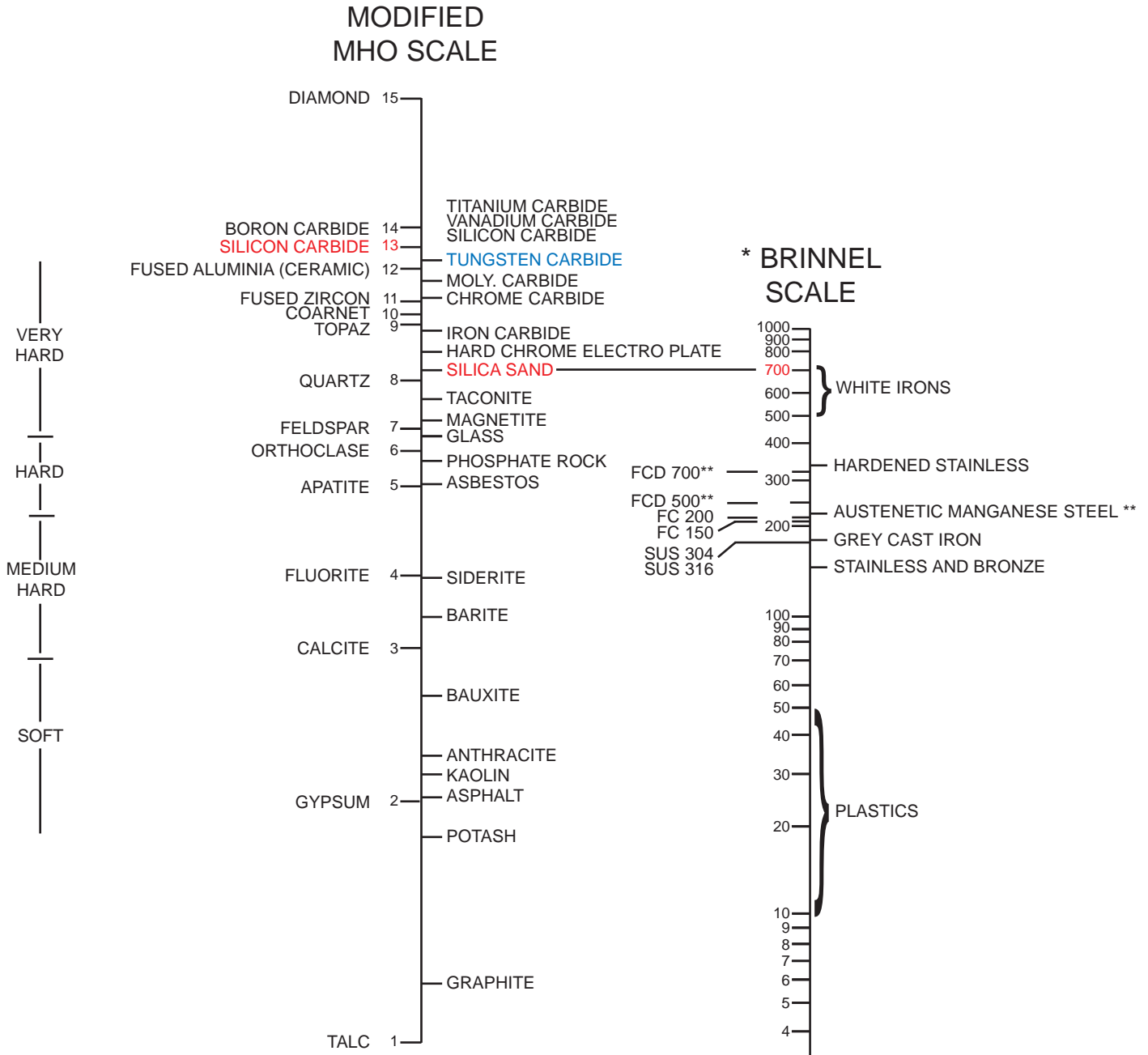
1. Spring failure causing the seal faces not to close properly, due to corrosion, abrasion or fouling.
2. Loss of cooling to the bottom seal faces during run dry conditions, causing bottom seal failure.

SILICON CARBIDE SEAL FACE FEATURES

1. Silicon Carbide's high, uniform hardness and high density makes it an extremely abrasion resistant material that outwears all other materials by a wide margin
2. High thermal conductivity, high tensile strength and low thermal expansion makes it very resistant to thermal shock
3. Does not heat check, like tungsten carbide does
4. Unlimited corrosion resistance
5. Low coefficient of friction

Mechanical Seal

B. Material Hardness



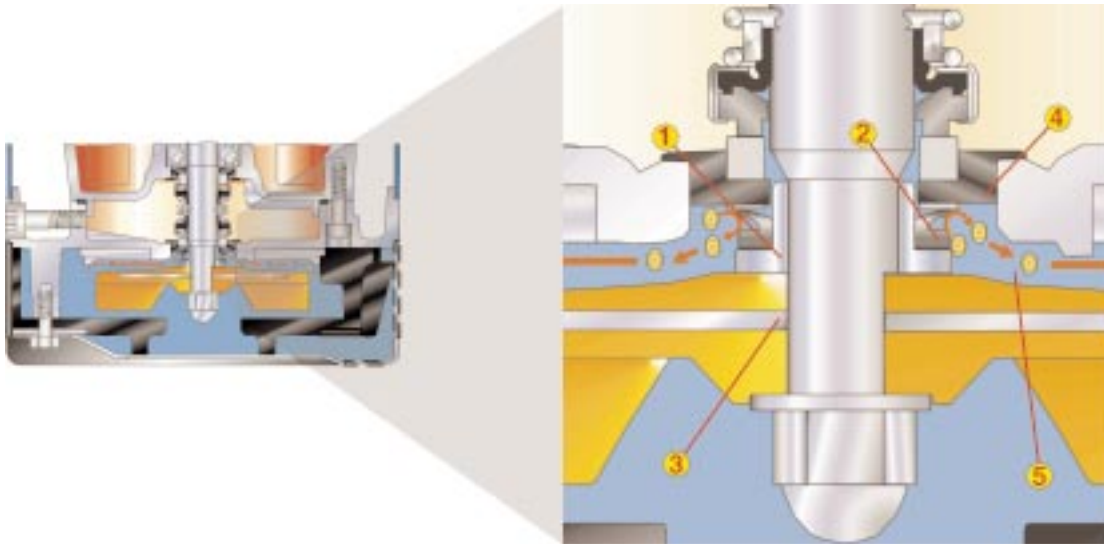
* 10mm Ball 3000 kg load
** work hardens under impact

Mechanical Seal

C. Protection Devices

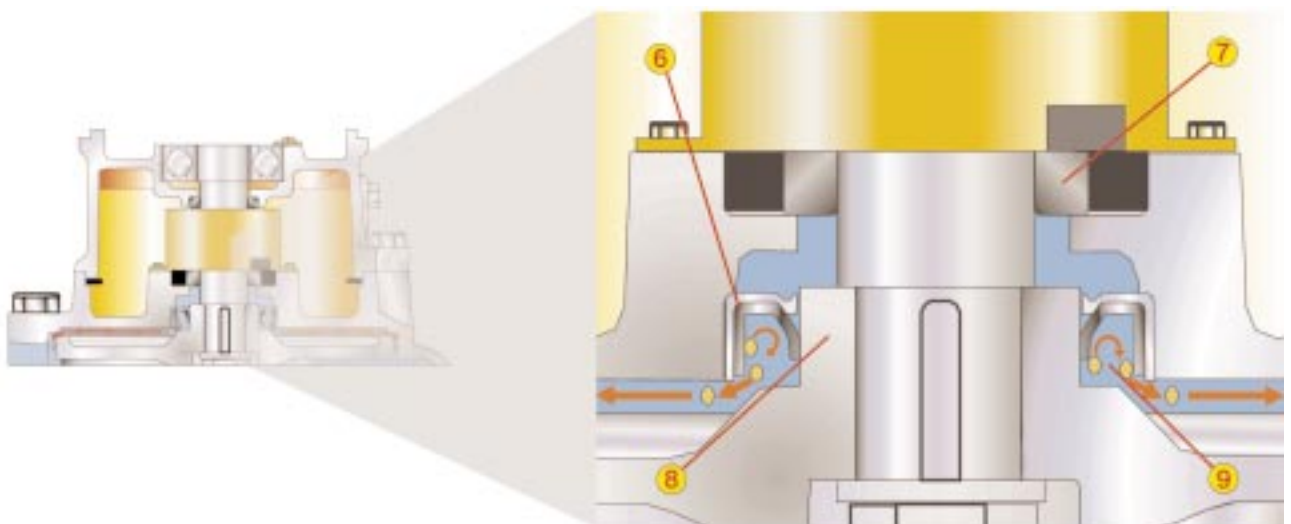
In addition to supplying the most durable mechanical seals Tsurumi incorporates two different exclusionary devices to prevent abrasive particles from entering into the area of the bottom seal faces.

1. "V"-Ring Type



The "V"- ring type consists of a special "V"-ring **2** mounted on a stainless steel shaft sleeve **1**. The "V"-ring rotates with the shaft sleeve and the impeller **3**. The upper lip of the "V"-ring runs against the bottom surface of the bottom seal face **4**. The design of the "V"-ring is such, that as it rotates, abrasive particles are expelled back into the flow and away from the seal faces **5**.

2. Lip Seal Type



The Lip Seal type consists of one or more Lip Seals **6** mounted in a chamber below the bottom seal faces **7**. The lip seal is stationary. The impeller hub **8** rotates against the flexible lip of the lip seal. The design is such, that abrasive particles are expelled back into the flow and away from the seal faces **9**. Large Sewage & Wastewater Pumps incorporate a shaft sleeve that rotates against the lip seals.

Note: Please check the individual product bulletin for the design incorporated in each series.

Mechanical Seal

D. Oil Lifter

In an ongoing effort to improve the longevity and durability of their submersible pumps Tsurumi have addressed the problem of maintaining proper lubrication of the top seal faces for an extended period of time with the invention of the Oil Lifter.

The problem of the top seal faces maintaining lubrication over a long period of time occurs because of the fact that all mechanical seals operate on a thin layer of lubricating liquid seeping across the seal faces. This thin layer is known as a hydrodynamic film. Normally an oil lubricated mechanical seal will be located in a chamber that consists of approximately 80% oil and 20% air space. The air space is required in order to allow for expansion of the oil due to the heat generated by the motor and the heating of the seal faces due to friction (**Fig. 1**).

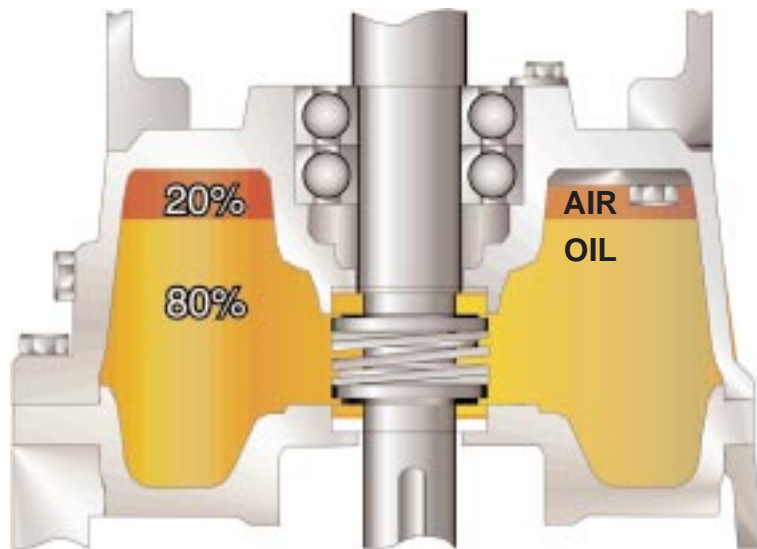


Fig. 1

Another problem that exists in the oil chamber is that as the mechanical seal is rotating inside the seal chamber it will impart energy to the oil. The oil will start to rotate thereby causing a vortex to form in the oil chamber. The rotating vortex will cause the oil to drop in the center of the rotation. This will cause the oil to pull away from the top seal faces starving them from lubrication (**Fig. 2**). Various manufacturers employ different methods to break up this centrifugal vortex. Some manufacturers rely on anti-vortexing vanes cast into the oil chamber itself (**Fig. 3** Item 1). This particular method is only effective as long as the oil level is maintained at a high level.

Mechanical Seal

(Oil Lifter - 2)

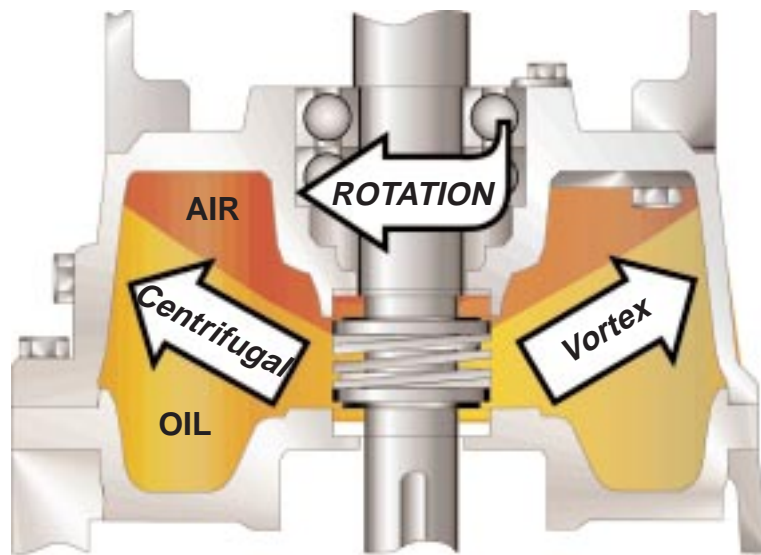


Fig. 2

Prior to the introduction of the Oil Lifter, Tsurumi incorporated a fabricated seal cage with external anti-vortexing vanes (**Fig. 3** Item **2**). As can be discerned from **Fig. 3** this method of stopping the vortex from forming is superior to the cast in anti-vortexing vane, in that it will continue to function to a much lower oil level than the cast in anti-vortexing vane.

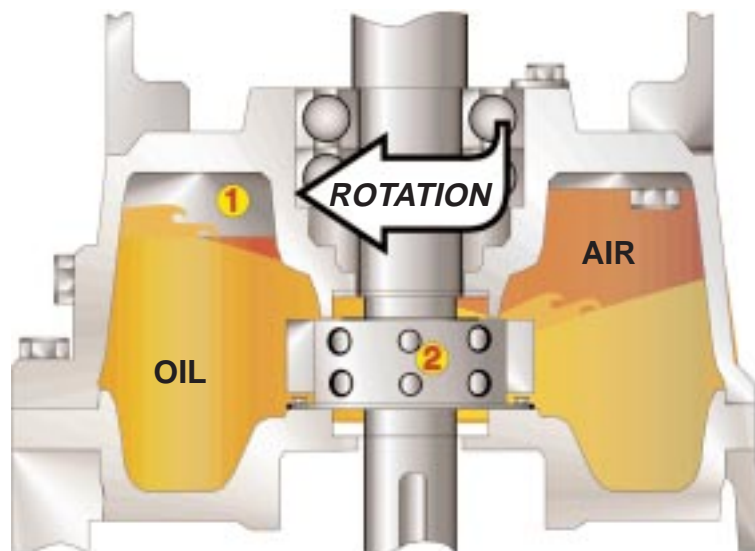


Fig. 3

Mechanical Seal

(Oil Lifter - 3)

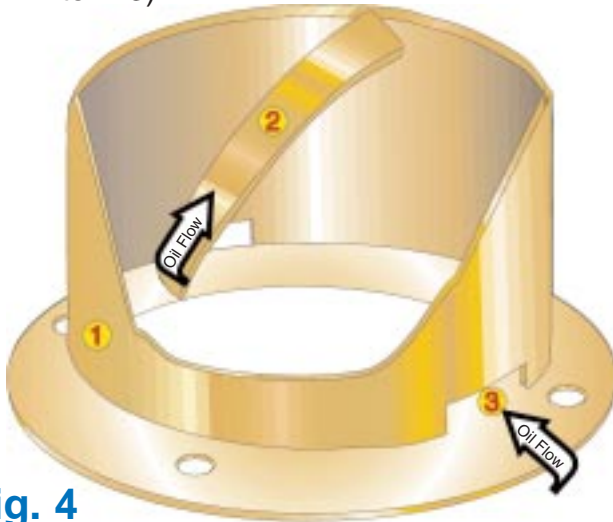


Fig. 4

In order to solve the two aforementioned problems, Tsurumi invented the oil lifter (**Fig. 4**) and have made it a standard feature on all pumps.

By providing positive lubrication to both upper and lower seal faces, this amazingly simple device turns wasted energy into added protection and increases the life expectancy of the mechanical seal.

The principle of construction and operation is as follows:

The Oil Lifter consists of a cylindrical, anodized seal cage (**Fig. 4**, Item **1**) that bolts on to the lower seal chamber intermediate. This encloses the mechanical seal completely except for the top seal faces (**Fig. 5**, Item **1**).

Located inside of the seal cage are two lifting vanes (**Fig. 4**, Item **2**).

Adjacent to the lifting vanes there are two oil inlet ports (**Fig. 4**, Item **3**).

As the shaft and mechanical seal start to rotate, centrifugal force is imparted to the oil inside the oil lifter, forcing the oil up the lifting vanes (**Fig. 4**, Item **2**).

The oil is forced to the top of the Oil Lifter, exiting at and providing positive lubrication of the top seal faces (**Fig. 5**, Item **1**).

This action forces oil to be taken into the oil inlet ports (**Fig. 4**, Item **3**) causing positive lubrication to the bottom seal faces (**Fig. 5**, Item **2**).

This combined action causes heat to be dissipated evenly across the seal faces and extends seal life.

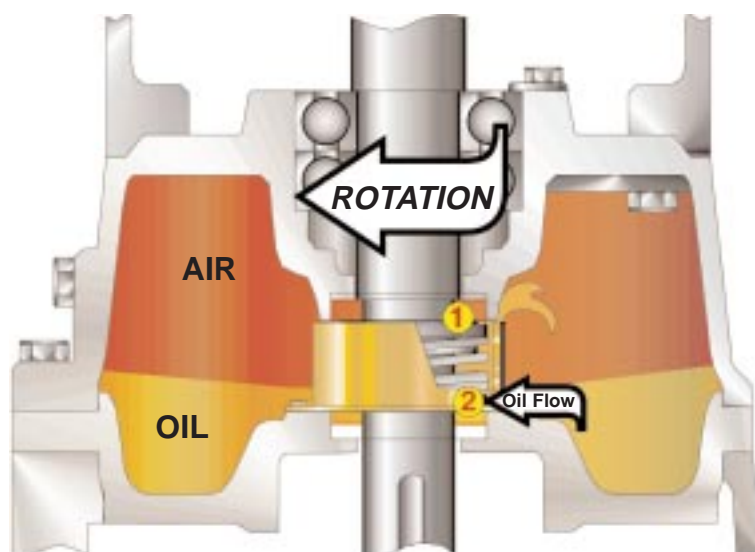


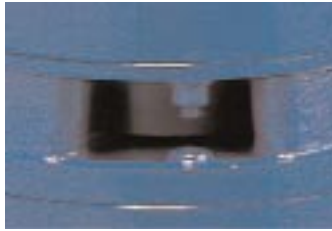
Fig. 5

Mechanical Seal

E. Seal Pressure Relief Ports



Seal Pressure Relief Port



All Tsurumi pumps designed to exceed 30m of head at shut off incorporate Seal Pressure Relief ports. This feature offers the following advantages:

1. The mechanical seal faces are only subjected to submergence pressure.
2. The mechanical seal is protected, from excess pressure, should water hammer occur.
3. Because of the flow path (shown below) is away from the bottom seal faces, build up of abrasive particles at the faces is prevented.

