

TE 4225

Seals and Prevention of Leakages

Seal Materials

- Usually flexible materials with sufficient temperature resistance.
- Selection of seal materials depends on working temperature.

Seal Materials



wiseGEEK



Seal Materials

- **Rubber seal and cork sheets:** Used in **low temperature** sealing area/ surfaces where operating temperature is not sufficient to melt or burn the sealing materials.
- **Copper sheet:** Can be used in **high temperature** surfaces. Engine head gasket of old model heavy engine is found to use copper sheet. **High price of copper have forced the manufacturers** to use **asbestos sheet with copper or aluminum** ring for engine head gasket now a days.

Seal Materials

- **Asbestos:** High temperature resistant and can be used for sealing at very high temp working conditions.
- Specially used is preventing steam leakage, exhaust gas leakages, and compression and water leakages in engine head gasket etc.

Types of seals

- **Water Seals:** Used for preventing leakage of water from water pump through the shaft of the pump connected drive unit (motor or engine or power transfer unit).
- Usually composed of an outer ring of ferrous material coated by anti rusted nickel or chromium coating within which rubber seal is casted or built up from rubber powder in metallic dies.
- Sometimes water pressure of the pump creates extra force for gripping the sealing surface to the shaft. For this extra force of gripping seal with shaft, the seal must be fitted properly or front side of seal should be toward incoming water of water pump or as per direction of assembling water pump in its manual.
- Usually seal diameter should be 0.5 to 1 mm smaller than shaft diameter. Otherwise water seal will fail for over-tightness or too looseness.

Types of seals

- **Oil Seal:** Similar to water seal and used on rotating shaft and prevent oil leakage through the shaft. Oil seal can be used as water seal. Mostly used to prevent leakage in oil pump, fuel pump, hydraulic oil pump, crankshaft front and rear ends and in oil and fuel flow lines.
- **Felt type oil seal:** In some engines like Mercedes Benz Truck, Tata etc. felt type oil seal is used as crank shaft oil seals (front and rear oil seals). Felt may be special type of fiber or asbestos rope.

Types of seals

- **O-ring:** Used in most of the high and low pressure hydraulic line for prevention of oil leakage. O-ring is fitted to the O-ring groove of pipeline in such a way that it is tightly fitted to the outer and inner mating part of the seal and fitting of pipe or hoses. More than one O-ring used for high pressure hydraulic lines.

Types of seals

(Previous)

- **Rubber flat gasket:** Used in that equipment with low temperature so that they don't get melted during operation of the equipment. Can be used in water line flange, in pump station and low temperature operating fluid line in industries. The surface condition where the rubber gasket will be used should be smooth and spotless.

Types of seals

- **Asbestos flat gasket:** Preferable for high and very high temperature operating conditions. Used in high pressure boiler, steam turbine, steam line, engine head, exhaust pipe line etc. Surface condition, where asbestos gasket will be used should be smooth and spotless.

Types of seals

(Previous)

- **Asbestos rope gasket or Gland packing:** Old model water pump used this type of gland packing where asbestos rope is **wounded** over water pump shaft in the pump body or housing after the pump fitting bearing. A conical flange is used to tight the gland packing.
- If the asbestos rope **over tighten** by conical flange then the pump shaft will be worn out very quickly. If the rope **loosely fitted**, then there is possibility of water leakage. Usually rope is compressed by gland packing in the **following steps-**

Types of seals

- **Most efficient technique of fitting gland packing:** Should be tightened **moderated initially**. After running **3-4 days** it should be **re-tightened** again for getting good leak proof service. It can be noted that, **after some operation** of the pump, the asbestos rope is **loosen** and it need final tightening.
- Now a days, high pressure compressor uses asbestos rope gland packing. Its leakage can be prevented by proper tightening as mentioned above.

Causes and remedies of leakage

Faults	Causes	Remedies
Leakage of liquid or gaseous materials through seal fitted with the equipment, plant or machineries .	<ul style="list-style-type: none"> i) Leakage may be for damages of seals. ii) Seals may be hard. iii) Seal may be loosely fitted. iv) Seal mating surface may be irregular. v) Water seals or oil seals may be fitted with too tight or too loosely. 	<ul style="list-style-type: none"> i) Check and change the seals by new one. ii) Replace the seals. iii) Re-tighten the seals. iv) Check the mating surface and make the mating surface smooth before fitting the seals. v) Usually rubber seals are 0.5-1.00 mm less than shaft diameter. If seals are loose or seal diameter is greater than the shaft dia, then leakage will continue. Otherwise if seals are tightly fitted or if seal diameter is very small or 2 mm less than shaft diameter, then seals will fail soon and leakage will continue after short period of operation.

Important checking for preventing leakage

- **Checking leakage through Seals, Shaft and Journal bearing:** Water pump shaft bearing may be **worn out beyond acceptable limit**. In this condition shaft shows false play in the bearing or it will deflect up/down/left or right.
- In this condition shaft bearing should be changed with water seal.
- Usual standard shaft clearance is **0.025 mm** (0.001 inch) for every **25 mm** (1 inch) of shaft diameter for journal bearing.
- The journal bearing replacement if clearance exceeds standard accepted clearance as recommended in the manuals or if shaft shows false play or if the clearance exceeds **+0.25 mm** (0.01 inch)

Important checking for preventing leakage

- **Checking seals, shaft and Frictionless bearing:**
Sometime water pump bearing may be radial ball bearing and seals. Radial bearing is fitted on the shaft so that **inner race is tightly fitted to the shaft and outer race is also tightly fitted to pump body.**
- Balls are also preloaded by 0.000002-0.000003 in. so that **no clearance** is present between the bearing balls and bearing races.
- During operation the clearance between balls and race may increase. In this condition the shaft shows false play. So, the bearing needs **replacement.**

Important checking for preventing leakage

- Sometimes, inner race of the bearing may rotate over the shaft causing shaft wear or shaft diameter reduction. This is very harmful to repairing works.
- If new bearing is fitted in this condition, it will be loosely fitted on the shaft which has been **worn out**.
- In this situation some **metallic packing** is given between inner race and shaft diameter by **unskilled repair man**.
- This gives **no good service** or cause similar failure very soon.

Important checking for preventing leakage

- The shaft should be repaired and rebuild to original size for better service.
- Rebuilding can be done by welding and machining.
- But if the shaft becomes more oversize, the bearing will crack during fitting.
- The shaft size must be same as manufacturer's size. Otherwise shaft should be 0.0005 in. to 0.001 in. (0.0012 mm to 0.0025 mm) oversize if the manufacturer's recommended size not available.

Leakage through valve stem and valve guide and it's checking

- Exhaust and inlet valve slide or move up and down inside valve guide. Oil seal is fitted in the valve guide. If valve guide clearance increase then oil seal is damaged then both oil seal and valve guide need to be replaced together.

Leakage from injector fitting and injector nozzle

- Sometimes diesel fuel is found to be leaked out from injector pipe and injector joint. Initially a trial may be given by increasing tightness of the joint but if the leakage is not stopped, the following steps should be taken, otherwise over tightness will cause the failure of the thread of the joint instead of stopping leakage.

Leakage from injector fitting and injector nozzle

- Dismantle the injector and pipe.
- Inspect the injector seat surface and pipe nipple surface.
- If surface is smooth then fit the nipple of the pipe properly to its seat at injector and then tight again the injector with pipe when leakage will be stopped.
- If surface is not smooth then recondition the damaged or scratched surface and then place them properly and tight again properly.

Leakage from injector nozzle

- Leakage from injector nozzle can be prevented similarly by checking mating surface condition and smoothing the surfaces by emery papers or lapping if required and then tightening.