

## **EXECUTIVE SUMMARY**

### **0.1 GENERAL**

- 0.1.1 Mechanical Seals are rotary shaft seals used in pumps, mixing vessels and marine propeller shafts to prevent leakage or ingress of fluids.
- 0.1.2 For centuries, gland packings had been the common method of fluid sealing. However, such a packing cannot normally prevent a certain amount of leakage. Mechanical Seals overcome this problem and are thus essential in areas where such leakage cannot be permitted. Mechanical Seals also use less energy and require less maintenance as compared to gland packing.
- 0.1.3 Mechanical Seals were first introduced in U.S.A. in the first quarter of this century. The production of mechanical seals in India started in 1970's. Both the major manufacturers have foreign collaborations.
- 0.1.4 The main usage of mechanical seals is in the chemical industry and are used in pumps, mixers, agitators, compressors etc. Simple mechanical seals are used in water pumps of automotive vehicles and also in water lifting pumps. The study covers the major usage of such seals by the chemical industry and excludes the simple seals used in the automotive industry and in water lifting pumps.

### **0.2 PROFILE OF THE MECHANICAL SEAL INDUSTRY**

- 0.2.1 Details of mechanical seals' sales in recent 5 years are given below:

<b>Year</b>	<b>Sales (Rs. lakhs)</b>
1989-90	2662
1990-91	3393
1991-92	3938
1992-93	4683
1993-94	4979

0.2.2 Currently, there are only two large units and two small scale units. The larger units account for 75% of the total production and the two small scale units account for the balance 25% of the total production.

0.2.3 The two units in the organised sector viz. M/s. Sealol Hindustan Ltd. Pune and M/s. Durametallic (India) Ltd., Madras started with foreign technical know-how and equity participation. Sealol and Durametallic have been carrying out their own development and have brought out various new designs of seals developed with the expertise of their own in-house R&D. Leak-Proof and Hi-Fab, the two small scale units, have not had any foreign collaboration, but have in-house capabilities for the development and manufacture of such seals. Both these units have developed their own market and Leak-Proof even exports its products to a small extent.

### **0.3 TECHNOLOGY STATUS-INDIVIDUAL MANUFACTURERS**

#### **0.3.1 Sealol Hindustan Limited**

- i) Initially, the unit was set up at Vapi, Distt. Valsad, Gujarat in 1973 as a small scale unit. Later on, additional manufacturing facilities were set up in 1980, at Pune. However, a small production activity is still continuing at Vapi. The technical collaboration with M/s. EG&G Sealol U.S.A. has ended in February, 1987; but the unit is continuing to get technical upgradation from its foreign principals, M/s. EG&G Sealol; who have a 20% equity stake in the unit.
- ii) The company has a strong R&D department, which is recognised by DSIR, and has been making modifications & adaptations to suit different applications e.g.
  - Development of High Speed Dry Running Seal.
  - Development of Blower Seal
  - Development of Rotary Dryer Seal
  - Special Seal arrangement for formentor
  - Resin Impregnation of making rings and seal rings

- Anti-rotation pins in place of lugs
- vulcanised spring disc for slurry seals
- Manufacture of split seals

### **0.3.2 Durametallic (India) Ltd.**

- i) The unit entered into collaboration with Durametallic Corporation, USA in 1975, which is still continuing. There is 40% foreign share holding.
- ii) Durametallic has its own R&D department and has been developing new designs of seals, making improvements in their life and working. Some of its achievements are :
  - Technology relating to new seals like X50, P50 cartridge seal have been absorbed.
  - Testing of tribology properties of indigenously available ceramic material have been completed and approved by their collaborators.
  - Computer Aided Design (CAD) facility for mechanical seals has been developed.
- iii) Durametallic has also worked on improvements in existing seals, for reduction of emission, improved safety and reliability.

### **0.3.3 Leak-Proof Engineering Pvt. Ltd.**

The company started manufacture of mechanical seals before Sealol and Durametallic set up their plants in the country. The company started with the manufacture of seal rings for the imported seals. Later on, the unit took up the manufacture of mechanical seals with its own development. The unit has manufacturing facilities and a R&D department to cater to the indigenous and export markets.

### **0.3.4 Hi-Fab Engineers Pvt. Ltd.**

The company manufactures mechanical seals to meet the OE and spare markets. The company has facilities for manufacture of quality mechanical seals.

### 0.3.5 Sealing Ring Manufacturers

The Tungsten Carbide Sealing ring manufacturers have collaborations with world renowned manufacturers. At present, the Nickel based Tungsten Carbide ring is not manufactured in the country. However, there are plans to manufacture such grades, as required in the mechanical seal industry.

## 0.4 TECHNOLOGY STATUS MECHANICAL SEAL INDUSTRY

- 0.4.1 Seals manufactured by Sealol & Durametalllic have interchangeability with those of their foreign collaborator. The technology is well absorbed by these two units and is nearly at par with their principals.
- 0.4.2 **Fugitive Emission** : There is no visible leakage in the form of drops. The average fugitive emission of mechanical seals is 0.4 cc/hour ( 5 drops/hour when condensed) in the form of gas, which is comparable with that of the world renowned manufacturers of mechanical seals. The international standards of emission control are stringent and with the passing of each year the level of emission is reduced. With the import of such mechanical seals in India, by the users, similar standards are developed and maintained by the Indian manufacturers, in order to maintain equivalence.
- 0.4.3 **Life** : Most users indicate that Indian Mechanical Seals are having life comparable with that of international seals. However, in some applications, such as very high pressure applications, users prefer imported seals because of better life.
- 0.4.4 **Safety** : Where stringent safety is required, the Indian industry relies on seals manufactured indigenously by Sealol and Durametalllic, the basic reason being, that these units have well absorbed the foreign technology and have now come up with innovative designs most suitable for Indian conditions.
- 0.4.5 **Reliability** : The Indian products are reliable. The quality control and testing facilities in the Indian industry are as stringent as in foreign countries.

## **0.5 RESEARCH & DEVELOPMENT**

0.5.1 The units in the organised sector have well established R&D organisations, but R&D expenditure as a percentage of the turnover varies from 0.15% to 2.5% as against over 5% in advanced countries. In view of the lower manpower rates in India, R&D expenditure need not be as high as in the developed countries and for the present, a level of 4% of turnover may be considered as an adequate target.

0.5.2 R&D establishment of Indian manufacturers have carried out good work and industry has brought out numerous new designs based on its own R&D work.

## **0.6 TECHNOLOGY GAPS**

The major technology gaps in the Indian industry which need to be tackled are detailed below :

### **0.6.1 Materials**

#### **0.6.1.1 Seal Rings**

i) Basic raw materials for seal rings are not available in the country. Generally, one seal ring is made of hard materials like Silicon Carbide, Tungsten Carbide, Stellite and the other one is carbon impregnated. The very hard sealing ring made of Nickel based Carbide and Silicon Carbide are not manufactured in India. Therefore, such rings have to be imported.

ii) In the case of carbon impregnated rings, impregnation of carbon is not fully satisfactory and here also some rings are imported.

#### **0.6.1.2 Spring**

Hastelloy B., Hastelloy C, Monel, Inconel A-20 stainless steel, required for some applications, is not available and is imported. Hastelloy springs are required for use in abrasive conditions.

### **0.6.1.3 Elastomers**

High quality elastomers are not available in the country. Indian elastomers can normally withstand temperatures upto 200°C, whereas, internationally elastomers capable of withstanding temperatures upto 260°C, are available. Thus, these have to be imported for some applications. Teflon required for such elastomers is also not available in the country.

### **0.6.2 Designs & Development**

The limited design and development activities affects development of new designs to be evolved for special applications.

### **0.6.3 Standards on Mechanical Seal**

Bureau of Indian Standards has not brought out any Indian standard on mechanical seals. The foreign standards are inch and metric based. Indian manufacturers are not able to adopt exactly metric sizes equivalent to the inch sizes manufactured in the world.

### **0.6.4. Uses**

The use of mechanical seals in India is limited to pumps used in the new chemical plants. There are a large number of old plants which are still working with pumps with gland packing.

## **0.7 RECOMMENDATIONS**

0.7.1 Indian manufacturers should earmark larger resources for R&D. Their present expenditure is only 0.5% to 2.5% of the turnover against 5% of turnover in the advanced countries. In the first instance, a target of 4% of turnover is suggested.

0.7.2 Mechanical seal manufacturers should take necessary action to continuously improve the performance of their seals in the following areas :

- Reduced emission
- Cost reduction

- Increased operating life
- Minimising maintenance and increasing periods between maintenance.
- Development of low cost seals for use in place of glands for simpler operation.

0.7.3 Seal manufacturers must design & develop seals which are presently being imported such as :

- Dry running gas seals.
- Seals for high pressure & high temperature applications.
- Seals for aeronautical & space applications.

0.7.4 R&D need be taken up in the following areas of national importance and of interest to the industry.

- Development of Nickel based tungsten carbide.
- Development of Silicon Carbide.
- Development of Hastelloy C.
- Development of Carbon Rings
- Development of 302 Stainless Steel.

Whenever feasible, industry must avail of the resources available in national laboratories and/or R&D units of public or private industry. Industry must also explore and avail the various facilities offered by the Govt. for research and development.

0.7.5 Bureau of Indian Standards should evolve standards for mechanical seals, which would act as a guide to the industry for standardisation of sizes and aid in achieving better accuracy, consistency and quality control.

0.7.6 Seals and Sealing Systems may be included as part of the curriculum in technical courses. The courses may be finalised

after taking into account the requirements of the mechanical seal manufacturers.

- 0.7.7 The Pollution Control Board may consider making the use of mechanical seals mandatory in polluting industries with a view to reduce pollution. Some of the industries which need be considered include chemicals, fertilizers, sugar, paper, solvent extraction and electroplating industries.
- 0.7.8 The seal manufacturers should take the initiative to form an association involving concerned manufacturers, users, R&D and academic institutions and others to identify future action plans which would benefit the industry and users.
- 0.7.9 The seal manufacturers should develop a training capsule for users and provide periodic opportunity to the users to send their staff for training in the fitting and maintenance of such seals.
- 0.7.10 The manufacturers may develop ISO 9000 competence.