EXECUTIVE SUMMARY

A. Industry

The Bimetal bearings industry is an industry ancillary to the prime mover engine manufacturing sector and manufactures bearings as per the design/specifications supplied by the user industry.

B. Product

A Bimetal bearing is a component made out of steel strip lined with bearing material (non ferrous metal alloy). It is used in the crank shaft, connecting rod and cam shaft assemblies of any (prime mover) engine or equipment with reciprocating and revolving systems.

It finds application in all varieties of diesel engines, petrol engines and air compressors.

Bimetal bearings come in three types – bearing half, bush and washer.

The diesel engine has a large variety according to its rating, number of cylinders and end use application, hence, the bimetal bearing also has a large variety for Original Equipment market and undersize/oversize varieties for replacement market.

C. Historical development

The Manufacture of bimetal bearings was started in India during the year 1952 by Kirloskar Oil Engines Ltd., the leaders of diesel engine manufacturing activity. Prior to this time, the bearings were imported by the user industry as a finished component.

Till such time as bimetal bearings were manufactured in an organised way, the Original Equipment (O.E.) requirement was completely imported whereas the replacement requirement was partially met by imports and partially by bearings manufactured by repair workshops employing the crude method/process of static casting and the dowel locking method.

To start with, bimetal strips were imported and bearings were manufactured by carrying out the required machining operations.

After some time, i.e. during 1958, strip manufacturing with imported metal powders was added to the production facilities.

Later, in 1978 metal powder manufacturing activity was introduced in bearing plants. Thus, during a course of about 20-21 years the industry developed the complete manufacturing process by backward integration.

The entire process has been developed through technical collaborations with world reputed units. At present, all the four manufacturers in organised sector are having foreign technical collaborations some of which are still continuing with repeated renewals.

The machine shop machinery is mostly imported; it is supplied by the collaborators.

The strip plants and metal powder plants have been fabricated indigenously against detailed specifications and with certain imported process control parameters, instruments/components.

The industry is in a position to reproduce the imported plants with the help of built-in tool room facilities or other precision engineering workshops.

The industry is now self-supporting, being able to perform the complete process within the plant.

The manufacturing facilities and the processes adopted in all the plants are generally of a similar nature even though the collaborators are different.

The industry, by and large, is able to satisfy the qualitative and quantitative requirements of the end-user industry and is also in a position to incorporate the developments taking place at the user end.

D. Structure of the Indian Industry

There are four industrial units manufacturing bimetal bearings in the organised sector. Their total licenced capacity is 35.50 million nos. of bearings against which the installed capacity is 34.50 million nos.

Product Range

All the four manufacturers share the present market and by and large manufacture all varieties of bearings of different materials. However,

Kirloskar Oil Engines Ltd. leads in Al-tin and white metal bearings, Bimetal Bearings Ltd. leads in the copper-tin-lead variety and Gleitlager India Ltd. leads in Al-lead bearings.

Small scale sector

Besides these 4 units in the organised sector, there are around 8 to 9 well-established unit in the small scale sector producing around 4.5 million bearings valued at around Rs. 75 million.

This sector caters mostly to the replacement part market and the small scale diesel engine manufacturing sector. The products covered by this sector are bearings of undersize above 0.06 inch and of non-standard size/type bearings required by the population of old style/type of diesel engines and vehicular engines. These bearings are required in very low quantities. The sector uses simple, conventional machines and is wholly dependent on skilled labour for quality. Often they avail services of an expert for process know how, production problems etc.

E. Technological status of Indian Industry

Source of Technology

All the manufacturers in the organised sector have entered into collaboration agreements for supply of complete process know how as well as supply of major manufacturing machinery. The collaboration agreements are still valid and the industry gets all assistance for process, know-how product development, customer development, tool design, production control techniques etc from them.

The following are the details of collaboration :

Sr.	Name of the unit	Name of the collaborator
1.	Kirloskar Oil Engines Ltd.	Glacier, U.K.
2.	Bimetal Bearings Ltd.	Clevite, U.S.A.
3.	Gleitlager (India) Ltd.	Gleitlager, W. Germany.
4.	Gabriel India Ltd.	Federal Mogul, U.S.A.

R&D Supports

There is no original research being carried out for bimetal products by the bearing industry as it is mostly within the purview of the end user.

However, all the developments relating to process or quality standards that are carried out by the collaborators are available to their Indian counterparts if the same developments are applicable to the Indian market.

Development projects are undertaken to improve the product to take care of customer complaints and after sales service feedback, improvement in productivity, tool design, design of production aids and to solve operational problems in the technical process, if any.

F. International Scenario

General

There is not much difference in the technology being followed in India and that in other developed countries. The products are the same, the process is the same and the kind of equipment is also the same. The only difference is the use of more sophistication and automation by developed countries due to the vast difference in the production volume handled.

In developed countries bearing design is left in the hands of bearing manufacturers.

Latest developments

There are no significant developments being carried out by various manufacturers except for some changes in bearing material composition, which will provide cost economy. These are being developed at users end.

G. Technology absorption

It is evident that the industry is manufacturing and supplying a product to the end-users that is satisfactory in respect of quality and quantity. The industry also appears to be able to incorporate suggestions made by the end user and undertake changes in the manufacturing process. These facts indicate that Indian bimetal bearing manufacturers have by and large, sufficiently absorbed the technology supplied by the collaborators. The degree of absorption by each unit may vary depending upon the capabilities of the management and its market mix.

However, from the user end there are indications of a few cases about inconsistency in quality. This problem exists to some extent but it is due

to small production batches of a variety of products, leading to frequent changes in the tool set up. Such a high frequency of batch change results in inconsistency. Such cases are related to dimensional tolerances only and not to bearing material or metal bond.

H. **Interaction with the end user**

The manufacturers are having good and regular interaction with the end users for understanding the product requirements, providing them all assistance for product testing/field trials, providing same products, holding technical discussions etc.

For any difficulties, the manufacturers call for the specific assistance from their collaborators and satisfy the user industry.

I. **Modernisation**

Modernisation in process and plant facilities, as economically viable and feasible for the production volume, is generally sought and implemented with the assistance of the collaborator.

No specific constraints are noticed or reported.

J. **Technology gaps**

Steel Strips

There is a reasonable room for improvement in the quality of steel strip with respect to surface finish, thickness tolerance and suitability to forming/drawing operations. The improved quality will help to improve the plating efficiency, reduce the consumption of bearing material and improve press tool life.

Machines

The availability or development of special purpose precision machines (finish machnining) at a reasonable cost, to suit small production batch quantities will help to widen the product mix so as to cover the entire market. Such machines will also ensure quality consistency.

K. **Thrust areas**

(i) Efforts should be made to improve the steel strip quality at the cold rolling mills as well as the quality of hot rolled steel strips at the

steel plant level. Cold rolling mills should look at this supply as an independent specific product and not club it with general purpose steel strip.

(ii) Efforts should be made to reduce the bearing material layer or thickness by arround 25-30% to economise the cost. The strip making process should be modified accordingly.

(iii) Lubricating oils and lubricating systems (especially the filters) should be studied in depth. Improvement in this area will enhance bearing-life. However, this development may be out of the purview of the bimetal bearing industry and the end user should take a lead.

(iv) The designs of a number of existing engines and compressors are over 25 years old. By reducing the bearing steel thickness and changing the configeration of connecting rods and the main bearing, at least 3 to 5% saving in steel as well as C.I. can be made without any effect on the engine or equipment quality. However, for this, the end users will have to take the proper lead.

(v) All bearing manufacturers should be allowed to sell bimetal strip manufactured by them at a price arrived at through discussions amongst the organised sector manufacturers to eliminate indiscriminate imports.

(vi) In the process of sintering, the manufacturer tries to achieve a cast structure of the bearing alloy from powder. The modern process is to directly cast copper-lead-tin alloy on channelled strip as it substantially saves energy inputs. This is done by melting copper, lead and tin in wire form in induction furnaces. The metals form an alloy as they land on the channelled strip at a temp of 900°C. This strip is then quenched by water to avoid segregation. Part of this process has to be completed in a reducing atmosphere to avoid oxidation. For this, sophisticated, auto-controlled, preferably computer controlled equipment is required. This would be required to be imported in India to ensure better quality of bimetal bearings.