

# **EXECUTIVE SUMMARY**

## **0.1 PRODUCT INTRODUCTION**

Springs find very many applications and are being used for a variety of applications, in Engineering/Defence and Railway Industries.

The oldest of springs dates back to 1400 BC in the form of dress pins, where its usage was very much limited. However, with technological development and availability of the right raw materials, it has been possible to develop various types of springs. As a result, springs find innumerable applications covering several industries.

The growth of this industry in India started basically because of the Railways and at a later stage due to the growth of the automobile industry.

In general, springs are classified according to shape and service conditions. A large variety of springs are available depending on the application.

Springs are also available in a variety of materials, but steel & its alloys are most commonly used.

The process of manufacture, types of springs available, materials etc. has been described in greater detail in the ensuing pages.

## **0.2 STRUCTURE OF INDUSTRY**

The spring industry has grown along with the growth of the Railways, defence, automobile and other engineering industries. There are a number of established units in this area. The performance & growth of the springs industry, depends on the performance of these industries.

Import of springs is relatively small. The bulk of requirements are being met indigenously. Import is only limited to specific requirements in terms of quality of raw material or a particular application pertaining to some specific international standard.

A number of units exist both in the organised, small scale and medium scale sectors. A large number of them are also at the level of tiny cottage units. All the units are well spread all over the country depending on the pattern of consumption of springs in a particular area.

Export of springs is very much limited to a few units from the organised sector. Export possibilities as such do exist, but this would mean efforts in terms of marketing and adoption of technology so as to meet international standards.

### 0.3 **INTERNATIONAL SCENARIO**

All over the world, wherever the automobile industry and engineering industries are located, the spring industry has also been located in the neighbourhood ranging from tiny units to large scale units.

The spring industry supplies springs to the automobile, electronics, agricultural machinery, mining & mineral industry, aircraft & aerospace and a host of other industries.

The main challenges to the spring manufacturers relate to:

- Safe operating stresses
- Increased fatigue life
- Corrosion resistance
- Operating temperatures.

These have been overcome by:

- \* Heat treatment
- \* Shot peening
- \* Alloying elements in steel
- \* Use of stainless steel.

The latest developments at the international level have been in the following areas:

- \* Non round selection of wire (Oval) against round wire
- \* Conical Valve Springs
- \* Composite materials for parabolic springs
- \* Automatic packaging
- \* Development of Coiling Machines with automation and computerisation.
- \* Development of materials to suit requisite conditions.
- \* Management techniques for supply in time, production planning & control etc.
- \* Design Software (Computer Aided Designs).

#### 0.4 **R&D EFFORTS**

The in-house and sponsored R&D activities in the Indian spring industry is limited and major efforts are not being made by various laboratories, except perhaps in the development of various steel grades.

The Bureau of Indian Standards have done excellent work in respect of standardisation of springs and materials suitable for springs. This includes testing of springs. Indian Standards are in consonance with other International Standards.

The testing facilities are generally adequate, but may require augmentation in:

- \* Magnetic Particle & Crack Detection Tests
- \* Statistical Process Control
- \* Fatigue Testing Facilities etc.

## **Technology Absorption Efforts**

The capital equipment required for Coiling Springs & Leaf Springs are already being manufactured in India. Facilities like testing equipment, shot blasting, heat treatment are easily available in India. But computerisation and use of sophisticated instrumentation, automation etc. are yet to be implemented.

The raw materials required may have to be further developed in India in co-operation with steel wire or flat producers. For this, know-how exercises are essential for new product development and promotion of spring applications. Visits abroad are again essential to promote these efforts.

Modifications and improvements are necessary to bring the present level of technology to international levels. This can be achieved by:

- \* Increment in the capacity of the units and diversification of products i.e. enlargement of the range of springs being manufactured.
- \* New units to be established or existing units to adopt new technology tuned to customer satisfaction and export feasibility.
- \* Improvements in the availability of raw materials.
- \* Use of composite raw materials, better testing facilities & automatic packaging.
- \* Improvements in the philosophy of the management of the manufacturing units.

## **Technology Gaps**

The technology gaps pertain to the availability of raw materials of proper quality and quantity in time. To improve the market for springs it is essential that there are new developments of springs in newer areas of applications. Besides, technology gaps exist in the process technology itself.

## CONCLUSIONS

- a. Spring are important elements in the engineering industry. The springs industry has developed with the automobile, Railway and defence industries. The changing conditions in recent years has placed an increasing demand on spring designers for better and cost effective designs leading to improved performance of machines, plants and systems. In order to produce superior quality springs, a quicker mode of manufacture through NC machines, use of automation and computerisation, energy savings and enviromental protection have come into the picture.
- b. The growth of the spring industry is dependent on adoption of new technologies. Introduction of state-of-the-art technologies is necessary, not only for the new plants, but also for modernisation of the existing units.
- c. While the spring industry abroad has generally kept pace with modern technological developments, the modern technology yet needs to be introduced in spring units in India.
- d. Abroad, most of the spring manufacturing units are financially sound and have developed new technologies through R&D efforts. Thrust is also on finding newer applications of springs. In most of the countries abroad the pattern of consumption is such that about 40% is consumed by the Automobile sector and 60% is consumed in applications in other industries. As against this, in India, the pattern of consumption is 60 to 80% (hot coiled springs) for the Indian Railways & leaf springs including precision springs for the automobile sector.
- e. The latest developments at the international level include improvement of valve springs, conical valve springs, use of clean steel for springs, composite material springs, parabolic springs with composite materials to reduce weight, automatic packaging of springs, development of coiling machines which are operated as CNC and computerised machines, computer aided designs, software development of designs, statistical process

control (SPC), coating springs with paints and ceramic coatings to avoid corrosion and use of raw materials for high temperature applications.

- f. Technology import may be necessary and technological improvements must be incorporated in not only new units but also in the older units.
- g. The strengths and the weaknesses of the indigenous spring manufacturing units have been identified. Some of the new technological developments will have to be incorporated at rapid pace and for this R&D efforts are essential.

## RECOMMENDATIONS

- a. Existing research institutes and industry may take up:
  - \* Dissemination of information on spring technologies and technical/commercial information.
  - \* Intensified R&D efforts.
  - \* Training of personnel for
    - Design of springs.
    - Spring material selection.
    - Corrosion protection of springs.
    - Manufacture of springs.

For this, training, special courses may be carried out periodically.

- \* There is need for augmentation of indigenous designing capability by introduction of computer aided design and computer aided manufacturing techniques through know-how and training from collaborators.
- \* There is an urgent need for going in for large-scale export, where product quality and cost of production would have

to be kept at par with that available from competing nations. This objective can be achieved by up-grading of technology of existing units through import of technology, if necessary. One could consider linking such imports with export of the product.

- \* Applications of springs in other industries such as agricultural machines, industrial equipment (material handling), recreation and leisure (toys, sports goods), energy, (engines & turbines), residential furniture, doors, garage doors, drapery hardware, business machines and electronic industry need be explored. It is, therefore, suggested the industry should take necessary steps, with the active cooperation of the end-user industry.
- \* It is suggested that the manufacturers should work for ISO certification standards so as to achieve global quality standards and thus improve the prospects of exports to EC countries as well.