

- Shut down / Annual turn around spares.

Determination of the requirement of spare parts must, therefore, be based on a precise knowledge of the types of maintenance / overhaul routines and the behaviour of the equipment in operation to obtain an idea of the probable failure, breakdowns, etc.

## **INITIAL PROVISIONING :**

The list of spares to be procured initially at the time of the introduction of the equipment must be based on a critical study of the technical literature about the equipment and a judicious technical appreciation of the manufacturers' recommendations for maintenance and spares.

The precise definition of the 'initial' period is dependent on a number of factors are :

- H whether the equipment is indigenous or imported.
- H the lead time for supply of its spares by the manufacturers
- H after-sales service facilities offered by the manufacturer

Broadly, the initial spares should include the following :-

### **a) Complete Equipment / Major Assemblies :**

- i) As insurance spares, particularly of critical and expensive items.
- ii) For replacement during the long overhaul period of the equipment in use, particularly when it is uneconomic to shut down operations during the overhaul period.
- iii) For renewal replacement after expiry of the life of the assembly.

### **b) Minor Sub-assemblies / other parts :**

For consumption during regular maintenance routines that will fall due during the 'initial' period.

For most equipment, it is a good policy to include in the initial spares those required for the first overhaul may not fall due within the 'initial' period. This provides a comprehensive range of spares to keep the equipment operational even if some random failures/breakdowns were to develop or accidental damage were to occur during the period.

Approaches to determine the quantities in each of the groups of spares indicated above are discussed in the succeeding paragraphs.

## **PERIODIC PROVISIONING :**

Once initial spares have acquired and the equipment goes into operation, it is necessary to keep the inventory under regular review for replenishment purposes. An important input for the review is maintenance experience. After all, the initial spares were obtained largely on the basis of technical judgement. An information system that makes available to the logistics group relevant maintenance information is a pre-requisite to successful periodic replenishment of inventory.

## **ANNUAL REPLENISHMENT :**

In most organizations, large numbers of the same equipment are not held and, therefore, the consumption of spares is invariably in small quantities. There would be relatively fewer items in the spare parts inventory which can be classified as fast moving, unlike in the general stores inventory. Thus the applicability of inventory control method like EOQ method, or its variant, the (S,s) method, would be doubtful for spare parts. The periodic replenishment method appears to be quite adequate and, therefore advisable. Also, as consumption of items is in relatively small quantities, depending on maintenance routines and equipment behaviours, an annual replenishment cycle can be considered to be quite sufficient.

## **REPLENISHMENT OF COMPLETE EQUIPMENT / MAJOR ASSEMBLIES :**

An annual review of the stock of complete equipment / major assemblies is necessary to identify any depletion in the spares cover initially provided under insurance and total replacement quantities. If items have had to be replaced due to ir-repairable damage, breakdown or failure, a comprehensive review of the stock must be undertaken after a thorough consideration of all relevant factors like the remaining life of the equipment, stock in hand, etc. Replenishment quantities so identified need to be indented.

## **REPLENISHMENT OF MINOR ASSEMBLIES / OTHER PARTS :**

Minor sub assemblies and other parts which are regularly consumed during the maintenance routines and upkeep of the equipment need to be annually replenished, based on the consumption pattern experienced for each item. An approach which takes into account both the cost and criticality of the item and which is based on a statistical consideration of past consumption data is discussed in the succeeding paragraphs.

## **OVERHAUL SPARES PROCUREMENT :**

There are some equipment and major assemblies which have periodically to be laid up for a considerable time for elaborate overhaul routines. It may not be feasible to hold up production or operation till the item is returned after overhaul. In such cases, fresh one

from stock has to be issued and the one in use removed to the workshop for overhaul, after which it is returned to stock.

### **COST AND CRITICALLY CATEGORIZATION :**

The classification of items into ABC categories accordingly to their annual usage cost is well known. However, when dealing with spares, it is also considered essential to classify them according to their criticality in use. The criticality categories used are Vital (V), Essential (E) and Desirable (D). An item will, therefore, bear the twin category label; AV, AE, BD, BV, etc.

Depending on its classification as above, it is essential to know what level of assurance it is to be stocked. Level of assurance, expressed as a percentage say, 90% indicates that in 90 cases out of 100, the item will be available in stock for issue on demand. It is easy to see that the higher the level of assurance specified, the higher the inventory level to be maintained, with all its attendant costs. For various cost-cum-criticality categories of spares, the levels of assurance can be specified as under :

	V	E	D
A	50%	Low	Low
B	75%	50%	Low
C	95%	75%	50%

Dept. A Practical Categorisation.

In practice, however, the more detailed the classification, the more elaborate becomes inventory control decision rules. In practice, therefore, it becomes advisable to simplify working by classifying inventory into as few categories as possible. Only two groupings are recommended:

- a) A composite group of A and critical items which must be controlled vigilantly so that no shortages or surpluses occur in them.
- b) All other items on which control can be relatively relaxed.

It will be noticed that items recommended lower assurance levels in accordance with Gen. Apte's formulation will be stocked at a slightly higher level of assurance in the above dispensation. This may have to be accepted rather than introduce very elaborate decision rules, which would entail loose and diffuse control spread over an extensive staff.

### **INSURANCE SPARES :**

Insurance spares are irregularly consumed spares. With a high reliability of performance. These are of high value and are not required for routine maintenance but would cause a

lengthy shutdown of vital equipment or the entire plant in case they are not available besides would cause high stock out cost.

Whether to buy an expensive assembly or the complete equipment as insurance spare is indeed a difficult question to answer. The probability of its being required is usually very low; yet if it is not readily available when required, the lost in production / sales / goodwill is so heavy as to be forbidding.

#### **H Stocking Policy of Insurance Spares :**

It is normal for many organizations to order one set of insurance spare part along with the equipment itself for all critical equipments where lead time of procurement is long and repairing of the damaged part locally not possible. Before ordering, it is necessary to examine the cost/benefit of the following three alternatives.

- i) Ordering a new part for stock in advance of a breakdown to enable immediate availability when required.
- ii) Ordering a new part and awaiting its arrival before repairs are undertaken, with the time interval indicating the stock out cost.
- iii) Scope of repairing the damaged part locally or at the factory without holding any stock and the cost there of for repairing and the stock out cost till it is repaired.

Before adopting the policy of one spare for each equipment, which if extended can give a standby factory, a selective approach is to be adopted. Otherwise, many of the spares which would not be used during the operating life of the machine get accumulated in the store when the machine is finally scraped.

### **MANAGEMENT INFORMATION SYSTEM FOR SPARE PARTS MANAGEMENT :**

A sound information system or a data base is very essential for forecasting requirement of spares, planning the procurement, controlling the consumption of spares, keeping check on inventories and thereby keeping down the overall cost of spares management. It provides the basis for decision concerning planning and controlling functions.

#### **H Data Base :**

Various types of information essential to fulfil the above requirements are :

1. Failure rates of various spares.
2. Reliability data.
3. Consumption pattern for regularly consumed spares.

4. Data regarding the stockout cost due to non-availability of various spares.
5. Lead time and its variation.
6. A number of file of parts containing part code, description, trade name and part nos. of different manufacturers, unit, price, location code, order quantity, safety stock, etc., cross reference indicating where the part used.
7. Information regarding availability and suppliers of spares. Information 1 and 2 and partly 3 (i.e. for capital and insurance spares) can be had from history card and suppliers recommendations, consumption pattern for regularly used spare can be obtained from bin cards and ledger.

## **H MIS System :**

The system would start with maintaining the stock ledger, incorporating the receipts, issued and stock on hand at any time. Based on whether the reorder level system or periodic review system is used, the initiation of purchase requisition would be made. Purchase orders must be entered into the system so that follow up can be initiated.

While the issues and receipts are being recorded, information regarding department and equipments needing the same part shall be fed into the system so that usage history data can be build to enable projection of demand. The schematic operation of the system is indicated below:-



The system should also provide to generate a number of monthly, quarterly and annual reports. These reports could help top management as well as spare parts executives in planning and controlling operations of spare parts management. The reports can give comparison of performance with previous month or year.

## H **Reports :**

The periodical reports needed for Management control are :

### a) **Accordinging :**

- i) Stock ledger report
- ii) Cost report
- iii) Shortage / Excess report
- iv) Annual inventory list

### b) **Planning :**

- i) Recomputed reorder levels based on latest movement data.
- ii) Indent report of items which have reached reorder level.
- iii) Indent follow up for each stage of procurement of all items.
- iv) Special reports on equipment with stocks of spare parts for review before overhaul.

### c) **Control :**

- i) Inventory levels variance analysis report.
- ii) ABC Analysis reports.

## **CHAPTER XII**

### **VALUE ANALYSIS / ENGINEERING :**

#### **INTRODUCTION:**

Value engineering has emerged to-day as one of the most useful and effective tool for cost reduction. The essential features of value engineering which differentiate it from other cost reduction techniques, is that it seeks at reducing cost without impairing the quality and reliability, in other words – the value, to the customer.

Value engineering primarily deals with material. It is of immense interest to material managers, as material account for more than 50% of the cost of production in most Indian industries and as all industries are having huge inventories, locked up working capital and high interest charges, all corroding the very viability of the organization, the value engineering offers a unique tool for cost and inventory reduction.

Value Analysis aims at a systematic identification and elimination of unnecessary costs resulting in the increased use of alternatives, less expensive material, cheaper designs, less costlier methods of manufacturing etc. to provide the same performance, quality and efficiency in a decrease of overall unit costs and consequently greater profits.

A more elaborate definition of Value Analysis as given below throws more light on the subject.

#### **TYPES OF VALUE :**