PROCESS INVENTORY CONTROL

INTRODUCTION :

In an organization where more than 10,000 items are in its inventory listing, it is not possible to control all items closely. Also, all inventory items do not require the same level of attention. Usually only a few (about 10% by number) contribute to 70 to 80% of locked up inventory or 70 to 80% of consumption value or their availability is vital for maintenance or the process. These 'vital few' items can be segregated for the closer control to ensure productivity.

Inventory control is concerned with achieving an optimum balance between two conflicting objectives. The objectives are –

1) To minimize investment in inventory.
2) To maximize the service levels.

RELEVANT COSTS :

Basically there are four costs relevant for consideration in developing an inventory model. These are :

1) the cost of placing a replenishment order.
2) the cost of carrying inventory.
3) the cost of under stocking.
4) the cost of over stocking.

The cost of ordering and inventory carrying cost are viewed as the supply side costs and help in the determination of the quantity to be ordered for each replenishment. The under stocking and over stocking costs are viewed as the demand side costs and help in the determination of the amount of variations in demand and the delay in supplies which the inventory should withstand.

COST OF ORDERING :

Every time an order is placed for stock replenishment, certain costs are involved, and for most practical purposes, it can be assumed that the cost per order is constant. The ordering cost (Co) may vary, depending upon the type of items; raw material like steel

against production components like casting. However, it is assumed that an estimate Co can be obtained for a given range of items. This cost of ordering, Co includes:

1) Paper work costs, typing and despatching an order.
2) Follow-up costs required to ensure timely supplies – includes the travel cost for purchase follow-up, telephone, telex and postal bills.
3) Costs involved in receiving the order, inspection, checking and handling in the stores.
4) Any set up cost of machines if charged by the supplier, either directly indicated in quotations or assessed through quotations for various quantities.
5) The salaries and wages to the purchase department.

The ordering cost in a typical firm is around Rs.100 per order, but experience shows that this cost varies considerably depending upon the efficiency of the purchasing department.

Particularly when dealing with staggered deliveries, the mathematical models can be suitably modified to get the "economic receipt quantity" instead of "economic order quantity."

COST OF INVENTORY CARRYING :

This cost (i) is measured as a percentage of the unit cost of the item. This measure, gives a basis for estimating what it actually costs a firm to carry stock. This cost includes:

1) interest on capital.
2) insurance and tax charges.
3) storage costs – any labour, the costs of provisions of storage area and facilities like bins, racks, etc.
4) allowance for deterioration or spoilage.
5) salaries of stores staff.
6) Obsolescence.

The inventory carrying cost varies in a typical Industry from 25 to 30 percent. A major portion of this is accounted for by the interest or capital which depends on the fiscal policies of the government. In the analysis and use of mathematical formula, only the variable costs should be considered, as the fixed costs will be constant irrespective of the number of orders placed or the inventory carried.

UNDERSTOCKING COST :

This cost (Ks) is the cost incurred when an item is out of stock. It includes the cost of lost production during the period of stock out and the extra cost per unit which might have to be paid for an emergency purchase.

OVERSTOCKING COST :

This cost (Ko) is the inventory carrying cost (which is calculated per year) for a specific period of time. The time varies in different contexts – it could be the lead time of procurement or the entire life-time of a machine. In the case of one-time purchases, over stocking cost would be equal to the difference to purchase price & scrap price (Purchase price-Scrap Price).

Based on the costs several scientific models have been developed. The need for using these models in India have been stressed by various committees and for proper inventory control, the scientific practices and techniques that have been developed in this regard.

INVENTORY TYPES :

There are four types of inventory with which a manufacturing firm must concern itself –

1) Raw materials and purchased components.
2) In process inventory.
3) Finished Products.
4) Maintenance, repair and tooling inventories.

To manage these various kinds of inventories, two alternative control procedures can be used –

1) Order Point Systems : This has been the traditional approach to inventory control. In these systems, the items are restored when the inventory levels become low.
2) Materials requirement planning – MRP.

It is important that the proper control procedure be applied to each of the four types of inventory. In general, MRP is the appropriate control procedure for inventory types 1 & 2. Order point systems are often considered the appropriate procedure to control inventory type 3 & 4.

VITAL FEW :

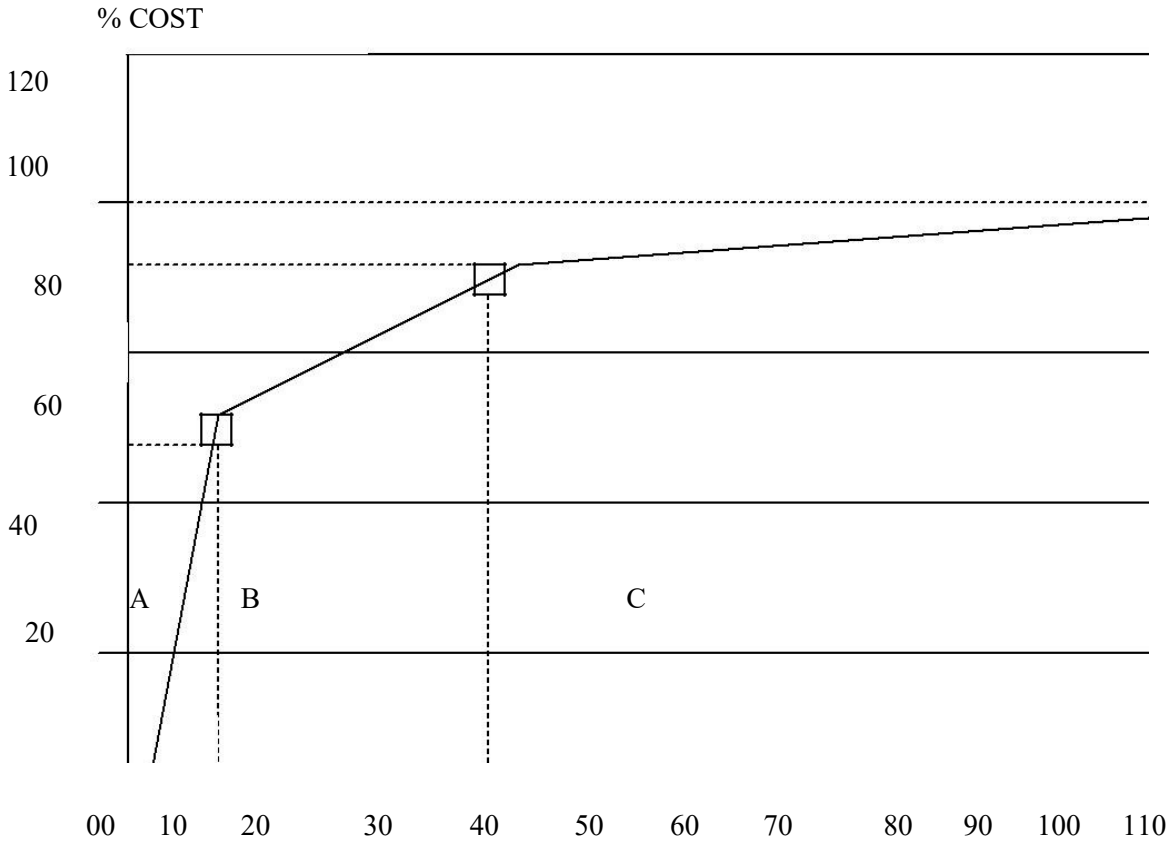
Company deals with stock of thousands of items raising a series problem of keeping control or track of all these items; also it may not be necessary to have the same closeness of control on each and every item. A close perusal of the inventory will reveal that only a few of the inventories require close attention to achieve desired results and the balance many may be trivial for the purpose. An analysis of the inventories based on selected criterion will help in selecting the 'vital few' and 'trivial many' in respect of control for achieving the objective. The criteria for classification may be annual consumption cost, criticality of spare, weight, unit cost, etc. Different types of analyses each having its own

specific advantages and purposes, help in finding a practical solution to the control of inventory with minimum efforts. Some important analysis carried out are :

ABC Analysis - based on annual consumption.
VED Analysis - criticality for production.
SDE Analysis - availability.
HML Analysis - weight / cost permit.
FSN Analysis - consumption rate.

ABC ANALYSIS :

ABC is said to connote "Always Better Control". The basis of analyzing the annual consumption cost (or usage cost) goes after the principle "VITAL FEW – TRIVIAL MANY", and the criterion used here is the money spent and not the quantity consumed. The following Exhibit brings out clearly the concept of ABC Analysis.



GRAPHIC ANALYSIS OF ANNUAL USAGE COST

The general picture of ABC Analysis will show the following position:-

	% Item	% of Annual Consumption Cost.
A – Items	10	70
B – Items	20	20
C – Items	70	10

VED ANALYSIS :

This analysis specially pertain to the classification of maintenance spares denoting the essentiality of stocking spares according to their criticality.

V - Stands for vital – items when out of stock or when not readily available, completely brings the production to a halt.

E - is for Essential items without which temporary losses of production or dislocation of production work occurs.

D - denotes Desirable items – all other items which are necessary but do not cause any immediate effect on production.

SDE ANALYSIS :

This analysis is based spares availability of an item –

S - refers to Scarce Items, especially imported and those which are very much in short supply.

D - are Difficult items which are procurable in market but not easily available. For example, items which have to come from far off cities or where there is not much competition in market or where good quality supplies are difficult to get or to be procured.

E - refers to Easy items – Items are those which are easily available; mostly local items.

It is normally advantageous to consider A, V & S items for selective controls.

HML ANALYSIS :

The cost per item (per piece) is considered for this analysis. High cost items (H), Medium Cost items (M) and Low Cost item (L) help in bringing controls over consumption at the departmental level.

FSN ANALYSIS :

This analysis is to help control obsolescence and is based on the consumption pattern of the items. The items are analyzed to be classified as Fast-moving (F), Slow-moving (S) and Non-moving (N) items. The Non-moving items (usually not consumed over a period of two years) are of great importance. Scrutiny of non-moving items is to be made to determine whether they could be used or be disposed off. The fast and slow-moving classifications help in arrangement of stock in stores and their distribution and handling methods.

OTHER TYPES OF ANALYSIS :

Items held in stock could be analyzed category-wise, product or project-wise. The turnover ratio or holding of stocks after such analysis are found very useful.

POLICIES FOR CONTROL OF 'A' ITEMS :

i) Annual contract for supplies with as frequent and staggered deliveries as is economical.
ii) Minimum safety stock or even fluctuating safety stocks by maintaining better vendor-vendee relationships, speculation of market conditions, supply conditions, etc.
iii) More frequent review of stock position and consumption patterns.
iv) Precise quality specifications or materials standards evolved.
v) Value analysis to find cheaper substitutes, better sources of supply and to reduce the overall costs.
vi) Waste control measures to reduce the scrap, rejection, re-work and sub-standards.
vii) Continuous developmental work or research carried out wherever possible.

INVENTORY REPLENISHMENT :

Inventory replenishment system should answer the two questions: When to order and how much to order in order to maintain optimum levels of stocks and avoid stock outs.

Order point systems are concerned with the two related problems of determining when to order and how much to order. Determining when to order is often accomplished by establishing a 'reorder point'. When the inventory level for a particular item falls to the reorder point, it is time to restock the item. A computerized inventory control system can be programmed to track the inventory level perpectually as transactions are entered against existing stocks. It automatically indicates when it is time to reorder, perhaps even generating a purchase requisition to do so.

The problem of determining how much to order is typically based on the use of the familiar economic order quantity (EOQ) formula, which states –

$$EOQ = \sqrt{\frac{2 A Co}{Cu\ i}}$$

Where EOQ = quantity of the item to be ordered in unit.
A = annual consumption in units.
Co = ordering cost in Rs. / order
Cu = cost per unit item.
I = inventory carrying cost / Re. of inventory in decimals.

It can also be written as –

$$EOQ = \sqrt{\frac{2 A S}{i}}$$

Where EOQ = quantity of item to be ordered in Rs.
A = annual consumption in Rs.
S = ordering cost in rupees.
I = inventory carry cost / Re. of inventory in decimals.

Normally two systems of ordering are followed and they are :

1. ROL method.
2. Periodic Ordering Method.

ROL METHOD :

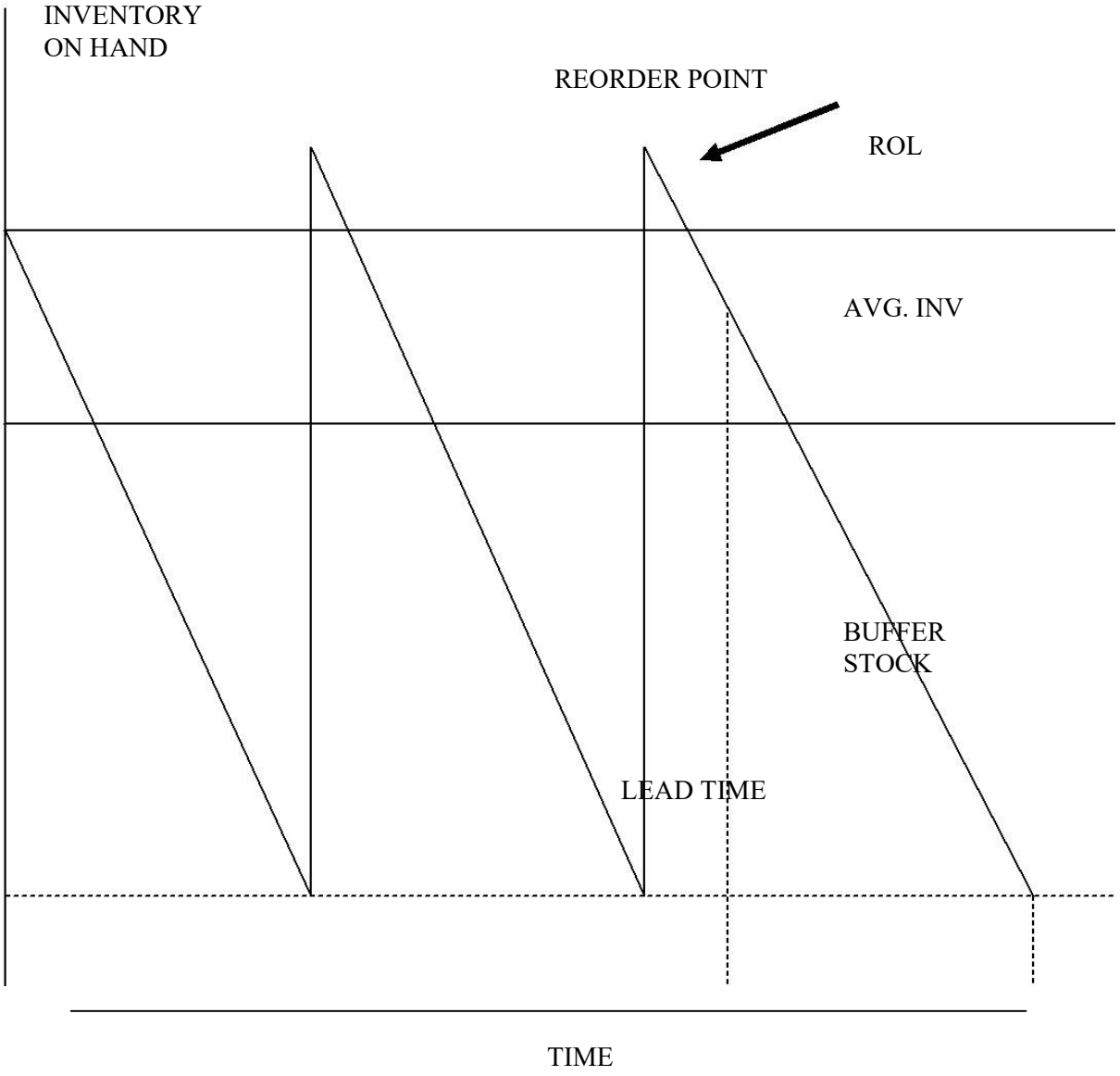
The orders are placed for la fixed quantity usually the Economic Order Quantity either as and when the stocks reach the Reorder Limit (ROL) or at the end of a predetermined review period if the stocks have fallen below the Reorder Limit.

i. The ordering quantity is fixed (the EOQ), it is checked whether the Reorder Limit is reached.

The ROL is determined by adding the lead time requirements to safety stock.

ROL = Safety Stock + Lead Time requirements

The ordering quantity is usually the economic ordering quantity, as shown in the following Exhibit



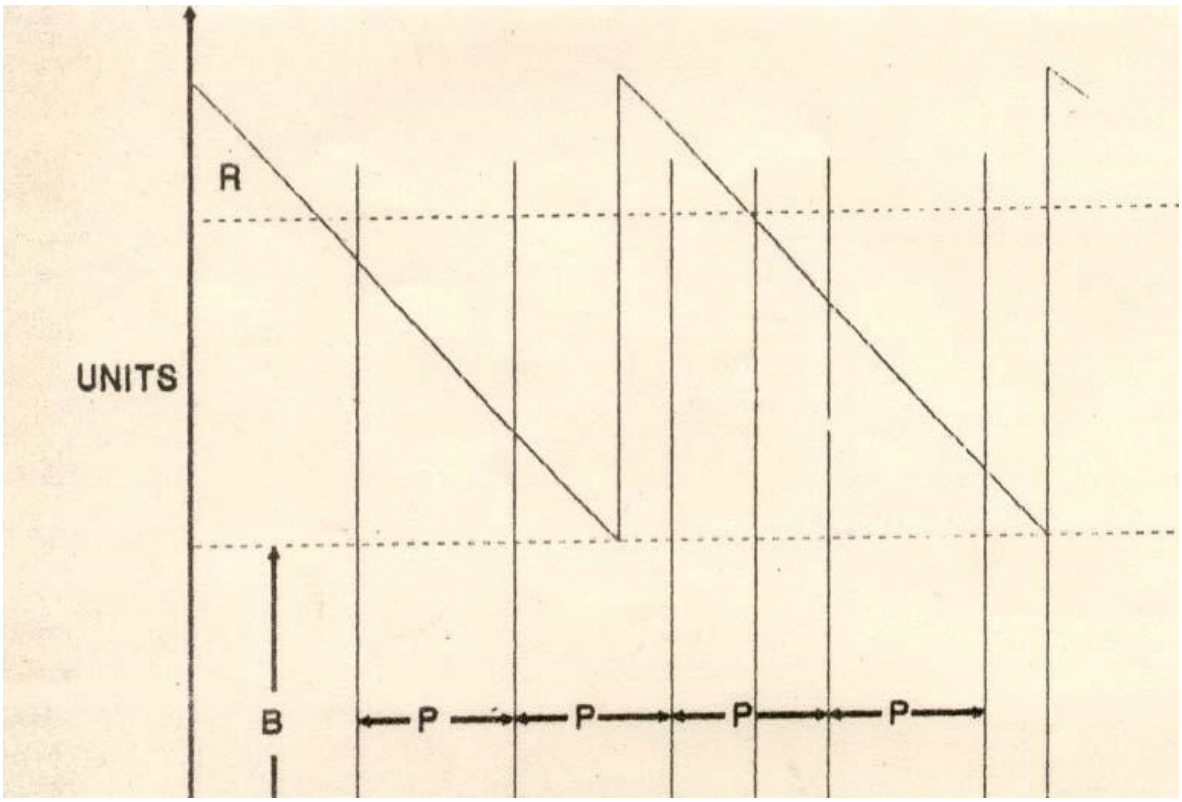
THE AVERAGE STOCKS MAINTAINED WILL BE SAFETY STOCK + ½ EOQ

ii) The ordering quantity is fixed (the EOQ) it is checked whether at the periodic review the stocks have fallen below a Reorder Limit ®. If the stock is lower than the Reorder Limit, order is placed for EOQ. Otherwise if it is above the Reorder Limit, no action need to be taken till the next Review Point.

The Reorder Point, R, is calculated as follows:

R = Safety Stock + Rate of Consumption (Lead Time + Review Period / 2) The inventory

model is shown in the following Exhibit.



R = Re-order Point (in units) B = Safety
Stock (in units)
SD = Average daily sales (units / day), R = B + Sd (L+P / 2) L = Average
Lead Time (in days)
P = Review Time (in days)

The average stock works out to : Safety Stock + ½ of EOQ.

PERIODIC ORDERING METHOD :

The stocks are received at fixed intervals of time (known as Review Period and orders are placed for a variable quality).
There is no fixed ordering quantity, the ordering quantity is determined as the difference between the actual stocks held at the time of Periodic Review and the Maximum Inventory Level (M).

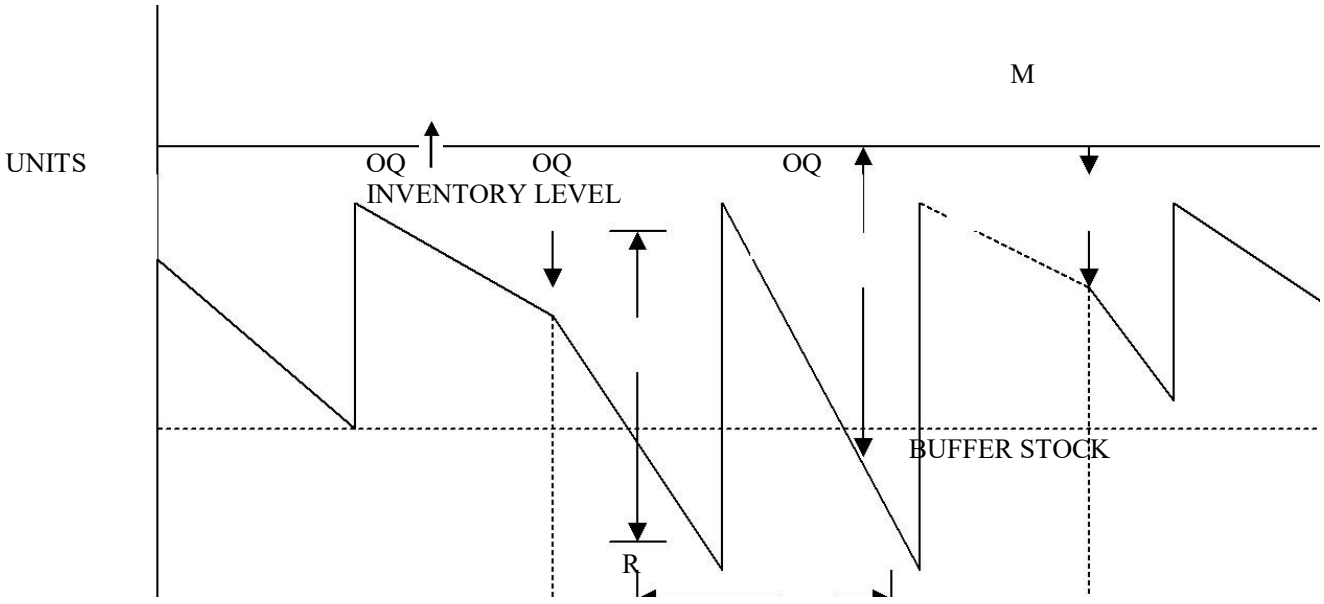
M = Safety Stock + Consumption Rate (Lead time + Review Period)

Depending upon whether the Lead time is greater or lesser than the Review Period, one of the following two rules is used in fixing the Reordering quantity.

If lead time < Review period, Ordering Quantity = M – Actual Stock held at the time of Review

If lead time > Review Period, Ordering Quantity = M – (Actual stock held at the time of Review + Quantity on Order)

The inventory fluctuation by this system is shown in the following Exhibit



R = REVIEW PERIOD
OQ = ORDER QUANTITY.

OPTIMUM REVIEW PERIOD :

The optimum review period could be calculated by using the following formula :

Optimum Review Period (in months) = $\frac{288Co}{Aci}$ = $\frac{288 \text{ X Cost per Order in Rs.}}{\text{Annual Usage (in units) X Unit Cost (in Rs.) X Annual inv. Carrying Cost}}$

SAFETY STOCKS :

The safety stocks become necessary in order to avoid 'Stock outs' if the rate of consumption increased and or the lead time gets extended from the values considered for the replenishing systems.

A simple way of establishing the safety stock would be to find out the above two variations that could normally occur over a period of time in terms of additional quantity of stock to be maintained.

i) When consumption variation is very high

Safety Stock = (Maximum rate of consumption – Normal rate of Consumption) X Lead time.

ii) When Lead time variation is very high

Safety Stock = Normal consumption rate X (Maximum lead time – Normal Lead time)