Just-in-time (JIT) Purchasing

Just-in-time purchasing is the purchase of materials immediately before these are required for use in production. According to CIMA, London JIT purchasing is *'matching receipts of materials closely with usage so that raw material inventory is reduced to near zero level.'* The purpose of JIT purchasing is to reduce stock levels to the minimum through creating closer relationship with suppliers and arranging frequent deliveries of materials in smaller quantities. It results in enormous savings in storage costs, material handling costs, spoilage, obsolescence etc. An important effect of JIT purchasing is that with frequent purchasing the issue price is likely to be closer to market prices. In order to save on ordering costs, long term agreements may be entered into with suppliers.

ABC TECHNIQUE (Selective Control)

ABC technique is a value based system of material control. In this technique, materials are analysed according to their value so that costly and more valuable materials are given greater attention and care. All items of materials are classified according to their value—high, medium and low values, which are known as *A*, *B* and *C* items, respectively. *ABC* technique is sometimes called *Always´Better Control* method.

'A' Items—These are high value items which may consist of only a small percentage of the total items handled. On account of their high cost, these materials should be under the tightest control and the responsibility of the most experienced personnel.

'B' Items—These are medium value materials which should be under the normal control procedures.

'C' Items—These are low value materials which may represent a very large number of items. These materials should be under simple and economical methods of control.

The point of classifying stock into *A*, *B* and *C* categories is to ensure that material management focuses on *A* items where sophisticated controls should be installed. *B* items may be given less attention and *C* items least attention.

Thus *ABC* technique is a selective control which aims at concentrating efforts on those materials where attention is needed most. This is so because it is unwise to give equal attention to all items in stock. The items are listed and ranked in the order of their descending importance showing quantity and value of each item. This is illustrated below with arbitrary percentage figures.

Category	*% of total value*	*% of total quantity*	*Type of control*
A	70	10	Strict control
B	25	30	Moderate control
C	5	60	Loose control
Total	100	100	

Reorder Quantity (Economic Order Quantity or EOQ)

Reorder quantity is the quantity for which order is placed when stock reaches reorder level. By fixing this quantity, the purchaser doesn't have to recalculate the quantity to be purchased each time he orders for materials.

Reorder quantity is known as Economic Order Quantity because it is the quantity which is most economical to order. In other words, economic order quantity is that size of the order which gives maximum economy in purchasing any material and ultimately contributes towards maintaining the material at the optimum level and at minimum cost.

While setting economic order quantity, two types of costs should be taken into account:

1. **Ordering cost** This is the cost of placing an order with the supplier. Because of so many factors involved, it is quite difficult to quantify this cost. It mainly includes the cost of stationery, salaries of those engaged in receiving and inspection, salaries of those engaged in placing orders, etc.

2. **Cost of carrying stock** This is the cost of holding the stock in storage. It includes the following:

(*a*) Cost of operating the stores, (salaries, rent, stationery, etc.)

(*b*) The incidence of insurance cost

(*c*) Interest on capital locked up in store

(*d*) Deterioration and wastage of materials

Note: At EOQ, ordering cost and cost of carrying stock are equal, *i.e.*, when the total of the two types of costs is the lowest.

The above two types of costs are of opposing nature. If, for instance, an attempt is made to reduce the costs of carrying stock by keeping stocks as low as possible, the cost

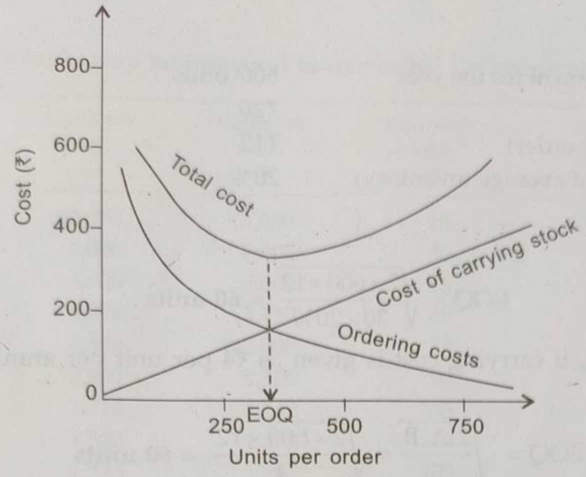

Fig. 2.3: *Economic Order Quantity*

of ordering will go up because the number of replenishment orders will automatically rise. On the other hand, if in order to save ordering costs, order is placed for a larger quantity at one time, the stock will remain longer in stores and the cost of carrying stock will go up. The problem is, therefore, to balance these two types of costs and the economic order quantity is fixed at a point where the aggregate cost is the minimum. This is shown in Figure 2.3, in which the line of cost of ordering has been shown sloping downward indicating lower cost when large quantity is purchased and the line representing cost of carrying stock going upward indicating higher costs for holding larger stocks. The economic order quantity, which is the ideal order size, is at a point where total cost curve is at its lowest point.

Mathematical Formulae of EOQ

The above graphic methods of determining economic order quantity may not provide the most accurate answer. Economic order quantity can also be calculated with the help of a formula as given below:

$$\boxed{EOQ = \sqrt{\frac{2.A.B}{C.S}}}$$

where EOQ = Economic Order Quantity
A = Annual consumption in units
B = Buying or ordering cost per order
C = Cost per unit
S = Storage or carrying cost as a percentage of average inventory

Estimated requirement for the year	600 units
Cost per unit	₹20
Ordering cost (per order)	₹12
Carrying cost (% of average inventory)	20%

Solution:

$$\text{EOQ} = \sqrt{\frac{2 \times 600 \times 12}{20 \times 20\%}} = \textbf{60 units}$$

In this illustration, if carrying cost is given as ₹4 per unit per annum, EOQ will be calculated as follows:

$$\text{EOQ} = \sqrt{\frac{2.\text{A.B}}{\text{S}}} = \sqrt{\frac{2 \times 600 \times 12}{4}} = \textbf{60 units}$$

Illustration 2.3

The annual demand for a product is 6,400 units. Inventory carrying cost is ₹1.50 per unit per annum. If the cost of one procurement is ₹75, determine:

(*a*) Economic order quantity
(*b*) No. of orders per year
(*c*) Time between two consecutive orders

Solution:

(*a*) $\text{EOQ} = \sqrt{\frac{2.\text{A.B}}{\text{S}}} = \sqrt{\frac{2 \times 6{,}400 \times 75}{1.50}} = \textbf{800 units}$

(*b*) No. of orders per year = Annual demand ÷ EOQ
= 6,400 ÷ 800 = **8 orders** in a year

(*c*) Time between two consecutive orders
12 months ÷ 8 orders = **1½ months**

STOCK LEVELS

In order to guard against under-stocking and over-stocking, most of the large companies adopt a scientific approach of fixing stock levels. These levels are: (*i*) maximum level; (*ii*) minimum level; (*iii*) reorder level; and (*iv*) reorder quantity. By adhering to these levels, each item of material will automatically be held within appropriate limits of control. These levels are not permanent and must be changed to suit changing circumstances. Thus, changes will take place if consumption of material is increased or decreased or if—in the light of a review of capital available, —it is decided that the overall inventory must be increased or decreased.

Modern inventory management makes use of operations research and statistical techniques in fixing stock levels. However, given below is the description of various levels along with formulae that are commonly used in their computations.

Factors Some of the factors which influence stock levels are:

1. Anticipated rate of consumption
2. Amount of capital available
3. Availability of storage space
4. Storage/warehousing costs
5. Procurement costs
6. Reliability of suppliers
7. Minimum order quantities imposed by suppliers
8. Risk of loss due to: (*a*) obsolescence; (*b*) deterioration; (*c*) evaporation; and (*d*) fall in market prices

Maximum Level

This is that level above which stocks should not normally be allowed to rise. The maximum level may, however, be exceeded in certain cases, *e.g.*, when unusually favourable purchasing condition arise. It is computed by the following *formula*:

$$\text{Maximum level} = \text{Reorder level} + \text{Reorder quantity} - \left(\text{Minimum consumption} \times \text{Minimum reorder period}\right)$$

The following factors are taken into account in setting this level:

1. Rate of consumption of material
2. Risk of obsolescence and deterioration
3. Storage space available
4. Costs of storage and insurance

5. Availability of funds needed
6. Seasonal considerations, *e.g.*, bulk purchases during off-season at low prices
7. Reorder quantity
8. Restrictions imposed by government or local authority in respect of certain materials in which there are inherent risks of fire, explosion, etc.

The idea of setting maximum stock level is to ensure that capital is not unnecessarily blocked in stores and also to avoid loss due to obsolescence and deterioration.

Minimum Level

It is that level below which stock should not normally be allowed to fall. This is essentially a safety stock and is not normally touched. In case of stock falling below this level, there is a risk of stoppage in production and thus top priority should be given to the acquisition of fresh supplies. It is computed by the following *formula*:

$$\text{Minimum level} = \text{Reorder level} - \left(\text{Normal consumption} \times \text{Normal reorder period}\right)$$

In fixing this level, the following factors are considered:

1. Rate of consumption.
2. The time required to acquire fresh supplies under top priority conditions so that stoppage in production can be avoided.

Reorder Level or Ordering Level

This is that level of material at which purchase requisition is initiated for fresh supplies. This level is fixed somewhere above minimum level. This is fixed in such a way that by reordering when materials fall to this level, then in the normal course of events, new supplies will be received just before the minimum level is reached. Its *formula* is:

$$\text{Reorder level} = \text{Maximum consumption} \times \text{Maximum reorder period}$$

The following factors are considered in fixing this level:

1. Rate of consumption of the material
2. Minimum level
3. Delivery time—*i.e.*, the time normally taken from the time of initiating a purchase requisition to the receipt of materials. This is also known as lead time
4. Variations in delivery time

Average Stock Level

This is computed as follows:

$$\text{Average stock level} = \tfrac{1}{2}(\text{Minimum level} + \text{Maximum level})$$

Alternatively, Average stock level = Minimum level + ½ (Reorder quantity)

Figure 2.2 shows the various stock levels. This is based on the assumption of constant lead time and constant rate of consumption with no interruption in production. However, in actual practice, both lead time and rate of consumption may not remain uniform.

Lead time is the time interval between the time when an item reaches reorder level and a fresh order is placed, to the time of actual receipt of materials. When purchased materials are received, the maximum level is reached. As materials are consumed, the stock level starts coming down. Fresh supplies are received when stock reaches minimum level.

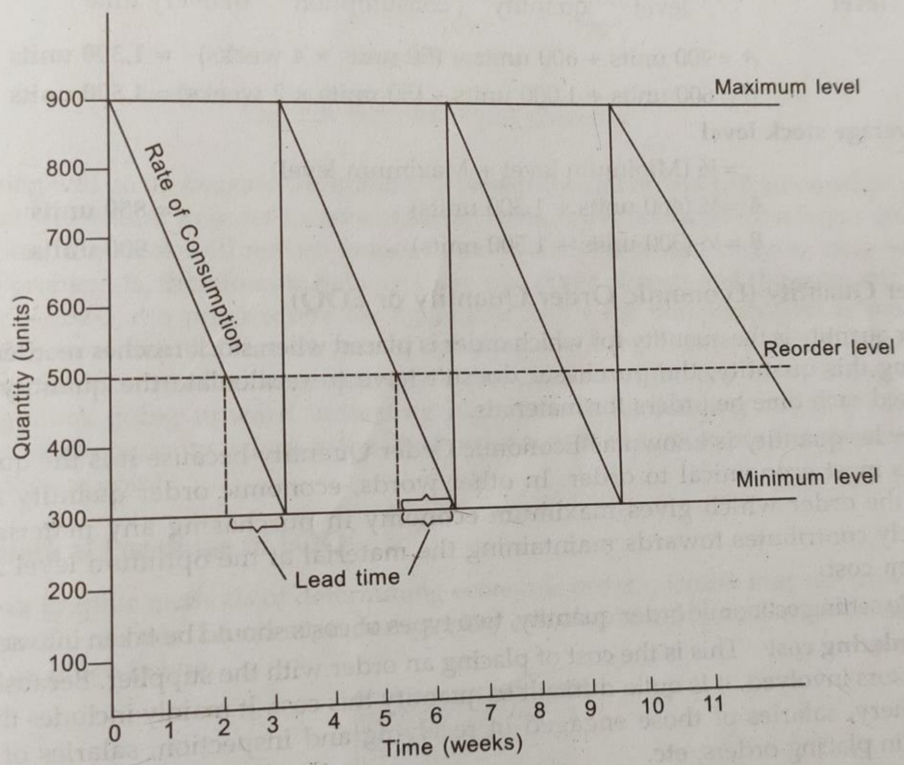

Fig. 2.2: *Various Stock Levels, With Constant Lead Time and Constant Rate of Consumption*

Question on Stock levels

Two materials *A* and *B* are used as follows:

Minimum usage	50 units per week each
Maximum usage	150 units per week each
Normal usage	100 units per week each
Reorder quantity	*A*—600 units, *B*—1000 units
Delivery period	*A*—4 to 6 weeks, *B*—2 to 4 weeks.

Calculate various stock levels.

Solution on Stock Levels

Solution:

Reorder level = Maximum consumption × Maximum reorder period

$A = 150$ units × 6 weeks = **900 units**

$B = 150$ units × 4 weeks = **600 units**

Minimum level = Reorder level − (Normal consumption × Normal delivery period)

$A = 900 - (100$ units × 5 weeks) = **400 units**

$B = 600 - (100$ units × 3 weeks) = **300 units**

Average reorder period has been taken as normal reorder period.

Maximum level = Reorder level + Reorder quantity − (Minimum consumption × Minimum delivery time)

$A = 900$ units + 600 units − (50 units × 4 weeks) = **1,300 units**

$B = 600$ units + 1,000 units − (50 units × 2 weeks) = **1,500 units**

Average stock level

= ½ (Minimum level + Maximum level)

A = ½ (400 units + 1,300 units) = **850 units**

B = ½ (300 units + 1,500 units) = **900 units**

Question No 1 on Stock level and EOQ

Problem 2.5

Medical Aids Co. manufactures a special product *A*. The following particulars were collected for the year 2012:

(*a*) Monthly demand of *A*	1,000 units
(*b*) Cost of placing an order	₹100
(*c*) Annual carrying cost per unit	₹15
(*d*) Normal usage	50 units per week
(*e*) Minimum usage	25 units per week
(*f*) Maximum usage	75 units per week
(*g*) Reorder period	4 to 6 weeks

Compute from the above: (1) Reorder Quantity; (2) Reorder Level; (3) Minimum Level; (4) Maximum Level; (5) Average Stock Level. *(CA Inter)*

Solution

Solution:

1. **Reorder Quantity** $= \sqrt{\frac{2.A.B}{C}}$ where A = Annual usage

B = Ordering cost

C = Carrying cost per unit

$= \sqrt{\frac{2 \times 2,600^{*} \times 100}{15}}$ = **186 units** (Approx.)

* Normal usage is 50 units per week. So, for one year it is 52 weeks × 50 = **2,600 units.**

2. **Reorder Level**

= Maximum usage × Maximum reorder period

= 75 × 6 = **450**

3. **Minimum Level**

= Reorder level – (Normal usage × Normal reorder period)

= 450 – (50 × 5) = **200 units**

4. **Maximum Level**

= Reorder level + Reorder quantity – (Min. usage × Min. reorder period)

= 450 + 186 – (25 × 4) = **536 units**

5. **Average Stock Level**

= ½ (Minimum level + Maximum level)

= ½ (200 + 536) = **368 units**

Question No 2 on Stock level and EOQ

About 50 items are required every day for a machine. A fixed cost of ₹50 per order is incurred for placing an order. The inventory carrying cost per item amounts to ₹0.02 per day. The lead period is 32 days. Compute:

(*i*) Economic Order Quantity

(*ii*) Reorder Level *(CA Inter)*

Solution:

(*i*) Economic order Quantity $= \sqrt{\frac{2.A.B}{S}}$

where A = Annual consumption (50 items × 365 days) = 18,250

B = Buying (ordering) cost = ₹50

S = Storage cost per item per annum (0.02 × 365 days) = ₹7.30

EOQ $= \sqrt{\frac{2 \times 18,250 \times 50}{7.30}}$ = **500 items**

(*ii*) Reorder Level = Max. consumption per day × Max. lead time

= 50 × 32 = **1,600 items**