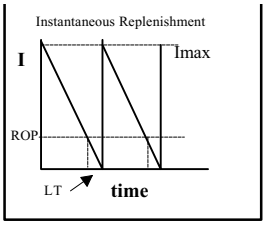
Inventory Formulas



TC = total relevant cost
Q = amount ordered or produced at a time
D = Demand (e.g. annual)
H = holding cost per unit
S = cost per startup or order processed
P = price per unit

Basic EOQ

(cost of good not considered when the same for all Q)

$$EOQ = \sqrt{\frac{2DS}{H}} \qquad TC = \frac{Q}{2} * H + \frac{D}{Q} * S + [P * D]$$

EOQ with Quantity Discount (COG must be considered. This is much more complicated if H is a function of P)

$$TC = \frac{Q}{2} * H + \frac{D}{Q} * S + P * D$$

Economic Run Size

(Production Order Quantity) $I_{Max} = ERS * (\frac{P-U}{P})$

P = production rate
U = rate of use
I_{max} = maximum Inventory

$$ERS = \sqrt{\frac{2DS}{H}} * \sqrt{\frac{P}{P-U}} \qquad TC = \frac{I_{Max}}{2} * H + \frac{D}{Q} * S$$

Reorder Point

d = demand
S_d = standard deviation of demand
LT = lead time
S_{LT} = standard deviation of lead time
Z_{SL} = Z score corresponding to a desired service level
SL = probability of meeting demand during an order cycle

Constant demand, Lead time $ROP = d * LT$

Demand variable $ROP = d * LT + Z_{SL} * \sqrt{LT} * \sigma_d$

Lead Time variable $ROP = d * LT + Z_{SL} * d * \sigma_{LT}$

Demand & Lead Time Variable

$$ROP = d * LT + Z_{SL} * \sqrt{LT * \sigma_d^2 + d^2 * \sigma_{LT}^2}$$

ROP Shortages

Units short per cycle $E_{(n)} = E_{(Z)} * \sigma_{dLT}$

Units short per year $E_{(N)} = E_{(n)} * \frac{D}{Q}$

Annual Service Level $SL_{Annual} = 1 - \frac{E_{(n)}}{D}$

note: the expression for σ_{dLT} is the same as those used for ROP, and depends on whether demand and/or lead time vary.

Fixed Interval

Assuming variable d, LT constant

$$Q = d * (OI + LT) + Z_{SL} * \sqrt{(OI + LT)} * \sigma_d - A$$

Q = Amount to order
A = amount on hand
OI = order interval

Single Period

$$SL = \frac{C_S}{C_S + C_e}$$

$$Q = d + Z_{SL} * \sigma_d$$

C_s = Cost of Shortage (lost profit)
C_e = cost of excess (cost of good less any salvage value, plus any disposal cost)

RJB, December 11, 1999