



Effective Inventory Management, Inc.

Achieving Effective Inventory Management with Microsoft Dynamics NAV Forecasting and Procurement Suite

Introduction

Distributors make money by selling inventory. But many, if not most distributors experience “challenges” in managing what is probably their largest investment. They have excess inventory of some items while experiencing stock outs of other items. The mission of Effective Inventory Management, Inc. (*EIM*) is to help organizations achieve the goal of effective inventory management:

“Effective inventory management allows a distributor to meet or exceed customers’ expectations of product availability with the amount of each item that will maximize the distributor’s net profits.”

The first part of the goal involves meeting your customers’ expectations. The second part discusses finding the amount of inventory, *required to meet these expectations*, which will result in the best return on the amount of money you have invested in these products. The two parts of the overall goal of effective inventory management are not contradictory. In fact, they compliment each other.

Last year I started working with Lanham Associates to improve the inventory management tool set available to Navision users. Working together with Microsoft, we transformed Navision’s good set of inventory and replenishment features into a “state of the art” inventory management solution. This result, *Advanced Forecasting and Procurement Suite (AFP)*, includes advanced formula based forecasting, customer collaborative forecasting and a robust procurement application to utilize the forecast to make good buying decisions.

Implementing a methodical, comprehensive action plan utilizing these advanced tools in the Navision system will lead to success and reduce the “heartburn” associated with an inventory that is out of control. Wouldn’t be nice to make the following statements you may have heard in your office or warehouse a thing of the past?

- “We aren’t stocking the products our customers expect us to have immediately available.”
- “Why are we constantly out of stock of the products asked for most often?”
- “There’s too much dead stock in our warehouse!”

- “Our turnover is much lower than most other distributors in our industry. What are we doing wrong?”
- “We work very hard. Why aren’t we making money?”

With this guide we want to help you:

- Increase the profitability of your company
- Provide outstanding service to your customers
- To work smarter, not harder
- To enjoy working in a well run organization

The tools you need to achieve these goals are integral parts of Navision and the Advanced Forecasting and Procurement Suite. We are going to discuss how to use them to the best advantage. Let’s get started!

Develop Your Approved Stock List

When you stock a product you are making a commitment: a commitment to have the item available in reasonable quantities for immediate delivery when your customers want them. Every distributor should have an approved stock list for each location or warehouse that maintains inventory. This list contains the products the distributor has committed to stock in that specific branch. This commitment does not necessarily mean that some of the item is always on the shelf. For example, seasonal products may be in stock for only part of the year. Or, you may reorder one piece of a slow-moving item when you sell the one piece in stock. But stocked products should normally be in your warehouse when your customers want them.

In most cases not all material in a location is on the approved stock list. Some of it may be unwanted “stuff”. Here are some ways unwanted stuff can find its way into a warehouse:

- Left over quantities of non-stock products. For example a customer orders ten pieces of a special order item and your buyer must order a case of 24 pieces. The customer buys the ten pieces but the remaining 14 pieces land up on a shelf in the back of your warehouse
- Customer cancellations or returns of non-stock items
- A customer stops buying products stocked specifically for them
- Left over quantities of discontinued products
- Left over quantities of new stock items that did not achieve the anticipated sales volume

The first step in achieving effective inventory management is to separate the stock from the stuff to create the approved stock list for each location. If you sell a lot of an item you should stock the product, right? Well maybe not. Consider these three items:

<i>Item</i>	<i>Annual Qty Sold</i>	<i>Annual Orders</i>
<i>A100</i>	10,000	2
<i>B200</i>	10,000	6
<i>C300</i>	10,000	50

You sold 10,000 pieces of all three items. But the 10,000 pieces of the first item were sold in two transactions (an average of 5,000 pieces per order). If customers only request the item twice a year, do you want to maintain the item in inventory at all times? If the customer could give you some advance notice of his needs, perhaps you could special order the product as it is needed and not keep any in inventory. The second item was sold six times during the year. You probably would want to maintain this item in inventory, especially if customers cannot give you any advance notice of when the item will be needed. Item #C300 was ordered by customers 50 times during the year or about once a week. A product requested this frequently certainly should be maintained in stock inventory.

You stock products to serve your customers and every order is another opportunity to demonstrate the superior service your company can provide. When deciding what products to include on your approved stock list, consider the number of times the product is requested, not the total quantity or value sold. Every time a product is requested is a “hit”. Navision maintains hits by product within each stocking site. This information is available on several reports and inquiries or can be displayed on a custom inquiry that sorts items in descending order based on the number of hits recorded in the past 12 months:

<i>Product</i>	<i>12 Month Hits</i>
<i>A100</i>	798
<i>C365</i>	673
<i>B459</i>	589
<i>A237</i>	461
<i>D593</i>	361
<i>C347</i>	100
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<i>F287</i>	2
<i>A202</i>	1
<i>A101</i>	1
<i>B398</i>	1
<i>C366</i>	0
<i>A912</i>	0
<i>B709</i>	0

Determine a minimum number of annual “hits” for an item to automatically remain on the approved stock list. Some industrial distributors question whether a product with fewer than four annual hits should be stocked while food distributors generally look for at

least 12 annual hits for an item to remain in stock inventory. Please note that we are not recommending the removal of all products with a low number of hits from stock inventory. We just want to be sure that you have a good reason for stocking each of these low usage products:

- The item is an emergency repair part that contributes to the your reputation as a reliable supplier
- It is necessary to stock this item to support the sale of other more profitable items
- It is a new item and sales are expected to increase dramatically in the near future
- The item has a high profit margin that outweighs the cost of carrying inventory for a lengthy period of time

The process of determining whether a high profit margin outweighs the cost of carrying inventory has historically been a subjective decision, based on a salesperson’s or management’s opinion. The AFP module transforms this into an objective decision with adjusted margin analysis. Let’s see how adjusted margin differs from gross margin and how it can be utilized to ascertain an item’s true profitability.

Gross margin is a common profitability measurement. It is calculated with the formula:

$$(\text{Annual Sales \$} - \text{Annual Cost of Goods Sold \$}) \div \text{Annual Sales \$}$$

Applying this formula, we find that these products have the same gross margin:

<i>Product</i>	<i>Sales \$</i>	<i>Cost of Good Sold \$</i>	<i>Avg Invty \$</i>	<i>Gross Margin %</i>
<i>A100</i>	\$15,000	\$10,000	\$5,000	33%
<i>B200</i>	\$15,000	\$10,000	\$10,000	33%
<i>C300</i>	\$15,000	\$10,000	\$1,000	33%

All three items produce a gross margin of 33%. But the average inventory investment necessary to generate each item’s sales is very different. The Adjusted Margin subtracts the annual cost of maintaining or “carrying” the average inventory investment for each item from the gross profit dollars with the formula:

$$\frac{(\text{Annual Sales \$} - \text{Annual Cost of Goods Sold \$}) - (\text{Annual Carrying Cost \%} * \text{Avg Invty})}{\text{Annual Sales \$}}$$

The annual carrying cost includes:

- **Cost of putting away stock receipts and moving material within the warehouse.** How much of your employees’ time is spent in these activities?
- **Rent and utilities for the portion of your warehouse used to store stock inventory.**
- **Insurance and taxes on inventory.** If it’s in your warehouse, you have to insure it, and it may be subject to tax.

- **Physical inventory and cycle counting.** The more material in your warehouse, the longer it takes to count.
- **Inventory shrinkage and obsolescence.** The more material in your warehouse, the higher the possibility of shrinkage and obsolescence. After all, it's hard to steal something that isn't there!
- **Opportunity cost of the money invested in inventory.** How much could you make if you were to take the money you're investing in inventory and invest it in a more traditional investment (such as treasury bills)? Or if you are financing your inventory, how much interest are you currently paying the bank?

The carrying cost percentage maintained by the AFP module will also be used to determine the "best buy" or economic order quantity for each item. In this example we are using an annual carrying cost percentage of 25%. That is, it costs 25 cents to maintain a dollar's worth of inventory in a warehouse for an entire year. To calculate your firm's specific cost of carrying inventory, fill out the questionnaire in appendix A. Let's look at the adjusted margin for all three items:

A100:

$$\frac{(\$15,000 - \$10,000) - (.25 * \$5,000)}{\$15,000} = 25.0\%$$

B200:

$$\frac{(\$15,000 - \$10,000) - (.25 * \$10,000)}{\$15,000} = 16.7\%$$

C300:

$$\frac{(\$15,000 - \$10,000) - (.25 * \$1,000)}{\$15,000} = 31.7\%$$

The third item has an average inventory investment of \$1,000, far less than the average investment of \$10,000 for the second item. As a result item #C300 has an adjusted margin of 31.7%. This is almost twice the adjusted margin of 16.7% experienced by item#B200. In all probability the distributor is able to bring in small quantities of the third product on a continual basis. As a result they are able to earn the same profit dollars with a much lower average inventory investment!

Consider establishing a minimum adjusted margin. If an item fails to meet this standard it should contribute to the sale of other products that are profitable enough to compensate for this low profit stock.

## When Should the Stock of a Product Be Replenished?

It's a hot day in August. The sales manager of CE Distribution bursts into the buyer's office and screams, "We're out of #B240 switches again. Get some in here right away!"

The buyer waited until the #B240 switches were out of stock before beginning the replenishment process. Unfortunately, it takes a week after a purchase order is placed for a shipment of #B240 switches to arrive from the vendor. That means that CE Distribution will be out of stock for the next seven days and won't be able to fill customer orders for the product.

Most distributors agree, at least in principle, that waiting until an item is out of stock is not the best time to begin the replenishment process for the product. But unfortunately, too many buyers decide which vendor line will be ordered next by skimming through a pile of sales tickets that contain backordered items. There has to be a better way.

In a perfect world, the replenishment shipment of a product would always arrive just as the last piece of the product was removed from the shelf to fill a customer order. Even though the world isn't perfect, this concept can help us determine when a product should be ordered. Let's look at the example again. It takes seven days to receive a shipment of #B240 switches from the vendor. If a replenishment order of the #B240 switches is placed when a seven day supply is still on the shelf, the replacement shipment should arrive on the day the last piece in stock is sold. We will avoid a stock out situation.

To determine this quantity, we need to examine two variables: expected upcoming usage for the product (also known as the demand forecast or average usage) and the projected or average lead time. Average usage is defined as the quantity of a stocked item we predict will be sold or otherwise consumed in an upcoming inventory time period, commonly a week or a month. The average lead time is the prediction of the amount of time it takes to get a new shipment of a product from the primary supplier of a product.

To avoid running out of stock, we must order the item when we have enough stock to fulfill anticipated demand during the average lead time. This is a quantity equal to:

$$\text{Average Usage/Day} * \text{Average Lead Time}$$

Will the average usage per day of an item correspond to the actual quantity sold or otherwise used in the upcoming month? Probably not. Nor will shipments from the supplier always arrive in a time period equal to the average lead time. The above equation represents a *prediction* of the quantity of the product that will be sold or otherwise used during the time we think it will take to replenish stock.

Now imagine this situation. You stock a popular item, the #S256 die blaster. In fact, you sell an average of two die blasters a day. Your supplier, the Die Blaster Company of America is usually a reliable supplier, and your average lead time for the product is seven

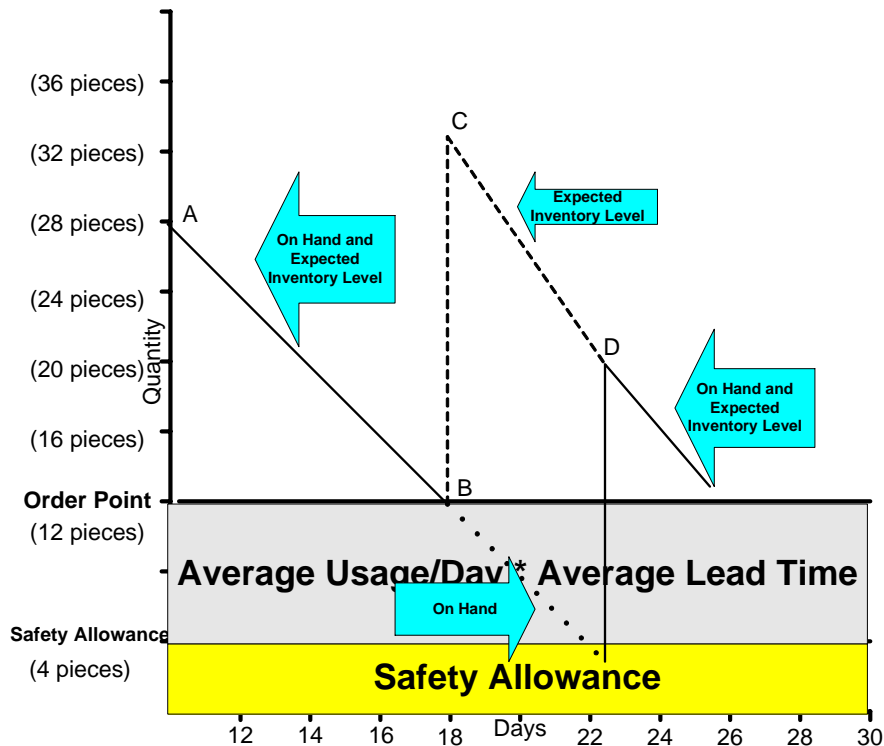
days. So, if you sell an average of two units per day, and it takes seven days to replenish your stock, you should reorder the die blasters when there are 14 pieces left on the shelf.

But, what if one day during the lead time you sell four die blasters? Or, the truck carrying your shipment is delayed by a freak snowstorm outside of Buffalo? What will happen? You'll probably run out of stock. What will your customers' reaction be when you explain that either they ordered too much of the product, or the shipment was delayed? They won't be happy. They count on you being a reliable supplier. Remember that part of the goal of effective inventory management is to "meet or exceed your customers' expectations of product availability."

For this reason, it is often wise to add an "insurance" quantity to the formula that determines when to reorder an item. We call this insurance the "safety allowance ." Safety allowance provides protection against greater than normal demand or delivery delays during the time it takes to order and receive a replenishment shipment. So, we want to order a product as soon as its "expected inventory level" (On-Hand - Committed on Customers Orders + Currently On Order From a Supplier) drops below an amount equal to:

$$(\text{Average Usage/Day} * \text{Average Lead Time}) + \text{Safety Allowance}$$

We refer to this stock level as the "order point". The following diagram helps illustrate the relationship between the on-hand quantity, the expected inventory level and the order point of a product:



At point “A,” we have 28 pieces on-hand and none on-order from the supplier, so the on-hand quantity equals the expected inventory level. As we sell the product, the on-hand quantity decreases until we reach the order point, designated by the letter “B” in the diagram. When the on-hand quantity reaches the order point, our buyer issues a purchase order for some of the item from the vendor. The expected inventory level jumps to point “C.” However, the on-hand quantity continues to decrease until the replenishment shipment arrives on day 22, at which point the on-hand and expected inventory level are equal again.

We reorder a product when its expected inventory level, not its on-hand quantity, reaches or falls below its order point. We can see why by looking at the illustration again. When the on-hand quantity reached the order point we reordered the product from the supplier. Though the on-hand quantity continued to decrease during the lead time, we knew that a shipment of the item was “on the way.” We don’t want to order more of the product!

Let’s take a closer look at the average usage, average lead time and safety allowance; the three elements of the order point formula.

## Average Usage

You’re obviously in trouble if you don’t have the inventory your customers expect you to have. And, if you’ve bought too much of an item, your money is tied up and can’t be invested in the other products that allow you to take advantage of new sales opportunities.

These challenges require the best possible product forecasting. You can no longer accept as “inevitable” great deviations between forecasts and actual sales. Formulas developed just to be “easy to understand” and “better than a guy with a clipboard” have to be replaced with more comprehensive methods.

Many systems will forecast future demand of a product with a simple average of past usage. Often this is the average of the usage recorded over the past six months. This works pretty well if an item has fairly consistent usage. For example, consider this item’s usage history:

	JUL	June	MAY	April	March	February	January	December
Usage	?	80	154	90	145	133	100	78

An average of the usage recorded over the past six months (January – June) would equal 117 pieces  $[(100 + 133 + 145 + 90 + 154 + 80) \div 6 = 117]$ . But what happens if an item is experiencing increasing or decreasing sales? Consider another product’s usage history:

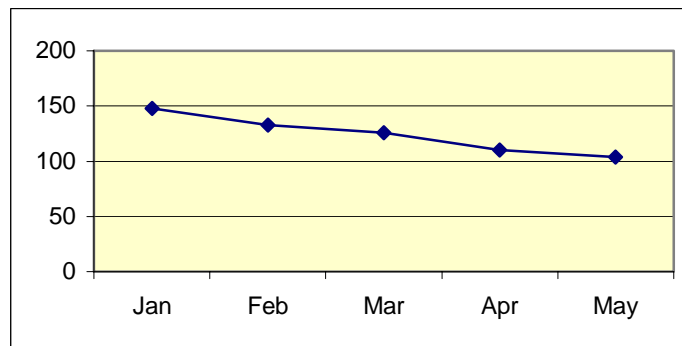
	July	June	May	April	March	February	January	December
Usage	?	154	145	133	100	90	80	78

Averaging the past six months usage would still result in a forecast of 117 pieces  $[(80 + 90 + 100 + 133 + 145 + 154) \div 6 = 117]$ , but this would probably not be a good estimate of July’s demand. It’s obvious that a simple average will not consistently result in an accurate forecast. The AFP module utilizes an advanced set of tools to calculate the most accurate forecast possible. One of these tools is weighted average forecasting. Weighted average forecasting allows you to put an emphasis or “weight” on the usage recorded in specific previous inventory periods. Different sets of weights are appropriate for products with different patterns of usage history. Let’s look at how weighted average forecasting can determine more accurate estimates of future usage.

### Non-Seasonal Products with Fairly Consistent Usage

When forecasting the demand of non-seasonal products with fairly consistent usage, we want to average the usage that was recorded during the past several inventory periods. But we also want to “weight” or place more emphasis on the most recent month. Why?

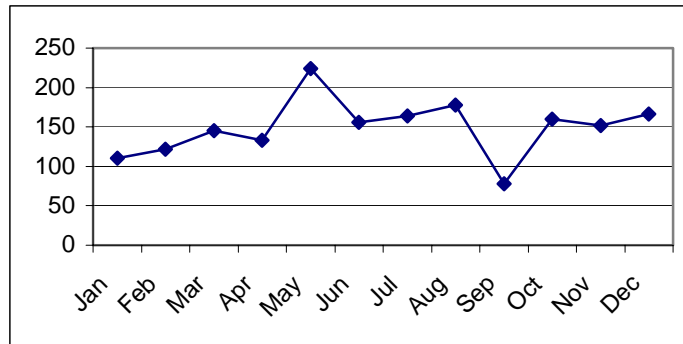
1. There are often gradual increases or decreases in a product’s usage as it becomes more or less popular over time. Look at the usage history of this item as an illustration:



Notice that usage for the item has gradually decreased over the five month period. We need to decrease the quantity of this item maintained in inventory

if we are to avoid overstocking the product. For non-seasonal products, demand in the upcoming inventory period may more likely be similar to the usage recorded in the past several inventory periods than what happened six, eight, or twelve months ago. Forecasting demand for seasonal products will be discussed later in this document.

2. At the same time, there is usually a certain amount of random variation in a product's usage from one inventory period to another. Notice how the usage of this item has fluctuated over the past 12 months:



Notice the temporary increase in usage in May and the short-lived decrease in usage in September. These “blips” in usage are common for inventory items with moderate to high sales. If we were to just use the most recently completed one or two inventory periods in our calculations, temporary fluctuations in usage will have too great an influence on the forecasted demand. Therefore we want to include enough history to ensure that random fluctuations do not have a significant impact on a product's forecast.

Here is a common set of weights to use in calculating demand for a non-seasonal item with moderate to high sales and fairly consistent usage. This weight set emphasizes the most recent history and utilizes enough usage history to discount the temporary “blips”:

- Place a weight of 3.0 on the usage recorded in the most recent period
- Place a weight of 2.5 on the usage recorded in the next previous period
- Place a weight of 2.0 on the usage recorded in the next previous period
- Place a weight of 1.5 on the usage recorded in the next previous period
- Place a weight of 1.0 on the usage recorded in the next previous period

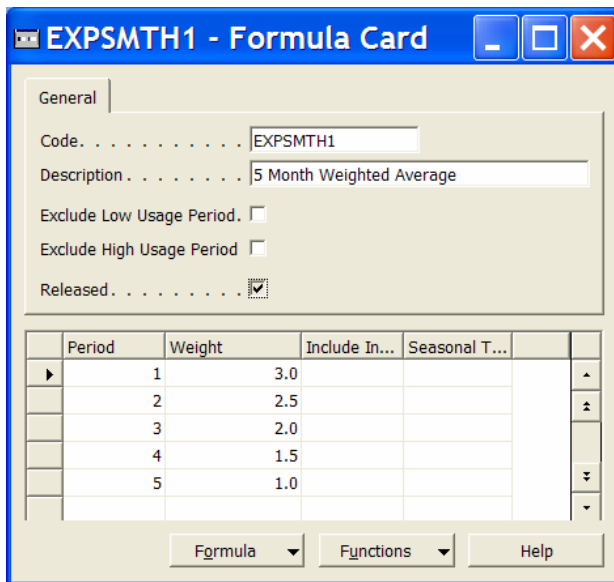
Let's see how the forecast for an item with the following usage history is calculated by the AFP module using this set of weights:

	December	November	October	September	August
<b>Usage</b>	166	152	160	106	178

To calculate the forecast demand for January:

<i>Month</i>	<i>Weight</i>	<i>Average Usage</i>	<i>Extension</i>
<i>December</i>	3.0	166	498
<i>November</i>	2.5	152	380
<i>October</i>	2.0	160	320
<i>September</i>	1.5	106	159
<i>August</i>	1.0	178	178
<b>Total</b>	10.0		1535

The total extension of 1535 divided by the total weight of 10.0 results in a forecast demand of 153.5 that we'll round to 154 pieces.



### 5 Month Weighted Average

This is how the formula discussed above would be setup in Navision AFP. Notice the weights applied to each period.

## Non-Seasonal Products with Significantly Increasing or Decreasing Usage

If a product is experiencing significant increases or decreases in usage, the history recorded five months ago may not be significant in determining the forecast for the product in the upcoming month. Consider an item with this usage history:

	June	May	April	March	Feb
Usage	256	228	171	110	76

Usage in June (256 pc.) is more than three times the usage recorded in February (76 pc.). When calculating the forecast demand for an item with this usage pattern, we'll normally consider fewer months' history in our forecast and a formula that utilizes a different set of weights:

Month	Weight	Average Usage	Extension
June	3.0	256	768
May	2.0	228	456
April	1.0	171	171
<b>Total</b>	<b>6.0</b>		<b>1,395</b>

Again the extension (1,395) is divided by the total weight (6.0) to forecast the usage per day for July of 232.5 pieces. Though better than a simple average, this forecast still lags behind this item's trend of increasing usage.

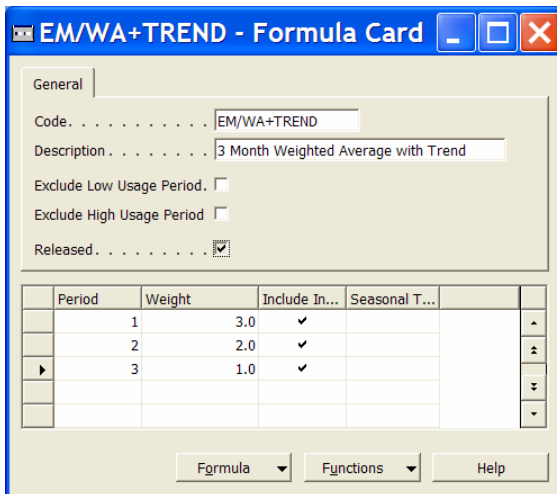
## Trend Factors

The item in the last example was experiencing increasing usage. Even though we heavily weighted the most recent history the resulting forecast still fell behind the trend. In fact no matter how much we weight any specific month's history, the resulting forecast can not exceed the highest month's usage.

We need to be able to apply a trend factor to products that are experiencing a consistent increase or decrease in usage. For example, we might average the percentage increase in usage over the past three months:

<b>June</b>	<b>May</b>	<b>Apr</b>
<b>256</b>	<b>228</b>	<b>171</b>
	<b>+12.3%</b>	<b>+33.3%</b>

The average increase over the three month period is 22.8%  $[(12.3\% + 33.3\%) \div 2 = 22.8\%]$ . If we add 22.8% to the formula result of 232.5 pieces the result is a forecast of 285.5 or 286 pieces. This seems to be a much more reasonable estimate of future usage. Trend factors usually are necessary if an item experiences consistent increasing or decreasing usage over a three month period.



### 3 Month Weighted Average with Trend

This formula uses a weighted average over the last 3 periods. It also applies a period to period trend if the trend for all 3 periods is consistently increasing or decreasing.

## Forecasting Seasonal Products

Some items, like beach umbrellas, are more popular in summer than in winter. On the other hand, portable heaters enjoy much higher sales when the weather gets cold. These are seasonal items. But the weather is not the only factor that determines whether or not an item is seasonal. If a product's usage is controlled by an event (such as Christmas or the start of school), or an annual activity (like yard clean up in the fall), the item is also considered to be seasonal. The usage of a seasonal product rises and falls throughout the year. Look at this seasonal item's usage history:

	Jun - 2004	May - 2004	Apr - 2004	Mar - 2004	Feb - 2004	Jan - 2004	
<b>Usage 2004</b>	?	300	150	80	50	30	

	Dec - 2003	Nov - 2003	Oct - 2003	Sep - 2003	Aug - 2003	Jul - 2003	Jun - 2003
<b>Usage 2003</b>	50	100	150	300	520	460	400

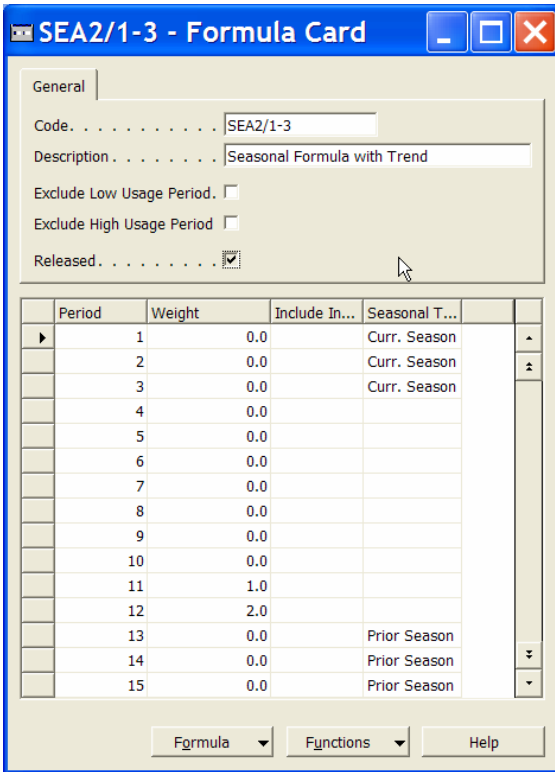
Usage of the product is very low during the winter months. But in early spring, sales begin a gradual increase and peak during the summer months of June, July and August. We've found that one of the best indicators of what demand will be for a seasonal item next month is the usage recorded during the upcoming season, last year. So, we normally calculate the demand forecast for seasonal items by considering the usage for the upcoming month and the following month or two, last year. Let's apply a forecast formula using a different set of weights to the usage history of this seasonal item:

- Place weight of 2.0 on the usage recorded in the month being forecast, last year.
- Place weight of 1.0 on the usage recorded in the month following the month being forecast, last year.

<i>Month</i>	<i>Weight</i>	<i>Average Usage</i>	<i>Extension</i>
<b>June 2003</b>	2.0	400	800
<b>July 2003</b>	1.0	460	460
<b>Extension</b>	3.0		1260

The extension (1,260) is divided by the total weight (3.0) to determine our prediction of the usage per business day for June, 2003 of 420 pieces.

A demand forecast of 420 pieces actually exceeds the usage recorded the previous June by a fair amount. Using this set of forecast weights tends to build up inventory at the beginning of an item's popular season and decrease inventory towards the end of the season. If you think about it, this probably isn't a bad way to handle seasonal products. And remember that you can apply a trend percentage to the results of the seasonal forecast formula to reflect overall changes in business volume experienced over the past 12 months.



## Seasonal Formula with Trend

This Formula Card in Navision AFP uses a weighted average of the upcoming 2 periods a year ago. In addition the formula also applies a trend based on the last 3 periods compared to the same period a year ago.

## Determining the Best Forecast Formula for an Item

Different items, even different items within the same product line, can have very different patterns of usage. Some products are growing in popularity while others are losing sales. One or two items might have a seasonal usage pattern due to the needs of a specific customer. And some items might have “lumpy” sales having a spike in sales every 60 or 90 days. To calculate the most accurate forecast possible, Navision’s AFP module allows you to maintain an unlimited number of forecast formulas, each with its own set of weights and an optional trend factor. But how do you know what forecast formula works best with each item?

The AFP module includes a tool which will test several forecast formulas against the usage history recorded over the last six months:

Item	Description	Nov'03	Oct '03	Sep '03	Aug '03	Jul '03	Jun '03
		Usage	Usage	Usage	Usage	Usage	Usage
A100	Black Widget	1203	934	1003	890	925	820
	<b>Demand Formula</b>	<b>Forecast</b>	<b>Forecast</b>	<b>Forecast</b>	<b>Forecast</b>	<b>Forecast</b>	<b>Forecast</b>
	Six Month Rolling Average	884	840	773	695	596	561
	Six Month Rolling Average w/4 Trend	890	901	826	773	662	680
	Three Month Rolling Average	942	939	878	826	741	667
	Three Month Rolling Avg w/ 4 Trend	949	1007	939	920	824	810

The forecast is then compared to the actual adjusted usage in that month and the forecast error is calculated:

Item	Nov'03	Oct '03	Sep '03	Aug '03	Jul '03	Jun '03	
	Usage	Usage	Usage	Usage	Usage	Usage	
A100	1203	934	1003	890	925	820	
Demand Formula	%Error	%Error	%Error	%Error	%Error	%Error	Average
Six Month Rolling Average	26.5%	10.0%	22.9%	22.0%	35.6%	31.6%	24.8%
Six Month Rolling Average w/4 Trend	26.0%	3.5%	17.6%	13.1%	28.5%	17.0%	17.6%
Three Month Rolling Average	21.7%	0.6%	12.4%	7.2%	19.9%	18.6%	13.4%
Three Month Rolling Avg w/ 4 Trend	21.1%	7.9%	6.4%	3.4%	11.0%	1.3%	8.5%

The formula that results in the lowest median average error is the formula that will be used to forecast that item in upcoming months.

### Compensating for Unusual Activity

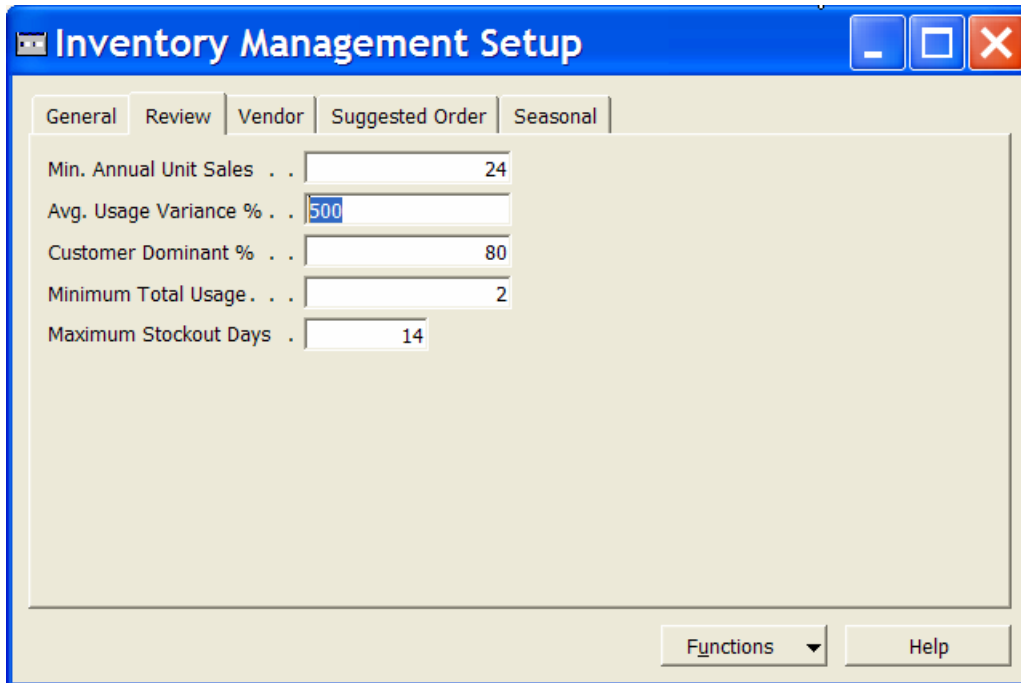
The forecast is a prediction of usage in an upcoming month. Significant differences between the forecast and actual usage occur as a result of:

- Unusual activity such as abnormal sales quantities or stock outs
- The start of a new trend in usage
- The forecast being calculated with the wrong forecast formula

Navision's AFP module lists items whose actual usage in the month just completed significantly exceeds the forecast. The following formula is used to calculate the difference between usage and the demand forecast:

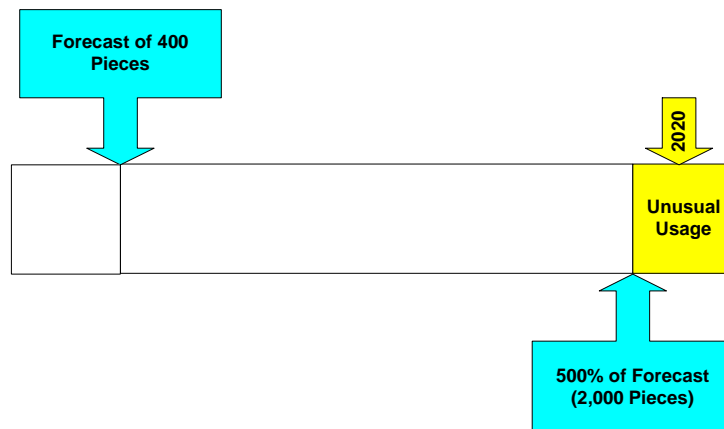
$$\text{(Actual Usage – Demand)/Demand} = \text{Percentage Difference}$$

If this percentage difference exceeds the value maintained in the Avg. Usage Variance % field on the Inventory Management Set Up Screen, the item will be flagged as possibly having unusual usage:



Let's look at an example

Average Usage Variance %	= 500%
Forecasted Demand	= 400 pieces
Actual Usage	= 2020 pieces



Five hundred percent of the forecast is 2,000 pieces. Actual usage exceeds this amount. This item should be brought to the attention of the buyer or sales department.

Dramatic increases in sales aren't the only type of unusual usage activity experienced by distributors. What if there is a pronounced decrease in usage? Examine the usage history for this item:

	June	May	April	March	February	January
Usage	40	210	260	185	290	160

What happened in June? Perhaps the product was out of stock for a good portion of the month. Navision will also bring to attention any item that was out of stock for more than the number of days specified in the Maximum Stockout Days field on the Inventory Management Setup screen. After all, if you don't have an item in stock, it is more difficult to sell. Your customers may not have been willing to wait for you to replenish your stock.

One of a buyer's most important responsibilities is to carefully examine these transactions that might represent unusual usage. One of Navision's helpful tools for this process is Navision's Usage Ledger:

The screenshot shows the 'Item Usage' window with the following data table:

Location C...	Item No.	Starting D...	Usage Qu...	Exclude U...	Adjustme...	Transfer ...	Adjusted ...	Average U...
ADV-FOR	02-71-31	11/01/03	3	0	0	0	3	1
ADV-FOR	03-81-31	11/01/03	0	0	0	0	0	1
ADV-FOR	04-82-405	11/01/03	0	0	0	0	0	0
ADV-FOR	05-82-429	11/01/03	0	0	0	0	0	0
ADV-FOR	06-01-447	11/01/03	54	0	-20	0	34	20
ADV-FOR	07-04-447	11/01/03	15	0	0	0	15	5
ADV-FOR	08-05-447	11/01/03	6	0	0	0	6	7
ADV-FOR	10-71-447	11/01/03	22	22	0	0	0	12
ADV-FOR	11-81-447	11/01/03	0	0	0	0	0	11
ADV-FOR	12-82-447	11/01/03	4	0	0	0	4	12
ADV-FOR	13-01-450	11/01/03	73	0	0	0	73	45

Look at item number "06-01-447", the buyer noted that 20 pieces of total usage of 54 pieces was unusual. Navision AFP will calculate demand forecasts based on the adjusted usage of 34 pieces. Sales people can also specify that the usage associated with specific orders should not be included in usage history. Notice that 22 pieces of item number "10-71-447" were excluded in the sales order process. To ensure that usage history accurately reflects normal warehouse shipments, Navision also gives you the option to include or exclude transfers and drop shipments in adjusted usage.

## Collaborative Forecasting

There is an old saying, “what you sold in the past is a good indication of what you will sell in the future”. But forecasting future demand solely on past usage history is like predicting weather from a windowless room only using a stack of old newspapers. Sure there is plenty of data available, but wouldn’t the forecaster get better information if he/she contacted other nearby weather stations, looked at current satellite data, or perhaps even opened a window?

Collaborative forecasting is the process of obtaining information that will affect future usage of stocked products that is not reflected in past usage. Sources of this information include:

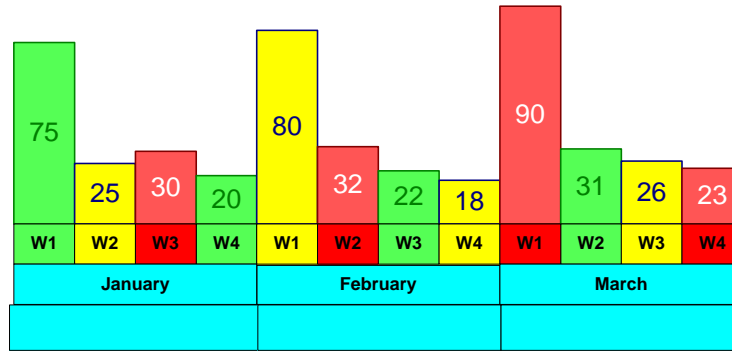
- **Salespeople.** Are they gaining or losing customers? How will these changes affect usage?
- **Customers.** Is the usage of particular products going to be significantly affected by changes in a customer’s production schedule or marketing plan?
- **The Market Environment.** Is there an upcoming event that will affect usage of specific products?

Navision’s collaborative forecasting tools allow a user to enter a quantity that reflects the effect of collaborative information. This can be either a positive or negative amount. The total demand for an upcoming month is equal to the results of the forecast demand formula (with or without a trend factor) and the optional collaborative quantity.

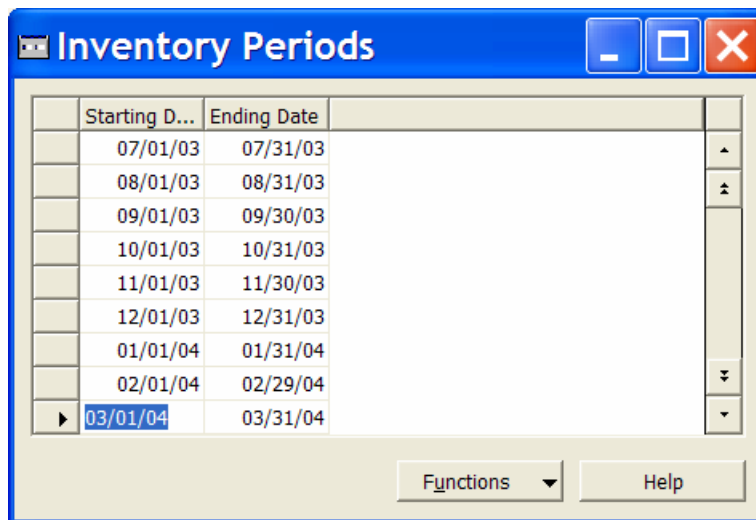
Location C...	Item No.	Description
▶ ADV-FOR	06-01-447	ALL-LOCK AUTOMOTIVE L

The collaborative forecast tool in Navision AFP allows you to forecast specific items by customer.





Notice that 50% - 53% of total usage each month occurs in the first week of the month. If we base our stocking decisions on selling an average of 5.0 – 5.6 pieces per day, we would probably not have enough stock for the first week in each month where usage is 10.7 to 12.9 pieces per day. To meet this need Navision does not restrict you to monthly forecasts. The system allows you to maintain a calendar of inventory periods and specify the start and end date of each period:



These periods can be based on months, weeks or some other time period. Please note that all inventory periods do not have to be of a uniform length or coincide with accounting periods.

## Average Lead Time

The second component of the order point formula is the average lead time:

$$\text{Order Point} = (\text{Average Usage/Day} * \text{Average Lead Time}) + \text{Safety Allowance}$$

The average lead time is the amount of time (in days) we estimate it will take to replenish our stock of an item from the normal source of supply. Previously, we found that past

usage of an item is often the best indicator of future demand of the product. The same concept is applicable to the average lead time. That is, recent lead times for a product are often a good indicator of how long it will take to get the item from the supplier if we were to order it today.

Lead times should be maintained separately for each item in each location. Why?

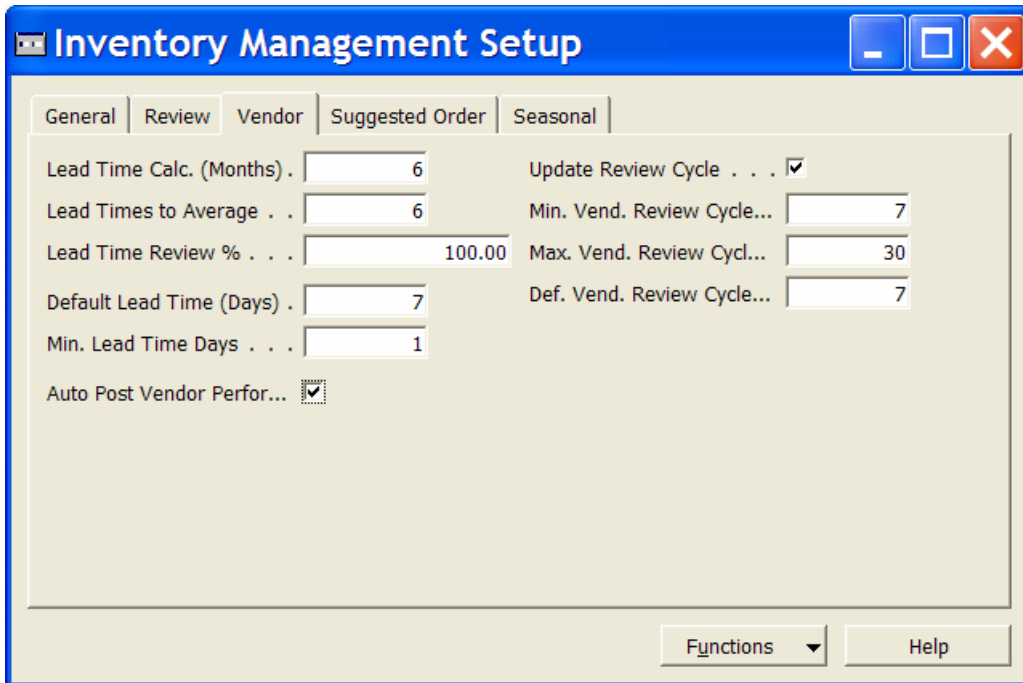
- Even though several products are obtained from the same vendor, their lead times can be very different. A popular product in the line may always be available from the vendor's shelf stock, while a slower moving item may have a lead time of several weeks, or even several months!
- A distributor may stock the same item in several warehouses. But each site may obtain the product from a different source. And, even if the same vendor supplies the item to all of the branches, the time it takes to get the item to each warehouse may be different.

In determining the average lead time for a product, you should only consider lead times for stock shipments from the primary source of supply for the item. This is important to help ensure the accuracy of your predictions. Suppose you had two vendors for a product, a primary supplier with a lead time of seven days and a secondary source with a lead time of 28 days. If we were to consider shipments from both vendors in our calculations, the result would be an average lead time of about 18 days  $[(7+28) \div 2]$ . In reality you might get the next shipment in seven days, or possibly 28 days, but probably not 18 days!

In determining how many stock receipts to use in calculating an average lead time, keep in mind that you don't receive an item as often as you sell it. Think of one of your most popular products. It may be sold every day; but it is probably received, at most, once or twice a month. In fact, you may have a six to twelve month supply of over half of your stocked items. That means that these products are received from the vendor only once or twice a year. A lot of things can occur over extended periods of time that will affect the lead time for an item. For example:

- Your vendor can add or shut down production lines
- Freight carriers can use different routes
- The availability of the raw materials needed to make the product may change

For these reasons, you may want to just use the several most recent lead times in your lead time calculations. Navision allows you to specify the number of lead times to average as well as the how old a lead time can be to be included in the calculation. After Navision AFP selects the lead times to average, it can also use the "Lead Time Review %" to exclude an extremely short or long lead time.



You can also manually maintain lead times if you know that past lead times are not reflective of future lead times for a product.

## Safety Allowance

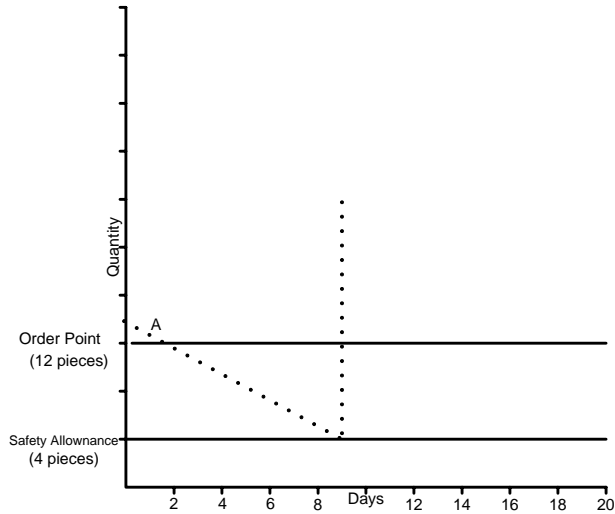
The last component of the order point formula is safety allowance:

$$\text{Order Point} = (\text{Anticipated Demand/Day} * \text{Average Lead Time}) + \text{Safety Allowance}$$

Safety allowance provides you with protection against running out of stock during the time it takes to replenish inventory. Why is this protection necessary?

- Demand is a prediction based on past history, trend factor(s), and/or collaborative information. The item’s actual usage will probably be a little more or a little less. Safety allowance is needed for those occasions when actual usage exceeds forecasted demand. It is “insurance” to help ensure that you can fulfill customer requests for a product.
- The average lead time is also a prediction, usually based on the lead times from the last several stock receipts. Sometimes the actual lead time will be greater than what was projected. Safety allowance provides protection from stock outs when the time it takes to receive a replenishment shipment exceeds the average lead time.

The following diagrams illustrate how safety allowance is used:

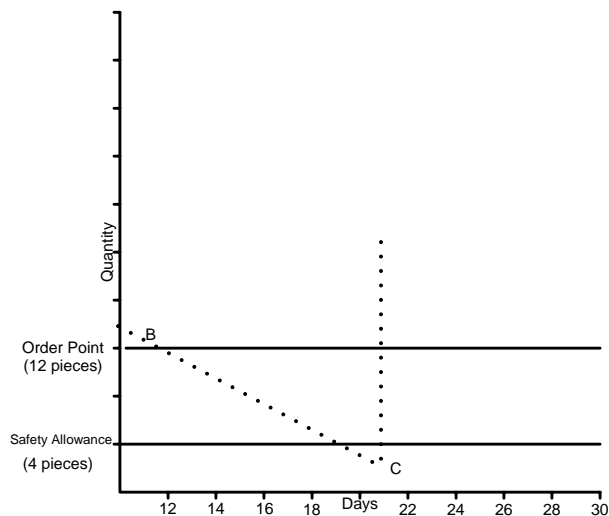


Average Lead Time = 8 Days  
 Demand = 1 piece/day  
 On Order with Vendor = 0

The dotted line in the graph represents the available quantity (On- Hand - Committed) of the item. A replenishment order is placed on the first of the month as the available quantity reaches the order point [“A” in the graph]. In this example, there is none of the product currently on incoming replenishment orders. Therefore, at point “A,” the item’s available quantity equals its expected inventory.

The actual usage of eight pieces during the lead time is consistent with demand. The shipment arrives on the 9th of the month. As the stock receipt is processed, the available quantity on the shelf is equal to the safety allowance quantity. The protection provided by the safety allowance was not needed.

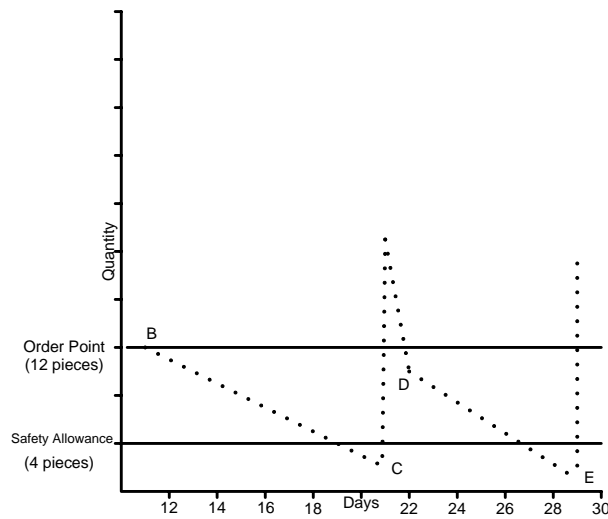
The product again reaches the order point on the 11th of the following month [“B” in the following graph]:



Average Lead Time = 8 Days  
Demand = 1 piece/day  
On Order with Vendor = 0

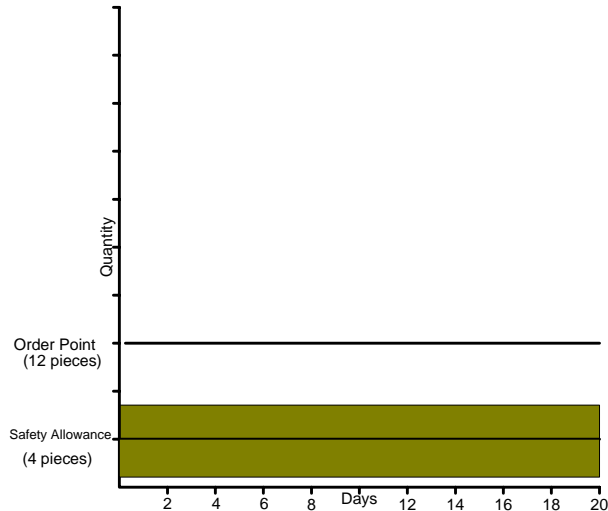
Another order is placed with the supplier. But the vendor is temporarily experiencing manufacturing problems and the shipment arrives two days late [“C” in the graph]. If it weren’t for the safety allowance, we would have run out of the product.

Shortly after the shipment arrives, a customer orders 10 pieces of the product. You experience more than a week’s usage in just one day. The available quantity falls to “D” in the following graph. A replenishment order is issued that day, but the available quantity is already below the order point.



The safety allowance quantity allows you to satisfy customer demand for the product until the replenishment shipment arrives from the supplier on the 29th of the month (“E” in the graph). Again, safety allowance prevented a stock out.

But is a large safety allowance quantity necessary for every stocked product? Take a look at this graph:



When a replenishment shipment arrives, the available quantity is usually somewhere in the shaded area of the graph. Notice that the safety allowance quantity is in the middle of the shaded area. About half the time you will use some, or all of the safety allowance before the replenishment shipment arrives. The other stock receipts will arrive before you use any of the safety allowance. On average, the full safety allowance quantity is always on the shelf when the replenishment shipment arrives. It is, on average, “non-moving” inventory.

A distributor puts inventory in her warehouse to sell it to customers. Profits from these sales are necessary to pay the distributor’s expenses and provide a return on her investment. With this thought in mind, it seems as though it would not be a good idea for a distributor to intentionally have non-moving inventory in stock.

On the other hand, keep in mind the goal of effective inventory management:

“Effective inventory management allows a distributor to meet or exceed customers’ expectations of product availability with the amount of each item that will maximize the distributor’s net profits.”

Safety allowance is, in reality, an expense of doing business. But, it is necessary to ensure good customer service. To maximize profits, we must carefully control all expenses, including safety allowance. Therefore, we want to achieve our customer service goals with the least possible amount of safety allowance. Some stock items require more safety allowance to maintain the desired level of customer service. And, believe it or not, you can maintain less safety allowance for other items and still retain a high level of customer service.

Navision calculates safety allowance as a percentage of average lead time demand. A percentage is multiplied by the projected demand during the lead time (Demand/Day * Average Lead Time) to determine the safety allowance quantity for the item. This

percentage can be specified for each item in each location. For example, say you specify that safety allowance should be 50% of the average lead time:

Average lead time = 10 Days  
Demand Per Day = 2 Pieces  
Safety allowance = 50% of the Average lead time

$$(2 * 10) * 50\% = 10 \text{ pieces}$$

We'd keep 10 pieces (a five day supply) as safety allowance.

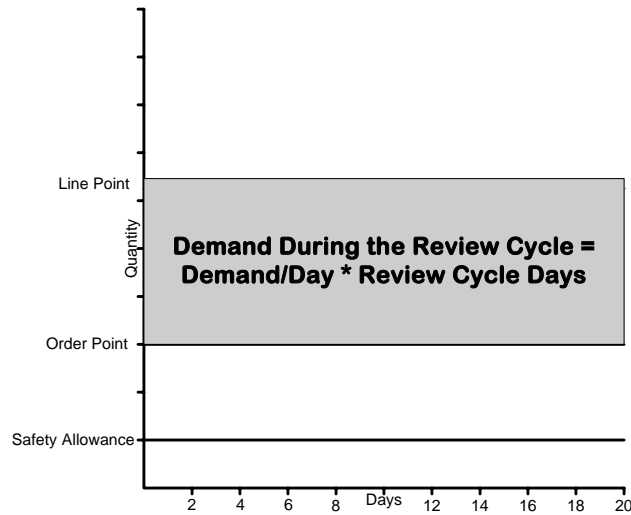
## The Review Cycle and the Line Point

To avoid a possible stockout, a product should be ordered as soon as its expected inventory (On-Hand - Committed + On Order) falls below its order point. Unfortunately, vendors usually do not accept purchase orders that just contain one product. Even if they do, the terms they offer for a small order probably prevent you from competitively selling the item. In order to meet the supplier's terms and buy "at the right price", you must often order a target amount of the vendor's products. This target amount can be expressed in:

- **Units.** A total number of pieces needs to be ordered. For example, if you order 1,000 pieces of 10 different items, you have achieved a 10,000 unit order target.
- **An Amount.** Many vendors will require an order target of "x" dollars, (based on your replacement cost for the material purchased)
- **Weight.** A target order weighing "x" pounds.
- **Volume.** This refers to the "space" filled by the merchandise ordered. It is a common measurement if a target order must fill a semi-trailer or shipping container.

The review cycle is the average amount of time (expressed in weeks) necessary to sell, transfer, or otherwise use enough of the vendor's products to achieve the target order requirement. Why is the review cycle important? Well, consider what would happen if you purchased \$1,000 worth of a vendor's products each week and just sold \$500 worth of those products to customers. You'd be overstocked before you knew it!

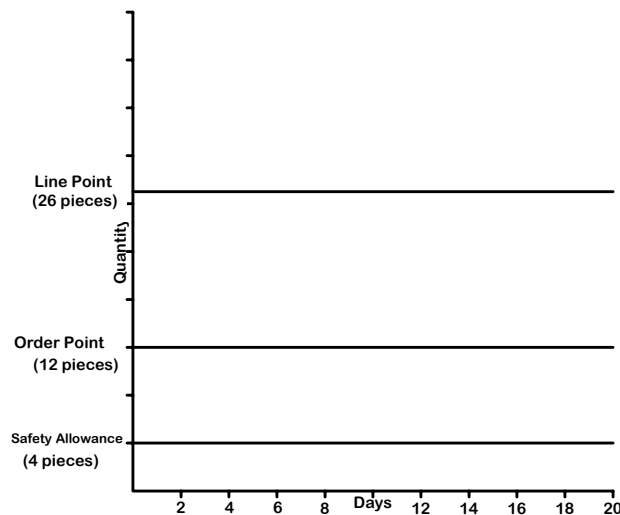
If we must meet a vendor's target purchase order requirement, we probably cannot order an individual product as soon as it drops below its order point. Therefore, when we place a target purchase order with the vendor, we want to include all items whose expected inventory will probably drop below their order point before we can place another target purchase order. If the review cycle for Hayward Plastics is 14 days, and we are issuing a purchase order to the vendor today, we want to include any Hayward item whose expected inventory will most likely drop below its order point within the next two weeks. Anticipated demand during the 14 day review cycle is depicted in the gray area of this graph:



So, any product whose expected inventory is in the gray area in this graph should be included on a target purchase order issued today. If one of these products is not included on the order, you run the risk of an eventual stockout because its expected inventory will probably be below its order point when the next target purchase order is issued. The quantity, equal to the sum of the order point and anticipated demand during the review cycle, is called the “line point”:

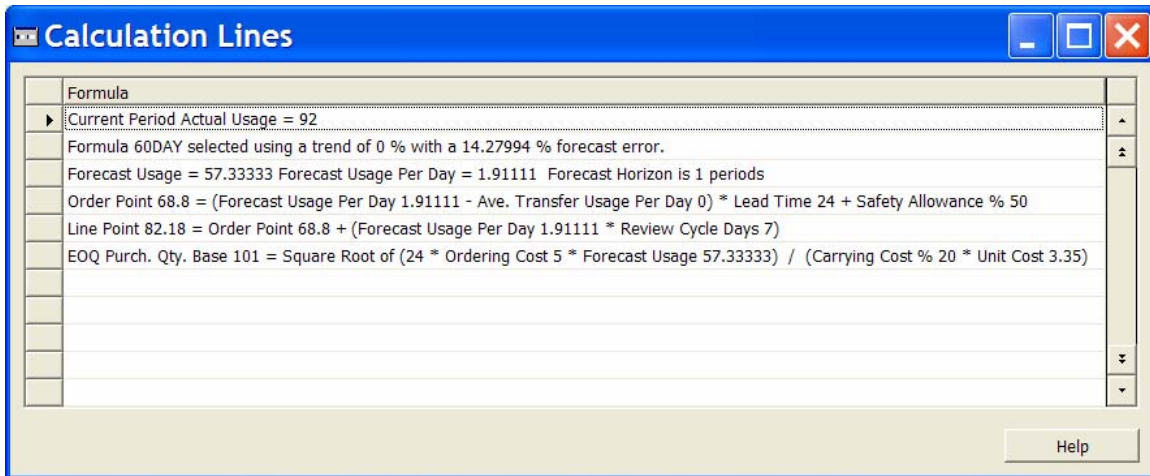
$$\text{Line Point} = \text{Order Point} + (\text{Anticipated Demand/Day} * \text{Review Cycle})$$

In the graph displayed above, the order point, plus the area shaded in gray, equals the line point. If the demand per day is two pieces, anticipated usage during the two week review cycle equals 14 pieces. If we add this review cycle demand to the order point of 12 pieces, the result is a line point of 26 pieces.



When we place a purchase order with a supplier, we want to include any item whose expected inventory is below its line point. Note that while the review cycle is calculated for an entire vendor line, the actual review cycle demand is applied to each individual stocked item to calculate a line point. The review cycle for an item's primary vendor is used to determine the line point for that product.

It's obvious that effective inventory management requires a lot of parameters and a lot of math. It can get very confusing. To make the calculations easier to understand, Navision allows users to "drill down" to see the actual replenishment calculations for a particular item:



## How to Determine the Best Replenishment Quantity

Up to now we have focused on when to reorder products; the key to meeting your customers' expectations of product availability. Now we will look at how much to order when you place a replenishment order with a vendor. This is the key to maximizing the profitability of your company.

You buy an item for \$1.00 and sell it for \$2.00. You made a 100% profit..... well, not exactly. In spite of what your salespeople may truly believe in their hearts, a distributor incurs costs, other than what he pays the vendor, when buying and maintaining a product for stocked inventory. These costs can be divided into two categories: the cost of ordering the material and the cost of carrying and handling the inventory in your warehouse. If we add these costs to the amount you actually pay for the material we get your total cost for the merchandise:

The inventory carrying cost was previously discussed in the explanation of adjusted margin. The cost of reordering material, also known as the replenishment cost, includes all of the expenses involved in issuing, processing and replenishment purchase orders. These costs include the time spent:

- Deciding what products need to be replenished
- Issuing the purchase order
- Expediting the purchase order (if necessary)
- Processing the receiving paperwork for the shipment
- Approving the vendor's invoice for payment
- Processing the vendor payment

The cost of reordering is expressed as the amount (in dollars) necessary to process a line item on a purchase order. It is calculated by dividing the total annual cost of ordering stocked products by the total number of purchase order line items for stocked products issued in the past 12 months:

$$\frac{\text{Total Annual Cost of Ordering Activities}}{\text{Number of Purchase Order Line Items Issued for Stocked Products in the Past 12 Months}}$$

If the annual cost of all reordering activities was \$125,000 and a total of 25,000 stocked line items were listed on purchase orders issued during the last 12 months, the cost of ordering each line item would be:

$$\frac{\text{Total Annual Cost of Replenishment Activities}}{\text{Purchase Order Line Items Issued (12 Months)}} = \frac{\$125,000}{25,000} = \$5 \text{ per line item}$$

The cost of ordering significantly fluctuates from one distributor to another. Recently, we've seen this cost range from \$4.00 to \$9.00 for each purchase order line item. To obtain accurate economic order quantities, you should calculate the cost of reordering inventory for each of your stocking locations. You can do this by answering the questionnaire in appendix B of this guide. If you want to begin purchasing before this analysis is complete, you can obtain a rough estimate of the cost of ordering from the following chart:

Company Characteristics	Typical Cost of Ordering
Small company in a rural area	\$5.00
Small company in an urban area	\$5.50
Large company in a rural area	\$6.00
Large company in an urban area	\$6.50
Company utilizing EDI or other electronic purchasing	\$3.00

These figures represent rough estimates and we cannot emphasize enough that you should calculate the reordering costs for each of your locations. However, notice the savings achieved by utilizing electronic purchasing. Is it any wonder that many companies are implementing these tools?

Again notice that the cost of ordering is expressed *per purchase order line item*. It is not the cost of issuing an entire purchase order, or the cost of obtaining each piece of a product. This is because it usually takes the same effort to replenish a particular product, regardless of the quantity ordered. If we order one piece, or one hundred pieces, on a single line of a purchase order, the replenishment cost is the same.

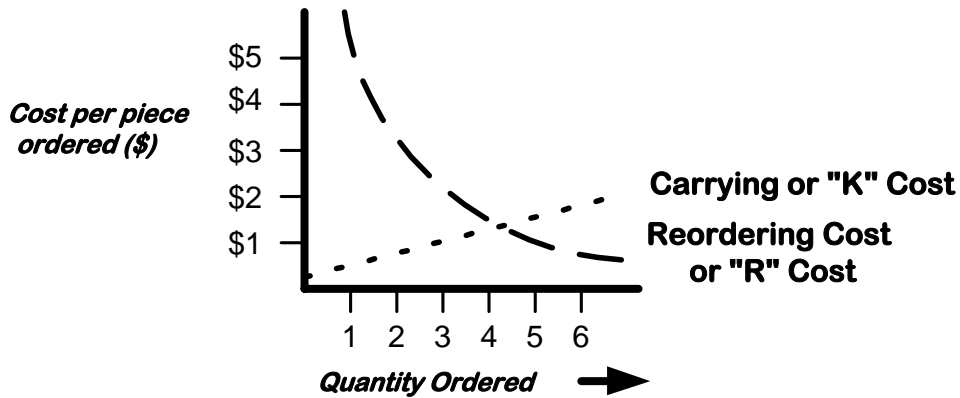
But, the more of a product we order, the lower the cost of ordering *per piece*. If we order one unit, that piece must absorb the entire ordering cost. If we order two pieces, each piece absorbs half the cost of ordering. If we order 1,000 pieces, each piece absorbs 1/1000 of the ordering cost. The following graph illustrates how the cost of ordering, per piece, decreases as the quantity purchased increases:



If we order one piece, the cost of ordering, per piece, is five dollars. If we order five pieces, the ordering cost drops to one dollar per piece. The more you buy, the lower the ordering cost per piece.

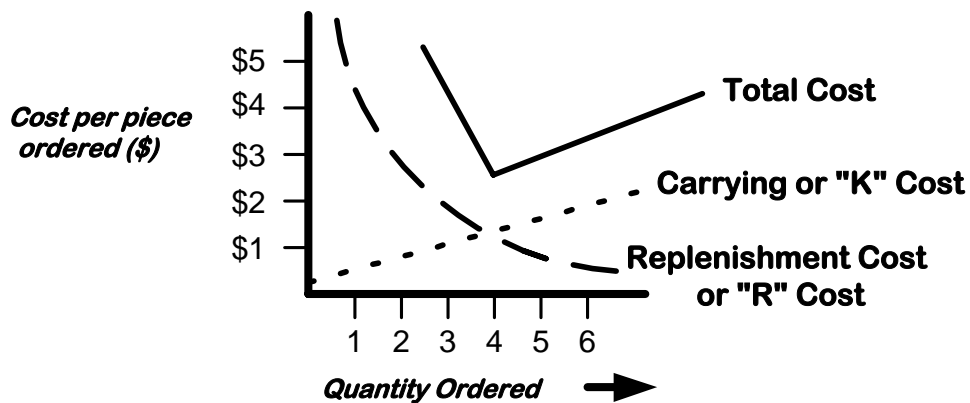
The total cost of carrying inventory, in dollars, grows as the investment in inventory grows. If you have more inventory, you have more money tied up in your warehouse stock. Inventory taxes and insurance increase. You probably also experience more inventory shrinkage (lost, damaged, or stolen material) and product obsolescence. Even apparently fixed expenses such as warehouse rent and utilities can vary with the amount of inventory maintained in your warehouse. Suppose you could eliminate 40% of your current inventory. Would you still need all of the warehouse space you now occupy? Could you lease or sub-lease part of the building? Remember that even if you own your warehouse building, you still have a rent expense.

The following illustration adds the inventory carrying cost to our graph of the reordering cost:



Please don't mis-read the graph. Ordering three pieces will not result in a carrying cost of one dollar. Remember that carrying costs are calculated on the *average* value of stocked inventory. And the longer material sits in your warehouse, the more carrying costs it will incur. For example, in most instances it will take longer to sell a shipment of five hundred pieces of a product than a shipment of twenty pieces of the same item. Part of the larger quantity remains in your warehouse for a longer period of time. And while it is there, it is accumulating carrying costs (your money's tied up, the inventory has to be counted, etc.) like a sponge.

If we add the amount we pay for the material (including freight, if applicable) to the reorder cost and carrying cost, we get the total cost for the material:



Notice that the lowest total cost quantity is the same quantity where the replenishment cost and carrying cost curves intersect. This is the economic order quantity (EOQ).

## The Economic Order Quantity Formula

It is not necessary to develop a graph to derive the economic order quantity. The EOQ formula will calculate the purchase quantity that produces the lowest total cost:

$$\sqrt{\frac{24 * \text{COST OF ORDERING (R)} * \text{AVERAGE USAGE}}{\text{COST OF CARRYING INVENTORY (K)} * \text{UNIT COST}}}$$

In the formula, the “24” in the numerator is a constant value; it won’t ever change. The cost of ordering and inventory carrying cost are described in previous sections of this chapter. Average usage is the amount of the product you predict will be sold, transferred, or otherwise used in the upcoming month. Finally, the unit cost is what you will pay the vendor for each piece of the product.

Let’s look at several examples of how the economic order quantity is calculated using the economic order quantity formula:

Example #1: Product A120

Average Usage = 25 pieces per month  
Unit Cost = \$10.00  
Cost of Ordering = \$ 5.00  
Carrying Cost = 30%

$$\sqrt{\frac{24 * \text{COST OF ORDERING (R)} * \text{AVERAGE USAGE}}{\text{COST OF CARRYING INVENTORY (K)} * \text{UNIT COST}}}$$

$$\sqrt{\frac{24 * \$5.00 * 25}{.30 * \$10.00}}$$

$$\sqrt{\frac{3000}{3.0}}$$

$$\sqrt{1000}$$

EOQ = 31.6 (rounded to  
32 pieces)

The economic order quantity is suggesting that when we replenish the stock of item #A120, we order 32 pieces. As average usage for the product is 25 pieces per month, this order quantity represents about a five week supply.

The economic order quantity will vary depending on the total annual cost of the product passing through inventory. This value can be calculated by multiplying the average usage by the unit cost. In the example above, \$250 (25 pieces * \$10 cost) pass through inventory each month. The higher the value of product passing through inventory, the smaller the economic order quantity (in terms of days or weeks supply) of the product.

Let's look at another example. Here the unit cost is \$50.00, much higher than the \$10.00 used in the first example:

Example 2: #B240

Average Usage = 25 pieces per month  
 Unit Cost = \$50.00  
 Cost of Ordering = \$ 5.00  
 Carrying Cost = 30%

$$\sqrt{\frac{24 * \text{COST OF ORDERING (R)} * \text{AVERAGE USAGE}}{\text{COST OF CARRYING INVENTORY (K)} * \text{UNIT COST}}}$$

$$\sqrt{\frac{24 * \$5.00 * 25}{.30 * \$50.00}}$$

$$\sqrt{\frac{3000}{15}}$$

$$\sqrt{200}$$

**EOQ = 14.1 (rounded to 14 pieces)**

The economic order quantity suggests that when we replenish stock of product #B240, we order 14 pieces or about a two week supply. This is less than one half of the five week supply the EOQ suggested for the first item. Why? Well, while \$250 of the first item passes through inventory each month, \$1,250 of second item is sold, transferred or used internally. Remember, **THE GREATER THE NUMBER OF DOLLARS OF A PRODUCT PASSING THROUGH INVENTORY, THE SMALLER THE ECONOMIC ORDER QUANTITY**. That is, in terms of days (or weeks) supply of the product.

You may be confused. Isn't it common sense to buy a lot of what sells? Let's look at it from another angle. The EOQ suggests that a distributor should order less of a fast moving product, more often. Remember that you invest in inventory and expect to earn a return on your investment. Every time you sell a product, you (hopefully) get back what you paid the vendor and also earn a profit. If you buy a dollar of inventory from a vendor and then sell it, you have "turned" that dollar once. That is, the dollar's back in your bank account (hopefully accompanied by a profit) and can be used again. If you buy more inventory with that dollar and then sell it, you've turned that dollar again. Every time you "turn" a dollar, you have an opportunity to earn a profit. Those profits are used to pay salaries, other expenses, and hopefully provide a return on investment to the owners.

Most hard goods distributors (earning between 20% and 30% gross margins) try to turn their inventory investment six to eight times a year. This means that \$1,000,000 dollars of stocked inventory should generate between \$6,000,000 and \$8,000,000 dollars in sales (at cost). But almost every distributor has products that are sold only once a year, or may

not sell at all. Inventory for these slow moving products may turn once annually, or not turn at all. Popular, fast moving, inventory items must turn more than eight times a year to make up for the slow moving inventory. If we order a two week supply of a popular product when it is time to replenish stock, we will turn the inventory of that product about 26 times a year!

Notice that the economic order quantity is concerned with the total cost of goods sold of a product passing through your warehouse, not the unit cost of each piece. In the next example, the product has a very low unit cost, but very high average usage:

Average Usage = 2,500 pieces per month  
 Unit Cost = \$0.10  
 Cost of Ordering = \$ 5.00  
 Carrying Cost = 30%

$$\sqrt{\frac{24 * \text{COST OF ORDERING (R)} * \text{AVERAGE USAGE}}{\text{COST OF CARRYING INVENTORY (K)} * \text{UNIT COST}}}$$

$$\sqrt{\frac{24 * \$5.00 * 2500}{.30 * \$0.10}}$$

$$\sqrt{\frac{300,000}{.03}}$$

$$\sqrt{10,000,000}$$

**EOQ = 3,162.3 (rounded to 3,162 pieces)**

Despite the fact that the unit cost of the item is only 10 cents, the EOQ formula suggests that we order a five week supply of the item (3,162/2,500 usage/month). This is because \$250 of the item passes through inventory each month. Our results are similar to those in the first example in which the product had similar total dollar movement.

What will the EOQ formula suggest for an item that is slow moving and inexpensive? Let's look at an item that has a unit cost of 10 cents, but average usage of only 25 pieces per month:

Average Usage = 25 pieces per month  
 Unit Cost = \$0.10  
 Cost of Ordering = \$ 5.00  
 Carrying Cost = 30%

$$\sqrt{\frac{24 * \text{COST OF ORDERING (R)} * \text{MONTHLY USAGE}}{\text{COST OF CARRYING INVENTORY (K)} * \text{UNIT COST}}}$$

$$\sqrt{\frac{24 * \$5.00 * 25}{.30 * \$0.10}}$$

$$\sqrt{\frac{3,000}{.03}}$$

$$\sqrt{100,000}$$

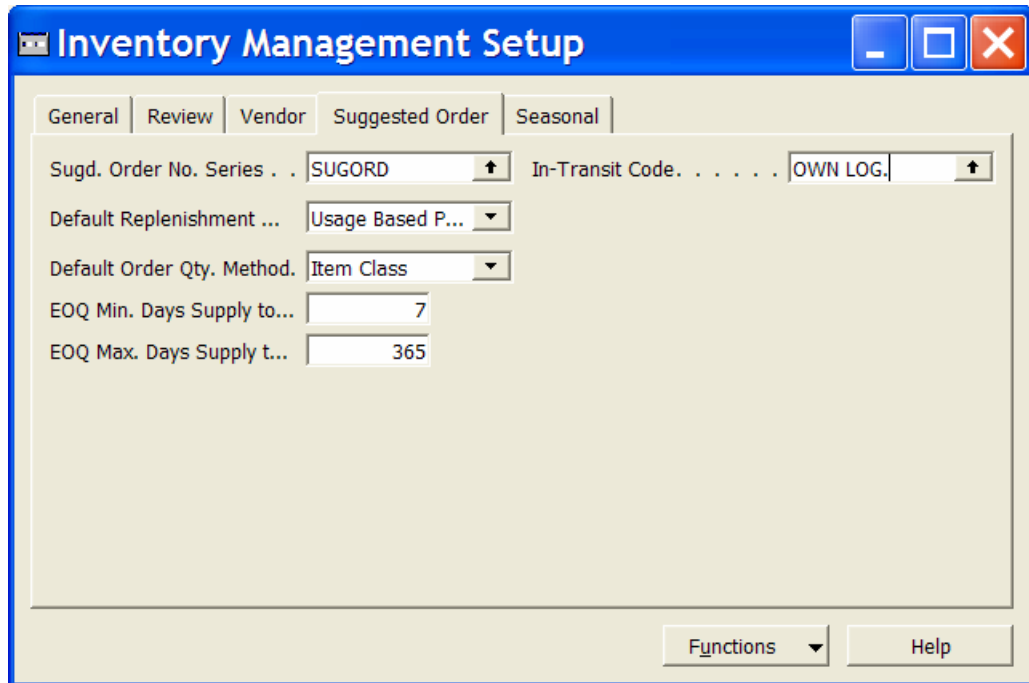
**EOQ = 316.2**  
**(rounded to 316 pieces)**

An economic order quantity of 316 pieces is greater than a one year supply (316/25 per month). A year's worth of a product! Who would ever buy that much of one item? Well keep in mind that your cost of one year's worth of the product is \$30.00. We calculated this amount by multiplying 12 (months) times 25 (average usage) times 10 cents (the unit cost). This small investment for a year's worth of the product makes sense, considering our cost of ordering the product is about \$5 every time it appears on a purchase order.

### Limits Of the Economic Order Quantity

The economic order quantity is a mathematical equation. It will always provide the replenishment quantity that provides the lowest total cost. But sometimes the result is not a practical stocking quantity. For this reason, Navision applies the following limits to the results of the EOQ formula:

- **REDUCE THE EOQ QUANTITY, IF NECESSARY, TO EQUAL A MAXIMUM of "X" DAY'S SUPPLY.** In the last example, we calculated an economic order quantity that was greater than one year's supply of the product. This assumes that monthly usage, unit cost, cost of ordering and carrying cost will remain constant for the entire year. While the cost of ordering and carrying cost change infrequently, monthly usage and unit cost of many items will fluctuate on a regular basis. And, it is an unfortunate fact that inventory shrinkage (loss, theft, breakage, etc.) and obsolescence increase dramatically when inventory remains in a warehouse for an extended period of time. For this reason, Navision allows you to specify that the EOQ will not exceed "x" day's supply the value of "x" is maintained in Inventory Setup:



*Because inventory shrinkage and obsolescence tend to dramatically increase when more than a year's supply of a product is maintained in stock, we recommend that most distributors set the maximum quantity equal to no more than a 180 to 365 day supply.*

- INCREASE THE EOQ QUANTITY, IF NECESSARY, TO EQUAL “Y” DAY’S SUPPLY. Increasing inventory turns increases gross profits. If we make a dollar every time we sell an item, we want to sell that item a lot! But if inventory turns continually increase, at some point a distributor may be overwhelmed by the amount of labor necessary to receive and stock the products stored in her warehouse. The increased labor costs will cause the cost of ordering to sky rocket. It may also cause your purchasing and warehouse employees to collapse from exhaustion. Ordering a product once a week supply of a product will provide approximately 52 inventory turns per year. This should be the upper limit of product movement for most of a hard-goods distributor’s items. Products whose inventory must turnover more frequently should be maintained with minimum/maximum parameters.

## The Result

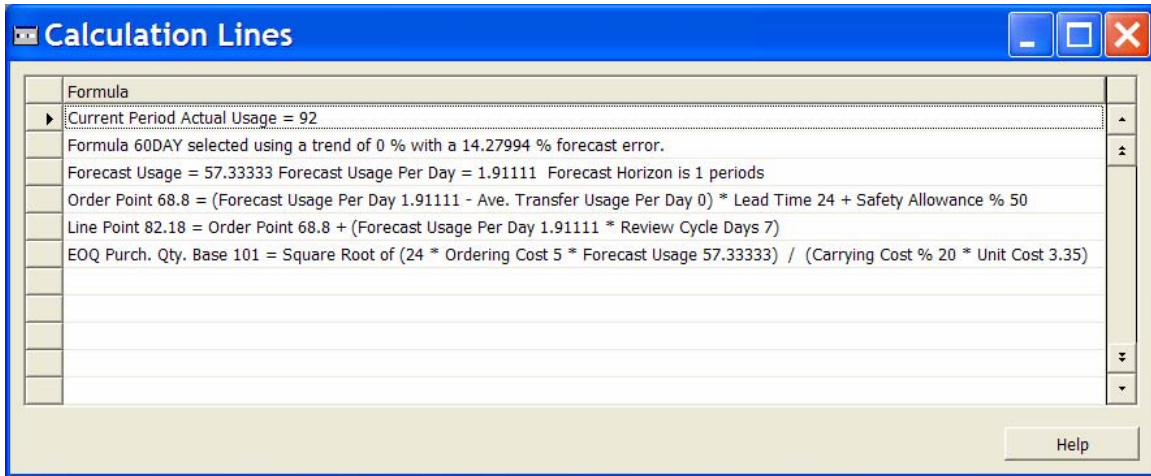
One of the obvious results of the Advanced Forecasting and Procurement concepts discussed in this document is the creation of a suggested order. The following suggested order is created by comparing the net expected inventory of each item to its Order Point and Line Point to determine if an item should be purchased.

The Economic Order Quantity is then used to determine how much of each item to purchase.

Purchase Reason	No.	Description	Qty. Available...	Unit of Measure ...	Quantity	Line Amount Excl. VAT
Target Stock Level	04-82-405	ALL LOCK VATS DECODER	0	PCS	1	147.55
Order Point	07-04-447	ALL-LOCK AUTOMOTIVE L	14	PCS	36	120.57
Line Point	14-02-450	ALL-LOCK AUTOMOTIVE L	73	PCS	101	338.35
Line Point	15-03-450	ALL-LOCK AUTOMOTIVE L	7	PCS	38	127.30
Order Point	16-04-450	ALL-LOCK AUTOMOTIVE L	12	PCS	47	157.45
Order Point	21-81-450	ALL-LOCK AUTOMOTIVE L	0	PCS	96	318.03
Order Point	23-02-550	ALARM LOCK DELAYED EGR	2	PCS	4	941.88

One of the main strengths of the Navision Advanced Forecasting and Procurement Suite is that the user is provided a clear view of all calculations used to make each decision.

If there is any doubt why AFP suggested the purchase of item 14-02-450 in the quantity of 101, the following information is available to backup each suggestion.



Use the concepts discussed in this document to verify the suggestion.

## Summary

In this short guide we have described some of the features found in Navision's Advanced Forecasting and Procurement Suite. This software also contains many other tools to help you maximize the productivity and profitability of your inventory investment including:

- **Central Warehouse Replenishment** – A central warehouse or distribution center accumulates demand for one or more receiving branches and transfers stock to those branches as needed to meet customer demand while maximizing inventory performance.
- **Comprehensive Customer Service Level, Inventory Turnover and Return on Investment Reporting**
- **Analysis of the Performance of New Inventory Items**

But remember that good software is just one of the keys to an effective inventory management program. It must be implemented by a team of people who thoroughly understand the distributor's unique needs and challenges combined with corporate policies and procedures that ensure that all material transactions are properly processed and recorded. This complete set of tools will lead you toward the goal of achieving effective inventory management!

## **Appendix A - Calculating the Carrying Cost Percentage and NIREP**

*The cost of carrying inventory expresses what it costs you to maintain a dollar's worth of inventory in your facility for an entire year. The carrying cost can be calculated by answering the following questions:*

1. What was your total warehouse/store labor expense (wages and benefits) during the past 12 months? This includes the expense of inspection, putting away stock, moving material from bin to bin as necessary, assembling kits, and filling customer orders. _____
2. What percentage of warehouse activity is dedicated to filling customer orders, transfers, and production assembly orders? _____
3. Calculate the amount you spend on handling material by subtracting the answer to #2 from "1.0" and multiplying the result by the answer to #1 _____
4. If the warehouse is rented, what is the annual rent? _____
5. If the warehouse is owned, what is the rental cost of comparable warehouse space under a "triple net" lease (i.e. a lease where the tenant pays all utilities, maintenance) _____
6. What is the total square footage of your facility? _____
7. What percentage of the total square footage of your facility is used to stock material? _____
8. Multiply the answer to question #4 or #5 by the answer to question #7 _____. This is your cost of warehouse space.
9. What were the property and other taxes you paid on your warehouse(s) last year? _____ Multiply this value by the percentage in question #7 _____
10. What were the inventory taxes you paid on your stock inventory last year? _____
11. What were the total warehouse utilities you paid last year? _____ Multiply this value by the percentage in question #7 _____
12. What was your total warehouse maintenance expense last year? _____ Multiply this value by the percentage in question #7 _____

13. What was your total warehouse supply expense (excluding shipping materials)? _____
14. What was the cost of warehouse equipment that was expensed (i.e. not capitalized) last year? _____ Multiply this value by the percentage in question #7 _____
15. What was your total depreciation expense for warehouse equipment last year? _____ Multiply this value by the percentage in question #7 _____
16. What was the value of written-off inventory last year? _____
17. What was the value of inventory shrinkage last year, not included in the written-off inventory value? _____
18. What is the value of your excess inventory (see chapter seven) that has not been written off? _____. What is a realistic liquidation value for this inventory? _____
19. What was the cost of insuring your warehouse and equipment last year? _____. Multiply this value by the percentage in question #7 _____.
20. What was the cost of insuring your inventory last year? _____
21. If additional labor was necessary to conduct physical counts of your inventory, what was the cost of this labor (includes taxes and benefits)? _____
22. If you borrow money to finance your inventory, what is the average outstanding balance over the past 12 months? _____ What is the annual interest rate? _____ What is your annual interest expense? _____
23. If you borrow money to finance warehouse equipment or improvements, what is the average outstanding balance over the past 12 months? _____ What is the annual interest rate? _____ Multiply this value by the percentage in question #7 _____
24. If you finance your own inventory purchases, what interest rate could you expect to receive if you invested that money in a relatively safe income-producing investment? _____
25. What was your average inventory value over the past 12 months (sum of month ending inventory values divided by 12)? _____
26. How much of your total inventory do you own? That is, the answer to #25 minus the amount of your inventory that is currently financed _____

27. Calculate your opportunity cost by multiplying the answer to #24 by the answer to #26 _____
28. Calculate the sum of the answers to questions 3, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 19, 20, 21, 22, 23 and 27 and then subtract the liquidation value recorded in question #18.
29. To calculate your cost of carrying inventory, divide the answer to question #28 by the answer to question #25.
30. To calculate your NIREP, divide all of your annual costs (from your profit and loss statement) that were not used in calculating the carrying cost by your annual sales (expressed as a monetary amount).

If you have any questions in completing this questionnaire, please give us a call at (972) 304-3325 or email at [info@EffectiveInventory.com](mailto:info@EffectiveInventory.com).

## Appendix B - Calculating the Cost of Reordering Inventory

The reordering cost is the administrative cost of issuing, receiving, and paying for one line item for a stocked product on a purchase order. To calculate your company's cost of reordering inventory, complete the questionnaire for your company:

1. How many purchase order line items for stocked products (as opposed to special order items or items/services to be consumed internally by the company) were issued in the past 12 months (approximate by taking one month's total and multiplying by 12)? _____
2. What percentage of all items purchased are for stocked products as opposed to special order items or items/services to be consumed internally by the company? _____.
3. What is your total purchasing and expediting department's labor expense (wages, taxes, and benefits) during the past 12 months? _____. Multiply this amount by the percentage specified in step #2_____.
4. What is your total accounts payable labor expense (wages, taxes, and benefits) during the past 12 months? _____. Multiply this amount by the percentage specified in step #2_____.
5. What is the total annual expense for purchasing supplies? _____. Multiply this amount by the percentage specified in step #2_____.
6. What is the total annual expense for accounts payable supplies? _____. Multiply this amount by the percentage specified in step #2_____.
7. What is your total labor expense (wages, taxes, and benefits) per year for the person or people who verify stock receipts? _____. Multiply this amount by the percentage specified in step #2 _____.
8. What percentage of this person's time is spent verifying stock receipts and processing receiving paperwork? _____. Multiply this percentage by the answer to step #7.
9. Add the answers to steps #3, #4, #5, #6, and #8 together.
10. Divide the answer to #9 by the answer to #1_____. *This is your reordering cost per purchase order line item.*

If you have any questions in completing this questionnaire, please give us a call at (972) 304-3325 or email at [info@EffectiveInventory.com](mailto:info@EffectiveInventory.com).