Purchasing and Receiving User Guide

Version 1.0
Updated October 13, 2003

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1. Overview

A successful replenishment buying module must be capable of suggesting stocking levels sufficient to satisfy normal customer needs without compromising management's objectives for inventory turn rates. In most distribution environments, this is basically the process of determining what quantity of a given item will be requested in the length of time that it takes the supplier to deliver that product.

In a perfect world, the order for the last "WIDGET" in stock would pulled, packed and staged for delivery just as the carrier were backing up to the incoming freight dock with the next shipment. Unfortunately, neither sales demand nor a vendor's ability to deliver product on a consistent basis is quite that predictable for all items in inventory.

At any given time however, a large percentage of the stocked items do fit predefined sales and delivery profiles within certain acceptable tolerances. Suggested replenishment quantities for these items can be reliably determined with minimal intervention. This leaves the buyer with more time to review and, if necessary, adjust the forecast values for the exceptions.

The forecasting techniques used by the DISTRIBUTION EXPRESS are founded on six basic principles:

1) Record item usage as it occurs.

2) Analyze the usage to establish demand patterns and to identify items with abnormal or unusual sales activity.

3) Project future usage from historical usage.

4) Record supplier fill rate and lead time independently for each item.

5) Determine suggested stocking levels based on the projected usage of each item over it's calculated days of supply (lead time plus review time plus a user-defined percentage of safety stock).

6) Identify, segregate and categorize for exception processing those items that do not fit within standardized sales
and/or delivery profiles.

Although the forecasting module utilizes several sophisticated mathematical calculations to determine projected usage and suggested stocking levels, the majority of these formulas are applied simply to decide if the historical data is adequate and within acceptable limits to support a reliable decision.

Those items which are consistently used at the rate of three per week, are purchased from a supplier who regularly ships within one week of the order date with a ninety-five percent fill rate and has a prepaid freight policy that dictates one order per month, should require only minimal effort from the buyer to generate a purchase order.

Overview continued:

No level of number crunching can accurately predict if an item that has sold for the first time in two years should be restocked or not. It is equally impossible to forecast a suggested order quantity sufficient to meet the demand of an item that has been on backorder from its sole supplier for the last three months. Exceptions such as these require manual intervention by a knowledgeable buyer.

The forecasting algorithms are designed to identify and isolate these exceptions and the purchasing review screens provide easy on-line access to every pertinent piece of data the buyer requires to make a knowledgeable purchasing decision.

2. Recording Usage

The most basic element of any replenishment forecasting system is the ability to monitor item usage over time. If sufficient historical data regarding an item's movement can be accurately recorded, mathematical analysis of that information can be applied to develop a projected usage pattern.

The sales history for each item must be updated frequently in order to provide the buyer with the information necessary to react to changes in inventory balances and sales demand in a timely manner. On-hand quantities are updated in a real time mode by the order entry system; as the ENTER key is pressed for each order entry line item, inventory is incremented by the ship quantity. During the daily closing process, the item history file is updated with the sales activity.

Of almost equal importance is the ability to distinguish 'normal' sales demand from usage that has been artificially impacted due to promotions, out of stock conditions, special orders and other extraneous (but common) item movement. The system provides several safeguards in this area.

First, the order entry user has the ability to override the system default that triggers an update to demand if he or she recognizes that the entry being made is not a typical sale. This is accomplished on a line item basis by changing the transaction code. A second check is made during the period close process where the total demand recorded during the period is validated against a user-defined filter and, if necessary, smoothed to remove spikes. Finally, the forecasting job itself is designed to flag any abnormal activity so that visual warnings are issued to the buyer during the review process.

Item history in the Distribution Express system is tracked by period with twelve periods per year. Each period carries separate fields to capture net ordered, ordered with demand and shipped quantities which are updated from the order entry line item detail on a daily basis. A fourth field, filtered demand, is calculated during the period closing process. This value represents the 'smoothed' usage of each item after applying formulas within user-defined parameters to reduce the effect of any abnormal activity that might have been recorded during the period. This filtered quantity is the value actually used to project suggested stocking levels.

The item history file is keyed by year and may be retained indefinitely with available disk space being the only constraint. A minimum of two full years of history plus that for the current year is required to maximize the effectiveness of the forecasting process. Any history retained beyond this minimum is not used by the system but is available through an inquiry window from the suggested buy screens and may be of benefit to a buyer.

2.1 Defining Usage Periods

Item usage is the net movement (sales minus credits) of each part number over pre-defined time increments. In the Distribution Express software, these increments are defined as periods with twelve periods designated within each calendar year. The beginning and ending dates for each period are user-defined.

As a general rule, these dates should be assigned so that each period contains approximately the same number of working days. It is also suggested that the ending date of each period fall on a weekend if possible. Although the period closing job can be run unattended and concurrently with all other system tasks except forecasting, it is a relatively long running task that requires considerable system resources and, as such, is better suited to processing during off peak hours.

Also contained in the period file is the number of business days in each period and the number of days that have been closed within that period. The system uses this information to determine what percentage of the current period remains open at any given time. This in turn enables the forecasting job stream to calculate what demand quantity of each item can be expected for the remainder of the period.

The specific instructions for assigning the number of periods are covered in the 'Database' manual.
The specific instructions for assigning the beginning and ending dates for each period are covered in the 'Data Base' manual. It is important to note that the periods used in forecasting affect only item movement quantities.
Sales Analysis and accounting periods are defined separately. It is not necessary that these periods have common date ranges and is even discouraged if your fiscal year does not begin on January 1st.

Although the system is designed to function properly in businesses having a fiscal year that does not coincide with the calendar year, this is typically an accounting decision and should not impact inventory management. Most buyers are more comfortable when year to date inventory movement figures represent what has occurred since January 1.

2.2 Capturing Usage

During the order entry process, an order quantity and a transaction code is entered for each item. Previously assigned flags within the transaction code or the order header that affect the forecasting process include:

1. Is this a debit or credit transaction?

2. Is an on-hand balance affected?

3. If on-hand is affected, which type (Available, Miscellaneous, Warranty, Damaged or Core)?

4. Is sales demand is affected?

*5. Is this a sale or credit that affects core, warranty or damaged on hand balances?

*6. Is this a sale or credit to a vendor type customer?

*7. Is this item being filled as the result of backorder processing?

* These transactions do not update the sales history file

Using this information, history is updated for all line items which have not previously been processed through a day close whether the order has been invoiced or not. The item creation date determines which period will be updated.

Each period in the item history file contains three buckets:

1. **Ordered** - The net order quantity of all debits and credits

2. **Demand** - The net order quantity of all debits and credits having a transaction code that is flagged to affect demand

3. **Shipped** - The net ship quantity of all debits and credits

Each of these values plays a critical role in the forecasting process. The ordered and shipped quantities provide fill rate percentages and quantify customer service level objectives. The demand value serves as the basis for projecting future sales activity.

2.3 Manual Overrides to Usage

Under some conditions, it may be desirable to manually pre-load expected item usage quantities. This is usually done where a special promotion is being run at some future date and management is able to accurately estimate what quantities of each item will be required to cover the expected demand during that time.

The figure shown below indicates the information available and the screen layout used to manually add projected demand.

Item: BW-1 BLUE WIDGET #1

Starting	Projected	Override	Add/Rpl	1 yr ago	2 yrs ago	Variance
8/01/94	57			42	4	38
9/01/94	59			43	6	37
10/01/94	59			44	8	36
11/01/94	62			45	9	36
12/01/94	62			46	10	36
1/01/95	57			42	5	37
2/01/95	62			45	8	37
3/01/95	65			48	10	38
4/01/95	74	20	A	51	13	38
5/01/95	77	20	A	57	15	39
6/01/95	82			57	18	40
7/01/95	77			60	20	40

Each item is accessed individually with the current open month at the top. If a spring promotion (April and May of 1995) were being planned in August, the user would indicate either the total number of "BW-1" widgets expected to be sold or the additional number of sales beyond normal demand that the promotion will generate. An "A" in the second input field will cause the override to be added to the normal projected demand for that period. A "R" will cause the normal projected demand to be replaced by the override value.

As each period between August and April is closed, the override demand quantity will be shifted forward so that it will be automatically included in the late February and early March forecasts.

2.4 Exceptions to Usage Processing

The day close process intentionally excludes certain types of activity from being updated to the history file. The update process for superceded items is also handled in a slightly different manner than previously outlined in this section.

Transactions that are totally omitted from the update process include:

1. All sales or credits made to any account coded as a vendor.
   - Items are 'sold' to a vendor to relieve inventory for stock adjustments and for warranty or core returns.

2. All sales and credits that affect core, warranty or damaged on-hand inventory balances.
   - These types of transactions should not impact demand or filtered demand and would, if included, distort the ordered and shipped quantities used to calculate fill rates.

3. All sales made as a result of the backorder fill process.
   - The ordered and demand quantity for backordered items is captured and updated with the original request. Updates to the history file would overstate demand and distort fill rates.

When a superceded item is processed through day close, the demand quantity is **always** updated to the superceding item regardless of which item was actually shipped. The order and ship quantities are updated for the item that was actually processed. The example shown below indicates the update process for various scenarios.

Item "A" is superceded to item "B" and item "A" is entered by the order entry user:

Order qty	On-Hand "A"	On-Hand "B"	Effect on "A" History Order	Effect on "A" History Demand	Effect on "A" History Ship	Effect on "B" History Order	Effect on "B" History Demand	Effect on "B" History Ship
3	3	10	3	0	3	0	3	0
3	1	10	1	0	1	2	3	2
3	0	10	0	0	0	3	3	3
3	1	1	1	0	1	2	3	1
3	0	0	0	0	0	3	3	0

3. Analyzing Usage

Period close, the next step in the forecasting process, analyzes the information which has been recorded and accumulated daily since the last period close. Each item's activity in the current period is evaluated against a statistical profile created from its historical usage. This comparison will indicate if the activity for the item in the current month is consistent with its prior history plus or minus a user-defined level of tolerance.

The current period demand quantity for each item is processed through a filtering test to determine if it is within a predefined percentage of the weighted average demand calculated in the previous period close. Any demand outside the acceptable range is 'smoothed' and the result is updated to the filtered demand quantity for the current month.

After determining the filtered demand quantity, the average weighted usage of each item per period is recalculated. A user defined weighting factor is applied to the filtered demand quantity for each of the prior twelve months of history. Typically, a higher weighting factor is assigned to the most recent period and incrementally adjusted downward so that the activity in the oldest period is emphasized the least. This weighting process creates an average usage that more accurately reflects any increase or decrease in usage than would be indicated by an average calculated on a straight-line basis.

Although the weighted average usage reflects to some degree upward or downward demand tendencies, a more useful and statistically reliable indicator is an item's trend rate. Dependent upon how much history is available, this value is calculated by comparing total filtered demand for the most recent year to the filtered demand of the prior year or by comparing the weighted average with the straight-line average.

The final task in analyzing item usage within period close is the determination and assignment of a ranking code to each item. The item rank identifies the relative popularity of an item when its usage is compared to that of other similar items within the same product line. Although the rank of an item has no effect on its projected demand, it is used by the forecasting job to determine the number of days of safety stock required and consequently the recommended stocking levels.

3.1 Filtering Usage

A fourth bucket contained in the history file, **Filtered Demand**, is generated during the period close process. The Demand quantity, which was updated on a daily basis, is subjected to a filtering test to determine if it deviates from the weighted average usage by more than a user-defined tolerance.

Filtered demand is calculated by comparing the average period usage of an item to a user-defined table with upper and lower usage ranges. A maximum acceptable deviation factor is assigned to each range. A typical filter profile is shown below:

Tier	Low range	Hi range	Filter	Est annual demand			Max filtered/prd +/-		
1	**-	.083	24.0	****	to	1	****-	to	2
2	.084	.167	18.0	1	to	2	2	to	3
3	.168	.250	15.0	2	to	3	3	to	4
4	.251	1.000	8.0	3	to	12	4	to	8
5	1.001	5.000	4.0	12	to	60	4	to	20
6	5.001	99999.999	2.5	60	to	*****	13	to	*****

"Estimated annual demand"- represents the approximate yearly sales expected for any item with a weighted period average between the upper and lower ranges.

"Maximum filtered per period"- indicates the maximum filtered demand that would be allowed for items with the lowest and highest averages in each tier.

An item with an average period usage of ".150" would be subject to the second filtering tier (.084 thru .167) and would have a maximum filtered usage value of plus or minus three:

{(Average of .150) X (filter of 18.0)} = 2.700 (rounded) = 3
Note: All decimal values are rounded to the next whole number

The filtered demand for an item with this profile could not be less than three negative or greater than three positive. If the demand for an item falls outside the calculated range, it will be flagged for additional scrutiny by the buyer on the forecast review screen.

Filters are assigned at the item rank group level and can be fine-tuned to fit virtually any usage profile.

It is important to note that "N" ranked items (New) and seasonal items are not subject to the filtering process.

Example - "Item Usage History"

A typical item history record contains the following information:

Prd	Beginning	Ending	Order	Demand	Filtered	Shipped
1	1/01/94	1/31/94	5	5	5	5
2	2/01/94	2/28/94	4	4	4	4
3	3/01/94	3/31/94	6	6	6	5
4	4/01/94	4/30/94	5	5	5	5
5	5/01/94	5/31/94	7	7	7	7
6	6/01/94	6/30/94	150	9	9	150
7	7/01/94	7/31/94	150	150	40	150
8	8/01/94	8/31/94	8	8	8	8
9	9/01/94	9/30/94	3	3	0	3
10	10/01/94	10/31/94				
11	11/01/94	11/30/94				
12	12/01/94	12/31/94				

In the sixth period, the "Order" quantity exceeds the "Demand" value. This illustrates the impact of a sale that was assigned a transaction code flagged to bypass demand update.

The seventh period is indicative of how the system smooths abnormal demand. Although "Order" and "Demand" quantities match, the system recognized that the "Demand" value greatly exceeded the usage profile for the item and adjusted the "Filtered" quantity downward.

The eighth period does not show a "Filtered" value because it is currently open. Period close calculates this quantity.

3.2 Weighted Average Usage

During period close, the weighted average usage of each item is recalculated based on its weighted filtered movement over the most recent twelve periods.

This value is used as the basis for projecting usage for any items with less than one year of usage history. It is also compared to the projected demand by the forecasting jobstream and will cause an exception flag to be set if the deviation between them is outside user-defined tolerances for any item that is not flagged as seasonal.

The item rank group carries the user-assigned factors that are applied to the filtered usage value in order to calculate weighted average usage. This concept provides the ability to place more emphasis on the most recent movement of an item and less weight on its activity twelve months ago. A typical weighting profile is illustrated below:

Prd	Factor	Filtered usage	Weighted usage
1	1.2500	9	11.2500
2	1.2000	7	8.4000
3	1.1500	6	6.9000
4	1.1000	4	4.4000
5	1.0500	3	3.1500
6	1.0000	3	3.0000
7	1.0000	2	2.0000
8	.9500	1	.9500
9	.9000	0	.0000
10	.8500	0	.0000
11	.8000	1	.8000
12	.7500	0	.0000
Totals	**12.0000**	**36**	**40.8500**

Straight-line average 36.00/12.00 = 3.0000
Weighted average..... 40.85/12.00 = 3.4042

If the item were created six months ago, only the
usage over those periods would affect the average

Straight-line average 32.00 /6.00 = 5.3333
Weighted average..... 37.10/ 6.75 = 5.4900

Although the variance between the straight-line average and the weighted average in these examples is relatively small, it is obvious that the factored value is more representative of the item's increased demand.

New items (those ranked as "N") are not subject to the weighting process. Their average demand is calculated as a straight-line value based on total usage divided by the number of periods closed since their creation date.

Seasonal items are also exempt from the weighting process. Their average is calculated by dividing the total demand over the past twelve periods by the number of periods having a net usage greater than zero.

3.3 Trend

During period close, a growth factor representing any upward or downward pattern in usage is calculated for each item except "N" ranked (new) items and items flagged as seasonal. This result, item trend, is applied to the historical demand to project anticipated usage by month for the next twelve months.

The trend factor for new and seasonal items is unconditionally set to a value of ".00" which indicates a flat or zero deviation in growth rate. The usage pattern for items in either of these categories is generally too erratic to provide any meaningful statistical analysis.

For all other items, the length of time an item has been in stock and the total filtered demand quantity over that period determine how the trend will be calculated.

Based on the creation date in the location item file, if the item was added to inventory at least two years prior to the ending date of the current period and has a weighted average usage of 1.0000 or higher, trend will be calculated using the following formula:

Trend = {(A - B) / (B)} X {(100)}

A = Total filtered usage for the preceding twelve months

B = Total filtered usage for months thirteen through twenty-four

The trend for items that have been in stock for less than two years or have a weighted average usage of less than 1.0000 is calculated with the following formula:

Trend = {(A - B) / (B)} X {(100)}

A = Weighted average usage

B = *Straight line average
* The total filtered demand quantity divided by the number of closed periods since the item's creation date plus one (Note: A maximum of twelve periods will be used)

3.4 Trend Examples

These examples illustrate how trend will be calculated under under various usage conditions. January 1994 is the period being closed.

"A" - Items with higher usage in the current year than in the prior year.
Weighted average usage is at least "1.0000".
Both years have a positive net usage.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1992	8	8	7	9	7	10	9	9	8	10	9	9
1993	8	9	8	10	9	11	12	10	8	11	10	9
1994	10											

- Total usage in current year (Feb 1993 thru Jan 1994) = 103
- Total usage in prior year (Feb 1992 thru Jan 1993) = 117
- **Trend** = (117 - 103) / (103) = .1359 = 13.59 % Up

"B" - Items with lower usage in the current year than in the prior year.
Weighted average usage is at least "1.0000".
Both years have a positive net usage.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1992	8	9	8	10	9	11	12	10	8	11	10	9
1993	10	8	7	9	7	10	9	9	8	10	9	9
1994	8											

- Total usage in current year (Feb 1993 thru Jan 1994) = 117
- Total usage in prior year (Feb 1992 thru Jan 1993) = 103
- **Trend** = (103 - 117) / (117) = .1197 11.97 % Down

"C" - Items with higher average weighted usage than straight line average.
Weighted average usage is less than "1.0000".
Both average weighted usage and straight-line usage are positive.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1992	0	0	0	0	0	0	0	1	0	0	0	2-
1993	0	0	0	0	0	0	0	0	0	1	0	0
1994	0											

* Total usage in last 12 months is "1"
* Usage occurred in fourth oldest period; weighted at "1.10"
- Weighted average usage = (1 X 1.10) / (12) = .0917
- Straight line average = (1) / (12) = .0833
- **Trend** = (.0917 - .0833) / (.0833) = .1008 = 10.08 % Up

Trend examples continued:

"D" - Items with lower average weighted usage than straight-line average.
Weighted average usage is less than "1.0000".
Both average weighted usage and straight-line usage are positive.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1992	0	0	0	0	0	0	0	1	0	0	0	2-
1993	0	0	1	0	0	0	0	0	0	0	0	0
1994	0											

* Total usage in last 12 months is "1"
* Usage occurred in eleventh oldest period; weighted at ".80"
- Weighted average usage = (1 X .80) / (12) = .0667
- Straight line average = (1) / (12) = .0833
- **Trend** = (.0667 - .0833) / (.0833) = .1993- = 19.93 % Down

The trend value for items with zero or negative usage in current year, prior year, weighted average or straight-line average is statistically meaningless. If one or more of these conditions occur, the trend value will be unconditionally set to the values indicated in the table below regardless of the value of the other element in the formula:

IF Curr Yr or Weighted Avg Is:	**AND Prior Yr or Straight Avg Is:**	**Trend is**
Positive	Negative	1.00 Up
Positive	Zero	1.00 Up
Zero	Positive	1.00 Down
Zero	Zero	.00
Zero	Negative	.00
Negative	Negative	1.00 Down
Negative	Zero	1.00 Down
Negative	Positive	1.00 Down

3.5 Item Ranking

During period close, all items within each rank group are evaluated for possible re-ranking. Ranking establishes the hierarchical position of each item within a group based on its relative usage when compared to other items with similar characteristics.

Ranking serves two purposes. First, it provides management with a tool to quickly see how their investment in inventory is spread between fast and slow moving items. Second, it enables the buyer to control the amount of safety stock carried by assigning a higher number of days to faster moving items and to reduce that level as items decline in popularity.

Although safety stock factors are assigned at the rank group level, the impact of this decision will be discussed in a later chapter of this manual. The rank of an item does not directly affect the projected usage but it is part of the analysis performed by the period close procedure.

The item ranking process is based on a number of user-defined parameters that are defined in the item rank group file. These include:

1. Base ranking on requested usage or actual shipped

   - Items may be ranked by their demand (average weighted usage) or by the total quantity shipped over the past twelve months.

   - It is DMS' recommendation that demand be used as that figure more accurately reflects the true usage.

2. Base ranking on units or value

   - Items may be ranked by units (requested or shipped) or by the result of units multiplied by the item's cost.

   - As a general rule, DMS recommends that units be used but if items that vary widely in cost are assigned the same rank group and it is management's objective to emphasize the fill rate of higher dollar Items, ranking by value should be selected.

3. Assign the number of periods of used to determine the break points

   - Items will be ranked into three broad categories; 1) Reasonably fast moving items, 2) Slower moving items and 3) Dead stock. To accomplish this two break points based on a number of periods are assigned to each rank group.

   - The first parameter sets a lower limit for items that will be ranked as "A" through "E" or "N". In order to qualify for consideration in this category the total usage for an item must within the number of periods specified as the break point must be greater than zero or the item must have a creation date more recent than the breakpoint date.

   - The second breakpoint identifies dead stock. Any item which has had zero or negative usage in the number of periods specified for this parameter will be ranked "X". Once an item has been assigned a "X" rank it will not be reclassified to a higher rank regardless of its future usage.

Item Ranking continued:

3. continued:

- Items which have not had a positive usage within the number of periods specified for the first breakpoint but do have positive usage or a creation date more recent than the second breakpoint will be ranked as "W".

* DMS recommends that the first breakpoint be set at four (4) and the second at twelve (12). In most environments,
four months is an adequate period of time for a new item to establish itself. It also implies that, on average, the majority of the items assigned to this category will receive at least three requests per year. Any item that has not had at least one request in the most recent twelve months should be classified as non-moving inventory and returned to the supplier. Items with one or two requests per year are slow movers but must be stocked by most distributors to insure customer satisfaction.

4. Define percentages used to assign ranks "A" through "E"

- Items within the first category, those that move reasonably well, are further classified based on their usage within this group. Breakpoints based on percentages are assigned to each rank.

* Based on the old adage that "Eighty percent of sales are made from twenty percent of the items in inventory", DMS recommends settings of:

"A" = 50%, "B" = "30%", "C"= 10%, "D" = 6% and "E" = 4 %.

3.6 Item Ranking During the Period Close

During period close, the following process is used to rank items.

1. All items within a common rank group are selected
   This process selects all items regardless of location or manufacturer code that have the same rank group code.

2. The ranking key field is calculated
   - This is the weighted average period usage multiplied by one hundred if ranking is based on units.

   - It is the weighted average period usage multiplied by the item's current cost plus, if applicable, it's current core cost
     if ranking is based on amount.

3. All items within the group are sorted and assigned a rank order
   - Items are sorted in descending order by their ranking key field.

   - The items are assigned a rank order value based on their position within the above sort with "1" being the best item within the group.

   - The hierarchy for determining rank order is rank key field, rank amount, location, manufacturer and item.

4. The percentage of use for each item is calculated
   - The total of the rank key field for all items is calculated

   - The rank key field value for each item is divided by the total of the rank key field for all items within the group to get
     a percentage of use for each item.

5. Items ranked as "N", "W" or "X" are identified
   - The “N”, and “W”, or “X”, items are segregated based on the breakpoints established in the rank group file.

6. The percentage of use of items not ranked “n”, “w” or “x” is calculated.
   - The total of the rank key field for all remaining items is calculated.

   - The rank key field value for each item is divided by the total of the rank key field for all items within the group to get
     a percentage of use for each item.

7. Item ranking is assigned.
   - Beginning with the first item in the group, the percentage of use is accumulated for each item until the breakpoint percent assigned in the item rank group for “A” ranked items is exceeded.

   - All items processed to this point are ranked “A”.

   - The accumulation process continues with the next item until the breakpoint percentage for “B” ranked items is exceeded. This continues until all items in the group have been assigned a system rank.

In summary, there are some key points regarding item ranking that should not be overlooked:

1. Item ranks are assigned based on the relative popularity of all items within the same rank group.

   - An "A" ranked item in one group may have an average usage that is less than a "B" or "C" ranked item that is assigned to a different ranking group.

   - "D" or "E" ranked items are not necessarily bad nor should a high comfort level be reached because "A" and "B" items make up eighty percent of the inventory value of a given group. Generalizations can be made from item ranking data but the actual average weighted usage of an item is a better indicator of its worth.

2. The rank order is the relative position of an item based on its weighted average usage when compared to all items within the group.

   - The lower the rank order, the faster the item is moving relative to other items in the same group.

   - It is possible that "W" or "X" ranked items may occasionally have a lower rank order than items with a more popular ranking code. This is particularly true of items that are highly seasonal.

3. Item rank does not affect projected usage. It does affect the forecast quantity.

   - Projected usage is based strictly on an item's past history.

   - Forecast quantity is based on the days of supply (Review time plus lead time plus safety stock) needed to cover the projected usage and item rank affects the calculated safety stock.

4. "X" ranked items are never re-ranked by the system.

   - Any item that has had the required number of consecutive periods without positive usage to be ranked "X" will NOT be re-ranked by the system regardless of usage.

   - If an "X" ranked item should show a consistent rise in usage, it should be manually re-ranked to "W" by the user in location item maintenance. The next period close will rank and sequence it properly within the group.

   - The number of consecutive periods without positive usage is determined from the item history file or, if this file shows no usage for up to two years, from the item location file.

Item ranking example (A=70%, B=15%, C=10%, D=5%, E=5%):

Seq	Item	Pcnt Rank key	Accum% % all	Accum% (A-E)	Prd (ALL)	Prd (A -E)	Rk	Cnt
1	121-10	796.25	8.31	8.73	8.31	8.73	A	0
2	121-33	773.33	8.07	8.48	16.38	17.21	A	0
3	121-28	753.33	7.86	8.26	24.24	25.47	A	0
4	121-29	709.58	7.41	7.78	31.65	33.25	A	0
5	121-25	641.67	6.70	7.03	38.35	40.28	A	0
6	121-7	635.42	6.63	6.97	44.98	47.25	A	0
7	121-41	602.50	6.29	6.61	51.27	53.86	A	0
8	121-18	562.50	5.87	6.17	57.14	60.03	A	0
9	121-11	480.00	5.01	5.26	62.15	65.29	A	0
10	121-35	382.92	4.00	4.20	66.15	69.49	A	0
11	121-45	371.25	3.88	4.07	70.03	73.56	A	0
12	121-8	301.67	3.15	3.31	73.18	76.87	B	0
14	121-6	299.17	3.12	3.28	76.30	80.15	B	0
15	121-14	297.95	3.11	3.27	79.41	83.42	C	0
16	121-43	242.08	2.53	2.65	81.84	86.07	C	0
17	121-31	215.83	2.25	2.37	84.19	88.44	C	0
18	121-5	148.75	1.55	1.63	85.74	90.07	D	0
19	121-30	119.58	1.25	1.31	86.99	91.38	D	0
20	121-2	113.75	1.19	1.25	88.18	92.63	D	0
21	121-27	106.25	1.11	1.00	89.29	93.63	D	0
23	121-1	87.50	.91	.96	90.20	94.59	D	1
24	121-3	78.75	.82	.86	91.02	95.45	D	2
25	121-17	72.50	.76	.79	91.78	96.24	E	3
26	121-32	42.08	.44	.46	92.22	96.70	E	2
27	121-9	34.58	.36	.38	92.58	97.08	E	1
28	121-34	32.50	.34	.36	92.92	97.44	E	1
29	121-15	29.17	.30	.32	93.22	97.76	E	6
30	121-13	28.75	.30	.32	93.52	98.08	E	1
32	121-23	24.58	.26	.27	93.78	98.35	E	1
33	121-16	23.75	.25	.26	94.03	98.61	E	1
35	121-19	18.33	.19	.20	94.22	98.81	E	2
36	121-24	17.50	.18	.19	94.40	99.00	E	3
37	121-4	17.08	.18	.19	94.58	99.19	E	4
38	121-40	15.83	.17	.17	94.75	99.36	E	2
39	121-12	15.42	.16	.17	94.91	99.53	E	4
40	121-37	8.75	.09	.10	95.00	99.63	E	2
41	121-21	8.33	.09	.09	95.09	99.72	E	5
44	121-50	6.67	.07	.07	95.16	99.79	E	2
46	121-36	5.42	.06	.06	95.22	99.85	E	6
Subtotal A-E		**9,121.27**			**99.85***			
13	121-46	300.00	3.13	N/A	98.35	N/A	N	0
22	121-48	100.00	1.04	N/A	99.39	N/A	N	0
48	121-47	.00	.00	N/A	99.39	N/A	N	4
42	121-39	7.50	.08	N/A	99.47	N/A	W	8
43	121-23	6.67	.07	N/A	99.54	N/A	W	10
45	121-42	6.25	.07	N/A	99.61	N/A	W	11
49	121-44	9.17-	.10-	N/A	99.51	N/A	W	12
31	121-38	27.08	.28	N/A	99.79	N/A	X	1
34	121-20	19.17	.20	N/A	99.99	N/A	X	4
47	121-22	.00	.00	N/A	99.99	N/A	X	33
Totals		**9,578.77**	**99.99*;**	Total may not be = to 100.00 due to rounding				

4. Projecting Usage

During period close, item usage by period is projected forward for the next twelve months. The specifics of this process will be documented in detail in subsequent sections of this chapter but the primary concept is to calculate a trend rate or growth factor representing any upward or downward pattern in each item's usage and to apply that result to it's historical demand.

Although the data in the example below is admittedly too consistent to be realistic, it illustrates the basic concept of projecting demand based on the calculation of a trend factor and the application of that factor to the historical filtered usage.

Mth	1992 usage	1993 usage	1994 projected
Jan	10	11	12
Feb	11	12	13
Mar	12	13	14
Apr	13	14	15
May	14	15	16
Jun	15	16	17
Jul	15	16	17
Aug	14	15	16
Sep	13	14	15
Oct	12	13	14
Nov	11	12	13
Dec	10	11	12
Total	**150**	**162**	**174**

Two years of history are compared to develop a trend factor that indicates the change, up or down, in an item's rate of usage. In this example the 1993 usage is up by eight percent, (162 - 150) / (150) = .08, over the 1992 usage. If the two columns representing filtered usage were switched so that the higher usage occurred in the earlier year, the trend factor would be .07- or seven percent down (150 - 162) / (162).

When calculating projected demand, a value of 1.00 is added to the trend and that result is multiplied by the filtered demand for each period within the past year to determine the expected usage for the next twelve months.

Item's with less than two years of history, slow moving items, items with sporadic demand and seasonal items are processed in a slightly different manner.

It is important to recognize that the trend factor is recalculated each month using the most recent history to project usage for the next twelve months. The period close at the end of July, 1994 will compare July 1992
through June 1993 usage with that of July 1993 through June 1994 to develop the trend factor and the usage will be projected through June of 1995.

4.1 Calculating Projected Usage

During period close, the projected usage over the next twelve months is calculated by multiplying the filtered usage for each of the previous twelve periods by the item's trend. The system is basically projecting each item's anticipated demand forward for one year from the current period based on it's usage for each month in the prior year plus or minus any adjustment that may be indicated due to an increase or decline in it's activity.

Most distributors have a definitive business cycle that swings up or down with the seasons of the year. The concept of basing future demand off the actual usage from the same period in the prior year compensates for this normal change in activity. Items that are truly seasonal such as snow blowers, tire chains or garden tools can be automatically identified by the system and processed on an exception basis.

In some instances, the demand for the same period in the prior year is not available or may not be a reliable indicator for projecting future usage. These exceptions and the manner in which they are processed are outlined below:

1. Slow moving items, new items and non-seasonal items with sporadic demand

   - The demand for items averaging less than one unit per period, new items ("N" ranked) and those that do not have a positive demand in each period of the prior year cannot be reliably determined by projecting current year usage from their activity in the same periods of the prior year.

   * Projected demand for items with this profile are based on their average weighted usage multiplied by their trend rate.

2. Items with zero or negative average weighted usage

   - If an item has zero or negative usage, it should not be considered for replenishment.

   * The projected demand for items with zero or negative average weighted usage will be set to zero for all future periods. It is important to note that DMS recommends that order entry credit transaction codes that do not affect available on-hand should also not affect demand. A slow moving item that is sold in one period and returned for warranty credit in the next could have a negative weighted usage if warranty credits are set to reduce demand. A return to stock credit could also cause a negative average but the unit would be in inventory and available for sale should future requests occur.

3. Adjustments to trend

- The trend factor is an indicator of any historical change, up or down, in an item's demand history. Extremely erratic demand however may generate a trend rate that is statistically unreliable.

* Although trend will be determined from the data available and the result of this calculation written to the location item record, the projected demand formula is set to filter any trend factor that is less than 1.00 negative or greater than 1.00 positive. The maximum values allowed are .99 negative and 1.00 positive. This limits the projected demand for any period to a minimum of zero and a maximum of double it's basis for projection (average weighted or actual usage). If trend is adjusted, the item will be visually flagged for the buyer's attention on the suggested buy review screen.

4. Adjustments to projected demand and carryovers

- If the item projected demand for the first period is less than "1", it will be adjusted to "1". If it is greater than "1", it will be adjusted to the nearest whole number.

* The average weighted usage is multiplied by the trend factor to project demand. If the result is less than "1", it is adjusted upward to "1". If the result is greater than "1", it is half adjusted to the nearest whole number. This adjusted projection is then subtracted from the original projection to calculate a carryover value for the next period as shown below:

Calculated projection	Adjusted projection	Carryover
.2500	1	.7500-
1.8625	2	.1375-
1.4500	1	.4500

* For periods two through twelve, the carryover value from the previous period is added to the calculated projection for that period and half adjusted to the nearest whole number. If the result is not .5 or greater, a zero is written to the projected demand for that period. Any difference between the two values is carried over and applied to the Projected Usage quantity in the next period.

5. Projecting seasonal items

* A separate chapter in this manual details the forecasting of seasonal items.

4.2 Projected Usage Examples

A. Projected usage for an item with a trend factor of .25 Up

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1993	6	8	7	9	7	10	9	9	8	10	9	9
1994	8	10	9	11	9	12	12	11	10	12	12	11
1995	10											

	Filtered usage		Trend + 1.00		Projected usage		Prev prd carryover			Adjusted projected	Carry over
2/93	8	X	1.25	=	10.00		N/A	=	2/94	10	.00
3/93	7	X	1.25	=	8.75	+	.00	=	3/94	9	.25-
4/93	9	X	1.25	=	11.25	+	.25-	=	4/94	11	.00
5/93	7	X	1.25	=	8.75	+	.00	=	5/94	9	.25-
6/93	10	X	1.25	=	12.50	+	.25-	=	6/94	12	.25
7/93	9	X	1.25	=	11.25	+	.25	=	7/94	12	.50-
8/93	9	X	1.25	=	11.25	+	.50-	=	8/94	11	.25-
9/93	8	X	.25	=	10.00	+	.25-	=	9/94	10	.25-
10/93	10	X	1.25	=	12.50	+	.25-	=	10/94	12	.25
11/93	9	X	1.25	=	11.25	+	.25	=	11/94	12	50-
12/93	9	X	1.25	=	11.25	+	.50-	=	12/94	11	.25-
1/94	8	X	1.25	=	10.00	+	.25-	=	1/95	10	.25-
Total	**103**									**129**	

B. Projected usage for an item with a trend factor of .25 Down

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1993	6	8	7	9	7	10	9	9	8	10	9	9
1994	8	6	5	7	5	8	7	6	6	8	7	6
1995	6											

	Filtered usage		Trend + 1.00		Projected usage		Prev prd carryover			Adjusted projected	Carry over
2/93	8	X	.75	=	6.00		N/A	=	2/94	6	.00
3/93	7	X	.75	=	5.25	+	.00	=	3/94	5	.25
4/93	9	X	.75	=	6.75	+	.25	=	4/94	7	.00
5/93	7	X	.75	=	5.25	+	.00	=	5/94	5	.25
6/93	10	X	.75	=	7.50	+	.25	=	6/94	8	.25-
7/93	9	X	.75	=	6.75	+	.25-	=	7/94	7	.50-
8/93	9	X	.75	=	6.75	+	.50-	=	8/94	6	.25
9/93	8	X	.75	=	6.00	+	.25	=	9/94	6	.25
10/93	10	X	.75	=	7.50	+	.25	=	10/94	8	.25-
11/93	9	X	.75	=	6.75	+	.25-	=	11/94	7	.50-
12/93	9	X	.75	=	6.75	+	.50-	=	12/94	6	.25
1/94	8	X	.75	=	6.00	+	.25	=	1/95	6	.25
Total	**103**									**77**	

C. Projected usage for an item with a trend factor of .02 Up; Weighted average of .2542

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1993	0	0	1	0	0	0	2	1-	0	0	0	0
1994	1	1	0	0	0	0	1	0	0	0	1	0
1995	0											

	Filtered usage		(X)	Trend + 1.00	=	Projected usage	+	Prev prd carryover	=	Adjusted projected	Carry over
2/93	0		X	1.02	=	.2593	+	N/A	=	2/94	.7407-
3/93	1		X	1.02	=	.2593	+	.7407-	=	3/94	.4814-
4/93	0		X	1.02	=	.2593	+	.4814-	=	4/94	.2221-
5/93	0		X	1.02	=	.2593	+	.2221-	=	5/94	.0372
6/93	0		X	1.02	=	.2593	+	.0372	=	6/94	.2965
7/93	2		X	1.02	=	.2593	+	.2965	=	7/94	.4442-
8/93	1-		X	1.02	=	.2593	+	.4442-	=	8/94	.1849-
9/93	0		X	1.02	=	.2593	+	.1849-	=	9/94	.0744
10/93	0		X	1.02	=	.2593	+	.0744	=	10/94	.3337
11/93	0		X	1.02	=	.2593	+	.3337	=	11/94	.4070-
12/93	0		X	1.02	=	.2593	+	.4070-	=	12/94	.1477
1/94	1		X	1.02	=	.2593	+	.1477	=	1/95	0 .4070
Total 3										**3**	

The average weighted usage of this item is less than 1.0000. Average weighted usage will be used in lieu of prior period filtered usage.

D. Projected usage for an item with a trend factor of .20 Up; Weighted average of 1.4917

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1993	2	4	3	1-	2	0	1	0	0	3	2	1
1994	3	1	2	2	2	1	2	2	2	2	1	2
1995	2											

	Filtered usage		(X)	Trend + 1.00	=	Projected usage	+	Prev prd carryover	=	Adjusted projected	Carry over
2/93	4		X	1.2000	=	1.7900	+	N/A	=	2/94	2 .2100-
3/93	3		X	1.2000	=	1.7900	+	.2100-	=	3/94	2 .4200-
4/93	1-		X	1.2000	=	1.7900	+	.4200-	=	4/94	1 .3700
5/93	2		X	1.2000	=	1.7900	+	.3700	=	5/94	2 .1600
6/93	0		X	1.2000	=	1.7900	+	.1600	=	6/94	2 .0500-
7/93	1		X	1.2000	=	1.7900	+	.0500-	=	7/94	2 .2600-
8/93	0		X	1.2000	=	1.7900	+	.2600-	=	8/94	2 .4700-
9/93	0		X	1.2000	=	1.7900	+	.4700-	=	9/94	1 .3200
10/93	3		X	1.2000	=	1.7900	+	.3200	=	10/94	2 .1100
11/93	2		X	1.2000	=	1.7900	+	.1100	=	11/94	2 .1000-
12/93	1		X	1.5000	=	1.7900	+	.1000-	=	12/94	2 .3100-
1/94	3		X	1.5000	=	1.7900	+	. 3100-	=	1/95	1 .4800
Total 19										**21**	

One or more periods contain zero or negative demand. Even though the weighted average is greater than 1.0000, average weighted usage will be used in lieu of prior period filtered usage.

5. Recording Supplier Fill Rate and Lead Time

After establishing the projected usage by item and period, the next step in the forecasting process is to evaluate the ability of each supplier to deliver product in a reliable and timely manner. The criteria for judging supplier performance are measurements of lead time and fill rate.

Lead time, review time and percentage of safety stock are the three elements that determine the required days of supply which must be maintained in order to meet demand. Of these variables, lead time typically has the greatest influence on stocking levels. Imprecise settings will result in either too much inventory reducing turn rates or too little inventory causing lower fill rates. Lead time is measured as the number of days between the date an item is ordered and the date it is received, checked in and added to inventory.

Fill rate is the primary indicator of a supplier's reliability and represents the percentage of each order that a supplier is able to ship. DMS measures the fill rate based on ordered and received quantities for each item on first time orders only.

To accurately gauge the performance of a supplier, both lead-time and fill rate must be considered. A supplier who ships an order within one week but has only a sixty percent fill rate may be less desirable than a second supplier with a lead time of two weeks and a ninety-five percent fill rate.

Supplier performance must also be judged on the types of orders being placed. Most distributors will place special orders with a vendor in response to a critical request by a customer. These orders typically occur after the buyer has established direct contact with the supplier, the product is confirmed as being available before the order is placed (100 percent fill rate) and an expedited delivery method is usually requested (short lead time). Orders of this type must be excluded or at least segregated from the fill rate and lead-time calculations used to establish a supplier's typical performance levels.

Another type of order that should not affect normal lead time and fill rate statistics are delayed shipment orders where an order is placed well in advance of the expected delivery date. Spring or fall dating orders typically fall into this category.

A flag at the purchase order line item level dictates whether or not each item affects supplier performance data. Special orders are set to a default value of "N" and replenishment orders default to "Y". Buyer overrides to default values are allowed.

Although purchase order and receiving history information may be retained indefinitely, only the last four receipts of each item are considered when evaluating supplier performance.

5.1 Lead Time

The order date, putaway date, quantity ordered and quantity received for each of the four most recent purchase order receipts is carried in the supplier item file. This file is updated by the purchase order receiving process for each item flagged by the buyer to affect lead-time and fill rate.

The activity for any item that is not received as ordered due to supplier backorders, cancellations, mis-shipments or other discrepancies will be updated to the supplier item file but may not affect the lead time or fill rate calculations. A minimum quantity of one must be received into available, miscellaneous or damaged on-hand types or as a drop shipment for a receipt to influence lead-time. If the entire order quantity of the item were flagged as backordered, cancelled or lost, that receipt would be written to the supplier item file and would influence fill rate but would not affect lead-time.

In measuring lead-time, the system calculates the number of days between the date an item was ordered and the date it was put away. The receiving process actually has two dates; the first is the date the shipment was pre-received and the second, the put away date, reflects the date the order was processed through receiving, shelf stocked and the inventory files updated with the new on-hand balances. Lead-time for backorder fill receipts from a previously received purchase order is calculated from the original order date.

The lead time used in determining required days of supply is recalculated each time the forecasting job is run and is based on the average of the most recent three receipts in the supplier item file if:

1. The received quantity must be one or more

2. The receipts must have occurred within the last year

If both conditions are met for the first three receipts their average lead time is used. If one of the first three receipts fails either test, the fourth receipt is checked and will be used if it passes both tests. If two or more of the receipts fail either test, lead time will be retrieved from the default value assigned by the user in the supplier file.

5.2 Fill Rate

Fill rate percentages are influenced by all receipts except backorder fills. Receiving actions that increase available, miscellaneous or damaged on hand types or that acknowledge the delivery of a drop shipment have a positive influence on fill rate. Backorder, cancel and lost actions have a negative impact.

Although multiple action codes may be taken against a single item during the receiving process, the results are combined and the supplier item file is updated under a single receipt.

Given the following receiving actions:

a. Order	Avail	Misc	Damaged	Dropship	B/O'd	Lost	Cancel
7	1	1	1	1	1	1	1

Fill rate is (4) / (7) = 57.14 %

b. Order	Avail	Misc	Damaged	Dropship	B/O'd	Lost	Cancel
7	0	0	0	0	7	0	0

Fill rate is (0) / (7) = 0.00 %

c. Order	Avail	Misc	Damaged	Dropship	B/O'd	Lost	Cancel
0	7	0	0	0	0	0	0

***** Backorder fill receipts are updated to the supplier item file and do affect lead time, but have no impact on fill rate.

The fill rate, regardless of its value, does not directly influence the suggested replenishment quantity calculated by the forecasting job. A low fill rate however, will trigger a visual warning to the buyer during the review process that a possible problem may exist.

6. Determining Suggested Stocking Levels

The replenishment buy forecast job calculates a suggested purchase quantity for each item based on:

1) The projected usage over a pre-determined period of time

2) The current inventory on-hand and on order position

3) Any adjustments necessary to bring this calculated value up to user-defined per job quantities and/or supplier minimum order quantities

The forecasting routine runs within day close and processes only those items assigned to purchase forecast groups that are designated for review. The frequency of review is user-defined and can be varied from one forecast group to another. DMS suggests that all items, except those products that are truly seasonal, be forecast on a daily basis.

The forecasting job first calculates the required days of supply based on the review time, lead-time and safety stock levels designated for each item. The projected usage that was previously determined by the period close job for each of the next twelve months is then compared to the required days of supply and an item stocking level is calculated. This result represents the quantity required to meet the anticipated demand for each item for the days of supply.

Next, using current inventory on hand and on order positions, a suggested buy quantity is calculated. If for example, the suggested stocking level were ten with three units on hand and six on order, the suggested buy quantity would be "one".

The suggested buy value is then compared with minimum factory pack quantities and adjusted to the proper multiple. In the previous example, if the minimum order quantity were three, the suggested buy quantity would be rounded upwards to "three". If adjustments are required to minimum order quantities, any suggested buy quantity that is greater than one but less than the first multiple will be adjusted upward to that multiple. Once the lowest minimum order quantity is met, the system will half adjust the suggested buy quantity to the nearest multiple.

6.1 Days of Supply

The replenishment buy forecasting job establishes the suggested stocking level for each item based on it's projected usage over the calculated days of supply. Days of supply is comprised of three variables:

Review time: The frequency with which a purchase order is placed with a supplier.

- This value is assigned by purchase forecast group. If purchasing to meet a supplier's prepaid freight requirements is desirable, divide last year's total purchases by the minimum order amount. The result is the approximate number of times prepaid shipping requirements were met. Allow for any expected increase or decrease in business and for the seasonality of products sourced from each supplier to determine the frequency with which each line should be reviewed.

- DMS suggests that the review time be set according to the above guidelines but that the system be coded to review all items each night.

Lead time: The average number of days between the date an order is placed with the supplier and the date the shipment is received and placed into stock.

- The system automatically calculates individual lead times based on the last four orders for each item. If three of these receipts did not occur within the last twelve months and did not have a receipt quantity of at least one, the system will use a default value assigned by the user at the supplier level.

Safety stock: The average number of days of excess inventory deliberately kept on hand to meet fill rate objectives in the event of unanticipated delays in lead-time and/or unexpected increases in item usage.

- Safety stock is calculated by applying a user assigned factor variable by item rank to average lead-time. If, for example, average lead were ten days and a safety stock factor of ".500" were assigned to an "A" ranked item, the safety stock would be calculated at five days.

- High safety stock factors will result in additional depth, which reduces the probability of missing a sale but increases inventory investment. DMS recommends that safety stock levels be linked to item rank and that higher factors be assigned to "A" "B" and "C" ranked items. Fill rate and lead-time also play a part in this decision. Suppliers who ship consistently with little deviation in lead-time or fill rate will require lower safety stock factors than a supplier with a more erratic history.

6.2 Determining Suggested Stocking Levels

The total of these three variables makes up the days of supply required for each item. If a given product line was assigned a review time of one week, had an average lead time of two weeks, a one hundred percent safety stock for "A" ranked items and a fifty percent safety stock for "B" ranked items, the days supply would be:

"A" ranked items	**"B" ranked items**
7 Days review	7 Days review
14 Days lead	14 Days lead
14 Days safety stock (14) X (1.00)	7 Days safety stock (14) X (.50)
35 Days of supply	**28 Days of supply**

Although review time is manually established, if pre-paid freight shipments are a factor in determining when an order can be placed, this setting is really beyond the control of the buyer. It should be set based on the frequency that the buyer can expect to accumulate an order large enough to meet the supplier's freight requirements. If pre-paid shipments are not an issue, the review time setting is even easier - "1" day. The system will generate a suggested order each night and, since the review process is on-line and all pertinent information is easily accessed, the buyer should be able to easily produce a purchase order on a daily basis.

Lead-time is also typically beyond the buyer's influence. The supplier's inventory position, order backlog, available workforce, freight carrier and even the weather all have an effect on item lead time. Different items from the same supplier may also have different lead times that often vary up and down throughout the year. There are simply too many factors and too many items in an average inventory for a buyer to be expected to manage and manually compensate for changing lead times. Since lead-time is tracked independently for each item, the system is able to automatically adjust to changes in the delivery cycle.

Of these variables, only the safety stock can be controlled by the buyer. The results of improperly assigned safety stock factors are often immediately obvious to everyone; a decline in customer fill rates or an increase in inventory investment or, in the worst possible scenario, both events occur concurrently.

There are probably as many rationales for establishing safety stock levels as there are buyers and two patently different strategies will often produce the same results in differing market areas. The key element to this discussion is to understand how safety stock settings affect forecasting and to apply that knowledge to the purchasing philosophy and corporate objectives of each buyer and distributor.

6.3 Calculating Suggested Stocking Level:

The days of supply provides the length of time that the forecast must cover and the projected demand file provides the expected usage quantities for each period starting with the most current and going forward for one year. Each period however, represents roughly one calendar month and the forecast is typically produced daily. The number of business days remaining in the current open month must be known in order to calculate what percentage of the projected demand for the current month will be required.

The period file contains the user-defined number of business days in each month. The day close job updates the number of days actually closed in each month. Using these two values the system is able to calculate what percentage of the month remains open. The quantity required for the number of days remaining in the current month can then be determined.

The suggested stocking level for all items regardless of rank is calculated in the same manner. The only user-controlled elements that affect the results are the percentages used for ranking; the number of periods used for ranking and the safety stock factors for items ranked "A" through "E" and "N". "W" and "X" ranked items do not have a safety stock factor but are otherwise subjected to the same calculations.

The only exceptions to this process are discontinued and superceded items. These items will have a suggested stocking level of zero.

Example:

Length of Supply

```
Review   6.9 days   .23 prds
Lead     5.7 days   .19 prds
Sfty     8.6 days   .29 prds
Total   21.2 days   .71 prds
```

Prd	Ttl	Clsd	% Open	% Required	% Used	Projected	Required
Aug	20	15	25 %	71 %	25 %	10	2.50
Sep	19	0	100 %	46 %	46 %	11	5.06
Oct	22	0	100 %	0 %	0 %	9	.00

Stocking level for 21.2 days is 7.56, half adjusted to "8"

In the above example, a total of 21.2 days or 71 % of a period is needed for the days of supply. The current period is August and fifteen days have previously been closed leaving five days or 25 % of the month still open. In order to cover the days of supply, the remainder of August (25 %) and part of September (46 %) is required. Based on the projected usage for each month, "2.50" units will be need for August (25% of 10) and "5.06" units for September (46% of 11).

6.4 Calculating recommended purchase quantity:

The suggested stocking level represents the quantity needed to meet the anticipated demand over the days of supply. This result is compared to the per job quantity (PJQ), a user defined value in the location item file, and the greater of the two quantities is used as the basis for determining the recommended purchase quantity (RPQ).

The RPQ is reduced by the quantities currently on hand and/or on order and increased by the quantity on customer backorder. Finally, this quantity is adjusted to conform to the minimum order requirements established by the supplier for each item.

This process flow is as follows:

A. Add available on-hand to on order

B. If the control record indicates that miscellaneous on-hand is to be considered as part of available on-hand, add that quantity to "A". If miscellaneous is to be excluded, add "0" to "A".

C. If the average weighted usage is greater than "0" but less than "1", Create a temporary work value of "1".

D. Compare the suggested stocking level, the per job quantity and the result of "C"; take the greater of the three.

E. Subtract "B" from "D"

F. Add the quantity on customer backorder to "E"

G. If "F" is greater than zero but less than one purchasing increment, adjust the quantity to the value of one purchasing increment

H. If "F" is greater than one purchasing increment, half adjust its value to the nearest multiple of the purchasing increment

I. Compare the quantity on customer backorder to "H"; if the customer backorder quantity is greater than "H", adjust "H" upward to the next multiple of the purchasing increment

7. Exception Processing

In addition to generating a recommended purchase quantity for each item, the forecasting job segregates the items into smaller groups that are more easily managed by the buyers. The decision-making process used for group assignment parallels that of a typical buyer. These stages are listed below in the order in which they occur:

1. Items are divided into groups based on their assigned buyer ID.
   - An unlimited number of buyers may be active but an item at any one location can be assigned to only a single buyer.

2. Within a buyer, items are grouped by their primary supplier.
   - An unlimited number of suppliers may be active for a single item at each location but one supplier must be designated as the primary.

   - The supplier code and the manufacturer code may differ.

3. Within a supplier, items are grouped by location.
   - Purchasing is a location-based function. Suggested buys are created and purchase orders are generated and received by location.

   - The primary supplier can differ from location to location for the same item.

4. Within a location, items are grouped by purchase forecast code.
   - In most cases, all items purchased from the same supplier or from different suppliers with the same ordering frequency will be assigned to the same forecast group.

5. Within a forecast code, items are grouped into classifications.
   - There are eight system-defined classifications that are hierarchically tested for each item. If an item passes all tests for a particular level, it is assigned to that classification even though it may also meet the requirements of a subsequent classification test.

   - Within the purchase review system, buyers may move items from one classification group to another or create new classification codes.

6. Within a classification, the buyer has the option to display only those items having a positive forecast quantity or to display all items assigned to that classification.
   - Displaying only those with a positive forecast quantity greatly reduces the number of items the buyer must review.

7. Within the detail item review screen, warning messages advise the buyer that one or more of the historical elements used in calculating the forecast quantity was statistically unreliable.
   - Various checks are performed to insure that the data used to calculate the forecast quantity is logical.

7.1 Classifications

The forecast routine performs a series of tests to determine which of eight potential classifications will be assigned to each item. The tests are applied in a certain hierarchy. Any item meeting all the qualifications for a certain class will be assigned to that group even though it may also meet the tests for a subsequent class.

For each classification, the user has the option of reviewing only those items with a positive forecast quantity (Action code "S") or of reviewing all items assigned to that classification (Action code "T"). Two of the groups, critical and priority, will contain only items with a positive forecast quantity.

A. Special Handling
- This feature will be activated in a future release.

B. Missed ETA or Supplier Backorder
- The item is not "N" or "X" ranked, not superceded and not discontinued.
- The forecast quantity may be greater than or equal to zero.
- The ETA date of at least one open purchase order for the item is older than the forecast date. OR The supplier backorder quantity is greater than zero.

* A problem with the supplier's ability to deliver the product has been identified.

C. Critical
- The item is not "N" or "X" ranked, not superceded and not discontinued.
- The quantity forecast must be greater than zero.
- The quantity on customer backorder exceeds the cumulative total of available plus reserved plus on order.

* Additional purchase quantities are required just to fill existing customer backorders.

D. Priority
- The item is not "N" or "X" ranked, not superceded and not discontinued.
- The quantity forecast must be greater than zero.
- The calculated ETA date is greater than the stockout date
- The next receipt date is greater than the stockout date

* Based on the average lead time for this item, the current on hand inventory balance will be exhausted before an order placed today through normal delivery channels will be received and the ETA date of the next receipt is also greater than the calculated stockout date.

Classifications, Continued:

E. Normal
- The item is not "N" or "X" ranked, not superceded and not discontinued.

- The quantity forecast may be zero or greater.

* Based on the average lead time for this item, the current on hand balance will not be exhausted before an order placed today through normal delivery channels will be received or the ETA date of the next receipt is less than the calculated stockout date.

F. "N" ranked items
- The item is "N" ranked, not superceded and not discontinued.

- The quantity forecast may be zero or greater.

* Any forecast quantities for these items should be carefully reviewed as it is based on limited history.

G. "X" ranked items
- The item is "X" ranked, not superceded and not discontinued.

- The forecast quantity may be zero or greater.

* These items have, at some point in their history, had no movement for a period of time sufficient to warrant being assigned a "X" rank. If more recent activity indicates a positive usage, a quantity may be forecast. All suggested buy quantities for "X" ranked items should be carefully reviewed.

H. Item is superceded or discontinued.
- The item is superceded or discontinued and is no longer available from the supplier.

- The forecast quantity may be zero or greater but will not exceed the total of customer backorder minus on hand and reserved.

* Any item in this category with a positive forecast quantity is on backorder to one or more customers.

It is recommended that a review code of "T" be used for items that have missed ETA dates or are on supplier backorder. The on order quantity may be sufficient to meet the anticipated demand, resulting in a forecast quantity of zero, but the item cannot be supplied by it's vendor. An alternate source of supply or a call to the vendor might be warranted for these items.

Items that are classified as critical and priority are those that are either currently out of stock or are predicted to be out of stock by the time the next shipment arrives. A separate purchase order for these items with an expedited method of shipment specified may be necessary. All items in either of these classifications will have a positive forecast quantity. The same data will be displayed whether a "T" or a "S" is used as the review action.
Classifications, Continued:

Items classified for normal replenishment with a positive forecast quantity are those with on hand and/or on order quantities sufficient to meet the demand that is expected to occur between the forecast date and the expected receipt date but not adequate to cover the requirements for safety stock and review time. Items in this group with a zero forecast quantity have sufficient on hand and/or on order quantities to meet their anticipated demand for their days of supply. In most environments, if all parameters are properly set, the majority of the items should be assigned to this classification. A review code of "S" is recommended for this classification.

The forecasting for "N" ranked or new items is based on limited history that increases the potential for an error. A review code of "T" is suggested with particular attention recommended for the forecast quantity.

"X" ranked items should be reviewed with an action code of "S". Items which have not moved within the past twelve months or those that have had demand but currently have an on hand or on order quantity greater than zero need not be reviewed and will have a zero forecast quantity. Those that have had a positive demand within the past year will have a forecast quantity only if current on hand and on order is less than the projected usage. Since an item is not automatically re-ranked after being assigned a "X" code, it is recommended that the rank be manually overridden to a "C" if the item is beginning to have usage.

Superceded and discontinued items should also be reviewed with a "S". A positive forecast will be created only for the difference between the customer backorder quantity and the total of available and reserved on hand plus the on order quantity. In most cases, items that have been superceded or discontinued are no longer available from the supplier. Any open backorders to a customer should probably be cancelled after advising the customer of the situation.

7.2 Warnings

From the detail item review screen, an item is displayed in high intensity if the forecast detected one or more conditions indicating a possible problem with the data used to create the recommended purchase quantity. Warnings may be issued for all forecast classifications. The specific condition(s) that caused the warning to be issued can be displayed by accessing the line item message function with an action code of "M".

The specific message associated with each warning and the condition that triggered the warning include:

1. “This item is discontinued"
   - This message indicates that the item is discontinued. It will appear only for items assigned to the discontinued and superceded class.

2. "This item is superceded by ??? ??????????????????"
   - This message indicates that the item is superceded. The superceding manufacturer and item will be displayed to the right of the message. It will appear only for items assigned to the discontinued and superceded class.

3. "Demand in the most recently closed period was adjusted due to filtering"
   - The actual demand exceeded the upper filter limit and was adjusted downward.

   - The recommended purchase quantity may need to be adjusted downward when caused by a data entry error or failure to use the proper transaction code during order entry. Use the "C" action code to display all orders for this item.

4. "Customer fill rate is less than one hundred percent"
   - At least one lost sale has occurred within the past sixty days.

   - It may be necessary to increase safety stock to reduce this possibility.

5. "Actual trend has been adjusted for forecast"
   - The trend rate indicating an increase or decrease in an item's movement exceeded either the lower or upper limits established for this rank group. This is caused by an extreme difference between the item's usage in the past year when compared to it's demand in the previous year or between it's weighted average usage and the straight-line average for the current year.

   - In either case, the change is so significant that the recommended purchase quantity is questionable and the actual demand history of the item should be reviewed.

Warnings Continued:

6. "The lead time for the last receipt is inconsistent with the average"
   - The lead time for the last shipment varied from the average by more than the user defined tolerances set in the supplier file.

   - This may be indicative of a problem with the supplier.

7. "The fill rate for the last receipt was less than one hundred percent"
   - The last order for this item was not completely filled by the supplier.

   - This may be indicative of a problem with the supplier.

8. "Projected usage is not consistent with average usage"
   - The projected quantity required for the days of supply is less than 50 percent or more than one hundred and fifty percent of the weighted average usage expected for that same period of time.

   - The item has recently experienced highly erratic usage and the recommended purchase quantity may be inaccurate. Use the history inquiry features to determine when and why the extraneous activity occurred.

9. "No previous history available - forecast qty may require adjustment"
   - The item has no history of usage within the past twelve months but has moved since the last period close

   - The forecast quantity is based on the total demand quantity for the current month minus the total of available on hand, reserved on hand and on order. This quantity may require adjustment.

In addition to these messages, the system will also advise the buyer that an item is subject to purchasing quantity breaks. A message literal of "QB " (Quantity break only) or "QBM" (Quantity break plus user generated message) will be displayed to the right of the item number if this condition exists.

An action code of "Q" will display a screen with the item cost at various levels and input for the quantity desired.