ALERE® MANUFACTURING

CONTROL THE FLOW

A White Paper on Key Features
And
Their Benefits

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Introduction

Key features within ALERE Manufacturing have the potential to help you significantly improve your manufacturing operation and reduce costs. The purpose of this document is to discuss those features and the benefits that are usually found to be unique to ALERE Manufacturing. This is what makes us different.

Bills of Material

Key Benefits

- Twenty-five bill levels support complex products.
- Indented levels can be built graphically on one screen to enhance control while allowing drill down to subassemblies and components.
- Revision support with active/inactive dates on the parent and children smoothly facilitate phasing in changes to bills without interrupting production or inventory.
- Work orders can be updated with new or past BOM revisions which keep in-process orders moving efficiently.
- Multiple bill types include Component, Modular, Alternate, Variable, Phantoms and Kits provide maximum engineering and planning flexibility.
- Component allocation based on start or finish quantities make allowances for shrinkage.
- Configuration definition with finished good part number assignment means Sales has a list of options that can be offered when entering a sales order that will automatically enter the correct part number based on the configuration the customer chooses.
- Sales order configuration pricing and cost rules will calculate and price configurable bills that do not have pre-defined finished good part numbers.
- Two images and matching descriptions for each bill can act as a library to support marketing materials and web sites.
- Embedded document management support for drawings, MSDS sheets, etc. keep related information easily available.
- Default route association for base product and individually configured finished goods speed work order creation and minimize errors.
- Email automation for notifications and alerts.

Discussion

The BOM, or Bill of Material, is the foundation of any manufactured product. An accurate, clean manufacturing bill of materials is important because it provides details on all the parts required to build a shippable product. ALERE uses a single screen to design a BOM and it does it in a graphical format where you can see the structure as it is developed. Each indented level automatically creates a matching single level bill as part of the documentation process.

Date driven revisions smoothly phase changes in and out of the BOM while retaining the ability to recreate and manufacture any given revision.

The use of modular and variable bill types (discussed in detail in this paper) can compress the hundreds of bills required for a product with options, down to one bill structure. This approach also facilitates sales order configuration that is updated every time engineering updates a BOM. Configurable bills can have their various permutations defined and assigned finished good part numbers, thus allowing a generic part number to be used to start a sales order and, after the features and options have been chosen, the matching part number substituted.

Modular Bills of Material

Key Benefits

- Reduces the number of bills needed to support features and options for a product.
- Increases BOM accuracy thereby reducing inventory costs.
- Saves valuable engineering time maintaining and changing bills.

Discussion

If your company relies heavily on bills of material for products with features and options, then modular bills could have a huge impact on the management of those bills and the costs associated with them. Here is why.

A standard BOM consists of a parent item and a list of components to make one of an item. So if you are making bicycles and those bicycles come in ten different colors, then you have to build and maintain ten separate bills, one for each color.

Now say that you offer boys and girls frames, five different styles (touring, mountain, etc.), four different tires, six derailleurs, and three lighting options. That would come to 10 x 2 x 5 x 4 x 6 x 3, or 7,200 unique bills that would have to be built, entered and maintained.

Let's guess at a cost for doing that. Typically an engineer, or someone of equivalent value, would be responsible for bill construction and maintenance. With pay and benefits they are probably in the range of $35 per hour or more. Assume that it will take approximately one hour to input and check any bill of reasonable size. So that comes to $35 x 7,200 hours or $252,000. That is probably an unreasonable number because you don't build every possible combination. So apply the standard 80/20 rule and reduce that number by 80% to $50,400. Somewhere in between is likely the real cost of bills for that one product line.

Here is where modular bills come in: A modular bill consists of the parent item and a list of choices instead of components. So instead of ten bills to cover the color choices, you would have one bill that has a component that looks like a subassembly. But instead of a list of components in the subassembly, you have a list of color choices. Whenever the bill for the bike is included on a work order, it asks you which color to use. The result is one bill structure that can be used to build any of the ten colors available for that bike. The same applies to the rest of the options. The net result is that one BOM, using modular bills, can be constructed to account for every permutation of that bicycle.

Here is an educated guess at the cost for setting up one bill with modular choices. Using the same per hour costs above, one hour per BOM to input, and allowing that it might take a little longer to set up the modular choices, say five hours, then the cost would be (1 + 5) x 35 or $210. That means the total difference for better than the same result (you can build all 7,200 permutations instead of 20% of them) comes to more than $50,000.

Now take those results and apply them to the much more complicated products you probably have.

The cost savings do not stop at the initial construction of the bill. What if the bike we used as an example above were to become available with two types of brakes? That would double the number of bills using the standard method of building bills. But it would only add one modular subassembly with two choices on it using the ALERE Manufacturing method of constructing bills.

What if one more colors was added? That would come to 11 x 2 x 5 x 4 x 6 x 3, or 7,920 unique bills, or about 10% more bills versus only one more choice added to an existing modular bill.

Modular bills also affect inventory due to bill accuracy. Each time there is an error on a bill of materials, two mistakes occur. First, the wrong material is ordered each time that bill is used. Second, the right material is not ordered. What is the probability that in 7,200 bills or more that there will be no errors? And what would you guess that impact is going to be on your inventory, the

purchasing department for correcting that order, and your production schedule when it is discovered that the wrong item was ordered?

By maintaining only one bill structure, using modular bills, the probability of making mistakes is reduced close to zero.

Variable Bills of Material

Key Benefits

- Reduces the number of part numbers and bills needed to support products that have variable quantities.
- Increases bill accuracy thereby reducing inventory costs.
- Saves valuable engineering time maintaining and changing bills.

Discussion

If you have bills of material for products that are essentially the same except for components that have a variable quantity, then variable bills can greatly reduce the number of part numbers and bills you must create and maintain.

For example, let's say you manufacture cables that consist of male and female connectors at each end and some length of cable in between. You offer that cable anywhere from one foot long to 1,000 feet long in increments of one foot. That means you need 1,000 part numbers (one foot, two feet, etc.) to account for all the different lengths.

If that cable is a subassembly included in other products you build, then that means 1,000 single level bills are needed to account for each length of cable times the number of upper level bills to allow for other product variations.

Let's estimate the engineering costs for creating 1,000 part numbers and matching bills. Use a $35 per hour labor cost, ten minutes to enter each part number in inventory, and 30 minutes to create a simple BOM. You get 35 X 1,000 x 0.17 plus 35 x 1,000 x 0.5 or about $23,500 worth of time. Keep in mind that this is a minimum number because all these part numbers and bills may need to be included in other BOM's.

A variable bill consists of a parent item, which allows a quantity to be entered, and no components. When a work order is created that uses a variable bill, you are asked to enter a quantity. For example, when a work order is created using the bill for the cable assembly, you would be asked how many feet to use. The result is one bill structure that can build any length of cable and only one part number that needs to be set up in inventory.

A quick calculation shows that a variable bill can reduce engineering costs to 35 x 0.17 plus 35 x 0.5 or about $24. That is quite a difference from more than $23,000!

Configuration and Dependency

Key Benefits

- Using modular and variable bills provides sales order configuration without any additional work.
- Modular bills can be nested to support rules based (dependent) configuration.
- When sales order configuration is based on BOM's it is always up to date and ensures that orders for products can only be placed for valid features and options.
- The order process is easier, more accurate, and requires much less engineering to support complex products.

- New products, and changes to the features and options of existing products, are much simpler and less expensive to introduce.

Discussion

Choosing to use modular and variable bills in your product BOM structures is the foundation for sales order configuration. ALERE Accounting has a Configuration module as part of its core. The Configuration module automatically extracts the questions that modular and variable bills contain and composes them to be used inside sales orders as part of the order entry process.

One key element of this process is the ability of modular bills to be nested within each other. For example, when constructing an indented BOM for a bicycle there may be a modular bill that has two choices: boy's bike or girl's bike. The answer "boy's bike" may itself be a modular bill with style choices. Choosing a style may lead to another modular bill with a choice of color unique to that style.

This process is called "Dependency". Making a choice on a modular bill leads to another set of choices that are "dependent" on the first choice made. And so on.

Dependency may be viewed as constructing a tree. Each branch can lead to other branches.

The use of nested modular bills and the resulting dependency allows you to create rules. For example, if you choose a "Mountain" bike style, then you have a choice of "Knobby" tires but not "Street" tires. You would have to choose another bike style to get a choice of "Street" tires.

The questions on modular bills will continue until they are all resolved to component answers.

Variable bills, on the other hand, are not dependent as they always resolve to an answer. Usually, a variable bill is the last question in the configuration process. For example, you choose a style of bike that has reflectors on the wheels. The variable question may be "How many reflectors?"

A second key element is that a bill of material may have multiple separate modular bills. Picture the trunk of a tree with many branches. Each branch may have a whole set of sub branches with their own choices. This allows very complex configurations to be built.

The result of using modular and variable bills is that one indented bill structure can be used to configure many, even thousands, of possible finished goods.

ALERE Manufacturing allows you to selectively assign part numbers to the finished good configurations. This permits:

- Inventory to track the different finished goods resulting from a bill that can be configured and associate specific prices and costs with those products.
- An order for an item to be started with a generic part number, for instance "BIKE" and resolved to the correct part number and pricing for a specific configuration.
- An order to be taken using the part number assigned to a finished good configuration and the configuration automatically completed.
- An order to be entered that has a configuration you do not normally stock and no new part numbers are required.

The use of configuration in your company can save considerable time and money.

- The sales order configurator is automatically created and updated from the bills of material.
- Complex products no longer require extensive engineering input during the sales order process, which significantly reduces, or even eliminates, that time demand on what is likely your most expensive resource.
- Training your sales force staff is simplified because they are led through the order entry process by the configurator.

- Order entry mistakes are eliminated which has implications for your inventory, job scheduling, and, perhaps most importantly, the confidence of your customers.
- New product roll-out or just adding features and options to an existing product is much faster and easier.

For many companies, the savings can range from thousands of dollars to hundreds of thousands of dollars.

Material Planning

Key Benefits

- MRP is accomplished with a single pass that includes all levels in a bill down to purchased components.
- Both “Bucketed” and “Bucketless” reporting allows you to choose between seeing time-phased data shown in time periods (monthly or weekly) or dated records.
- System recommends work orders and purchase orders that can be reviewed and released.
- Individual item planning can be done online.
- An *Order Push Pull* report recommends actions that can be taken to better utilize existing orders including canceling ones no longer needed.
- Email automation is available for notifications and alerts.

Discussion

MRP, or Material Requirements Planning, is the heart of any system for controlling inventory intensive manufacturing processes. ALERE Manufacturing brings more than fifteen years of practical experience to this critical function.

Traditionally, MRP is run once for each level in a bill of material. After each run, work orders and purchase orders are created and released based on the requirements of that bill level. This continues until the bottom most level has been planned. Needless to say, that could be a time-consuming process.

In ALERE Manufacturing, all that planning is combined into one process that time-phases all requirements for all levels of the bills. One unified list of recommended work orders and purchase orders is compiled. From that list the orders may be created and released automatically.

ALERE Manufacturing supports two reporting methods of viewing the time-phased data. The Bucketed system accumulates the data into time periods, or buckets. If the period of accumulation is one week, then the system is said to have weekly buckets. The pro side of doing it this way allows total requirements to be seen for the time period. The con side is that it is difficult to support JIT (Just in Time) systems that usually require more accurately dated planning.

The Bucketless system processes, stores, and displays data using dated records. This permits you to see the actual flow of supply and demand and does an excellent job of supporting JIT.

Having both reporting systems available in ALERE Manufacturing allows you to choose which is more suited for your business.

Another critical element of ALERE Manufacturing is the *Order Push Pull* Report. It has the ability to make recommendations to reschedule open orders when due dates and need dates are not in phase. This includes canceling orders that are no longer needed. Not only does the order push pull function affect the timely arrival of material but it impacts on inventory levels. This planning function is usually missing from MRP systems at the lower to mid level capabilities range and even from much more expensive packages.

Almost every company spends a significant amount of time managing “priority” jobs. As fast as MRP is in ALERE Manufacturing, sometimes you need near instant material planning for specific

items. For that reason we have developed an online method of entering an item number and immediately seeing supply and demand for it in a bucketless format.

Finite Capacity Scheduling (FCS)

Key Benefits

- Finite capacity scheduling predicts a projected finish date for jobs.
- Extremely fast scheduling allows rapid management response to changes.
- FCS supports the use of synchronous manufacturing.
- Graphical schedule board permits operation steps to be dragged and dropped to fine tune schedule
- A list of job priorities for the shop floor is available.
- It can compress time through the shop by allowing multiple operation steps to overlap.

Discussion

If you manage dozens or even hundreds of work orders moving across a manufacturing floor, then you understand the challenge of prioritizing and coordinating that activity. In its simplest form, finite capacity scheduling (FCS) takes each work order, assigns it a priority, looks at the route to build it, reserves time on the work centers it will use, and comes up with a date when it is expected be done. With this method there is no need to manage queues as every step on a job has time slots assigned on work centers.

The FCS system supports both “Forward” and “Backward” scheduling. Forward scheduling is most commonly used when you give the order a start date and you want to know when it will be completed. Backward scheduling often occurs when a customer wants the order by a certain date and you want the scheduler to tell you when to start it. Individual orders can be set to use either method. Both forward and backward work orders are simultaneously scheduled.

The scheduler can be set to have a resolution of one minute or one hour. At one minute, the next job is scheduled to start within one minute of the ending of the last one. At one hour, the next job is scheduled to start within one hour of the ending of the last one. Which resolution is right for you will depend on the types of jobs that are scheduled. In either case, the scheduler is amazingly fast. Thousands of route steps can be processed per minute.

One of the advantages of using the scheduler is that even if you ignore the start and finish times of the jobs, you still have a listing of jobs by work center that are in priority order.

A major feature of the scheduler is that it permits route steps to overlap. What this means is that the next step can start working while the current step is still finishing parts. Used correctly, this can significantly compress the time it takes to process a job and, more importantly, it can increase the utilization of expensive machinery that might otherwise sit idle waiting for an operation step to complete.

Finally, the scheduler supports **Synchronous Manufacturing**, a very advanced way of tying the production schedule to MRP planning. There is more on this in the next section. The key is that the components on a bill of material can be matched up to the route operation steps on which they are used. When the steps on work orders are scheduled you are, in effect, also scheduling when the material is needed.

Synchronous Manufacturing

Key Benefits

- MRP is tied to the production schedule through Finite Capacity Scheduling (FCS).
- Having more effective material ordering results in smaller inventories.

- There is better understanding of Work In Process (WIP) costs.
- The concept of Just In Time (JIT) is expanded.
- Jobs are permitted to start before material required on later route steps is available.

Discussion

If your average work order can last days or even weeks and has an extensive material list that is spread over multiple route steps, then synchronous manufacturing has a lot to offer.

Traditionally, MRP is run using buckets of time in months or weeks. Additionally, the material for the jobs that fall within that bucket must be on hand at the beginning of that time frame. For example, if MRP uses monthly buckets, then all the jobs that are scheduled to begin anytime in June must have their material available by June 1. That could easily add up to many thousands of dollars in inventory for jobs that might not start until the last days in June and won't finish until many days or weeks later.

In this type of system you incur inventory carrying costs. You add overhead to jobs trying to manage where material is needed and when. Also, in many cases, your cash flow suffers because invoices from suppliers come due before the material is even required for the job.

What synchronous manufacturing does is integrate MRP with the finite scheduling system in ALERE. The simplest way to explain the result is that we can literally have material arriving the day before it is needed. ALERE can give you a pick list that says "Get this list of material from inventory and deliver it to work center 120 by 8:00 am on Wednesday because work order 5678 needs it to complete route step 50."

Accomplishing this advanced level of planning and making it useable is what sets ALERE apart from the competition.

It starts with the master routes. Material is assigned to the operation steps where it is used. Modular and variable bills that are assigned to a step become place holders waiting for you to make a choice or enter a quantity.

The next step is running the finite scheduler so that the individual work orders, which have the routes attached to them, are scheduled through the manufacturing floor. Scheduling the operation steps automatically schedules the material that is assigned to each step.

Next, the options for MRP are set. The MRP report supports both bucketed (which we described before) and bucketless planning. A bucketless system processes all time-phased data and displays dated records, such as the actual day material is required. This is done in place of defined time buckets. The bucketless option can be chosen along with an option to tie the MRP report to the finite scheduler.

The result is synchronous manufacturing: the system actually knows when and where material for a job is required. Thus material can be delivered to the correct work center at the appropriate day and time.

The potential for improving your material ordering process and managing material distribution on your factory floor is enormous.

Disassemble

Key Benefits

- The Disassemble function permits a raw material to be exploded into a wide range of end products using an inverted bill of material.
- It allows an item from a sales order, work order, or inventory to be quickly disassembled, or de-kitted, with its components returned to inventory.

Discussion

The ability to disassemble an item has two major implications in a manufacturing environment. The first is to simply take something apart and return the components to inventory. Most commonly this occurs when a product is returned to your company and the desire is to salvage the useable parts. Similarly, the item being returned may be a kit where no disassembly is required but the parts still need to be “de-kitted” and placed back in inventory.

The need to disassemble may extend to manufacturing work orders when a partially completed job is stopped due to a cancelled order or for any number of other reasons.

Inventory overstock or discontinued product may also be the cause for the need to disassemble.

ALERE Manufacturing can quickly handle all of these situations. You can choose to base the disassembly/de-kitting on a line item of a sales order or return order, a work order, or a bill of material. The disassemble function can save you the considerable effort required to tediously return components one transaction at a time.

The second major implication has to do with supporting different types of businesses. Traditionally, we think of manufacturing as producing a product from a number of parts. But industries such as wood products, petroleum, sawmilling, major chemicals, paper and pulp, dairy and meat, electronics, rubber, and others start with one raw material and “explode” it into a wide range of end-products, co-products and by-products using what is called an “inverted bill of material”. ALERE Manufacturing supports this type of bill and permits these types of processes.

Work Orders

Key Benefits

- Work orders are completely self-contained with material and production instructions.
- They are transaction-based for maximum flexibility when in-process changes are necessary.
- Work orders may be printed with bar codes to assist in quickly scanning and posting transactions.
- Complete lot, serial and trait traceability is supported of all material used in the production process.
- The material planning tools can automatically create, modify and cancel work orders.
- There is embedded document management support for drawings; MSDS sheets, etc. keep related information easily available.
- Notifications and alerts can be handled using email automation.

Discussion

ALERE calls the document that is used to authorize a manufacturing job a “Work Order”. They are used to assemble or manufacture parts and perform rework or maintenance work. Work orders can be automatically generated through the planning process, started from a sales order or manually.

When making a part, they initiate the job in the shop and provide the instructions and a list of the materials required. They also track the progress of orders and report on the details. Most importantly, work orders are transaction-based which means that each activity that occurs as a result of processing the work order is recorded with a transaction. Transactions are posted when the order is released; materials are issued; labor is accrued; operation steps completed; material is scrapped; work-in-process is recorded; rework occurs, and parts are finished. All these transactions can be recorded using bar coding and data collection. Transactions provide work orders with a great deal of flexibility to meet the many requirements of a manufacturer.

Each work order is self-contained meaning that it has a route attached which can be modified to handle production changes as they occur. Included on the order is a material list created from a BOM that can be edited, along with information on how the part is configured with features and options. The order tracks lot, serial and trait material that is issued to the job and lists all the transactions made during its life. Created automatically when the work order is started is a job cost record that projects the expenses of the job by recording the in-process material, labor and overhead costs that are incurred. At the close of the job it will report on any cost variances that occur.

When a work order is completed, it moves the part it is making from WIP to inventory.

There is also a shortcut that fast tracks a work order by simply entering the item to be manufactured and the quantity. In a single step this process will create the work order, issue the material, post the labor required to make it, and post the finished goods to inventory.

Maintenance Capabilities

Key Benefits

- Both preventative and breakdown maintenance can be handled by ALERE.
- It is integrated into material planning and scheduling systems.
- Work order based makes it a seamless part of your production floor.
- Associated expenses from maintenance work are recorded in the general ledger activity.
- Information is accrued for subsequent analytics.

Discussion

An essential element of managing manufacturing is servicing the machines that are used on the production floor. ALERE supports three major maintenance activities; preventative maintenance, breakdown maintenance and periodic certification and calibration.

Maintenance definitions for a work center, each with their own route, item number, and maintenance interval, may be defined along with a BOM that list the materials required to perform the work. Material can be allocated to the routes that are used to do maintenance on the work centers. Hyperlinks can be embedded in the routes to reference machine manuals, part lists, drawings, vendor web sites, etc. to support the operation steps.

In turn, recommended maintenance can be included in material planning and scheduling, resulting in maintenance orders that can be automatically generated and placed in the system.

The maintenance capabilities include having the ability to assign each work center an inventory item number. This allows a GL account number to be tied to the expenses associated with a work center, or group of work centers, and be tracked at whatever level of detail is desired. The item number also allows planning for maintenance items, such as certifications and calibrations of equipment, by setting them up as work centers.

When a machine breakdown occurs, a downtime record can be created which records when the out-of-service occurred, the reason, and when it is expected back. This allows the scheduling system to plan around the machine and provides a basis for analyzing breakdowns for patterns.

Since maintenance is done using a work order, all the advantages of planning, posting transactions, issuing material, and tracking labor and overhead accrue for subsequent analytics.

In Summary

This white paper by no means covers the full range of capabilities that are incorporated in ALERE Manufacturing. Rather, it talks about a few key features that have proven to be of immense importance to clients.

There is another aspect of this paper that you should take away with you and that is a sense of the depth of these features.

What do we mean by that?

Products are most commonly judged by their list of features simply because that is the easiest approach to take. However, there is a big difference between products when it comes to how a feature is actually implemented. Take, for example, modular bills. When a competitor advertises they have modular bills, what are they really saying? Is it that they support a single level bill that has choices? If so, then while they can claim to have modular bills, they are by no means are offering the same power and flexibility of ALERE which allows those bills to be nested within other modular bills to support dependency. Without that capability, there cannot be decision trees and true sales order configuration.

Too often, judging a product by a features checklist is not going to provide you with the capabilities you think you are purchasing. A manufacturing system is a mission critical component of your business. Take time to ask questions and understand claims. In the end, you will see why thousands of users have chosen ALERE.