put your BOM to work

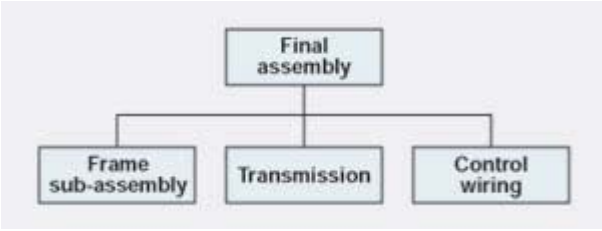
A well-crafted bill of materials offers keys to improved efficiency.

by Anthony Rante

As manufacturing companies strive to remain competitive, they're also seeking to improve efficiency. Today's manufacturing environment has pushed companies into a constant search for improved production and better management.

This inevitably means that all departments with a hand in product development, building, and shipping must become ever more efficient. To do that, managers soon find that they need to communicate better with other production departments.

Easier said than done. Efficiency. Communication. What's a manager to do? One strategy is to revert to bill of materials basics, where you'll find all the answers you need. Here's a look at how to do that and what you can expect to find.



A typical bill-of-materials structure will look something like this. This chart represents only the top level of a typical bill. Each of the three lower blocks would break down further into their components until you reach the lowest level of raw materials and purchased parts.

Each company has a unique product flow. The flow depicts each step a product goes through from start to finish. Ideas for a future product typically begin in sales and continue through the company, gradually taking shape until the final product is shipped. The flow evolves over time and becomes a function of several factors, including product market, customer demands, and company organization.

For example, you might need to take into account specialized production features or an inspection step. If customers have to approve the product any time during this production process, you must include that approval step in your flow chart. These approvals will show two lines of flow; a non-approval line will double back to a previous block in the flow to begin that step again.

Mapping out the product flow is a great exercise to do across departments. It gets departments communicating and gives everyone the big picture. If you work out your product flow for several products, you can isolate your production trends and identify how documents and materials move through production. If you get all departments involved in the process, your final flow chart gives you all the necessary details to see these things up close.

Bill of Materials First

When most engineering managers think of engineering deliverables, they immediately think of drawings. To make anything, an organization needs several types of drawings: assemblies, detail or piece-part drawings, and schematics, to name a few. Although these drawings are a major part of your production plans, your bill of materials is, in fact, your primary deliverable.

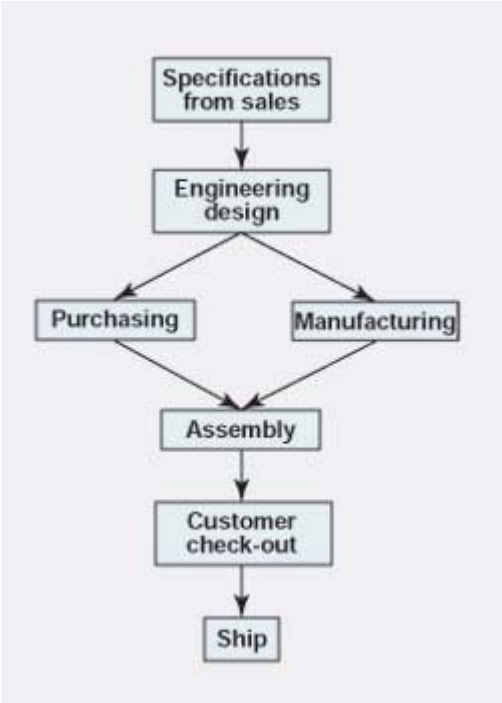
That's why you must develop the bill of materials before engineers create the drawings. This is a better way to plan the project. The bill determines the way the materials are purchased and processed, and should be the first part of the overall project plan.

Coming up with an as-built bill structure for a product is like creating a detailed map of how each part of the assembly comes together. It starts down at the levels of raw materials and purchased parts, and flows upward as they're turned into subassemblies. The subassemblies then

flow into the final assembly—the top block on the structure.

Reading down from the top block of a typical bill, each lower layer breaks down into more and more blocks, representing the components of the layer above. The breakdown continues until you reach the lowest level of raw materials and purchased parts.

Looked at from the bottom, the chart follows a linked path from the bottom of each leg to the top. Develop this structure to follow the way each component flows through production and you have an as-built bill of materials. Alternatively, you could structure your bill by engineering discipline— mechanical, electrical, hydraulic, or pneumatic—but such a bill usually doesn't follow the as-built scenario and doesn't produce the desired benefits.



A typical flow for a made-to-order product will have some of these basic elements. This is a very basic flow chart; it almost always must be expanded.

As you create the as-built bill of materials for a product, you again need to communicate across departments. It's the only way to get it right. You'll need to have several discussions, with all the major players present, to get all the product details in the right place. Once you complete the as-built document, you can refer to it during talks about improving efficiency. The document keeps the discussion on actual facts and helps everyone understand his or her part in the process.

It also gives engineers a clear understanding of which drawings are required and which aren't. The drawings are the visual aids tied to blocks in the bill.

The as-built document also helps the production scheduling and process planning departments because it lays out details they require for each leg of the bill. Typically, the document becomes the route required to turn raw material into actual piece parts.

In addition to creating manufactured parts, the demands for supplying purchased components at the right time in the process will have to be addressed by the materials control department. When and where to stock components or subassemblies is best answered by integrating your production schedule with your bill structure.

Review and Improve

Once you've completed your bill of materials, you can review product cost in a more organized way. Each leg of the bill will have a cost associated with it. The cost is then rolled up, following the structure of the bill, to give you the finished product's final cost. Conversely, that total cost will be broken down as you move lower into the bill and break down the costs for the raw materials and supplied components.

A company's value improvement committee will find it a lot more productive to review these cost roll-ups and to address the highest-cost areas first.

The bill also provides opportunities for flexibility. When you make a family of products, for instance, you usually want to meet production requirements with subassemblies or parts that can be common across all products. The challenge is to do this without compromising any product features. By tying steps in the bill's structure to customer requirements, you can move toward these more modular designs.

With a matrix, you can best understand how your bill is related to the product features. Along the top of the matrix you list the product's major subassemblies. Along the side of the matrix, list the customer specifications associated with the product.

You then review each specification against each major subassembly and determine if the subassembly would require a change for that spec. If it does, you put a one in the square; if it doesn't, you put a zero in the square.

Complete this process for each specification, comparing it to each major subassembly. An entire column of zeroes under a particular subassembly indicates that subassembly is unaffected by the customer's specifications. It's standard and can be used across the family of products.

For many designs you won't find these standard subassemblies without some investigation and revision. This is where the review of the bill comes into play. Your objective now is to look for minor adjustments to the bill in order to create independent subassemblies. In addition to a bill change, maybe a slight design change is required as well. If you can achieve this through a revision, the design becomes more modular. A modular subassembly can be used in other products on your production line.

The pressure for continuous improvement in efficiency isn't going to go away. Getting back to the basics of the bill of materials is one way to address it. This method provides for positive and fact-based communication.

Anthony Rante, P.E., is president and principal engineer of Artech Engineering Inc. in Darien, Ill. He has more than 25 years of experience in engineering, including various design, management, and consulting activities. He is also the presenter of a recorded course, "Bill of Material Basics & Engineering Document Control," available through pdhcourses.com.