

Seradex White Paper

A Discussion of Issues in the Manufacturing OrderStream

Engineering Change Process

Every manufacturing organization makes product design changes. In advanced technological industries such as electronics, and Make-to-Order environments, rapidly evolving bills of material are commonplace.

Modifications may range from a small change affecting a single item, to a design change involving a number of assemblies. The changes may affect the BOM, routing, tooling or inspection equipment.

The objectives of Engineering Change Order (ECO) include the following activities:

- Record item additions and/or deletions
- Communicate change information throughout the organization to avoid the manufacture or purchase of items no longer needed, and to ensure new parts arrive in time.
- Document the cost of the change
- Determine when the change is effective - immediately, on a certain date or when existing inventory is consumed.

To achieve these objectives the user must answer some basic questions such as:

Which assemblies/end items are impacted?

How will this change impact end item cost?

What material losses will be incurred?

What work-in-process will the change affect?

Answering these questions requires access to the following data:

- Bill of Material multi-level where used
- On-hand quantity and inventory value of item(s) to be replaced

- Cost and lead time impact on affected assemblies
- Purchasing commitments for the item(s) to be replaced
- Existing work in process (WIP) of the item(s) to be replaced

Ineffective ECO Process

The number of different departments involved complicates control of engineering changes in the planning for and implementation of each change. It is crucial that all departments be able to easily collaborate and integrate the supply design chain into the development process

Failure to communicate engineering changes can result in the following issues:

- The finished product does not meet specifications leading to customer dissatisfaction and the loss of future sales.
- Incorrect product costing
- Obsolete parts are produced resulting in scrap or rework.
- Purchase Orders are issued for discontinued parts, resulting in inventory write-offs or cancellation costs.
- Purchase orders for the new parts are placed late, resulting in material shortages.

Engineering Change Types

The reasons for making an engineering change include:

- **Market or Customer Driven**

A mandatory customer requirement may lead to a customer driven change. In many situations, the cost of the change is frequently negotiable as a charge back to the customer. Thus the timeliness and accuracy of data used to estimate item availability and cost of the change must be precise.

- **Product Improvement**

On-going product development and feedback from industrial engineers and field service engineers cause changes affecting the bills of material and routings.

- **Cost reduction**

Improvements to process efficiencies may yield changes to routings that affect item costs, lead times, tools and work center loads. The individual responsible for making the change will review projected requirement dates and estimated costs. This will be accomplished by examining the effect of a single proposed change and many alternative changes. For example, alternate materials can be introduced for an item, or a class of items, to obtain comparative cost effects. The date at which a proposed change will be implemented can be varied to discover the date yielding the lowest total cost, based on existing stocks and open purchase orders and work orders.

Vendor Driven Change

Your vendor may change, alter or obsolete a supplied part requiring a design change.

Job Addition

In Engineer to Order industries it is common for the bill of material to evolve throughout the project. Long lead items are entered first, followed by increasingly detailed levels of engineering.

- **Safety Considerations**

Changes made for reasons of safety are generally considered mandatory and must be implemented immediately. If they also apply to products already in service with customers, the engineering change level i.e. item Rev or serial number and the customer site location of these products must be known.

Effectivity Dates

The timing of engineering changes can be based on different criteria:

- **Stock run-out.** Timing of the change is not urgent so replacement items that are in stock or WIP can be consumed before the change becomes effective.

- **Replacement Item Lead Time.** The change cannot be implemented until the new item is available.

- **Immediate change.** If the change is mandatory such as a safety related change, it is implemented without consideration for existing stock or work-in-process items. The change may also involve products already shipped to customers, which may trigger a recall, rework or field service.

Types of Engineering Change

Engineering changes typically fall into three categories: those affecting item data only, those affecting bill of material data only, and those affecting both. For example, a dimension change for a better fit affects the specification and

routing of the item without affecting the bill of material in which the item is used. On the other hand, a change in the item quantity required per assembly affects only the bill of material or structure records.

A typical change may involve many item usages and replacements, all of which must be coordinated. The actual changeover quantities and dates may vary from the plan if inventory accuracy is not correct.

ECO Status Codes

The ECO Status Codes enables the user to define acceptable engineering change status. Typical status codes can include open, approved, released and implemented.

The status codes enable you to track the individuals that have reviewed the ECO. When it's obvious who is holding up the process, people will become more responsive to the process.

ECO Cost Impact

Prior to executing an engineering change the expected cost impact of the proposed change must be analyzed. This includes the new standard cost, inventory on hand, items on purchase, sales and work orders. Any proposed inventory write-offs must be assigned a cost and the appropriate GL account selected.

Another component of cost is lead times – replacing an item with a 1 week delivery time to a new item with an 8 week delivery time must be factored into the final decision.

By reviewing options and run out quantities, PO cancellations, vendor return policies and product substitutions the cost impact can be often be eliminated or minimized.

This information is visible to all affected departments and management to ensure sound decisions are made.

ECOs Online

It is important to have all ECO History maintained in one place. Assign an ECO number and record all relevant information in a database. This provides a searchable audit trail of all current and historical ECOs. You can track ECOs from creation to approval to execution.

With ECOs available on line, the complete product team from engineers to suppliers can contribute to the change process.

ECO Pending

When an Engineering Change is pending for an item, the system should warn a user when attempting to enter a new transaction. Typically warnings are needed at:

- Material Requisition
- Purchase Order generation
- Receiving
- Inventory Transfers
- Work Order generation or completions
- Manufacturing Completions
- Estimating and Sales Orders

Item Revisions

An ECO can also be conveniently used to create the next sequential revision number for an item. The current item, including Item Master, BOM, Supplier and Cost, can be copied to the same item number with a newly assigned revision number. The user can then modify the item as necessary.

Let's look at some of the challenges you face in controlling and tracking the Engineering Change Process.

1. Paper is the enemy. It adds time, hassle and inefficiency to the engineering change process. You can't track its progress as paper gets lost and

accountability is impossible to enforce. Electronic routing and tracking is the solution.

2. Real-time access is your friend.

Real-time visibility that enables people throughout the organization to view change information at any point in the process saves time and money. This visibility needs to accommodate everyone involved from engineering, production, purchasing and management.

3. Include your supply chain.

Including your suppliers in the change process saves you time and money. Reducing scrap and purchasing errors has significant ROI. Advanced organizations include suppliers in change decisions.

Three Solutions

1. Go electronic.

Moving away from paper-based product documentation frees you from the limitations that paper imposes.

● Create electronic change orders.

Stop shuffling paper and organize change information into a virtual document folder. You'll need thorough documentation of product changes for ISO-9001 compliance, and a well-organized ECO system is the foundation for adherence.

● Capture complete change history.

With electronic change management, compiling and reviewing change history is easy. You don't have to wade through file cabinets or binders to find records of changes.

● Manage access automatically.

Set up user permissions that ensure that the right people can view and approve ECOs. When the administrative overhead of managing the change process is handled electronically, resources are freed to focus on core competencies.

● Have change information automatically incorporated into the product definition.

Don't rely on manual reconciliation. Fold changes into the product specification as soon as they are approved.

2. Make it easy to get up to speed.

The more time that individual reviewers spend trying to understand an ECO, the longer the process takes.

● Attach documentation to the ECO itself.

Include documents like inventory reports with the ECO.

3. Route ECOs electronically to anyone in the organization or supply chain.

Once your change process is paper-free, you gain enormous flexibility about how that information moves through the organization.

● Notify people automatically when their decision is needed.

Have an email message with a link directly to the ECO sent automatically to each reviewer. Include details of the parts and assemblies involved.

● Don't limit visibility to the change board.

The change boards are not the only people who need to see an ECO. Don't limit visibility to them. Let other people view and subscribe to ECOs so that they are notified when the ECO has been submitted, modified, rejected or approved.

● Capture decisions and comments on line. Enable people to approve and reject ECOs immediately, and let others see their decisions.

Product Lifecycle Planning (PLM) Software

3rd Party PLM

There are many companies that supply software for product lifecycle control. While the capabilities vary widely these products facilitate supply chain collaboration.

Seradex offers many of the same features as these standalone products. Critical features such as linking the

inventory cost adjustment to a specific ECN or effectivity of a stock run out requires tight integration to the ERP system.

The ability to notify purchasing there is an ECN pending on the item about to be purchased cannot be implemented via third party solutions.

Collaboration

Are your products introduced into the market on time? Our solutions encourage information sharing between departments and external partners to streamline product development by working more efficiently and sharing knowledge early in the process to reduce delays.

ECN Control – The Payoff!

Get the most from your investment
From creation to validation of the complete design, ECN driven modeling solutions can provide you with the tools to facilitate optimal design processes and collaboration.

Now you can benefit from the ability to:

- Maximize and reuse design information across different product development programs
- Easily drive changes in the design at any stage of its development without introducing massive delays
- Help you quickly adapt to individual customer preferences and shorten production time.
- Reduce operating costs associated with product research and development
- Improve product time-to-market to improve your competitive position

- Develop more innovative and personalized products to increase revenue



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