Coping with the complexity of product manufacturing

*ANALYSIS**MANAGEMENT***

by David Tokell

AS most readers understand, a product that often appears simple to the user and the designer may tax t and may need to be re-specified to allow it to fit the available manufacturing processes.

The reasons for this can vary but many products are designed consideration being given to the details of manufacture.

However, the discipline of systems engineering has been deve such complex problems. It offers some simple tools for both d manufacturers to allow communication of the key issues witho investment of resources.

First, the product designer and the other stakeholders must d requirements for even a simple product. The manufacturer mu requirements specification. If the manufacturing stage of the l been considered this is the manufacturer's opportunity to hav

The approaches outlined below will help to make sure all of th issues have been captured.

Life cycle

Each stage of the product's life should be considered by the designer in defining the product's requiremer period after sale. A typical life-cycle would be:

- design and test;
- manufacture and test;
- shipping and delivery;
- installation/set-up;
- use (including idle periods);
- maintenance; and
- disposal.

This forces the designer to explicitly address the needs of the manufacturer as the stakeholder during on product life cycle.

Manufacturing staff should check the requirements specification to ensure that the manufacturing stage h adequately considered.

Manufacturers may have a standard set of requirements with which they will ask designers to comply. Si include moulding machine capacity or tool size or weight.

Context diagram

This simple tool forces the designer to think about the product's requirements without clouding the issues itself.

Simply consider one portion of the product's life cycle and consider all of the inputs and outputs to the pr period.

The designer and the manufacturing engineer then need to quantify the constraints that apply to the tool

characteristics and production cost. This gives the designer some structured information on the manufact for the product.

It is not uncommon for the requirements of production testing to be overlooked during product design. Tl should capture these requirements and make sure they are visible to the product designer.

Risk assessment and FMEA

It is usual to consider the various risks and hazards associated with a manufacturing process. However, a technical risks associated with product manufacture should also be carried out.

There are several tools available, including Failure Mode and Effects Analysis and Failure Mode Effects an Analysis. These tools rely on identifying a failure mode and then categorising each failure in terms of likel They are described in detail in IEC60812 Analysis Techniques For System Reliability-Procedure for FMEA.

Identifying how a process will fail is the most time-consuming part of the analysis. This should be done w present. Failure modes can be identified by:

1. Considering each function that the product or process must carry out and determining how each of the fail.

For example, a container could fail to hold a liquid product as a result of a faulty moulding. The faulty mo caused by a short shot or a moulding gate breaking out the wall of the container.

This approach is usually termed 'top-down'.

2. Start with a standard list of failures and then identify the ultimate consequences.

For example a short shot could cause the container to lose its contents but it could also cause other featu correctly, which will lead to other consequences.

This approach is termed 'bottom-up'.

Whichever process is used, it is useful to use a Fault Tree to capture the failure modes during this meetin in detail in IEC61025, Fault Tree Analysis (FTA). The key to this process working is the involvement of all including designers and manufacturers.

Each failure then needs to be catergorised in terms of likelihood and severity and a decision made on whe will be detected or some action is required. Actions will usually involve placing some constraint on the pro production process.

Feeding these constraints back to the designer as de-facto requirements is one way to ensure they are pr in the product's development.

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