

KEMET, like many other manufacturers, devotes a high level of effort to continuously improving the quality of both its manufacturing and support operations.

Revolutionary Quality Improvement (RQI) is an important KEMET program that focuses on improving the quality of objectives and the quality of the processes used to achieve those objectives. Within the R & D and Engineering groups, a formalized methodology for development projects has contributed significantly to RQI. The article below describing KEMET's development process was written by Larry Mann, a member of the team responsible for developing this methodology.

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KEMET Advanced Quality Planning System

by Larry A. Mann

Any development project must go through three distinct phases:

Phase I	Objective-Setting
Phase II	Development of the Means to Achieve the Objectives
Phase III	Implementation

Most of us can think of projects that suffered because one or more of these phases was neglected. Engineers in particular are prone to spend too little time in the objective-setting phase because they are anxious to get into the nuts-and-bolts issues associated with developing something new. Management sometimes encourages hasty implementation of results in response to a perceived crisis, shortchanging both Phases I and II. The neglect of one or more phases is usually reflected in the outcome of the project: the team may discover that they have developed the solution to the wrong problem, or they have developed a solution that is unacceptable due to some factor outside the scope of their effort. In either case, the results can be devastating to the morale of the people involved and are clearly not in the best interests of the company.

KEMET has found that the use of a standard methodology for developing new products, processes, and equipment can significantly impact cycle time and project effectiveness. The benefits are especially evident in the case of projects that involve more than one department, more than one "customer," and/or compromises among several objectives. KEMET's methodology, called the

KEMET Advanced Quality Planning System (KAQPS), establishes expectations for each phase of a development project to ensure that the desired outcomes are achieved in a timely manner.

KAQPS treats each of the three phases of a project separately, breaking each into a series of steps, followed by a review. The flow diagram on the next page shows the individual steps of each phase. While the steps are self-explanatory, some features of the methodology warrant special attention.

Highlights of Phase I

One of the keys to Phase I is active participation of the customer(s), both internal and external, in establishing project objectives. To date, Product/Marketing Managers have been relied on to identify and assess the needs of KEMET's external customers. As KAQPS matures, more direct participation of external customers will be encouraged.

A powerful tool that can be used in the objective-setting phase is Quality Function Deployment (QFD). An integral part of QFD is the translation of customer needs and wants into technical objectives. (In the KEMET documentation describing KAQPS, tools such as QFD that are appropriate for a given step accompany the flow diagram.)

Another key aspect of the Phase I methodology is getting the formal approval of the customers early in the project regarding the objectives and project concept, before significant resources in the form of time and money are spent. The Phase I Review serves as a checkpoint to make sure that internal and external customer needs are understood, and that concepts proposed for further development are likely to successfully meet those needs.

Highlights of Phase II

The majority of the engineering effort is spent in Phase II. The initial step is to document the existing processes and/or equipment pertinent to the project. Flow charting the process is useful at this point. The engineering trials and prototyping come next, with a focus on identifying and optimizing the critical parameters associated with the process. Once this is accomplished, the actual manufacturing system can be developed, fabricated, and debugged.

The process sounds straightforward, but these are often iterative steps. Although most of the work is carried out by development engineers, it is important to keep customers informed and involved during these stages.

Neglecting to do so often results in the real or perceived need to re-develop the process when it is transferred into manufacturing. This is demoralizing to both organizations and impacts cycle time dramatically.

At some point, the project team must conduct qualification tests. Because some tests may take months to complete, it is desirable from a cycle time point of view to begin them as early as possible. On the other hand, typically all critical parameters must be established before qualification testing

can begin. To prevent delays, it is important to determine early in the development cycle what qualification tests are required, and to begin testing product as soon as possible, usually in the prototyping step. This enables the early detection of problems, ensures the availability of appropriate test facilities and tooling, and provides greater confidence in the results of the final qualification tests. In KAQPS, the qualification plan is established before the Phase II Review. Preferably, preliminary test results are obtained by this point as well.

The Phase II Review is a critical point in the development process. At this point, the manufacturing organization critically evaluates the efforts of the development team preparatory to taking responsibility for the manufacturing system in Phase III. The Phase II Review is a strong motivator to keep internal and external customers informed and involved throughout the development phase.

Highlights of Phase III

In Phase III, control plans for the process are formalized; manufacturing instructions are written, and process potential studies are done. Manufacturing usually takes the lead role in this phase, with the development team offering strong support.

Once the qualification tests are completed, manufacturing begins. A Phase III Review is held after sufficient time has passed to ensure that all critical objectives have been met. In successful projects, this is when the development and manufacturing team celebrate their achievement.

Conclusion

KAQPS was originally developed by a KEMET team representing R & D, Equipment Engineering, Process Engineering, Product Engineering, and Manufacturing. The methodology was first used in KEMET's Technology and Equipment Engineering departments in 1990. After several projects that used KAQPS were completed, the methodology was reviewed, and modified based on the experience gained. One of the changes was to require an analysis after each phase to determine how cycle time might have been decreased. KAQPS is now also used by the Process Engineering departments at each plant.

Experience has shown several advantages of the formalized development process:

1. Roles and expectations are clearly defined for the various departments involved.
2. Tools such as QFD, FMEA, DOE, benchmarking, etc., are integrated into the process.
3. Communication is simplified by providing a common framework for all development projects.
4. Ownership of the project is instilled across department boundaries.

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