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An important part of KEMET's technical activity is the development.of supplier-partners for our raw materials. This edition of Tech Topics describes several aspects of our supplier partnership program. The author is Joe Aurichio, a Raw Materials Engineer in our Quality Assurance Engineering Department.

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Improving Supplier Quality: The KEMET Approach

by Joe Aurichio

In the electronics industry, where technology is advancing so rapidly that quality and reliability standards are a moving target, components manufacturers are challenged to locate raw materials that will satisfy the requirements of their customers. The purchase of raw materials for critical use no longer means simply shipping "off the shelf" product that conforms to specifications. Instead, manufacturers must develop long-term partnerships for quality improvement with key suppliers, to ensure that raw materials are suitable not only for today's products but for tomorrow's innovations.

KEMET Electronics Corporation, which manufactures solid tantalum and ceramic capacitors in leaded and surface-mount configurations, has developed a special approach to improving the quality of the critical raw materials it receives. Our Supplier Quality System emphasizes the identification and continuous improvement of suppliers' critical characteristics through a process of hands-on, intense coaching and guidance in Quality philosophies and tools. By forming customer-supplier "commodity" teams for each critical material in the KEMET process, we have become more knowledgeable of those aspects of our suppliers' products and processes that most affect KEMET. By visiting our suppliers, conducting audits based on the Malcolm Baldrige National Quality Award criteria, offering performance ratings and training in quality-related topics, we have helped our suppliers to improve their overall quality systems. Finally, by empowering our suppliers to take control of their own improvement initiatives, we have enabled our top suppliers to discover their own approaches to continuous quality improvement.

From "Conformance to Specification" to Continuous Improvement

Before the Supplier Quality System was introduced, suppliers were approved based on a one-time business assessment, and raw materials were accepted for use in KEMET product based on conformance to specifications, which was determined at receiving inspection. The inspection process was time-consuming and expensive, and when we began to examine the system in the mid-1980s, we found that there was often little correlation between the material characteristics being measured and the finished capability of KEMET product. In other words, the criteria by which we measured our suppliers was not always critical to KEMET's customers, and some factors that should have been measured were not being considered. Further, although KEMET had a system for approving suppliers for business, we decided that a more comprehensive approach was needed if we were to obtain the best available material at the lowest overall cost—including such costs as quality, delivery, partnership attitude toward business, and effectiveness of corrective actions. Once suppliers were approved, we needed an evergreen system for improving all aspects of our partnership relations, including service performance. To address all of these issues, in 1989 we launched the Supplier Quality System, which included the following elements:

- supplier approval process
- supplier continuous improvement process
- supplier quality audit
- supplier corrective action
- supplier rating system
- raw material specifications

The Supplier Quality System began as a method of gaining more control of the quality of all aspects of our suppliers' performance, and became a tool for empowering our suppliers in long-term partnerships for continuous improvement. Along the way, we at KEMET discovered that before we could attempt to impose "best-in-class" requirements onto our suppliers, we had to re-examine our own definition of critical characteristics for raw materials.

Supplier Capability: Beyond Cpk

When the Supplier Quality System was introduced, Cpk data was targeted as one of the key measures of supplier process improvement. However, we quickly found that the Cpk indicators we had were based on product bulletins and did not accurately reflect many suppliers' true capability. Further, some of the characteristics considered critical to our suppliers' process were not critical to the material's use in KEMET products; we realized we did not need high Cpk values for these characteristics, while other characteristics might need greater emphasis. The raw material engineers at KEMET determined that in order to fulfill our Corporate Purchasing Vision of obtaining "continually improving, high quality raw materials which are delivered on time and have the lowest total cost of ownership," they would have to learn more about both KEMET's and our suppliers' products and processes.

To identify those raw material characteristics critical to KEMET finished product, we consulted the KEMET manufacturing facilities, which identify critical characterization through the KEMET Process Improvement Methodology[1] (KPIM). This is a method of process characterization that uses such tools as Cause and Effect/Failure Mode and Analysis matrices and process variables. KPIM begins with the first step of the KEMET manufacturing process and traces the relationship of critical factors through to the finished product. With this methodology, identifying critical raw materials and the important measurables of those materials was relatively straightforward.

The next step was to translate these measurables into goals for our suppliers of critical materials. At this point we confronted the difference between our manufacturing process and that of many of our suppliers: not only had KEMET been practicing Total Quality Management for over a decade, but the nature of our manufacturing cycle had always made process control and capability essential. For many of our suppliers, who literally dig minerals out of the earth, such basic Quality discipline elements as reduction in variation, variables vs. attributes data, and sampling plans were entirely new. Further, among our suppliers were many "small shops" and sole-source providers who

[1] KEMET TechTopics Vol.3, No. 9 (Nov 1993)

could not comply with our requirements immediately. This diversity of supplier "readiness," which we initially perceived as a serious drawback to our Supplier Quality System, eventually became its greatest strength. It enabled us to develop a unique approach to supplier relations which is now the backbone of the Supplier Quality System.

Continuous Improvement

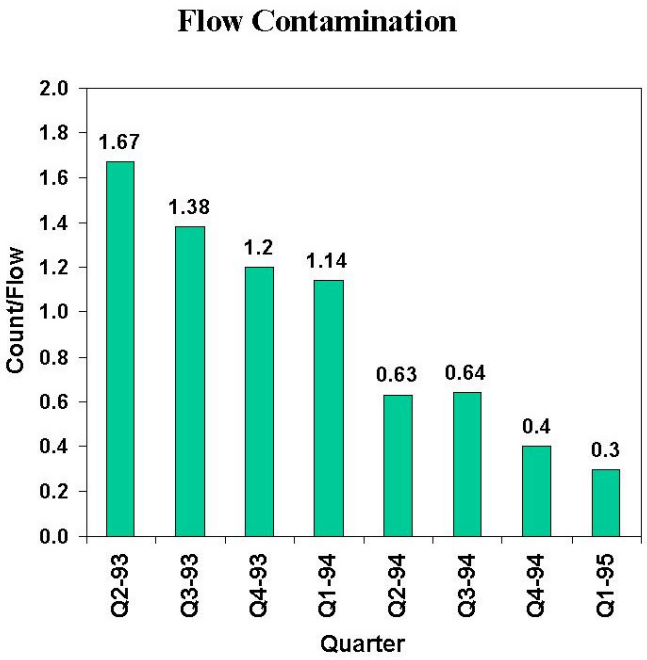
To ensure that all of our critical suppliers, regardless of their starting position, made as much progress as rapidly as possible, we determined that the focus of the Supplier Quality System would be product consistency, achieved through the continuous improvement of the suppliers' quality system requirements, including effective training, clear documentation of procedures, and process development. To facilitate this objective, we designed the Continuous Improvement Cycle. Modeled after the Plan-Do-Check-Act (PDCA) process, the Continuous Improvement Cycle consists of two preliminary steps and four cyclical phases.

In the ***Commodity Preparation*** stage, the team identifies the critical characteristics of the commodity and sets target quality levels. During ***Supplier Preparation***, the commodity team conducts orientation sessions to familiarize suppliers with the system and help them to prepare the quality-related documentation (quality manual, control plans, etc.) necessary to participate in the Continuous Improvement Cycle. When the preparatory stages are complete, the ***Target*** phase begins with the commodity team and the supplier mutually setting realistic goals tailored to the individual supplier. These goals are entered into a Key Supplier Continuous Improvement Plan, which is updated annually as suppliers meet their objectives and new goals are set. During the ***Improve*** phase, the supplier applies process improvement methodologies to reach the targeted goals. As the supplier works on these improvements, a Quality Operating System is used in the ***Monitor*** phase to evaluate quality data. When improvements are in place, the supplier identifies preventive measures to ensure that the gains are maintained. This is the ***Prevent/Recognize*** phase, in which the commodity team continues to monitor quality data to verify that the improvement is permanent, while formally recognizing those suppliers who have exhibited continuous system/product improvement. KEMET has established three quality award levels based on defined scores in the areas of quality and delivery ratings, Quality System Audit performance, and statistical or other measures of improving critical product characteristics.

Results

The KEMET Supplier Quality System was initially developed out of the need to better identify the characteristics most important to KEMET product. However, the true benefit of the system has been to build successful partnerships through quality improvement. Not only have our key suppliers been successful in meeting the criteria for KEMET's quality awards— fully one-third have currently achieved Quality Membership, and two more have progressed to the status of Quality Partner— but more importantly, all of these suppliers have embraced the philosophy of continuous quality improvement in all areas of their business. Supplier audit scores have increased an average of 28 per cent over the past five years, and many suppliers have shared the sentiments of one respondent to KEMET's audit evaluation: KEMET's audit is "the most comprehensive and informative session we've experienced."

The audit has provided an opportunity for KEMET and the supplier to identify characteristics affecting the raw material that previously might not have been considered critical. For example, during one audit the KEMET team noticed a situation in the supplier's plant that might reflect product deficiencies. Particulate contamination in the manufacturing process was identified, and the supplier and KEMET set a mutual goal to reduce the levels of contamination. The supplier initiated a program that included all employees in the improvement effort. Teams were formed, the sources of contamination identified, and improvements undertaken (figure below). Throughout the process, the supplier updated KEMET with progress reports. The improvement benefited the supplier much more than simply improving the quality of characteristics of significance to KEMET; overall product quality was enhanced, and the supplier experienced team-oriented problem-solving.



The Supplier Quality System has been of particular benefit to suppliers just beginning the quality improvement process. For example, one new supplier to KEMET failed to meet the minimum assessment score to qualify for approval when it was discovered that the manufacturing process lacked quality documentation. KEMET engineers were depending on this material for use in a new process under development, and KEMET's raw material engineers stressed to the supplier the urgency of system documentation and development. They volunteered to assist the supplier's management team in understanding and meeting the requirements for this documentation. The KEMET commodity team representatives worked closely with this supplier until the minimum criteria for approval were met. The supplier now has an entrenched continuous quality improvement philosophy that enables product and process gains to continue without KEMET's close involvement.

As our suppliers' quality systems mature, the KEMET Supplier Quality System becomes a useful method for tracking progress and maintaining gains. The intense coaching and collaborating between KEMET and the supplier may no longer be necessary, but with the foundation of a partnership built on mutual goals and understanding of the path to be taken in reaching those goals, our suppliers have the tools to continue evaluating and improving the critical elements in their own quality systems, thus helping KEMET to meet the rigorous demands of our changing technology.