

Advanced Energy[®] Corporate Quality



Quality System Overview

- **Corporate Quality System**

- AE[®] is certified to the ISO 9001:2000 standard and has been certified since 1996; re-certification audits of primary design & manufacturing facilities in Fort Collins, Colorado (U.S.A.), Shenzhen (China), and Hajiochi (Japan)

- **Quality Management System (QMS)**

- Governing system of processes and procedures
- Foundation of ISO certification
- Continual review and updating based on internal audits, third-party audits, customer feedback, and continuous improvement programs (CIPs)
- Foundation of system:
 - *Product Development Process*—defines guidelines for designing and developing products
 - *Operations Quality System*—defines the system used to ensure continuous process improvement within operations
 - *Closed-Loop Corrective Action Process*—consists of progressive levels of review, and analysis of continuous improvement activities, for product reliability, quality, and processes

- **Six Sigma Methodology**

- Corporate-sponsored program for reducing cost of poor quality (COPQ) by using the tools and problem-solving process defined through Six Sigma



Quality System Overview (cont.)

- **Product Development Process (PDP)**
 - This process was defined through a cross-functional team effort with emphasis on process rigor and metric-driven tollgates, which are the control points for product developmental phases from initial product concept through volume manufacturing.
 - Standardized processes yield standardized product performance expectations. These processes include:
 - PDP steering committee at the director & VP levels
 - Formal phase-transition tollgate approval requirements to proceed
 - Metric-driven decisions to pass through tollgate to next phase
 - Three phases of the PDP:
 - *Concept & Feasibility*—Prove the concept/business case and proceed, or disprove and abandon.
 - *Alpha/Eng Develop*—Company commits to significant investment. Product reliability and regulatory requirements verified. Design generally frozen with customer concurrence.
 - *Beta/Manufacturing*—Entirely run by Operations. Supported by Sustaining or Manufacturing Engineering (as opposed to Design Engineering). CIP of process and test methods.



Quality System Overview (cont.)

- **Operations Quality System**

- Product Quality Teams (PQTs)—PQTs drive improvement in the performance of the product and manufacturing processes to meet customer and business objectives.
 - Organized by product line—cross-functional in composition, leaders are operations engineers (process or test engineers)
 - Include goals such as out-of-box defect reduction (infant mortality/early life failure reductions), internal assembly defect reduction, and test yield improvements
 - Measured by a scorecard system that drives achievement of target goals in all metrics as well as use of the corporate-sponsored problem solving methodology (Six Sigma process)
 - Utilize interactive SPC tracking software so that data collection is real time. Data is used to monitor process capability and drive reduction in process variability
 - Include ongoing reliability testing (ORT) as part of the manufacturing process on multiple product lines to ensure outgoing quality is consistent



Quality System Overview (cont.)

- **Operations Quality System**

- **Supplier Quality**

- Drive improvements at supplier by using Six Sigma methodologies for problem solving
 - (DMAIC: Define, measure, analyze, improve, control process)
- Implement three-year plan to reduce incoming defects from suppliers by 2X each year from 2005 to 2007; focus starting with workmanship improvements and working to more sophisticated screening and test programs
- Improve processes and tracking around supplier selection, qualification, and approval
- Conduct yearly quality and business system audits as well as quarterly business reviews with all key suppliers



Quality System Overview (cont.)

- **Closed-Loop Corrective Action System**
 - Driven at all levels of organizational structure through regular management reviews and corrective action procedures
 - **Product Quality Teams (PQTs)**
 - Action registers for continuous improvement managed for each team. Action items are added based on data from internal and external metrics. Any out of box failure at a customer location is added to the register with highest priority for immediate action
 - Monthly & quarterly PQT scorecard reviews conducted to assess performance and status of improvement activities
 - **Product Quality Teams**
 - Annual failure rate (AFR) and annual return rate (ARR) reports—product performance during the warranty period, and reports on overall field population performance, drive product reliability improvements by product line.
 - Monthly product quality meetings are held to review progress on reliability performance and closure of product improvement activities.
 - **Senior Management Reviews**
 - Quarterly reviews are conducted to review internal audit status, customer feedback, corporate quality objectives, and overall effectiveness of the quality system.



Quality System Overview (cont.)

- **Six Sigma Program**

- AE currently has five Six Sigma black belts on staff and has been conducting green belt training classes in the primary design and manufacturing locations (Fort Collins and Shenzhen) since 2004 with well over 100 employees trained in green belt techniques.
- Green belt and black belt projects are initiated to support corporate objectives for quality, profitability, and velocity. Monthly reviews ensure that projects are kept on schedule and any related gains are carefully tracked.
- Six Sigma methodologies of problem solving are not only used as part of formal projects but are applied as part of the program management of quality improvement and other programs.
- AE will continue to expand the program to other functional areas outside of Operations as part of the 2007 quality objectives.



Summary

- Advanced Energy Industries Quality System
 - Focused on the voice of the customer in ensuring goods and services meet or exceed customer expectations
 - Driven by data and metrics in prioritizing actions
 - Based on continuous improvement in all that we do
 - Supported by a sound and robust series of quality policies & procedures
 - Employs the Six Sigma approach of define, measure, analyze, improve, and control in problem solving efforts
 - Incorporates closed-loop corrective action plans in addressing process or product shortcomings

