

tyco

Electronics

Total
Quality
Management

Process

Quality Manual 102-1

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TOTAL QUALITY MANAGEMENT PROCESS

1. SCOPE

For the purpose of this document, Tyco Electronics refers to the portion of the Tyco Electronics Corporation that operates in North America (refer to Figure 1). Tyco Electronics Corporation is one of the major operating units of Tyco International Ltd.

This Total Quality Management Process provides the basis for analyzing customer requirements, defining the processes that contribute to the achievement of a product or service that is acceptable to the customer, and provisions for keeping these processes in control. In recognition of the varying organizational structures and needs of the Business Units, this quality manual may be supplemented by additional detailed procedures. Such additional procedures may not be less stringent than those provided herein unless specifically required in the customer contract; records shall be kept of such contract exceptions.

1.1. Customer Satisfaction

The Total Quality Management Process is the comprehensive process of satisfying the customer, starting with a request for a product or service through the delivery and use of the item that satisfies that request. The Total Quality Management Process is the attention and control that must be given to all features of a product or service to ensure total customer satisfaction. In addition to the obvious characteristics – such as form, fit, function, and reliability – the Total Quality Management Process involves maintainability, storability, appearance, ease of application, end use of a product or service, efforts to accomplish error-free documentation and systems, and countless other aspects contributing to the overall value to the internal operations or the external customer.

1.2. Quality System Evolution

The Tyco Electronics Total Quality Management Process shall meet the requirements of the International Standard ISO 9001:2000 and TL 9000 Release 3.0.

Additional QS-9000 requirements, printed in italic type with a (QS) following the statement, shall be implemented when customers require compliance to QS-9000. (QS)

Additional ISO / TS 16949 requirements are printed in italic type with a (TS) following the statement. Compliance to TS 16949 will require implementation of these requirements in addition to the requirements of QS 9000. (TS)

When implemented in conjunction with the requirements of Quality Specification 102-152, the Tyco Electronics Total Quality Management Process complies with the Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants (10CFR50 Appendix B). When implemented in conjunction with the requirements of Quality Specification 102-153, the Tyco Electronics Total Quality Management Process complies with the Aerospace Standard AS 9100. Development of the quality manual was also influenced by documents such as: Product Assurance Program for Electronic and Fiber Optic Parts Specification (MIL-STD-790); Quality Program Provisions for Aeronautical and Space Contractors (NHB 5300.4 (1B)) and Inspection System Provisions for Aeronautical and Space System Materials, Parts, Components and Services (NHB 5300.4[1C]). The basic operation of this process is preventing problems from occurring, detecting them when they do, identifying the root cause, remedying the cause, preventing recurrence, and supporting continual improvement.

2. APPLICABLE DOCUMENTS

The following documents constitute a part of this specification to the extent specifically set forth herein. Unless otherwise specified, the latest edition of the document applies.

2.1. Documents / Specifications

- A. 102-2 Glossary
- B. 102-143 Total Quality Management Documentation System
- C. 102-152 Additional TQM Requirements for Products Sold for Nuclear Applications
- D. 102-153 Additional TQM Requirements for Products Sold for Aerospace Applications
- E. 402-39 Quality System Cross-Reference
- F. 402-105 Quality Tools and Statistics Reference Guide

2.2. International Standards/Industry Standard

- A. ISO 9000 Quality Management Systems – Fundamentals and Vocabulary
- B. ISO 9001 Quality Management Systems – Requirements
- C. ISO 9004 Quality Management Systems – Guidelines for Performance Improvement
- D. ISO 10012-1 Quality Assurance Requirements for Measuring Equipment
- E. ISO/IEC Guide 25: General Requirements for the Competence of Calibration and Testing Laboratories
- F. ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories
- G. QS-9000 Quality System Requirements
- H. AIAG Advanced Product Quality Planning and Control Plan Reference Manual
- I. AIAG Fundamental Statistical Process Control (SPC) Reference Manual
- J. AIAG Measurement Systems Analysis Reference Manual
- K. AIAG Potential Failure Mode and Effects Reference Manual
- L. AIAG Production Part Approval Process Manual
- M. AIAG Quality System Assessment
- N. QuEST TL 9000 Quality System Requirements
- O. QuEST TL 9000 Quality Measurements Handbook
- P. AS9100 Quality Systems, Aerospace Model for Quality Assurance in Design, Development, Production, Installation and Servicing
- Q. ISO/TS 16949 Quality Management Systems Automotive Suppliers
- R. 10CFR50B USNRC Regulation 10, Code of Federal Regulations Part 50 Appendix B: Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants

2.3. Military Specifications and Standards

- MIL-STD-790 Standard Practice For Established Reliability and High Reliability Qualified Products List (QPL) Systems For Electrical, Electronic, and Fiber Optic Parts Specifications

3. DEFINITIONS

Definitions contained in MIL-STD-790, ISO 9000, and Quality Specification 102-2 are incorporated herein.

3.1. Tyco Electronics

Tyco Electronics is an operating Corporation of Tyco International, Ltd. Product brands include, but are not limited to, Agastat, Alcoswitch, AMP, Buchanan, Critchley, Elcon, Elo Touchsystems, HTS, M/A-COM, Madison Cable, Microdot, OEG, Potter & Brumfield, Raychem, Schrack and Simel. The phrase “the company” refers to the portion of Tyco Electronics Corporation as defined in the scope of this document and represented by the Organizational Structure in Figure 1.

3.2. AMP

AMP is a product brand of the Tyco Electronics Corporation. Prior to Revision M of this document, AMP was synonymous with the company.

3.3. Business Unit

Any organization within Tyco Electronics that produces a product or provides a service.

3.4. Customer

The external recipient of a product or service.

3.5. Product

The output of a team or work unit, such as connectors, cables, relays, sensors, tools, molds, dies, software, specifications, reports, or services.

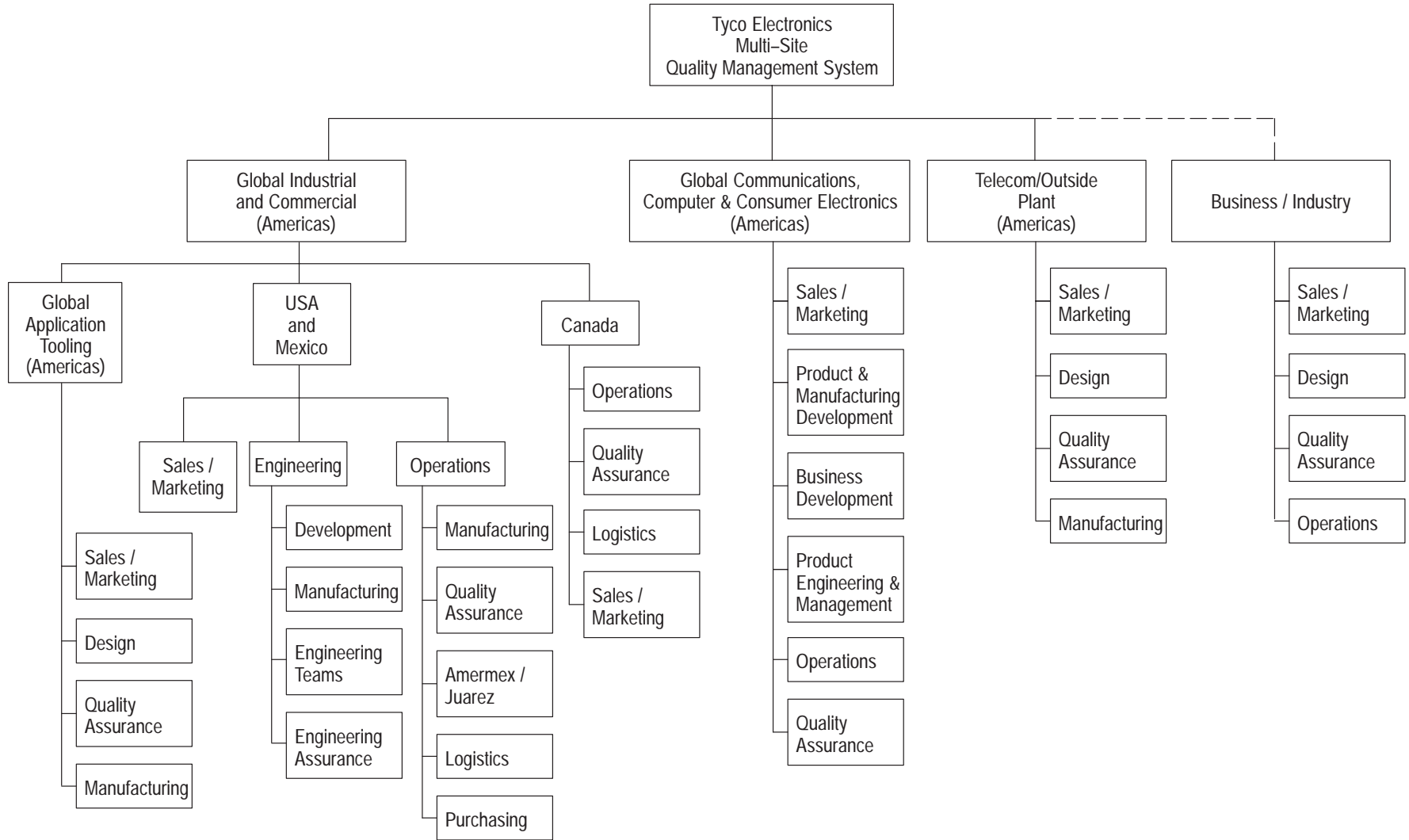


Figure 1. Organizational Structure

4. QUALITY MANAGEMENT SYSTEM

4.1. Quality System – General Requirements

The Tyco Electronics model for the quality management system is derived from ISO 9004 and is supplemented by customer specific requirements. As specific quality system models, ISO 9001, TL 9000, QS-9000 and TS 16949 provide the framework for areas to be documented, implemented, maintained and improved with appropriate feedback from inspection, audits, and customers to assess system effectiveness. National and international quality awards – such as the Malcolm Baldrige National Quality Award (MBNQA) and European Foundation for Quality Management (EFQM) – further complement the model with cultural, business, and competitor analysis activity.

The goal of the Tyco Electronics Total Quality Management Process is delivering products and services that provide value and meet the customer's requirements. The quality policy, associated metrics and goals of the quality management system shall be evaluated for continued suitability as part of the business assessment process and associated management review. The ability to provide continual improvement and breakthrough improvement is a key element for growth and identifying organizational and individual achievements for recognition.

The Quality Management System shall foster and provide guidance for the continual improvement efforts including customer satisfaction, and the quality and reliability of our products, processes and services. The Six Sigma Operational Excellence initiative provides the framework and process for managing breakthrough improvement. Specific authority shall be given to those responsible for product, process, or system quality to:

- Determine the sequence and interaction of the processes needed to maintain the quality management system;
- Determine criteria and methods needed to ensure that both the operation and control of the processes are effective;
- Measure, monitor and analyze these processes and implement actions necessary to meet goals and to drive continual improvement;
- Initiate action to prevent nonconformances;
- Initiate action to identify, record, and correct problems;
- Initiate, recommend or provide solutions;
- Verify implementation of solutions;
- Control further processing, delivery, or installation of nonconformances;
- Utilize the DMAIC (Define, Measure, Analyze, Improve and Control) process to implement breakthrough improvement;
- Represent the needs of the customer in internal functions in addressing QS-9000 and TS 16949 requirements.

The sequence and interaction of the processes within the quality system is described in Figure 2.

Tyco Electronics maintains control over and responsibility for all processes that affect product conformance to requirements, regardless of whether the process is completed internally or by an external supplier.

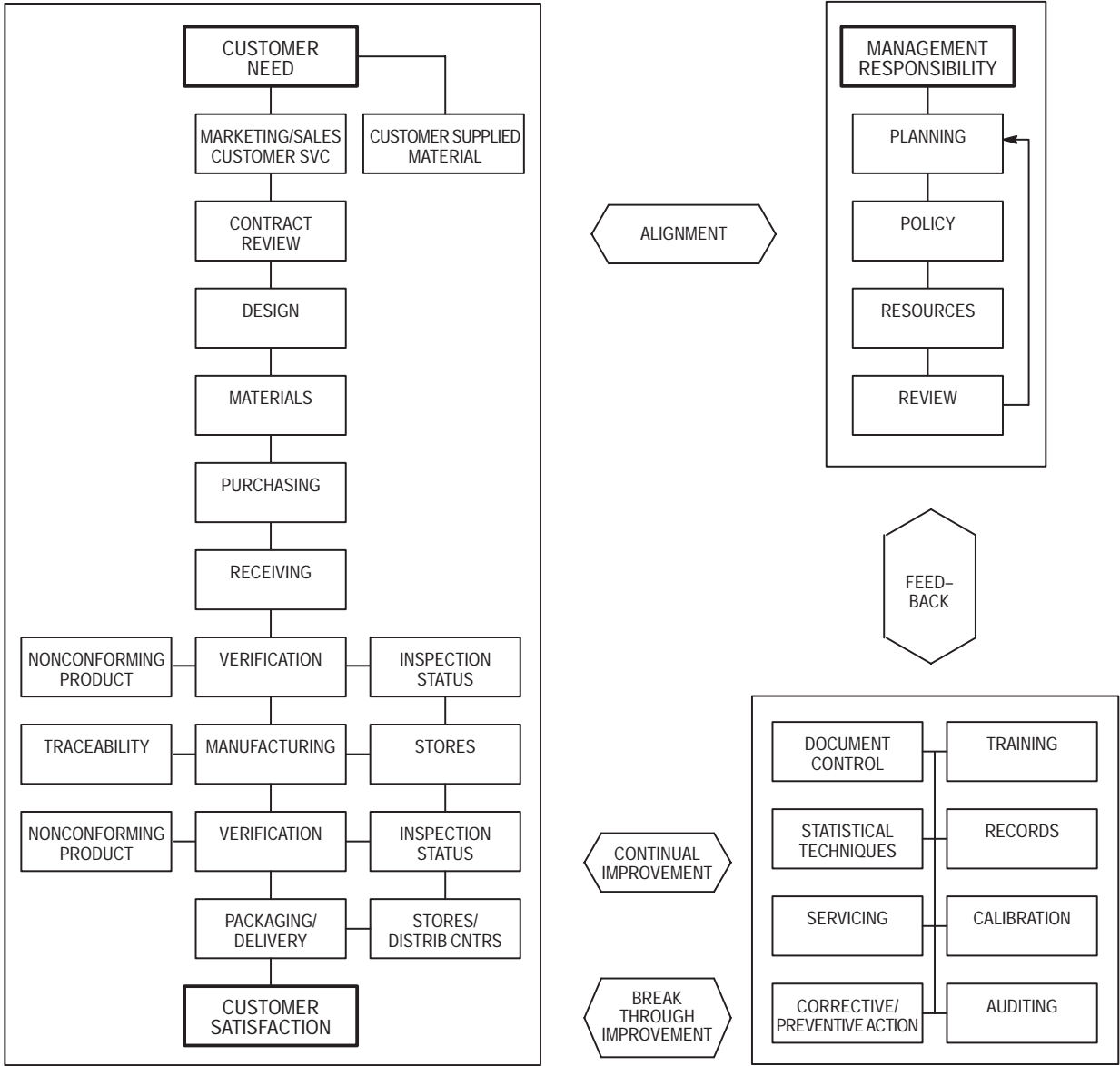


Figure 2. Quality System

4.2. Documentation Requirements

4.2.1. Quality Policy and Quality Objectives

This quality manual contains the statement of the Quality Policy and Quality Objectives.

4.2.2. Quality Manual

The Quality function shall establish, implement, and maintain a documented quality system as a means of ensuring that products and services conform to specified requirements. This documented system shall include this Quality Manual (102–1) supported with detailed procedures and specifications as described in Quality Specification 102–143 (Total Quality Management Documentation System). This manual provides a guide for design, manufacture and marketing of Tyco Electronics products. It represents official policy and shall be used as a standard by all Business Units and operations of Tyco Electronics (as defined by the Scope) in developing and administering systems for continual improvement and the control of quality and reliability of products and services.

The documented quality system shall provide for timely consideration of the following activities in meeting specified requirements:

- Quality planning;
- The identification and facilitation of controls, processes, inspection, equipment, fixtures, production resources, and skills that may be needed to achieve the required quality;
- The updating, as necessary, of quality control, inspection, and testing techniques, including the development and acquisition of new instrumentation;
- The clarification and documentation of standards of acceptability for all features and requirements, including those which may contain a subjective element;
- For the entire product life cycle, ensuring the compatibility of the design, support services, production process, installation, inspection and test procedures, and the accuracy of the applicable documentation;
- The identification of suitable verification at appropriate stages of product or service development;
- The identification, preparation, and maintenance of quality records.

4.2.3. Document and Data Control

The document control process shall provide for the timely review (e.g. business days, not weeks or months), distribution and maintenance of documentation for policies, processes, procedures, or techniques. The process shall provide for document approval, the use of a unique identifier for each controlled document, a distribution list or an equivalent method for identifying recipients, and change control. This control applies to documents regardless of format or media.

A master list or equivalent document control procedure shall identify the current revision of documents in order to preclude the use of non–applicable documents. Where practicable, this list shall be available on line to provide timely knowledge of, or access to, the appropriate revision of the controlling document. A history file of document revisions shall be retained.

Changes shall not be permitted in data records that verify product, process, or system acceptance without adequate control and approval.

Corporate forms should be used where possible; equivalent forms may be generated electronically as long as they contain the same information.

Customer supplied documents that can influence the design, verification, validation, inspection, testing or servicing of the product shall be controlled in accordance with the established procedures.

Documents shall be reviewed and changes implemented based on the customer required schedule. A record of the date on which each change is implemented in production shall be maintained. (TS)

4.2.3.1. Initial Issue

The initial issue of internally controlled documents shall be coordinated with and approved by the appropriate authorized personnel prior to release of the documents. Initial release of documents shall be through the documented Engineering Change process. When non-Tyco Electronics documents have been verified as applicable to Tyco Electronics, the revision status shall be monitored and distribution shall be controlled within the company by the chartered function.

4.2.3.2. Changes

Subsequent changes to controlled documents shall be made in accordance documented procedures and shall be reviewed and approved by the same functions that performed the original review and approval unless specifically designated otherwise. The procedure shall require date of approval and the effective date that product / document compliance to the change is required.

When changes are made to products or processes or when new processes are initiated that affect the customer drawing or product specification, identified internal and external customers shall be notified in accordance with documented procedures.

Product Part Approval Process (PPAP) documents shall be updated when affected by changes to controlled documents. (QS)

4.2.3.3. Drawings, Standards, and Specifications

All drawings shall be prepared in accordance with Tyco Electronics Drafting Standards. The Development / Product Engineering function shall be responsible for the preparation, maintenance, standardization, and obsolescence of all product drawings.

All applicable Tyco Electronics Standards and Specifications – such as Design, Material, Mold, Finish, Quality, and Packaging – shall be used. The applicable Engineering function shall be responsible for the preparation, maintenance, standardization, and obsolescence of all standards and specifications.

4.2.4. Control of Quality Records

It is the responsibility of all Business Units to identify, collect, maintain, store, and dispose of quality records to demonstrate conformance to established requirements and the effective operation of the quality management system. Records shall remain legible, readily identifiable and retrievable. Quality records include:

- Records of customer contracts that require less stringent quality systems procedures;
- Management quality system reviews;
- Employee qualifications and training records;
- Design, development, and testing activities;
- Customer contract and / or purchase order reviews;
- Design inputs;
- Design reviews and resulting actions;
- Results of verification and validation testing, including any necessary actions;
- Changes during the development process;
- Supplier records;
- Qualified processes, equipment, and personnel as appropriate;
- Unique identification of the individual product or lot – when traceability is a specified requirement;
- Notification to the customer when customer property is lost, damaged, or is otherwise unsuitable for use;
- Calibration records and test software verifications;
- Quality system audits;
- Inspection plans / control plans and results, including, as applicable, receiving, in-process, and final;
- Records of nonconforming material transactions, including: inspection rejections, internal rejections, deviations, customer complaints, and return material;
- Corrective and preventive actions;
- *Other records as specified by the customer. (TS)*

Safeguards shall be maintained for records on any media that protects against disaster, system obsolescence, and loss.

4.2.4.1. Record Retention (QS)

Production part approvals, tooling records, purchase orders and amendments shall be maintained for the length of time that the part (or family of parts) is active for production and service requirements plus one calendar year unless otherwise specified by the customer. (QS)

5. MANAGEMENT RESPONSIBILITY

5.1. Management Commitment

Senior management has total quality leadership responsibility for Total Quality Management and Six Sigma Operational Excellence. This includes ensuring the availability of resources, establishment and review of the quality policy and quality objectives, implementation, and continual improvement of the quality management system and deployment of breakthrough process improvement initiatives. Senior management also has the responsibility to communicate the importance of meeting customer, safety and regulatory requirements. The Business Unit Leaders, including Quality Assurance, Engineering, Operations, Sales and Marketing support and assist senior management in these initiatives.

Senior management shall monitor the product realization processes and the support processes to assure their effectiveness and efficiency. (TS)

5.2. Customer Focus

Tyco Electronics welcomes the opportunity to meet with representatives of our customers. Frequently these meetings involve the review of our performance as a supplier to these customers. The Sales and Marketing organization is the primary representative during these customer meetings. They will request participation from other applicable functions depending on the agenda for the meeting. Additionally, the opportunity to host customer representatives in our manufacturing and engineering facilities frequently results in a better mutual understanding of customer requirements and supplier capabilities.

The various organizational structures and entities, such as teams, account management, industry management and customer service are deployed by management to align our internal capabilities with the needs of our customers.

5.3. Quality Policy

“It is the policy of Tyco Electronics to deliver error-free products and services on time. Processes and controls shall be implemented such that tasks are performed properly the first time and to ensure that all products and services provided to our customers and to internal operations meet established requirements. Quality, continual improvement and customer satisfaction are the personal responsibility of each employee.”

5.4. Planning

5.4.1. Quality Objectives

The quality management system and sustaining processes must support the Quality Policy and the company’s goal of achieving EBIT (Earnings Before Interest and Taxes) performance. An effective quality management system will assist the company in meeting the needs of our customers through the on time delivery of error free products and services. The quality management system will provide for timely and effective corrective action and provide a factual basis for continual improvement and defect prevention. Six Sigma Operational Excellence utilizes

the DMAIC process to achieve breakthrough results. Performance against the targets that are established for the applicable TL 9000 measurements will be monitored at the senior management level:

- Total problem reports
- Problem report fix time
- Overdue problem fix responsiveness
- On time delivery.

Each Business Unit is responsible for establishing quality and performance objectives and for conducting regular management reviews to ensure that processes are meeting customer requirements and internal improvement goals.

5.4.2. Quality Management System Planning

Quality planning at the company level shall consist of implementation, updating, and maintenance of this Quality Manual, Specification 102–1 and the supporting quality specifications. Customer and supplier feedback, as supplied through formal reports, through performance reviews, during audits or through surveys shall be considered during the update reviews of this document. The approach and deployment of quality planning within the Business Unit shall include, as appropriate:

- Design / Development Assurance Plans;
- Short and long term plans, including Six Sigma Black Belt projects, with goals for improving quality and customer satisfaction. Performance to these goals shall be monitored and reported. These plans shall address:
 - Product quality
 - Cycle time
 - Customer service
 - Training
 - Cost
 - Delivery commitments
 - Process capability
 - Product reliability
- Maintaining methods for disaster recovery;
- Cross–functional teams;
- Subcontractor / supplier input;
- Feasibility reviews;
- Potential Failure Mode and Effects Analysis (FMEA);
- Control plans, inspection and testing techniques;

- Identification of customer special characteristics;
- *Consideration and awareness of product safety issues relative to design and process control; (QS)*
- *Utilization of mistake proofing methodologies when planning processes, facilities, equipment and tooling; (QS)*
- *Quality Planning, utilizing Automotive Industry Action Group (AIAG) QS-9000 Supplemental Manuals (APQP and Control Plan, FMEA, SPC, MSA, and PPAP). (QS)*

5.4.2.1. Quality Planning Requirements For Suppliers (QS)

Suppliers shall utilize quality planning to support the requirements of APQP and PPAP. (QS)

5.4.2.2. Business Plan (QS) (TS)

Each Business Unit Director shall have the authority and responsibility for ensuring compliance to the company's Business Plan requirements. As appropriate, the Business Plan shall be communicated throughout the organization. Comprehensive continual improvement activities shall be included in the plan. These activities shall address opportunities in quality and productivity. Business Plan results shall be tracked, reviewed, and revised by management at appropriate intervals. Records of such reviews shall be maintained. (QS)

Senior management of the Business Unit shall define quality objectives that address customer expectations and measurements that shall be included in the Business Plan and used to deploy the Quality Policy. (TS)

5.5. Responsibility, Authority and Communication

5.5.1. Responsibility and Authority

The responsibility, authority, and interrelationship of all personnel and functions who influence product design, quality, processes, preventive and corrective action, or the quality system are defined through, but not limited to, organizational charts, job or position descriptions, skill requirements, individual performance reviews (e.g. PBRs – Performance for Business Results, PEP – Performance Excellence Program), documented quality specifications, and the functional responsibilities defined in this document.

All levels of personnel have the authority to halt nonconforming processes and initiate, recommend, or provide corrective / preventive solutions through designated channels.

5.5.1.1. Business Unit Director Responsibilities:

- Ensuring that the requirements of the Total Quality Management Process are implemented, maintained and communicated and ensuring compliance with the requirements of the ISO 9001, TL 9000 and / or QS-9000 / TS 16949 standards;
- Ensuring adequate resources and trained personnel for management and support of work;
- Approving Six Sigma Operational Excellence projects, including the goals, objectives and expected results;
- Establishing and maintaining appropriate communication processes within the unit.

5.5.1.2. Quality Assurance Director or Manager Responsibilities:

The organizational Quality Assurance Directors and Managers shall have the authority and responsibility for ensuring that the requirements of the Total Quality Management Process are implemented and maintained.

- Regularly reporting to management the current performance of the Quality System and the level of customer satisfaction as a mechanism for continual improvement;
- Ensuring that the Business Unit complies with the applicable requirements of ISO 9001, TL 9000, and / or QS-9000 / TS 16949 standards;
- Providing liaison with external bodies on matters relating to the Quality System;
- Ensuring annually that the Business Unit has deployed the latest revision of ISO 9001, TL 9000, and / or QS-9000 / TS 16949 that supports this Quality Manual;
- *Notifying their certification body / registrar in writing within 5 working days when a customer places the site in any of the following statuses: (QS)*
 - *Chrysler "Needs Improvement" (QS)*
 - *Ford Q-1 Revocation (QS)*
 - *General Motors Level II Containment. (QS)*

5.5.1.3. Six Sigma Champion Responsibilities:

- Developing and implementing the specific Six Sigma Operational Excellence strategy within the Business or designated portion of the Business;
- Mentoring and supporting the Master Black Belts, Black Belts and Green Belts within the Business or designated portion of the Business.

5.5.1.4. Management / Supervision Responsibilities:

- Ensuring that every employee under their direction is properly trained and aware of their role and responsibilities in carrying out the assigned quality activities that are defined in the quality policy and applicable quality specifications;
- Serving as the Six Sigma Operational Excellence Deployment Champion for Black Belt projects within their facility or team;
- Participating in the periodic review of the Total Quality Management Process and the implementation of any identified required improvements;
- Ensuring that adequate resources are assigned and made available for the completion of the appropriate quality activities within their assigned scope of responsibility;
- Determining the sequence and interaction of the processes needed to maintain the quality management system;
- Measuring, monitoring and analyzing these processes and implementing actions necessary to meet goals and to drive continual improvement;

- Ensuring the availability of information necessary to support the operation and monitoring of these processes;
- Ensuring compliance with applicable safety and regulatory requirements.

■ 5.5.1.5. Team / Product Engineering Responsibilities:

- Assurance and validation that all newly released products for sale comply with all agreed upon customer requirements;
- Ensuring that all customer requirements are identified and planned for as part of the product design documentation, including but not limited to, material requirements, requirements for packaging and shipping, and required / agreed upon documentation that may be required with shipments;
- Identifying, analyzing, reviewing, and documenting any special customer quality, test, packaging requirements, including any exceptions prior to submitting a quotation or proposal;
- Internal coordination of customer / product line approvals and periodic product requalification;
- Measuring, monitoring and analyzing these processes and implementing actions necessary to meet goals and to drive continual improvement.
- Utilizing the DMAIC process when participating on Six Sigma Operational Excellence project teams or other applicable improvement activities.

■ 5.5.1.6. Team / Manufacturing Engineering Responsibilities:

- Definition, validation, and installation of manufacturing processes that will consistently produce product in accordance with all identified safety, regulatory and customer requirements, including any applicable process control methodologies to assure conformance to requirements;
- Ensuring that appropriate process documentation is initiated and maintained;
- Implementing appropriate methods for the initiation / collection of any customer required process documentation (e.g. process control records, SPC, test / inspection records, traceability etc.);
- Measuring, monitoring and analyzing these processes and implementing actions necessary to meet goals and to drive continual improvement.
- Utilizing the DMAIC process when participating on Six Sigma Operational Excellence project teams or other applicable improvement activities.

■ 5.5.1.7. Master Black Belt Responsibilities:

- Works with senior management to identify, classify and prioritize Six Sigma Operational Excellence projects;
- Organizes and provides Six Sigma training within the Business or designated portion of the Business;

- Coaches and assists the Black Belts and Green Belts with the technical aspects of the DMAIC process.

5.5.1.8. Black Belt Responsibilities:

- Serving as the key Six Sigma Operational Excellence project leader within the Business or designated portion of the Business;
- Implementing the principles, practices and techniques of Six Sigma and LEAN to achieve the goals and objectives of the assigned project;
- Providing on-site project management and support;
- Coaches and provides technical support to the Green Belts assigned to Six Sigma projects within the Business or designated portion of the Business;
- Utilizing the DMAIC process on assigned projects.

5.5.1.9. Green Belt Responsibilities:

- Participate on or lead Six Sigma Operational Excellence teams as directed by management;
- Utilizing the DMAIC process on assigned projects.

5.5.1.10. Human Resources Organization Responsibilities:

- Cultivate a culture that provides employees with the opportunity to realize their fullest potential to pursue the quality and performance objectives;
- Recruitment and placement qualified new employees;
- Promotion and recognition of employee contributions;
- Encouragement of increased employee empowerment, involvement, responsibility and innovation;
- Ensuring a work environment conducive to the well being, growth, and development of all of Tyco Electronics employees.

5.5.2. Management Representative

Company and Business Unit senior management shall appoint representatives who, irrespective of other responsibilities, shall have the responsibility and authority for:

- Ensuring that the requirements of the Total Quality Management Process are defined, implemented, and maintained, and ensuring compliance with the requirements of ISO 9001, TL 9000 and / or QS-9000 / TS 16949 standards and other quality system requirements agreed to by contract with the customer;
- Reporting to senior management on the current performance of the quality system as a basis for continual improvement;
- Assisting senior management in promoting customer requirements and continual improvement throughout the organization.

5.5.2.1. Total Quality Management Committee

This is an ad hoc committee composed of the Quality Management, which has the following responsibilities:

- Assisting senior management with the deployment of the Total Quality Management Process;
- Maintaining, and improving the Total Quality Management Process;
- Developing and implementing company policy, systems, and procedures covering requirements for corrective action, preventive action, quality, reliability and other product assurance factors;
- Providing input to training programs with regard to policies and procedures relating to customer quality and reliability activities.

5.5.2.2. Customer Representative (TS)

Senior management shall designate individual(s) to represent the needs of the customer in internal functions in addressing QS-9000 and TS 16949 requirements (e.g. selection of special characteristics, setting quality objectives, training, corrective and preventive actions, product design and development). (TS)

5.5.3. Internal Communication

Senior management shall promote awareness of the quality policy, disseminate progress on quality performance and customer satisfaction and changes in the quality management system. This promotion may include activities such as meetings of key personnel, Tyco Electronics Intranet sites, videotapes, voice message announcements, newsletters, training programs, status reports, daily interactions, group meetings, and customer contact.

5.6. Management Review

5.6.1. General

The senior management team representing the scope of the certification shall review the Quality System semi-annually. This review identifies trends and adjusts policy and business plans, as necessary to meet the established goals for customers, suppliers, Tyco International and internal activity. The reviews shall also address, as appropriate, suitability of the Quality Policy, quality objectives and Quality Management System; changing business needs, customer satisfaction, operational and performance results, quality trends, continual improvement, assessment of resources, the results of quality audits, and corrective and preventive action activities.

The management team of a Business Unit is responsible for local deployment of the Total Quality Management Process and for reviewing the quality management system. The purpose of the review is to assess the adequacy of resources, effectiveness and continuing suitability of the quality system. This review shall include all elements of the entire quality system and must be conducted at least annually.

Records of quality system reviews shall be maintained.

Management review shall include all elements of the quality management system, performance trends, monitoring the quality objectives and reporting and evaluation of the cost of poor quality. Results of the review shall address achievement of the objectives specified in the Quality Policy and Business Plan and customer satisfaction. (TS)

5.6.2. Review Input

The input to management review shall include information on:

- Audit results;
- Feedback from customers;
- Process performance and product conformity;
- Status of preventive and corrective actions;
- Follow up actions from previous management reviews;
- Changes that could affect the quality management system;
- Improvement recommendations;
- *Analysis of actual and potential field failures and their impact on quality, safety or the environment; (TS)*
- *Design and development project summary measurements. (TS)*

5.6.3. Review Output

The output from the management review shall include any decisions and actions related to:

- Improvement of the effectiveness of the quality management system and it's supporting processes;
- Improvement of product related to customer requirements;
- Resource needs.

6. RESOURCE MANAGEMENT

6.1. Provision of Resources

It is the responsibility of Business Unit management to ensure that the resources that are essential to the achievement of the organization's objectives, including implementing, maintaining and improving the quality management system and enhancing customer satisfaction, are identified during the planning processes. Resource requirements are usually planned during the budgeting process and adjusted during the year in response to sales growth, profit plans, capacity constraints, changing customer requirements and other internal needs. Management shall review the adequacy of resources and adjustments shall be made based on identified business needs.

6.2. Human Resources

6.2.1. General

Adequately trained personnel shall be provided to perform the required activities. Personnel performing work affecting product quality shall be competent on the basis of appropriate education, training, skills and experience.

6.2.2. Competence, Awareness and Training

The need for training can be identified through a comparison of job skills with the job description, changes in procedures, and nonconforming activity. When a need has been identified, training shall be scheduled and completed.

Tasks affecting product, process, or system quality shall be performed by personnel who are qualified to perform their assigned tasks in accordance with established standards. Qualification shall be based on education, experience, and / or training.

6.2.2.1. Human Resources Organization

The Human Resources organization has the responsibility for establishing, maintaining and implementing company wide training programs. Internal training courses shall be planned, developed and implemented in accordance with established procedures. Company-wide programs may be augmented with programs deployed at the local level.

6.2.2.2. Qualification Training

Job training shall be provided for personnel, including contract or agency personnel, in any new or modified job affecting product quality. Local Business Unit management shall establish operator qualification and requalification requirements as appropriate. Requirements for qualification shall, at a minimum, address employee education, experience, training and demonstrated competency. Employee qualification records shall be maintained at the local facility and be available to the employee and supervision.

Records of formal training, including supervisor-conducted programs, shall be maintained on file as part of the employee's personal history in Human Resources.

Personnel with product design responsibilities shall be qualified to achieve the design requirements and shall be skilled in applicable tools and techniques. (TS)

6.2.2.3. Quality Training

To ensure that there is an awareness of the importance of quality, employees who have a direct impact on the quality of the products, including the senior management, shall be trained in the fundamental concepts of quality improvement, problem solving and customer satisfaction.

Personnel whose work can affect quality shall be informed about the consequences to the customer when there is a nonconformance to specified quality requirements. (TS)

6.2.2.4. Training Requirements and Awareness

Training requirements shall be defined for all employees. Employees shall be made aware of training opportunities.

A documented procedure shall be established and maintained for identification of training needs and achievement of competency of all personnel performing activities affecting product quality. Attention shall be given to satisfy any customer specific requirements. (TS)

6.2.2.5. Training Effectiveness

The effectiveness of a training program is expected to manifest itself through improvement in job performance and / or product quality. Program evaluations shall be conducted to verify this relationship. Methods such as pre- and post-testing, audits, employee interviews and performance appraisals may be used.

6.2.2.6. Employee Motivation and Empowerment (TS)

A process for motivating employees to achieve quality objectives, to make continual improvements and to create an environment to promote innovation shall be established. The process shall include the promotion of quality and technological awareness throughout the organization. (TS)

The Business Unit shall have a process to measure the extent to which employees are aware of the relevance and importance of their activities and how they contribute to the achievement of the quality objectives. (TS)

6.3. Infrastructure

Business Unit management shall define, provide and maintain the infrastructure necessary to ensure that product conforms to established requirements.

6.3.1. Facility Planning (TS)

A system shall be utilized which uses a multi-disciplinary approach for developing facilities, processes and equipment plans. Plant layouts shall optimize travel, handling and value-added use of floor space and shall facilitate synchronous material flow. Methods shall be developed and implemented to evaluate and monitor the effectiveness of existing operations. (TS)

6.4. Work Environment

Facilities, including workstations and associated equipment, shall be maintained in a state of order, cleanliness, and repair appropriate to the product(s) manufactured or to the service being provided. All work areas must comply with established safety, regulatory and environmental standards and codes.

The established requirements, as described in the Quality Policy, include addressing of product safety and means to minimize potential risks to employees. These requirements shall especially be addressed in design, development, and manufacturing process activities. (TS)

7. PRODUCT REALIZATION

7.1. Planning of Product Realization

It is the responsibility of the Business Unit to identify and plan for the production processes necessary for product realization. These processes should be carried out in accordance with documented procedures.

7.1.1. Life Cycle Model

Tyco Electronics has developed a set of guidelines to model the activities required to take customer requirements and convert them into internal requirements and specifications that support manufacturing and maintaining the integrity of the products, delivering the products and discontinuing the products as customer demands change.

7.1.2. New Product Introduction

The design review process is utilized to assure appropriate introduction of new products. Procedures and processes for the introduction of new products are detailed in Section 7.3 (Design and Development Planning) and in the related quality specifications. Safe Launch procedures may be applied to a new product introduction or to significant product or process changes.

7.1.3. Disaster Recovery Planning

Business recovery plans are developed and maintained at the facility level to ensure the ability to maintain product and service continuity in the event of a disaster. *Contingency plans shall be prepared in the event of emergency (e.g. utility interruptions, labor shortages, key equipment failure, field returns) to reasonably protect the customer's supply of product. (TS)*

7.1.4. End of Life Planning

Tyco Electronics has developed a process to ensure the efficient discontinuance of products. This process attempts to minimize the inconvenience for the customer, while at the same time, allowing Tyco Electronics to achieve the required business objectives.

7.1.5. Configuration Management

Configuration management is maintained through the utilization of engineering change control and through control of the process documentation.

7.2. Customer Related Processes

7.2.1. Determination of Product Requirements

The Marketing / Sales function shall launch the establishment of product requirements by:

- Determining the need for a product or service;
- Evaluating the potential for delivering a profitable product or service;

- Accurately defining the market demand and sector, since doing so is important in determining the grade, quantity, price, and timing estimates for the product or service;
- Accurately determining customer requirements, including the requirements for availability, delivery and support, by a review of contract or market needs; including an assessment of any unstated expectations or biases held by customers;
- Communicating all customer requirements clearly and accurately.

The Marketing / Sales function shall provide a formal statement or outline of product requirements which translates customer requirements and expectations into a preliminary set of specifications as the basis for subsequent design work.

Development / Product Engineering is responsible for documenting any other product requirements, including regulatory (e.g. UL, CSA) requirements into the design objectives / product specification or equivalent.

7.2.2. Customer Contract / Purchase Order Review

Records of the results of the review of customer contracts and / or purchase orders shall be maintained.

7.2.2.1. Customer Service

The Customer Service function shall be responsible for:

- Ensuring adequate definition of customer requirements;
- Forwarding to the appropriate functions customer specifications, requests for quotes, contracts, or purchase orders in which the customer is ordering product with nonstandard requirements;
- Requests for alterations to products and services as specified in the customer documentation.

In those cases where there is an established cross-reference between the customer part number and a Tyco Electronics part number, the Sales Correspondent shall review the order to confirm the pricing and delivery requirements. If any discrepancies are observed, the order is reconciled within the Business Unit and transmitted to the Sales Correspondent. Booking the order is confirmation that there are no known discrepancies between the customer request and the ability to meet the request.

7.2.2.2. Customer Specification Review

The appropriate functions responsible for verifying that the customer request can be satisfied shall review the purchase order, request for quote, drawing or specification. Appropriate action shall be initiated to resolve differences to ensure satisfaction of contractual requirements before acceptance of the order. This verification shall include a consideration of verbal and electronic ordering methods as well as a means to convey changes to existing order requirements. Amendments to contracts shall be reviewed and appropriate actions shall be initiated to resolve any differences. The review of customer specifications shall include as appropriate:

- The Development / Product Engineering function shall be responsible for determining product compliance with the customer's requirements and the initiation of the cross-reference process;
- The Quality function shall be responsible for determining compliance to those quality requirements that include measurement data, performance criteria, verification requirements, customer special requirements, audit parameters and processing customer complaints;
- The Packaging Engineering function shall be responsible for determining compliance to special labeling and packaging requirements;
- The Materials function shall be responsible for determining compliance to the delivery requirements;
- The Contracts Administration function in conjunction with the Legal Department, shall be responsible for review of any contract documents containing other than Tyco Electronics standard terms and conditions;
- *The Manufacturing Engineering function shall investigate, confirm and document the manufacturing feasibility of the proposed products, including risk analysis. (TS)*

7.2.3. Customer Communication

The Sales and Marketing organization is the primary interface for ensuring that all customer requests for information are satisfied. In addition, there are multiple electronic systems to assist customers in obtaining product information.

Customer Service is the primary function for providing responses to customer inquiries about purchase orders and delivery dates.

Quality Assurance is the primary function for establishing the process for resolving customer complaints, including problem escalation, customer feedback and product recall. Quality Assurance, in conjunction with Field Sales, is also responsible for communicating with customers during the resolution of complaints or product nonconformity issues.

Customer communications shall include the ability to exchange information and data in a customer-specified language and format. (TS)

7.3. Design and Development

7.3.1. Design and Development Planning

The design of a product must be the result of thorough and careful consideration of the customer's requirements, the potential use of the product, the potential product life cycle and the manufacturability of the product. The following activities shall be the responsibility of Business Unit Engineering and Quality functions. Records shall be kept of design, development, and testing activities.

7.3.1.1. Project Planning

Timely project plans shall be prepared by engineering management that identify the responsibility, budgets, staffing and schedules for each design and development activity. The plans shall be updated and communicated to the appropriate individuals as each design evolves. The plans, based on the life cycle model, shall describe or reference the following activities, as applicable:

- Organizational and technical interfaces between different groups (internal and external) shall be identified and the necessary information documented, transmitted, and reviewed;
- Project roles and responsibilities;
- Project reporting requirements, including tracking and resolving open issues;
- Risk management and contingency plans;
- Performance, safety, security and other critical requirements;
- Any project specific training requirements;
- Usage or licensing rights;
- Post project analysis.

7.3.1.2. Product Test Planning

Product available for sale shall be described with product specifications. If the product is intended to meet an equivalent specification – such as government, agency, specific customer specification, or a recognized industry standard – that document shall be considered the controlling or minimum specification of the requirements.

A preliminary document clearly marked “Design Objectives” shall be prepared for use during engineering development and related testing activity by the Development / Product Engineering function, with the assistance of the Quality and/or Reliability Engineering functions. This specification shall define the intended performance characteristics.

7.3.2. Design and Development Input

Design input requirements relating to the product requirements shall be identified, documented and reviewed by the Business Unit. Records of design input shall be maintained. Design inputs shall consider, but not be limited to:

- Requirements established by the customer input;
- Functional and performance requirements;
- Design constraints;
- Requirements for certification / agency approvals;
- Overall fitness for and impact on the customer’s application, including, as applicable, installability, usability and maintainability;
- Supplier capability and input;

- Performance characteristics such as environmental and usage conditions, including any reliability requirements;
- Ergonomic characteristics such as ease of handling and ease of use;
- Installation, configuration, or fit;
- Industry standards and safety and regulatory requirements;
- Packaging and marking;
- Quality / product assurance inspection activities;
- Verification and validation testing requirements;
- Application requirements;
- Manufacturing and procurement requirements;
- Analysis of similar product (including competitive product) and process designs, work operations, deviations, quality records, service reports, and customer complaints to detect and eliminate potential causes of nonconforming product;
- Manufacturability of design, *including any design constraints, nominal values and tolerances; (QS)*
- *Appropriate resources and facilities to utilize computer-aided product design, engineering and analysis and technical leadership for these functions if subcontracted; (QS)*
- *CAD / CAE systems two way interface with customer systems; (QS)*
- *Establishment of targets for product quality, life, reliability, durability, maintainability, timing and cost. (TS)*

7.3.2.1. Customer and Supplier Input

During the development of a new product, or during the extension of an existing product, customer input can be received in a variety of formal and informal methods, including:

- Customer supplied documents and prints;
- Industry standards and documents;
- Field Sales Proposal Requests or Sales Logs;
- Customer Visit Summaries.

The Tyco Electronics tooling engineer is responsible for soliciting input from suppliers as required to ensure that the suppliers will meet the delivery schedules and the product will conform to established requirements.

7.3.2.2. Manufacturing Process Design (TS)

The manufacturing process design shall be identified, documented and reviewed. Design inputs shall include: (TS)

- *Data from the output of the product design; (TS)*
- *Targets for productivity, process capability and cost; (TS)*
- *Applicable customer requirements; (TS)*
- *Experience from similar products and previous process development. (TS)*

7.3.3. Design and Development Outputs

The design output shall be documented and expressed in terms of requirements, calculations and analyses, and shall:

- Meet the design input requirements;
- Provide the information required for manufacturing the product – including any purchasing information;
- Define the acceptance criteria;
- Conform to documented industry, safety and regulatory requirements where appropriate;
- Identify those characteristics of the design that are crucial to the safe and proper functioning of the product;
- Result from a process that makes appropriate use of the Basic and Advanced Quality Tools, such as Design of Experiments (DOE), Failure Mode and Effects Analysis (FMEA); Statistical Tolerance Analysis, etc.;
- *Identify special characteristics in the control plan; (TS)*
- *Comply with customer specified definitions and symbols by providing these symbols or equivalent on control plans, drawings, FMEA's and operator instructions; (TS)*
- *Consider product error-proofing as appropriate. (TS)*

7.3.3.1. Manufacturing Process Design Output (TS)

The manufacturing process design output shall include: (TS)

- *Specifications and drawings; (TS)*
- *Manufacturing process flow chart or layout; (TS)*
- *Process FMEA's; (TS)*
- *Control plan; (TS)*
- *Work instructions; (TS)*
- *Process approval acceptance criteria; (TS)*

- *Data for quality, reliability, maintainability and measurability; (TS)*
- *Results of error-proofing activities as appropriate; (TS)*
- *Identification of methods for rapid detection and feedback of product and process nonconformances. (TS)*

7.3.4. Design and Development Review

All product, process, and application tooling designs shall be analyzed via a formal design review process. Design review activities shall be held at key times during the development cycle. Design review activities shall be documented and administered in accordance with the specification for design review. Records of design review activities and resulting actions shall be maintained.

The design review activities shall include verification that the design output meets the design input requirements as identified by the customer or Marketing, the identification of any problems and their proposed resolution. Design verification shall include, as appropriate, alternative calculations, comparison to a comparable proven design, and / or testing.

7.3.4.1. Confidentiality

Confidentiality of customer-contracted products under development and related product information shall be ensured.

7.3.4.2. Monitoring (TS)

Measurements at specified stages of design and development shall be defined, analyzed and reported with summary results as an input to management review. (TS)

7.3.5. Design and Development Verification

During development, every product shall be subjected to a testing program designed to evaluate the ability of the product to meet the design objectives for its intended end use. These programs shall be planned, established and conducted jointly by the Product / Development, Quality, and/or Reliability Engineering functions to:

- Investigate potential failure modes and verify their effects on both the design and the manufacturing processes;
- Demonstrate the product design capability for each performance characteristic specified in the design objectives. The design of these tests should consider mechanical and environmental stresses at least as severe as the design objectives, the necessity to generate data for statistical analysis, and, when required, the establishment of a reliability statement.

Records of the results of verification testing and any necessary actions shall be maintained.

7.3.6. Design and Development Validation

Following successful completion of design verification, product for sale shall be validated to ensure compliance with the product specification. All requests for qualification / requalification shall be submitted to a Tyco Electronics test laboratory. When necessary, actual testing may be performed at other qualified test facilities, but shall be under the coordination and approval of the Tyco Electronics test laboratory receiving the initial test request.

7.3.6.1. Qualification Tests

At the appropriate point in the development cycle of the product, *or as required by timing of the customers program, (TS)* the Design / Quality function shall coordinate a product performance evaluation. This shall be done by submitting product(s) certified as acceptable by the responsible function in the Business Unit to the qualification test sequence described in the preliminary product, customer, or agency specification.

A report of the results shall be prepared, and any differences between specification requirements and test data must be reconciled and documented, to permit product qualification. Successful qualification shall permit removal of the “Design Objectives” qualifier from the product specification.

Records of the results of validation testing and any necessary actions shall be maintained.

7.3.6.2. Production Prototypes

Customers shall be supplied with production prototypes as required. Whenever possible, these prototypes shall utilize the same suppliers, tooling and processes that will be used during production.

7.3.7. Control of Design and Development Changes

All design changes – for example: product, process, system, software, packaging style, packaging type, and material or component substitution – shall be identified, documented, reviewed, and approved by authorized personnel before implementation. Records of changes during the development process shall be maintained. Development / Product Engineering is responsible for monitoring and ensuring that the changes do not adversely affect product quality, performance or reliability. Customers shall be notified of design changes affecting the form, fit, function, packaging style or packaging type of a product. In addition and where contracted or mandated by quality system certification requirements, customer approval of design changes shall be obtained. An internally defined or customer directed process for obtaining such approvals shall be utilized.

For proprietary designs, impact on form, fit, function, performance and reliability shall be reviewed with the customer. (TS)

7.4. Purchasing

7.4.1. Purchasing Process

Purchasing, in consultation with the Business Unit, Advanced Materials Technology, Product Engineering, Manufacturing, Supplier Quality Assurance and Legal, is responsible for supplier selection. Purchasing is also responsible for on-going support, risk analysis, supply base management, technical leadership, contract definition and ensuring that proprietary, usage and licensing agreements are completed. Order releases may be done by the Purchasing function, the Materials organization, or Contract Administration. To ensure that the supplier has the necessary documentation to provide what is requested, Purchasing is responsible for coordinating with the appropriate function such items as drawings, referenced specifications, packaging and labeling requirements, and quality assurance requirements for all initial purchase orders. This documentation shall be updated by the appropriate function to include any changes on an as-needed basis and shall be transmitted to the supplier by Purchasing. Records of acceptable suppliers shall be maintained. Purchased product shall comply with all governmental, safety, and environmental requirements for the country of manufacture and sale.

7.4.1.1. New Suppliers

New suppliers of production materials, components and assemblies, as well as service suppliers that could impact product quality or delivery, shall be evaluated prior to classification as an approved supplier. Acceptable methods include: surveys (including statistical enhancement of survey results), on-site audits, first article submittal, certification by a known source, and experience of our customers. It is the responsibility of the Purchasing and Quality functions to complete this evaluation. Records of the results of evaluations and any necessary actions resulting from supplier evaluations shall be maintained by Purchasing.

In the event an external customer has an approved subcontractor list, the responsible Business Unit must coordinate with Purchasing to make sure that those suppliers are included in the Tyco Electronics supply base. Tyco Electronics is responsible for products and services purchased from customer designated suppliers. Optionally, the Business Unit may work with the customer to have the Tyco Electronics supplier added to their list of approved suppliers.

The supplier shall comply with the applicable legal and environmental requirements.

7.4.1.2. Supplier Performance

Quality and delivery performance ratings shall be transmitted to the suppliers based on supplier activity. *Additional supplier monitoring indicators include customer disruptions, field failures and special status customer notifications related to quality or delivery issues. (TS)* Purchasing and Supplier Quality Assurance shall administer the evaluation of suppliers' performance.

The supplier's quality system shall be subject to development by Tyco Electronics as required. Options for development may include training, supplier days, and one-on-one sessions with suppliers for corrective action review.

Suppliers shall be third party registered to ISO 9001:2000 with the goal of compliance to TS 16949. (TS)

Additional development activity can be identified utilizing the monthly supplier reports that are sent to the supply base. Purchasing / Supplier Quality Assurance, in response to poor performance as identified by the reports and based on status and importance, will solicit corrective actions to eliminate this poor performance. *Additional assistance may be offered to the supplier if the development activity or corrective action is determined by the Business Unit to be significant. (QS)*

Business Units shall utilize the Logistics reporting for the tracking of premium freight charges. Tracking shall facilitate whether the premium freight was for inbound or outbound freight. (QS)

7.4.2. Purchasing Information

Purchase orders placed with suppliers shall define the product, the revision level and any additional quality assurance requirements beyond those established in the Tyco Electronics Quality Assurance Requirements for Suppliers.

7.4.3. Verification of Purchased Products

Process control is an essential part of our product assurance requirements. Production suppliers are encouraged to ensure that their processes are continuously capable of producing within specified limits via statistical process control or other appropriate method that will provide confidence in the quality and delivery of the product at a competitive price.

Under requirements of the purchase order, appropriate data may be requested from a supplier's process control system, *or Tyco Electronics may verify the product at the supplier's site. (TS)*

7.4.3.1. First Article Approval

When purchasing any production tooling that requires first-article approval, the Quality, Manufacturing, and Materials organizations shall ensure that the required documentation is sent to the supplier. The purchase order shall note requirements for first-article approval.

For products supplied to automotive customers, the PPAP methodology, or other customer recognized procedures, shall be utilized for production tool approval. (QS)

7.4.3.2. Receiving Inspection

It shall be the responsibility of the Business Unit to determine the means of verifying that suppliers meet their contractual obligations related to the quality of the procured items. This can be accomplished by one of five methods:

- Stock as Received (SAR) – following receipt of the material, it can be placed directly into stores without any receiving inspection activity. Material may be designated Stock as Received based on supplier or part number certification as administered through Purchasing / Supplier Quality Assurance or as approved by the Business Unit. Purchasing / Supplier Quality Assurance is responsible for periodic assessments of certified suppliers.
- Supplier warrants or Certificate of Analysis (C of A), with test results, submitted with the material.
- Incoming inspection – each lot of received material shall be inspected to confirm conformance to specifications.

- Skip lot inspection – lots of received material are inspected as defined by a skip lot plan.
- Product is evaluated and reported as acceptable by an accredited supplier or test laboratory.

In the event that materials are needed for manufacturing commitments before receiving inspection is complete, a plan shall be developed to provide for positive identification and control of the product produced until the material is deemed to be acceptable.

Unless the manufacturing site or the Business Unit implements specific directives, material received from other locations or subsidiaries of Tyco Electronics shall be processed directly into stock without receiving inspection of product characteristics. Product acceptance shall be completed as defined in documented procedures. In all cases it is the responsibility of the supplying operation to ensure the product meets established requirements.

It shall be the responsibility of receiving inspection to identify and segregate nonconforming procured items so they are not inadvertently used. Disposition of nonconforming items shall be made by the responsible engineering disciplines, or designee. The supplier shall be formally advised of both the rejection and if there is a requirement to provide corrective action.

7.5. Production and Service Processes

7.5.1. Control of Production and Service Processes

Identification and planning of production and service processes that directly affect quality shall ensure that these processes are carried out with documented procedures.

Tyco Electronics shall comply with reference standards and codes, engineering / production drawings and specifications, quality plans and other documented procedures to monitor and control suitable process parameters and product characteristics. These product characteristics include special characteristics, which need specific attention because excessive variation might affect a product's safety, compliance with customer specified characteristics, government regulations, fit, function, appearance or the quality of subsequent manufacturing operations. Qualified operators shall carry out the processes.

Tyco Electronics shall identify key process equipment, monitoring / measuring devices and provide appropriate resources for machine / equipment maintenance and develop an effective, planned total preventive maintenance system. Maintenance activities are deployed to sustain process capability requirements and product quality requirements. *As a minimum, the preventive maintenance system shall include planned maintenance activities, packaging and preservation of equipment, tooling and gauging, availability of replacement parts for key manufacturing equipment and documenting, evaluating and improving maintenance activities. (TS)*

Records shall be maintained for qualified processes, equipment and personnel, as appropriate.

Predictive maintenance methods shall be used to continually improve the effectiveness and efficiency of production equipment. (TS)

7.5.1.1. Control Plans (TS)

Control plans shall be developed and maintained for pre-launch and production operations for raw materials, components and finished product. Control plans shall consider the output from the design and process FMEA's. Control plans shall include: (TS)

- *Controls for the manufacturing process; (TS)*
- *Controls for special characteristics; (TS)*
- *Applicable customer requirements; (TS)*
- *The specified reaction plan when the process becomes unstable or not statistically capable. (TS)*

Control plans shall be reviewed and updated whenever any change occurs affecting the product, manufacturing process, measurement technique, logistics, supplier or FMEA. (TS)

7.5.1.2. Tooling Management (QS) (TS)

A tooling management system shall be implemented which includes: (QS)

- *Maintenance and repair facilities and personnel; (QS)*
- *Storage and recovery; (QS)*
- *Setup; (QS)*
- *Tool change programs for perishable tools; (QS)*
- *Tool modification, including tool design documentation and engineering change level; (QS)*
- *Tool identification and defining the status of the tool. (QS)*

The Business Unit shall provide resources for tool and gauge design, fabrication and verification activities. (TS)

The Business Unit is responsible for monitoring these activities when any of this work is completed by external suppliers. (TS)

7.5.1.3. Delivery

Tyco Electronics shall arrange for storage that will protect the quality of product after final inspection and test. Product shall be shipped to customers in accordance with the requirements recorded on the distribution shipping papers.

Tyco Electronics shall adhere to up-to-date customer-specified transportation mode, routings, and containers. In addition, records of premium freight shall be maintained.

7.5.1.3.1. Electronic Communication

A computerized system for receipt of customer planning information and ship schedules shall be utilized, unless waived by the customer.

7.5.1.3.2. Production Scheduling

The production scheduling activity shall be order-driven to maintain conformance to customer requirements.

7.5.1.3.3. Delivery Performance Monitoring

Tyco Electronics shall have a systematic approach to develop, evaluate and monitor adherence to established lead-time requirements. A system shall be implemented to monitor performance to customer delivery requirements where corrective actions shall be taken as appropriate.

7.5.1.3.4. Early Warning

An early warning system shall report instances of anticipated late delivery.

7.5.1.3.5. Shipment Notification System (QS)

Unless waived by the customer, a computerized system for on-line transmittal of advanced shipment notifications (ASNs), transmitted timely to shipments shall be maintained. A back-up method shall be in place in the event that the on-line system fails. In such an event it shall be verified that all ASNs match shipping documents and labels. (QS)

7.5.1.4. Servicing

When applicable, procedures shall be established and maintained to ensure that contractual service agreements and product warranties are fulfilled. The procedures shall address verification that service meets customer requirements and / or expectations and that appropriate manufacturing, engineering, and design activities are aware of service concerns. When these procedures exist, problem severity, classification, resolution, *training of servicing personnel (TS)* and emergency service processes shall be addressed.

7.5.2. Validation of Production and Service Processes

7.5.2.1. Process Monitoring and Operator Instructions

Documented process monitoring and work instructions shall be prepared for all employees having responsibilities for operation of production and service processes. These instructions shall be accessible at the workstation. *The work instructions shall be derived from sources such as the quality plan, the control plan, production drawings and the design review process. (TS)*

7.5.2.2. Maintaining Process Control

Process capability or performance, as dictated by the customer requirements, shall be maintained or exceeded. Significant process events (e.g. tool change, machine repair) should be noted on the control charts. When process and / or product data indicate a high degree of capability (e.g. Six Sigma capability), the work instructions may be modified.

Process studies shall be completed on all new manufacturing processes to verify process capability and provide input for control of the process. Manufacturing process documentation shall include operating procedures, measurement, test and maintenance procedures. Objectives for manufacturing process capability, reliability, maintainability, capacity and acceptance criteria shall be documented. (TS)

Process capability or performance shall be maintained as specified by the requirements of the customer part approval process. And shall ensure implementation of the control plan and process flow diagram, including adherence to the specified measurements techniques, sampling plans, acceptance criteria and reaction plans. (TS)

Reaction plans for either unstable or non-capable processes should include containment of process output and 100% inspection. A corrective action plan shall then be completed indicating specific timing and assigned responsibilities to assure that the process becomes stable and capable. The plans are to be reviewed with and approved by the customer when so required. (QS)

7.5.2.3. Modified Process Control Requirements

In some cases, the customer may specify capability or performance requirements. In these cases, the work instructions shall be annotated accordingly.

7.5.2.4. Verification of Process Setups and Operational Changes

Process setups shall be verified whenever a setup is performed (e.g. initial run of a job, material changeover, job change, significant time periods lapsed between runs, etc.). Verification shall include a critical inspection of the initial product produced after the setup is completed.

Job instructions shall be available for setup personnel. *Where applicable, statistical methods of verification shall be utilized. (TS)*

7.5.2.5. Process Changes (QS)

Records of process change effective dates shall be maintained. Changes to promote continuous improvement are encouraged. The customer may be consulted for guidance on approval requirements for such changes. (QS)

7.5.2.6. First Article Examination

First-article examination requirements shall indicate the amount of inspection and documentation required. This objective evidence shall verify that new or modified molds, dies, assembly machines, and other manufacturing tools and processes are capable of producing parts that conform to the engineering drawings and specifications.

7.5.3. Product Identification and Traceability

All production materials in process and in inventory shall be identifiable as to part number, and shall be traceable to revision level, and inspection status. A comparable identification methodology shall apply to sample / prototype / preproduction parts which must meet customer requirements. Configuration control shall be maintained in accordance with documented procedures for product and process change control.

Specific traceability from raw material to final item is not required, with the following exceptions:

- Where alternate polymeric compounds are authorized, the specific raw material identity shall be maintained through final inventory;
- Where lot traceability is required by customer contract and has been properly negotiated as to additional costs and requirements, then records shall be maintained for the unique identification of the individual product or lot;
- The identification of the material part number of the plastic in the housing that touches the metal contact(s) shall be maintained through finished goods inventory.

All product in final inventory shall be date-coded on the part or the package. To the maximum extent possible, the date-code shall identify the week of the manufacturing operation / inspection of the item.

7.5.3.1. Inspection and Test Status

All production materials in-process or in inventory shall be identifiable as acceptable for further processing or shipment. This marking shall appear on each unit container used for handling and storage. This marking may be on cartons, reel tags, routing cards, product travelers, or any other suitable location, provided there is a clear indication that prior verification operations have been performed. The verification status indication shall permit identification of the operator(s) / inspector(s) who performed the prior inspection(s) or review. Records shall be maintained of authorized identifiers.

When required by the customer, additional verification / identification requirements shall be met. (TS)

When the status is identifiable through machine-readable code, there shall be sufficient information provided to identify verification status when the reader is not available.

It shall be the responsibility of the supervisor of any stores area to receive into stock only items that are clearly identified as acceptable.

For the service and support areas of the company, an appropriate indication of approval shall be used; when verification is electronic, this identifier shall take into account computer security measures.

7.5.3.2. Traceability of Design Changes

Manufacturing date codes and factory order numbers are utilized to maintain production lot / batch traceability.

7.5.4. Control of Customer Supplied Product

Documented procedures for the control of verification, storage, and maintenance of customer-supplied product, including customer-owned packaging, for incorporation into the supplies or for related activities shall be established and maintained. Any such product that is lost, damaged or is otherwise unsuitable for use shall be reported to the customer and records shall be maintained.

7.5.4.1. Control of Customer Owned Tooling

Customer-owned tools and equipment used in the manufacture and / or inspection of product shall be permanently marked so that the ownership of each item is visually apparent. Maintenance shall be in accordance with customer contracts.

7.5.5. Preservation and Packaging of Product

Documented procedures shall be established and maintained for handling, storage, packaging, preservation and delivery of product. Methods for handling product that prevents damage or deterioration shall be provided.

Designated distribution warehouse storage areas, general warehouse storage areas or stock rooms are utilized to prevent damage or deterioration of product, pending use or delivery. Appropriate methods for authorizing receipt to and dispatch from such areas shall be stipulated. Each stocking location shall apply appropriate methods for preservation and segregation of

product to ensure that material or product will remain undamaged pending use or delivery. In order to detect deterioration, each stocking area shall, at appropriate intervals, assess the condition of the product.

Inventory systems to optimize inventory turns over time, assure stock rotation, and minimize inventory levels shall be utilized.

Packaging and labeling / marking processes shall be controlled to the extent necessary to ensure conformance to established requirements. This shall include systems to conform to specific customer packaging and labeling requirements.

7.5.5.1. Anti-Static Protection

Where applicable, anti-static protection shall be employed to provide protection against electrostatic discharge (ESD) damage. Packaging Engineering is responsible for establishing the requirements for product packaging. Manufacturing Engineering is responsible for establishment of ESD controls within the manufacturing operations.

7.5.5.2. Packaging and Labeling Audit

The quality plan shall include assessments for adherence to the requirements for packaging and labeling, including, but not limited to, correct part number, count accuracy, and label formats.

7.5.5.3. Shelf-Life

Materials that have a shelf life shall be clearly marked with an expiration date, or a date of manufacture that can be used to calculate an expiration date. Materials shall not be used past the expiration date.

7.6. Control of Inspection, Measuring and Testing Devices

Gages, measuring devices, and testing equipment used to determine the acceptability of components, assemblies, materials, and tooling affecting product quality shall be specified and / or provided by the Engineering, Manufacturing, or Quality functions as appropriate. These shall be controlled and calibrated in accordance with a system that conforms to the requirements and intent of ISO 10012-1, -2 / 17025, or equivalent national or industry standard. Where system test and verification relies on software-controlled devices, the functionality shall be verified through the Quality function. The control of inspection, measuring, and test equipment shall include:

- Process and product measurement devices that provide the required accuracy and precision shall be selected and verified before production. Measuring and monitoring devices shall be controlled to ensure that measurement capability is consistent with measurement requirements.
- All measuring devices used to verify product quality shall be uniquely identified and calibrated at prescribed intervals against certified equipment having a known relationship to a nationally or internationally recognized standard. If no standard exists, the method of calibration shall be identified and recorded.
- Procedures shall be developed for the calibration process and resulting records with adequate controls that protect product quality. All measuring devices shall have an indication of calibration status. If the calibration status indication is invalid, the measuring device shall not be used.

- All inspection, measuring and test equipment that does not require calibration shall be appropriately identified.
- A process shall be established that assesses the validity of previous inspection and test results when measuring devices are found to be out of calibration. Records of this assessment shall be maintained.
- Conditions shall be established that provide a suitable environment for calibration and use of measuring devices and that these devices are stored and handled in a way that maintains accuracy and fitness for use.
- Methods shall be developed to safeguard measuring devices, including test hardware and software, from adjustments which would invalidate the calibration settings.
- Appropriate statistical studies of the variation present in measurement and test systems shall be completed as part of process capability analysis and as specified in customer approved control plans. Such studies shall conform to generally recognized measurement system analysis methodologies.
- All product produced with suspect measuring equipment shall be segregated and audited. Customer notification / product recall shall be considered if suspect product was shipped.
- Non-standard measuring equipment, such as pin detectors, vision systems, etc., shall be verified by the local manufacturing location by using product having known defects or other suitable means. This internal verification schedule shall be established by the Product / Manufacturing Team. The verification results shall be recorded.
- Should non-standard measuring equipment be determined non-functional, it shall be removed from service until it is repaired and declared operational, and another inspection method substituted as developed by the Quality function.
- Devices that are either inactive or unsuitable for use shall be visibly identified and shall not be used.

The variation of measuring and test equipment referenced in the control plan must be analyzed through the completion of appropriate statistical studies. (TS)

7.6.1. Internal Laboratory Requirements (TS)

Tyco Electronics laboratories shall have a defined scope and documented laboratory procedures that are analogous or traceable to the applicable industry standard. Laboratory personnel shall be qualified to conduct testing. Records of test results shall be maintained. (TS)

7.6.2. External Laboratory Requirements (TS)

External laboratories that are utilized for inspection, test or calibration services shall have a defined scope and shall be accredited to ISO / IEC 17025 or national equivalent. There shall be evidence that the external laboratory is acceptable to the customer. (TS)

8. MEASUREMENT, ANALYSIS AND IMPROVEMENT

8.1. Inspection and Testing

Processes shall have sufficient controls at all stages to ensure that only acceptable products and services are delivered to internal operations or to the external customer. Defect prevention techniques – particularly statistical process control, error proofing, and / or automated techniques – shall be used wherever possible. Inspection and test results shall be recorded.

8.1.1. Statistical Techniques

The Quality organization shall identify the need for and use of statistical techniques required for establishing, controlling, and verifying process or product inputs that impact product characteristics and process capability. Statistical tools, if applicable, for each process or product should be determined during the design assurance process or as a result of a Six Sigma project or the QOS reviews. The SPC requirements shall be included in the appropriate control plan. Process measurements shall be implemented and monitored at the appropriate points to ensure continual product conformance and to promote increased effectiveness of the process.

The appropriate personnel should understand basic statistical concepts such as variation, control (stability), process capability and over-adjustment. Understanding and deployment of statistical concepts shall be accomplished through training and documented procedures; refer to Manual 402–105 (Quality tools and Statistics Reference Guide).

Appropriate statistical tools for each process shall be determined during the advanced quality planning process and included in the control plan. Basic statistical concepts shall be understood and utilized throughout the organization. (TS)

8.2. Monitoring and Measurement

8.2.1. Customer Satisfaction

There shall be a documented process for determining customer satisfaction, including frequency of determination, and how objectivity and validity are assured. Trends in customer satisfaction and key indicators of customer dissatisfaction shall be documented and supported by objective information. As appropriate, these trends should be compared to those of competitors, or benchmarks, and reviewed by senior management.

Customer satisfaction data are received in a variety of methods, including:

- Feedback received in response to answers to customer complaints;
- Dialogue between the customer and Field Sales or Product Management which is then documented in a Field Report or trip visit summary;
- Industry positioning surveys;
- Lost business reports;
- Supplier “report cards”;

- Meetings with customers;
- Ship to customer request performance.

Customer satisfaction / dissatisfaction will be included as a topic within the senior level management review. If applicable, actions taken will be monitored within the management review process.

Customer recognition and awards are posted on the Tyco Electronics Intracomm and the Quality Systems and Engineering Assurance websites. In addition, numerous other reporting methods exist, including Global Delivery Scorecard, backlog status, Customer Service metrics and local QOS reviews.

Performance indicators for customer satisfaction shall be based on objective data and include, but not be limited to: (TS)

- *Delivered product quality performance; (TS)*
- *Customer disruptions, including return material; (TS)*
- *Delivery performance, including premium freight; (TS)*
- *Customer notifications related to quality or delivery issues. (TS)*

Manufacturing process performance shall be monitored to demonstrate compliance with customer requirements for product quality and process efficiency. (TS)

8.2.2. Internal Audit

Quality system audits shall be conducted annually to verify compliance with planned arrangements, effectiveness, and suitability to meet objectives of the Tyco Electronics Total Quality Management Process, and ISO 9001, TL 9000, QS 9000 and / or TS 16949. Results of these audits shall be reviewed by management as feedback for continual improvement and verification of conformance to the quality system. Records of such audits and reviews shall be maintained.

Each organization shall conduct audits of the quality system in accordance with established specifications at regular intervals based on status and importance of the activity. Audits of the quality system shall be carried out by qualified personnel independent of those having direct responsibility for the area being audited and should cover all shifts. Follow-up audit activities shall verify and record the implementation and effectiveness of the corrective action taken.

Internal audits shall cover all the quality system, activities and shifts and shall be completed in accordance with an annual plan. When nonconformities (internal and external) or customer complaints occur, the audit frequency shall be appropriately increased. (TS)

The effectiveness of each manufacturing process shall be evaluated through audits that are completed at defined intervals. Product audits shall be completed at appropriate stages of the production process. (TS)

8.2.2.1. Customer Surveys and Inspection of Facilities

Tyco Electronics recognizes that it will be necessary for some customers to perform supplier audits. During such customer surveys, source inspections, or quality audits, employees shall neither demonstrate nor discuss manufacturing equipment, processes, methods, etc. which are considered to be proprietary. In those circumstances where the customer may require additional information about aspects of manufacturing considered proprietary, additional consideration may be possible through the use of confidential disclosure agreements.

Customer requests to review nonproprietary manufacturing inspection data, including review of SPC data, capability data, and other statistical data shall be supported. However, Tyco Electronics reserves the right to deny requests for process data below the level of the customer drawing / specification on the premise that such information is regarded as proprietary.

8.2.3. Quality Management System Processes Monitoring and Measurement

The results of the audits of the quality system, coupled with the assessment of customer satisfaction and dissatisfaction shall be the primary indicators of the effectiveness of the defined Total Quality Management system. When audits determine an inadequacy in the implementation of the Quality Management system, appropriate corrective action shall be taken. This corrective action could include, but is not limited to:

- Development and deployment of training to bring actual practice into alignment with documented requirements;
- Change the documented requirements to ensure alignment with current business needs and practices;
- Change the documented requirements to cause deployment of new practices.

The manufacturing process documentation and / or the quality inspection plan shall include measurements and control points to ensure the continued suitability and effectiveness of the process to produce conforming product.

8.2.4. Monitoring and Measurement of Product

Product characteristics shall be measured and monitored throughout the manufacturing process to ensure that the product meets the established requirements. Usually these inspection and testing activities are documented in a quality inspection plan for the part number, product or process. Evidence of conformity with the acceptance criteria shall be maintained and the records shall identify the individual(s) completing the inspection activities.

Where applicable, inspection plans shall classify characteristics for impact on the customer. This impact shall be guided by the following:

- Critical characteristic – a characteristic where judgment and experience indicate that nonconformance is likely to result in hazardous or unsafe conditions for individuals using or depending on the product or service;

- Major characteristic – a characteristic other than critical, where nonconformance renders the product incapable of performing its intended function or materially reduces the usability of the product or service;
- Minor characteristic – a characteristic including workmanship, appearance, etc., where nonconformance does not materially reduce the usability of the product or service.

8.2.4.1. In-Process Inspection

In-process inspection, test, or review operations shall be clearly identified in all process documentation. The Quality function shall be responsible for ensuring that appropriate inspection, test, or review operations are included. They shall also ensure that adequate instructions are provided for such operations and that adequate records are maintained and properly retained. All nonconformances at these operations shall be identified, segregated from acceptable material (when practical), and shall become the responsibility of the Quality function, which shall coordinate disposition and corrective action.

Where operator inspection or automatic inspection devices are utilized to determine product acceptance, appropriate product auditing shall be maintained to insure the integrity of the Quality System.

Where in-process inspection, test, or review operations are performed by other than the Quality function (such as an engineer, technician, operator, setup person, or team member), records of verification performed and results of that verification must still be provided and retained.

One of the goals of the quality system is to direct process activities toward defect prevention methods rather than defect detection. (QS)

8.2.4.2. Final Inspection

When specified in a documented procedure, final inspection and / or testing are performed to complete the evidence of conformance of the finished product to established requirements. Records of final inspection / testing shall be maintained.

All finished goods shall have visible indication of acceptability. This acceptability indication normally shall be applied during or following the final manufacturing inspection operation. However, if the Quality function has identified the need for a final inspection or audit operation, the evidence of acceptability will be applied after product compliance is verified.

Quality Assurance shall coordinate the activity of layout inspection and functional verification at a frequency as negotiated with the customer.

Final package material audits (e.g. product integrity, packaging, labeling, documentation, quantity, marking) should be scheduled at appropriate intervals.

8.2.4.3. Sampling Inspection Strategies

When sampling inspection is used, the following shall apply:

Attribute sampling:

- Critical characteristics shall be controlled to ensure 100% conformance;

- Major and minor characteristics shall be subjected to zero–acceptance–number sampling plans.

Variables sampling plan shall be in accordance with the quality inspection plan or control plan as applicable.

“Skip Lot” strategies may be used when supported by inspection history.

8.2.4.4. Re–Testing

If design changes or changes to the manufacturing process that have the potential of affecting the form, fit, or function of the product are specified by customer requirements, agency requirements or when determined by a requirement established within the design review process, the Quality function shall coordinate requalification testing. Product / Development Engineering, in concert with the test laboratory, will define the content of the re–testing. Requalification tests may be limited to those tests that are affected by the design or manufacturing process change. Quality Assurance may also request requalification testing in response to analysis of field failure data, product extensions, manufacturing process location changes or material changes. The utilization and frequency of requalification testing shall be in accordance with the customer contracts or as established by the Business Unit Quality and Engineering functions to periodically reassess the ability of the product to continue to meet the requirements of the product specification.

8.3. Control of Nonconforming Product

All product – whether production materials, components, assemblies, final product, or other types of work – detected or suspected as not conforming to requirements shall become the responsibility of the Quality function for:

- Controlling further movement of the material to prevent material from unintended use or delivery;
- Documenting and reviewing material;
- Coordinating the disposition action;
- Notifying appropriate personnel;
- Initiating and verifying corrective action and effectiveness;
- Establishing and tracking a prioritized defect reduction plan;
- Trend analysis and providing input for corrective and preventive action.

Nonconforming or suspect nonconforming material, including unidentified material, shall immediately be positively and visually identified as nonconforming, and shall be prevented from inadvertent further processing, where practicable, by storage in an area that is visually identified and segregated for this purpose.

Review and disposition of nonconforming or suspect nonconforming material shall be coordinated by Quality with the appropriate operations / manufacturing and engineering functions. The material may be sorted, reworked, returned to the supplier, scrapped, or deviated.

Nonconforming product may be released for use when a deviation has been processed and approved. All deviations shall clearly specify the temporary limits of acceptability, state the definitive corrective action and be approved by the appropriate engineering functions. If the affected dimension, feature, or characteristic is a specified customer requirement, no deviation shall be issued unless the customer has granted documented concession. This applies equally to product or services purchased from suppliers. The Business Unit shall concur with any requests by a supplier before submission to the customer. The Business Unit shall maintain records of the expiration date or quantity authorized. The Business Unit shall also ensure compliance with the original or superseding specification and requirements when the deviation expires. Internally, components shipped under deviation shall reference the deviation number on each unit container. Material shipped with authorization for concession shall be identified on each shipping container as required by the customer.

If the nonconforming material is accepted for rework / repair, rework instructions shall be provided and the material shall be reinspected to an approved quality plan before it returns to the process. Authority to dispose of defective material shall be defined by the manufacturing organization.

Records of nonconforming material transactions, including deviations, shall be maintained.

8.4. Measurement and Analysis of Organizational Performance

The Quality Assurance Director / Manager and each Business Unit Director shall have the responsibility to maintain performance data including the required TL 9000 metrics, *TS 16949 measurements, (TS)* and trends in quality, customer satisfaction and / or dissatisfaction, operational performance (e.g. productivity, efficiency, effectiveness) for key products and services. Customer satisfaction / dissatisfaction is evaluated through several tools that may include: customer complaints, customer feedback responses, the Quality Operating System (QOS) process, reports and information from Field Sales and Product Management and from Industry Reports. Trends in quality and operational performance shall be compared with progress toward objectives. Data shall be translated into actionable information to support the Quality Policy, business plans, and customer satisfaction. Business Unit Management on a periodic basis shall evaluate the measurements and goals.

All functions shall utilize facts, data, and quality records for improvement planning, for minimizing repetitive nonconformance situations, and for determining corrective / preventive action strategies. As appropriate, summaries of quality costs, in-process and final inspection results, quality audits, disposition of nonconformances, supplier performance and requalification test activity shall be prepared by the Quality function and submitted to management.

8.5. Improvement

One of the major objectives of the Tyco Electronics Total Quality Management Process and the Six Sigma Operational Excellence initiative is to foster improvement in all aspects of our business. The company strives to improve the satisfaction of our customers with our products and services. This can be best accomplished by the on-going initiatives to improve the quality and reliability of our products and to improve the operating effectiveness of the manufacturing equipment and processes. Employees are encouraged to review the information posted on the Tyco Electronics Intracomm website to learn more about the various improvement tools and for feedback on customer satisfaction.

8.5.1. Continual Improvement

The Business Units shall promote and manage continual improvement in quality, productivity, service, and value. Improvement projects shall include as appropriate: external customer, corporate, supplier, safety and regulatory requirements. Continual improvement shall be measured against goals and objectives. One or more of the following techniques may assist with achieving the goals and objectives:

- **Quality Operating System (QOS):**
A regular review by management to demonstrate that processes are meeting customer requirements and internal continual improvement goals; utilizing trend chart(s), goal(s), Pareto analysis, problem summary chart(s), and verification chart(s).
- **LEAN:**
A series of tools and techniques that focus on process optimization through cycle time reduction and the elimination of waste.
- **Successfully Demonstrated Practices (SDP):**
A total employee involvement technique focused upon implementing best practices that are successfully deployed in Tyco Electronics facilities.
- **Manufacturing Resource Planning (MRP):**
A formal process for integrating and controlling all business planning processes for the purpose of balancing supply and demand in the most effective and efficient way.
- **Application of Statistical Sciences:**
Utilization of the “Engineering for Quality” tools, including: Statistical Process Control (SPC), Design of Experiments (DOE), Regression Analysis, Analysis of Variance (ANOVA).
- **Management Methods:**
Self Assessment and Gap Analysis (SAGA), ISO 9001 / AS 9100 / ISO 9004 / TL 9000 / QS-9000 / TS 16949 assessments, benchmarking, suggestion systems, taskforce teams, cross functional teams, Performance for Business Results, performance reviews, training, apprentice programs, bonus programs and business planning.

Continual improvement shall focus upon control and reduction of variation in product characteristics and manufacturing process parameters. (TS)

8.5.1.1. Quality Improvement Program

The spirit of our quality improvement program is to cost effectively achieve the basic tenets of the Tyco Electronics Quality Policy: delivery of error free products and services, on time. Improvement initiatives should be directed at reaching this state of “zero defects”. This quality improvement program consists of many activities including:

- The on-going review of this Quality Manual and the supporting documents;
- Actions resulting from audits, management review, corrective action, preventive action and the Quality Operating System (QOS) process;
- Analysis of customer provided information, such as satisfaction data, supplier performance reports, and data relative to the quality and reliability of our products;
- Analysis of measurements and actions directed at improving customer satisfaction, process performance, and product quality, such as improving delivery, improving response time to customer communications, decreasing scrap, improving manufacturing utilization, decreasing inventory, and reducing design and manufacturing lead times.

As stated in the Quality Policy, continual improvement is the personal responsibility of each employee. Formal methods for encouraging employee involvement may include: employee recognition systems, employee suggestion systems, department / shift / team meetings, bonus programs, and participation on problem solving or improvement teams.

8.5.2. Corrective Action

Corrective action eliminates the root cause of a known problem; it is reactive. Preventive action eliminates the root cause of an anticipated problem; it is proactive. A problem is an undesirable effect that involves any situation that results in customer dissatisfaction or waste.

In all cases where a nonconformance is identified or where analysis indicates a nonconformance, the responsible function shall be notified in writing and shall receive a corrective action statement. The corrective action plan shall be reviewed with the function(s) responsible for implementation of the corrective action. The function responsible for corrective action shall use disciplined problem solving methods and mistake proofing methodologies. Additional guidance on the corrective action and preventive action processes is available in the Quality Tools and Statistics Reference Guide.

A system shall be implemented and maintained to transfer any customer complaints to the owning Business Unit such that the issues may be resolved in a timely fashion as defined by the customer.

Where a nonconformance is identified, the responsible Business Unit shall implement corrective action according to documented procedures. Unless there is a specific format required by the customer, the Eight Discipline (8-D) process for problem solving and corrective action shall be utilized for all complaints received from external customers. Consideration should be given to utilizing the Eight Discipline process when responding to internal failures. Corrective action shall be to the degree appropriate to the magnitude of the problem and commensurate to the risks encountered. Understanding the benefits, risks, and costs are crucial in maintaining a balance in implementing the Total Quality Management Process. The corrective action process shall include but not be limited to:

- The effective and timely handling of customer complaints, return of defective material, reports of product nonconformance (from internal operations and external suppliers), and internal and external audit corrective action requests;
- Identifying and investigating the root cause of nonconforming product, nonconforming processes, and systemic quality system deficiencies, and recording the results of the investigation;
- Determining the corrective action needed and applying controls to ensure corrective action is taken and root cause has been addressed;
- Implementing and recording changes in procedures resulting from corrective action;
- Analyzing customer impact and notifying customers who are under contract for notification;
- *Prompt notification of the persons responsible for corrective action when a product or process fails to meet the required specifications. (QS)*

Records of the results of action taken shall be maintained and shall be included as an input for management review.

8.5.3. Preventive Action

Preventive action can take two forms. The first is the elimination of potential failure modes. This technique should be deployed in the advanced quality planning stage of new product or process development. The designer and the design assurance engineers are responsible for deploying these quality tools. The following tools shall be considered when designing a new product or process:

- Design FMEA's;
- Process FMEA's;
- Quality Function Deployment;
- Similar product / process baselining / benchmarking;
- Design of Experiments.

The second form of preventive action is the elimination of potential failure modes when information from processes, systems, work operations, process capability studies, yield analyses, deviations, concessions, quality records, audit reports, service reports, or customer complaints suggests a nonconformance may occur. Steps shall be taken according to documented procedures to eliminate potential nonconformances. The minimum, preventive action process should include, but not be limited to:

- Determining the steps needed to verify or deny the potential nonconformances;
- Gathering and analyzing the required data;
- Determining the effectiveness of the implemented containment actions;
- Applying controls to ensure the solution is effective in resolving the problem at an acceptable level corresponding to the risks encountered;

- Reviewing preventive action activities by management for trends and impact on procedures, products, processes, and systems.

The following tools should be considered:

- Product and process audits;
- Equipment preventive and productive maintenance;
- Value-added audits;
- Review of Product and Process FMEA's.

Records of preventive action shall be maintained and shall be included as an input for management review.

8.5.3.1. Alternative Action

If corrective / preventive action is not implemented, one of two alternatives shall be exercised:

- The responsible function shall change the requirements for the item in question so that the nonconforming condition is acceptable by specification or drawing; or
- A fixed-quantity or fixed-duration deviation may be issued. No nonconforming condition shall be deviated for a period exceeding 12 months. The Quality function incorporates the deviation into the inspection acceptance instructions as necessary.

8.5.4. Six Sigma Operational Excellence

Six Sigma Operational Excellence is a comprehensive approach to business process improvement. Six Sigma Operational Excellence is lead by senior management and deployed through Champions, Master Black Belts, Black Belts and Green Belts. Breakthrough improvement is achieved through the disciplined methodology known as the DMAIC process. Within Tyco Electronics, the tools utilized for Six Sigma projects are a blend of the traditional statistical tools and the tools associated with LEAN technology.

The basic elements of the DMAIC process:

Define:

- Identify the gap in meeting the business strategy or objective
- Establish the scope and boundary for the project
- Identify the Black Belt and the project team
- Establish the project goals and savings
- Obtain the endorsement of the Business Executive

Measure:

- Understand the current process
- Characterize the baseline performance
- Determine measurement capability

Analyze:

- Understand the key product performance characteristics and how they are impacted by the process variables
- Understanding of the relationship between the input and output variables

Improve:

- Identification of the root cause of the variation
- Identification of what needs to be done to close the performance gap
- Deploy appropriate tools

Control:

- Document revised process parameters to maintain the gains
- Return the process to the process owner and sustaining operations