Quality Manual

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Applicable Locations

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Note- This document is maintained in multiple languages. Any revision must be made to all versions.

1. Index and Revision

1.1 Index

1.2 Amendment Status

Rev	Date	Change
-	5/12/04	Initial Release, supersedes the following documents: LORD Mechanical Products Quality Manual, MPQM, revision P LORD Chemical Products Quality Manual, Revision 09/10/2003
A	07/27/04	Adopted by Elverson, July 1, 2004. Supersedes Metech Quality Manual, Rev G, 7/03
A	07/27/04	Revised 4.2.3.1 to: [[The review of customer engineering standards/specifications and changes that impact delivery of customer requirements shall be completed within two weeks maximum.]] - was - [[This review shall not exceed two working weeks for engineering standards/specifications that impact current production.]] Added: Implementation includes updated documents "and if required, customer approval of changes."
A	07/27/04	Added 5.5.2.1: Customer Representative. [[The President and CEO appoints personnel, in accordance with documented procedures, the responsibility and authority to ensure customer requirements are addressed. This includes selection of special characteristics, setting quality objectives and related training, corrective and preventive actions, product design and development.]]
A	07/27/04	Revised 5.6.1 to: The primary forum for management review is the quality council channel consisting of (increasing in level) the plant quality council, the corporate quality council, and the Supply Chain Excellence committee. - was -The ongoing quality review is part of the agenda of the Supply Chain Excellence Committee and the Sales and Operations Planning process.
A	07/27/04	Added to 5.6.2: i) [[summary results at specified design and development stage, Ref: 7.3.4.1]].
A	07/27/04	Added to 7.1.2: For attribute data sampling, the acceptance level is zero defects.
A	07/27/04	Added to 7.1.4: for "product and process" changes
A	07/27/04	Added to 7.3.4.1: These measurements include quality risks, lead-times, critical paths and others, as appropriate]].
A	07/27/04	Added to 7.3.5: Verification "of product and manufacturing processes"
A	07/27/04	Added to 7.3.6: Validation "of product and manufacturing processes"
A	07/27/04	Revised 7.3.6.3 to: Supplier - was - customer.
A	07/27/04	Added to 7.5.1.7: LORD establishes and maintains a process for communication of service concerns including external non-conformances to manufacturing, engineering, and design activities
A	07/27/04	Revised 7.5.1.8 to: LORD does not enter into formal service agreements - was - Not applicable – Service agreement contracts do not apply to LORD.
A	07/27/04	Added to 7.5.2: LORD validates all processes for production. Validation demonstrates the ability of these processes to achieve planned results.
A	07/27/04	Revised 7.5.3 to: LORD identifies the product by suitable means throughout product realization. - was - where appropriate, LORD identifies the product by suitable means throughout product realization.
A	07/27/04	Revised 8.2.4 to: For attribute data sampling, the acceptance level is zero defects (i.e., the plan precludes acceptance of lots whose samples have known nonconformances). - was - the plan precludes the acceptance of lots whose sample has known nonconformities.
NC	11/8/04	Changed reference in 4.2.2, regarding the process interaction model, from Appendix A to associated document LQM-PIM-01. Removed Process Interaction Model from Appendix A. Renumbered Appendix B, Organization chart as Appendix A. Did not change the revision level since there was no change in the system, only in document format.
B	05/03/2006	Updated section 2.3 to reflect regulatory agency name change from Joint Aviation Authorities (JAA) to European Aviation Safety Agency (EASA). Updated section 5.6.1 Management Review to reflect current process. Changed "Manager, Global Quality" to "Director, Global Quality and Process Improvement" to reflect current title and restate delegation. Update 7.4.1.2 to include an exception for small suppliers. Updated Appendix A Organization Chart to reflect current organization. Also capitalize all letters of LORD throughout the manual.
C	02/29/2008	Added applicable locations to cover sheet, per request of the FAA, to clearly indicate that the manual applies to the aerospace facilities.

D	09/22/2008	Added Lord de Mexico to the Applicable Locations – Title Page. Update organizational chart to include regional support facilities reference.
E	12/31/2009	Added reference to LQM-SSS-004 in Introduction where the site specific scope is listed for each facility. Updated document to reflect the needs of ISO 9001:2008 and ISO/TS16949:2009. Updated Introduction to include reference to FAA-PMA extension to Cambridge Springs.
F	04/08/2010	Added note to comply with the changes in 14 CFR Part 21 issued October 16, 2009. Note states that references to “parts/product” should read as “articles” for all civil aeronautical applications. In specific references to FAA documents, the words “product or part” were replaced with the word “article”.
G	12/20/2011	Updated document to reflect the needs of AS9100 Revision C. Removed the Elverson location from Applicable Locations. Updated the Organizational Chart.
H	06/25/2014	Updated Applicable locations to include Robison Road, Erie PA and the Williston location. Updated Appendix A Organization Chart to reflect current organization. Updated sections 2.3, 4.2.2 and 7.3.7 in regards to regulatory requirements.
J	03/16/2015	Updated applicable locations to remove West 12th Street and Grandview, Erie PA. Updated Appendix A Organization Chart to reflect current organization.

2 Introduction

2.1 LORD Corporation

LORD Corporation develops, manufactures, and markets innovative adhesive, coating, and motion management products and services for business-to-business niche markets. LORD Corporation, a privately-owned company, originated in Erie, Pennsylvania and was founded in 1924 as LORD Manufacturing Company. LORD Corporation is headquartered in Cary, North Carolina; domestic and international manufacturing facilities and business offices are located throughout the world.

2.2 LORD Quality Management System

LORD Corporation's quality management system (QMS) meets the requirements of ISO 9001:2008, ISO/TS 16949:2009, AS9100C and specific customer and statutory and regulatory requirements. For site specific QMS scope summaries, see LQM-SSS-04.

Key for quality system requirements:

ISO9001:2008	Selections in regular type apply across the organization.
AS9100C/FAA Regulations:	Italicized selections in [*Brackets*] are selectively applied to Aviation, Space and Defense materials/processes, including articles governed by FAA regulations.
ISO/TS 16949:2009	Selections in [[double brackets]] are selectively applied to OEM automotive materials/processes.

The purpose of the Quality Manual is to document the quality system and policies and to inform LORD customers of the controls implemented to assure product quality. The Quality Manual provides for a quality management system to:

a) consistently provide products that meet customer and applicable statutory and regulatory requirements,
b) enhance customer satisfaction through effective application of the quality system, including processes for continual improvement of the system and assurance of conformity to customer and applicable statutory and regulatory requirements.

2.3 Regulatory Authority Approvals

LORD Corporation holds an FAA-issued production approval to manufacture articles under a Parts Manufacturer Approval (PMA). Reference FAA Order 8120.22. The Erie Pennsylvania facility is the original and principal Production Approval Holder (PAH) facility [PQ0466NE]. An associate facility is located in Cambridge Springs Pennsylvania, and a separate PAH facility [PQ2716CE] is located in Dayton Ohio. All three facilities operate under the same FAA-approved quality system, and use the same design data and manufacturing procedures and processes. Control of the design, as well as the quality of the article for which the approval was granted, is maintained by Erie as the principal facility.

As the principal facility, Erie is also responsible for the acceptance and/or approval of all proposed changes to approved data and the approved quality manual, and for immediate notification to the FAA of all changes that may affect the inspection, conformity, or airworthiness of its articles.

The Cambridge Springs and Dayton facilities are authorized to manufacture complete PMA articles provided adequate housing, qualified personnel, and required equipment/tooling is available. Both facilities are also authorized to request appointment of DMIRs in accordance with FAA Order 8100.8. Authorization is limited to articles only for function codes 01, 03, 05, 06, and 07. Shipment of any PMA article or component thereof to a LORD Corporation customer is also authorized.

MRB authority for PMA articles has been granted to the Cambridge Springs and Dayton facilities with no limitations. No re-delegation of Material Review authority to other facilities or suppliers performing manufacturing and/or processing of PMA articles is permissible.

Annual quality system audits of the Erie, Cambridge Springs, and Dayton facilities are conducted by the LORD Corporation Global Quality Department to ensure compliance with the LORD Corporation Quality Manual (LQM).

The Erie facility operates an approved repair station/maintenance organization. Approval has been granted by the following regulatory authorities:

Federal Aviation Administration (FAA) per 14 CFR Part 145, FAA Repair Station Number: **GV1R180K**
European Aviation Safety Agency (EASA) per EASA-145, EASA Reference Number: **EASA.145.4643**
Egyptian Civil Aviation Authority (ECAA) per ECAA Part 145, ECAA Number: **CAI/LORD/AS/01/03**

The scopes of these approvals (capabilities and limitations) are defined in certificates issued by the regulatory authorities. Controls applicable to these approvals are as defined within this manual and the applicable repair station and maintenance organization manuals.

This manual and the quality system registration certificates are available for review at www.lord.com.

Approved by:	Name	Title
Document Owner:	Patricia J. Snippert	Quality Manager, Global Quality
Sponsoring Authority:	Cynthia R. Fowle	Director, Global Quality & Process Improvement
Approval:	Ed L. Auslander	President / CEO

Document approved electronically.

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3 Quality Policy

LORD Corporation is committed to providing products and services that consistently meet our customers' expectations of quality and value. We continually monitor and improve our processes as a means to ensure overall customer satisfaction, achieve our quality objectives, and share best practices.

This quality policy has been established by senior management of LORD Corporation to guide the actions of all employees regarding quality. To ensure that it is understood and implemented at all levels of LORD, the quality policy is explained and discussed during general orientation of new employees, and is reviewed annually with all employees.

All employees are responsible for understanding their customers' and co-workers' requirements and the processes by which they are met, and for performing these processes as defined. In addition, all employees are empowered to initiate improvement actions within established change guidelines, and are expected to participate in formal improvement initiatives to assure that changing customer and co-worker value expectations are continually met.

4 Quality Management System

4.1 General Requirements

LORD maintains and implements a documented quality management system (QMS) and continually improves its effectiveness in accordance with the requirements of the applicable quality system standards and specific customer and statutory and regulatory requirements.

LORD
a) determines the processes needed for the QMS and their application throughout LORD,
b) determines the sequence and interaction of these processes,
c) determines criteria and methods needed to ensure that both the operation and control of these processes are effective,
d) ensures the availability of resources and information necessary to support the operation and monitoring of these processes,
e) monitors, measures where applicable, and analyzes these processes, and
f) actions necessary to achieve planned results and continual improvement of these processes.

When processes that affect product conformity with requirements are outsourced, LORD maintains responsibility for meeting customer requirements, by ensuring appropriate controls over such processes. LORD identifies the type and extent of control to be applied within the QMS.

[NOTE: To comply with the changes in 14 CFR Part 21 issued October 16, 2009, references to "parts/product" should read as "articles" for all civil aeronautical applications. Per 14 CFR Part 21, an article is defined as a material, part, component, process, or appliance.]

4.2 Documentation Requirements

4.2.1 General

The QMS documentation includes:
a) documented quality policy and quality objectives,
b) this quality manual,
c) documented procedures and records required by the applicable QMS standards, customers, and applicable regulatory authorities, and
d) documents and records determined by LORD to be necessary to ensure the effective planning, operation, and control of its processes.

LORD ensures that personnel have access to QMS documentation and changes and are aware of relevant procedures. Customer and regulatory authority representatives are provided access to QMS documentation.

4.2.2 Quality Manual

This manual is maintained by Global Quality Management in accordance with document control requirements and includes:

a) the scope of the QMS, including details of and justification for any exclusion,
b) a description of the interaction between the processes of the QMS (see associated document LQM-PIM-01).

Documented procedures have been established for the QMS. LORD maintains a cross-reference of the relationship between the various QMS requirements and the documented QMS procedures (see associated document LQM-xref, "Procedure Cross-Reference to Requirements").

[*Procedures requiring FAA approval prior to implementation are contained in LQM-FAAref, "LORD FAA Referenced Documents Index". This revision controlled document lists the document number, title, and current revision level of the required procedures. When any of these procedures are revised, this document will be updated, and sent with the revised procedure for FAA review and approval prior to release and implementation at LORD. In the event that the FAA notifies LORD that a revision is not acceptable, LORD Global Quality will work with the document owner to revise the document and resubmit it to the FAA for review and approval*.]

4.2.3 Control of Documents

Documents required by the QMS are controlled.

A documented procedure has been established to define the controls needed:

a) to approve documents for adequacy prior to issue,
b) to review and update as necessary and re-approve documents,
c) to ensure that changes and current revision status of documents are identified,
d) to ensure that relevant versions of applicable documents are available at points of use,
e) to ensure that documents remain legible and readily identifiable,
f) to ensure that documents of external origin that are necessary as determined by LORD for the planning and operation of the QMS are identified and their distribution controlled, and
g) to prevent the unintended use of obsolete documents, and to apply suitable identification of them if they are retained for any purpose.

LORD ensures that personnel have access to, and are aware of, relevant QMS documentation and changes.

4.2.3.1 Engineering Specifications

LORD has implemented a process to ensure the timely review, distribution, and implementation of all customer engineering standards/specifications and changes based on customer-required schedule. [[The review of customer engineering standards/specifications and changes that impact delivery of customer requirements shall be completed within two weeks maximum.]]

LORD maintains a record of the date on which each change is implemented in production. Implementation includes updated documents and if required, customer approval of changes.

4.2.4 Control of Records

LORD establishes and maintains records that provide evidence of conformity to requirements and of the effective operation of the QMS. These records are controlled to assure that they remain legible, readily identifiable and retrievable. A documented procedure has been established to define the controls needed for the identification, storage, protection, retrieval, retention time and disposition of records, [*including records that are created by and/or retained by suppliers*]. Records are available for review by customers and/or regulatory authorities in accordance with contract or regulatory requirements, for the specified record retention period.

5 Management Responsibility

5.1 Management Commitment

Executive management (Officers) provides evidence of its commitment to the development and implementation of the QMS and continually improving its effectiveness by:

a) communicating to LORD employees the importance of meeting customer as well as statutory and regulatory requirements,
b) establishing the quality policy,
c) ensuring that quality objectives are established,
d) conducting management reviews, and
e) ensuring the availability of resources.

5.1.1 Process efficiency

Senior management (responsible functional managers) reviews the product realization processes and the support processes to assure their effectiveness and efficiency.

5.2 Customer Focus

Senior management (responsible functional managers) ensures that customer requirements are determined and are met with the aim of enhancing customer satisfaction, by ensuring the establishment of processes for identification, review and implementation of customer requirements and monitoring of customer satisfaction.

Senior management ensures that product conformity and on-time delivery performance are measured and that appropriate actions are taken if planned results are not, or will not be, achieved.

5.3 Quality Policy (see section 3 of this manual)

Executive management (Officers) ensures that the quality policy:
a) is appropriate to the purpose of LORD,
b) includes a commitment to comply with requirements and continually improve the effectiveness of the QMS,
c) provides a framework for establishing and reviewing quality objectives,
d) is communicated and understood within LORD, and
e) is reviewed for continuing suitability.

5.4 Planning

5.4.1 Quality Objectives

Executive management (Officers) ensures that quality objectives, including those needed to meet product requirements and to deploy the quality policy, are established and documented at relevant functions and levels within LORD. Measurable quality objectives are established during the annual planning process and are included in the business plan.

5.4.2 Quality Management System Planning

Senior management (responsible functional managers) ensures that:
a) the planning of the QMS is carried out in order to meet the requirements given in 4.1, as well as the quality objectives, and
b) the integrity of the QMS is maintained when changes to the QMS are planned and implemented. Changes to the quality system are approved by applicable regulatory authorities and customers, if required, prior to implementation.

5.5 Responsibility, Authority, and Communication

5.5.1 Responsibility and Authority

Senior management (responsible functional managers) defines and communicates responsibilities and authorities within LORD through organization charts, position descriptions, and operating policies and procedures.

This includes responsibilities and authorities to assure customer requirements are addressed (i.e., selection of special characteristics, setting quality objectives and related training, corrective and preventative actions, and product design and development).

5.5.1.1 Responsibility for Quality

Managers with responsibility and authority for corrective action are promptly informed of products and processes that do not conform to requirements.

Personnel responsible for product quality have the authority to stop production to correct quality problems.

Production operations across all shifts are staffed with personnel in charge of, or delegated responsibility for, ensuring product quality.

5.5.2 Management Representative

The President and CEO of LORD Corporation appoints the Director, Global Quality and Process Improvement as the Management Representative. The Management Representative has unrestricted access to top management and has the authority, responsibility, and organizational freedom to:

a) ensure that processes needed for the QMS are established, implemented and maintained,
b) report to executive and senior management on the performance of the QMS and any need for improvement,
c) ensure the promotion of awareness of customer requirements throughout LORD,
d) resolve matters pertaining to quality, including the control of further processing, delivery, or installation of nonconforming product until the deficiency or unsatisfactory condition has been corrected, and
e) ensure that the system always complies with the requirements of the applicable QMS standards, and specific customer and regulatory requirements

The Director, Global Quality and Process Improvement delegates this responsibility through the Quality Organization to each manufacturing facility and support facility for administration of the quality system at the local level.

Delegation of quality assurance activities, when applicable to a particular facility, is in accordance with defined procedures detailing the specific responsibilities and training requirements.

5.5.2.1 [[**Customer Representative**]]

[[The President and CEO appoint personnel, in accordance with documented procedures, the responsibility and authority to ensure customer requirements are addressed. This includes selection of special characteristics, setting quality objectives and related training, corrective and preventive actions, product design and development.]]

5.5.3 Internal Communication

Senior management has established appropriate communication processes within LORD and communicates information regarding the effectiveness of the QMS at appropriate levels within the organization.

5.6 Management Review

5.6.1 General

Senior management (at a minimum, the Vice President, Global Operations; Vice President, Research and Technology; Plant Management; and other responsible management, as defined) reviews LORD's QMS at planned intervals and at appropriate levels within the organization, to ensure its continuing suitability, adequacy, and effectiveness. The primary forum for management review is the quality council. The review includes assessing opportunities for improvement and the need for changes to the QMS, including the quality policy and quality objectives. Management reviews include all requirements of the QMS and its performance trends as an essential part of the continual improvement process.

Part of the management review includes the monitoring of quality objectives, and the regular reporting and evaluation of the cost of poor quality.

Records of management reviews are maintained to provide, as a minimum, evidence of:

- the quality objectives specified in the business plan, and
- customer satisfaction with product supplied.

5.6.2 Review Input

The input to management review includes information on:

a) results of audits,
b) customer feedback,
c) process performance,
d) status of preventive and corrective actions,
e) follow-up actions from previous management reviews,

f) changes that could affect the QMS,
g) recommendations for improvement,
h) [[analysis of actual and potential field-failures and their impact on quality, safety, or the environment]], and
i) [[summary results at specified design and development stage, Ref: 7.3.4.1]].

5.6.3 Review Output

The output from the management review includes any decisions and actions related to:
a) improvement of the effectiveness of the QMS and its processes,
b) improvement of product related to customer requirements, and
c) resource needs.

6 Resource Management

6.1 Provision of Resources

LORD determines and provides the resources needed:
a) to implement and maintain the quality management system and continually improve its effectiveness, and
b) to enhance customer satisfaction by meeting customer requirements.

6.2 Human Resources

6.2.1 General

Personnel performing work directly or indirectly affecting conformity to product requirements are competent on the basis of appropriate education, training, skills, and experience.

6.2.2 Competence, Training, and Awareness

LORD assures that personnel are adequately prepared for their responsibilities. Each department manager:
a) determines the necessary competence for personnel performing work affecting conformity to product requirements,
b) where applicable, provides training or takes other actions to achieve the necessary competence,
c) evaluates the effectiveness of the actions taken,
d) ensures that its personnel are aware of the relevance and importance of their activities and how they contribute to the achievement of the quality objectives, and
e) maintains appropriate records of education, training, skills, and experience.

6.2.2.1 Product Design Skills

LORD ensures that personnel with product design responsibility are competent to achieve design requirements and are skilled in applicable tools and techniques. LORD identifies applicable tools and techniques.

6.2.2.2 Training

LORD establishes and maintains documented procedures for identifying training needs and achieving competence of all personnel performing activities affecting product quality. Personnel performing specific assigned tasks shall be qualified, as required, with particular attention to the satisfaction of customer requirements.

6.2.2.3 On-the-Job Training

LORD provides on-the-job training for personnel in any new or modified job affecting product quality, including contract or agency personnel. Personnel whose work can affect quality are informed about the consequences to the customer of nonconformity to quality requirements.

6.2.2.4 Employee Motivation and Empowerment

LORD has processes (such as team incentive and lean manufacturing) to motivate employees to achieve quality objectives, to make continual improvements, and to create an environment to promote innovation. These processes include the promotion of quality and technical awareness throughout the organization.

[[LORD has a process (for example, use of 20 keys) to measure, by work areas, the extent to which our personnel are aware of the relevance and importance of the activities and how they contribute to the achievement of the quality objectives]].

6.3 Infrastructure
LORD determines, provides, and maintains the infrastructure needed to achieve conformity to product requirements.

6.3.1 [[**Plant, Facility and Equipment Planning**]]
[[LORD uses a multidisciplinary approach for developing plant, facility, and equipment plans. Plant layouts attempt to optimize travel, handling and value-added use of floor space, and to facilitate synchronous material flow. The effectiveness of existing operations is evaluated and monitored by department management as part of normal plant operation]].

6.3.2 [[**Contingency Plans**]]
[[LORD has contingency plans to satisfy customer requirements in the event of an emergency such as utility interruptions, labor shortages, key equipment failure and field returns]].

6.4 Work Environment
LORD determines and manages the work environment needed to achieve conformity to product requirements. Additionally, LORD strives to ensure productive, quality-oriented employees by providing appropriate compensation and a safe and healthy work.

6.4.1 Personnel Safety to Achieve Product Quality
Product safety and means to minimize potential risks to employees are addressed by the organization during the design and development process and are implemented in manufacturing process activities using a formally managed safety program.

6.4.2 Cleanliness of Premises
LORD maintains its premises in a state of order, cleanliness and repair consistent with the product and manufacturing process needs. LORD follows the 5-S process of Lean Manufacturing.

7 Product Realization

7.1 Planning of Product Realization
LORD plans and develops the processes needed for product realization (AIM Process). Planning of product realization is consistent with the requirements of the other processes of the quality management system.

In planning product realization, LORD determines the following, as appropriate:
a) quality objectives and requirements for the product,
b) the need to establish processes and documents, and to provide resources specific to the product,
c) required verification, validation, monitoring, measurement, inspection, and test activities specific to the product and the criteria for product acceptance,
d) records needed to provide evidence that realization processes and resulting product meet requirements,
e) *[configuration management appropriate to the product]*, and
f) [*the identification of resources to support the operation and maintenance of the product*].

The output of this planning is in a form suitable for LORD's method of operation and may vary based on the producing plant.

7.1.1 Planning of Product Realization – Supplemental
LORD includes customer requirements and references to technical specifications in the planning of product realization as a component of the quality plan.

7.1.2 Confidentiality (Ref: TS16949 7.1.3)
LORD ensures the confidentiality of customer-contracted products and projects under development, and related product information.

7.1.3 [***Project Management***]

[LORD plans and manages product realization in a structured and controlled manner to meet requirements at acceptable risk, within resource and schedule constraints.]

7.1.4 Acceptance Criteria (Ref: TS16949 7.1.2)

LORD defines acceptance criteria and where required obtains approval of the customer. For attribute data sampling, the acceptance level is zero defects.

7.1.5 [*Risk Management]* (Ref: AS9100 7.1.2)]

[LORD establishes, implements and maintains processes for managing risk to achieving applicable requirements, that includes as appropriate

a) assignment of responsibilities for risk management,
b) definition of risk criteria,
c) identification, assessment and communication of risks throughout product realization,
d) identification, implementation and management of actions to mitigate risks that exceed the defined risk acceptance criteria, and
e) acceptance of risks remaining after implementation of mitigating actions.]

7.1.6 Change Control (Ref: TS16949 7.1.4)

LORD has a process to control and react to product and process changes that impact product realization. The effects of changes, including those changes caused by the supplier, are assessed, and appropriate verification and validation activities are defined, to ensure compliance with customer requirements. Changes are evaluated before implementation.

For proprietary designs, impact on form, fit and function (including performance and/or durability), is reviewed with the customer so that all affects can be properly evaluated.

When required by the customer, additional verification/identification requirements, such as those required for new product introduction, are met.

7.1.7 [*Configuration Management (Ref: AS9100 7.1.3*]

[LORD establishes, implements, and maintains a configuration management process appropriate to the product, through part numbering and change control processes. The configuration management process includes, as appropriate

a) configuration management planning,
b) configuration identification,
c) change control,
d) configuration status accounting, and
e) configuration audit].

7.1.8 Control of Production Process Changes (Ref: AS9100 7.5.1.2)

LORD identifies personnel authorized to approve changes to production processes.

LORD controls and documents changes affecting processes, production equipment, tools or software programs.

LORD assesses the results of changes to production processes to confirm that the desired effect has been achieved without adverse effects to product conformity.

7.1.9 Control of Work Transfers (Ref: AS9100 7.1.4)

When planning the permanent or temporary transfer work (e.g., from one LORD facility to another, from LORD to a supplier, or from one supplier to another), LORD defines the process to control and verify the conformity of the work to requirements.

7.2 Customer-Related Processes

7.2.1 Determination of Requirements Related to the Products

LORD determines:

a) requirements specified by the customer, including the requirements for delivery and post-delivery activities,

b) requirements not stated by the customer but necessary for specified or intended use, where known,
c) statutory and regulatory requirements applicable to the product, and
d) any additional requirements considered necessary by LORD.

7.2.1.1 [[**Customer-designated Special Characteristics**]]
[[LORD demonstrates conformity to customer requirements for designation, documentation and control of special characteristics]].

7.2.2 Review of Requirements Related to the Product

LORD reviews the requirements related to the product, during quotation or order review/entry. This review is conducted prior to LORD's commitment to supply a product to the customer (e.g. submission of tenders, acceptance of contracts or orders, acceptance of changes to contracts or orders) and ensures that:
a) product requirements are defined,
b) contract or order requirements differing from those previously expressed are resolved,
c) LORD has the ability to meet the defined requirements,
d) [special requirements of the product are determined], and
e) [*risks (e.g., new technology, short delivery time scale) have been identified*].

Records of the results of the review and actions arising from the review are maintained.

Where the customer provides no documented statement of requirement, LORD confirms the customer requirements before acceptance via a confirmation document provided to the customer.

Where product requirements are changed, LORD ensures that relevant documents are amended and that relevant personnel are made aware of the changed requirements.

7.2.2.1 [[**Review of Requirements Related to the Product – Supplemental**]]
[[Waiving the requirement stated in 7.2.2 for a formal review requires customer authorization]].

7.2.2.2 [[**Organization Manufacturing Feasibility**]]
[[LORD investigates, confirms, and documents the manufacturing feasibility of the proposed products, including risk analysis, during the design and development and contract review processes]].

7.2.3 Customer Communication

LORD determines and implements effective arrangements for communicating with customers in relation to:
a) product information,
b) enquiries, contract, or order handling, including amendments, and
c) customer feedback, including customer complaints.

7.2.3.1 Customer Communication – Supplemental
When required, LORD communicates necessary information, including data, in a customer specified language and format (e.g. computer-aided design data, electronic data exchange)

7.3 Design and Development

7.3.1 Design and Development Planning

LORD plans and controls the design and development of product. During the design and development planning, the organization determines:
a) the design and development stages,
b) the review, verification and validation that are appropriate to each design and development stage, and
c) the responsibilities and authorities for design and development.

Where appropriate, LORD divides the design and development efforts into distinct activities and for each activity, defines the tasks, necessary resources, responsibilities, design content, input and output data and planning constraints.

[*The different design and development tasks to be carried out are based on safety and functional objectives of the product in accordance with customer, statutory and regulatory requirements*].

[Design and development planning shall consider the ability to produce, inspect, test and maintain the product.]

LORD manages the interfaces between different groups involved in design and development to ensure effective communication and clear responsibility of authority.

Planning output is updated, as appropriate, as the design and development progresses.

7.3.1.1 [[**Multidisciplinary Approach**]]
[[LORD uses a multidisciplinary team to prepare for product realization, including:
a) development/finalization and monitoring of special characteristics,
b) development and review or FMEA's, including actions to reduce potential risks, and
c) development and review of control plans]]

7.3.2 Design and Development Inputs

Inputs relating to product requirements are determined and records maintained.
These inputs include:
a) functional and performance requirements
b) applicable statutory and regulatory requirements
c) where applicable, information derived from similar designs, and
d) other requirements essential for design and development.

These inputs are reviewed for adequacy. Requirements defined are complete, unambiguous and not in conflict with other requirements.

7.3.2.1 [[**Product Design Input**]]
[[LORD identifies, documents and reviews product design inputs requirements, including the following:
a) customer requirements (contract review) such as special characteristics identification, traceability and packaging;
b) use of information: LORD utilizes information gained from previous design projects, competitor analysis, supplier feedback, internal input, field data, and other relevant sources, for current and future projects of a similar nature;
c) targets for product quality, life, reliability, durability, maintainability, timing and cost]].

7.3.2.2 [[**Manufacturing Process Design Input**]]
[[LORD identifies, documents, and reviews the manufacturing design input requirements, including:
a) product design output data,
b) targets for productivity, process capability and cost,
c) customer requirements, if any and
d) experience for previous developments]].

7.3.2.3 [[**Special Characteristics**]]
[[LORD identifies special characteristics and:
a) includes all special characteristics in the control plan,
b) complies with customer-specified definitions and symbols, and
c) identifies process control documents including drawings, FMEAs, control plans, and operator instructions with the customer's special characteristic symbol or LORD's equivalent symbol or notation to include those process steps that affect special characteristics.]]

7.3.3 Design and Development Outputs

The outputs of the design and development are provided in a form suitable for verification against the design and development input. Outputs are approved prior to release.

Design and development outputs:
a) meet the input requirements for design and development,
b) provide appropriate information for purchasing, production, and service provision,
c) contain or reference product appearance criteria,
d) specify the characteristics of the product that are essential for its safe and proper use, and

e) identify [*critical items including key characteristics*] or [[special characteristics]], when applicable, and specific action to be taken for these items.

LORD has defined the data required to allow the product to be identified, manufactured, inspected, used and maintained; including for example:
a) drawings, parts lists, specifications necessary to define the configuration and the design features of the product, and
b) the material, process, manufacturing and assembly data needed to ensure the conformity of the product.

7.3.3.1 [[**Product Design Outputs – Supplemental**]]
[[The product design output is expressed in terms that can be verified and validated against product design input requirements. The product design outputs include:
a) design FMEA, reliability results,
b) product special characteristics and specifications,
c) product error-proofing as appropriate,
d) product definition including drawings or mathematically based data,
e) product design review results, and
f) diagnostic guidelines where appropriate]].

7.3.3.2 [[**Manufacturing Process Design Output**]]
[[The manufacturing design output is expressed in terms that can be verified and validated against manufacturing process design input requirements. The manufacturing process design output includes:
a) specifications and drawings
b) manufacturing process flowchart/layout,
c) manufacturing process FMEAs
d) control plan
e) work instructions
f) process approval acceptance criteria
g) data for quality, reliability, maintainability and measurability,
h) results of error-proofing activities, as appropriate, and
i) methods of rapid detection and feedback of product/manufacturing process nonconformities]].

7.3.4 Design and Development Review
At suitable stages, systematic reviews of design and development are performed in accordance with planned arrangements:
a) to evaluate the ability of the results of the design and development to meet requirements,
b) to identify any problems and propose necessary action, and
c) to authorize progression to the next stage.

Participants in such reviews include representatives of functions concerned with the design and development stage(s) being reviewed. Records of the results of the reviews and any necessary actions are maintained.

7.3.4.1 [[**Monitoring**]]
[[Measurements at specified stages of design and development are defined, analyzed and reported with summary results as an input to management review. These measurements include quality risks, lead-times, critical paths and others, as appropriate]].

7.3.5 Design and Development Verification.
Verification of product and manufacturing processes is performed in accordance with planned arrangements to ensure that the design and development outputs have met the design and development input requirements. Records of the results of the verification and any necessary actions are maintained.

7.3.6 Design and Development Validation
Validation of product and manufacturing processes is performed in accordance with planned arrangements to ensure that the resulting product is capable of meeting the requirements for the specified application or intended use, where known. Wherever practicable, validation is completed prior to the delivery or implementation of the product. Records of the results of the validation and any necessary actions are maintained.

7.3.6.1a Design and Development Validation – Supplemental
Design and development validation is performed in accordance with customer requirements including program timing.

7.3.6.1b Design and Development Verification and Validation Testing
Where tests are necessary for verification and validation, these tests are planned, controlled, reviewed, and documented to ensure and prove the following:
a) test plans or specifications identify the product being tested and the resources being used, define test objectives and conditions, parameters to be recorded, and relevant acceptance criteria,
b) test procedures describe the method of operation, the performance of the test, and the recording of the results,
c) the correct configuration of the product is submitted for the test,
d) the requirements of the test plan and the test procedures are observed, and
e) the acceptance criteria are met.

7.3.6.2a Prototype Program
When required by the customer, LORD has a prototype program and control plan. LORD uses, whenever possible, the same suppliers, tooling and manufacturing processes that will be used in production.

All performance testing activities are monitored for timely completion and conformity to requirements.

While services may be outsourced, LORD is responsible for the outsourced services, including technical leadership.

7.3.6.2b Design and Development Verification and Validation Documentation
At the completion of design and/or development, reports, calculations, test results, etc. demonstrate that the product definition meets the specification requirements for all identified operational conditions.

7.3.6.3 [[**Product Approval Process**]]
[[LORD conforms to a product and manufacturing process approval procedure recognized by the customer. This product and manufacturing process approval procedure also applies to the supplier]].

7.3.7 Control of Design and Development Changes
Design and development changes are identified and records maintained. The changes are reviewed, verified and validated, as appropriate, and approved before implementation. The review of the design and development changes includes evaluation of the effect of the changes on the constituent parts and the product already delivered. Records of the results of change reviews and any necessary actions are maintained.

[*The LORD configuration management process provides for customer and/or regulatory authority approval or notification of changes, when required by contract or regulatory requirement. Changes to parts, including articles regulated by the FAA, are classified as minor (Class 2) or major (Class 1) to indicate the type of change and determine if customer, government, or regulatory approval/notification is required. Reference 14 CFR 21.319 for regulatory requirements.*

With regards to FAA-regulated articles (PMA articles), other factors such as the PMA design approval basis and criticality of the article determine if regulatory notification or approval is required. Order 8110.42 defines the applicable requirements for PMA parts with a design approval basis of identicality without a licensing agreement and test and computation. Order 8120.22 defines the applicable requirements for PMA parts with a design approval basis of identicality with a licensing agreement. Both FAA Orders 8110.42 and 8120.22 are consulted as required to ensure compliance with notification/approval requirements.]

7.4 Purchasing

7.4.1 Purchasing Process

LORD ensures that purchased product conforms to specified purchase requirements. The type and extent of control applied to the supplier and the purchased product is dependent upon the effect of the purchased product on subsequent product realization or the final product.

LORD is responsible for the conformity of all products purchased from suppliers, including product from customer defined sources.

LORD evaluates and selects suppliers based on their ability to supply product in accordance with LORD's requirements. Criteria for selection, evaluation, and re-evaluation are established. Records of the results of evaluations and any necessary actions arising from the evaluation are maintained.

LORD:
a) maintains a register of suppliers that includes approval status and the scope of approval,
b) periodically reviews supplier performance; results of these reviews are used as a basis for establishing the level of controls to be implemented,
c) defines the necessary actions to take when dealing with suppliers that do not meet requirements,
d) ensures, where required, that both the organization and all suppliers use customer-approved special process sources,
e) defines the process, responsibilities and authority for the approval status decision, changes of the approval status and conditions for a controlled use suppliers depending on their approval status, and
f) determines and manages the risk when selecting and using suppliers.

7.4.1.1 Regulatory Conformity
All purchased products or materials used in product conform to applicable regulatory requirements.

7.4.1.2 [[**Supplier Quality Management System Development**]]
[[LORD performs quality management system development with the goal of supplier conformity to ISO/TS 16949:2002]].

[[Unless otherwise specified by the customer, suppliers to LORD are third party registered to ISO 9001:2000 by an accredited third-party certification body or have been defined as small suppliers exempt from third-party certification]].

7.4.1.3 Customer-Approved Sources
Where specified by the contract, (e.g. customer engineering drawing, specification), LORD purchases products, materials, or services from approved sources.

LORD is responsible for ensuring the quality of purchased products, including those purchased from customer designated sources.

7.4.2 Purchasing Information
Purchasing information describes the product to be purchased, including, where appropriate:
a) requirements for approval of product, procedures, processes and equipment,
b) requirements for qualification of personnel,
c) quality management system requirements,
d) the identification and revision status of specifications, drawings, process requirements, inspection/verification instructions and other relevant technical data,
e) requirements for design, test, inspection, verification (including production process verification), use of statistical techniques for product acceptance and other instructions for acceptance by LORD, [*and as applicable critical items including key characteristics*],
f) requirements for test specimens (e.g., production method, number, storage conditions) for design approval, inspection/verification, investigation, or auditing,
g) requirements regarding the need for the supplier to:
   - notify LORD of nonconforming material
   - obtain LORD's approval for supplier nonconforming product disposition
   - notify LORD of changes in product and/or process, changes of suppliers, change of manufacturing location and, where required, obtain LORD's approval,
   - flow down to the supply chain the applicable requirements, including customer requirements,

h) records retention requirement
i) right of access by LORD, LORD's customers, and regulatory authorities to the applicable areas of all facilities, at any level of the supply chain involved in the order and to all applicable records, and

LORD ensures the adequacy of specified requirements prior to their communication to the supplier.

7.4.3 Verification of Purchased Product

LORD establishes and implements inspection or other activities necessary for ensuring that purchased product meets specified purchase requirement.

7.4.3.1 Incoming Product Quality

LORD utilizes one or more of the following methods to assure the quality of purchased product:
a) receipt of, and evaluation of, objective evidence of the quality of the product from the supplier, e.g. accompanying documentation, test reports/statistical data, certificates of conformity, process control,
b) receiving inspection and/or testing such as sampling based on performance,
c) second- or third-party assessments or audits of supplier sites, when coupled with records of acceptable delivered product quality,
d) product evaluation by a designated laboratory,
e) delegation of verification to the supplier or supplier certification,
f) another method agreed with the customer.

Where LORD or its customer intends to perform verification at the supplier's premises, LORD states the intended verification arrangements and method of product release in the purchasing information.

Where purchased product is released for production use pending completion of all required verification activities, it shall be identified and recorded to allow recall and replacement if it is subsequently found that the product does not meet requirements.

[*Where LORD delegates verification activities to the supplier, the requirements for delegation are defined and a register of delegations maintained*].

Verification by the customer is not used by LORD as evidence of effective control of quality by the supplier and does not absolve LORD of the responsibility to provide acceptable product, nor does it preclude subsequent rejection by the customer.

7.4.3.2 Supplier Monitoring

Supplier performance is monitored through the following indicators:
a) delivered product quality,
b) customer disruptions including field failures,
c) [[delivery schedule performance [[including incidents of premium freight]], and
d) special status customer notifications related to quality or delivery issues.

[[LORD promotes supplier monitoring of the performance of their manufacturing processes]].

7.5 Production and Service Provision

7.5.1 Control of Production and Service Provision

LORD plans and carries out production and service provision under controlled conditions. Controlled conditions include, as applicable:
a) the availability of information that describes the characteristics of the product,
b) the availability of work instructions, as necessary,
c) the use of suitable equipment,
d) the availability and use of monitoring and measuring equipment,
e) the implementation of monitoring and measurement,
f) the implementation of product release, delivery, and post-delivery activities,
g) accountability for all products during production (e.g., parts quantities, split orders, nonconforming product),
h) evidence that all production and inspection/verification operations have been completed as planned, or otherwise documented and authorized,
i) [*provision for the prevention, detection, and removal of foreign objects*],

j) monitoring and control of utilities and supplies such as water, compressed air, electricity, and chemical products to the extent they affect conformity to product requirements,
k) [*criteria for workmanship, specified in the clearest practical way (e.g., written standards, representative samples or illustrations)*].
l) [*establishing, implementing and maintaining appropriate processes to manage critical items, including process controls where key characteristics have been identified*],
m) [*designing, manufacturing, and using tooling to measure variable data],*
n) [*identifying in-process inspection/verification points when adequate verification of conformance cannot be performed at as later stage of realization],*
o) [special processes],
p) drawings, part lists, process flow charts including inspection operations, production documents (e.g., manufacturing plans, travelers, router, work order, process cards) (ref: AS9100 7.5.1.1 a.),
q) a list of non-specific tools and numeric control (NC) machine programs required and any specific instructions associated with their use. (Ref: AS9100 7.5.1.1 b.)

7.5.1.1 [[**Control Plan**]]
[[LORD:
a) develops control plans at the system, subsystem, component and/or material level for the product supplied, including those for processes producing bulk materials as well as parts, and
b) has a control plan for pre-launch and production that takes into account the design FMEA and manufacturing process FMEA outputs.]]

[[The control plan:
a) lists the controls used for the manufacturing process control,
b) includes methods for monitoring of control exercised over special characteristics defined both by the customer and the organization,
c) includes the customer-required information, if any, and,
d) initiates the specified reaction plan when the process becomes unstable of not statistically capable.]]

Control plans are reviewed and updated when any change occurs affecting product, manufacturing process, measurement, logistics, supply sources or FMEA.]]

[*7.5.1.1a Production Process Verification*]
[*LORD's system uses a representative item from the first production run of a new part or assembly to verify that the production processes, production documentation and tooling are capable of producing parts and assemblies that meet requirements. This process shall be repeated when changes occur that invalidate the original results (e.g., engineering changes, manufacturing process changes, tooling changes)*].

7.5.1.2 Work Instructions
LORD prepares documented work instructions for all employees having responsibility for the operation of processes that impact product quality. These instructions are accessible for use at the workstation.

[[These instructions are derived from the sources such as the quality plan, the control plan and the product realization process]].

7.5.1.3 Control of Production Equipment, Tools and Software Programs
[*LORD validates prior to release for production and maintains production equipment, tools and software programs used to automate and control/monitor product realization*].

[[Job set-ups are verified whenever performed, such as the initial run of a job, material changeover or job change]].

Work instructions shall be available for job set-up personnel. [[LORD shall use statistical methods of verification where possible]].

[*LORD defines storage requirements, including periodic preservation/condition checks, are for production equipment or tooling in storage. This may include provisions to restore durable tooling to operating condition prior to use*].

7.5.1.4 Preventive and Predictive Maintenance

LORD identifies key process equipment and provides resources for machine/equipment maintenance and develops an effective planned total preventative maintenance system. As a minimum, this system includes the following:
a) planned maintenance activities,
b) packaging and preservation of equipment, tooling and gauging,
c) availability of replacement parts for key manufacturing equipment, and
d) documenting, evaluating and improving maintenance objectives.

LORD utilizes predictive maintenance methods to continually improve the effectiveness and the efficiency of production equipment.

7.5.1.5 Management of Production Tooling.
LORD provides resources for tool and gage design, fabrication and verification activities.

LORD establishes and implements a system for production tooling management including:
a) maintenance and repair facilities and personnel,
b) storage and recovery,
c) set-ups; tool-change programs for perishable tools,
d) tool design modification documentation, including engineering change level,
e) tool modification and revision to documentation, and
f) tool identification, defining the status, such as production, repair or disposal.

LORD monitors these activities when work is outsourced.

7.5.1.6 Production Scheduling
Production is scheduled to meet customer requirements, such as just-in-time. This is supported by an information system that permits access to production information at the key stages of the process, and is order driven.

7.5.1.7 [*Post Delivery Support*]
[*LORD shall provide post-delivery support as applicable for the*
a) collection and analysis of in-service data,
b) actions to be taken, including investigation and reporting, when problems are detected after delivery,
c) control and updating of technical documentation,
d) approval, control and use of repair station schemes, and
e) *controls required for off-site work, if applicable*]

7.5.1.8 Feedback of Information from Service
LORD establishes and maintains a process for communication of service concerns including external non-conformances to manufacturing, engineering, and design activities.

7.5.1.9 Service Agreement with Customer
LORD does not enter into formal service agreements.

7.5.2 Validation of Processes for Production and Service Provision
LORD validates all processes for production. Validation demonstrates the ability of these processes to achieve planned results.
LORD establishes arrangements for these processes including, as applicable:
a) defined criteria for review and approval of the processes,
   - [*qualification and approval of special processes prior to use*],
b) approval of equipment and qualification of personnel,
c) use of special methods and procedures,
   - [*control of the significant operations and parameters of special processes in accordance with documented process specifications and changes thereto*],
d) requirements for records, and
e) revalidation.

7.5.3 Identification and Traceability
LORD identifies the product by suitable means throughout product realization.

[*LORD maintains the identification of the configuration of the product in order to identify any differences between the actual configuration and the agreed configuration. FAA/PMA articles are identified as specified in FAA Part 45*].

LORD identifies the product status with respect to monitoring and measurement requirements throughout product realization.

[*When acceptance authority media are used (e.g., stamps, electronic signatures, passwords), LORD establishes appropriate controls for the media*].
Where traceability is a requirement, LORD controls the unique identification of the product and maintains records.

[According to the level of traceability required, LORD's system provides for, at a minimum]:
a) [identification to be maintained throughout the product life,
b) all the products to be manufactured from the same batch of raw material or from the same manufacturing batch to be traced, as well as the destination (delivery, scrap) of all products of the same batch,
c) an assembly, the identity of its components and those of the next higher assembly to be traced, and
d) a given product, a sequential record of its production (manufacture, assembly, inspection) to be retrieved].

7.5.4 Customer Property
LORD exercises care with customer property while it is under LORD's control or being used by LORD. LORD identifies, verifies, protects and safeguards customer property provided for use or incorporation into the product. If the customer property is lost, damaged or otherwise found to be unsuitable for use, this is reported to the customer and records maintained.

7.5.4.1 [[**Customer-owned Production Tooling**]]
[[Customer-owned tools, manufacturing, test, inspection tooling and equipment is permanently marked so that the ownership is visible, and can be determined]].

7.5.5 Preservation of Product
LORD preserves products during internal processing and delivery to the intended destination to maintain conformity to requirements. As applicable, preservation includes identification, handling, packaging, storage, and protection. Preservation also applies to the constituent parts of a product.

[*Preservation of product also includes, where applicable in accordance with product specifications and applicable statutory and regulatory requirements, provision for]*:
a) [cleaning,
b) prevention, detection and removal of foreign objects,
c) special handling for sensitive materials,
d) marking and labeling including safety warnings,
e) shelf life control and stock rotation, and
f) special handling for hazardous materials]

7.5.5.1 Storage and Inventory
In order to detect deterioration, LORD shall ensure the condition of the product in stock is assessed at appropriate intervals.
LORD uses an inventory management system to optimize inventory turns over time and assure stock rotation, such as "first-in-first-out" (FIFO). Obsolete product is controlled in a similar manner to nonconforming product.

7.6 Control of Monitoring and Measuring Equipment
LORD determines the monitoring and measurement to be undertaken and the monitoring and measuring equipment needed to provide evidence of conformity of product to determined requirements.

LORD establishes processes to ensure that monitoring and measurement can be carried out and are carried out in a manner that is consistent with the monitoring and measurement requirements.

Where necessary to ensure valid results, measuring equipment:

a) is calibrated or verified, or both, at specified intervals, or prior to use, against measurement standards traceable to international or national measurement standards. Where no such standards exist, the basis used for calibration or verification shall be recorded,
b) is adjusted or re-adjusted as necessary,
c) have identification in order to determine its calibration status,
d) is safeguarded from adjustments that would invalidate the measurement result,
e) is protected from damage and deterioration during handling, maintenance, and storage,
f) includes a register of these monitoring and measuring devices,
g) includes defining the process employed for their calibration including details of equipment type, unique identification, location, frequency of checks, check method and acceptance criteria, and
h) is recalled for calibration or verification per established process.

LORD ensures that environmental conditions are suitable for the calibrations, inspections, measurements and tests being carried out.

In addition, LORD assesses and records the validity of the previous measuring results when the equipment is found not to conform to requirements. LORD takes appropriate action on the equipment and any product affected. Records of the results of calibration and verification are maintained.

When used in the monitoring and measurement, the ability of computer software to satisfy the intended application is confirmed. This is undertaken prior to initial use and reconfirmed as necessary.

7.6.1 [[**Measurement System Analysis**]]
[[LORD conducts statistical studies to analyze the variation present in the results of each type of measuring and test equipment system. This requirement applies to measurement systems referenced in the control plan. The analytical methods and acceptance criteria conform to those in the customer reference manuals on measurement system analysis. Other analytical methods and acceptance criteria may be used if approved by the customer]].

7.6.2 Calibration/Verification Records
LORD maintains records of the calibration/verification activity for all gages, measuring and test equipment, needed to provide evidence of conformity of product to determined requirements, including employee- and customer-owned equipment. This includes:
a) equipment identification, including the measurement standard against which the equipment is calibrated,
b) revision following engineering changes,
c) any out-of-specification condition,
d) an assessment of the impact of the out-of-specification condition,
e) statements of conformity to specification after calibration/verification, and
f) notification to the customer if suspected product or material has been shipped.

7.6.3 [[**Laboratory Requirements**]]

7.6.3.1 [[**Internal Laboratory**]]
[[LORD's internal laboratories have a defined scope that includes its capability to perform the required inspection, test or calibration services. This laboratory scope is included in the quality management system documentation. The laboratories specify and implement, as a minimum, technical requirements for:
a) adequacy of the laboratory procedures,
b) competence of the laboratory personnel,
c) testing of the product,
d) capability to perform these services correctly, traceable to the relevant process standard (such as ASTM, EN, etc.), and
e) review of related records]].

7.6.3.2 [[**External Laboratory**]]
[[External/commercial/independent laboratory facilities used for inspection, test or calibration services by LORD have a defined laboratory scope that includes the capability to perform the required inspection, test or calibration. The external laboratory shall be:
a) acceptable to the customer, or
b) the original equipment manufacturer or be accredited to ISO/IEC 17025 or national equivalent]].

8 Measurement, Analysis and Improvement

8.1 General

LORD plans and implements the monitoring, measurement, analysis, and improvement processes needed:
a) to demonstrate conformity to product requirements,
b) to ensure conformity of the quality management system, and
c) to continually improve the effectiveness of the quality management system.

This includes determination of applicable methods, including statistical techniques, and the extent of their use.

8.1.1 [[**Identification of Statistical Tools**]]

[[Appropriate statistical tools for each process are determined during advance quality planning and included in the control plan]].

8.1.2 [[**Knowledge of Basic Statistic Concepts**]]

[[Basic statistical concepts, such as variation, control (stability), process capability and over-adjustment is understood and utilized throughout LORD]].

8.2 Monitoring and Measurement

8.2.1 Customer Satisfaction

As one of the measurements of the performance of the quality management system, LORD monitors information relating to customer perception as to whether LORD has met customer requirements. Information to be monitored and used for the evaluation of customer satisfaction includes, but is not limited to:

a) product conformity including internal and delivered product quality performance
b) on-time delivery performance including incidents of premium freight
c) customer complaints and notifications regarding quality and delivery issues (including disruptions and field returns),
d) corrective action requests,

LORD has determined the methods for obtaining and using this information.

LORD monitors the performance of manufacturing processes to demonstrate compliance with customer requirements for product quality and efficiency of the process.

LORD develops and implements plans for customer satisfaction improvement that addresses deficiencies identified by these evaluations and assesses the effectiveness of the results.

8.2.2 Internal Audit

LORD conducts internal audits at planned intervals to determine whether the quality management system:
a) conforms to the planned arrangements, applicable QMS standards, customer requirements, applicable statutory and regulatory authority requirements and the QMS requirements established by LORD, and
b) is effectively implemented and maintained.

The audit program is planned, taking into consideration the status and importance of the processes and areas to be audited, as well as the results of previous audits. The audit criteria, scope, frequency, and methods are defined. The selection of auditors and conduct of audits ensures objectivity and impartiality of the audit process. Auditors do not audit their own work.

The responsibilities and requirements for planning and conducting audits, and for reporting results and maintaining records of those audits are defined in a documented procedure.

Records of the audits and their results are maintained.

The management responsible for the area being audited ensures that any necessary corrections and corrective actions are taken without undue delay to eliminate detected nonconformities and their causes. Follow-up activities include the verification of the actions taken and the reporting of verification results.

8.2.2.1 Quality Management System Audit
LORD audits its quality management system to verify compliance to the applicable QMS standards, customers, and applicable regulatory authorities and any additional quality management system requirements.

8.2.2.2 [[**Manufacturing Process Audit**]]
[[LORD audits each manufacturing process to determine its effectiveness]].

8.2.2.3 [[**Product Audit**]]
[[LORD audits products at appropriate stages of production and delivery to verify conformity to all specified requirements, such as product dimensions, functionality, packaging and labeling, at a defined frequency]].

8.2.2.4 [[**Internal Audit Plans**]]
[[Internal audits cover all quality management related processes, activities and shifts, and is scheduled according to an annual plan]].

[[When internal/external nonconformities or customer complaints occur, the audit frequency is appropriately increased]].

8.2.2.5 [[**Internal Auditor Qualifications**]]
[[LORD has internal auditors who are qualified to audit the requirements of ISO/TS 16949]].

8.2.3 Monitoring and Measurements of Processes
LORD applies suitable methods for monitoring and, where applicable, measurement of the quality management system processes. These methods demonstrate the ability of the processes to achieve planned results. When planned results are not achieved, correction and corrective action are taken, as appropriate.

In the event of product nonconformity, LORD:
a) takes appropriate action to correct the nonconforming process,
b) evaluates whether process nonconformity has resulted in product nonconformity,
c) determines if the process nonconformity is limited to a specific case or whether it could have affected other processes or products, and
d) identifies and controls the nonconforming product in accordance with clause 8.3

8.2.3.1 [[**Monitoring and Measurement of Manufacturing Processes**]]
[[LORD performs process studies on all new manufacturing (including assembly or sequencing) processes to verify process capability and to provide additional input for process control. The results of process studies are documented with specifications, where applicable, for means of production, measurement and test, and maintenance instructions. These documents include objectives for manufacturing process capability, reliability, maintainability and availability, as well as acceptance criteria.]]

[[LORD maintains manufacturing process capability or performance as specified by the customer part approval process requirements. LORD ensures that the control plan and process flow diagram are implemented, including adherence to the specified:
a) measurement techniques,
b) sampling plans,
c) acceptance criteria, and
d) reaction plans when acceptance criteria are not met.]]

[[Significant process events, such as tool change or machine repair, are recorded.]]

[[LORD initiates a reaction plan from the control plan for characteristics that are not statistically capable or are unstable. These reaction plans include containment of product and 100% inspection as appropriate. A corrective action plan is completed by LORD, including specific timing, and assigned responsibilities to assure that the

process becomes stable and capable. The plans are reviewed with and approved by the customer when so required]].

[[LORD maintains records of effective dates of process changes]].

8.2.4 Monitoring and Measurement of Product

LORD monitors and measures the characteristics of the product to verify that product requirements have been met. This is carried out at appropriate stages of the product realization process in accordance with the planned arrangements. Evidence of conformity with the acceptance criteria is maintained.

[*LORD documents measurement requirements for product acceptance and includes*
a) *criteria for acceptance and/or rejection,*
b) *where in the sequence measurement and testing operations are to be performed,*
c) *requirement records of the measurement results (at a minimum, indication of acceptance or rejection), and*
d) *any specific measurement instruments required and any specific instruction associated with their use*].

[*When critical items, including key characteristics, have been identified the organization shall ensure they are controlled and monitored in accordance with the established process*].

When LORD uses sampling inspection as a means for product acceptance, the plan is justified on the basis of recognized statistical principles and appropriate for use. When required, the plan is submitted for customer approval.

When product is released for production use pending completion of all required measurement and monitoring activities, it shall be identified and recorded to allow recall and replacement if it is subsequently found that product does not meet requirements. Materials under positive recall must be approved by a relevant authority and, where applicable, by the customer. [*Positive recall of FAA-PMA articles is limited to release within LORD for production purposes only. Release to inventory/shipping/customer is not permitted*].

Records indicate the person(s) authorizing the release of product for delivery to the customer.

[*Where required to demonstrate product qualification LORD ensures that records provide evidence that the product meets defined requirements*].

The release of product and delivery of service to the customer shall not proceed until the planned arrangements have been satisfactorily been completed, unless otherwise approved by a relevant authority and, where applicable, by the customer.

LORD ensures that all documents required to accompany the product are present at delivery.

8.2.4.1 [[**Layout Inspection and Functional Testing**]]

[[A layout inspection and a functional verification to applicable customer engineering material and performance standards are performed for each product as specified in the control plan. Records are available for customer review]].

8.2.4.2 [[**Appearance Items**]]

[[For manufacturing parts designated by the customer as ‘appearance items’, LORD provides:
a) appropriate resources including lighting for evaluation,
b) masters for color, grain, gloss, metallic brilliance, texture, distinctness of image (DOI), as appropriate,
c) maintenance and control of appearance masters and evaluation equipment, and
d) verification that personnel making appearance evaluations are competent and qualified to do so]].

8.3 Control of Nonconforming Product

LORD ensures that product which does not conform to product requirements is identified and controlled to prevent its unintended use or delivery. The controls and related responsibilities and authorities for dealing with nonconforming product are defined in a documented procedure.

LORD's documented procedure for nonconforming product defines the responsibility for review and authority for review and disposition of nonconforming product and the process for approving personnel making these changes.

Where applicable, LORD deals with nonconforming product by one or more of the following ways:
a) by taking action to eliminate the detected nonconformity,
b) by authorizing its use, release, or acceptance under concession by a relevant authority and, where applicable, by the customer,
c) by taking action to preclude its original intended use or application,
d) by taking action appropriate to the effects, or potential effects, of the nonconformity when nonconforming product is detected after delivery or use has started, and
e) by taking action necessary to contain the effect on the nonconformity on other processes or products.

Dispositions of use-as-is or repair shall only be used after approval by an authorized representative of the organization (LORD or customer) responsible for design.

LORD shall not use disposition of use-as-is or repair, unless specifically authorized by the customer, if the nonconformity results in a departure from the contract requirements.

Unless otherwise restricted in the contract, organization-designed product which is controlled via a customer specification may be dispositioned by LORD as use-as-is or repair, provided the nonconformity does not result in a departure from customer-specified requirements.

[*Product dispositioned for scrap is conspicuously and permanently marked, or positively controlled, until physically rendered unusable. Aerospace parts, including articles regulated by the FAA, which are dispositioned scrap, shall be mutilated to render them useless for their intended use in accordance with FAA AC 21-43 and applicable LORD procedures*].

Records of the nature of nonconformities and any subsequent actions taken, including concessions obtained, are maintained.

8.3.1 Control of Nonconforming Product – Supplemental
Product with unidentified or suspect status is classified as nonconforming product.

8.3.2 Control of Reworked Product
Instruction for rework, including re-inspection requirements, is accessible to and utilized by the appropriate personnel. When nonconforming product is corrected, it is subject to re-verification to demonstrate conformity to the requirements.

8.3.3 Customer Information
Customers are informed promptly in the event nonconforming material has been shipped. LORD takes action appropriate to the effects, or potential effects, of the nonconformity.

[*In addition to any contract or regulatory authority reporting requirements, LORD's system provides for timely reporting of delivered nonconforming product that may affect reliability or safety. Notification includes a clear description on the nonconformity, which includes as necessary parts affected, customer and/or organization part numbers, quality, and date(s) delivered*].

8.3.4 [[**Customer Waiver**]]

[[LORD obtains a customer concession or deviation permit prior to further processing whenever the product or manufacturing process is different from that which is currently approved]].

[[LORD maintains a record of the expiration date or quantity authorized. LORD shall also ensure compliance with the original or superseding specifications and requirements when the authorization expires. Material shipped on an authorization is properly identified on each shipping container]].

[[This applies equally to purchased product. LORD agrees with any requests from suppliers before submission to the customer]].

8.4 Analysis of Data

LORD determines, collects, and analyzes appropriate data to demonstrate the suitability and effectiveness of the quality management system and to evaluate where continual improvement of the effectiveness of the quality management system can be made. This includes data generated as a result of monitoring and measurement and from other relevant sources.

The analysis of data provides information relating to:

a) customer satisfaction,
b) conformity to product requirements,
c) characteristics and trends of processes and products including opportunities for preventive action, and
d) suppliers.

8.4.1 Analysis and use of data

Trends in quality and operational performance are compared with progress toward objectives and lead to action to support the following:

a) development of priorities for prompt solutions to customer-related problems,
b) determination of key customer-related trends and correlation for status review, decision-making and longer term planning, and
a) an information system for the timely reporting of product information arising from usage.

8.5 Improvement

8.5.1 Continual Improvement

LORD continually improves the effectiveness of the quality management system through the use of the quality policy, quality objectives, audit results, analysis of customer and internal data, corrective and preventive actions, and management review.

LORD monitors the implementation of improvement activities and evaluates the effectiveness of the results.

8.5.1.1 Continual Improvement of the Organization

LORD has defined a process for continual improvement.

8.5.1.2 Manufacturing Process Improvement

Manufacturing process improvement continually focuses upon control and reduction of variation in product characteristics and manufacturing process parameters. Lean Manufacturing initiatives, including Kaizen events, are data driven and use statistical methodologies where appropriate.

8.5.2 Corrective Action

LORD takes action to eliminate the causes of nonconformities in order to prevent recurrence. Corrective actions are appropriate to the effects of the nonconformities encountered.

A documented procedure is established to define requirements for:

a) reviewing nonconformities (including customer complaints),
b) determining the causes of nonconformities,
c) evaluating the need for action to ensure the nonconformities do not recur,
d) determining and implementing action needed,
e) records of the results of action taken, and
f) reviewing the effectiveness of corrective action taken,
g) flowing down corrective action requirements to a supplier, when it is determined that the supplier is responsible for the nonconformity,
h) specific actions where timely and/or effective corrective actions are not achieved, and
i) determining if additional nonconforming processes or products exist based on causes of the nonconformities and taking further action when required to eliminate the cause of the nonconformity. (Ref: AS9100 Section 8.5.2 e) and TS 16949 Section 8.5.2.3)

8.5.2.1 Problem Solving

LORD has a defined process for problem solving leading to root cause identification and elimination. If a customer-prescribed problem-solving format exists, LORD uses the prescribed format.

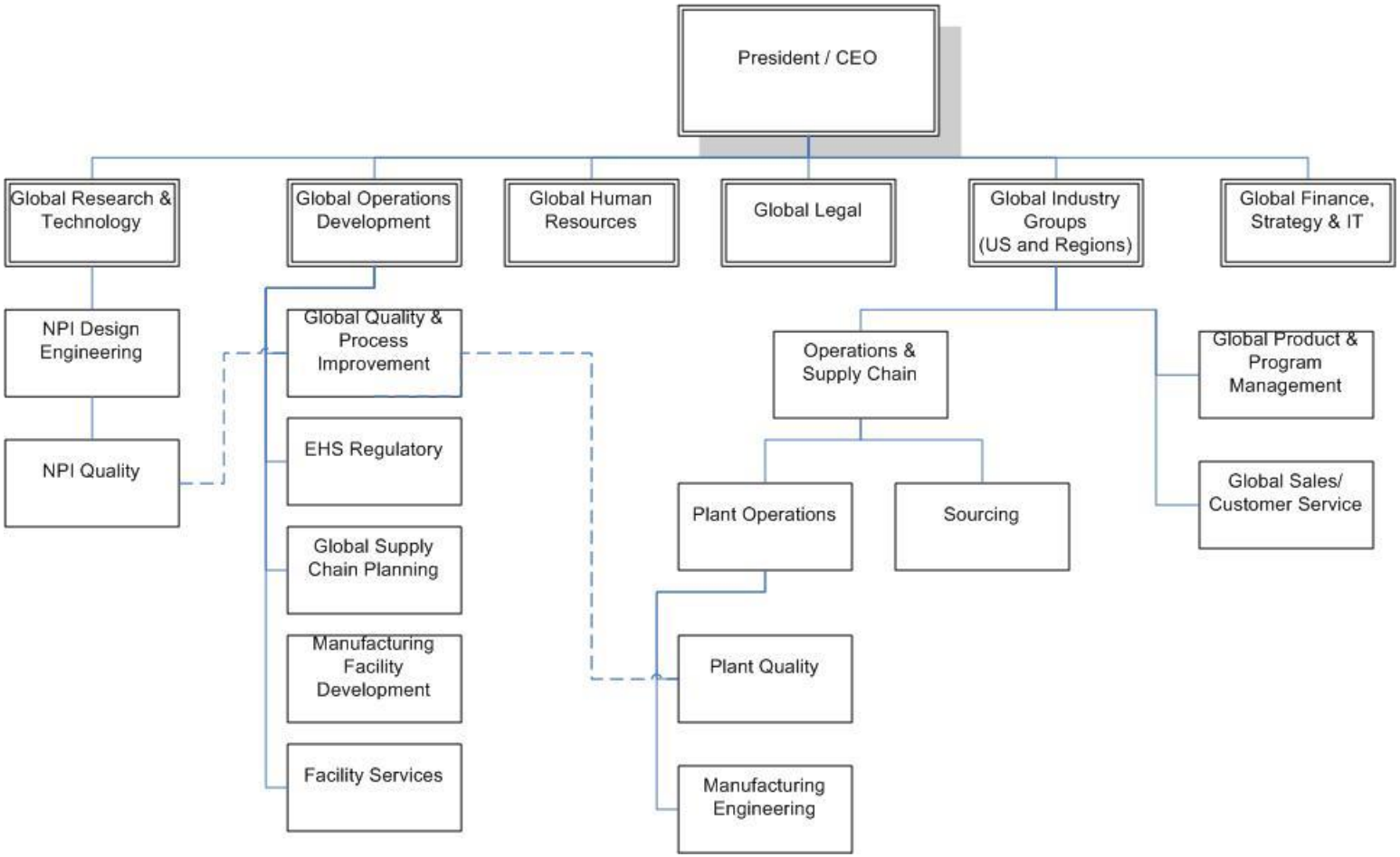
8.5.2.2 Error-proofing
LORD uses error-proofing methods in the corrective action process.

8.5.2.3 Rejected Product Test/Analysis (Ref: TS16949 Section 8.5.2.4)
LORD analyzes parts rejected by the customer's manufacturing plants and engineering facilities. LORD minimizes the cycle time of this process. Records of these analyses are kept and made available on request. LORD performs an analysis and initiates corrective action to prevent recurrence.

8.5.3 Preventive Acton
LORD determines actions to eliminate the causes of potential nonconformities in order to prevent their occurrence. Preventive actions are appropriate to the effects of the potential problems.

A documented procedure is established to define requirements for:
a) determining potential nonconformities and their causes,
b) evaluating the need for action to prevent occurrence of nonconformities,
c) determining and implementing action needed,
d) records of results of action taken, and
e) reviewing the effectiveness of preventive action taken.

ORGANIZATION CHART



Partial Organizational Chart Emphasizing Product Realization Roles