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MIL-Q-9858 Quality Program Policies and Procedures

Mo/Yr

Revisions		Rev:	
Letter	E.O. Number - Description	Date	

Used On	Contract#:	**Your Company Name**
Prepared By: [redacted]	[redacted]	**QUALITY PROCEDURE**
		Your Procedure #
	[redacted]	[redacted] 1 of 34

Your Company Logo

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Footnotes relate to paragraph numbers from MIL-Q-9858
Numbers in parentheses refer to paragraph numbers within this document, e.g.,
footnote 1, para 1.2(1.0) [1.2 is from MIL-Q and (1.0) is from this manual]

1.0 SCOPE

It is a policy of (Your Co) to perform all activities in a manner that reflects a total commitment to quality. This means maintaining the highest standards of quality in all products and services, and a dedication to the principle of maintaining the highest levels of quality and integrity in communicating with people inside and outside of (Your Co). It is also a policy of (Your Co) to prevent production and distribution of products that would pose unreasonable risks to health, safety, or the environment.

It is a goal of the company to encourage all employees to strive for individual excellence in their work and in their association with other people inside and outside of the workplace. (Your Co) strives to motivate employees to achieve this excellence by providing leadership, training, proper materials and facilities, and a cooperative environment.

(Your Co) managers are responsible for developing organizations and systems that accommodate the goal of achieving Customer satisfaction. Managers are to recognize and support employees charged with the responsibility of interfacing with Customers. Employees who are authorized to deal with Customers are responsible for carefully listening to Customers and fully understanding their requirements and expectations. These employees shall be as responsive as possible to those needs within the province and spirit of good business practices. Managers are to monitor Customer satisfaction on a continuing basis, making appropriate adjustments and corrections if problems occur. This Quality Manual is produced to provide guidance and purpose to achieve the policies and goals of (Your Co). This manual of policies and procedures is subject to review by the Customer.[1]

(Your Co)'s Mission is to continually improve our products and services to meet our Customers' requirements, allowing us to prosper as a business and to produce a reasonable return on capital investment.

(Your Co)'s Vision is to provide products and services that meet or exceed our Customers' expectations by thoroughly evaluating their unique needs and tailoring our products and performance to those needs.

(Your Co) will design and maintain an effective and economical quality program, covering both processes and products, which makes data available to our Customers that is suitable for determining compliance to established product acceptance criteria and the requirements of the contract.[2] This is achieved by controlling all work operations and manufacturing processes, as well as all inspections and tests.[3] This quality program was developed in consonance with all (Your Co) administrative and technical processes and applies to supplies and services produced at (Your Co) or at any other source to the extent necessary to assure conformance to contractual requirements.[4]

[1] para 1.2 (1.0)
[2] para 1.2 (1.0)
[3] para 1.1 (1.0)
[4] para 1.3 (1.0)

2.0 ORGANIZATION[5]

2.1 General

(Your Co) provides the following management elements: Accounting, Contracts, Environmental, Facilities, G and A, Manufacturing, Products, Purchasing, and Quality. These management elements are directly or indirectly related to product quality.

2.1.1 Direct Management

Product management includes the following groups:

Manufacturing, Products, Purchasing, and Quality

- Manufacturing is responsible for the following functions:
- Products is responsible for the following functions:
- Purchasing is responsible for the following functions:
- Quality is responsible for the following functions:

All direct management efforts are accomplished using

2.1.2 Indirect Management

Supportive management includes the following groups:

Accounting, Contracts, Environmental, Health and Safety, Facilities, and G and A

- Accounting is responsible for the following functions:
- Contracts is responsible for the following functions:
- Environmental, Health and Safety is responsible for the following functions:

[5] para 3.1 (2.0-2.3)

- Facilities is responsible for the following functions:
- G & A is responsible for the following functions:

2.2 Quality Responsibility and Authority[6]

The Quality Group is responsible for facilitation of these policies and procedures.
The quality manager has the responsibility and authority to

The Quality Group is divided into five units:

- Quality Management and Administration:
- Quality Engineering:
- Quality Plans and Procedures:
- Inspection:
- Metrology: s

2.2.1 Problem Resolution

Quality problems resulting from a variance to a program requirement are resolved by

[6] para 3.1 (2.0-2.3)

2.3 Review of the Quality Program[7]

The Quality Group collects data for determining the acceptability of this quality program, which may include, but is not limited to:

[redacted]

Quality Program status review reports, when produced, are [redacted]

2.4 Initial Quality Planning[8]

2.4.1 Quality Management

The Quality Group is responsible for [redacted]

2.4.2 Contracts Management

The Contracts Group is responsible for [redacted]

[7] para 3.1 (2.0-2.3)

[8] para 3.2 (2.4)

2.4.3 Products Management

The Products Group is responsible for [redacted]

2.4.4 Evaluation Record

Specific elements of the quality effort are detailed in a Compliance Matrix, (Your #), to the extent determined by the Quality Group. A careful review of all documents and referenced documents provided by the contract is performed. The Compliance Matrix serves as a [redacted] and is required to list the following:

[redacted]

The Compliance Matrix serves as the planning record to monitor compliance to the tasks, assignments, and completion dates produced by the Work Breakdown Structure.

Planning for indoctrination and training of inspection personnel performing work that affects quality is [redacted]

2.4.5 Training

Training efforts are based upon the quantity of work to be performed, and the experience and/or education of the personnel performing the work.

When the work is limited [redacted]

2.5 Work Instructions[9]

2.5.1 Preparation

All work affecting quality is described by [redacted]

2.5.2 Mfg/QA Traveler/Planner (Optional)

The Mfg/QA Traveler/Planner or Operation Sheet (OS), (Traveler), is designed to [redacted]

[9] para 3.3 (2.4.4; 2.4.5; 2.5)

[redacted]

The Quality or Products Group may prepare the (Traveler) by performing tasks which may include, but are not limited to:

[redacted]

The traveler may include, but is not limited to:

Traveler#	ECP# and date of effectivity
Traveler revision letter and date of release	Split-lot control
Page#	Description of manufacturing operation (even#)
Form#	Description of inspection operation (odd#)
[redacted]	[redacted]

[redacted]

After the traveler is reviewed, it is approved by the Quality or Products Group in the space provided. After approval, the traveler is [redacted]

2.5.3 Inspection Instructions

The Quality Group prepares the inspection instruction sheet by performing tasks that may include, but are not limited to:

[redacted].

- Prepare Inspection Instruction Sheet, (Your #) (IIS). The IIS may include, but is not limited to:

IIS#	Specification number(s) and revision letter(s)
Title of IIS	Mfg/QA Traveler/Planner# supported by the IIS
IIS revision letter and date of release	ECP# and date of effectivity
Page#	Special instructions
Form#	IIS log# for sign-off
IIS title	Operation letter
QA approval	Description of inspection operation including a listing of the documents that are essential to the process, e.g., drawing(s), specification(s), test procedure(s) and revision letters for each, the attributes to be verified and the method to be used
[redacted]	[redacted]

[redacted]

[redacted]

After approval, the IIS is [redacted]

2.5.4 Manufacturing Procedure

The Manufacturing procedure does not specify 'how to do' the task, but rather specifies 'what to do' for the work function.

The Manufacturing and Products Groups have lead responsibility for creating Manufacturing procedures. The Products, and Quality Groups have collateral responsibilities for this function related to providing [redacted] The Manufacturing or Products Group prepares the Manufacturing procedure by performing tasks that may include, but are not limited to:

[redacted]

Prepare the Manufacturing procedure using form (Your #). The procedure may include, but is not limited to:

Scope of the operation	Model/Type of equipment
Theory of operation	Production operations; 'how-to' details are described in training documents
References to applicable documents	Performance requirements
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

[redacted]

2.5.5 Workmanship Standard

The Products and Quality Groups have lead responsibility for [redacted]

The Products or Quality Group evaluates workmanship standard trade-offs based on factors such as, but not limited to:

[redacted]

DCC controlled issues of workmanship standards are forwarded to [redacted]

2.5.6 Work Instruction

The Quality Group has lead responsibility for preparing work instructions for administrative and technical operations that are not described by a written procedure or Bulletin.

Work instructions include, but are not limited to: [redacted]

- Work Instructions are produced using [redacted]
- Work Instructions require [redacted]
- Valid Work Instructions are recorded or logged in [redacted]
- Work Instructions are produced using [redacted]
- Work Instructions contain the following sections: [redacted]

[redacted]

[10] para 6.2 (2.5.6)

2.6 Records[11]

2.6.1 General

Data to be recorded includes any record appropriate to the economical and effective operation of [redacted]

2.6.2 Record Verification

The Quality Group verifies records for [redacted]

2.6.3 Record Maintenance

The Document Control Center maintains archive files for records. Records are maintained as directed by the contract, or for [redacted]

2.6.4 Active Records

Records for active contracts are maintained in the quality department handling the operations. Records are removed [redacted]

2.6.4.1 Objective Evidence

Records are collected or produced to the extent necessary to [redacted]

2.6.5 Analysis and Use of Records

When product or process abnormalities or defect trends are detected, [redacted]

2.6.5.1 Defect Trends

Inspectors are instructed to prepare form (Your #), Notice of Defect Trend, following its format, whenever defects exceed [redacted]

[redacted]

[11] para 3.4 (2.6)

[12] para 3.4 & 3.5 (2.6.6; 2.7)

2.7 Corrective Action [13]

2.7.1 Internal Corrective Action Requests

A Corrective Action Request (CAR), or a Request for Corrective Action (RFCA), (Your #), is initiated as promptly as practicable to determine [redacted]

2.7.2 Corrective Action Implementation by the MRB

The MRB forwards the CAR or RFCA to the assigned Group where [redacted]

2.7.2.2 Corrective Action Monitoring

An initial review of the adequacy of improvements and corrections, and the monitoring of the effectiveness of actions taken, is [redacted]

2.7.3 Supplier Corrective Action

A supplier corrective action is initiated by [redacted]

2.7.4 Customer Request for Corrective Action

A Customer request for corrective action may be communicated to (Your Co) verbally, by letter, or by formal corrective action request. These requests may be received by [redacted]

[13] para 3.5 (2.6.6; 2.7)

2.7.4.1 Corrective Action Implementation

The Corrective Action Board (CAB), working with other (Your Co) organizations as needed, [redacted]

2.7.4.2 Corrective Action Progress

Progress of the corrective action is [redacted]

2.7.5 MIL-STD-1520

Contract directives that specify use of MIL-STD-1520 are accomplished using [redacted]

2.8 Costs Related to Quality[14]

2.8.1 Responsibility

The Quality Group has the lead responsibility for [redacted]

The quality cost information is organized and summarized in four categories:

1-Prevention, 2-Appraisal, 3-Internal Failure, and 4-External Failure.

Quality cost data do not require [redacted]

2.8.1.1 Prevention Costs

The quality costs relative to the prevention category are those associated with [redacted]

Appraisal Costs

The quality costs relative to the appraisal category are those associated with [redacted]

2.8.1.3 Internal Failure Costs

The quality costs relative to the internal failure category are those associated with [redacted]

[14] para 3.6 (2.8)

2.8.1.4 External Failure Costs

The quality costs relative to the external failure category are those associated with [redacted]

2.8.2 Reports

Quality costs may be reported by category or by program, and may [redacted]

2.8.3 Cost of Quality Evaluation

The Quality Group has lead responsibility for [redacted]

3.0 FACILITIES AND STANDARDS[15]

3.1 Drawings, Documentation and Changes

The Quality Group participates in design reviews, and at least one quality representative participates on the Configuration Control Board (CCB). The Quality Group verifies that documents received for application are [redacted]

Engineering drawings are reviewed by the Quality Group (Your #) for adequacy and completeness, with corrective action taken regarding discrepancies. Audits are conducted periodically (Your #) and on a random basis to [redacted]

3.2 Change Control

Engineering Orders, Requests for Waivers or Deviations, and Engineering Change Proposals are reviewed to [redacted]

Effectivity points for change incorporation are established [redacted] for

[15] para 4.1 (3.0)

changes that have been approved, and deliverable documents are [redacted]

3.2.1 Supplier Change Control

Supplier change authority and control is specified in [redacted] and [redacted]

3.3 Design Review Participation

3.3.1 Protection of Quality During Production, Storage, and Use.

The Quality Group provides input at Design reviews for new, pending, and existing contracts. Product protection design factors are considered, such as, but not limited to:

[redacted]

3.3.2 Inspection and Test Planning[16]

Product inspection and test design factors are considered, such as, but not limited to:

[redacted]

Pursuant to contract requirements, any precision measurement need exceeding [redacted]

3.4 Measuring and Test Equipment[17]

3.4.1 Application

All measuring and test equipment instruments and devices used to determine an item's conformance[18] to specified requirements are [redacted]

[16] para 4.5 (3.3.2)

[17] para 4.2, 4.3 (3.4)

[redacted]

New measuring and test equipment instruments and devices received by (Your Co) are evaluated by the Quality Group at receiving inspection to [redacted]

3.5 Use of Contractor's Inspection Equipment[19]

3.5.1 Availability

(Your Co) owned gauges, inspection devices and test equipment are made available for use by Customers when there is a need to verify product conformance with specified requirements. The Customer's use of the equipment is routinely under the direct observation of [redacted]

[18](3.4.1) e.g., a measuring instrument reports a thickness, but a load of 200 lbs is required -- the psi gage and measurement instrument must be calibrated; all process and product measurement instruments require calibration unless the term 'approximate' is used to specify a 'process' parameter -- this exception is only applicable to 'processes'

[19]para 4.4 (3.5)

3.6 Control of Purchases[20]

3.6.1 Request for Evaluation of Candidate Supplier

Requests to conduct an evaluation of a potential supplier are directed to the Quality Group and can be originated by [redacted]

3.6.2 Survey of the Candidate Supplier

The effectiveness and integrity of the control of quality by (Your Co) suppliers is assessed and reviewed at intervals consistent with [redacted]

The capability of a supplier to conform to quality requirements is determined by [redacted]

3.6.2.1 Minor Procurement Levels

Minor procurements include purchases for [redacted]

[20] para 5.1 (3.6; 3.7.1; 3.7.3; 3.7.4; 3.7.5)

3.6.2.2 Major Procurement Levels

Major procurements include purchases for products or services that are [redacted]

3.6.3 Supplier Evaluation Report

Quality surveys of candidate suppliers are reviewed and evaluated by the Quality Group. In the case of candidate suppliers who have performed work for (Your Co) in the past, their historical quality records or ratings are procured and studied. Each evaluation is [redacted]

3.6.4 Supplier Process Certification

Requests to certify a supplier's process are directed to the Quality Group and can be originated by any (Your Co) department. Authorization to certify a candidate supplier's process is given by the management personnel of [redacted]
These personnel have the authority to [redacted]

3.6.5 Source Surveillance and Inspection

Source surveillance and inspection of supplies at a supplier's facility is performed whenever it is specified as a requirement on a contract or purchase order. The source inspection is made at the point of fabrication and assembly prior to shipment to (Your Co). The inspections are [redacted]

[21] para 5.2 (3.6.5)

[redacted] Source inspection and surveillance may involve, but is not limited to, the following tasks:

[redacted]

Source inspectors complete a record that contains information specified by this Quality Program's Application Handbook. A Source inspection tag may [redacted]

3.6.5.1 Contracted Source Inspection

The circumstance under which the use of a source inspection representative might be considered are as follows: [redacted]

The (Your Co) Quality Group identifies the type or types of tasks to be performed, such as, but

not limited to: [redacted]

3.6.6 Supplier Quality Rating

The evaluating and rating of supplier performance in terms of quality and workmanship is the responsibility of [redacted]

3.6.7 Procurement Document Requirements Review[22]

Procurement documents such as requisitions, purchase orders, purchase order change notices, and subcontracts are forwarded to [redacted] add to this document provisions for any one or combination of the following:

[redacted]

[22] para 5.2 (3.6.7)
[23] para 6.1 (3.6.7)

[redacted]

Relative to the procurement of software, the reviewer determines the need for, and if justified, adds [redacted]

3.7 Materials and Materials Control[24]

3.7.1 Supplier Part Qualification

(Your Co) requests to candidate suppliers for parts and data to be submitted for qualification purposes are made through the use of [redacted]

[24] para 5.1 & 6.1 (3.7.1; 3.7)

[redacted]

3.7.2 1st Article Inspection

The Purchasing Group is responsible for citing on a purchase order the requirement for a 1st article inspection. 1st article inspection is normally performed in [redacted]

3.7.3 Receiving Inspection[25]

All materials are evaluated by receiving inspection to the extent necessary to assure conformance to [redacted]

A statistically sampled lot of material awaiting non-conformance disposition is not released to production until completion of MRB. Acceptable material from a lot subjected to 100% inspection may be released to production upon completion of appropriate documentation. Measuring and test equipment devices and measurement standards that have been received from external calibration [redacted]

[25] para 5.1 (3.7.3)

[redacted]

All incoming supplies are processed in the priority sequence of [redacted]

Prior to inspecting received supplies, the inspector obtains all appropriate [redacted]

All limited shelf life items received with 25% [redacted]

Supplies are inspected and results are recorded as specified by this Quality Program's Application Handbook. [redacted]

Accepted supplies are identified with [redacted]
Rejected supplies are identified and/or forwarded to [redacted]

At the completion of each inspection, the inspector [redacted]

Receiving inspection personnel observe the following document order of precedence in the event of conflict, ambiguity or contradiction:

[redacted]

3.7.4 Raw Material Inspection

The Purchasing Group specifies physical and/or chemical characteristics and properties on purchase orders for raw materials. The purchase order requires the supplier to [redacted]

[redacted] An open CRR prevents delivery of supplies unless waived by the Customer. When periodic verification of certification validity is required by contract, receiving inspection [redacted]

3.7.5 Control of Special Materials[26]

Items that are hazardous (such as [redacted]), temperature sensitive (requiring refrigeration, for example), static sensitive, and precious metals are processed using alternate receiving inspection routines. The materials are inspected according to [redacted]

Precious metal supplies are [redacted]

[26] para 6.4 (3.7.5)

[redacted]

3.8 Production Processing and Fabrication[27]

3.8.1 In-process Inspection

The Quality Group is responsible for examining engineering and manufacturing documentation for the purpose of [redacted]

3.8.1.1 Special Processes

Ultra precise and super complex work functions are controlled using [redacted]

[27] para 6.2 (3.8)

3.8.2 Inspection Methods

Inspection methods may include, but are not limited to: [redacted]

3.8.2.1 Calculated Risk Release

In the event materials, components, or assemblies are needed prior to receipt of Certified Test Data, Certificate of Compliance or Analysis, approved Request for Deviation or Waiver, or other limited risk condition, cognizant MRB members of the Products and Quality Group may [redacted]

3.8.3 Identification

Parts or assemblies found to be in compliance with inspection requirements are identified as acceptable on the accompanying Traveler, OS, Routing Ticket, or a Good Material Tag. Supplies that require rework are routed to the appropriate department with rework instructions. Supplies that are rejected are forwarded to [redacted]

3.8.4 Computer Software

Computer software units and their associated documentation, throughout the intermediate stages of development, are [redacted]

3.8.5 Review of Inspection Methods

On a regular basis, the in-process inspection instructions are reviewed to [redacted]

3.8.6 Process Survey

The Quality Group conducts surveys of manufacturing processes at regular intervals, or under the following conditions:

[redacted]

The surveys are conducted using criteria established by the Quality Group.
Corrective action follow-up is the responsibility of the Quality Group and requires [redacted]

3.8.7 Failure Reporting

A Material Report, (Your #), is initiated by process or inspection personnel for each failure detected, including those discovered during [redacted]

3.8.8 Tooling Inspection

All production tools such as jigs, fixtures, and templates used for producing deliverable goods are [redacted]

3.9 Completed Item Inspection and Testing[28]

3.9.1 Final Inspection

All finished goods are inspected as specified on the applicable Inspection Instruction or Traveler, or as specified by the Quality Group. Parts and assemblies are processed only after all operations specified on applicable process documentation are identified as complete and accepted. Inspections are made using [redacted]

[28] para 6.3 (3.9)

[redacted]

When modifications, repairs or replacements are required after final inspection or testing, re-inspection and retesting of any characteristic affected is performed to the extent required.

3.9.2 Final Acceptance Testing

Supplies are approved for acceptance testing after a determination has been made that the supply is [redacted]

3.9.3 Final Acceptance Processing

After successful completion of final inspection and test, completed supplies are examined for the following:

[redacted]

Documentation attesting to the acceptance of the supply is [redacted]

3.10 Handling, Storage and Delivery[29]

3.10.1 Protecting Product Quality

The Quality Group specifies, where required and in accordance with contractual directives, instructions for the proper handling, preservation, storage, packaging, and shipping of supplies

[29] para 6.4 (3.10)

to [redacted]

The following routines apply:

[redacted]

3.11 Nonconforming Material[30]

3.11.1 Material Review Board

The MRB Chairperson selects members of the Material Review Board from the Quality, Products, and Manufacturing Groups.

The primary responsibility of the Material Review Board is [redacted]

[redacted]

[30] para 6.5 (3.11)

3.11.2 Material Review Processing

[redacted]

3.12 Statistical Quality Control and Analysis[31]

Inspection by statistical sampling is applied, as appropriate and when specified, in [redacted]

3.13 Indication of Inspection Status[32]

3.13.1 Inspection Stamps

The Quality Group controls inspection stamps. The primary acceptance stamp is [redacted]

3.13.2 Identification Media

The inspection status of supplies is recorded on accompanying paperwork with a rubber stamp by Quality Group personnel, and in some instances with [redacted]

[31] para 6.6 (3.12)

[32] para 6.7 (3.13)

[redacted]

3.14 Government Inspection at Subcontractor or Vendor Facilities[33]

When the Government or other Customer wishes to conduct Source Inspections of supplies at (Your Co)'s supplier facilities, a statement is normally contained in the original purchase agreement with (Your Co). When the contract is accepted, the Purchasing Group incorporates Source Inspection statements in procurement instruments to affected suppliers IAW Purchasing Policies and Procedures, (Your #). Customer Source Inspections do not relieve (Your Co) of its responsibility to provide conforming products or services, or waive (Your Co)'s requirement to

[redacted]

3.15 Government Property[34]

Government and Customer property is controlled in accordance with (Your #), Property Control Policies and Procedures, specified contractual requirements, and [redacted]

3.15.1 Bailed Property[35]

Bailed property is controlled in accordance with specified contractual requirements, and [redacted]

Index of Referenced Documents

[redacted]

[33] para 7.1 (3.14)
[34] para 7.2, 7.2.1, 7.2.2 (3.15)
[35] para 7.2.3 (3.15.1)

[redacted]

(Your #), Material Report
(Your #), Internal Quality Audits

[redacted]

(Your #), Inspection Instruction Sheet

[redacted]

Glossary of Terms

Mfg/QA Traveler/Planner, or Operation Sheet (OS):

[redacted]

Routing Ticket:

[redacted]

Inspection Instruction:

[redacted]

[redacted]

Workmanship Standard:

[redacted]

Work Instruction:

[redacted]

[redacted]

[redacted]

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Quality Policy

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Prepared By: [redacted]	[redacted]		
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Your Company Logo

It is a policy of the Company to perform all activities in a manner that reflects a total commitment to quality. This means [redacted]

It is a goal of the company to encourage all employees to [redacted]

The Company's Mission is to [redacted]

The Company's Vision is to [redacted]

The Company will design and maintain an effective and economical quality program, covering [redacted]

This quality program was developed in coordination with all the Company administrative and technical processes and applies to supplies and services produced at the Company or at any other source to the extent necessary to assure conformance to contractual requirements.

[redacted]

[redacted]

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Management Review

(mo/yr)

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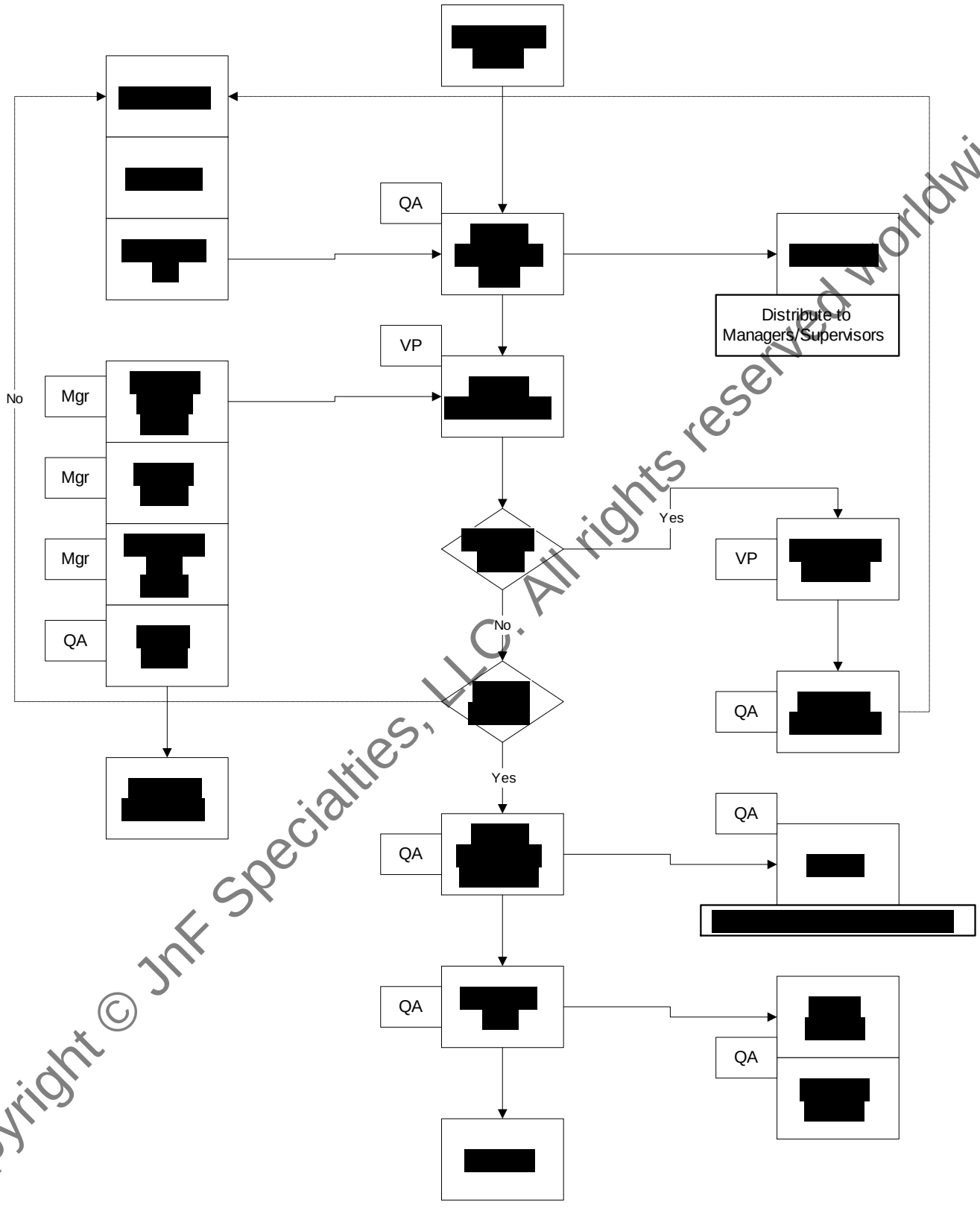

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Defect Prevention Training Program

Mo/Yr

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1.0 PURPOSE

This program establishes the requirements for the development and maintenance of a defect prevention/training program.

2.0 SCOPE

Fabrication and inspection personnel must be trained and properly certified, in addition, machines, equipment and procedures used in *special process operations* must be certified. This certification process must be conducted whenever Contract or (Your Co) requirements suggest the need for certification. This program does not address the training needs for specialists or professional personnel.

3.0 ORGANIZATIONAL

The Quality Group of (Your Co) is responsible for [redacted]

4.0 GENERAL

Machines, equipment and procedures used in *special process operations* that are not certified at the start of a new contract must [redacted]

[redacted]

5.0 PROCEDURES

5.1 The First Day for the New Employee

This orientation day is to make the new employee aware of [redacted]

5.2 Basics

A substantial portion of the training of fabrication and inspection personnel must be concerned with meeting the criteria of [redacted]

[redacted]

5.3 Training of Fabrication and Inspection Personnel

Written specifications or verbal instructions that apply to an operation must be used extensively with the goal of informing the Operator, through practical application, the exact operation to perform. (The policy of the Quality Group regarding verbal instructions is to reduce them to Work Instructions whenever possible prior to implementation into a training routine.)

When standardized samples are available, they [redacted]

During the course of training, the Operator must be made constantly aware of [redacted]

[redacted]

5.3.1 Qualification

A test procedure that establishes an Operator's proficiency in a process must be [redacted]

5.3.2 Certification

Each individual satisfactorily completing the training and qualification tests may [redacted]

6.0 WORKMANSHIP

Adherence to applicable federal, state, local, and Company environmental, health, and safety requirements is mandatory.

[redacted]

[redacted]

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Configuration Management

Mo/Yr

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1.0 SCOPE

These policies and procedures describe, define and establish controls for maintaining the configuration status of deliverable products and provide for each of the following functions:

Responsibility and authority for Configuration Management	Formal Audits: Physical Configuration Audit, Functional Configuration Audit, Internal Reviews and Audits
Configuration Control Board	Continuous Acquisition Support
Problem Reporting	Technical Information Services, Computer Data Storage, Data Management
Preparation and completion of configuration documents	Item configuration conformance prior to installation
Change evaluation criteria, engineering change proposals, classification of changes, engineering orders	Subcontractor surveillance, guidance and control
Program tailored status accounting of product configuration at all times by specification and/or engineering drawing, part number and serial number when appropriate	As-built configuration verification
Processing Deviations and Waivers, classification of defects, role of MRB	Formal Reviews: Preliminary Design Review, Critical Design Review, Test Readiness Review, Production Readiness Review

2.0 THEORY

The following documents form a part of this procedure to the extent specified herein and unless otherwise indicated, the latest revision in effect shall apply. In the event of conflict between this procedure and the referenced document, the contents of this procedure shall be considered a superseding requirement.

3.0 ORGANIZATION & RESPONSIBILITIES

3.1 General

The Engineering, Manufacturing and Quality managers serve as the Configuration Control Board [CCB], which has [redacted]

3.2 CCB responsibilities:

[redacted]

3.2.20 Establish and maintain program documentation and program data libraries to include [redacted].

3.2.21 Control redlined documents pending approval by [redacted]

3.3 Material Review Board (MRB)

The MRB may use the Nonconformance Report Form QC-103-2 as a Calculated Risk Release or Advance Change Notice to [redacted]

4.0 CONFIGURATION IDENTIFICATION

4.1 General

Every deliverable item of hardware maintains configuration identification in the form of technical documentation. These technical documents may include, but are not limited to, [redacted]

4.2 Specifications

New specifications are prepared as needed to define the requirements relating to [redacted]

4.3 Engineering Drawings and Lists

To the extent necessary to provide the full engineering description of the physical and functional requirements of the supply, a set of engineering drawings and associated lists may be prepared according to the requirements for [redacted]

Purchase Orders for supplies may waive, supersede, obsolete or amend the requirements of the engineering drawing when directed by the CCB as evidenced by [redacted]

All deliverable items are fabricated and assembled according to [redacted].

No oral instruction or other random or unwritten authority is accepted in place of formal change control (see the Baseline Management section herein). Redlined technical documents may [redacted]

4.4 Test Plan

The Project Engineer prepares a Test Plan that defines the overall test program in terms of which supplies to test, which tests to perform and [redacted]

4.5 Test Procedures

Using the Test Plan as the overall guidance, the Project Engineer assigns the responsibility to [redacted]

4.6 Document Identification

All engineering documents are assigned identification numbers that are unique to the document. Once a number has been assigned to an engineering document that has been issued, the assigned number will [redacted]

[redacted]

4.6.1 Forms

Forms are exempt from Engineering Order processing but must be controlled and may include, but are not limited to: [redacted]

4.7 Re-identification Practices

A change to an item on an existing engineering document results in complete item interchangeability with regard to [redacted]

4.8 Baseline Management

A configuration baseline may be established to identify and create [redacted]

4.8.0.1 **Pre-Release Baseline**

The formal release of configuration documents is required prior to production of deliverable supplies; however, [redacted]

4.8.1 Functional Baseline

The Functional Baseline (program requirements) is established prior to any scheduled [redacted]

[redacted] At the Functional Baseline, the configuration management system is operating and the released documents have described the following:

[redacted]

4.8.2 Allocated Baseline

After successful completion of the Preliminary Design Review (PDR), the Allocated Baseline (design requirements) is established by [redacted]

The development (performance) configuration documents include:

[redacted]

Formal change control procedures are invoked concurrent with the release of the development (performance) configuration documents.

4.8.3 Product Baseline

After successful completion of the Critical Design Review (CDR), the Product Baseline (Product Configuration) is established with [redacted]

This baseline prescribes:

[redacted]

This baseline and approved changes serve as the configuration reference point for all subsequent reviews. Redlined technical documents may be used if accompanied by a CCB signed and approved Bulletin or written authorization from the applicable Customer. The CCB must [redacted]

4.8.4 Baseline Maintenance

Once established, the baselines serve as the approved departure point for updating by incorporation of changes that have been approved by the Configuration Control Board.

The baselines plus the approved changes represent the product configuration at any point in time. All baseline documentation is processed through the release system.

The release of a technical document requires that it be placed into the normal control system for configuration documents. This control system:

[redacted]

The release system is shown in Figure 2.

[redacted]

5.0 CONFIGURATION CONTROL

5.1 General

Configuration control is the process of maintaining the baseline identification and regulating all changes to that baseline. The 'as-designed' technical documentation must equal the 'as-built' hardware except for approved deviations, waivers or Engineering changes.

This is accomplished by:

[redacted]

5.2 Configuration Control Board

Concurrent with the establishment of the baseline by the approved configuration documentation, change control is vested in the Configuration Control Board. All proposed changes to the baseline documents are [redacted]

5.3 Change Evaluation

The CCB is charged with the responsibility for evaluation of each proposed change that is presented to the CCB. This evaluation includes [redacted]

The need for the change is justified if [redacted]

5.3.1 Multiple Program Usage

Joint change control authority is established where any program shares a commonly identified item with another program.

5.4 Types of Configuration Changes

Changes to the configuration are implemented after approval of [redacted] The definition for each is as follows:

1. Engineering Change [redacted]

2. Deviation [redacted]

3. Waiver [redacted]

5.5 Change Classification

5.5.1 General

Changes in configuration are classified by the CCB as either Class I or Class II. The change classification assigned by the CCB is entered on the Engineering Order, which serves as the document to [redacted]

5.5.2 Class I Change

After the need for the change has been established by the CCB, the engineering change is classified as Class I when it affects one or more of the following:

[redacted]

5.5.3 Class II Changes

Any change that does not fall within the Class I definition is a Class II change. Class II changes are [redacted]

5.6 Change Implementation

5.6.1 General

All approved changes are implemented under the guidance of the configuration management function. Configuration Management maintains [redacted]

[redacted]

5.6.1.1 Multiple Release Levels

Superseded revision levels of drawings may be used by direction of the Contract or Engineering Groups using [redacted]

5.6.2 Engineering Change

During the evaluation of the ECP or EO, the CCB determines [redacted]

5.6.3 Deviation

Implementation of a deviation is by Program Management direction and all resulting configuration changes are noted on the configuration status records, with [redacted]

5.6.4 Waiver

The initial request for a waiver is reviewed by the authorized Material Review Board (MRB) to determine if the requested action is [redacted].

5.7 Change Control

The formal change control functions apply at [redacted]

Preliminary plans, specifications, diagrams and drawings become contractually binding documents [redacted]

[redacted]

5.8 Change Processing

5.8.1 General

Engineering changes are fully documented on an Engineering Order QC-109-3 and presented to the CCB for evaluation. All proposed changes are evaluated by the CCB for:

[redacted]

The CCB exercises restraint in the processing of changes to limit them to those actions where [redacted]

A summary of the processing flow is shown in Figure 1.

5.8.2 Processing Class II Changes

Class II changes are prepared by the Engineer or designee and processed through [redacted]

5.8.2.1 Supplement Releases

All changes require the processing of an Engineering Order; however, Supplements to existing documents that [redacted]

5.8.3 Processing Class I Changes

Proposed Class I engineering changes are approved by the CCB and are submitted to the Customer in the form of [redacted]

[redacted]

5.9 Subcontractor and Vendor Changes

Baselines are established by the subcontract or purchase order. Only those subcontractors having a funded design effort are permitted to [redacted]

5.10 Management Directives

Management members of the CAB/CCB/MRB issue their binding policies, procedures and directives to personnel within their exclusive organization in the form of a Bulletin (Engineering, Manufacturing or Quality). The Bulletin is [redacted].

5.10.1 Work Instructions/Process Guides

Management members of the CCB or delegated Supervisors may issue Work Instructions (for permanent retention) to personnel within their [redacted]

6.0 Configuration Accounting

6.1 General

The baseline documentation is entered into a database that maintains current and historical data for every configuration list. As new configuration lists are generated, approved and placed in the release system, they are [redacted]

6.2 Configuration Accounting Records and Reports

By appropriate sorting of the configuration accounting database, the revision level is [redacted]

The following lists are revised as required to include the latest configuration status of listed documents. Typical records and reports include:

1. Numerical lists [redacted]
2. Indentured Lists [redacted]
3. As-Built Parts List [redacted]
4. EO Status [redacted]

[redacted]

5. Data Lists

[redacted]

6.3 Configuration Account Record

For systems, integrated and tested by the Company, a configuration account record is [redacted]

6.4 Configuration Item Identification Report

As part of the product acceptance for each configuration item, a review of the 'as-designed' configuration is made and compared with the 'as-built' configuration. All differences are [redacted]

6.4.1 As-Built vs. As-Designed Configuration

The 'as-designed' configuration for each deliverable supply is contained in a database. For each serialized subassembly or assembly a listing of the current 'as-designed' configuration is prepared at the time a release to build is processed. This configuration listing is used as the 'As-Designed Parts List' baseline document to [redacted]

[redacted]

7.0 Interface Management

7.1 Interface Control Responsibilities

The Program Manager is responsible for interface definition and control. This activity...

[redacted]

8.0 Configuration Audits

8.1 Quality Group Audits

Each physical item presented for acceptance to the Quality Group is accompanied by [redacted]

8.2 Audit Reports

Audit reports (including all necessary interim reports) document the findings, the corrective actions taken and [redacted]

9.0 Subcontractor and Supplier Control

9.1 Requirements

The applicable configuration management [CM] requirements of this document are flowed-down by the statement of work or purchase order issued to the supplier. The absence of a flow-down clause in procurement documentation indicates that the supplier is not authorized to [redacted] Applicability of specific CM elements to procurements is determined by the Program or Quality function by classifying suppliers as follows:

Category A

[redacted]

Category B

[redacted]

Category C

[redacted]

Category D

[redacted]

9.2 Evaluation of Supplier CM System

All CM plans and supplier internal documentation required by the Company are evaluated. Where deficiencies are observed, approval of procedures is [redacted]

9.3 Subcontractor Control

All major subcontractors to the Company establish and operate subsidiary CCB's conducted in the same manner as the Buyer's CCB. Direction to the subcontractor's CCB is provided by [redacted]

9.4 Vendor Control

All vendor items procured by the Company and its subcontractor(s) are documented on [redacted]

10.0 Software Configuration Management

10.1 Product and Test Software Control

Production of software for integration into deliverable products is controlled according to [redacted]

Figure 1

Change Control Flowchart

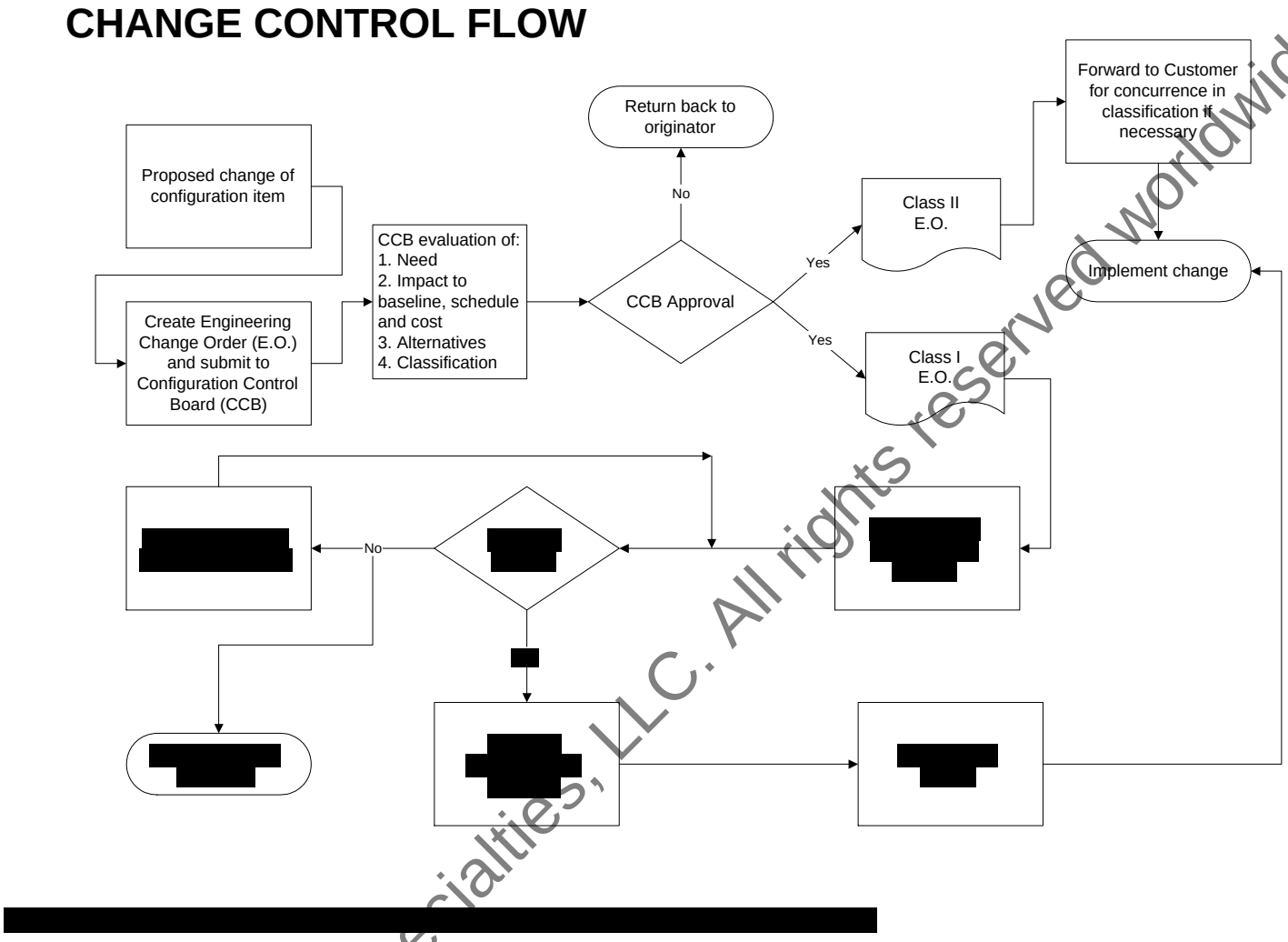
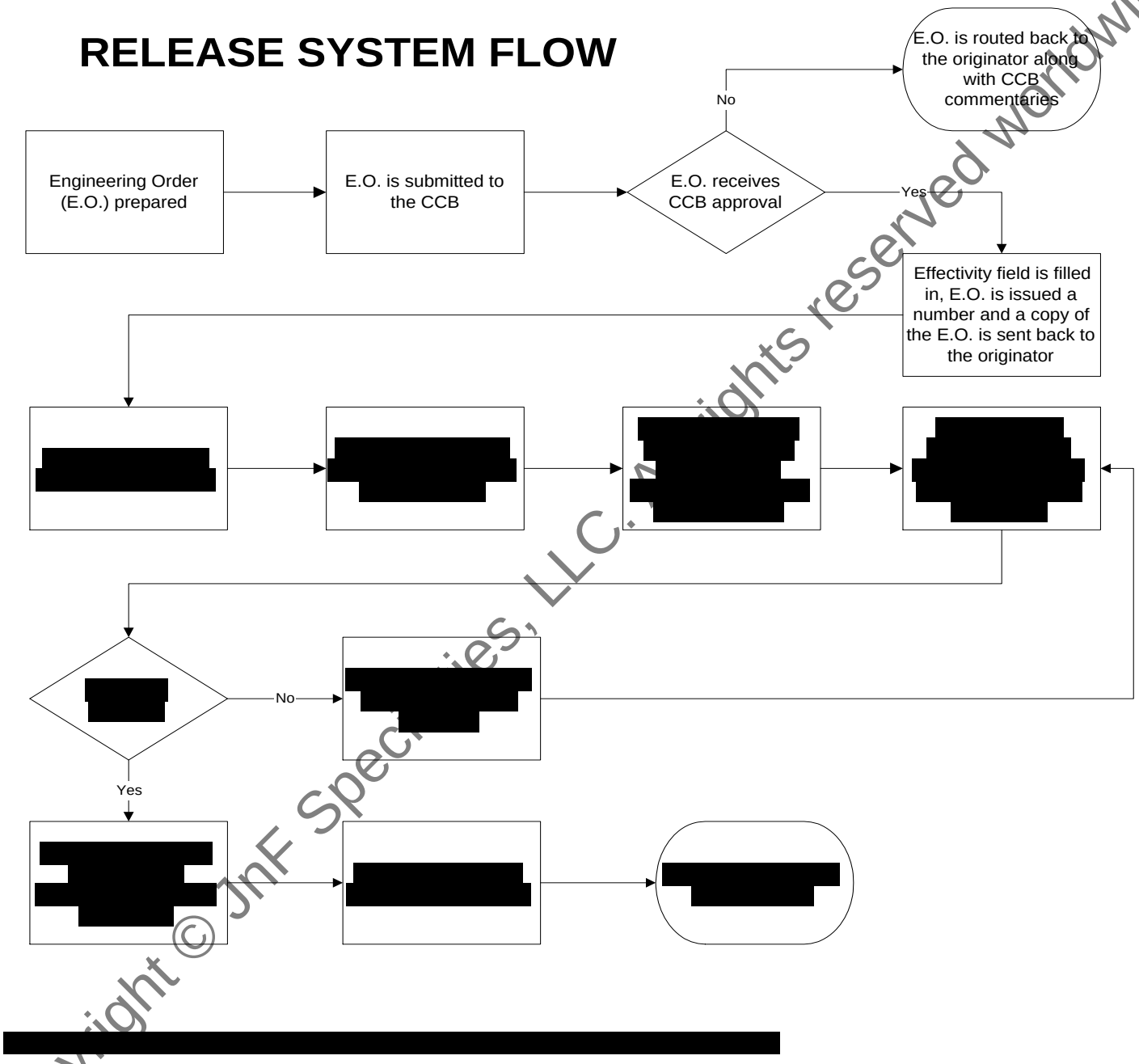


Figure 2

Release System Flowchart



[redacted]

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Property Control

(mo/yr)

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1.0 PURPOSE

To prescribe the minimum procedures for the control of Customer Property according to the regulations outlined in [redacted]

2.0 SCOPE

This procedure shall cover all property furnished to or acquired for use on contracts.

a. Property Administrator means [redacted]

b. Property means [redacted]

1. Property in the possession of or acquired directly by the Customer and subsequently delivered or otherwise made available to the contractor.
2. Contractor acquired property is [redacted]

c. Customer material is property that [redacted]

d. Special Tooling means [redacted]

e. Plant Equipment means [redacted]

f. Scrap means [redacted]

g. Salvage means [redacted]

h. Custodial Records means [redacted]

[redacted]

i. Individual Item Record means [redacted]

j. Stock Record means [redacted]

k. Discrepancies Incident to Shipment means [redacted]

l. Work-in-Process is the definition used for the purpose of [redacted]

m. CPFF Material, Contractor procured CPFF material is [redacted]

n. Bonded Storage means [redacted].

3.0 RECEIVING

Receiving Inspection shall inspect all Customer furnished property upon receipt to [redacted]

3.1 If overages, shortages or damaged conditions are noted upon receipt of property acquired for the Customer account (under a CPFF contract), the Company shall [redacted]

3.2 Upon receipt of Customer furnished property or property acquired by the Company for the account of the Customer the receiving function shall [redacted]

3.3 Shipping containers that pack Customer property that are of a reusable nature shall [redacted]

4.0 CUSTOMER PROPERTY RECORDS

Upon receipt of Customer owned property and/or material, the Company Property Administrator shall [redacted] In the case of material items, stock record cards shall be prepared and shall contain the following information:

[redacted]

4.1 Records of Misdirected Shipments

Misdirected shipments shall be reported to [redacted]
Records shall be maintained to provide the following information:

[redacted]

The Company shall forward this information in writing to [redacted]

4.2 Documentation

Documentation supporting all entries to the Customer Property Records shall [redacted]

4.3 Postings to Property Records

All property record postings shall be made as promptly as possible. No more than [redacted]

[redacted]

5.0 MATERIAL REQUISITION/ISSUE

After receipt of Customer furnished material and preparation by the Company Property Administrator of the required stock record cards the material shall [redacted]

5.1 Sensitive material issued according to 5.0 shall [redacted]

6.0 UTILIZATION

It is the responsibility of the Company Property Administrator to assure that Customer owned property is [redacted]

7.0 MAINTENANCE

The Company Property Administrator shall insure that Customer owned plant equipment is [redacted]

8.0 PHYSICAL INVENTORIES

Inventory, as used in this procedure, consists of [redacted]

The personnel who perform the physical inventory shall not [redacted]

[redacted]

8.1 The Company shall investigate and report to the Customer Property Administrator (CPA) all cases of [redacted]

The report shall contain at a minimum:

[redacted]

9.0 DISPOSITION

At the completion of a contract under which Customer property was furnished, the Company shall [redacted]

10.0 SUBCONTRACT CONTROL

The Company purchasing function shall insure that the following statement is included in all subcontracts or vendor purchase orders where Customer furnished material or property is furnished to the subcontractor or vendor:

[redacted]

[redacted]

Unless relieved by the Contracting Officer with respect to Customer property as herein provided, Seller shall [redacted]

10.1 The provisions of paragraph 8.1 apply to subcontractors possessing or controlling Customer property accountable under the contract.

11.0 REPORTS

Reports shall be prepared by the Property Administrator according to [redacted]

12.0 PRECIOUS METALS, EXPLOSIVE COMPOUNDS

12.1 Immediately upon receipt Receiving Inspection (R&I) shall inspect material according to [redacted]

12.1.1 Sensitive material shall [redacted]

12.2 The Company's Property Administrator, upon taking possession of accepted sensitive material, shall [redacted]

12.2.1 The Company Property Administrator shall complete stock record cards according to [redacted]

12.2.2 Property records shall exhibit special marking [redacted]

12.3 The Property Administrator shall issue material according to [redacted]

12.4 All other conditions of this procedure shall [redacted]

12.5 The Property Administrator shall notify the Customer Property Administrator by telephone immediately upon the discovery of missing sensitive materials and shall forward a written report according to paragraph 8.1 within [redacted]

13.0 REQUESTING AND/OR ACQUIRING CUSTOMER FURNISHED PROPERTY

A. Requests for Customer furnished property are subject to [redacted]

B. Requests and/or acquisition of Customer Owned Property by direct purchase from outside suppliers or items issued from contract owned inventory is [redacted]

14.0 HAZARDOUS WASTE MANAGEMENT

Property received from or acquired for Customer that contains material of a hazardous nature shall [redacted]

14.1 [redacted]

14.2 The Company's EHS Group shall be notified immediately upon receipt and instructions for handling the material shall [redacted]

14.2.1 The instructions shall contain [redacted]

14.2.1.1 Storage and handling instructions may [redacted]

14.3 Scrap or Salvage materials shall [redacted]

15.0 WORKMANSHIP

Adherence to applicable federal, state, local and environmental, health and safety requirements is mandatory.

[redacted]

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Quality Planning

Mo/Yr

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1.0 Initial Quality Planning

1.1 Quality Management

The Quality Group is responsible for [redacted]

1.2 Contracts Management

The Contracts Group is responsible for [redacted]

1.3 Engineering Management

The Engineering Group is responsible for [redacted]

1.4 Evaluation Record

Specific elements of the quality effort are detailed in a Compliance Matrix, QC-120 to the extent determined by the Quality Group. A careful review of all documents and referenced documents provided by the contract is performed. The Compliance Matrix serves as a Work Breakdown Structure for the Quality Group, and is required to list the following:

[redacted]

The Compliance Matrix serves as [redacted]

1.5 Training

Training efforts are based upon [redacted]

When the work is limited to R&D or the quantity of work is less than [redacted]

2.0 Documented Instructions

2.1 Preparation

All work affecting quality is described by [redacted]

2.2 Mfg / QA Traveler – Routing Ticket

The Mfg / QA Traveler or Routing Ticket is designed to [redacted]

The Quality Group prepares the Traveler by performing tasks which may include but are not limited to:

[redacted]

The traveler may include, but is not limited to:

Traveler#	ECP# and date of effectivity
Traveler revision letter and date of release	Split-lot control
Page#	Description of manufacturing operation (even#)
Form#	Description of inspection operation (odd#)

[redacted]

After the traveler is reviewed it is approved by [redacted]

2.3 Inspection Instructions

The Quality Group prepares inspection instructions by performing tasks that may include, but are not limited to:

[redacted]

- Prepare Inspection Instruction, QC-110. The instruction may include, but is not limited to:

Instruction#	Specification number(s) and revision letter(s)
Title of Instruction	Mfg/QA Traveler/Planner# supported by the inspection instruc
[redacted]	[redacted]

Instruction title	Operation letter
QA approval	Description of inspection operation including a listing of the documents that are essential to the process, e.g., drawing(s), specification(s), test procedure(s) and revision letters for each, the attributes to be verified and the method to be used
Drawing# and revision letter	Supplemental directives
[redacted]	[redacted]

[redacted]

After approval, the inspection instruction is released for use where specified. The inspection instruction is exempt from [redacted]

2.4 Manufacturing Procedure

The Manufacturing procedure does not specify 'how to do' the task but rather specifies 'what to do' for the work function. The Manufacturing and Engineering Groups have lead responsibility for creating Manufacturing procedures. The Engineering and Quality Groups have collateral responsibilities for this function related to providing [redacted] The Manufacturing or Engineering Group prepares the Manufacturing procedure by performing tasks that may include, but are not limited to:

[redacted]

[redacted]

Prepare the Manufacturing procedure using form QC-129-1 or -2. The procedure may include, but is not limited to:

Scope of the operation	Model/Type of equipment
Theory of operation	Production operations; 'how-to' details are described in training documents
References to applicable documents	Performance requirements
[redacted]	[redacted]

2.5 Workmanship Standard

The Engineering and Quality Groups have lead responsibility for [redacted] The Engineering or Quality Group evaluates workmanship standard trade-offs based on factors such as, but not limited to:

Business economics	Ease of manufacture
Customer satisfaction	Operational and use requirements
[redacted]	[redacted]

[redacted]

DCC controlled issues of workmanship standards are forwarded to personnel who perform [redacted]

2.6 Work Instruction

The Quality Group has lead responsibility for preparing work instructions for administrative and technical operations that are not described by a written procedure or Bulletin, QC-109-5, 109-6 or 109-7. Work instructions include, but are not limited to: [redacted].

[redacted]

[redacted]

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Calibration System
Policies and Procedures

(mo/yr)

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[redacted]

1.0 Scope

These procedures comply with the requirements of MIL-STD-45662. Measuring instruments are calibrated, at a temperature of 55°F to 95°F and 5% to 95% relative humidity, in the QC office, engineering office, production area, or laboratory. Sufficient temperature stabilization time is allowed before calibration. For cases where calibration must be conducted in the production area, stabilization time is also allowed.

2.0 Definitions

a) Gages are precision devices that compare the characteristics of an item to specified requirements.

b) Recall - All gages require recertification at established intervals. Recall dates are identified by a month/year designation. Certification is performed no later than the last day of the month/year designation except as otherwise provided. All gages may be used for acceptance/rejection of product during the month/year recall interval.

c) M&TE - Measurement and test equipment

d) Standards - Accepted values of natural physical constants or values traceable to National or International Standards.

e) Procurement of Gages - Gages are procured from a qualified source and are inspected by Gage Inspection before use. A newly acquired measuring or test device that has been certified as calibrated, and whose certification indicates an NIST reference number, may be issued to the user activity after a calibration interval and records have been established.

f) Special Equipment - (Your Co) standards, instruments, chemicals, and tools for which a measurement standard is not available on-site to perform calibrations.

g) Significantly out-of-tolerance - An instrument's accuracy that exceeds the manufacturer's published limits.

h) Adequacy - Adequacy, range, resolution and stability of M&TE and standards is determined by quality characteristic measurement requirements on an individual basis.

I) Accuracy Ratio - 10:1 for linear, weight, current, and voltage transfer standards.

3.0 Procedures

3.1 Identification

When a gage does not provide its own serial number [redacted]

3.2 Storage of Gages

All company owned gages are kept clean and are stored in [redacted]

3.3 Recall

A rotating card file system is maintained on all instruments. The form used is QC-116-1. The rotating card file provides the means for [redacted]

3.4 Working Record

In addition to the card file system, a working record sheet, QC-116-4 is kept on each company-owned gage/standard. The purpose of this record is to [redacted]

3.5 Calibration Frequency

Calibration intervals are based on the following criteria: [redacted].

Calibration intervals are established in terms of [redacted].

Tools that are identified as "Spares" in the calibration database are calibrated based upon [redacted]

TABLE I, Calibration Intervals

Calibration Cycle	Recalibration Cycles to Qualify for New Calibration Cycle	New Calibration Cycle
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

3.6 Interval Adjustment

M&TE whose calibration error is recorded as being greater than the last recorded calibration error, [redacted]

3.7 Interval Extension / Adjustment

M&TE calibration intervals may be extended or adjusted [redacted]

3.8 Calibration Overdue

Overdue items are prevented from [redacted]

3.9 Calibration Identification

A calibration tag, QC-116-2, showing date of calibration, calibration accuracy, calibration expiration date (end of last day of Mo/Yr) and the technicians stamp or initial is [redacted]

3.10 Calibration Standards/Special Equipment

It is the position of the National Conference of Standards Laboratories (NCSL) that:

[redacted]

When calibrations are made for special equipment the purchase order specifies, "Insure for full replacement value with shipper" and also require the lab to submit a report which contains:

[redacted]

3.11 Recall

A rotating card file system is maintained on all (Your Co) Transfer Standards indicating [redacted]

3.12 Standards Control

A current list of all calibration standards used by the calibration section is [redacted]

3.13 Customer Furnished Tooling

The Metrology department places all Customer furnished inspection gages on the calibration system. Records are kept showing [redacted]

3.14 Out-of-Tolerance Equipment and Tooling

Equipment and tooling found to be significantly out of tolerance, damaged, inoperative, erratic or exhibiting some other form of anomalous condition should [redacted]

3.15 Provision for Use of Out-of-Tolerance Equipment (apply sparingly)

An instrument whose calibration error is significantly out-of-tolerance [redacted]

3.16 Suspected Product Nonconformance

Any product certified with M&TE subsequently found to be out-of-tolerance is [redacted]

3.17 Traceability

Inspection instruction sheets and manufacturing travelers specify measurement and test equipment utilized for product conformance inspection. The M&TE number is [redacted]

3.18 Production Tooling Used as Media of Inspection

Any production tooling which is used to accept attributes of a part, sub-assembly or assembly is [redacted]

3.19 Employee Owned Tools

Personal Tooling or gages owned as personal property by employees of (Your Co) are [redacted]

3.20 Subcontractor Calibration

The quality requirements outlined in Supplier Quality Requirements QC-117 are [redacted]

3.21 Storage and Handling of M&TE

[redacted]

3.22 Setting / Selecting a Reference Standard

Rule: The measurement range of a device being checked for accuracy must be [redacted] – see the following examples.

[redacted]

VOLTMETER:

A voltmeter that is required to be calibrated shall be verified for accuracy within an equivalent range on the reference standard, e.g.,

[redacted]

CURRENT SHUNT:

[redacted]

OTHER MEASUREMENT DEVICES:

[redacted]

[redacted]

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Cost of Quality

Mo/Yr

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1.0 Costs Related to Quality

1.1 Responsibility

The Quality Group has the lead responsibility for collecting quality cost data; organizing, evaluating, and maintaining records of this information, and generating quality cost reports. The quality cost information is organized and summarized in four categories:

1-Prevention, 2-Appraisal, 3-Internal Failure, and 4-External Failure.

Quality cost data do not require 'to-the-penny-accuracy'. Hourly and salary Quality Group personnel record their time charges by the four categories.

1.2 Prevention Costs

The quality costs relative to the prevention category are those associated with the efforts devoted to keeping defects from occurring, such as corrective action, quality planning, test procedure preparation, quality training and indoctrination, data collection and reporting, process planning, and design review.

1.3 Appraisal Costs

The quality costs relative to the appraisal category are those associated with the efforts devoted to maintaining quality levels by means of formal evaluations, such as inspection and testing at suppliers, receiving inspection, in-process inspection and test, final inspection and test, chemical analysis, calibration, internal audits, and Customer audits.

1.4 Internal Failure Costs

The quality costs relative to the internal failure category are those associated with the efforts devoted to products or process that do not meet specifications or Customer expectations internally, such as rework, repair, scrap, re-inspection, retesting, material review, and contract penalties according to contract agreements.

1.5 External Failure Costs

The quality costs relative to the external failure category are those associated with the efforts devoted to products or process that do not meet specifications or Customer expectations externally, such as repair or rework of returned supplies, replacement of returned supplies, complaint processing, and handling and shipping damage.

1.6 Reports

Quality costs may be reported by category or by program, and may be summarized and compared to current and historical costs of quality. Certain supplies may also be correlated to part type or P/N to assist in identifying problems and to aid in trend analysis. Reports are furnished to the Customer upon request.

1.7 Cost of Quality Evaluation

The Quality Group has lead responsibility for evaluating the quality cost reports, which may be used to initiate CAB directives. Management periodically reviews the Costs of Quality to determine appropriate action to assure product and service quality, and to avoid unnecessary costs.

CAB=Corrective Action Board

Cost of Quality Data

Frank	[redacted]	8	3			5	2.5	1	1
Michelle	[redacted]	5.5		4.5	4.5				13.5
Wanda	[redacted]			1	6.25				24.75
Mary	[redacted]				3.75				
Hannelore	[redacted]				1	4			27.5
Suzy	[redacted]			3.5		21.5			7
Melinda	[redacted]								32
Debra	[redacted]								33
Chantal	[redacted]				12				19
Susan	[redacted]			32					
Laura	[redacted]							32	
Judith	[redacted]								
Tiffany	[redacted]			32.25					
Test-Lab	[redacted]								
Frank	[redacted]	16					16		4
Michelle	[redacted]			4	1.5	2			33
Wanda	[redacted]			2.5	20.25				16.75
Mary	[redacted]								4.5
Hannelore	[redacted]				10	1.5			28.5
Suzy	[redacted]					26.5			2
Melinda	[redacted]								40
Debra	[redacted]								43.5
Chantal	[redacted]					6			34
Susan	[redacted]			36.75					
Laura	[redacted]							40.5	
Judith	[redacted]								
Tiffany	[redacted]			41					
Test-Lab	[redacted]								
Frank	[redacted]	3.5		3.5		12.5	2.5	2	
Michelle	[redacted]			6.25					28.25
Wanda	[redacted]			4.75	28.25	2.5			4.5
Mary	[redacted]	15		4		19.5			0.5
Hannelore	[redacted]			2.75	8.25	2.25			26.75
Suzy	[redacted]			2.5					29.5

[redacted]

Cost of Quality Dollars

	p1	p2	p3	p4	p5	p6	p7	a1	a2
Calc Sum Row	24.75	696	552.25	1599.3	2632	556.25	139.5	1873.8	9999.
Hours	24.75	696	552.25	1599.3	2632	556.25	139.5	1873.8	9999.
	p1	p2	p3	p4	p5	p6	p7	a1	a2
Percentages	0.09	2.54	2.01	5.83	9.59	2.03	0.51	6.83	36.44

*Green = cells with formulas

Total Possible = (People in dept plus Test Lab * 40 hours in a week* Weeks with that numb

**Test lab=24 (for holiday) or 30 (regular days) total possible hours. For ease in c

Actual vs. Available

85%

$189,837.84 Actual

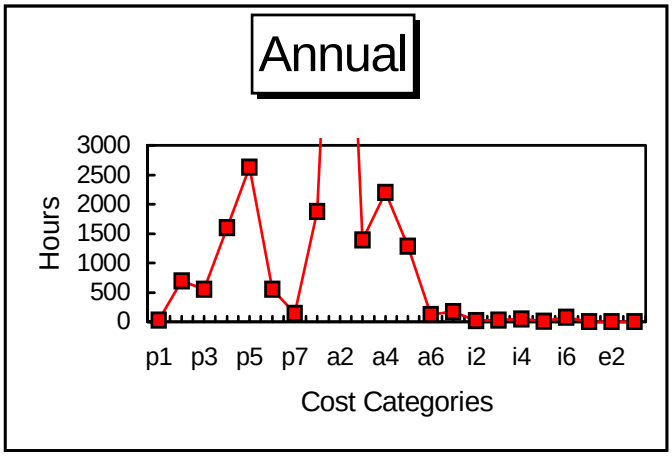
$222,264.00 Available

Prevention Cost	Appraisal Cost	Internal Failure	External Failure
P1 Corrective Action	A1 R&I QC	I1 Failure Analysis	E1 Warran
P2 Quality Planning, PO's	A2 QC	I2 EP Scrap/Rework	E2 [redacted]
P3 Test Procedure Prep	A3 Lab/Test Chemicals	I3 R&I Scrap/Rework	E3 [redacted]
P4 [redacted]	A4 [redacted]	I4 [redacted]	
P5 [redacted]	A5 [redacted]	I5 [redacted]	
P6 [redacted]	A6 [redacted]	I6 [redacted]	
P7 [redacted]			

[redacted]

Cost of Quality Graphs

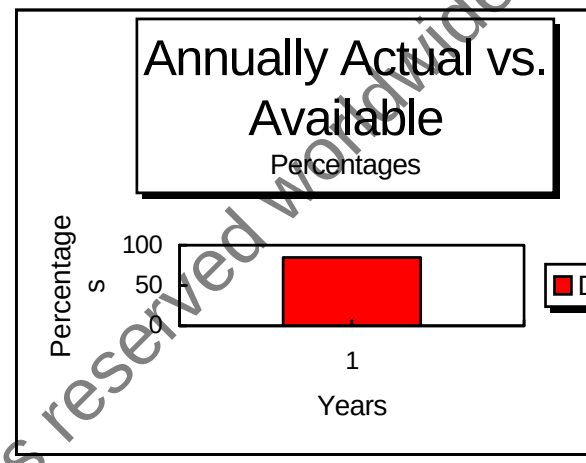
COST CATEGORIES



a2=10000 hrs

PERCENTAGES

Year1 85



Prevention Cost	Appraisal Cost	Internal Failure	External Failure
P1 Corrective Action	A1 R&I QC	I1 Failure Analysis	E1 Warranty Rep
P2 Quality Planning, PO's	A2 QC	I2 EP Scrap/Rework	E2 [redacted]
P3 Test Procedure Prep	A3 Lab/Test Chemicals	I3 R&I Scrap/Rework	E3 [redacted]
P4 [redacted]	A4 [redacted]	I4 [redacted]	
P5 [redacted]	A5 [redacted]	I5 [redacted]	
P6 [redacted]	A6 [redacted]	I6 [redacted]	
P7 [redacted]			

[redacted]

Your Logo

Your Company Name

PURCHASING

Origination Date: XXXX

Document Identifier:	Purchasing
Date:	Latest Revision Date
Project:	Customer, Unique ID, Part Number
[redacted]	[redacted]
[redacted]	[redacted]

Abstract:
This document describes [redacted]

[redacted]

REVISION LOG

Issue	Date	Comment	Author
0-0			

DOCUMENT CHANGE RECORD

Issue	Item	Reason for Change

[redacted]

TABLE OF CONTENTS

1.0 PURPOSE

This document defines the Purchasing process including or making reference to procedures for the various activities within the process.

Note: this procedure applies to suppliers of products or providers of services that directly affects the quality of our products or services. Suppliers that provide office and maintenance supplies, furniture, grounds keeping services, etc. are not subject to the controls of this procedure.

2.0 THEORY

The purchase of materials that go into our products or services that help us produce products affects everything we make. As a result, it is important to monitor and control the quality of both products and services that we receive as well as the suppliers of such products and services.

3.0 PROCEDURE: SUPPLIER EVALUATION AND SELECTION

3.1 All suppliers of product related materials or services must be evaluated unless these suppliers are: listed on a Customer's approved Supplier list, Government approved Supplier or listed on the Customer's requirements.

3.2 Supplier evaluation is conducted by following the format on the Supplier Evaluation Form.

3.3 The Supplier Evaluation Form ensures that all new suppliers are properly evaluated for criteria related to quality, delivery, pricing, reputation and other factors.

3.4 Once approved through the Supplier Evaluation Form, the Quality Manager will update the Approved Supplier List.

3.5 The following ratings apply to suppliers:

[redacted]

3.6 Once entered into the Approved Supplier List, suppliers are rated as CONDITIONAL. Conditional suppliers are subject to verification of their products or services upon receipt or delivery to advance in rating.

3.7 Using incoming (receiving) inspection results for product suppliers and employee feedback on service providers, the Quality Manager will determine if the Supplier should be increased in rating to UNRESTRICTED.

3.8 Using the results from combination of the following functions for product suppliers, the Quality Manager will determine if the Supplier should be increased in rating to DOCK-TO-STOCK: [redacted]

3.9 For suppliers providing product, incoming inspection results are recorded on the Subcontractor Performance Rating Spreadsheet, which calculates the Supplier's current quality rating based on parts received and parts accepted. A new Supplier that rates 100% on their first delivery may be upgraded to UNRESTRICTED.

3.10 If a new Supplier rates 50 – 99%, the Supplier [redacted]

3.11 If any Supplier rates less than 50% (RED) the Supplier [redacted]

3.12 If items are returned to any Supplier using a Material Shipper, the Quality Manager will determine a course of action and a rating.

3.13 Any Supplier may be de-rated to [redacted]

3.14 Management may override [redacted]

3.15 During management review, the entire Approved Supplier List is [redacted]

4.0 PROCESSING REQUISITIONS AND PURCHASE ORDERS

4.1 During review of each requisition, the Quality Group will [redacted]

4.2 When appropriate, the purchase order defines acceptance criteria for [redacted]

4.3 As applicable, purchase order information includes:

[redacted]

d) requirements relative to:

[redacted]

4.4 The requirements for delegation are defined when [redacted]

4.5 When the Company or its Customer needs to perform verification activities at a Supplier facility, the Purchase Order [redacted]

4.6 See the process map herein.

4.7 Emergency Purchasing Authority: The Company will authorize [redacted]

5.0 OTHER PURCHASING RULES

5.1 In all instances, the Purchasing Department will [redacted]

5.2 Any employee of the Purchasing Department that has any financial or other interest in a supplier company, either directly or through any member of his/her immediate family, shall [redacted]

5.3 The acceptance by purchasing personnel of gifts or gratuities from suppliers is [redacted]

5.4 The acceptance of items intended for the purpose of advertisement and bearing the name of the Supplier is [redacted]

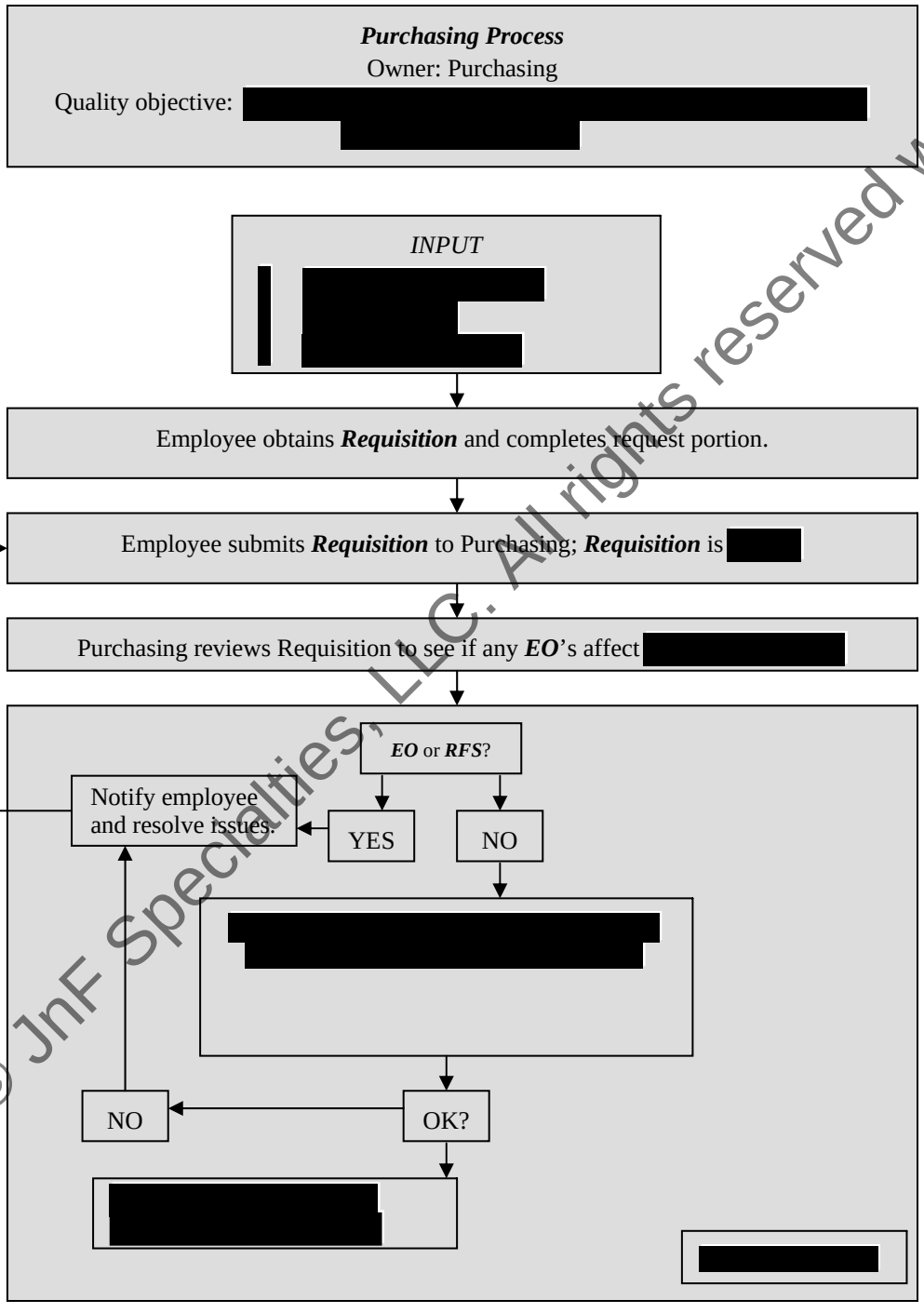
5.5 The Purchasing department will cooperate with Customer-related activities and will [redacted]

5.6 The Purchasing department will not, [redacted]

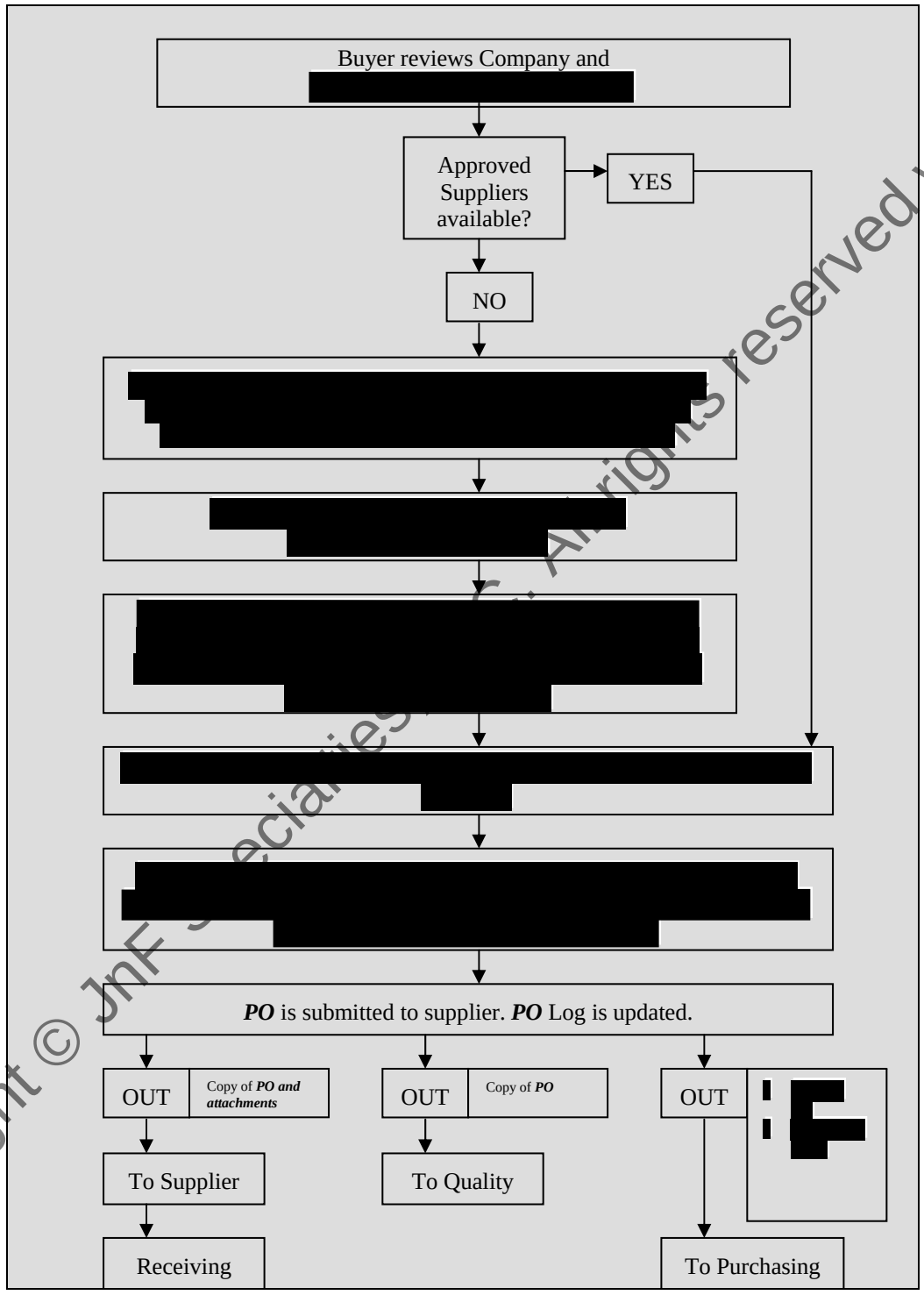
5.7 The Company will [redacted]

[redacted]

6.0 PROCESS MAP



from previous page…



[redacted]

[redacted]

Tips:
Double click grey area at top and bottom of page to edit header/footer
Search for the word “your” throughout doc and replace as required

Manufacturing Readiness Review

(mo/yr)

Revisions		Rev:	
Letter	E.O. Number - Description	Date	
Used On	Contract#:	**Your Company Name**	
Prepared By: [redacted]	[redacted]	**YOUR PROGRAM**	
		Your Procedure #	
	[redacted]	[redacted]	1 of 8

Your Company Logo

TABLE OF CONTENTS

1.0 PURPOSE

The purpose of the Manufacturing Readiness Review (MRR) is to demonstrate the overall production readiness of a supplier and assure that the items to be manufactured will meet the requirements of the Statement of Work and engineering drawings. All necessary manufacturing plans, travelers, tools, facilities and other resources shall be in place and available to ensure conformance to all quality and design requirements within the negotiated program budget and schedule.

2.0 SCOPE

2.1 This procedure shall apply to all in-house production and outside subcontractors/suppliers that fabricate and/or assemble deliverable hardware. Manufacturing Readiness Reviews should be identified during the proposal phase of a program and shall be specified in the negotiated contract, purchase order, and Statement of Work (SOW).

2.2 This document addresses issues related only to 'readiness to start manufacturing'. In instances where a Supplier is responsible for design and analysis tasks, additional design reviews shall be required. Design/analysis reviews and how to conduct them are not in the scope of this document. However, any residual issues from design reviews that are related to manufacturing shall be considered suitable for inclusion in the MRR agenda.

3.0 APPLICABLE DOCUMENTS

This document is subject to the requirements of the following subcontract documents in descending order of precedence.

[redacted]

4.0 GENERAL

4.1 A manufacturing readiness review is required when any of the following conditions exist.

[redacted]

5.0 MRR PROCESS, REQUIREMENTS AND RESPONSIBILITIES

5.1 GENERAL

5.1.1 An MRR is a formalized process of review and critique conducted jointly by [redacted]

5.1.2 The review shall be conducted on-site at the Suppliers facility jointly by [redacted]

5.2 MRR TEAMS

The Customer Team shall consist of representatives from [redacted]

5.2.1 It will be the responsibility of the Subcontract representative to act as [redacted]

5.2.2 Similar to the Customer Team, the Supplier Team shall be comprised of [redacted]

5.3 MRR DATA PACKAGE

5.3.1 The data package shall include the documentation identified in paragraphs 5.3.2 and 5.3.6. Items marked with an asterisk are considered mandatory and are to be included in the package that will be supplied to the team members prior to the proceedings The remaining items shall be discussed during the proceedings.

5.3.2 It is the responsibility of the respective team leader(s) to ensure that data packages are complete and that adequate review time is given per 5.1.2.

5.3.6 [redacted]

5.4 MRR SCHEDULE

5.4.1 The date of the MRR proceedings shall be set at the time of contract award, if possible, but no later than [redacted]

5.4.2 A complete data package shall be provided to each of the participants on the two teams at least [redacted]

5.5 MRR AGENDA AND PROCEDURES

5.5.1 The agenda for the MRR Proceedings shall, in general, follow the items listed in para. 5.3 and shall be finalized by the two team leaders. Additional related topics, such as lessons learned from previous similar jobs, may be included for review as deemed appropriate.

5.5.2 The MRR proceedings shall be held on-site at the Supplier facility and the Supplier's Team leader, usually the Program Manager, shall act as [redacted]

5.5.3 It is the responsibility of the respective team leaders to ensure [redacted]

6.0 POST-MRR EVALUATION AND ACTION ITEMS FOLLOW-UP

6.1 CUSTOMER FEEDBACK AND READINESS RATING

6.1.1 Following the MRR proceeding, the Customer Team shall provide [redacted] An overall readiness rating shall be assigned from the following three categories:

[redacted]

[redacted]

6.2 ACTION ITEMS

6.2.1 All action items generated through the MRR proceedings and the feedback briefings to the Supplier management shall [redacted]

[redacted]

Attachment 1

ACTION ITEM

Date:		Action Item Number:	
Meeting:		Due date:	
[redacted]			
[redacted]		[redacted]	
[redacted]		[redacted]	

Action Item Response:

Signature:_____

Date:_____

[redacted]

ACTION PLAN

			Page: _____ of _____
			Date: _____
Department:		Responsible Authority:	
Team Designation:			
Project Goal:			
[redacted]	[redacted]		[redacted]

[redacted]	[redacted]	[redacted]		[redacted]		[redacted]

Your Form# (mo/yr)

[redacted]

CERTIFICATE OF TEST

PO No:		Quantity:	
P/N:		P/N Rev:	
P/N Name:		Item No:	
Mfr's Lot No if Used:		**PO No. to Mfr if Used:**	

It is hereby certified that the items supplied in this shipment have been found to be in conformance with

_____ _____ _____

Authorized Representative Title Date

Your Form# (mo/yr)

Your business logo Your business name, address, phone, fax, email, URL	**CERTIFICATE OF TEST**
Sold To:	Shipped To:

[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]
	[redacted]	[redacted]
	[redacted]	[redacted]

[redacted]

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[redacted]

[redacted]

[redacted]	[redacted]
Signed:	Date:

Your Form # (mo/yr)

[redacted]

CERTIFICATE OF COMPLIANCE

From:	
To:	
Attention: Receiving Inspection	
PO#:	
Customer P/N:	
[redacted]	
[redacted]	
[redacted]	
[redacted]	
[redacted]	
[redacted]	

NOTICE

[redacted]

Your Form# (mo/yr)

Your Logo

[redacted]

Your Logo
Address
Phone, Fax, etc

CERTIFICATE OF COMPLIANCE FOR MILITARY PRODUCT

Distributor	Supplier	Customer
Name:	Name:	Name:
Address:	Address:	Address:
City:	City:	City:
State / Zip:	State / Zip:	State / Zip:
Phone:	Phone:	Phone:
[redacted]	[redacted]	

[redacted]

[redacted]	[redacted]	[redacted]
[redacted]		
[redacted]		

[redacted]

Authorized Signature:

Date:

Your Form# (mo/yr)

[redacted]

Your Logo	Your Business Name, Address, Phone, Fax, Email, URL	**Material Certification**	
		Date	Number
		Purchase Order Number	
Sold To:		Ship To:	
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]			

		[redacted]
		[redacted]

Your Form # (mo/yr)

This is to certify that the above shipment is [redacted]

Name and Date

[redacted]

CERTIFICATION

Your Logo	Your Business Description	Your Address, Phone, Fax, Email, URL

Date:		Customer Order No:	
Customer:		Part No:	
Quantity:		Revision:	

[redacted]

Your Form # (mo/yr)

WE CERTIFY:

[redacted]

[redacted]

Tips:
Double click grey area at top and bottom of page to edit header/footer
Search for the word “your” throughout doc and replace as required

Manufacturing Control Document
Template for Operations Manual

(mo/yr)

Revisions		Rev:	
Letter	E.O. Number - Description		Date

Used On	Contract#:	**Your Company Name**	
Prepared By:			
[redacted]:			
[redacted]:		**MANUFACTURING CONTROL DOCUMENT**	
[redacted]		MCD-TBD	
		[redacted]	[redacted] 1 of 1

TABLE OF CONTENTS (content is simulated)

Instructions for producing MCD (remove these instructions when complete):

Electronic copy: [redacted]

Paper copy: [redacted]

PROPRIETARY STATEMENT

This Manufacturing Control Document is proprietary and may not be reproduced for any reason in whole or in part without [redacted]

[redacted]

CONTROLLED/ UNCONTROLLED CHANGES

1.0 CONTROLLED CHANGES

1.1 The Company will notify the Buyer of any controlled areas of change. Specifics of the change will be given in [redacted].

1.2 If the change is not accepted by the Buyer, the impact may [redacted]

2.0 UNCONTROLLED CHANGES

2.1 The Company will notify the Buyer in writing when changes occur in manufacturing or service operations that are not controlled by the Company and will significantly alter the performance characteristics of the product or service. The notification will identify the [redacted]

[redacted]

QUALITY ASSURANCE

The Quality Group ensures that the Manufacturing Control Document is effective and all Procurement Specifications and Contract Requirements are satisfied. The Product Assurance procedures and policies relevant to MCD-TBD are implemented by QC-100, the Product Assurance Plan.

Additional documents that support the work-product of the MCD are prepared as required, such as, but not limited to:

Documents that are referenced by the procedures contained in the MCD apply only to the extent they are specified and at their most current revision level.

Glossary:

WORKMANSHIP

Adherence to applicable federal, state and local environmental health and safety (EHS) requirements is mandatory. All production areas must be maintained at standards of cleanliness that are required to ensure quality products and services.

SUPPLIER SURVEY

SUPPLIER INFORMATION: **CAGE CODE**: _____

Supplier Name: _____ **Supplier Code: _____**

Address: _____
(Street) (City) (State) (Zip)

Quality Manager: _____ Phone: _____ Fax: _____

SURVEY BACKGROUND INFORMATION:

Reason for Survey: New Supplier ☐ Recertification ☐ Corrective Action Follow-Up ☐

Survey Date:_____ Approval Date:_____

Approval Method: Survey ☐ History ☐

(If History, attach summary) History summary attached: Yes ☐ No ☐

Special Process Codes (if known) _____

[redacted]

Surveyor's Office Phone Number: _____. Survey was requested by site: _____

Signature: _____ Date: _____

SUPPLIER SURVEY

[redacted]

Audit and HDBK 50 Question Number	MIL-Q-9858 Paragraphs	Acceptable	In space under 'Acceptable' enter 'Y' for conformance, 'N' for Nonconformance, or 'X' for Not Applicable. Under comments enter terse statement describing nature of nonconformance for each 'N' entry. **Comments are mandatory for all objective evidence observed.**
	1.0 Scope **1.1 Applicability (Not applicable)** **1.2 Contractual intent (Not applicable)** **1.3 Relation to other contract requirements (Not applicable)** **2.0 (Not applicable)** **3.0 Quality Program Management** **3.1 Organization**		
1. (1)	Does the established program identify the organizational element responsible for each of the various quality efforts?		
2. (2)	Do the personnel performing the quality functions have sufficient authority, responsibility, and freedom of action to identify and evaluate quality problems and initiate, recommend, or provide solutions?		
3. (3)	Does management regularly review the status and adequacy of the quality program?		
	3.2 Initial Quality Planning		
4. (1)	Does the supplier conduct a complete review to identify and provide for special or unusual contract requirements?		
5. (2)	Does the supplier perform initial quality planning as early as possible?		
6. (3)	[redacted]		
[redacted]	[redacted]		
	3.3 Work Instructions		
8. (1)	Are documented work instructions available and used for all work operations which affect quality?		
9. (2)	Are such work instructions complete and appropriate?		
10. (3)	Are standards available for each work operations?		
11. (4)	Are work instructions compatible with associated inspection and testing?		
12. (5)	Do supervisors, managers, and inspectors make proper use of work instructions?		
13. (6)	[redacted]		
[redacted]	[redacted]		

SUPPLIER SURVEY

Audit and HDBK 50 Question Number	MIL-Q-9858 Paragraphs	Acceptable	In space under 'Acceptable' enter 'Y' for conformance, 'N' for Nonconformance, or 'X' for Not Applicable. Under comments enter terse statement describing nature of nonconformance for each 'N' entry. **Comments are mandatory for all objective evidence observed.**
	records indicate the quantitative degree of acceptance or rejection of product of work effort?		
19. (6)	If rejection is recorded, do records show resulting action?		
20. (7)	Do management actions reflect the analysis and use of records?		
	3.5 Corrective Action		
21. (1)	Does the program provide for prompt detection of inferior quality and correction of its assignable causes?		
22. (2)	[redacted]		
28. (8)	When corrections are made, is their effectiveness reviewed and are they monitored later?		
	3.6 Costs Related to Quality		
29. (1)	Has the supplier determined the specific quality cost data that it needs?		
30. (2)	[redacted]		
	4.0 Facilities and Standards		
	4.1 Drawings, Documentation and Changes		
34. (1)	Is there a procedure for assuring the engineering adequacy of drawings?		
35. (2)	Is there a procedure to ensure currentness and completeness of drawings?		
36. (3)	[redacted]		

SUPPLIER SURVEY

Audit and HDBK 50 Question Number	MIL-Q-9858 Paragraphs	Acceptable	In space under 'Acceptable' enter 'Y' for conformance, 'N' for Nonconformance, or 'X' for Not Applicable. Under comments enter terse statement describing nature of nonconformance for each 'N' entry. **Comments are mandatory for all objective evidence observed.**
40. (7)	Is there appropriate monitoring by the supplier of all changes not requiring Customer approval?		
41. (8)	Does the program clearly delineate and cover the supplier's responsibility for controlling and recording design and other changes originating with subtier suppliers?		
42. (9)	[redacted]		
[redacted]			
[redacted]			
[redacted]			
	4.2 Measuring and Test Equipment		
46. (1)	Are the gauges, testing and measuring equipment necessary to assure that products meet technical requirements available and used?		
47. (2)	Is this test and measuring equipment properly maintained?		
48. (3)	[redacted]		
[redacted]			
[redacted]			
[redacted]			
[redacted]			
[redacted]			
	4.3 Production Tooling used as a Media of Inspection		
54. (1)	Is all tooling which is used as inspection equipment proved for accuracy prior to use?		
55. (2)	[redacted]		
	4.4 Use of Suppliers' Inspection Equipment		
56. (1)	[redacted]		
57. (2)	Does the supplier provide personnel to perform this inspection, if warranted?		
	4.5 Advanced Metrology Requirements		

SUPPLIER SURVEY

Audit and HDBK 50 Question Number	MIL-Q-9858 Paragraphs	Acceptable	In space under 'Acceptable' enter 'Y' for conformance, 'N' for Nonconformance, or 'X' for Not Applicable. Under comments enter terse statement describing nature of nonconformance for each 'N' entry. **Comments are mandatory for all objective evidence observed.**
58. (1)	Has the supplier reviewed the request for proposal or contract to determine whether or not there are any unusual precision measurement requirements?		
59. (2)	[redacted]		
	5.0 Control of Purchases **5.1 Responsibility**		
60. (1)	Does the program assure that products and services furnished by subtier suppliers meet contract requirements?		
61. (2)	Does the program provide for the selection of subtier suppliers on the basis of their ability to perform satisfactorily as well as evidence of their capability to produce quality products?		
62. (3)	Is objective quality evidence provided by the subtier supplier and is it used to assure effective and economical control of quality?		
63. (4)	[redacted]		
	5.2 Purchasing Data		
72. (1)	Does the supplier require his subtier suppliers to have effective control of product quality?		
73. (2)	Do the supplier's purchasing documents contain all of an item's specific design, manufacturing, and testing requirements?		
74. (3)	[redacted]		

SUPPLIER SURVEY

Audit and HDBK 50 Question Number	MIL-Q-9858 Paragraphs	Acceptable	In space under 'Acceptable' enter 'Y' for conformance, 'N' for Nonconformance, or 'X' for Not Applicable. Under comments enter terse statement describing nature of nonconformance for each 'N' entry. **Comments are mandatory for all objective evidence observed.**
	[redacted]		
	6.0 Manufacturing Control		
	6.1 Materials and Materials Controls		
79. (1)	Does the supplier inspect subtier supplier's material to the extent necessary upon receipt?		
80. (2)	Does the supplier adjust the extent of receiving inspection on the basis of objective data?		
81. (3)	Does the supplier assure that raw materials conform to [redacted]		
	6.2 Production Processing and Fabrication		
85. (1)	Are all production processes accomplished under controlled conditions?		
86. (2)	Does control include documented work instructions, adequate production equipment, and appropriate working environments?		
87. (3)	Do work instructions provide criteria for determining whether production, processing, and fabrication work is acceptable or unacceptable?		
88. (4)	Does the quality program monitor both the issuance of work instructions and compliance with them?		
89. (5)	[redacted]		

SUPPLIER SURVEY

Audit and HDBK 50 Question Number	MIL-Q-9858 Paragraphs	Acceptable	In space under 'Acceptable' enter 'Y' for conformance, 'N' for Nonconformance, or 'X' for Not Applicable. Under comments enter terse statement describing nature of nonconformance for each 'N' entry. **Comments are mandatory for all objective evidence observed.**
	[redacted]		
	6.3 Completed Item Inspection and Testing		
99. (1)	Are completed items given a final inspection and test which indicates overall quality?		
100. (2)	Does the final testing adequately simulate performance in use?		
101. (3)	[redacted]		
	6.4 Handling, Storage, and Delivery		
103. (1)	Are adequate work and inspection instructions prepared and implemented for handling, storage, and delivery of material?		
104. (2)	Are handling, storage, and delivery procedures monitored in accordance with established quality program requirements?		
105. (3)	Are there procedures and regular schedules for the [redacted]		
	6.5 Nonconforming Material		
111. (1)	Does the supplier have an effective system for controlling		

SUPPLIER SURVEY

Audit and HDBK 50 Question Number	MIL-Q-9858 Paragraphs	Acceptable	In space under 'Acceptable' enter 'Y' for conformance, 'N' for Nonconformance, or 'X' for Not Applicable. Under comments enter terse statement describing nature of nonconformance for each 'N' entry. **Comments are mandatory for all objective evidence observed.**
	nonconforming material?		
112. (2)	[redacted]		
[redacted]	[redacted]		
[redacted]	[redacted]		
[redacted]	[redacted]		
[redacted]	[redacted]		
	6.6 Statistical Quality Control and Analysis		
117. (1)	Are supplier-designed sampling plans available for review by the Customer Representative?		
118. (2)	Do supplier-developed sampling plans provide valid confidence and quality levels?		
119. (3)	[redacted]		
	6.7 Indication of Inspection Status		
120. (1)	Does the supplier have an effective system for identifying the inspection status of products?		
121. (2)	[redacted]		
	7.0 Coordinated GE and/or Government/Supplier Actions **7.1 GE Inspection at Supplier or Subtier Supplier Facilities**		
122. (1)	Do supplier purchasing documents require Customer or Government source-inspection of subtier suppliers only when Customer or Government so requests?		
123. (2)	[redacted]		
[redacted]	[redacted]		
	7.2 Government Property **7.2.1 Government Furnished Material** **7.2.2 Damaged Government Furnished Material (GFM)** **7.2.3 Bailed Property**		
125. (1)	Does the supplier examine GFM upon receipt for damage, quantity, completeness, and type?		
126. (2)	[redacted]		
[redacted]	[redacted]		

SUPPLIER SURVEY

Audit and HDBK 50 Question Number	MIL-Q-9858 Paragraphs	Acceptable	In space under 'Acceptable' enter 'Y' for conformance, 'N' for Nonconformance, or 'X' for Not Applicable. Under comments enter terse statement describing nature of nonconformance for each 'N' entry. **Comments are mandatory for all objective evidence observed.**
128. (4)	[redacted]		
	[redacted]		
	[redacted]		
	[redacted]?		
132. (8)	Are records of all inspections and maintenance work on bailed property maintained and available for review by the Government Representative?		

SUPPLIER SURVEY

NOTES

CM - Configuration Management
(Co) - Your Company
CS - Colorado Springs
EO - Engineering Order
HP - Handling Procedure
IIS - Inspection Instruction Sheet
MCD- Manufacturing Control Document
MN - Materials Note
PP - Purchasing Policy
PR - Process Record
QC - Quality Control
R&I - Receiving and Inspection
RFW - Request For Waiver
RW - Rework
WI - Work Instruction
WP- Welding Procedure
WS - Workmanship Standard

[redacted]

ACTION ITEM

Date:		Action Item Number:
Meeting:		Due Date:

ACTION REQUIRED

[redacted]

Date: _____

[redacted]

Your Logo

[redacted]

Tips:
Double click grey area at top and bottom of page to edit header/footer
Search for the word “your” throughout doc and replace as required

Nonconformance Report Disposition Process

(mo/yr)

Revisions		Rev:	
Letter	E.O. Number - Description	Date	
Used On	Contract#:	**Your Company Name**	
Prepared By: [redacted]	[redacted]	**YOUR PROGRAM**	
		Your Procedure #	
	[redacted]	[redacted]	1 of 1

Your Company Logo

1.0	Reporting Agent	When a nonconformance, continuous improvement or calculated risk condition occurs in manufacturing, testing or inspection, record the condition on the top-half of a Material Report, QC-103-2, following its format. Do not leave any spaces blank above the "Send-To" field. The Nonconformance, CIO, or CRR row is for MRB use. [redacted]
1.1	Reporting Agent	Forward completed MR to Document Control (DCC).
2.0	DCC	Enter MR into the routing database, copy the MR, stamp DCC on the form and forward original to the Quality Mgr.
3.0	Quality Mgr.	[redacted]
3.1	Quality Mgr.	Review and implement the MRB policies of QC-103.
3.2	Quality Mgr.	Forward the MR to DCC for further processing.
4.0	1st MRB Reviewer	Review and implement the MRB policies of QC-103. *Policy:* The MR is a tool to reduce cost and gain control.
4.1	1st MRB Reviewer	[redacted]
	IF	THEN
	Engineering Order (EO) or Request for Waiver (RFW) is the normal course of action	Record the EO# or RFW# in the Corrective Action Section. Forward the EO or RFW to the Configuration and Discrepancy Mgr.
4.2	1st MRB Reviewer	[redacted]
[redacted]		

	IF	THEN
	MRB Member Disagrees with recorded disposition	[redacted]
[redacted]	[redacted]	[redacted]
6.0	Quality Mgr.	Perform actions required to complete the Material Review Board Acceptance Section of the MR. [redacted]
	IF	THEN
	Customer Required	Forward MR to Configuration and Discrepancy Mgr. for retrieval of Customer concurrence of disposition or signature when required by contract (RFW or ECP A/R).
6.1	Quality Mgr.	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
	IF	THEN
	Hold Purchase or CAB Required	Copy the MR to Purchasing. Add the MR to the CAB Agenda.

[redacted]

MATERIAL REPORT

☐Nonconformance ☐Continuous Improvement Opportunity ☐Calculated Risk Release

SUBCONTRACTOR:_____ DATE RECEIVED: _____

MR#: SHEET _____ OF _____

Traveler#:		Op#:		Quantity Received:		Job Number:	
Item Name:		**Description: ID S/B Spec#, Para#, & IS Condition w/Quantity &Dimension Affected**					**# Discrepant**
Dwg/Spec:							
Part#:							
Part# Rev:							
Lot or S/N:							
P.O.#:							

[redacted]

MINOR [redacted]

[redacted]

Your Logo Use other side for additional information **Shaded Area for Administrative Use Only**

QC-103-2 (mo/yr)

REQUEST FOR CORRECTIVE ACTION

1	RFCA#:	Date:	MR#:
2	☐Internal	☐External	
3	To:	Return To: Your Co. Attention: Address:	
4	Classification of Defect ☐Critical ☐Major ☐Minor Required Response(Working Days) ☐___Days ☐15Days ☐30Days ☐Implement Next Purchase Order	Nonconformance Report#: Purchase Order#: Part#: Spec#: Lot Qty: Reject Qty: Supplier Type:	

[redacted]

[redacted]

CALCULATED RISK RELEASE

Date:		[redacted]	
[redacted]			

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Tips:
Double click grey area at top and bottom of page to edit header/footer
Search for the word “your” throughout doc and replace as required

Nonconformance Disposition Procedure

Mo/Yr

Revisions		Rev:	
Letter	E.O. Number - Description	Date	
Used On	Contract#:	**Your Company Name**	
Prepared By: [redacted]		[redacted]	
		YOUR PROGRAM	
		Your Procedure #	
		[redacted]	1 of 13

Your Company Logo

TABLE OF CONTENTS

1.0 SCOPE

These policies and procedures define the actions taken and the documentation used when suspect material is detected in supplies.

2.0 APPLICABILITY

The following documents will serve as guidelines. This document will take precedence should a conflict arise concerning Material Review Procedure.

Military

ANSI Z1.4	Inspection by Attributes
ANSI Z1.9	Inspection by Variables

[redacted]

3.0 MATERIAL CONTROL

When a deliverable supply is suspected of noncompliance to applicable drawings, specifications or other requirements it is [redacted]

3.1 Documentation

The Material Report (MR) QC-103-2 is used to document suspect material, MRB action, specification interpretation, [redacted]

3.1.1 Material Report (MR)

Reporting document for suspect material is provided to all necessary personnel. This document provides: [redacted]

3.1.2 Request for Corrective Action, QC-103-3

This document as well as the MR form is used to [redacted]

3.1.3 Material Report, Purpose

The MRB checks a box at the top of the Material Report to identify the purpose of the MR. [redacted]

3.1.4 Material Report, Change Implementation

"Conditional Acceptance" recommendations are subject to a review for the appropriateness of a documentation change and the method for accomplishing the change (i.e., a design change or a recommendation for a change to Customer requirements).

[redacted]

3.2 Remedial and Preventive Action

The following MRB functions may be performed, but are not limited to:

[redacted]

3.3 Material Review Dispositions

3.3.1 Initial Review

An Initial Review of the prepared MR is conducted by QA to determine the adequacy and completeness of the record. Immediate action may include, but is not limited to:

[redacted]

A Material Report may not be voided by the Initial Review procedure since the MR may act as [redacted].

3.3.2 Submit to MRB

Three qualified MRB signatures are required to implement MRB dispositions. Dispositions may include, but are not limited to: [redacted]

3.3.3 Return to Vendor (Receiving Inspection)

Receiving inspection initiates an MR for suspect material. After review of production schedules and contractual commitments, QA may request Receiving Inspection personnel to conduct a 100% inspection of the material to [redacted]

Returned supplies are accompanied by an MR or Discrepancy Notice, or other suitable documentation in the event that the supplies are obviously unfit for use. If a Corrective Action is requested, the supplier is provided [redacted]

Corrective action may be requested based on the following criteria:

[redacted]

3.4 Material Review Board (MRB)

Material Review is conducted by a delegated board comprised of one (1) representative whose primary responsibility is Quality (usually the Quality Manager), one (1) representative whose primary responsibility is Engineering, [redacted]

[redacted]

3.4.1 Responsibility

The Material Review Board:

[redacted]

At least two members of the Configuration Control Board (CCB) must review and sign all MRB dispositions to [redacted]

3.4.2 Applicable Dispositions

MRB dispositions may include, but are not limited to:

[redacted]

3.4.2.1 Applicable Classifications

Major: This classification applies to a Waiver/Deviation, RTV, and Scrap disposition. Corrective and preventive action is normally required for this classification; however, these actions are not mandatory for supplies that are scrapped due to loss by expected processing attrition, supplies that are obviously unfit for use, or for supplies that meet the definition of Minor Nonconformance.

Minor: This classification applies to a Conditional Accept, Standard Rework/Repair, and Non-Standard Rework/Repair disposition. Corrective and preventive action is at the discretion of the MRB.

[redacted]

3.4.2.2 Customer Disposition Authority

Major: A Waiver/Deviation disposition *is subject* to Customer approval.
RTV and Scrap dispositions are *not subject* to Customer approval.

Minor: Conditional Accept and Non-Standard Rework/Repair dispositions are *subject to* Customer approval.
Scrap, RTV, or Standard Rework/Repair dispositions are *not subject* to Customer approval.

[redacted]

3.4.3 Customer MRB Review

An incomplete MR is not subject to Customer review.

3.4.4 MRB Qualification

A Material Review Board member must:

[redacted]

3.5 Definitions

The following definitions apply:

a) Anomaly

A condition that is discovered during routine manufacturing or testing that is not specifically prohibited, previously documented or practiced, but could affect product or process safety, reliability, durability, performance, interchangeability, or the basic objectives of a contract.

b) Continuous Improvement Opportunity

A tool to document conditions that do not conceivably affect product or process safety, reliability, durability, performance, interchangeability, safety, or the basic objectives of a contract. A metric for the Continuous Improvement Program.

c) Major Nonconformance

Any nonconformance that after execution of the MRB disposition will result in hazardous or unsafe conditions for individuals using or maintaining the affected product or process or that may adversely affect safety, reliability, durability, performance, interchangeability of parts or assemblies, weight or the basic objectives of the contract.

d) Minor Nonconformance

Any nonconformance that after execution of the MRB disposition will **not** result in hazardous or unsafe conditions for individuals using or maintaining the affected product and will **not** adversely affect safety, reliability, durability, performance, interchangeability of parts or assemblies, weight or the basic objectives of the contract.

[redacted]

f) Repair

Any additional work performed to bring the supply to a condition that departs from one or more characteristics of the drawing, specification, or purchase order. Repairs are accomplished with MRB and/or Customer approved procedures.

[redacted]

i) Suspect

Any condition that deviates from standard practice or any alleged nonconformance

j) Technical Documents

[redacted]

3.6 Corrective Action Board (CAB)

The CAB insures that causes of nonconformances are determined according to [redacted]

3.6.1 CAB Authority and Responsibilities:

[redacted],

[redacted]

3.6.2 SPC Data Review (Optional)

When process control techniques are used, and analysis of cumulative data for a targeted condition reveals [redacted]

3.6.2.1 Process Control (SPC is Optional)

When corrective action is required due to inadequate SPC process control, and until such time as it has been demonstrated that the corrective action has been effective, the CAB may request that the subject process include:

[redacted]

3.6.3 Monitoring Effectivity

The CAB insures that reviews of MRB decisions are [redacted]

3.7 Disposition of Material

3.7.1 All Material Reports are disposed of by an MRB decision:

[redacted]

[redacted]

3.7.2 Reprocessing

Instructions for reprocessing material after repair are included in [redacted]

3.7.3 Customer Repair/Rework Approval

Proposed repair/rework methods are submitted to the MRB and the Customer for review and [redacted]

3.7.4 Repair Inspection

Material that has been satisfactorily repaired is subject to [redacted]

3.7.5 Scrap Identity

Scrapped material is conspicuously identified and controlled to preclude its subsequent use as other than scrap.

3.8 Material Report Documentation

3.8.1 Summary

The system maintains records of suspect material, dispositions, assignable causes, corrective actions and effectiveness of corrective actions. The cycle time between Material Report (MR) preparation and completion is targeted at no more than [redacted]

Records are organized to permit efficient retrieval for:

[redacted]

3.8.2 MR Preparation

The Material Report documents all suspect conditions. The Material Report includes:

[redacted]

3.8.3 MR Completion

The MRB adds the following information to the documentation:

[redacted]

Upon signature approval by all MRB members the MR is [redacted]

3.8.4 Request for Corrective Action [RFCA]

If the MRB requires corrective action according to the "Applicable Classification" paragraph herein, the following information is recorded on the MR or RFCA as appropriate to internal or external activities:

[redacted]

3.8.5 Analysis of Trends (Optional)

If corrective action is not warranted according to the "Applicable Classifications" paragraph herein, but corrective action is elected by the MRB, the CAB [redacted]

3.8.6 Costs (Optional)

Data for costs associated with material reporting is collected to the extent specified by the CAB. A system using actual costs, relative cost constants, estimates by qualified personnel, or any combination thereof is used. The CAB uses the cost data for appropriate action. The cost data may include, but is not limited to the following:

[redacted]

3.9 Summary Report (Optional)

A Summary Report may include, but is not limited to:

[redacted]

[redacted]

3.9.1 Data Availability (Optional)

This data is available for on-site review by the Customer unless it is defined as "Competition Sensitive".

[redacted]

Inspection Tags
Green = Good, Yellow = Withhold, Red = Bad
Use standard, colored card stock – size approximately 3.5" tall by 5.75" wide or use stock size

GOOD MATERIAL TAG			Your Logo		
P/N:		PO #:		Date:	
Dwg #:		Rev:		Lot #:	
[redacted]		[redacted]		[redacted]	
[redacted]		[redacted]		[redacted]	
[redacted]			[redacted]		
[redacted]					
[redacted]					

QC-105 (mo/yr)

GOOD MATERIAL TAG			Your Logo		
P/N:		PO #:		Date:	
Dwg #:		Rev:		Your Lot #:	
Customer P/N:		Customer Lot #:		Customer:	
[redacted]		[redacted]		[redacted]	
[redacted]		[redacted]		[redacted]	
[redacted]		[redacted]		[redacted]	
[redacted]			[redacted]		
[redacted]					
[redacted]					
[redacted]					
[redacted]					

QC-105-1 (mo/yr)

[redacted]

WITHHOLD TAG		Your Logo	
Date:		Item Name:	
[redacted]		[redacted]	
[redacted]		[redacted]	
[redacted]			

QC-106 (mo/yr)

BAD MATERIAL TAG		Your Logo	
Date:		Item Name:	
[redacted]		[redacted]	
[redacted]		[redacted]	
[redacted]			

QC-113 (mo/yr)

[redacted]

GOOD MATERIAL TAG		Your Logo		
P/N:		Rev:		Date:
PO#:		Lot#:		
MR#:		Qty Ok:		
Ready For:				
Initials:				

QC-105-2 (mo/yr)

GOOD MATERIAL TAG		Your Logo		
P/N:		Rev:		Date:
PO#:		Lot#:		
MR#:		Qty Ok:		
Ready For:				
Initials:				

QC-105-2 (mo/yr)

GOOD MATERIAL TAG		Your Logo		
P/N:		Rev:		Date:
PO#:		Lot#:		
MR#:		Qty Ok:		
Ready For:				
Initials:				

QC-105-2 (mo/yr)

GOOD MATERIAL TAG		Your Logo		
P/N:		Rev:		Date:
PO#:		Lot#:		
MR#:		Qty Ok:		
Ready For:				
Initials:				

QC-105-2 (mo/yr)

GOOD MATERIAL TAG		Your Logo		
P/N:		Rev:		Date:
PO#:		Lot#:		
MR#:		Qty Ok:		
Ready For:				
Initials:				

QC-105-2 (mo/yr)

GOOD MATERIAL TAG		Your Logo		
P/N:		Rev:		Date:
PO#:		Lot#:		
MR#:		Qty Ok:		
Ready For:				
Initials:				

QC-105-2 (mo/yr)

GOOD MATERIAL TAG		Your Logo		
P/N:		Rev:		Date:
PO#:		Lot#:		
MR#:		Qty Ok:		
Ready For:				
Initials:				

QC-105-2 (mo/yr)

GOOD MATERIAL TAG		Your Logo		
P/N:		Rev:		Date:
PO#:		Lot#:		
MR#:		Qty Ok:		
Ready For:				
Initials:				

QC-105-2 (mo/yr)

GOOD MATERIAL TAG		Your Logo		
P/N:		Rev:		Date:
PO#:		Lot#:		
MR#:		Qty Ok:		
Ready For:				
Initials:				

QC-105-2 (mo/yr)

GOOD MATERIAL TAG		Your Logo		
P/N:		Rev:		Date:
PO#:		Lot#:		
MR#:		Qty Ok:		
Ready For:				
Initials:				

QC-105-2 (mo/yr)

WITHHOLD TAG		Your Logo	
Date:		Item Name:	
PO #:		Item Part Number:	
Lot #:		Material Report #:	
S/N:		Initials:	
Reason for Withholding:			

QC-106-1 (mo/yr)

WITHHOLD TAG		Your Logo	
Date:		Item Name:	
PO #:		Item Part Number:	
Lot #:		Material Report #:	
S/N:		Initials:	
Reason for Withholding:			

QC-106-1 (mo/yr)

WITHHOLD TAG		Your Logo	
Date:		Item Name:	
PO #:		Item Part Number:	
Lot #:		Material Report #:	
S/N:		Initials:	
Reason for Withholding:			

QC-106-1 (mo/yr)

WITHHOLD TAG		Your Logo	
Date:		Item Name:	
PO #:		Item Part Number:	
Lot #:		Material Report #:	
S/N:		Initials:	
Reason for Withholding:			

QC-106-1 (mo/yr)

WITHHOLD TAG		Your Logo	
Date:		Item Name:	
PO #:		Item Part Number:	
Lot #:		Material Report #:	
S/N:		Initials:	
Reason for Withholding:			

QC-106-1 (mo/yr)

WITHHOLD TAG		Your Logo	
Date:		Item Name:	
PO #:		Item Part Number:	
Lot #:		Material Report #:	
S/N:		Initials:	
Reason for Withholding:			

QC-106-1 (mo/yr)

Helpful Hint:
Purchase green “presentation” paper for the Good Material Tag and yellow “presentation” paper for the Withhold Tag, then print and cut whenever you need…

ACCEPTED MATERIAL		Your Logo		
THIS MATERIAL HAS BEEN INSPECTED AND ACCEPTED				
P/N:		Rev:		Date:
PO#:		Lot#:		
MR#:		Qty Ok:		
Initials:				

QC-105-3 (mo/yr)

ACCEPTED MATERIAL		Your Logo		
THIS MATERIAL HAS BEEN INSPECTED AND ACCEPTED				
P/N:		Rev:		Date:
PO#:		Lot#:		
MR#:		Qty Ok:		
Initials:				

QC-105-3 (mo/yr)

ACCEPTED MATERIAL		Your Logo		
THIS MATERIAL HAS BEEN INSPECTED AND ACCEPTED				
P/N:		Rev:		Date:
PO#:		Lot#:		
MR#:		Qty Ok:		
Initials:				

QC-105-3 (mo/yr)

ACCEPTED MATERIAL		Your Logo		
THIS MATERIAL HAS BEEN INSPECTED AND ACCEPTED				
P/N:		Rev:		Date:
PO#:		Lot#:		
MR#:		Qty Ok:		
Initials:				

QC-105-3 (mo/yr)

ACCEPTED MATERIAL		Your Logo		
THIS MATERIAL HAS BEEN INSPECTED AND ACCEPTED				
P/N:		Rev:		Date:
PO#:		Lot#:		
MR#:		Qty Ok:		
Initials:				

QC-105-3 (mo/yr)

ACCEPTED MATERIAL		Your Logo		
THIS MATERIAL HAS BEEN INSPECTED AND ACCEPTED				
P/N:		Rev:		Date:
PO#:		Lot#:		
MR#:		Qty Ok:		
Initials:				

QC-105-3 (mo/yr)

ACCEPTED MATERIAL		Your Logo		
THIS MATERIAL HAS BEEN INSPECTED AND ACCEPTED				
P/N:		Rev:		Date:
PO#:		Lot#:		
MR#:		Qty Ok:		
Initials:				

QC-105-3 (mo/yr)

ACCEPTED MATERIAL		Your Logo		
THIS MATERIAL HAS BEEN INSPECTED AND ACCEPTED				
P/N:		Rev:		Date:
PO#:		Lot#:		
MR#:		Qty Ok:		
Initials:				

QC-105-3 (mo/yr)

ACCEPTED MATERIAL		Your Logo		
THIS MATERIAL HAS BEEN INSPECTED AND ACCEPTED				
P/N:		Rev:		Date:
PO#:		Lot#:		
MR#:		Qty Ok:		
Initials:				

QC-105-3 (mo/yr)

ACCEPTED MATERIAL		Your Logo		
THIS MATERIAL HAS BEEN INSPECTED AND ACCEPTED				
P/N:		Rev:		Date:
PO#:		Lot#:		
MR#:		Qty Ok:		
Initials:				

QC-105-3 (mo/yr)

FINAL INSPECTION

PERFORMED BY

____

YOUR LOGO

QC-105-4 (mo/yr)

FINAL INSPECTION

PERFORMED BY

____

YOUR LOGO

QC-105-4 (mo/yr)

FINAL INSPECTION

PERFORMED BY

____

YOUR LOGO

QC-105-4 (mo/yr)

FINAL INSPECTION

PERFORMED BY

____

YOUR LOGO

QC-105-4 (mo/yr)

FINAL INSPECTION

PERFORMED BY

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YOUR LOGO

QC-105-4 (mo/yr)

FINAL INSPECTION

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QC-105-4 (mo/yr)

FINAL INSPECTION

PERFORMED BY

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YOUR LOGO

QC-105-4 (mo/yr)

FINAL INSPECTION

PERFORMED BY

____

YOUR LOGO

QC-105-4 (mo/yr)

[redacted]

Helpful Hints:

Purchase “presentation” paper in your choice of color and then print and cut labels whenever you need.

Purchase peel-and-stick labels of the correct size and then print whenever you need.

Your Logo

ROUTING TICKET

ACCOUNT#:

Operator:				Date:	
XXX Lot#:			XXX Lot#:		
Drawing#:		Rev:		Lot#:	

[redacted]

Prepare Routing Ticket for each…

QC-107 (mo/yr)

[redacted]

Manufacturing / QA Process Audit Record					Survey#:
Process:	[redacted]	Inspector:		Date:	
[redacted]		[redacted]		[redacted]	[redacted]

Quality System Impact Analysis		
Auditor(s):	Procedure Name and # under Audit:	
Date:	Supervisor Affected:	Areas Audited:
Brief Description of Practice:	[redacted]	
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	
[redacted]		
Comments:		

QC-108-2 (mo/yr)

[redacted]

[redacted]

Tips:
Double click grey area at top and bottom of page to edit header/footer
Search for the word “your” throughout doc and replace as required

INTERNAL AUDIT PLAN

(Mo/Yr)

Revisions		Rev:	
Letter	E.O. Number - Description		Date

Used On	Contract#:		**Your Co Name**
Prepared By:			
[redacted]			**INTERNAL AUDIT PROCEDURE**
			QC-108
			[redacted] 1 of 6

Your Logo

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[redacted]

1.0 PURPOSE

Establish a schedule and criteria for auditing production, administration and quality control procedures that are specified on various product Data Lists, Mfg/QA Travelers, Operation Sheets, Inspection Instruction Sheets, Manufacturing Control Documents, Engineering Drawings and established Policies and/or Procedures for work functions that affect a deliverable product.

2.0 GENERAL

The auditing operation shall be conducted at least once every calendar year; more frequently as directed by the Quality Group. The audit personnel shall determine procedural conformance to each manufacturing, administrative and quality control operation referenced on the applicable Data List or contained within a referenced document found on the Data List. A General Practice policy or procedure that is not referenced on a Data List is subject to audit if the process affects a deliverable product. Processes, procedures and policies that do not directly affect a deliverable product are exempt from audit.

3.0 REQUIREMENTS

3.1 Written Policies and/or Procedures; Product Line Specific

Prepare form Mfg/QA Process Survey QC-108-1 to exhibit a paragraph by paragraph data entry for each directive in the procedure and/or policy referenced on the applicable document that is directly or indirectly referenced therein.

[redacted]

3.2 General Practices (Unwritten Policies and/or Procedures)

An unwritten, sound business practice, policy and/or procedure that affects a deliverable product must be recorded on the Mfg/QA Process Survey QC-108-1 to the fullest extent practicable at the time of discovery.

[redacted]

Complex math knowledge as a basis for the engineering design discipline
Inspection station setup to measure part compliance
[redacted]
.

3.2.4 Sample practices that *do* require written procedures include specific elements of many disciplines. Specific elements are those understood to be germane to subjects such as, but not limited to:
[redacted]

3.3 Product Conformance Records

Records produced to provide evidence of deliverable product conformance shall be examined for comparison to the latest Document Control Center (DCC) record or applicable product procedure.
[redacted]

4.0 WORKMANSHIP

Adherence to applicable federal, state, local, and environmental, health and safety requirements is mandatory.

[redacted]

Manufacturing / QA Process Audit					Survey#:
Process:		Inspector:		Date:	
[redacted]		[redacted]			
[redacted]		[redacted]		[redacted]	[redacted]

QC-108-1 (mo/yr)

[redacted]

Quality System Impact Analysis		
Auditor(s):	Procedure Name and # under Audit:	
Date:	Supervisor Affected:	Areas Audited:
[redacted]		

QC-108-2 (mo/yr)

[redacted]

****THIS FORM *MUST* BE FILLED OUT COMPLETELY****

DCC Request Form

For: ☐Vendor ☐Production/Inspection ☐Archive
☐Customer ☐Management/Engineering ☐Other

[redacted] _____ [redacted]

Name:	
Department:	
[redacted]	[redacted]

[redacted]:

DCC USE ONLY

[redacted]

QC-109-10 (mo/yr)

[redacted]

Instructions on how to fill out the DCC Request Form

The person requesting the document(s) does the following:

[redacted]

The DCC Clerk fills out the rest of the form.

[redacted]

DOCUMENT NUMBER LOG

[redacted]	[redacted]	[redacted]	[redacted]

[redacted]

DCC Document Update Notice

☐ NEW DWG ☐ NEW REVISION [redacted] ☐ CUSTOMER DWG NUMBER _____

Today's Date:	
[redacted]	

[redacted]

DISTRIBUTION:
(Your List Here)
Project Engineer:_____

[redacted]	[redacted]	[redacted]	[redacted]

QC-109-12 (mo/yr)

[redacted]

Instructions for filling out the **DCC Document Update Notice**

For a new document (drawings with a revision - or orig.) check the box "NEW DWG"
For documents with a new revision check the box "NEW REVISION"
Under the box "NEW REVISION" write-in the E.O. number that changed the document in the space provided.
For a Customer document check the box "CUSTOMER DWG NUMBER"
In space provided under the section "CUSTOMER DWG NUMBER", write the name of the Customer.

[redacted]

QC-109-12 (mo/yr)

[redacted]

[redacted]

Tips:
Double click grey area at top and bottom of page to edit header/footer
Search for the word “your” throughout doc and replace as required

Configuration Audit

(mo/yr)

Revisions		Rev:	
Letter	E.O. Number - Description	Date	

Used On	Contract#:		**Your Co Name**		
Prepared By:					
[redacted]					
			Your Procedure Name		
			QC-109-1		
			[redacted]		[redacted] 1 of 1

Your Logo

Op#	STEP	ACTION
Steps may be performed before, during or after manufacturing		**(Your) Assembly**
1	QC	Produce Data List QC-109-8 – complete all fields, particularly the field labeled <Rev A/D> for each item
2	QC	Record the revision level of P/N's recorded on the travelers in the applicable <Rev A/B> fields on the Data List
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
	IF	THEN
4.1	Revs for A/D do not match Revs for A/B	Notify the Quality Mgr and Project Engr., then determine the root cause for the difference and perform appropriate corrective actions; e.g., revise Data List to correct typo, or produce Material Report (MR) or Engineering Order (EO)
4.1.1	Revs for A/D and A/B are different	[redacted]
4.2	Supplier name is not listed in QC-121-3	Notify the Quality Mgr, then determine the root cause for the [redacted]
Op#	STEP	ACTION
Steps may be performed before, during or after manufacturing		**(Your) Assembly**
5	QC	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
	IF	THEN
8.1	As-Designed does not match As-Built or As-Tested	Notify the Quality Mgr and Project Engr., then determine the root cause for the difference and perform appropriate corrective actions; e.g., revise List to correct typo, or produce MR or EO
8.2	Supplier name is not listed in the Approved Supplier Listing	[redacted]

[redacted]

[redacted]

Tips:
Double click grey area at top and bottom of page to edit header/footer
Search for the word “your” throughout doc and replace as required

Document Archive

(mo/yr)

Revisions		Rev:	
Letter	E.O. Number - Description		Date
Used On	Contract#:	**Your Company**	
Prepared By:			
[redacted]		**Work Instruction**	
		QC-109-2	
	[redacted]	[redacted]	1 of 2

Your Logo

1	Responsibility	Prepare Box for Storage
1.1	Owner	Owner prepares a detailed list of the contents of each storage box
1.2	DCC Clerk	Place a copy of the list in the box and in the archive file
1.3	DCC Clerk	Record a box number on each container and department or division identifier
1.4	DCC Clerk	[redacted]

[redacted]

EO NUMBER:	DATE:	MR#:

ENGINEERING ORDER

Page of

CLASS

I☐ II☐

PERSON REQUESTING ENGINEERING ORDER:

PERSON WRITING ENGINEERING ORDER:

E.O. Orientation:

ENGINEERING BULLETIN

NUMBER:

PROGRAM NAME:		DOCUMENTS AFFECTED:	
PROCESS AFFECTED:		PROJECT ENGINEER AFFECTED:	
[redacted]		[redacted]	
[redacted]		[redacted]	

[redacted]

☐ **RETAIN** ☐ **DISCARD AFTER** (DATE) ☐ CCB N/A

☐ [redacted]

☐ [redacted]

[redacted]

ENGINEERING MANAGER: _____ REA: _____

[redacted]

[redacted]

[redacted]

[redacted]

ENGINEERING BULLETIN

NUMBER: _____

CONTINUATION PAGE: QC-109-5 (mo/yr)

PAGE 2 TEXT BLOCK: Insert page 2 text here

[redacted]

(Your Co Name) DATA LIST	DATA LIST REVISION:				PROJECT:				Page 1 of
P/N:			ENGINEERING:						
[redacted]			[redacted]						
[redacted]			[redacted]						
[redacted]	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[redacted]

[redacted]	[redacted]	[redacted]

Use latest revision at the time of contract, or as specified by contract

A/D = As Designed; A/B = As Built; or use A/T = As Tested

* [redacted]

[redacted]

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

QC-109-8 (mo/yr)

[redacted]

DOCUMENT ARCHIVE

Box#:__________________ **Owner:________________**

[redacted] [redacted]

[redacted]	[redacted]	[redacted]	[redacted]

QC-109-9 (mo/yr)

[redacted]

Drawing No:		INSPECTION RECORD	QC-110-1 (mo/yr)
Item Name:		(Your Co)	Front
		(Description of Inspection Process)	

	[redacted]					[redacted]													
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[redacted]

Description of Inspection Operation continued...

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[redacted]

Your Logo	Inspection Instructions		QC-110 (mo/yr) Page 1 of 1
	[redacted]	Specification:	
		Specification:	
		[redacted]	

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[redacted]

Drawing No: [redacted]					**RECEIVING INSPECTION REPORT** [redacted]					
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Your Logo

QC-114-1 (mo/yr)

[redacted]

Your Logo	Receiving Inspection Instructions		QC-114 (mo/yr) Page 1 of 1
	Special Instructions: ANSI Z 1.4; Level I reduced, AQL 1.0 Die-controlled = 5/lot Commercial or items >50Lbs = 1/Lot	Specification:	
		Specification:	
		Approval:	

Oper	Qty	Description of Inspection Operation	Gage	Comment
R&I	---	Op 1: [redacted] Op 2: [redacted] Op 3: [redacted] Op 4: [redacted] Op 5: [redacted] Op 6: [redacted]		

[redacted]

Metrology Recall Card

Description:						Calib Frequency:			
Type:			Model:		S/N:				
Property ID#:									
[redacted]									
[redacted]	[redacted]								
[redacted]									
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

QC-116-1 (mo/yr)

Instrument and Case Identification Tag (shrink to fit)

Tool #:		Tech:	
Calib. Accuracy:			
[redacted]:			

QC-116-2 (mo/yr)

Instrument Deviation Tag (shrink to fit)

Tool#:	
[redacted]	[redacted]
[redacted]	
[redacted]	QC-116-3 (mo/yr)

[redacted]

Measuring and Test Equipment Calibration Report

☐ In Tolerance as Received	☐ Out-of-Tolerance as Recv'd	PO# for M&TE:
Department:	Date:	
Equipment:	Location:	
Size-Range:	Mfg-Model:	
Serial #:	M&TE Accuracy:	

Remarks:

Calib. Manual#:	Rev:	Temp:

QC-116-4 (mo/yr) Front

IMPACT ANALYSIS REPORT

Number of parts that may be out-of-spec – List Model # and projected quantities for each type that [redacted]

± tolerance range for each dimension checked with the out-of-spec equipment – list by P/N

Estimate of [redacted].

[redacted]

Your Procedure # Rev: (mo/yr)	[Title] Calibration Instruction Sheet		QC-116-5 (mo/yr) Page 1 of
Special Instructions:		Specification:	
		Specification:	
[redacted]		[redacted]	

[redacted]	[redacted]	[redacted]	[redacted]

[redacted] [redacted]

[redacted]

Tips:
Double click grey area at top and bottom of page to edit header/footer
Search for the word “your” throughout doc and replace as required

Hazard Analysis

(mo.yr)

Revisions		Rev:	
Letter	E.O. Number - Description	Date	
Used On	Contract#:	**Your Company Name**	
Prepared By: [redacted]	[redacted]	**YOUR PROGRAM**	
		Your Procedure #	
	[redacted]	[redacted]	1 of 17

Your Company Logo

TABLE OF CONTENTS

ISO 14001 Reference: 4.3.1

1.0 Background

Operation Analysis and Identification of Products, Activities and Services (PAS)
The organization shall establish and maintain (a) procedure(s) to identify the Hazard Analysis of its products, activities or services that it can control and over which it can be expected to have an influence to determine those which have or can have [redacted]

2.0 Requirements

The identification of the organization's Hazard Analysis is a key element of the EHS System as these determine those issues and areas that should be the primary focus for monitoring, control and improvement.
Each functional area's products, activities and services (PAS) will [redacted]

3.0 Scope

This procedure applies to the Hazard Analysis of [redacted]

4.0 Objective

The purpose of this procedure is to [redacted]

4.1 Identification of Impacts

Once the Hazard Analysis review team has successfully identified all of the site's functional areas and their associated PAS, the team wil[redacted] The worksheet follows the impact categories which relate the EHS elements:

[redacted]

In the following tables, a guidance list of potential "issues" for each EHS element impact is provided to ensure a [redacted] The team should consider all of the following in identifying the potential impacts:

EMPLOYEE HEALTH & SAFETY ELEMENT	
[redacted]	[redacted]

ENVIRONMENTAL ELEMENT			
[redacted]	[redacted]	[redacted]	[redacted]

PROPERTY ELEMENT		
[redacted]	[redacted]	[redacted]

[redacted]

RESOURCE IMPACTS	
CONSUMPTION ISSUES	SCRAP ISSUES
[redacted]	[redacted]

PRODUCT IMPACTS		
[redacted]	[redacted]	[redacted]

This process requires consideration of the impacts of the EHS elements for each PAS. Worksheet QC-118-1 should be completed for each functional area's PAS as found at the end of this section. The first step for the worksheet will [redacted]

4.2 Significance Analysis

After the PAS impacts have been identified for each of the EHS elements (*employee health and safety, the environment, property, resources and products)* the significance ranking process is the next step to be completed using the same Hazard Analysis Worksheet. This is a six-step procedure that [redacted]

4.2.1 The Hazard Analysis review team will [redacted]

4.2.2 The comment section of the worksheet should be used to [redacted],

[redacted].

4.3 Analysis Scoring by Element

The Hazard Analysis Review Team, in consultation with other facility personnel as appropriate, will [redacted]

4.4 Employee Health & Safety

4.4.1 **Frequency or likelihood of occurrence of the impact** – defined as the possibility of occurrence of safety related employee accidents or incidents or the frequency of employee accidents occurring in this PAS compared to the facility as a whole. Another point of view for this evaluation would be [redacted]

Frequency or Likelihood of Occurrence of the Impact	
[redacted]	

4.4.2 **Severity of the impact** – defined as the actual or potential safety risks or seriousness of an employee accident that may or has occurred in this PAS. This may require reviewing [redacted].

Severity of the Impact	
[redacted]	

4.4.3 **Scale of use of the impact** – defined as the actual or potential scale (e.g., size, volume, magnitude) of the resulting employee safety impact. This should be evaluated [redacted]

Scale of Use of the Impact	
[redacted]	

4.4.4 **Legal or regulatory concern –** defined as regulatory exposure of employee safety as related to [redacted]

Examples of specific regulations include:

SPECIFIC SAFETY MANAGEMENT PROGRAMS		
[redacted]	[redacted]	[redacted]

Legal or Regulatory Concern of the Impact	
[redacted]	[redacted]

4.4.5 **Degree of control or influence of the impact**– defined as the level of control that the site has over employee health and safety. The thought process for this evaluation involves [redacted]

Degree of Control or Influence of the Impact	
[redacted]	[redacted]

4.4.6 **Stakeholder concern of the impact** – defined as the actual or potential risk of the PAS to its employees and the surrounding community as perceived by internal or external groups.

Stakeholder Concern of the Impact	
1	[redacted]

The Hazard Analysis Review Team ranks the significance of each employee safety impact for each PAS according to [redacted]

[redacted]

4.5 Environment

4.5.1 **Frequency or likelihood of occurrence of the impact** – defined as the possibility of occurrence of the environmental impact, the number of times the impact occurs and/or the duration of each occurrence. All impacts should be [redacted]

Frequency or Likelihood of Occurrence of the Impact	
[redacted]	

Severity of the impact – defined as the actual or potential severity of the resulting environmental impact (e.g., [redacted]

Severity of the Impact	
[redacted]	

4.5.2 **Scale of use of the impact** – defined as the actual or potential scale (e.g., [redacted]:

Scale of Use of the Impact	
[redacted]	

4.5.3 **Legal or regulatory concern of the impact** – defined as regulatory exposure of the PAS related to applicable federal, state, and local environmental laws (including [redacted]

Legal or Regulatory Concern of the Impact	
1	Not [redacted]

4.5.4 **Degree of control or influence of the impact** – defined as the level of control that the site has over the environmental aspect. In general, environmental aspects generated from site activities are considered

[redacted]

Degree of Control or Influence of the Impact	[redacted]
[redacted]	

4.5.5 **Stakeholder concern of the impact** – defined as the actual or potential severity of the environmental impact as perceived by [redacted]

Stakeholder Concern of the Impact	[redacted]
[redacted]	

The Review Team ranks the significance of each environmental impact in each PAS according to the above criteria and scoring system using the Worksheet provided with this procedure. The total significance ranking for each PAS is derived from [redacted]

4.6 Property

4.6.1 **Frequency or likelihood of occurrence of the impact** – defined as the possibility of occurrence of [redacted]

Frequency or Likelihood of Occurrence of the Impact	[redacted]
[redacted]	

4.6.2 **Severity of the impact** – defined as the actual or potential severity of the resulting in loss (e.g., [redacted]

Severity of the Impact	[redacted]
[redacted]	

4.6.3 **Scale of use of the impact** – defined as the actual or potential scale (e.g., [redacted]

Scale of Use of the Impact	
[redacted]	

4.6.4 **Legal or regulatory concern of the impact** – defined as regulatory exposure from a property standpoint of the PAS, as related to applicable federal, state, and local laws (including [redacted]

Legal or Regulatory Concern of the Impact	
[redacted]	

4.6.5 **Degree of control or influence of the impact** – defined as the level of control that the site has over the PAS. In general, site activities are considered [redacted].

Degree of Control or Influence of the Impact	
[redacted]	

4.6.6 **Stakeholder concern of the impact** – defined as the actual or potential severity of the resulting impact in terms of [redacted]

Stakeholder Concern of the Impact	
[redacted]	

The Hazard Analysis Review Team ranks the significance of each property impact in each PAS according to [redacted]

4.7 Resources

4.7.1 Frequency or likelihood of occurrence of the impact – defined as the frequency that raw materials are [redacted].

Frequency or Likelihood of Occurrence of the Impact	
[redacted]	[redacted]

4.7.2 **Severity of the impact** – defined as the actual or potential severity of the raw material consumption or scrap generation. Under normal conditions, [redacted]

Severity of the Impact	
[redacted]	[redacted]

4.7.3 **Scale of use of the impact** –defined as the actual or potential scale (e.g., [redacted]

Scale of Use of the Impact	
[redacted]	[redacted]

4.7.4 **Legal or regulatory concern** – defined as regulatory exposure of the PAS as it relates to consumption of raw materials applicable to federal, state, and local laws (including regulations, permit conditions) as well as Corporate or "other" standards. For example, [redacted]

Legal or Regulatory Concern	
[redacted]	[redacted]

4.7.5 **Degree of control or influence** – defined as the level of control that the site has over raw material consumption or scrap generation. For raw materials, [redacted]

Degree of Control or Influence	
[redacted]	[redacted]

[redacted]

4.7.6 **Stakeholder concern** – defined as the actual or potential severity of the consumption of raw materials or scrap generation as perceived by [redacted].

Stakeholder Concern

[redacted]

The Hazard Analysis Review Team ranks the significance of each resource impact in each PAS according to the [redacted]

4.8 Products

4.8.1 **Frequency or likelihood of occurrence** – defined as [redacted]

Frequency or Likelihood of Occurrence of the Impact

[redacted]

4.8.2 **Severity of impact** – defined as the actual or potential severity of the accident rate or environmental impact (e.g., [redacted]

Severity of Impact

[redacted]

Scale of use or impact – defined as the actual or potential scale (e.g., [redacted]

Scale of Use or Impact

[redacted]

4.8.3 **Legal or regulatory concern** – defined as regulatory exposure of the PAS as it relates to the production of final products applicable to federal, state, and local laws as well as Corporate or "other" standards. For example,

Legal or Regulatory Concern	

4.8.4 **Degree of control or influence** – defined as the level of control that the site has over the final product's safety and recycle ability for the end user. For products,

Degree of Control or Influence	

4.8.5 **Stakeholder concern** – defined as the actual or potential severity of the final product, in terms of its potential to impact worker safety or damage to the environment (e.g.,

Stakeholder Concern	

The Hazard Analysis Review Team ranks the significance of each product impact in each PAS according to the

4.9 Significance Ranking Cut-off

4.9.1 The Hazard Analysis Review Team, in consultation with the site management, will establish a separate significance ranking cut-off level for each individual EHS element. PAS with total significance rankings at or above the cut-off level for each individual element will be considered a "Significant Operation".

4.9.2

4.9.3 :

Functional Area/Specific PAS/Impact

[redacted]

4.9.4 If this was the only impact for this specific PAS that scored above the significance cut-off level after evaluating all of the EHS elements, then the facility would develop [redacted]

4.9.5 The list of Hazard Analysis is used to [redacted] ts.

4.9.6 The cut-off level for each EHS element is re-evaluated by the EHS on an annual basis, at a minimum. [redacted] .

4.9.7 The EHS is responsible for keeping the list of PAS up-to-date on an annual basis, at a minimum. Additionally, the EHS [redacted]

4.9.8 It is anticipated that in time, as the site makes improvements through achieving its objectives and targets, many of the initially designated Hazard Analysis will be re-assessed at a lower ranking. Similarly, other PAS that were ranked as less significant will move up in priority as the significance cut-off levels are lowered. It is through this process that the site will effect [redacted]

5.0 Records

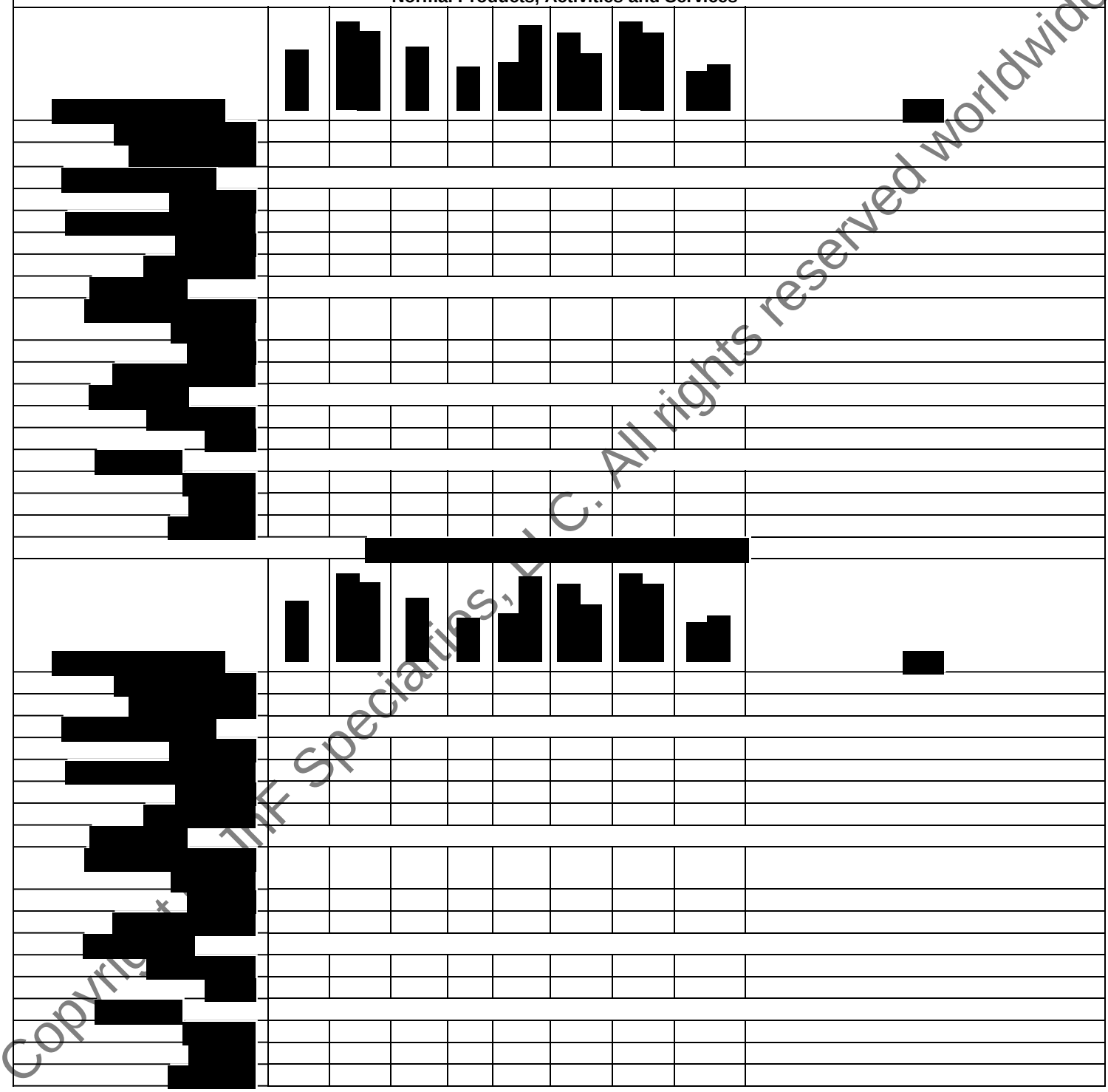
The following records will be generated as a result of this procedure:

[redacted]

Figure 3: Hazard Analysis

Date:	
Functional Area:	

Normal Products, Activities and Services



QC-118-1 (mo/yr)

LIST OF HAZARDS

Employee Health & Safety

Environmental

Property

Resources

Products

[redacted]

Implementation Tips

Your Company Name and Logo

Date

(Your Co name) has made a commitment to our Customers to become ISO [redacted]

[redacted]

_____
(Your Signature)
(Your printed name)

[redacted]

CUSTOMER PERCEPTION SURVEY

(Your Co name)

Customer Name:		
Completed By:	Date:	

Please rate the following items from 0 to 10 (0 = Bad and 10 = Excellent)

1)	Score	**Satisfaction**
2)	Score	**Performance**
3)	Score	**Competitiveness**
4)	Score	**Prediction**

Comments:

Thanks again for your support

QC-119 (mo/yr)

Please Fax the completed survey to: (Your Name and Fax#)

Compliance Matrix (set page to "Landscape")

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

QC-120-1 (mo/yr)

[redacted]

[redacted]

Compliance Matrix for (Program Name – Contract - Revision)

Para #	Title	Narrative	Accept	Modify
[redacted]				
			[redacted]	[redacted]
[redacted]				

QC-120-2 (mo.yr)

[redacted]

Work Breakdown for (Program Name) check-off each box when complete.

Para #	Title	Narrative	Action
[redacted]			
		☐	
		☐	
		☐	
		☐	
[redacted]			
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[redacted]			
		☐	
[redacted]			
		☐	
		☐	
		☐	
		☐	
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		☐	
		☐	

QC-120-3 (mo/yr)

[redacted]

[redacted]

Tips:
Double click grey area at top and bottom of page to edit header/footer
Search for the word “your” throughout doc and replace as required

Supplier Performance Assurance

(mo/yr)

Revisions		Rev:	
Letter	E.O. Number - Description	Date	
Used On	Contract#:	**Your Company Name**	
Prepared By: [redacted]	[redacted]	**YOUR PROGRAM**	
		Your Procedure #	
	[redacted]	[redacted]	1 of 1

Your Company Logo

Supplier Requirements	Importance: 1=Hi, 4=Lo	Compliance Resource
4 Quality management system [QMS]		
4.1 General requirements of the QMS		
[redacted]		
4.2 Documentation requirements		
4.2.1 General		
[redacted]		
4.2.2 Quality manual		
[redacted]		
4.2.3 Control of documents		
[redacted]		
4.2.4 Control of records		
[redacted]		

Supplier Requirements	Importance: 1=Hi, 4=Lo	Compliance Resource
[redacted]		
5 Management responsibility		
5.1 Management commitment		
[redacted]		
5.2 Customer focus		
[redacted]		
5.3 Quality policy		
[redacted]		
5.4 Planning		
5.4.1 Quality objectives		
[redacted]		
5.4.2 Quality management system planning		
[redacted]		

Supplier Requirements	Importance: 1=Hi, 4=Lo	Compliance Resource
[redacted]		
5.5 Responsibility, authority and communication		
5.5.1 Responsibility and authority		
[redacted] ny		
5.5.2 Management representative		
[redacted]		
5.5.3 Internal communication		
[redacted]		
5.6 Management review		
5.6.1 General		
[redacted]		
5.6.2 Review input		
[redacted]		
5.6.3 Review output		
[redacted]		
6 Resource management		
6.1 Providing resources		
[redacted]		

Supplier Requirements	Importance: 1=Hi, 4=Lo	Compliance Resource
[redacted]		
6.2 Human resources		
6.2.1 General		
[redacted]		
6.2.2 Competence, awareness and training		
[redacted]		
6.3 Infrastructure		
[redacted]		
6.4 Work environment		
[redacted]		
7 Product realization		
7.1 Planning of product or service realization		
[redacted]		

Supplier Requirements	Importance: 1=Hi, 4=Lo	Compliance Resource
[redacted]		
7.2 Customer-related processes		
7.2.1 Determination of requirements related to the product or service		
a) the Company determines Customer requirements, including		
[redacted]		
7.2.2 Review of requirements related to the product or service		
[redacted]		
7.2.3 Customer communication		
[redacted]		
7.3 Design and development		
7.3.1 Design and development planning		
[redacted]		
7.3.2 Design and development inputs		
[redacted]		

Supplier Requirements	Importance: 1=Hi, 4=Lo	Compliance Resource
[redacted]		
7.3.3 Design and development outputs		
[redacted]		
7.3.4 Design and development review		
[redacted]		
7.3.5 Design and development verification		
[redacted]		
7.3.6 Design and development validation		
[redacted]		

Supplier Requirements	Importance: 1=Hi, 4=Lo	Compliance Resource
[redacted]		
7.3.7 Control of design and development changes		
[redacted]		
7.4 Purchasing		
7.4.1 Purchasing process		
[redacted]		
7.4.2 Purchasing information		
[redacted]		
7.4.3 Verification of purchased items		
[redacted]		
7.5 Production and service		
7.5.1 Control of production and service		

Supplier Requirements	Importance: 1=Hi, 4=Lo	Compliance Resource
[redacted]		
7.5.2 Validation of processes for production and service		
[redacted]		
7.5.3 Identification and traceability		
[redacted]		
7.5.4 Customer property including intellectual property		
[redacted]		
7.5.5 Preservation of product or service		
[redacted]		
7.6 Control of monitoring and measuring devices		
[redacted]		

Supplier Requirements	Importance: 1=Hi, 4=Lo	Compliance Resource
[redacted]		
8 Measurement, analysis and improvement		
8.1 General		
[redacted]		
8.2 Monitoring and measurement		
8.2.1 Customer satisfaction		
[redacted]		
8.2.2 Internal audit		
[redacted]		

Supplier Requirements	Importance: 1=Hi, 4=Lo	Compliance Resource
[redacted]		
8.2.3 Monitoring and measurement of processes		
[redacted]		
8.2.4 Monitoring and measurement of product or service		
[redacted]		

Supplier Requirements	Importance: 1=Hi, 4=Lo	Compliance Resource
[redacted]		
8.3 Control of nonconforming product or service		
[redacted]		
8.4 Analysis of data		
[redacted]		

Supplier Requirements	Importance: 1=Hi, 4=Lo	Compliance Resource
[redacted]		
8.5 Improvement		
8.5.1 Continual improvement		
[redacted]		
8.5.2 Corrective action		
[redacted]		
8.5.3 Preventive action		
[redacted]		

[redacted]

SUPPLIER PERFORMANCE RATING REPORT

Job #: Performance Reporting Dates:

Supplier:

OVERALL PERFORMANCE RATING **100**

95-100 Excellent

[redacted]

Quality: [redacted]

Delivery: [redacted]

Documentation: [redacted]

Cooperation: [redacted]

Purchasing Agent_____ Date_____

QC-121-2 (mo/yr)

[redacted]

SUPPLIER RATING WORKSHEET

Supplier:
P/N:

QUALITY

Scheduled Quantity	Quantity Rejected	Quantity Accepted	Weighted Score

DELIVERY

Date Due	Date Received	# of Days Difference	Weighted Score

DOCUMENTATION

Possible Points	Actual Performance	Weighted Score
100		

COOPERATION

Possible Points	Actual Performance	Weighted Score
100		

[redacted]

Supplier Overall Performance Rating

Supplier:	Overall Performance Rating					Month:	
PO#	P/N	[redacted]					[redacted]
		☐	☐	☐	☐		
		☐	☐	☐	☐		
		☐	☐	☐	☐		
		☐	☐	☐	☐		
		☐	☐	☐	☐		
		☐	☐	☐	☐		
[redacted]							

Supplier Monthly Rating Report

Supplier	Rating	Monthly and Average Percentage Rating											
		J	F	M	A	M	J	J	A	S	O	N	D
	Quality												
	Delivery												
	Documentation												
	Cooperation												
	Average												

QC-121-2 (mo/yr)

Prepared by: _____ Date: _____

[redacted]

[redacted]

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Search for the word “your” throughout doc and replace as required

Supplier Approval Procedure
Approved Supplier List

(mo/yr)

Revisions		Rev:	
Letter	E.O. Number - Description		Date
Used On	Contract#:	**Your Company Name**	
Prepared By: [redacted]			
		PROCEDURE and LIST	
		QC-121-3	
		[redacted]	1 of 3

Your Logo

References:

QC-109-2, Document Archive Procedure
QC-121-4, Subcontractor Evaluation
QC-121-7, Review of Purchase Orders and Requisitions
QC-121-5, Supplier Evaluation Disposition

Procedure:

Supplier evaluation:
The Quality or Purchasing Group forwards QC-121-4 to a Supplier
QA evaluates QC-121-4 according to QC-121-5
The evaluation package is delivered to the Document Control Center for database storage according to QC-109-2.
Supplier evaluation **is required** for (you define).
Supplier evaluation **is *not* required** for (you define) and 'non-deliverable' material Suppliers.
Supplier Past experience is determined according to QC-121-5.

[redacted]

Acceptable Practice:

Suppliers are added bi-annually to this Approved Supplier List or [redacted]

[redacted]

Glossary:
Non-deliverable: Supplies that **are not used** to manufacture products for delivery to a Customer

[redacted]

Your List of Suppliers

[redacted]

Your Company Name
QUALITY SYSTEM EVALUATION

Company Name:					
Street Address:					
City:		**State:**		**Zip:**	
Phone No:		**Fax No:**			

GENERAL INFORMATION

Quality Program Representative:_____ Title:_____
Does the above have other responsibilities? Yes___ No___
If yes, explain:_____
Describe/List Company's major products/services:_____
_____
Plant/Facility Area _____ Mfg. Area_____

[redacted]

If yes, indicate Features that are included:

	:Management Commitment	Planning of Product Realization:	
	:Customer Focus	Customer Related Processes:	
	:Quality Policy	Design and Development:	
	:Planning	Purchasing:	
	[redacted]		

QC-121-4 (mo/yr)

Specification(s) to which your Company works? _____
_____

Does your Company have a Material Review Board (MRB)?_____

[redacted]

BUYER USE ONLY BELOW LINE

APPROVAL STATUS: Conditionally Approved _____ Approved_____

On-site Survey Required _____ Disapproved _____ Vendor Code_____

[redacted]

QC-121-4 (mo/yr)

[redacted]

[redacted]

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Supplier Survey Disposition

Mo/Yr

Revisions		Rev:	
Letter	E.O. Number - Description	Date	
Used On	Contract#:	**Your Company Name**	
Prepared By:	[redacted]	[redacted]	
[redacted]		**YOUR PROGRAM**	
		Your Procedure #	
		[redacted]	[redacted] 1 of 1

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STEP	RESPONSIBILITY	ACTION
1	Quality Group	Verify mail-in survey form QC-121-4 is fully completed.
1.1	Quality Group	Determine which quality control system is employed by the Supplier.
--	IF	THEN
1.2	MIL-I-45208	[redacted]
	[redacted]	
	[redacted]	
	IF	THEN
1.6	No flowdown	[redacted]
	[redacted]	
STEP	RESPONSIBILITY	ACTION
2	Quality Group	[redacted]
--	IF	THEN
2.1	Supplier check marked all applicable procedures	Check mark “Approved” on survey form QC-121-4.
2.2	Supplier did not check mark all applicable procedures	Evaluate Supplier for defect-free performance over the past six purchase [redacted]
	[redacted]	[redacted]
	[redacted]	[redacted]
	[redacted]	[redacted]
	[redacted]	[redacted]
	[redacted]	[redacted]
	[redacted]	[redacted]
	[redacted]	[redacted]
	[redacted]	[redacted]
	[redacted]	[redacted]
STEP	RESPONSIBILITY	ACTION
3	Quality Group	[redacted]

Quality System Cross-Reference Matrix					
Quality System Elements	**MIL-I 45208**	**MIL-Q 9858**	**ISO 9001**	**ISO 9002**	**ISO 9003**
Management Responsibility:	(3.1)	(1.3, 3.1)	(4.1)	(4.1)	(4.1)
Quality System, Initial Quality Planning:	(1.1)	(1.3, 3.2)	(4.2)	(4.2)	(4.2)
Contract Review:	(1.2)	(3.2, 1.4)	(4.3)	(4.3)	(4.3)
Design Control:	N/A	(4.1)	(4.4)	N/A	N/A
Document and Data Control:	(3.2)	(4.1)	(4.5)	(4.5)	(4.5)
Purchasing:	N/A	(5)	(4.6)	(4.6)	N/A
Control of Customer Supplied Product:	(3.6)	(7.2)	(4.7)	(4.7)	(4.7)
Product Identification and Traceability:	N/A	(6.1)	(4.8)	(4.8)	(4.8)
Process Control:	(3.4)	(6.2)	(4.9)	(4.9)	N/A
Inspection and Testing:	(3.1, 3.2.1, 3.12)	(6.1, 6.2, 6.3)	(4.10)	(4.10)	(4.10)
Control of Inspection, Measuring and Test Equipment:	(3.3)	(4.2-4.5)	(4.11)	(4.11)	(4.11)
Inspection and Test Status:	(3.5)	(6.7)	(4.12)	(4.12)	(4.8)
Control of Nonconforming Product:	(3.7)	(6.5)	(4.13)	(4.13)	(4.13)
Corrective and Preventive Action:	(3.2.3)	(1.3, 3.5)	(4.14)	(4.14)	(4.14)
Handling, Storage, Packaging, Preservation, and Delivery:	(3.6)	(6.4)	(4.15)	(4.15)	(4.15)
Control of Quality Records:	(3.2.2)	(3.4)	(4.16)	(4.16)	(4.16)
Internal Quality Audits:	N/A	N/A	(4.17)	(4.17)	(4.17)
Training:	N/A	N/A	(4.18)	(4.18)	(4.18)
Servicing:	N/A	(1.3)	(4.19)	(4.19)	N/A
Statistical Techniques:	N/A	(6.6)	(4.20)	(4.20)	(4.20)
					QC-121-5 (mo/yr)

[redacted]

Quality Systems Cross-Reference Matrix

Quality System Elements	ISO 9001-94	ISO 9002-94	ISO 9003-94	ISO 9001-2000
Management Responsibility:	(4.1)	(4.1)	(4.1)*	5.1, 5.3, 5.4.1, 5.5.1, 5.5.2, 5.6.1, 6.1, 6.2.1, 8.5.1
Quality System, Initial Quality Planning:	(4.2)	(4.2)	(4.2)*	4.1, 4.2.1, 4.2.2, 5.4.2, 7.1
Contract Review:	(4.3)	(4.3)	(4.3)	5.2, 7.2.1, 7.2.2, 7.2.3
Design Control:	(4.4)	N/A	N/A	7.2.1, 7.3.1 - 7.3.7
Document and Data Control:	(4.5)	(4.5)	(4.5)	4.2.3
Purchasing:	(4.6)	(4.6)	N/A	7.4.1 - 7.4.3
Control of Customer Supplied Product:	(4.7)	(4.7)	(4.7)	7.5.4
Product Identification and Traceability:	(4.8)	(4.8)	(4.8)*	7.5.3
Process Control:	(4.9)	(4.9)	N/A	6.3, 6.4, 7.5.1, 7.5.2
Inspection and Testing:	(4.10)	(4.10)	(4.10)*	7.1, 7.4.3, 7.5.3, 8.1, 8.2.4
Control of Inspection, Measuring and Test Equipment:	(4.11)	(4.11)	(4.11)	7.6
Inspection and Test Status:	(4.12)	(4.12)	(4.8)	7.5.3
Control of Nonconforming Product:	(4.13)	(4.13)	(4.13)*	8.3
Corrective and Preventive Action:	(4.14)	(4.14)	(4.14)*	8.5.2, 8.5.3
Handling, Storage, Packaging, Preservation, and Delivery:	(4.15)	(4.15)	(4.15)	7.5.1, 7.5.5
Control of Quality Records:	(4.16)	(4.16)	(4.16)*	4.2.4
Internal Quality Audits:	(4.17)	(4.17)	(4.17)*	8.2.2, 8.2.3
Training:	(4.18)	(4.18)	(4.18)*	6.2.2
Servicing:	(4.19)	(4.19)	N/A	7.5.1
Statistical Techniques:	(4.20)	(4.20)	(4.20)*	8.1, 8.2.3, 8.2.4, 8.4
				QC-121-5 (mo/yr)

[redacted]

[redacted]

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Supplier Quality Requirements

Mo/Yr

Revisions		Rev:	
Letter	E.O. Number - Description	Date	
Used On	Contract#:	**Your Company Name**	
Prepared By:	[redacted]		
[redacted]		**YOUR PROGRAM**	
		Your Procedure #	
	[redacted]	[redacted]	1 of 4

Your Company Logo

☐PURPOSE and SCOPE

To establish the minimum requirements for supplier Quality Systems necessary to ensure that materials, parts, components, and services meet the requirements of the Contract. Procedures used to implement the provisions of this requirement shall be subject to (Your Co) approval upon request.

☐APPLICABILITY

These requirements shall apply to all supplies and services when referenced on the Purchase Order and amendments thereto.

[redacted]

☐DEFINITIONS and ABBREVIATIONS

A. The term 'Buyer' or '(Your Co)' means (Your Co).
B. The term 'Seller' means the legal entity that is the contracting party with the Buyer with respect to the Purchase Order.
C. 'IAW' means in accordance with.
D. 'MRB' means Material Review Board

☐SELLER's QUALITY SYSTEM, GENERAL

The Seller shall maintain [redacted]

☐NEGOTIATIONS

It is not the intent of this specification to restrict the Seller in his mode of operation; therefore, it is [redacted]

[redacted]

☐PROPRIETARY INFORMATION

The Seller must identify in writing the intended use in performance of the Purchase Order of [redacted]

☐PROCESS CONTROL

The Seller shall provide for complete review of contract requirements at the earliest practical phase of contract performance to make [redacted]

(Your Co) contracts and resultant facility planning by Seller shall be reviewed by the Seller's Quality Control Department prior to release for production and/or pre-production to assure that all (Your Co) quality requirements are reflected in production and inspection procedures.

[redacted]

☐ **SUBCONTRACTOR CONTROL**

The Seller shall be responsible for [redacted]

☐ **DRAWING and CHANGE CONTROL**

The Seller shall have a procedure and designate a responsible department for [redacted]

☐ **RECEIVING INSPECTION**

The Seller shall inspect incoming material to [redacted]

[redacted]

☐STOCK CONTROL

The Seller shall provide for protection and control of [redacted]

☐SAMPLING INSPECTION

Acceptance sampling procedures, if other than ANSI Z 1.4, must have (Your Co) approval prior to use; sampling to permit defects is [redacted].

☐TOOL, GAGE, and TEST EQUIPMENT

The Seller shall be responsible for providing and ascertaining the accuracy and stability of tools, gages, and test equipment to assure supplies conform to contractual requirements.

[redacted]

☐MATERIAL CONTROL

Nonconforming material shall be positively identified and [redacted]

The Seller shall maintain traceability of raw material used in the manufacture of deliverable products. A correlation shall be made between [redacted]

The Seller shall maintain controls to assure accomplishment of preservation, packaging and shipping requirements of the contract. [redacted].

☐TECHNICAL REQUIREMENTS

[redacted]

[redacted]

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Purchase Order Review

(mo/yr)

Revisions		Rev:	
Letter	E.O. Number - Description	Date	
Used On	Contract#:	**Your Company Name**	
Prepared By: [redacted]	[redacted]	**YOUR PROGRAM**	
		Your Procedure #	
	[redacted]	[redacted]	1 of 1

Your Company Logo

1	Quality Group	-- The reviewer determines the need for, and if justified, imposes the requirements of [redacted]
2	Quality Group	-- Forward Requisition to Document Control for drawing and/or specification revision identification -- initials adjacent to the revision letter on the Requisition indicates that the revision is correct -- "Under Revision" will be stamped on the Requisition if the revision is not correct. -- [redacted]
	IF	THEN
2.1	Older Revision Supply Required	-- [redacted]
2.2	Requisition is marked "Under Revision"	-- [redacted]
2.3	A Raw Material Requirement **is not** Specified	-- [redacted]
2.4	*Deviation to drawing is noted on Requisition such as "Less Note" Deviation to drawing is*	[redacted]

	noted on Requisition such as "Less Note"	[redacted]
2.5	*Order is for production but doesn't reference engineering drawing #*	[redacted]
3	Quality Group	Add provisions for any one or combination of the following to the Requisition or P.O. when justified: -- [redacted] -- [redacted]

4	Quality Group	Relative to the procurement of software, the reviewer determines the need for, and if justified, adds to the procurement document provisions for any one or combination of the following: -- [redacted]
5	Discrepancy in Requisition or P.O.	-- Return to Purchasing Group for correction(s)
5.1	Supplier Quality Requirements applies	-- [redacted]
5.2	P.O. requires additional conditions related to supplier	-- Record supplier related add-on text to Requisition or P.O. -- [redacted]
	IF	THEN
5.2.1	P.O. requires additional conditions related to in-house processing	Record add-on text to Requisition or P.O. and forward to User
5.2.2	Requisition or P.O. Ok	-- When R&I QC is required, sign and forward *PO's in numerical order* to *R&I* (*Procurement Technician* must be cognizant of all purchases) -- [redacted]
6	Quality Group ISO 9001 Applies	Forward Subcontractor Evaluation QC-121-4 to the Supplier.

[redacted]

[redacted]

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Statistical Procedures

Mo/Yr

Revisions		Rev:	
Letter	E.O. Number - Description	Date	

Used On	Contract#:	**Your Company Name**
Prepared By: [redacted]	[redacted]	**POLICIES AND PROCEDURES**
		QC-122
		[redacted] 1 of 17

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TABLE OF CONTENTS

[redacted]

1.0 Scope

Describe a process for systematically evaluating or reducing variation of key process and product characteristics. Begin by addressing obvious sources of variation and progressively move to more subtle sources. Continue variation analysis or reduction until a key characteristic is in statistical control and capable of meeting engineering requirements, or is determined to be 'state-of-art' with inherent variation that is not capable of statistical control.

2.0 Goals

Implement procedures that allow for the determination and measurement of key process and product characteristics, and ensure that action is taken when a key characteristic is not in-control, or a record of analysis is available that determined that a characteristic is not capable of control.

3.0 Referenced Documents

3.1 Figure 1, Statistical Process Implementation Matrix
3.2 Figure 2, Statistical Process Plan
3.3 ASQ Quality Engineering

4.0 Statistical Planning

4.1 Statistical Process Implementation Matrix

Figure 1 shows the step-by-step process and documentation requirements for implementation of statistical process control. Any equivalent process or documentation that achieves these requirements may be used.

4.2 Statistical Process Plan

Figure 2, the Statistical Process Plan, is the collector of all relevant information on a process or product. The information on this form, or equivalent form, serves as the basis for a database.

5.0 Requirements

5.1 Key Characteristics

A **key characteristic** is a product or process variable that can be directly manipulated to

[redacted]

5.2 Collect Data to Determine Key Characteristics

Collecting information pertinent to the process or product is the first step in identifying key characteristics. Data collected should be relevant to Form, Fit, Performance, and Service Life.

This data may include [redacted]

5.3 Establish Key Characteristics

There are no set rules for establishing key characteristics. Even if a feature is not identified as a key characteristic, that feature will still receive the same attention it has historically. Features designated 'key' receive special attention and do not diminish the importance of other characteristics. [redacted]

5.4 Document Key Characteristics and Engineering Requirements

The Statistical Process Plan shown at Figure 2 is the collector of all information needed to assure control of key characteristics. The key characteristic identified by the Company or its Customer must [redacted].

5.5 Determine Process Steps Where Key Characteristics are Measured

Before measurements can be taken on the key characteristic, it must be decided where in the manufacturing flow the measurements will be taken, and the capability of the measurement tool. [redacted]

5.6 Select Appropriate Control Charts

Evidence of variation in the key characteristic must be shown using control charts with variable data if at all possible. Only if variable data cannot be established [redacted]

Variable data is quantifiable. It can be put on a numeric scale. Examples are: [redacted]

Attribute data is 'go/no-go' data. The key characteristic passes or fails; has a defect or doesn't have a defect. Common control charts used are [redacted]

5.6.1 Acceptance Chart

When the question of 'in-control' is not relevant or has very little value, acceptance charts which are standardized in such a fashion that ongoing process monitoring can be done on a single chart is considered, similar to [redacted]

5.7 Document Process Steps, Control Charts, Sample Size and Frequency

Once the appropriate control chart has been selected, the next step is [redacted]

5.8 Collect Measurements and Maintain Control Charts

Once in production, measurements on the key characteristics must be collected and control charts maintained. Samples must be taken in such a manner that the measurements represent [redacted]

[redacted]

5.9 Is the Key Characteristic in Statistical Control?

Statistical control is determined directly from the control chart being used to monitor the key characteristic. All control charts place statistical limits upon the natural (common cause) variation of a process. [redacted]

5.10 Does the Key Characteristic Meet Minimum Capability?

Once a key characteristic is in statistical control, its capability can be established.
An index called Cpk is used to determine if the capability is sufficient to meet engineering specifications. [redacted]

[redacted]

Cpk Table

Number of Measurements Taken	90% Probability That True Cpk Equals or Exceeds										
	1.00	1.10	1.20	1.30	1.40	1.50	1.60	1.70	1.80	1.90	2
[redacted]	[redacted]										

The values in the above table are the calculated Cpk values required to be 90% confident that the actual Cpk is greater than or equal to the Cpk value at the top of the respective column.

[redacted]

Examples: If 30 parts are measured and the required Cpk is 1.0, the calculated Cpk from the 30 parts needs to be at least 1.23 - if 20 parts are measured and the calculated Cpk is 1.91, the actual Cpk is [redacted]

If attribute data is used, then capability is measured in terms of the proportion of defective units. To meet an equivalent Cpk of 1.0, the maximum acceptable proportion of defectives is [redacted]

[redacted].

5.11 Can Special Causes of Variation be Assigned?

If an out-of-control condition arises, the question [redacted] should be asked; not, [redacted] A control chart tells where and when the change took place. If a reason can be assigned to these special causes of variation, then they can be designated as [redacted].

5.12 Remove Special Causes of Variation

Corrective action consists of eliminating the activity, situation, or policy that is creating the out-of-control condition. Commonly, the process operator readily finds the reasons for these special causes. [redacted]

5.13 Collect New Measurements

Once a special cause of variation has been assigned and removed, new measurements must be [redacted]

5.14 Has Gage Variation Study been Performed and Documented?

If the measurement system has been analyzed by conducting a gage variation study, and results have been documented on the Process Plan, then other potential sources of variation should be addressed. If not, a [redacted]

5.15 Perform Gage Variation Study and Document Results on the Process Plan

Poor measurement systems reduce the ability to demonstrate control or capability and make investigation into the sources of variation difficult. Therefore, a measurement system that provides [redacted] should be used.

Before investigating common cause variation, gage capability must be determined. This is done by [redacted]

5.16 Was Corrective Action Taken on the Measurement System?

The decision to take corrective action on the measurement system is not mandatory. It is suggested that the measurement system consume no more than [redacted]

5.17 Identify Potential Sources of Process Variation

Sources of common cause variation can be found by [redacted]

5.18 Correlate Sources of Process Variation with the Key Characteristic

Based on experience, rejection history, or other historical information, relevant processes should be prioritized according to [redacted]

[redacted]

5.19 Establish Controls for Key Process Parameters

It is necessary to establish controls that will ensure that the **key process parameters** and their settings do not change. Controls may be in the form of [redacted]

5.20 Document Operation, Key Process Parameters, Settings and Control Method

Each **key process parameter** must be documented on the Process Plan. The name and operation number of the pertinent manufacturing process should be recorded in the column titled [redacted]

5.21 Update Process Database or Historical Records

The results of the correlation study and data contained on the Process Plan must be placed in a permanent record system for future use. The preferred database is an automated system that is conducive to digital processing and analysis. The following data should be stored:

[redacted]

It is expected that operators will use this database in pre-production planning activities to minimize the variation of **key characteristics** for existing and new parts.

[redacted]

5.22 Statistically Estimating Required Samples

When the sigma of a population is known, a means to estimate the number of samples to measure that will provide 95% confidence in the sample measurement is given by:

[redacted]

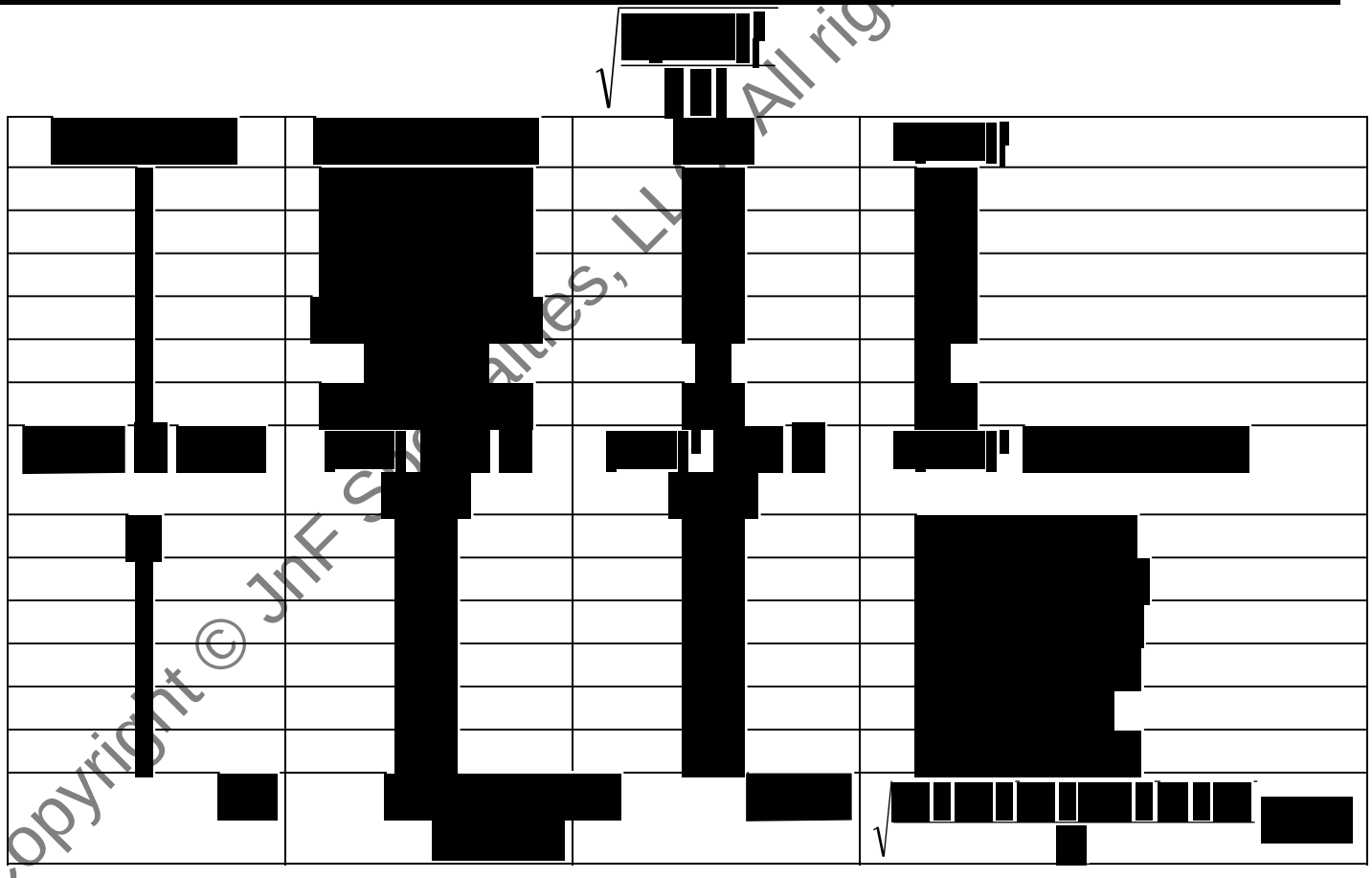
Some discretion must be used when a sampling plan is derived using these formulas. The results may be [redacted]

5.23 Evaluating Outlying Data Points

Reject outlier(s) from a set of data if [redacted]

5.24 Pooled Standard Deviation

When a large population of samples cannot be easily obtained, an estimate of sigma can be calculated that is superior to the value from any individual subset. To obtain a pooled estimate of sigma, [redacted]



5.25 Bias Problems in Process Monitoring

Avoid unpleasant surprises in production by (a) setting tolerances considering both the bias and the variability of component production processes, and (b) monitor processes appropriately to control excessive bias. Employ the following suggestions:

- [redacted]
- [redacted]
- [redacted]

5.26 Chemical Batch Process Capability

Establish written procedures for every task to ensure that all employees conduct the task in the same manner. Maintain checklists for batch and equipment preparation. Determine each solution's key parameter analysis capability using standard GR&R methods. Perform a chi-square test using each analytical capability as the known variance and each solution's key parameter to determine that process variability is greater than measurement error. If the test statistic exceeds the chi-square critical value there is opportunity to reduce process variation and improve product consistency. Determine the total variance for each key solution parameter and subtract the analytical variance to report the percentage of total product variation that is available for improvement. Perform a t-test to analyze means to determine if equipment is capable of producing to a target value.

6.0 Example Implementation Routine

6.1 Training Plan

Training includes:

- [redacted]

[redacted]

6.2 Systematic Process

Step 1: [redacted]s

Step 2: [redacted]

Step 3: [redacted].

Step 4: [redacted]

Step 5: [redacted].

Step 6: [redacted].

Step 7: [redacted]

A process that identifies rationale for:

[redacted]

A process that identifies strategy for:

[redacted]

A process that identifies criteria for:

[redacted]

A process that identifies responsibilities for:

[redacted]

Step 8: Process Control Implementation

Communicate and coordinate the implementation of SPC with [redacted]

Step 9: Defect Accountability

Identify and report the different defect types and their sources, e.g., [redacted].

Step 10: Measurement of Effectiveness

Determine that desired results were achieved and plan to maintain results by:

[redacted]

6.3 Quality Targets

Establish individual workstation targets in [redacted]

[redacted]

Figure 1: SPC Implementation Matrix

	Management	Steering Committee	SPC System	SPC Training	SPC Analysis	Improvement	Prevention	Suppliers	Pro-gress
10	SPC in all business operations?	Customers receive reports?	Are teams defined?	Training ongoing?	Reviews ongoing?	Processes charted?	Equipment capable?	SPC a contractual req'mt?	Row 10 done?
9	[redacted]								
8	[redacted]								?
7	[redacted]								
6	[redacted]								
[redacted]	[redacted]								
[redacted]	[redacted]								
[redacted]	[redacted]								
[redacted]	[redacted]								
[redacted]	[redacted]								
0	No knowledge	No Committee	No system	No SPC training.	No Pareto's	No techniques	No prevention	No effort	No pro-gress.

[redacted]

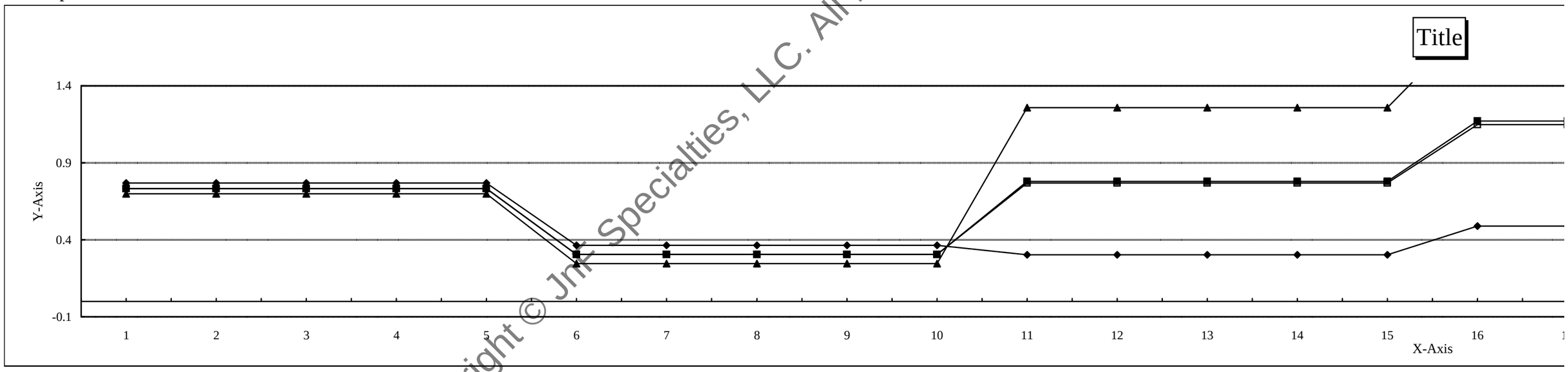
Figure 2: Sample Statistical Process Plan

Characteristic Evaluation							Gage Variation		Process Variation				
Characteristic	Specification	When Measured	Chart to Use	Qty Ck'd each test	Sample Freq	Cpk	Type, Make & Model	G R & R	Process Control Parameter	Variables in Process Control Parameter	Variable Settings	Control Method	DOE ?
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]		[redacted]	[redacted]	[redacted]	
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]		[redacted]	[redacted]	[redacted]	
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]		[redacted]	[redacted]	[redacted]	
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]				[redacted]	[redacted]	[redacted]	[redacted]	
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]				[redacted]	[redacted]	[redacted]	[redacted]	
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]				[redacted]	[redacted]	[redacted]	[redacted]	
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]				[redacted]	[redacted]	[redacted]	[redacted]	
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]				[redacted]	[redacted]	[redacted]	[redacted]	
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]				[redacted]	[redacted]	[redacted]	[redacted]	
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]				[redacted]	[redacted]	[redacted]	[redacted]	
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]				[redacted]	[redacted]	[redacted]	[redacted]	
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]				[redacted]	[redacted]	[redacted]	[redacted]	
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]				[redacted]	[redacted]	[redacted]	[redacted]	
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]								
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]								
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]								
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]								
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]								
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]								
[redacted]									[redacted]				
[redacted]						[redacted]			[redacted]			Your # (mo/yr)	

[redacted]

USL: 1.75 LSL: 1.55 Cpm Target: 1.65 Minimum Cpk, Cpm: 1.33

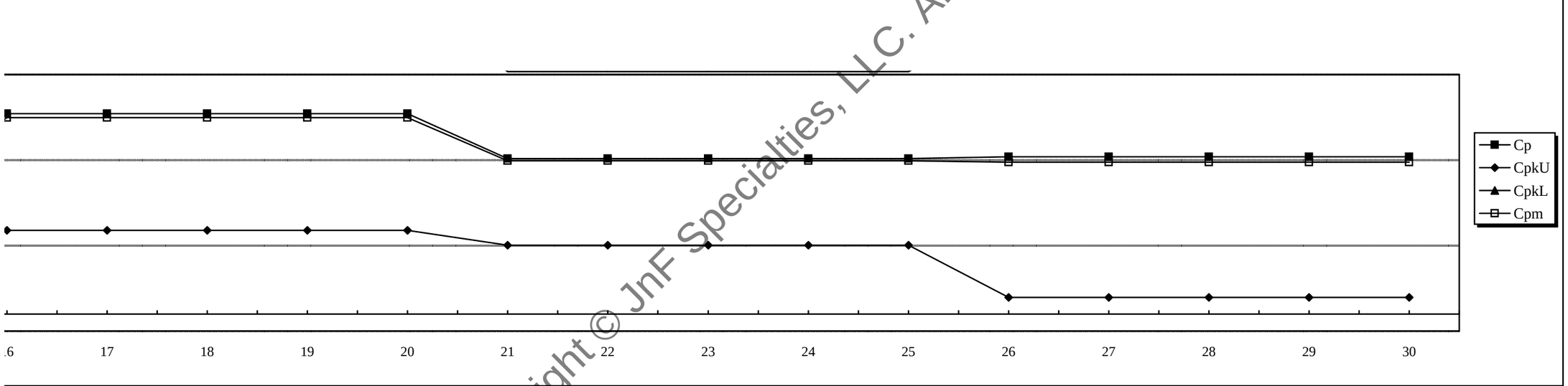
Lot:	223	223	223	223	223	224	224	224	224	224	225	225	225	225	225
Comments:															
Date:															
1	1.72	1.65	1.62	1.64	1.59	1.59	1.61	1.65	1.71	1.68	1.70	1.71	1.68	1.62	1.64
2	1.68	1.65	1.63	1.68	1.67	1.00	1.60	1.65	1.68	1.70	1.68	1.74	1.71	1.60	1.70
3	1.61	1.63	1.63	1.64	1.64	1.57	1.63	1.63	1.55	1.64	1.73	1.69	1.73	1.73	1.68
4	1.65	1.60	1.65	1.66	1.68	1.61	1.60	1.72	1.58	1.65	1.81	1.74	1.74	1.75	1.72
5	1.61	1.66	1.64	1.69	1.74	1.70	1.65	1.60	1.72	1.65	1.75	1.77	1.68	1.68	1.72
6	1.53	1.66	1.64	1.69	1.75	1.67	1.67	1.60	1.66	1.69	1.75	1.72	1.69	1.73	1.80
7	1.62	1.59	1.73	1.60	1.61	1.71	1.66	1.64	1.66	1.68	1.68	1.72	1.76	1.66	1.73
8	1.65	1.61	1.70	1.58	1.59	1.65	1.67	1.59	1.63	1.68	1.71	1.68	1.75	1.66	1.71
Average:	1.63	1.63	1.66	1.65	1.66	1.56	1.64	1.64	1.65	1.67	1.73	1.72	1.72	1.68	1.71
Control ?:	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out
Cp:	0.7335425	0.7335425	0.7335425	0.7335425	0.7335425	0.3044561	0.3044561	0.3044561	0.3044561	0.3044561	0.780074	0.780074	0.780074	0.780074	0.780074
CpkU:	0.7683858	0.7683858	0.7683858	0.7683858	0.7683858	0.3630639	0.3630639	0.3630639	0.3630639	0.3630639	0.3022787	0.3022787	0.3022787	0.3022787	0.3022787
CpkL:	0.6986992	0.6986992	0.6986992	0.6986992	0.6986992	0.2458483	0.2458483	0.2458483	0.2458483	0.2458483	1.2578693	1.2578693	1.2578693	1.2578693	1.2578693
Cpm:	0.7334818	0.7334818	0.7334818	0.7334818	0.7334818	0.3042844	0.3042844	0.3042844	0.3042844	0.3042844	0.7688242	0.7688242	0.7688242	0.7688242	0.7688242



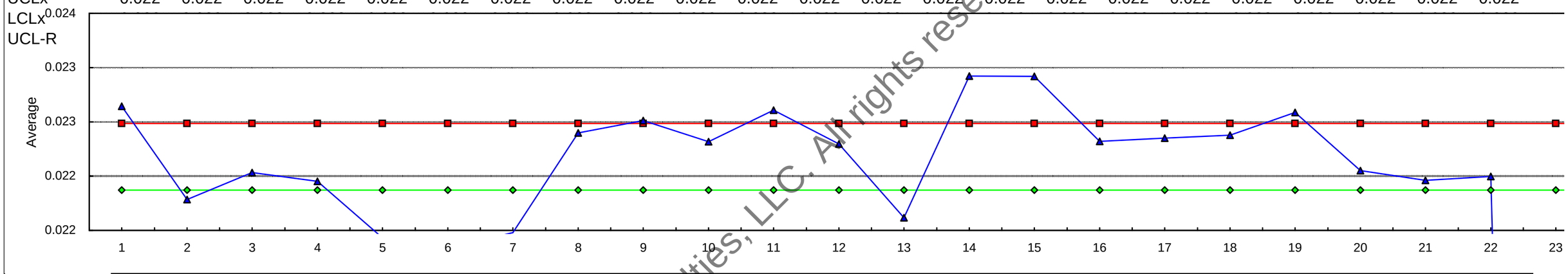
Cpm measures the process mean relative to the target
Cpk measures the process mean relative to the midpoint between specification limits
Cp measures the spread of the data to the specification limits

Lot#:
StdDev:
Avg:

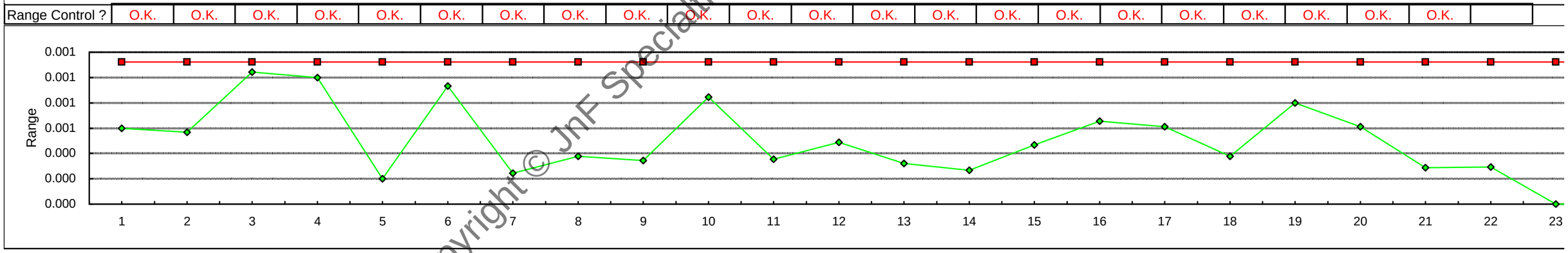
226	226	226	226	226	227	227	227	227	227	228	228	228	228	228
1.75	1.77	1.71	1.69	1.68	1.67	1.67	1.73	1.76	1.72	1.72	1.75	1.74	1.72	1.78
1.70	1.71	1.71	1.68	1.69	1.67	1.63	1.73	1.72	1.76	1.73	1.72	1.72	1.73	1.75
1.66	1.67	1.72	1.72	1.69	1.64	1.73	1.76	1.64	1.78	1.69	1.80	1.68	1.75	1.70
1.69	1.63	1.73	1.73	1.70	1.69	1.71	1.73	1.66	1.74	1.71	1.77	1.67	1.75	1.75
1.73	1.73	1.72	1.73	1.70	1.64	1.73	1.67	1.75	1.70	1.73	1.74	1.73	1.62	1.76
1.70	1.70	1.71	1.72	1.70	1.69	1.67	1.71	1.72	1.72	1.77	1.75	1.72	1.73	1.78
1.69	1.75	1.73	1.68	1.75	1.69	1.70	1.71	1.69	1.70	1.72	1.76	1.76	1.80	1.76
1.70	1.71	1.73	1.66	1.76	1.69	1.75	1.71	1.70	1.75	1.78	1.80	1.71	1.76	1.77
1.70	1.71	1.72	1.70	1.71	1.67	1.70	1.72	1.71	1.73	1.73	1.76	1.72	1.73	1.76
Out	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out
1.1716208	1.1716208	1.1716208	1.1716208	1.1716208	0.9090933	0.9090933	0.9090933	0.9090933	0.9090933	0.9192998	0.9192998	0.9192998	0.9192998	0.9192998
0.4891517	0.4891517	0.4891517	0.4891517	0.4891517	0.4022738	0.4022738	0.4022738	0.4022738	0.4022738	0.0965265	0.0965265	0.0965265	0.0965265	0.0965265
1.85409	1.85409	1.85409	1.85409	1.85409	1.4159127	1.4159127	1.4159127	1.4159127	1.4159127	1.7420731	1.7420731	1.7420731	1.7420731	1.7420731
1.1487865	1.1487865	1.1487865	1.1487865	1.1487865	0.8964289	0.8964289	0.8964289	0.8964289	0.8964289	0.886654	0.886654	0.886654	0.886654	0.886654



Sample #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	19	18	19	20	21	22
Comments:																							
Date:																							
Time:	11:19	11:35	11:51	12:07	12:30	01:30	03:30	06:09	06:58	07:46	08:34	09:22	10:11	10:59	11:47	12:35	01:24	01:24	02:12	04:44	05:33	06:21	
Operator:	YS	YS	YS	YS	RC	RC	RC	IS	IS	RC	DD	DD	IS	IS	RC	DD	YS	DD	DD	IS	IS	IS	
Sample 1	0.0229	0.0215	0.0218	0.0217	0.0214	0.0208	0.0216	0.0225	0.0225	0.0223	0.0226	0.0221	0.0214	0.0230	0.0226	0.0227	0.0222	0.0223	0.0230	0.0221	0.0220	0.0220	
Sample 2	0.0228	0.0220	0.0216	0.0224	0.0213	0.0216	0.0213	0.0223	0.0226	0.0224	0.0227	0.0225	0.0217	0.0228	0.0227	0.0220	0.0226	0.0224	0.0226	0.0219	0.0218	0.0218	
Sample 3	0.0223	0.0217	0.0226	0.0220	0.0215	0.0217	0.0216	0.0222	0.0224	0.0228	0.0224	0.0222	0.0217	0.0229	0.0231	0.0226	0.0221	0.0226	0.0222	0.0219	0.0219	0.0220	
Sample 4	0.0224	0.0218	0.0222	0.0214	0.0215	0.0212	0.0215	0.0224	0.0223	0.0219	0.0227	0.0221	0.0217	0.0229	0.0230	0.0222	0.0222	0.0224	0.0228	0.0219	0.0219	0.0220	
Sample 5	0.0227	0.0219	0.0220	0.0223	0.0215	0.0214	0.0215	0.0225	0.0227	0.0222	0.0226	0.0226	0.0217	0.0230	0.0231	0.0222	0.0227	0.0222	0.0223	0.0225	0.0221	0.0221	
Sum:	0.1132	0.1089	0.1102	0.1098	0.1072	0.1067	0.1074	0.1120	0.1126	0.1116	0.1130	0.1115	0.1081	0.1146	0.1146	0.1116	0.1118	0.1119	0.1129	0.1103	0.1098	0.1100	
Average: (x)	0.0226	0.0218	0.0220	0.0220	0.0214	0.0213	0.0215	0.0224	0.0225	0.0223	0.0226	0.0223	0.0216	0.0229	0.0229	0.0223	0.0224	0.0224	0.0226	0.0221	0.0220	0.0220	
Range - R	0.0006	0.0006	0.0010	0.0010	0.0002	0.0009	0.0002	0.0004	0.0003	0.0008	0.0004	0.0005	0.0003	0.0003	0.0005	0.0007	0.0006	0.0004	0.0008	0.0006	0.0003	0.0003	
Xbar Control ?	?	?	O.K.	O.K.	?	?	?	O.K.	?	O.K.	?	O.K.	?	?	?	O.K.	O.K.	O.K.	?	O.K.	O.K.	O.K.	
UCLx	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022
LCLx																							
UCL-R																							



Range Control ?	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	



The upper and lower control limit calculations are located under the x-bar graph

REPEATABILITY AND REPRODUCIBILITY

GAGE TYPE: 6" Deep Throat Micrometer
PART NAME: Gage Block
PART NUMBER: 0.025000"
PRODUCT SPEC: N/A

DATE:
GAGE NUMBER: MI-30
CHARACTERISTIC: Thickness
TOLERANCE RANGE: 0.0030

COLUMN#:	1	2	3	4	5	6	7	8	9	10	11	12
OPERATOR:	A-	Anne		B-	Darrell		C-	Mary Mc		D-	Suzy	
SAMPLE#	1stTRIAL	2ndTRIAL	DIFF	1stTRIAL	2ndTRIAL	DIFF	1stTRIAL	2ndTRIAL	DIFF	1stTRIAL	2ndTRIAL	DIFF
1	0.0249	0.0250	0.0001	0.0250	0.0251	0.0001	0.0250	0.0250	0.0000	0.0250	0.0248	0.0002
2	0.0252	0.0249	0.0003	0.0251	0.0250	0.0001	0.0251	0.0250	0.0001	0.0253	0.0250	0.0003
3	0.0252	0.0248	0.0004	0.0251	0.0250	0.0001	0.0251	0.0250	0.0001	0.0248	0.0250	0.0002
4	0.0252	0.0250	0.0002	0.0250	0.0250	0.0000	0.0251	0.0250	0.0001	0.0250	0.0248	0.0002
5	0.0250	0.0249	0.0001	0.0251	0.0250	0.0001	0.0250	0.0250	0.0000	0.0250	0.0250	0.0000
6												
7												
8												
9												
10												
TOTALS	0.1255	0.1246	0.0011	0.1253	0.1251	0.0004	0.1253	0.1250	0.0003	0.1251	0.1246	0.0009
AVERAGES	0.0251	0.0249	0.0002	0.0251	0.0250	0.0001	0.0251	0.0250	0.0001	0.0250	0.0249	0.0002

Col1Avg:	0.0251	**Col4Avg:**	0.0251	**Col7Avg:**	0.0251	**Col10Avg:**	0.0250
SumCol1&2Avgs:	0.0500	**SumCol4&5Avgs:**	0.0501	**SumCol7&8Avgs:**	0.0501	**SumCol10&11Avgs:**	0.0499
Avg(OperatorA):	0.0250	**Avg(OperatorB):**	0.0250	**Avg(OperatorC):**	0.0250	**Avg(OperatorD):**	0.0250

RANGE VARIATION

AvgCol3	0.0002
AvgCol6	0.0001
AvgCol9	0.0001
AvgCol12	0.0002
SUM	0.0005

[redacted]

Insert the actual D4 value above

#Trials:	2	3	4
D4	3.27	2.58	2.28

REPRODUCIBILITY = OPERATOR VARIATION

DIFFERENCE IN MEANS

X_{Diff} = ($AvgOper_{Max}$) - ($AvgOper_{Min}$) = 0.0001

[redacted]

REPRODUCIBILITY AND REPEATABILITY (COMBINED)
STANDARD DEVIATION (R&R) = SQRT of [SDM^2 + SDR^2]

REPEATABILITY = EQUIPMENT VARIATION

DIFFERENCE IN READINGS

R_1 = (Table D_4 Value)x(Avg Range)

[redacted]

PERCENT TOLERANCE CONSUMED BY R&R
P.T.C. = [((5.15) x (SDRR))/TOLERANCE RANGE]*100

Tolerance Range must be inserted for P.T.C. to calculate SDRR= 0.0001

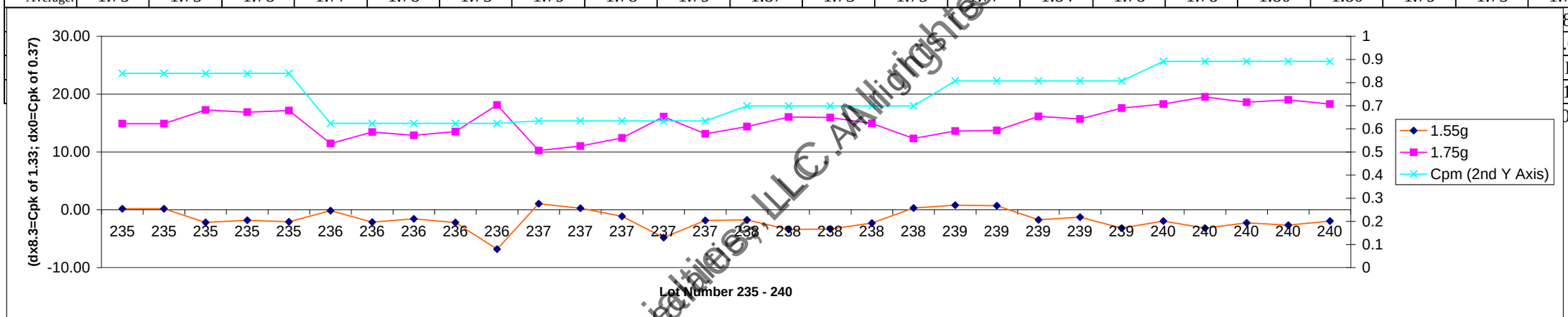
%= 21.2

Insert ($1/d_2$) for SDM and SDR from Table; 0.446 and 0.885 are correct for 4 appraisers and at least 3 parts.

USL, g: 1.75 LSL, g: 1.55 Sample Process

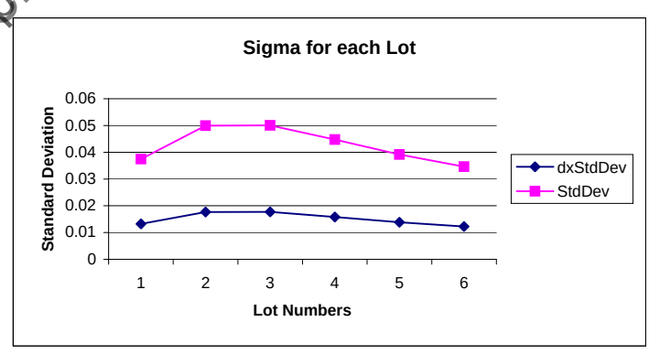
Process Acceptance Chart

Lot#:	235	235	235	235	235	236	236	236	236	236	237	237	237	237	237	238	238	238	238	238	239
Comment:																					
Date:																					
1	1.76	1.75	1.84	1.82	1.77	1.74	1.78	1.76	1.78	1.91	1.75	1.76	1.78	1.78	1.80	1.80	1.84	1.85	1.80	1.77	1.76
2	1.73	1.73	1.84	1.80	1.84	1.76	1.71	1.79	1.79	1.84	1.75	1.75	1.78	1.79	1.86	1.82	1.71	1.85	1.77	1.77	1.76
3	1.75	1.74	1.73	1.81	1.76	1.73	1.76	1.76	1.77	1.93	1.68	1.69	1.79	1.88	1.73	1.81	1.85	1.77	1.81	1.80	1.72
4	1.74	1.66	1.76	1.78	1.75	1.76	1.78	1.80	1.74	1.88	1.67	1.74	1.73	1.85	1.75	1.83	1.77	1.77	1.78	1.76	1.77
5	1.77	1.81	1.74	1.75	1.75	1.73	1.84	1.81	1.79	1.85	1.78	1.76	1.77	1.88	1.83	1.78	1.85	1.81	1.80	1.67	1.73
6	1.79	1.77	1.80	1.76	1.77	1.76	1.81	1.71	1.78	1.88	1.79	1.73	1.75	1.81	1.79	1.76	1.79	1.80	1.78	1.66	1.75
7	1.72	1.76	1.77	1.75	1.83	1.76	1.81	1.78	1.83	1.85	1.70	1.75	1.76	1.83	1.77	1.70	1.84	1.77	1.76	1.78	1.71
8	1.72	1.76	1.75	1.72	1.75	1.78	1.81	1.81	1.83	1.82	1.73	1.78	1.80	1.86	1.73	1.72	1.78	1.80	1.79	1.75	1.71
Average:	1.75	1.75	1.78	1.77	1.78	1.75	1.79	1.78	1.79	1.87	1.73	1.75	1.77	1.84	1.78	1.78	1.80	1.80	1.79	1.75	1.74



$$dx = \frac{avg - LSL}{\sigma / \sqrt{n}} > 4\sqrt{n} - 3$$

$$dx = \frac{USL - avg}{\sigma / \sqrt{n}} > 4\sqrt{n} - 3$$



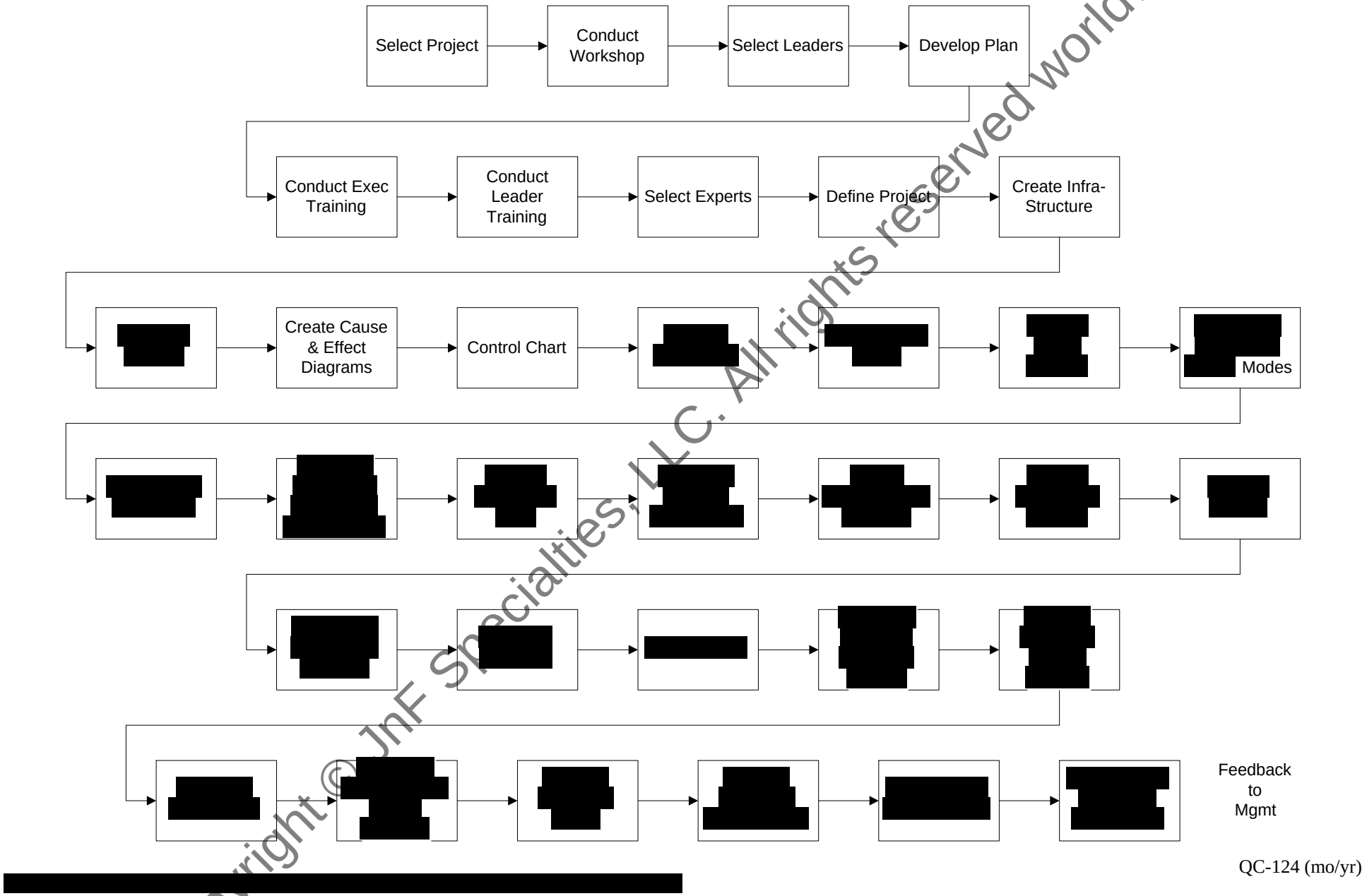
dx provides a means to answer the question:
Are we making acceptable parts? -- instead of -- Are we in control?

The Cpm capability index depends on both variability and centering.

This is not a control chart

Acceptance is based on the Lower Acceptance Limit

Six Sigma Implementation



[redacted]

QC-124 (mo/yr)

[redacted]

Tips:
Double click grey area at top and bottom of page to edit header/footer
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Continuous Improvement Metrics

(mo/yr)

Revisions		Rev:	
Letter	E.O. Number - Description		Date
Used On	Contract#:	**Your Company**	
Prepared By: [redacted]			
		Your Procedure Name	
		QC-125	
		[redacted]	[redacted] 1 of 8

Your Logo

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1.0 SCOPE

Explain the relationship between organizational objectives and metrics and provide some examples of the tools and techniques for collecting metric data.

2.0 THEORY

Nothing gets improved unless it is measured and a metric that is not tied to an objective is worthless.

3.0 OBJECTIVES

3.1 Focus on Customer requirements
3.2 Support goals and targets
3.3 Address the desired improvement
3.4 Stretch the organization
3.5 Allow for measurement

4.0 OVERVIEW

4.1 Measurements vs metrics
4.2 Tools for data collection
4.3 Attributes of a metric
4.4 Example of a metric
4.5 Metrics development worksheet

5.0 DEFINITIONS

5.1 Measurement

The act or process of quantitatively comparing results to requirements to arrive at a quantitative estimate of performance.

5.2 Metric

A measurement taken over a period of time that communicates vital information about a process or activity. A metric should drive appropriate leadership or management action.

6.0 TOOLS

6.1 Sampling

Sampling instead of 100% measurement is useful when there are too many items to check, destruction of the item is necessary, [redacted]

[redacted] Data used to establish a metric should be [redacted]

[redacted]

6.2 Check Sheet

The results of a measurement sample can be presented on a check sheet to establish a trend.
The check sheet can list attributes or variables type data:

Attributes type data		
Standard	Quantity	
Not…	𝍸 ||	
Not…	|||	
Should Be…	||	
Should Be…		
Not…		
Should Be…	𝍸 𝍸 𝍸	

Variables type data		
[redacted]		

6.3 Frequency Table

The check sheet is useful as a snapshot of the counts of an activity but it is not a metric.
The check sheet can be improved by converting it to a frequency table:

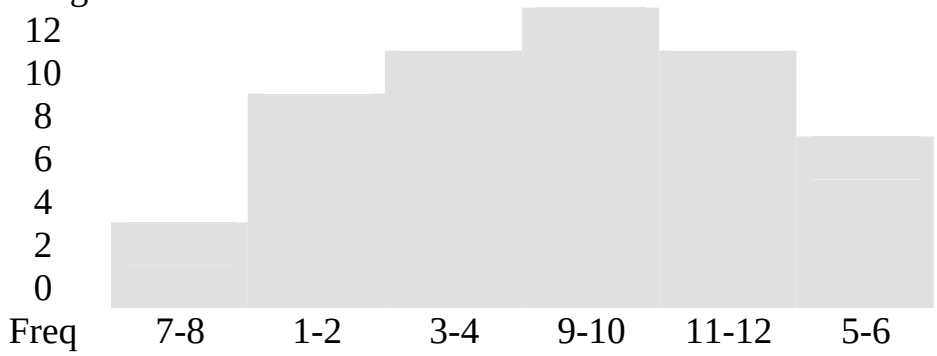
Attributes type data		
Standard	Quantity	[redacted]
Not 1…	𝍸 ||	
[redacted]		

Variables type data		
Time Study	Quantity	[redacted]
1-2	𝍸 ||	
[redacted]		

6.4 Histogram

The frequency table helps to quantify the cumulative number of recurring events but it is not a metric. Converting the frequency data to a Histogram is useful to display the central tendency of the data:

Histogram of Variables Data



6.5 Pareto Analysis

The frequency table helps to quantify the cumulative number of recurring events but it is not a metric. Converting the frequency data to a Pareto Chart is useful to display the most recurring event to the least recurring event:

Pareto Analysis of Attributes Data

6.6 Miscellaneous Charts, Diagrams and Statistics

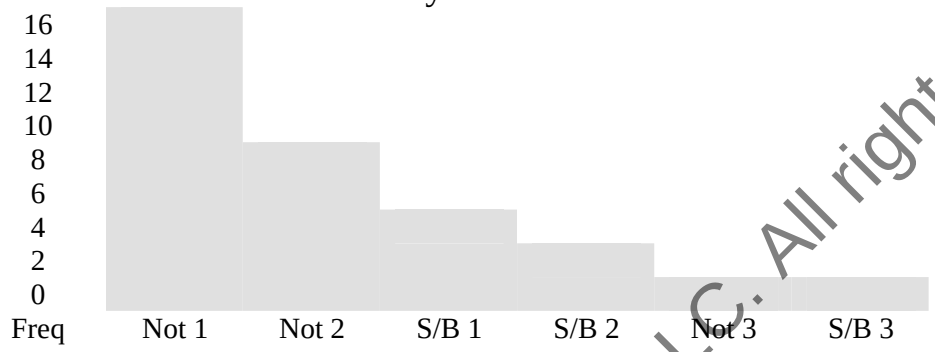
Trend and control charts accumulate data over time so they are more than a snapshot of events but they are still not data that meets the attributes of a metric. A scatter diagram can be used to [redacted].

7.0 ATTRIBUTES OF A METRIC

[redacted]

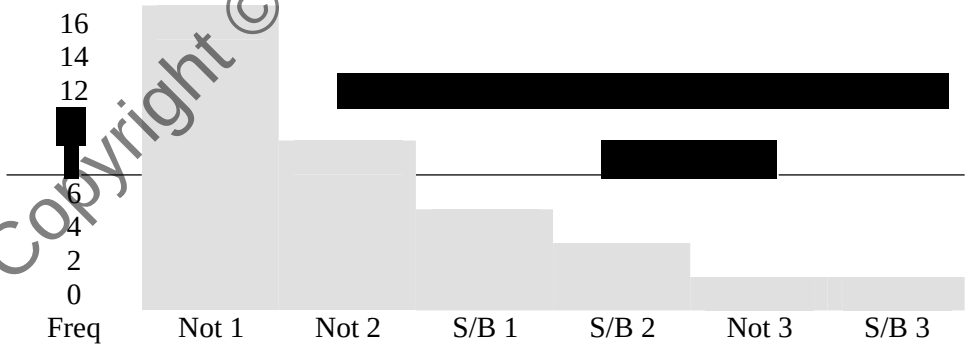
8.0 EXAMPLE OF A METRIC

Lets examine the Pareto Analysis of the Attributes Data



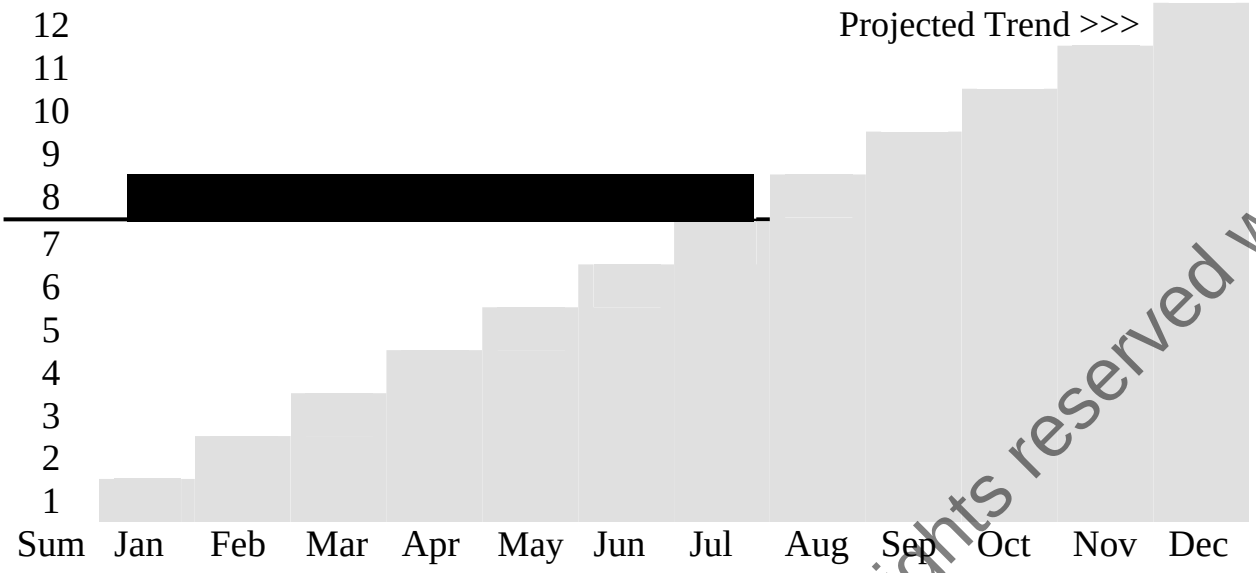
The chart has value because it identifies the <few> from the <many> but it is not a metric by itself unless it is [redacted].

The chart has been modified to [redacted]



The modified chart is still not a metric because it [redacted]

The following chart is the best representation of a metric:



The chart now meets the objectives of a metric because [redacted]

METRICS DEVELOPMENT WORKSHEET

Organization Objective:

Customer(s):

[redacted]

RECORD OF PROCEEDINGS

(Your) Team Date: _____

[redacted]	[redacted]	[redacted]

[redacted]	[redacted]	[redacted]

[redacted]

RECORD OF PROCEEDINGS

(Your) Team Date: _____

[redacted]	[redacted]	[redacted]

[redacted]

Your Company Name	MFG/QA TRAVELER Your Title	QC-127-1 Page 1 of 1

Your #	Rev mo/yr	Customer P/N-Rev:	
Program:		P.O.# & Rev:	
Account#:		Drawing# & Rev:	
Customer:		SPECIFICATION:	

SPECIAL INSTRUCTIONS [redacted]

PART I						
PART II						
PART III						
PART IV						

[redacted]

Comments:

[redacted]

Tips:
Double click grey area at top and bottom of page to edit header/footer
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Manufacturing/QA Traveler, Style 2
Your Item's Name
Drawing No: Your Dwg No.

Revisions	Rev:
[redacted]	

Your Company Logo

Your Item Name			
PROGRAM:		SPECIFICATION:	
WORK ORDER#:		SPECIFICATION:	
CUSTOMER:		SPECIFICATION:	
SPECIAL INSTRUCTIONS:	Use talc-free latex or nylon gloves	PO#:	
	to handle electrodes.	Recent Changes:	
Monthly Lot/Sublots:			

[redacted]

[redacted]									
Your #									
Your #									
Your #									
Your #									
Your #									
Your #									
Your #									
Your #									
Your #									
Your #									
Your #									
Your #									
[redacted]									

QC-127-2 (mo/yr)

OPER	DEPT	Description of Task for Your #

NOTE:

QC-127-2 (mo/yr)

[redacted]

[redacted]

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Handling Procedure
Electrostatic Discharge Sensitive Devices
(ESD)

Mo/Yr

Revisions		Rev:	
Letter	E.O. Number - Description	Date	

Used On	Contract#:	**Your Company Name**
Prepared By: [redacted]	[redacted]	**YOUR PROCEDURE NAME**
		Your Procedure #
	[redacted]	[redacted] 1 of 13

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[redacted]

1.0 Purpose

To define minimum requirements for effective electrostatic discharge (ESD) control. Adherence to this procedure will provide adequate protection for ESD sensitive devices during handling and storage processes. MIL-STD-1686B and MIL-HDBK-263A provided guidance for preparing this procedure.

2.0 Scope

This procedure is specifically written for the handling of an ESD sensitive circuit card but may be applied to any ESD sensitive device included in any process as deemed applicable by the Responsible Authority (RA).

3.0 Discussion

All processing of an ESD sensitive device or of a subassembly or assembly containing an ESD sensitive device must be completed with the intent of providing maximum protection against electrostatic discharge. Even though care must be exercised in the handling of the device, thought must be given to the actual application of the ESD sensitive device. For instance, a circuit card could be used in a variety of atmospheric and weather conditions, thus, as long as a static discharge is not induced, the device should be capable of surviving in any atmosphere.

4.0 Responsibility

4.1 Personnel

All personnel who handle ESD sensitive parts and assemblies must [redacted]

4.2 Supervisor/Training Requirements

All lead operators, supervisors, or other personnel who directly oversee or manage individuals who handle ESD sensitive parts and/or assemblies shall [redacted]

4.3 Non-Company Personnel

Customers, Government representatives, or other non-Company personnel (i.e., security guards) who have access to any area within the Company where ESD type components or assemblies may be present shall [redacted]

5.0 Definitions

Anti static (Anti-stat) - Unable to drain a charge within a few minutes. Has low enough resistivity (10^9 to 10^{14} ohms/sq) to resist formation of static charge when rubbed, but not capable of preventing the build up of a voltage along or across the surface. (blue or pink bags, bubble wrap)

Electrostatic Discharge (ESD) - A transient, or rapid transfer of charge, between bodies at different electrostatic potentials (voltages), either:
a) caused by direct contact,
b) by arc-over due to the items being close, or
c) induced by an electrostatic field.

Electrostatic Discharge Sensitive (ESDS) - Susceptible to damage or destruction by electrostatic discharge, usually from melting of a microscopic segment of semiconductive material.

ESDS Device (component, part) - Any component whose structure incorporates: (a) very thin insulating layers between conductive materials, (b) very small junction areas, or (c) very thin layers of a conductive material or any combination of these structures. This is inclusive of any assembly containing such devices, although once installed in a container (or other appropriate Faraday cage) slightly different handling procedures may be used.

ESDS Device Zone - An identified zone where there are exposed ESDS devices present. A high level of static awareness should be maintained.

Electrostatic Field - An electric field developed between two items at different voltages

Faraday Cage - a container in which ESDS devices are no longer considered sensitive

Insulator - Able to generate an electrostatic potential on its surface. Because of its high resistive nature it requires very long periods of time to lose its charge. Resistivity for this material is greater than 10^{14} ohms/sq.

Resistivity (Surface) - A measure of resistance across the surface of a conductive mat, tabletop, floor, etc. The measurement is made in units of ohms/sq. What this means is for every square piece of conductive material the electrical resistance from along one side to the opposite side will measure the same no matter how big the square piece is, this the value of ohms/sq. The lower the value of resistivity, the easier and quicker it is to drain away the static charge.

Static Conductive - Able to drain an electrostatic charge very rapidly, the range of resistivity for this material is less than 10^5ohms/sq. Because of its low resistivity it has a high current carrying capacity.

Static Dissipative - Able to drain a charge in a few seconds to a few minutes. The range of resistivity for this material is 10^5 ohms to 10^{15} ohms/sq. (i.e., most ESD mats)

Static Protective - Materials characterized by static-conductive and antistatic properties, provides shielding from electrostatic fields, electrostatic discharge, and from frictional charge generation.

Static Safe - This is any material with resistivity less than 10^{14} ohms/sq. characterized by its ability to not generate a charge, and (except for antistatic, above) can remove static charge from conductive items (including employees). It creates an environment that has a lower risk of charge build up within a Static Safe Perimeter. This is a general term including antistatic, static dissipative, static conductive, static shielding, and static protective.

Static Safe Perimeter - A radius of 12 inches around an ESDS device that shall not have an electric field that exceeds ±100 volts, as measured with an ESD field meter.

Static Shielding - Able to shield the product from direct contact with electrostatic discharge, and from breakdowns caused by a near electrostatic field. Shields are conductive or have a conductive layer buried inside.

Static Table Mat - A flexible work surface composed of vinyl or rubber with an added component to allow static to drain from its surface to ground via a connected ground cord. There are two styles of mats used at Static Safeguarded Work Stations:

a) Multilayered - with conductive middle layer, a dissipating top layer, and an insulating (or dissipating in some models) bottom layer.

b) Single layered - Homogeneous - No conductive middle layer, rather the entire mat is uniformly resistive.

6.0 ESDS Identification

6.1 ESDS ID requirements

All ESDS devices or assemblies containing ESDS components must be readily identified and easily recognizable at every location. The following provisions need to be reviewed for applicability and addressed as necessary:

[redacted]

6.2 ESDS Device Designation

An ESDS device or component may reach a point during production where the assembled components are no longer considered ESD sensitive. This is true when the device is enclosed in a "Faraday Cage" such as a sheet metal container. Once the device has reached this point, the RA may decide to change the ESDS designation or the handling procedures as long as they do not violate contractual requirements. Once the device is installed in a Faraday Cage, the container may be treated the same as any other container with the following exceptions:

[redacted]

Note: Work within the container should be treated as a potential ESDS hazard and be performed in an ESDS workstation whenever possible.

7.0 ESDS Device Handling Procedures

7.1 ESDS Device Handling

The handling procedures for ESDS devices have two basic requirements:

[redacted]

These requirements are met with [redacted]

ESDS devices include both discrete components (individual parts) and assemblies having these components. Special handling procedures will apply to:

[redacted].

7.2 Receiving Inspection Handling

When any item is received that indicates an ESDS device may be present, it shall have the outside packing container inspected for damage or penetration. If any damage exists, notify the [redacted]

[redacted]

7.3 ESDS Device Transportation

ESDS devices or assemblies will be transported to the ESD Workstation using [redacted]

7.4 Shipment of ESDS Device

When packaging an ESDS device for return shipment, keep it in the static shielding bag that it was received in, unless the bag was damaged. Close the bag using staples or other suitable method. The outside shipping container must show that an ESDS device is contained within.

[redacted]

7.5 Specific Handling Procedures

ESDS devices should be kept in contact with [redacted]

Warning: When working where 120 volts or more may be present, always remove your wrist strap grounding cord and ESD coat before applying power. After turning off the power, reattach to your grounding strap and coat before handling the ESDS assembly.

7.5.1 The circuit cards used in a container will be kept in the original shipping carton until needed for inspection, testing, or assembly. The cards may [redacted]

7.6 Low Humidity Operation

When the relative humidity drops below 30%, the following precautions must be taken:

[redacted]

8.0 Static Safeguarded Work Station/Zone Requirements

8.1 Static Safeguarded Work Stations

Static Safeguarded Work Stations shall include:

[redacted]

Basically, a properly grounded ESD mat with the connections for operator wrist straps along with an isolated work area are [redacted]

8.2 ESDS Device Work Zone Requirement

Work zones that will be used for ESDS device processing will consist of [redacted]

[redacted].

The work zone shall include the following requirements:

[redacted]

[redacted]

9.0 ESDS Work Zone Operations

9.1 Personnel Grounding

For processes in which an operator stays at a fixed location and handles an ESDS device, an electrical connection from operator to work surface (wrist strap to mat ground connection) is

[redacted]

Warning: When working where 120 volts or more may be present, always remove your wrist strap grounding cord and ESD coat before applying power. After turning off the power, reattach to your grounding strap and coat before handling the ESDS assembly.

9.2 Personnel Apparel

Clothing and its movement on the operator is a significant source of static generation during the handling process. Clothing made of cotton is considered to be the safest clothing for an operator to wear during processes involving the handling of ESDS devices. The following will minimize the static generation within the Static Safe Perimeter.

[redacted]

9.3 ESD Shop Coats

All personnel working on ESDS devices in an area identified as a Static Safeguarded Work Station or personnel who will be in the ESD work zone while ESDS devices are present must

[redacted]

[redacted]

9.4 Prohibited materials

High static generating materials must not be allowed in the ESD Work Zone when ESDS devices are exposed. In general, this means that the following items shall be removed from the work zone prior to removal of any ESD protection from ESDS device(s).

[redacted]

9.5 Paperwork

Paper and wood products with normal humidity conditions (over 30% relative humidity) do not pose a problem with ESDS devices in the area. These type products absorb water out of the air and therefore tend not to build up static. As a normal precautionary measure, [redacted]

9.6 Ionized Air

Excessive static charge must be neutralized by providing a flow of ionized air over the affected work area and equipment when one or more of the following exist:

[redacted]

[redacted].

9.7 Equipment grounding (Electrical)

All electrical equipment used in the processing of ESDS devices must have a connection directly to ground unless the test setup needs a floating ground for proper measurement. [redacted]

9.8 Hand Tools

All hand tools must be either conductive or dissipative (with the use of dissipative handle coatings), or treated with an anti static coating on the non-conductive parts. In addition, these materials [redacted]

9.9 ESD Shielding Bags

The standard bag for all ESD protection will be the ESD shielding bag. This bag is dark or silver tinted, and is slightly see through. Any shielding bag shall be discarded if found [redacted]

Use the following rule: [redacted].

10.0 Work Station and Equipment Calibration

Equipment required:

[redacted]

10.1 Calibration of Work Station

[redacted].

The static field meter [redacted]

10.2 Equipment Checks

Using the ohmmeter or DMM, measure the resistance from the tip of the soldering iron to the ground prong of the power plug. The value must [redacted]

11.0 Potential Damage

[redacted]

[redacted]

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Double click grey area at top and bottom of page to edit header/footer
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Procedure Writing Technique, Style 1

Mo/Yr

Revisions		Rev:	
Letter	E.O. Number - Description	Date	
Used On	Contract#:	**Your Company Name**	
Prepared By: [redacted]	[redacted]		
		PROCEDURE	
		QC-129-1	
		[redacted]	1 of 1

Your Company Logo

1.0 Scope

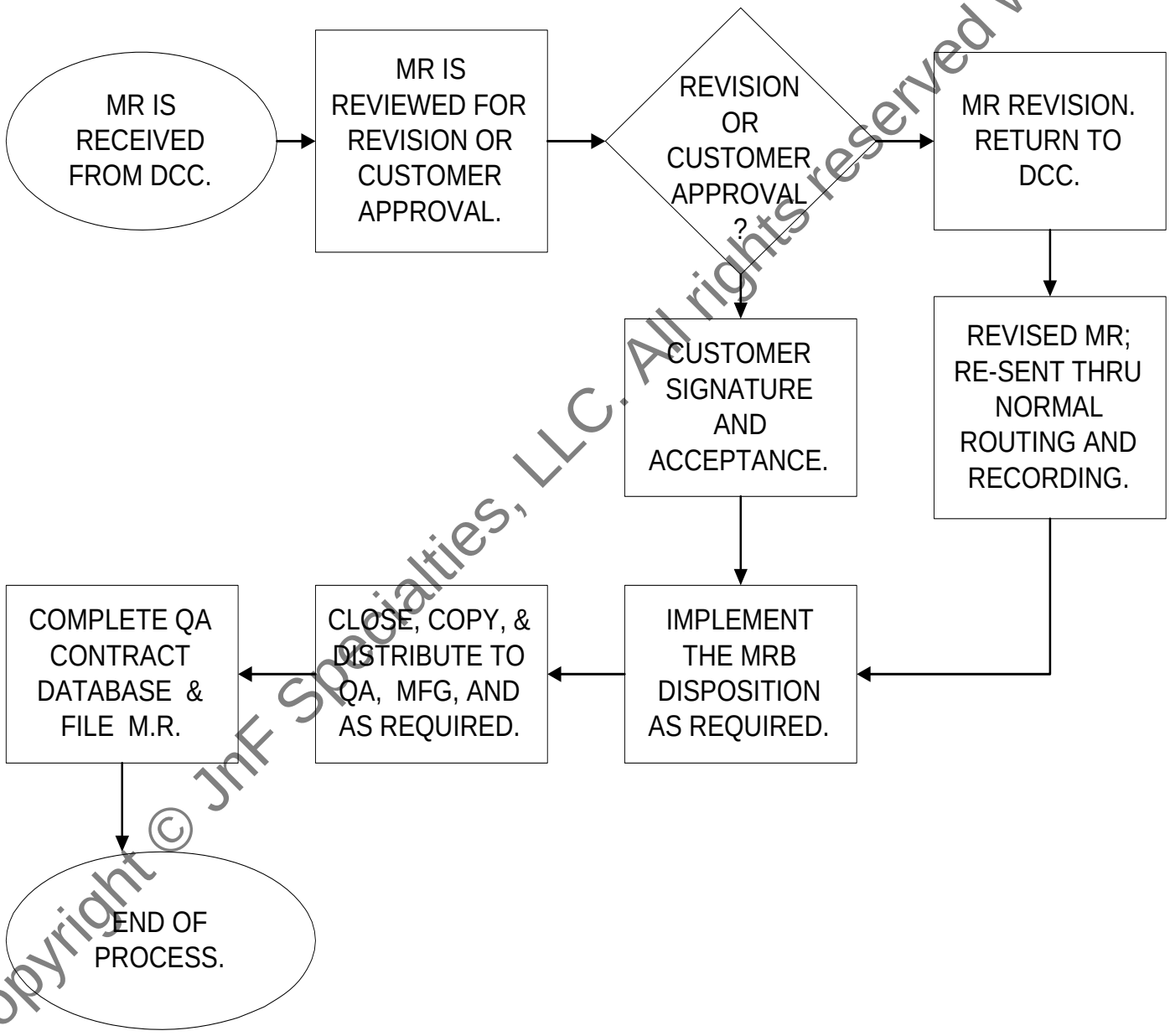
Document procedures using [redacted]

An example of this writing technique follows on pages 3, 4, and 5.

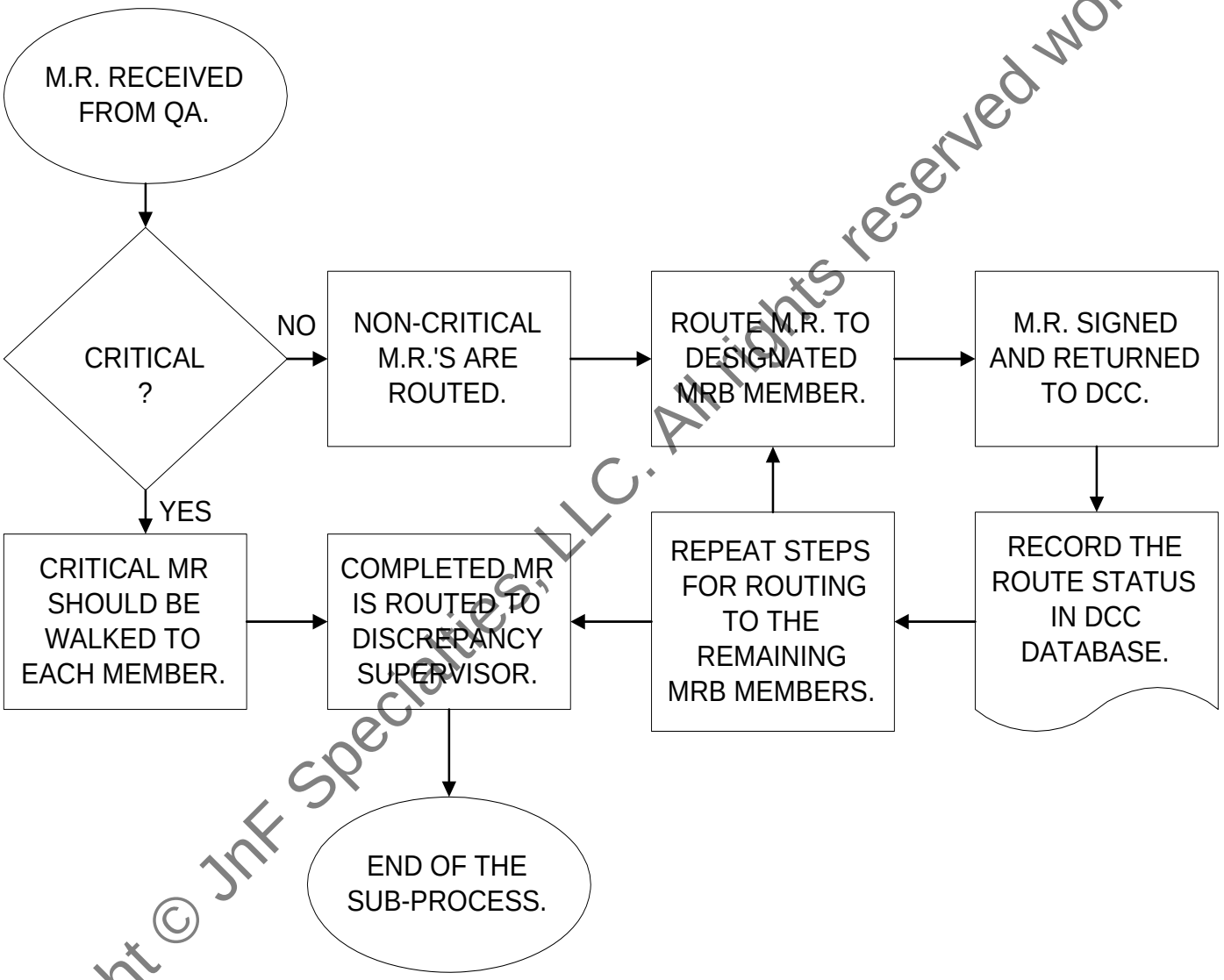
[redacted]

Option: Insert image

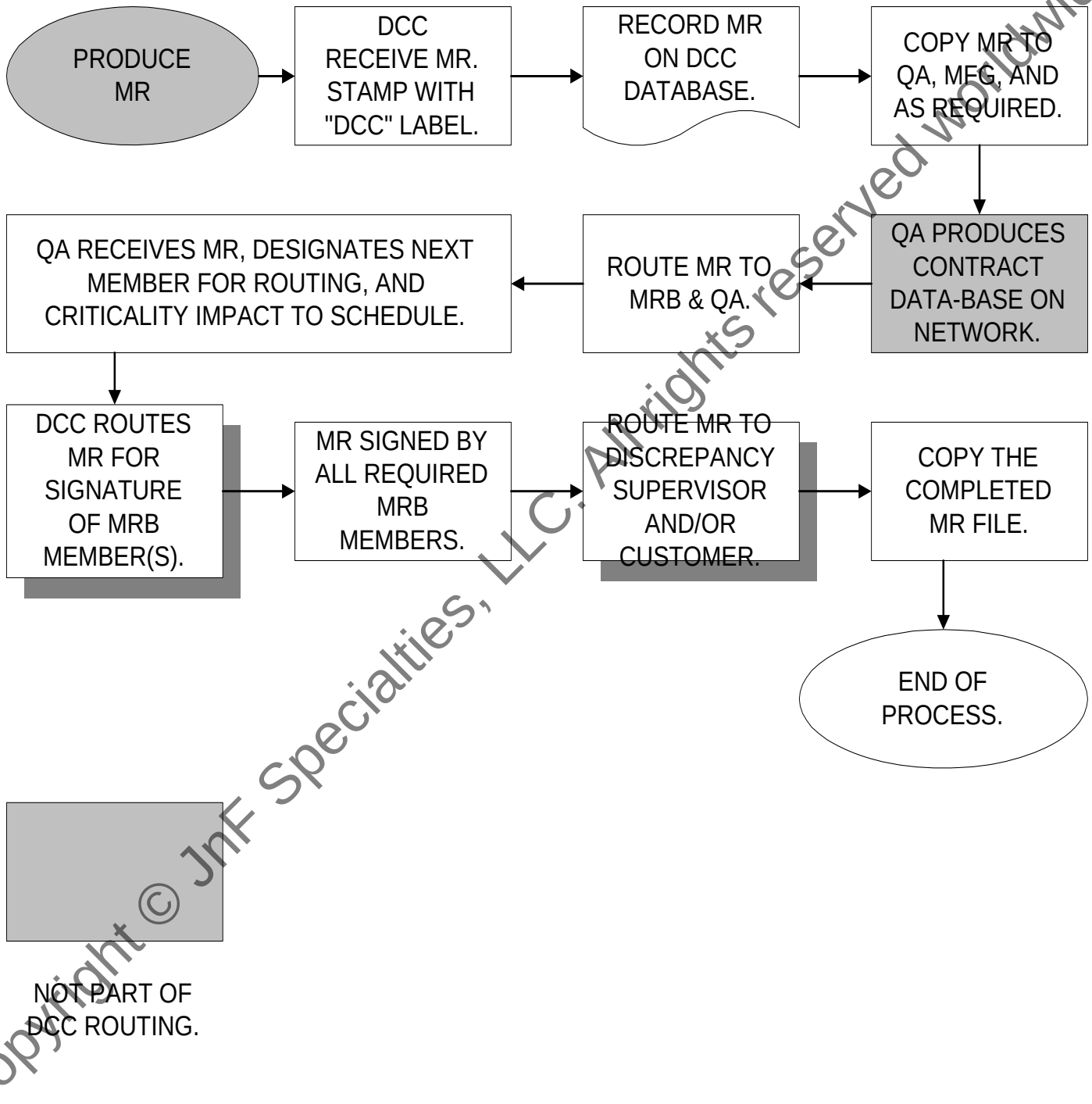
MATERIAL REPORT PROCESSING (DISCREPANCY SUPERVISOR) SUB-FLOWCHART



MATERIAL REPORT "DCC" ROUTING FOR SIGNATURES (MRB) SUB-FLOWCHART



MATERIAL REPORT (MR) ROUTING FLOW-CHART



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Writing Procedure, Style 2
Supplier Survey Disposition

Mo/Yr

Revisions		Rev:	
Letter	E.O. Number - Description	Date	

Used On Surveys	Contract#:	**Your Company Name**
[redacted]	[redacted]	
		WORK INSTRUCTION
[redacted]		QC-129-2
[redacted]	[redacted]	[redacted] 1 of 1

Your Logo

STEP	RESPONSIBILITY	ACTION
1	Quality Group	[redacted]
2.3	Supplier record is defect-free	Check mark “Approved” on survey form Your #.
2.4	Supplier record is not defect-free	[redacted]
STEP	RESPONSIBILITY	ACTION
3	Quality Group	[redacted].

Quality Systems Cross-Reference Matrix					
Quality System Elements	**MIL-I 45208**	**MIL-Q 9858**	**ISO 9001**	**ISO 9002**	**ISO 9003**
Management Responsibility:	(3.1)	(1.3, 3.1)	(4.1)	(4.1)	(4.1)
Quality System, Initial Quality Planning:	(1.1)	(1.3, 3.2)	(4.2)	(4.2)	(4.2)
Contract Review:	(1.2)	(3.2, 1.4)	(4.3)	(4.3)	(4.3)
Design Control:	N/A	(4.1)	(4.4)	N/A	N/A
Document and Data Control:	(3.2)	(4.1)	(4.5)	(4.5)	(4.5)
Purchasing:	N/A	(5)	(4.6)	(4.6)	N/A
Control of Customer Supplied Product:	(3.6)	(7.2)	(4.7)	(4.7)	(4.7)
Product Identification and Traceability:	N/A	(6.1)	(4.8)	(4.8)	(4.8)
Process Control:	(3.4)	(6.2)	(4.9)	(4.9)	N/A
Inspection and Testing:	(3.1, 3.2.1, 3.12)	(6.1, 6.2, 6.3)	(4.10)	(4.10)	(4.10)
Control of Inspection, Measuring and Test Equipment:	(3.3)	(4.2-4.5)	(4.11)	(4.11)	(4.11)
Inspection and Test Status:	(3.5)	(6.7)	(4.12)	(4.12)	(4.8)
Control of Nonconforming Product:	(3.7)	(6.5)	(4.13)	(4.13)	(4.13)
Corrective and Preventive Action:	(3.2.3)	(1.3, 3.5)	(4.14)	(4.14)	(4.14)
Handling, Storage, Packaging, Preservation, and Delivery:	(3.6)	(6.4)	(4.15)	(4.15)	(4.15)
Control of Quality Records:	(3.2.2)	(3.4)	(4.16)	(4.16)	(4.16)
Internal Quality Audits:	N/A	N/A	(4.17)	(4.17)	(4.17)
Training:	N/A	N/A	(4.18)	(4.18)	(4.18)
Servicing:	N/A	(1.3)	(4.19)	(4.19)	N/A
Statistical Techniques:	N/A	(6.6)	(4.20)	(4.20)	(4.20)
					Your # (mo/yr)

[redacted]

Quality Systems Cross-Reference Matrix

Quality System Elements	ISO 9001-94	ISO 9002-94	ISO 9003-94	ISO 9001:2000
Management Responsibility:	(4.1)	(4.1)	(4.1)*	5.1, 5.3, 5.4.1, 5.5.1, 5.5.2, 5.6.1, 6.1, 6.2.1, 8.5.1
Quality System, Initial Quality Planning:	(4.2)	(4.2)	(4.2)*	4.1, 4.2.1, 4.2.2, 5.4.2, 7.1
Contract Review:	(4.3)	(4.3)	(4.3)	5.2, 7.2.1, 7.2.2, 7.2.3
Design Control:	(4.4)	N/A	N/A	7.2.1, 7.3.1 - 7.3.7
Document and Data Control:	(4.5)	(4.5)	(4.5)	4.2.3
Purchasing:	(4.6)	(4.6)	N/A	7.4.1 - 7.4.3
Control of Customer Supplied Product:	(4.7)	(4.7)	(4.7)	7.5.4
Product Identification and Traceability:	(4.8)	(4.8)	(4.8)*	7.5.3
Process Control:	(4.9)	(4.9)	N/A	6.3, 6.4, 7.5.1, 7.5.2
Inspection and Testing:	(4.10)	(4.10)	(4.10)*	7.1, 7.4.3, 7.5.3, 8.1, 8.2.4
Control of Inspection, Measuring and Test Equipment:	(4.11)	(4.11)	(4.11)	7.6
Inspection and Test Status:	(4.12)	(4.12)	(4.8)	7.5.3
Control of Nonconforming Product:	(4.13)	(4.13)	(4.13)*	8.3
Corrective and Preventive Action:	(4.14)	(4.14)	(4.14)*	8.5.2, 8.5.3
Handling, Storage, Packaging, Preservation, and Delivery:	(4.15)	(4.15)	(4.15)	7.5.1, 7.5.5
Control of Quality Records:	(4.16)	(4.16)	(4.16)*	4.2.4
Internal Quality Audits:	(4.17)	(4.17)	(4.17)*	8.2.2, 8.2.3
Training:	(4.18)	(4.18)	(4.18)*	6.2.2
Servicing:	(4.19)	(4.19)	N/A	7.5.1
Statistical Techniques:	(4.20)	(4.20)	(4.20)*	8.1, 8.2.3, 8.2.4, 8.4

[redacted]

[redacted]

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Product Realization Plan

Mo/Yr

Revisions		Rev:	
Letter	E.O. Number - Description		Date

Used On	Contract#:	**Your Co**	
Prepared By:			
[redacted]		**ENGINEERING PROCEDURE**	
		QC-130	
		[redacted]	

Your Logo

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[redacted]

1.0 GENERAL

1.1 BASIC REQUIREMENTS

This Product Realization Plan (PRP) applies to hardware-software and ensures that Good Manufacturing Practices (GMP) and Quality Assurance requirements are satisfied throughout all phases of the project.

1.2 SCOPE OF REQUIREMENTS

This PRP describes the methods and controls to be implemented for the GMP and QA program. The PRP shall be invoked and maintained throughout the project. The deliverable hardware being built by (Your Supplier) for the project falls within the definition of Quality Assurance Level ?? of the Supplier Quality Assurance Plan.
The requirements of this PRP shall be flowed down to subcontractors and/or suppliers. Conformance to approved internal procedures shall allow subcontractors and suppliers to maintain compliance with the requirements of the project. The following list provides a summary of the developed hardware-software requirements for the project:

[redacted]

[redacted]

1.2.1 REFERENCES

(Your Co)

1.3 ORDER OF PRECEDENCE

Once approved by the Customer, this plan becomes the primary controlling document for [redacted]

1.4 MANAGEMENT OF THE ASSURANCE PROJECT

The Customer Project Office and the Company Program Manager have been given oversight responsibility for reliability, quality assurance, and design issues. The Program Manager reports [redacted]

Figure 1. (Your Co) Organization

Figure 2. (Your Co) Quality Assurance Group Organization

The Company shall employ drafting, package design, fabrication, assembly, and Quality Control (QC) inspection services to build deliverable hardware. Figure 3 shows the Company organization that supports hardware fabrication. Quality Control (QC) inspectors work with the Customer personnel to provide the workmanship and configuration control inspections necessary to ensure a reliable and adequately configured end product. Quality Assurance has the following functions:

[redacted]

Figure 3. (Your Co) Department Organization

1.5 STATUS REPORTS

The REA shall report the status of QA activities, problems, and deficiencies, (both in-house and from outside subcontractors) to the Program Manager and the Customer Project Office monthly, via the Contracts Group. The REA shall include the following quality assurance information as part of the QA report:

[redacted]

1.6 PROCUREMENT

1.6.1 General

All purchased hardware specifications shall have quality requirements included in the procurement documents. The Company shall perform the following tasks as appropriate to verify the quality and reliability of hardware purchased from subcontractors and vendors for the project:

[redacted]

1.6.2 Supplier Controls

1.6.2.1 General

The Company shall review the reliability and quality requirements of purchased materials, articles, and services for the hardware as necessary.

1.6.2.2 Selection of Qualified Procurement Sources

When requested, the Company shall [redacted]

1.6.2.3 Preferred EEE Parts Supplier

The Customer may have identified certain preferred manufacturers of parts and components, based on [redacted].

1.6.2.4 Procurement Documents

The requirements of this plan shall be imposed upon subcontractors and/or suppliers to the extent necessary to assure compliance with the requirements of the project. Provisions shall be included for:

[redacted].

1.6.2.5 Specifications Review

All procurement specifications shall be reviewed prior to release. This review shall determine, as a minimum, that:

[redacted]

1.7 SURVEYS AND AUDITS

The Quality Assurance Group shall perform surveys and audits, as necessary, to evaluate the adequacy of and conformance to these QA requirements. Audits shall be performed according to [redacted]

2.0 PRODUCT ASSURANCE REVIEWS

2.1 DESIGN DRAWINGS

The Project shall use a Level ?? drawing system. Level ?? drawing and change control signature responsibilities shall be documented. All drawing changes shall [redacted]

2.2 DESIGN REVIEWS

2.2.1 Design Reviews

The Company, under the direction of the REA, shall conduct formal and documented design reviews of the hardware designs. These reviews shall [redacted]

[redacted]

2.2.2 Subsystem Design Reviews

Acceptance reviews shall be held for instruments, components, and hardware/software. The REA shall [redacted]

2.2.3 Design Review Support

The Company shall participate in design reviews. The REA shall [redacted]

2.2.4 Review of Existing/Modified Designs

Certain components that have heritage in previously accepted hardware shall [redacted]

2.3 ACCEPTANCE DATA PACKAGE

An Acceptance Data Package shall be available ten days prior to the Final Acceptance Review as a part of the data package for that review. The Acceptance Data Package shall include [redacted]

3.0 PERFORMANCE VERIFICATION REQUIREMENTS

3.1 GENERAL

All components of the hardware (including instruments) shall be tested to levels necessary to ensure the capability of the design to perform its intended function. Test plans shall [redacted]

3.2 ACCEPTANCE TEST DOCUMENTATION

Acceptance tests shall be performed on all components and instruments. Acceptance tests shall [redacted].

3.2.1 Acceptance Test Report

A brief test report summarizing test results and their implications shall [redacted]

3.2.2 Documents and Records of All Acceptance Tests and Inspections

The disposition of acceptance test documents and records shall be as specified in the Acceptance Test Plans and Procedures. The scope, duration, and number of inspections and tests to be conducted on the completed equipment shall [redacted]

3.3 GROUND SUPPORT EQUIPMENT (GSE)

Prior to use for testing hardware, all GSE (if applicable) shall [redacted].

3.4 TEST REVIEW BOARD (TRB)

A Test Review Board shall be established. The TRB members shall include (or represent) the cognizant Design Engineer, REA, QA Engineer, and Program Manager. The TRB shall:

- [redacted]
- [redacted]
- [redacted]

3.5 PROJECT DOCUMENTATION RECORDS

Records that provide evidence of inspections, tests, configuration and material review actions during the fabrication and assembly process shall [redacted] The documentation listed below shall [redacted]

a) Receiving Inspection Log for Parts.

[redacted]

3.6 PROBLEM/FAILURE REPORTS AND CORRECTIVE ACTION

Problem/failure reporting is initiated with acceptance testing of a component or instrument and continues throughout integration and test of the final assembly. Problem/failures occurring at subcontractor or other team organizations shall [redacted]

3.7 FAILURE-FREE OPERATION

Hardware shall demonstrate a minimum [redacted]

4.0 SAFETY ASSURANCE

The Program Manager is responsible for ensuring safety in the project. This responsibility includes [redacted]

[redacted]

4.1 PERSONNEL SAFETY

All appropriate precautions shall be taken to provide for maximum protection of personnel. Where necessary, [redacted]

4.2 HARDWARE SAFETY

Provisions shall be made to protect hardware from damage. Accepted safety practices include but are not limited to the following:

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]

5.0 EEE PARTS REQUIREMENTS AND DEFINITIONS

The Company shall: [redacted]

5.1 PARTS, MATERIALS, & PROCESS SELECTION and SPECIFICATION

Approved EEE parts for hardware include Customer Preferred Parts List (PPL) and those items purchased and/or screened to Customer requirements. The REA shall [redacted]

5.2 EEE PARTS SCREENING

5.2.1 EEE Parts Screening and Test

EEE screening shall be in accordance with documented requirements. Optional additional testing [redacted]

[redacted]

5.2.2 Data Evaluation

All manufacturer test data purchased with EEE parts, and test data generated shall be reviewed for [redacted]

5.2.3 Destructive Physical Analysis

When recommended, Destructive Physical Analysis (DPA) shall be performed in accordance with [redacted]

5.2.4 Re-testing of EEE Parts in Stock

Parts intended to be issued from existing stock shall be reviewed for storage life considerations prior to issuance to systems. If at the time of review, the parts have not been electrically tested and visually inspected within [redacted]

5.3 (Your Customer) MANUFACTURED EEE PARTS

Parts manufactured at the Customer for assembly shall be evaluated as above. The REA shall [redacted]

6.0 MATERIALS AND PROCESS CONTROLS

6.1 MATERIALS AND PROCESSES

Materials and processes used to fabricate hardware shall be reviewed for acceptability, compatibility, and conformance to [redacted]

[redacted]

6.2 METALLIC MATERIAL SELECTION

Materials selected for use as structural elements, housings, brackets, etc. shall be subject to [redacted]

6.3 PARTS AND MATERIALS LIST

Materials shall be identified in fabrication drawing bills of materials for hardware. An as-built parts and materials list shall be prepared for hardware, and shall include the following:

[redacted]

6.4 CRITICAL FASTENERS

For the project, any fastener whose failure could contribute to a single point failure of the system shall be designated a “Critical Fastener.” “Critical Fasteners” shall be identified during the design phase of the project. The list of identified “Critical Fasteners” shall be supplied as [redacted]

6.5 CORROSION PROTECTION

Metals shall be of the corrosion-resistant type or suitably protected to resist corrosion. The hardware shall be designed so as to [redacted]

6.6 FINISHES AND COATINGS

The use of cadmium, zinc and pure tin is prohibited.

[redacted]

6.7 PRINTED WIRING BOARDS

Printed wiring boards (PWBs) shall meet the requirements of [redacted]

7.0 DESIGN ASSURANCE AND RELIABILITY REQUIREMENTS

7.1 RESPONSIBILITIES AND ORGANIZATION

The reliability tasks shall be undertaken and achieved using (Your #) as a guide.

7.2 WORST-CASE ANALYSIS

Electronic circuits and electromechanical and mechanical items shall be designed using a worst-case design philosophy, in which [redacted]

7.3 TREND ANALYSIS

Trend analyses shall identify performance parameters for critical components, subsystems, and systems, which may [redacted]

7.4 MAINTAINABILITY

To the extent possible, design features shall allow component access and facilitate performance of all checkout, repair, and maintenance tasks. Features intended to eliminate potential failures due to [redacted]

7.5 EEE PARTS STRESS DERATING

EEE parts derating shall be in accordance with (Your #). Each electronic/electrical design engineer shall be responsible for [redacted]

7.6 LIMITED-LIFE ITEMS

Limited-life items shall be identified on a Limited-Life Items List and included as part of the deliverable data package.

[redacted]

8.0 QUALITY ASSURANCE

8.1 TRAINING AND CERTIFICATION OF PERSONNEL

Supervisors shall ensure that all persons working on high-reliability hardware have received the proper training to produce high quality workmanship. Training is comprised of specific instruction in several basic areas as follows:

[redacted]

8.2 ELECTROSTATIC DISCHARGE (ESD) CONTROL

Hardware shall be protected from ESD damage according to QC-128.

8.3 NON-CONFORMANCE CONTROL

Nonconforming articles or materials (defined as those not satisfying fabrication, processing, assembly, or configuration requirements) shall be reviewed initially by Quality Assurance personnel and shall be subjected to one of the following dispositions:

[redacted]

8.4 MATERIAL REVIEW BOARD (MRB)

All referred non-conformances shall be evaluated by a MRB, as a minimum consisting of:

[redacted]

[redacted]

8.5 SUBCONTRACTOR QUALITY REQUIREMENTS

8.5.1 Source Selection

Source selection shall be based upon the supplier's past performance history. Where no previous quality records are available, [redacted].

8.5.2 Supplier Product Assurance Requirements

Supplier Quality Requirements document QC-121-6 shall be generated to delineate the QA requirements.

8.5.3 Quality Assurance Inspection at Subcontractor Facilities

Source inspection at the supplier's facility may be required by purchase order or contract upon the recommendation of the QA authority and approved by the PM. The appropriate QA authority or a designated alternate shall [redacted]

8.5.4 Supplier MRB

When suppliers of components, subsystems, or systems are delegated MRB authority, they shall be required to [redacted]

8.5.5 Hardware Buy-Offs

For subcontracted equipment, the buy-off meeting serves the purpose of [redacted]

8.6 INSPECTION AND CONTROLS

QA personnel shall work closely with the REA to jointly determine the most cost effective, practical approach to ensure QA requirements are met. Inspections, evaluations, and/or audits shall be performed at the level necessary to assure compliance with the following:

[redacted]

Inspection of support equipment shall be limited to the level necessary to assure compliance with [redacted]

8.7 STAMP CONTROL SYSTEM

8.7.1 Stamp Log

An inspection stamp log shall be used to maintain traceability to the individual responsible for the use of each specific stamp. Issuance of the stamp and maintenance of the log are controlled by the Quality Group.

8.7.2 Stamp Use

Inspection stamps shall be used to [redacted]

8.8 SOFTWARE QUALITY ASSURANCE

The Software Group shall develop a Software Management Plan applicable to the project and shall implement software assurance controls and reviews in accordance with the plan.
The Software Management Plan shall be based on [redacted]

8.9 INSPECTION, MEASURING, AND TEST EQUIPMENT CALIBRATION

Hardware acceptance testing requires the use of Class 1 test equipment as defined in Test and Measurement Equipment Calibration Practices and Procedures, QC-116. Calibrations shall be performed using [redacted]

8.10 PRESERVATION, PACKAGING, HANDLING, STORAGE, AND SHIPPING

8.10.1 General

The Company shall maintain procedures for preserving, packaging, handling, storing, and shipping to [redacted]

8.10.2 Preservation

Preservation procedures shall be designed to protect items that are subject to deterioration from [redacted]

8.10.3 Handling

Any article subject to damage due to normal handling during fabrication or testing shall be provided with [redacted]

8.10.4 Storage

The Company shall provide protected and controlled storage for all assembled articles. Special attention shall be given to [redacted].

8.10.5 Packaging and Shipping

Packaging procedures shall be maintained for protection from damage or deterioration of the articles being shipped. These procedures shall take into consideration [redacted]

9.0 CONTAMINATION CONTROL REQUIREMENTS

9.1 PROTECTION

Gloves, protective covers, and other appropriate measures shall be used as required. The hardware shall be covered when [redacted]

9.2 FACILITIES

All fabrication of electronic hardware shall be performed in class M7 air-conditioned areas. In addition, assembly and testing at the system level and for critical components shall be performed in controlled access class M7 areas. [redacted]

9.3 MONITORING

During periods of activity, Quality Assurance personnel shall [redacted]

[redacted]

10.0 ACRONYMS AND ABBREVIATIONS

CDR Critical Design Review
CVCM Collected Volatile Condensable Mass
DCN Drawing Change Notice
DF Discrepancy Form
DESC Defense Electronic Supply Center
DPA Destructive Physical Analysis
DRR Drawing Release Review
EDR Engineering Design Review
EEE Electrical, Electronic, and Electromechanical
EMC Electromagnetic Compatibility
EMI Electromagnetic Interference
EO Engineering Order
ESD Electrostatic Discharge
FRR Fabrication Feasibility Review
GIDEP Government Industry Data Exchange Program
GSE Ground Support Equipment
GSI Government Source Inspection
ICD Interface Control Document
DMR Discrepant Material Report
IRR Integration Readiness Review
Mil-Spec Military Specification
MRB Material Review Board
NCR Nonconformance Report Form
NIST National Institute of Standards and Technology
QA Quality Assurance
PRP Performance Assurance Plan
PDR Preliminary Design Review
PER Pre-Environmental Review
PI Purchase Instruction (or Principle Investigator)
PM Project Manager
PPL Preferred Parts List
PPP&M Preservation, Packaging, Packing, and Marking
PSR Pre-Ship Review
PWB Printed Wiring Boards
QA Quality Assurance
QC Quality Control
QML Qualified Manufacturers List
QPL Qualified Product List
REA Responsible Engineering Authority
RR Readiness Review
TML Total Mass Loss
TRB Test Review Board
TRR Test Readiness Review

PPP&M INSTRUCTIONS

Program Name:		Contract #:		Date:	
P/N:		Prepared By:		Approval:	

☐ Ten (10) work days prior to shipping, furnish the Customer with the anticipated ship date, bill of lading number and carrier identity. Provide information to the **COTR** and to the Customer Contracting Officer.

Date of notification: _____.

☐ Date Approved to ship:_____.

☐ Reactivate desiccant at 250º for 18 hours

☐ [redacted]

☐ Place desiccant in and around the item. To determine the number of packets required, measure the length and width of the bag and calculate the area. Determine the quantity required using a desiccant calculator.

☐ [redacted]

NOTE: All work on this order is subject to inspection and test by the Customer at any time and place.
The Customer shall be notified 48 hours in advance of the time that articles or materials are ready for inspection or test.

[redacted]

☐ Apply label to container with the following information and cover coat with clear packaging tape:

[redacted]

☐ Apply additional label to container with following information:

[redacted]

[redacted]

Make sure the shipping address is the same as specified by the contract.

The Items No. 1 through 18 line may change dependent upon what is actually shipped with the item.

[redacted]

NOTE: All work on this order is subject to inspection and test by the Customer at any time and place.
The Customer shall be notified 48 hours in advance of the time that articles or materials are ready for inspection or test.

[redacted]

NOTE: All work on this order is subject to inspection and test by the Customer at any time and place.
The Customer shall be notified 48 hours in advance of the time that articles or materials are ready for inspection or test.

[redacted]

Tips:
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Product Preservation

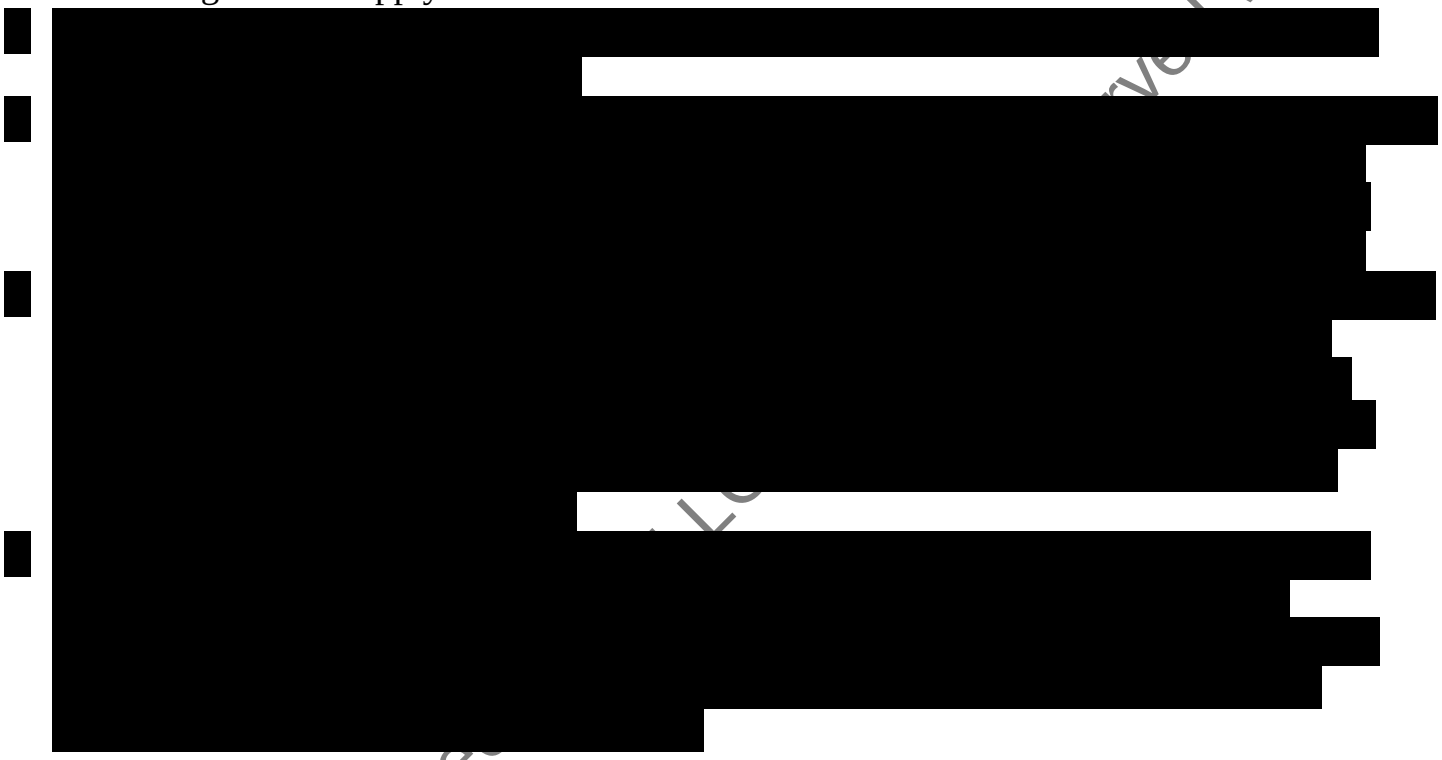
Mo/Yr

Revisions		Rev:	
Letter	E.O. Number - Description	Date	
Used On	Contract#:	**Your Company Name**	
Prepared By: [redacted]	[redacted]		
		QUALITY PROCEDURE	
		QC-131	
		[redacted]	[redacted] 1 of 4

Your Company Logo

1.0 Scope

The Quality Group specifies instructions for the proper handling, preservation, storage, packaging and shipping of supplies to protect quality and prevent damage, loss, deterioration, degradation or substitution of products. The instructions must be detailed in the applicable inspection instruction, traveler, manufacturing procedure or as specified by the Quality Group. Periodic inspection of products in storage is provided. In the event that preservation criteria are not specified in the contract, a commercial pack according to ASTM-D-3951 is utilized – a written work instruction is not required.
The following routines apply:



2.0 Shipping and Receiving

Instructions are contained herein for the shipping carrier and the Customer for preventing damage to products.

3.0 REQUIREMENTS

3.1 Product Warnings

3.1.3 The product must not be dropped or transported with equipment that is not attenuated to prevent shock and vibration.
PRODUCT PERFORMANCE IS DEGRADED WHEN IT IS SUBJECTED TO SHOCK AND VIBRATION THAT EXCEEDS THE PERFORMANCE ENVELOPE -- THE PRODUCT MUST BE HANDLED AND TRANSPORTED BY QUALIFIED PERSONNEL ONLY

3.2 General

Every effort must be made to prevent product damage during handling and transportation. Products must not be exposed to [redacted]

3.3 Visual Examination

Each shipping container must be examined for [redacted]

3.4 Transportation

[redacted]

3.5 Handling

Products and shipping container instruments must not be dropped or roughly handled. Products and the shipping container must [redacted]

3.6 Re-packaging for Re-Shipment

The shipping container is designed to provide maximum protection for the product during transportation. It is recommended that [redacted]

3.7 Environmental Sensors

Shipping containers may be equipped with environmental sensors that record the actual shipping impact to the packaging relative to shock, vibration and temperature. Sensor telemetry

needs to be analyzed by the Company – when a sensor is provided, [redacted]

3.8 Shipping Container Disposition

The shipping container and all internal components should be returned within [redacted]

3.9 Preservation, Packaging, Packing, and Marking Instructions

A copy of this procedure and a copy of the preservation, packaging, packing and marking (PPP&M) instruction must [redacted]

[redacted]

[redacted]

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HOW-TO PERFORM

Soldering Instruction

Revisions		Rev:	
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Used On	Contract#:	**Your Company Name**	
Prepared By: [redacted]	[redacted]	**YOUR PROGRAM**	
		Your Procedure #	
	[redacted]	[redacted]	1 of 25

Your Company Logo

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1.0 Classroom Requirements

To achieve a passing grade for this program, students will need to perform approximately 40 hours of classroom participation and approximately 10 hours of non-classroom specification review.

1.1 Workmanship Standards for Soldered Electrical Connections

Each classroom PWB and terminal connection requires the following minimum fabrication attributes according to NASA-STD-8739.3:

- **Terminals** -- 1) Smooth, 2) Nonporous, 3) Undisturbed, 4) Satin to Bright Finish, 5) Wet all Elements, 6) Fillet between Connection Elements, 7) Visible Lead Contour, 8) Absence of Defects
- **PWB** -- 1) Items 1 through 8 above, and, 9) Stress Relief in Leads or Conductors and 10) Part Marking Visible

1.2 Soldering Requirements

1) Each soldered electrical connection of a **terminal configuration** must achieve 8 points as specified above. A point is deducted for each workmanship element that is not visible at an inspection magnification between 4X and 10X, i.e., one point deducted for each defect. Additional points may be applied at the discretion of the Instructor, such as insulation clearance and damage or other criteria from Chapters 1 through 11 and 13 and Appendix A and B of NASA-STD-8739.3.

- **Terminal Sample**:

5 terminals x 8 points = 40 points possible
If 1 minimum workmanship element was not visible for each terminal then 5 points would be deducted from 40 possible points
40-5=35 -- 35/40=87.5% score

2) Each soldered electrical connection of a **PWB configuration** must achieve 10 points as specified above. A point is deducted for each workmanship element that is not visible at an inspection magnification between 4X and 10X, i.e., one point deducted for each defect. Additional points may be applied at the discretion of the Instructor, such as component clearance from the PWB and Kit Instructions or other criteria from Chapters 1 through 11 and 13 and Appendix A and B of NASA-STD-8739.3.

- **PWB Sample**:

54 individual soldering terminations may exist on a Hobby Kit; the total number of possible points is 54 x 10 = 540
If 2 minimum workmanship elements were not visible for each termination then 108 points would be deducted from 540 possible points
540-108=432 -- 432/540=80% score

1.3 Visual Examination Requirements

Produce soldered electrical connections for examination by the Instructor. Score the components for workmanship as specified above. Students inspect the work of at least one other Student and compare their findings with the Instructor's findings for the same work. The Student's inspection results must exactly match the Instructor's inspection results. A point is deducted for each omitted finding and a point is deducted for each finding that exceeds the finding of the Instructor.

1.4 Written Tests

Use the quizzes and final examination contained herein to establish the knowledge proficiency of each student.

1.5 Certification Requirements

Soldering personnel must achieve a score of 80% for certification. Re-certification is performed according to the requirements of NASA-STD-8739.3.

1.6 General

Soldering Theory

Soldering is a process by which molten solder is used to metallurgically join two or more metal parts. Solders are by definition metals or metal alloys that melt below 425 degrees Centigrade / 797 degrees Fahrenheit. A number of metals and their alloys fall into this category but only a few are in common usage.

Composition of Eutectic Tin/Lead Solder

In electronics, solder is used primarily as a means of creating a conductive path between parts. The bulk of the solders used employ Sn (tin) as either the primary metal or as an alloying agent. Tin metallurgically wets a broad range of base metals such as copper and imparts good flow properties on the molten solder.

Most solder are binary (two components) or ternary (three components) alloys. The most common ***primary*** metals used in solder are Sn (Tin), Pb (Lead) and In (Indium). The most common alloying metals used to alter the properties of the primary metal are Ag (Silver), Sb (Antimony) and Bi (Bismuth) along with Sn and Pb.

To many people the term solder has become synonymous with the tin-lead alloy; however, there are many other alloy combinations such as tin-zinc, cadmium-zinc, zinc-aluminum, etc.

The most common solder family used in electronics, including this training program, is the Sn-Pb solder alloy.

A solder alloy with Sn 63/37 composition indicates 63% tin and 37% lead. This particular alloy is known as ***eutectic*** solder that means the “lowest melting point.” It is used in this training class.

Tin lead ratio and melting point

Sn 63/37 and 60/40 solder are used by NASA for soldering. The 60/40 has the advantage of lower cost; the 63/37 has the advantage of a eutectic melting point that reduces the probability of disturbed solder connections.

Tin-Lead Fusion

The three phases of the tin-lead alloy are ***solid***, ***plastic*** and ***liquid***. When heat is applied to a solid solder alloy, the alloy starts to melt at the eutectic temperature that is 361 degrees F.
For Sn 63/37 solder alloy (eutectic) this temperature is the temperature at which it melts and becomes liquid. On removal of the heat source the 63/37 alloy becomes solid at this temperature. For all intents and purposes there is no plastic phase.
For tin-lead solder alloy other than 63/37, on the application of heat, the solid alloy starts to melt at the eutectic temperature of 361 degrees F. The melting process goes through the plastic phase and on reaching the liquidus temperature of the solder alloy the alloy becomes liquid.
On removal of the heat source the alloy starts to solidify at the liquidus, goes through the plastic phase and at the solidus temperature becomes solid.
At the ***plastic*** phase the solder alloy is neither solid nor liquid. The wider the plastic phase the higher the probability of a disturbed solder connection; thus, the advantage of eutectic solder (63/37) is the very narrow plastic phase.

Flux cored solder

Flux cored solder comes in a variety of configuration. There is a specific ratio between flux and solder and pulling on the solder wire changes this ratio and may affect the wetting process since sufficient flux may not be available to remove the oxide.
Flux has four functions in soldering.
(a) acts as a metal cleaner for oxide removal; (b) acts as a solvent for some minor surface contamination; (c) acts as a molten solder surface tension reducer; (d) acts as a protective cover to prevent re-oxidation
Metals oxidize when exposed to moisture, an example would be rust. This oxidation process occurs at different rates depending on the metal type and temperature. For example, with the application of heat, such as a solder iron, this oxidation process is enhanced (note the rapid oxidation of metals during the summer months and in tropical climates). This oxide acts as a barrier between the solder and base metal and prevents wetting, a very important component of soldering.
To strengthen the fluxing properties of rosin, additives called activators are introduced. Examples of activators are halide base, organic acid, amines and amides. Certain activators may become corrosive at elevated temperature or become conductive; hence, cleaning to remove flux residue is a very important step in the soldering process. 8739.3 requires the use of flux type RMA (rosin mildly activated) and if post solder cleaning is not practical then type R (non-

activated) is used. Type RA (rosin activated) may be used with approval from the NASA procuring installation.

Wetting Action

The definition of wetting is "Flow and adhesion of a liquid to a solid surface characterized by smooth, even edges and a low dihedral angle.

During the soldering operation using tin solder, a metallurgical reaction takes place between tin and the base metal such as copper.

This is known as the intermetallic layer. This intermetallic layer serves as the ***"glue"*** to hold the solder joint between the solder and the base metal. It has different physical and mechanical properties than the metals that make them up, ie tin and lead. In normal soldering this intermetallic layer is generally in the order of 1 to 5 μm. The general rule is to maintain a layer as thin as possible. This intermetallic layer is brittle and oxidizes readily when exposed to air.

Wetting Action /Oxide Film

The presence of contamination such as oxide, grease, etc., prevents wetting and the formation of the intermetallic layer to take place. Without this layer to serve as "glue" between the solder and base metal the solder joint is mechanically and electrically unreliable. Cleaning is paramount before soldering to remove all contaminants for proper wetting and after soldering to avoid possible corrosive effects and shorting of circuits by flux residues.

Factors to Consider

A number of factors must be considered in the soldering process.

- First is the temperature, the recommended temperature is 600°F ± 10° F for Sn63/37 and 60/40. Once the idle temperature is set the tolerance is ±10°F. (see 8739.3 paragraph 6.5).
- The next factors to consider are the iron tip size and the mass of the connection. The tip size must match the mass of the connection being soldered to provide sufficient heat and to control the dwell time.
- The iron capacity refers to the ability of the iron to maintain sufficient heat to the connection during the soldering operation. When the iron is placed on a connection heat is transferred from the tip to the connection and the iron temperature decreases. The iron must have the capacity to supply additional heat to return to the idle temperature and maintain solder flow.
- Surfaces must be clean prior to the soldering operation. Contaminants such as oxide, skin oils prevent wetting and the solder and base metal will not react with one another to form the "intermetallic layer."
  As noted earlier this layer serves as "glue" between the solder and the base metal.
- Thermal linkage can also be called "thermal bridge" or a more common expression is "solder bridge." By adding a small amount of solder at the contact point between the iron tip and the connection the area of heat transfer is enlarged shortening the dwell time.

Slow Temperature Rise

The small iron tip will require a longer dwell time in order to heat the large mass. This long dwell time may damage the PWB and/or the component.

Fast Temperature Rise

With a large iron tip heat transfer will occur rapidly and may damage the PWB and/or part. The rapid heating and rapid expansion of the PWB/part may result in measling, board delamination or part damage.

Correct Match

Adjusting the iron tip size with the mass of the work results in a dwell time that does not compromise the integrity of the PWB and/or part - no thermal bridge may result in possible damage to the PWB and or parts.

Small Linkage Area

Besides tip size, another approach to lower dwell time is to add small amount of solder to produce a solder bridge.

Large Linkage Area

By adding solder at the tip/lead junction the area of heat transfer is enlarged reducing the dwell time. Three to five second dwell time is a good bench mark to follow.

HAND SOLDERING STEPS

1. **PREPARE CONNECTION**
2. **POSITION CONNECTION**
3. **CLEAN CONNECTION**
4. **CUT AND CLEAN SOLDER**
5. **CLEAN IRON**
6. **POSITION IRON**
7. **APPLY SOLDER**
8. **TIN IRON**
9. **CLEAN CONNECTION**
10. **EXAMINE CONNECTION**

[redacted]

NASA SOLDERING PROGRAM - NASA-STD-8739.3 QUIZ 1

Question #	Question	True	False
1	Operator-adjustable wire strippers can be used for Teflon insulated wire.		
2	Temperature regulated thermal wire strippers shall not damage the wire or un-stripped insulation.		
3	The minimum lead wrap for 22 AWG wire on a hook terminal is 1/2 turn (180 degrees).		
4	The maximum lead wrap for 22 AWG wire on a turret terminal is 3/4 turn (270 degrees).		
5	The insulation clearance for a hook terminal is one (1) wire diameter (with insulation) maximum.		
6	Eutectic solder has no plastic state.		
7	SN 60/40 is eutectic solder.		
8	The solder pot temperature used in class is 315.5° ± 19.4° C (600° ± 35° F).		
9	The soldering iron tip temperature used in class is 260° ± 13.9° C (500° ± 25° F), controllable within ±5.5° C (±10° F).		
10	The melting point of SN 63/37 solder is 182.8° C (361° F).		
11	One purpose of flux is to remove surface oxidation from the connection to be soldered.		
12	It is preferred to remove excess solder from the iron tip by using a shop wipe.		
13	To create a thermal bridge, fresh solder should be added at the junction between the iron tip and the connection.		
14	The next step after soldering is to clean the connection.		
15	Residues and contamination shall be removed during interim cleaning within 1/2 hour after soldering.		

NASA SOLDERING PROGRAM - NASA-STD-8739.3 QUIZ 1 ANSWERS

Question #	Question	True	False
1	Operator-adjustable wire strippers can be used for Teflon insulated wire. *Para 6.62a, page 6-4 fixed dies, or adjustable to calibrated stops*		X
2	Temperature regulated thermal wire strippers shall not damage the wire or un-stripped insulation. *Para 6.6-2b, page 6-4*	X	
3	The minimum lead wrap for 22 AWG wire on a hook terminal is 1/2 turn (180 degrees). *Para 9.4, page 9.7*	X	
4	The maximum lead wrap for 22 AWG wire on a turret terminal is 3/4 turn (270 degrees). *Para 9.2, page 9.2*	X	
5	The insulation clearance for a hook terminal is one (1) wire diameter (with insulation) maximum. *Para 9.1-1 & 2, page 9-1*		X
6	Eutectic solder has no plastic state. *From lecture*	X	
7	SN 60/40 is eutectic solder. Fr*om lecture*		X
8	The solder pot temperature used in class is 315.5° ± 19.4° C (600° ± 35° F). *From lecture, instructor demonstration*		X
9	The soldering iron tip temperature used in class is 260° ± 13.9° C (500° ± 25° F), controllable within ±5.5° C (±10° F). *From lecture, instructor demonstration*		X
10	The melting point of SN 63/37 solder is 182.8° C (361° F). *From lecture*	X	
11	One purpose of flux is to remove surface oxidation from the connection to be soldered. *From lecture, instructor demonstration*	X	
12	It is preferred to remove excess solder from the iron tip by using a shop wipe. *From lecture, instructor demonstration, student workbook*	X	
13	To create a thermal bridge, fresh solder should be added at the junction between the iron tip and the connection. *From lecture, instructor demonstration, student workbook.*	X	
14	The next step after soldering is to clean the connection. *From lecture, instructor demonstration, student workbook and 10 soldering steps*		X
15	Residues and contamination shall be removed during interim cleaning within 1/2 hour after soldering. *Para 10.4-1, page 10-2*	X	

NASA SOLDERING PROGRAM - NASA-STD-8739.3 QUIZ 2

Question #	Question	True	False
1	The minimum wrap for a 22 AWG wire on a turret terminal is 3/4 turn or 270 degrees.		
2	The insulation clearance to all terminals is measured from where the conductor first contacts the terminal.		
3	For all fluxing applications where adequate subsequent cleaning is not practical, only type RMA flux shall be used.		
4	Immersion of conductors in a solder pot during tinning shall exceed 7 seconds.		
5	The main reason for gold plating is for oxidation protection.		
6	Gold plating on surfaces that become part of the soldered connection shall be removed by two or more successive tinning operations.		
7	The maximum insulation clearance for a solder cup is less than two lead diameters with insulation.		
8	There is no limit to the number of conductors in a solder cup provided they are bottomed and in contact with the full height of the inner wall of the cup.		
9	The reason for wiping a soldering iron tip on a damp sponge is to remove light oxidation.		
10	Visual inspection shall be aided by magnification between 4X and 10X, with higher magnification to resolve anomalies or defects.		
11	The contour of the wire in a connection must be visible after soldering.		
12	The tinned surface of conductors shall exhibit at least 95% coverage.		
13	A disturbed solder connection has a smooth, nonporous appearance.		
14	An overheated solder connection usually appears grainy.		

[redacted]

NASA SOLDERING PROGRAM - NASA-STD-8739.3 QUIZ 2 ANSWERS

Question #	Question	True	False
1	The minimum wrap for a 22 AWG wire on a turret terminal is 3/4 turn or 270 degrees.		X
2	The insulation clearance to all terminals is measured from where the conductor first contacts the terminal.	X	
3	For all fluxing applications where adequate subsequent cleaning is not practical, only type RMA flux shall be used.		X
4	Immersion of conductors in a solder pot during tinning shall exceed 7 seconds.		X
5	The main reason for gold plating is for oxidation protection.	X	
6	Gold plating on surfaces that become part of the soldered connection shall be removed by two or more successive tinning operations.	X	
7	The maximum insulation clearance for a solder cup is less than two lead diameters with insulation.	X	
8	There is no limit to the number of conductors in a solder cup provided they are bottomed and in contact with the full height of the inner wall of the cup.	X	
9	The reason for wiping a soldering iron tip on a damp sponge is to remove light oxidation.	X	
10	Visual inspection shall be aided by magnification between 4X and 10X, with higher magnification to resolve anomalies or defects.	X	
11	The contour of the wire in a connection must be visible after soldering.	X	
12	The tinned surface of conductors shall exhibit at least 95% coverage.		X
13	A disturbed solder connection has a smooth, nonporous appearance.		X
14	An overheated solder connection usually appears grainy.	X	

[redacted]

NASA SOLDERING PROGRAM - NASA-STD-8739.3 QUIZ 3

Question #	Question	True	False
1	Straight-through leads on a PWB may be bent up to 30 degrees from the vertical.		
2	Part leads terminated straight through a PWB shall extend from 0.51 mm to 2.29 mm (0.020 inch to 0.090 inch).		
3	The minimum distance from a part body or end seal to a bend in the lead is 1.57 mm (0.06inch).		
4	The bend radius on a part lead shall be a minimum of one lead diameter.		
5	Fully clinched leads are those bent between 75 and 90 degrees from a vertical line perpendicular to the PWB surface.		
6	The clinched portion of part leads shall be at least 1/2 the largest dimension of the pad or 0.78 mm (0.031 inch), whichever is greater.		
7	Non-bendable part leads shall be clinched.		
8	Heat sinks shall be used when soldering heat sensitive parts.		
9	Functional PTH's on double-sided PWB's require the use of filler wire if the PWB coupon has not been evaluated by construction analysis.		
10	When installing parts, only the part value needs to be visible.		
11	The last step of the soldering procedure is to inspect the connection.		
12	Slight dewetting of the solder around the periphery of the pad on the part side of the PWB is allowed.		
13	Excessive heat on a PWB may cause measling.		
14	Wrist straps only need to be checked once a week.		

[redacted]

NASA SOLDERING PROGRAM - NASA-STD-8739.3 QUIZ 3 ANSWERS

Question #	Question	True	False
1	Straight-through leads on a PWB may be bent up to 30 degrees from the vertical. *Para 8.5-3, page 8-11*	X	
2	Part leads terminated straight through a PWB shall extend from 0.51 mm to 2.29 mm (0.020 inch to 0.090 inch). *Para 8.5-3, page 8-11.*	X	
3	The minimum distance from a part body or end seal to a bend in the lead is 1.57 mm (0.06inch). *Para 8.1-6, page 8-2*		X
4	The bend radius on a part lead shall be a minimum of one lead diameter. *Para 8.1-6, page 8-2*	X	
5	Fully clinched leads are those bent between 75 and 90 degrees from a vertical line perpendicular to the PWB surface. *Para 8.5-2, page 8-11*	X	
6	The clinched portion of part leads shall be at least 1/2 the largest dimension of the pad or 0.78 mm (0.031 inch), whichever is greater. *Para 8.5-2, page 8-11*	X	
7	Non-bendable part leads shall be clinched. *Para 8-5-2, page 8-11*		X
8	Heat sinks shall be used when soldering heat sensitive parts. *Para 10.1-2, page 10.1*	X	
9	Functional PTH's on double-sided PWB's require the use of filler wire if the PWB coupon has not been evaluated by construction analysis. *Para 11.2-4a, page 11-2*	X	
10	When installing parts, only the part value needs to be visible. *Para 8.1-3, page 8-1*		X
11	The last step of the soldering procedure is to inspect the connection. *From lecture, student workbook*	X	
12	Slight dewetting of the solder around the periphery of the pad on the part side of the PWB is allowed. *Para 11.2-3c, page 11-2; Para 13.6-1f(2), page 13-4*	X	
13	Excessive heat on a PWB may cause measling. *From lecture*	X	
14	Wrist straps only need to be checked once a week. *From lecture*		X

[redacted]

NASA-STD-8739.3 – FINAL WRITTEN EXAMINATION

Print your name on the answer sheet.

CONTENTS OF TEST:

1. **True - False** **25 questions**
2. **Multiple Choice** **25 questions**

INSTRUCTIONS TO TRAINEES:

1. **Each question counts 2 points.**
2. **You are permitted to consult only the NASA-STD-8739.3 document during the test.**
3. **After you have completed the examination, return it to the instructor.**
4. **Your instructor will grade and return the test to you for review and discussion.**

[redacted]

TRUE/FALSE

The following statements are either true or false. On the answer sheet, mark an "X" in the TRUE column if the statement is true or an "X" in the FALSE column if the statement is false.

1. **Pits are acceptable in a solder connection, provided the bottom is visible from all angles of vision.**
2. **When soldering, a temperature controlled iron shall be used.**
3. **Contamination shall be removed from solder joints and surrounding areas.**
4. **The contour of the wire in a connection, other than high voltage, must be visible after soldering.**
5. **Gold plating on surfaces which become a part of the finished connection must be removed before soldering because the mixture of gold and solder can severely embrittle solder connections.**
6. **Excessive heat applied to the pad of a PWB may cause measling of the PWB.**
7. **Thermal shunts (heat sinks) shall be used to absorb heat from part leads as necessary to protect parts, insulating materials, and / or previously completed connections from damage during soldering operations.**
8. **The lay of wire strands shall be restored as nearly as possible to the original lay if disturbed.**
9. **If at any time, during any phase of the part mounting and / or the soldering operation, a condition should arise that the operator feels may damage or in any way affect the reliability of the hardware, the work should be halted until that condition is reviewed and resolved.**
10. **Eutectic solder has a plastic state.**
11. **Solder resembling tinning is allowed along the outside surface of a solder cup.**

12. **The preferred way to remove the oxidation from a soldering iron tip is by using a sponge.**
13. **Stranded wire should be formed around the terminal before tinning.**
14. **The melting point of SN 63/37 solder is 210°C (410°F).**
15. **Wrist straps only need to be checked once a week.**
16. **The solder surface on a good solder connection will appear grainy.**
17. **Operator adjustable mechanical strippers may be used in place of thermal strippers.**
18. **Solder splash or solder balls on the printed wiring assembly (PWA) are acceptable.**
19. **The next step after soldering is to clean the connection.**
20. **Stress relief provides freedom of movement of part leads or conductor between points of constraint.**
21. **The ultrasonic cleaner shall not be used as a method for cleaning electronic parts or assemblies.**
22. **Lighting shall be a minimum of 100-foot candles on the surface being soldered or inspected.**
23. **Leads or wires exhibiting smooth impression marks (resulting from bending tool) that do not expose base metal are acceptable.**
24. **Non-bendable part leads shall not be clinched.**
25. **Visual inspections shall be aided by magnification between 4x and 10x with higher magnification to resolve suspected defects.**

[redacted]

MULTIPLE CHOICE

The following items are incomplete statements or questions followed by several possible answers. Mark the corresponding letter of the most correct choice on the answer sheet.

26. After soldering, residues shall be removed within a maximum of:

- **A. 5 minutes**
- **B. 10 minutes**
- **C. 15 minutes**
- **D. 30 minutes**

27. The preferred way to determine the quality of soldered connections is by:

- **A. Pull Test**
- **B. Probing**
- **C. Visual Inspection**
- **D. Chemical dye test**

28. Part leads terminated straight through the PWB shall extend:

- **A. 3.17 - 6.35 mm (1/8 - 1/4 inch)**
- **B. 0.50 - 2.29 mm (0.020 - 0.090 inch)**
- **C. Soldering iron tip width maximum - soldering iron tip length minimum**
- **D. None of the above**

29. When installing axial leaded parts on a PWB, the part body shall be:

- **A. Parallel to the surface of the board**
- **B. In contact with the surface of the board**
- **C. Insulated from the board if it is conductive**
- **D. All of the above**

30. Tinned surface of conductors shall exhibit at least _____% coverage:

A. 85%

B. 90%

C. 95%

D. 100%

31. An approved solvent for cleaning is:

A. Methyl alcohol

B. Ethyl alcohol

C. Isopropyl alcohol

D. All of the above

32. The maximum insulation clearance for a wire attached to a terminal is:

A. Soldering iron tip width

B. 2.29 mm (0.090 inch)

C. 1/16 inch

D. Less than two wire diameters including insulation

33. Examples of wave solder parameters that shall be defined in the supplier's process documentation are:

A. Preheat temperature; Temperature of the solder

B. Conveyor speed and angle; Height of the solder wave

C. Flux density; Flux height

D. All of the above

34. When forming a part lead, the minimum distance from the part body, end seal or weld bead to the beginning of the bend shall be:

A. 2.29 mm (0.090 inch)

B. 1/16 inch

C. One times the diameter of the lead

D. Two times the diameter of the lead

35. A Static Meter is used:

A. To sense and measure electrostatic charge

B. To sense and measure the static on a radio

C. To inject an electrostatic charge into electronic equipment

D. All of the above

36. The minimum wire wrap for a 22 AWG wire on a turret terminal is:

A. 150 degrees

B. 180 degrees

C. 360 degrees

D. 270 degrees

37. The maximum wire wrap for a 22 AWG wire on a hook terminal is:

A. 190 degrees

B. 180 degrees

C. 360 degrees

D. 270 degrees

38. The temperature of the solder iron tip used in training class is:

A. 371°± 19°C (700 ± 35°F)

B. 260°± 14°C (500 ± 25°F)

C. 315°± 14-C (600° ± 25°F)

D. 315.5°± 19.4°C (600° ± 35°F)

39. Which of the following is acceptable on soldered connections:

A. Solder spikes

B. Contamination

C. Wetting

D. Convex fillet

40. Which of the following is preferred to have visible after installation of a part?

A. Polarity

B. Traceability code

C. Part value

D. All of the above, if possible

41. The temperature of the solder pot and the soldering iron shall be maintain within:

A. + 5.5°C (± 10° F)

B. +14°C (± 25°F)

C. +19°C (± 35°F)

D. +3°C (± 5°F)

42. Which of the following is the most important in electrostatic discharge control?

A. Use of nonconductive materials in the work area

B. Grounding of the operator via a wrist strap

C. Wearing of synthetic materials by the operator

D. The display of ESD posters and warning signs

43. Swaged terminals shall be swaged such that:

A. For elliptical swages or swage type terminals secured to the PWB by a V funnel swage, they can be rotated under finger force

B. They are free of circumferential splits or cracks

C. **A maximum of three (3) radial splits or cracks separated by at least 90 degrees are allowed**

D. **All of the above**

44. The main reason for tinning a stranded wire is to:

A. **Ensure dewetting during the soldering operation**

B. **Prevent solder from wicking under the insulation**

C. **Promote wicking to assure a non-flexible wire**

D. **Improve solderability and hold the strands together**

45. High voltage connections shall:

A. **Have a smooth fillet**

B. **Be free of discontinuity or severe change in contour**

C. **Be defined in the engineering documentation.**

D. **All of the above**

46. The maximum number of conductors permitted in a solder cup is:

A. **Maximum of 4**

B. **Maximum of 3**

C. **As many can fit provided conductors bottom in the cup and in contact with the full height of the inner wall of the cup**

D. **Only one**

47. The quality standards for a reworked connection:

A. **Shall include a rework factor.**

B. **Shall be relaxed.**

C. **Are not important.**

D. **Shall be the same as for an original connection.**

48. Functional PTH's on double sided PWB's require the use of:

A. Epoxy for support .

B. Filler wire for support if the PWB coupon has not been evaluated by construction analysis.

C. Solder plugs.

D. None of the above

49. In order to improve conduction of heat from the soldering iron tip to the connection:

A. Use a heat sink

B. Use a smaller iron tip

C. Use an oxidized tip

D. Use a thermal bridge

50. Retraining of operators or inspectors is required under the following circumstances:

A. Proficiency or workmanship is in question

B. Two years after last certification

C. Work period interruptions exceed 6 months

D. Any of the above

[redacted]

FINAL EXAM ANSWER SHEET

Date: _____/_____/_____ Name: _____

TRUE / FALSE			MULTIPLE CHOICE				
Question	True	False	Question	A	B	C	D
1			26				
2			27				
3			28				
4			29				
5			30				
6			31				
7			32				
8			33				
9			34				
10			35				
11			36				
12			37				
13			38				
14			39				
15			40				
16			41				
17			42				
18			43				
19			44				
20			45				
21			46				
22			47				
23			48				
24			49				
25			50				

FINAL EXAM ANSWER KEY

TRUE / FALSE			MULTIPLE CHOICE				
Question	True	False	Question	A	B	C	D
1	X		26				X
2	X		27			X	
3	X		28		X		
4	X		29				X
5	X		30				X
6	X		31				X
7	X		32				X
8	X		33				X
9	X		34				X
10		X	35	X			
11	X		36		X		
12	X		37				X
13		X	38				X
14		X	39			X	
15		X	40				X
16		X	41	X			
17		X	42		X		
18		X	43				X
19		X	44				X
20	X		45				X
21	X		46			X	
22	X		47				X
23	X		48		X		
24	X		49				X
25	X		50				X

GOOD MATERIAL TAG		Your Logo		
P/N:		Rev:		Date:
PO#:		Lot#:		
MR#:		Qty Ok:		
Ready For:				
Initials:				

Your Form# (mo/yr)

GOOD MATERIAL TAG		Your Logo		
P/N:		Rev:		Date:
PO#:		Lot#:		
MR#:		Qty Ok:		
Ready For:				
Initials:				

Your Form# (mo/yr)

GOOD MATERIAL TAG		Your Logo		
P/N:		Rev:		Date:
PO#:		Lot#:		
MR#:		Qty Ok:		
Ready For:				
Initials:				

Your Form# (mo/yr)

GOOD MATERIAL TAG		Your Logo		
P/N:		Rev:		Date:
PO#:		Lot#:		
MR#:		Qty Ok:		
Ready For:				
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Your Form# (mo/yr)

GOOD MATERIAL TAG		Your Logo		
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PO#:		Lot#:		
MR#:		Qty Ok:		
Ready For:				
Initials:				

Your Form# (mo/yr)

GOOD MATERIAL TAG		Your Logo		
P/N:		Rev:		Date:
PO#:		Lot#:		
MR#:		Qty Ok:		
Ready For:				
Initials:				

Your Form# (mo/yr)

GOOD MATERIAL TAG		Your Logo		
P/N:		Rev:		Date:
PO#:		Lot#:		
MR#:		Qty Ok:		
Ready For:				
Initials:				

Your Form# (mo/yr)

GOOD MATERIAL TAG		Your Logo		
P/N:		Rev:		Date:
PO#:		Lot#:		
MR#:		Qty Ok:		
Ready For:				
Initials:				

Your Form# (mo/yr)

GOOD MATERIAL TAG		Your Logo		
P/N:		Rev:		Date:
PO#:		Lot#:		
MR#:		Qty Ok:		
Ready For:				
Initials:				

Your Form# (mo/yr)

GOOD MATERIAL TAG		Your Logo		
P/N:		Rev:		Date:
PO#:		Lot#:		
MR#:		Qty Ok:		
Ready For:				
Initials:				

Your Form# (mo/yr)

WITHHOLD TAG		Your Logo	
Date:		Item Name:	
PO #:		Item Part Number:	
Lot #:		Material Report #:	
S/N:		Initials:	
Reason for Withholding:			

Your Form# (mo/yr)

WITHHOLD TAG		Your Logo	
Date:		Item Name:	
PO #:		Item Part Number:	
Lot #:		Material Report #:	
S/N:		Initials:	
Reason for Withholding:			

Your Form# (mo/yr)

WITHHOLD TAG		Your Logo	
Date:		Item Name:	
PO #:		Item Part Number:	
Lot #:		Material Report #:	
S/N:		Initials:	
Reason for Withholding:			

Your Form# (mo/yr)

WITHHOLD TAG		Your Logo	
Date:		Item Name:	
PO #:		Item Part Number:	
Lot #:		Material Report #:	
S/N:		Initials:	
Reason for Withholding:			

Your Form# (mo/yr)

WITHHOLD TAG		Your Logo	
Date:		Item Name:	
PO #:		Item Part Number:	
Lot #:		Material Report #:	
S/N:		Initials:	
Reason for Withholding:			

Your Form# (mo/yr)

WITHHOLD TAG		Your Logo	
Date:		Item Name:	
PO #:		Item Part Number:	
Lot #:		Material Report #:	
S/N:		Initials:	
Reason for Withholding:			

Your Form# (mo/yr)

[redacted]

Helpful Hint:
Purchase green “presentation” paper for the Good Material Tag and yellow “presentation” paper for the Withhold Tag, then print and cut whenever you need…

ACCEPTED MATERIAL | Your Logo

THIS MATERIAL HAS BEEN INSPECTED AND ACCEPTED

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Validation of Tools and Molds

Mo/Yr

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Used On	Contract#:	**Your Company Name**	
Prepared By:	[redacted]		
		YOUR PROGRAM	
		Your Procedure #	
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Table of Contents

[redacted]

1.0 General

1.1 Scope

This procedure defines the terms and the policy concerning the validation and certification of tooling and molds.

2.0 Applicable Documents

Your Document(s)
Note: Delete and renumber the following paragraphs if paragraph 2.0 is not applicable.

3.0 Requirements

3.1 Tooling/Mold Dimensions

Use dimensional conformance inspections of the tool or hard mold when routine inspection of a product feature is not technically or economically feasible. The characteristics on the product drawing are equal to the tooling/mold dimensions unless the raw material of the deliverable product is known to shrink or distort over time.

3.2 Tool Control and Mold Control for Hard and Soft Molds

Use dimensional conformance inspections of critical product dimensions when tool or hard mold controls and materials, processes and equipment are correctly used to produce a product of satisfactory quality.
Note: [redacted].
Note: [redacted]

3.3 Certified Tool or Mold

A tool or mold is considered certified when [redacted]

4.0 Certification and Authorization

4.1 Validation/Revalidation

Tool and mold validation shall be performed prior to [redacted]

4.2 Product Acceptance

Acceptance of deliverable products may be based upon [redacted]

[redacted]

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Validation Plan

(mo/yr)

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Prepared By:					
[redacted]					
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1.0 Scope

Procedures in this standard may be used to validate conformance to requirements of the following:

a. End items
b. Components or basic materials
c. Operations or services
d. Materials in process (cleaning, sterilization, preservation, etc)
e. Supplies in storage
f. Maintenance operations
g. Data or records
h. Administrative procedures

Note: use of the word "product" throughout this standard also refers to processes, services and other deliverables.

1.1 Product Requirements

The Company is required to produce and submit product that meets all contract and specification requirements. Each step of the manufacturing process must be controlled to maximize the probability that the finished product meets all quality and design specifications. The application of procedures from this standard does not relieve the Company of its responsibility for meeting all contract requirements. The Company's quality system must be established and operated to consistently produce products that meet all requirements. Absence of any inspection or process control requirement in the contract does not relieve the Company of its responsibility for assuring that all products submitted for acceptance conform to all requirements of the contract.

1.2 Limitations

The procedures of this standard are not intended for use with destructive tests or when product screening is not feasible or desirable and/or when end-product testing does not reveal all variations that may occur in the product that may impact on safety and effectiveness. In such cases, validation procedures will be defined in the product specification. There are too many products, devices, processes and manufacturing facilities to list all validation functions. Several broad concepts have general applicability that manufacturers can use successfully as a guide in validating a product. Although the particular requirements of validation will vary according to such factors as the nature of the product and the complexity of the process, the broad concepts stated in this standard have general applicability and provide an acceptable framework for building a comprehensive approach to the validation process.

2.0 Recommended Reading

ANSI/NCSL Z540-1 - General Requirements for Calibration Laboratories and Measuring and Test Equipment
ANSI Z1.1/ASQC B1 - Guide for Quality Control Charts.
ANSI Z1.2/ASQC B2 - Control Chart Methods of Analyzing Data.
ANSI Z1.3/ASQC B3 - Control Chart Method of Controlling Quality During Production.
ASME Y14.5M - Dimensioning and Tolerancing
ISO 10012 - Quality Assurance Requirements for Measuring Equipment

2.1 Order of precedence

Nothing in this document supersedes applicable laws and regulations unless a specific exemption has been obtained.

3.0 Definitions

-Acceptance
The act of an authorized representative of the Customer by which the Customer, for itself or as agent of another, assumes ownership of supplies tendered or approves specific services rendered as partial or complete performance of the contract.
-Alpha risk (a)
This is also known as the producer's risk. When referring to lot acceptance sampling, it is the probability that an acceptable lot will be rejected. When applied to control charts, the alpha risk is the probability that an out-of-control signal will be observed when the process is actually in control.
-ANOVA (Analysis of Variance)
A technique that subdivides the total variation of a set of data into meaningful component parts associated with specific sources of variation for the purpose of testing some hypothesis on the parameters of the model or estimating variance components. The technique, in conjunction with the F ratio, is used to provide a test of significance for the effects of these sources of variation and/or to obtain estimates of the variances attributable to these sources. The basic assumptions are that the effects due to all the sources of variation are additive and that the experimental errors are independently and normally distributed with zero mean and have equal variances throughout all subdivisions of data.
-Benchmarking
A continuous, systematic process for evaluating the products, services and work processes of organizations that are recognized as representing best practices for the purpose of organizational improvement.
-Beta risk (b)
This is also known as the consumer's risk. When referring to lot acceptance sampling, it is the probability that a lot of rejectable quality will be accepted. When applied to control charts, the

beta risk is the probability that an out-of–control condition will not be observed when it actually exists.

-Bonus Tolerance (also known as “Increase in Positional Tolerance”)

Where the actual size of a feature is at maximum material condition (MMC), the geometric tolerance is zero. Where the actual size of the feature has departed from MMC, an increase in the geometric tolerance is allowed (bonus tolerance) equal to the amount of such departure. The total permissible variation is maximum at least material condition (LMC). Bonus tolerancing is applied on an MMC, LMC or ‘regardless of feature size” (RFS) basis. The bonus tolerance, datum and symbols are contained within feature control frames. This tolerance is in addition to the feature tolerance and permits the feature location and form to vary from true (theoretically exact) position. Basically, while maintaining the specified size limits of the feature, the center, axis or feature surface may not exceed the boundary established by the bonus tolerance. This may produce a distribution that is not centered on nominal and/or skewed. A detailed explanation is available in ASME Y14.5M, Dimensioning and Tolerancing.

-Cause and Effect Diagram

A method that graphically illustrates the factors (Causes) that impacts on a quality characteristic or contributes to some problem (the Effect). The causes are categorized under general headings that relate to the effect. Commonly used headings are; “Materials, Methods, People, Machines, Measurement and Environment”. This technique is used to aid in determining and ranking the severity or impact of the causes on the effect.

-Central tendency

Central tendency is the tendency of a set of measurement data to cluster or to center about certain numerical values.

-Check Sheets

A check sheet is a data collection sheet where categories or ranges of possible measurements are printed on the sheets. The data collector records tally or tick marks across from the appropriate category or measurement. It allows the user to systematically record and compile data from historical sources or observations as they happen so that patterns and trends can be clearly detected and shown.

-Chi-square test (goodness of fit test)

This is a statistical test that provides confidence levels and intervals to describe whether or not the data truly approximates a particular distribution such as the normal distribution.

-Common Cause

Factors that contribute to variation and are inherent to the process. When a process is in statistical control, the only variation existing comes from common causes. Common cause variation can only be reduced by management action on system components, e.g., improving equipment capability, better training, etc. (Also called chance cause).

-Continuous process improvement

This is a goal of quality driven organizations to continually improve and optimize their processes.

-Contract quality requirements

The technical requirements relating to the quality of the product - contract clauses prescribing inspection - other quality controls incumbent on the Company to assure that the product conforms to contractual requirements.

-Critical characteristic

A characteristic that experience and judgment indicate must be met to avoid hazardous or unsafe conditions for individuals using, maintaining or depending upon the product; or that experience and judgment indicate must be met to assure performance of the end product.

-Critical nonconforming unit

A unit of product that fails to conform to specified requirements for one or more critical characteristics.

-Customer quality assurance

The various functions performed by the Customer to determine whether a Company has fulfilled the contract obligations pertaining to quality and quantity.

-Cycle variation

This is the variation from piece to piece with no time element involved. The pieces could have been made in any time order.

-Histogram

A Histogram is plot of frequency distribution in the form of a bar chart whose bases are equal to the cell interval and whose areas are proportional to the frequencies. It is used to summarize data from a process that has been collected over a period of time and graphically presents its frequency distribution.

-Inspection

Examining and testing supplies or services including raw materials, components and intermediate assemblies to determine whether they conform to requirements.

- Installation qualification

Establishing confidence that process equipment and ancillary systems are capable of consistently operating within established limits and tolerances.

-Key characteristic

The feature of a material, part or process whose variation has a significant influence on product fit, performance, service life or manufacturability.

-Major characteristic

A characteristic, other than critical, that must be met to avoid failure or reduced usability of a product. Major characteristics will require more verification effort than minor characteristics. VL-VII requires the highest level of effort and the effort decreases as the VL decreases to the lowest level VL-I.

-Major nonconforming unit

A unit of product that fails to conform to specified requirements for one or more major characteristics but conforms to all critical characteristics.

-Minor characteristic

A characteristic, other than critical or major, whose departure from its specification requirement is not likely to reduce the usability of a product or whose departure from established standards has little bearing on the effective use or operation of the unit.

-Minor nonconforming unit

A unit of product that fails to conform to specified requirements of one or more minor characteristics but conforms to all critical and major characteristics.

-Nonconformance

A departure from a specified requirement for any characteristic.

-Nonconforming unit

A unit of product that has one or more nonconformances.

-Normal probability paper

Paper that is scaled to show graphically how close a variables data distribution approximates a normal distribution is called normal probability paper.

-Normality

This is the tendency of variables data to pattern itself in a bell shaped curve. Many processes innately behave in this manner. Some processes do not produce output whose measurements can be characterized by the normal distribution; therefore, before performing operations that depend on assumptions of normality, it is wise to test those assumptions.

-Pareto Analysis

A Pareto Analysis is used to graphically focus efforts on the problems that offer the greatest potential for improvement by showing their relative frequency, cost or other metric in a descending bar graph. It is based on the proven Pareto principle: approximately 20% of the sources cause approximately 80% of any problem.

-Poka-Yoke

Poka-Yoke is Japanese for “mistake proofing”. These devices are used either to prevent the special causes that result in defects or to inexpensively inspect each item that is produced to determine whether it is acceptable or defective. A Poka-Yoke device is any mechanism that either prevents a mistake from being made or makes the mistake obvious.

-Positional variation

This is the within piece variation. (e.g., measuring the paint thickness on the fender of a truck.)

-Process performance qualification

Establishing confidence that the process is effective and reproducible.

-Product performance qualification

Establishing confidence through appropriate testing that the finished product produced by a specified process meets all release requirements for functionality and safety.

-Production interval

A period of production under continuous sampling assumed to consist of essentially homogeneous quality. It is normally a single shift. It can be a day if it is reasonably certain that shift changes do not affect quality of product but shall not be longer than a day.

-Prospective validation
Validation conducted prior to the distribution of either a new product, or product made under a revised manufacturing process, where the revisions may affect the product's characteristics.
-Quality
The composite of material attributes including performance features and characteristics of a product to satisfy a given need.
-Quality assurance
A planned and systematic pattern of all actions necessary to provide adequate confidence that adequate technical requirements are established; products conform to established technical requirements and satisfactory performance is achieved.
-Quality audit
A systematic examination of the acts and decisions with respect to quality in order to independently verify or evaluate the operational requirements of the quality program or the specification or contract requirements of the product.
-Quality program
A program which is developed, planned and managed to cost effectively carry out all efforts to affect the quality of materials from concept through validation, full-scale development, production, deployment and disposal.
-Quality system
This is a documented procedure, written by the supplier explaining just how the organization will control quality in its processes and/or production of product.
-Rational subgroup
These are subgroups that are rationally or logically selected to only include common cause variability.
-Retrospective validation
Validation of a process for a product already in distribution based upon accumulated production, testing and control data.
-Run/Trend Charts
A run (or trend) chart is a line graph of the data, with time units represented on the x-axis and the data values on the y-axis. This type of chart is used to show visual signals in the ‘behavior’ of the process data with time; it is not a control chart per se and typically does not include any form of limits.
-Scatter Diagram
A scatter diagram is an X-Y plot of paired data from two variables. It is used to examine the strength of the relationship between a variable plotted on the horizontal axis and a second variable plotted on the vertical axis. A scatter diagram provides visual information that should be used in conjunction with investigations such as correlation analyses.
-Screening inspection
An inspection process whereby every unit is checked and all nonconforming units are removed; also referred to as 100 percent inspection.

-Shapes of distributions

These are the patterns formed by data when placed on a histogram.

-Shapiro-Wilk Test

The Shapiro-Wilk Test is a quantitative test for normality. It is designed for sample sizes less than or equal to 2000 and it computes the Shapiro-Wilk statistic (W). The statistic measures the strength of linear relationship between the set of data and the expected Normal distribution.

-Short run SPC

Short run SPC is a method for using control charts when a small number of items are manufactured; too few to use traditional control charts.

-Skewness

This is an indication of asymmetry of the data distribution. If skewed, a distribution is skewed to the right or left. If skewed to the right, the distribution has a long “tail” to the right and if skewed to the left, the distribution has a long “tail” to the left.

-Special Cause

A factor that contributes to variation and that is feasible to detect and identify. Examples are operator error or a faulty set-up.

-Stratified Sampling

The process of selecting units deliberately from various locations within a lot or batch or from various phases or periods of a process to obtain a sample. An attempt is made with stratified sampling to select known homogeneous areas within a lot that is not homogeneous - random samples are then taken from these various locations, usually proportional in number to the size of the strata. If the strata are known, stratified random sampling will reduce the sampling variability.

-Taguchi loss function

A formula that assigns a monetary value to the loss to society incurred due to a quality characteristic deviating from its optimum (target) value.

-Temporal variation

This is the measured piece to piece variation of a characteristic over time.

-Traceability

The ability to trace the history, application or location of an item or activity, or similar items or activities by means of recorded identification.

-Transformations

A mathematical process that changes data into a desired distribution (e.g., a normal distribution).

-Type I Error

The incorrect decision that a process is unacceptable when, in fact, perfect information would reveal that it is located within the zone of acceptable processes. (Ex. The decision to reject a lot of material that does not contain enough nonconformities to be classified as unacceptable).

-Type II Error

The incorrect decision that a process is acceptable when, in fact, perfect information would reveal that it is located within the zone of rejectable processes. (Ex. The decision to accept a lot of material that contains enough nonconformities to be classified as unacceptable).

-Validation

Establishing documented evidence which provides a high degree of assurance that a specific process will consistently produce a product meeting its pre-determined specifications and quality attributes.

-Validation protocol

A written plan stating how validation will be conducted, including test parameters, product characteristics, production equipment, and decision points on what constitutes acceptable test results.

-Verification level (VL)

Prescribes the level of significance or utility of a characteristic to the user. The amount of effort to assure conformance can be allocated on the basis of importance to the user.

-Worst case

A set of conditions encompassing upper and lower processing limits and circumstances, including those within standard operating procedures, which pose the greatest chance of process or product failure when compared to ideal conditions. Such conditions do not necessarily induce product or process failure.

-ZBA

Zero Based Acceptance (ZBA) plans are sampling plans in which the acceptance number is zero for any sample taken. They are also referred to as C=0 and Accept on Zero (AoZ) sampling plans.

4.0 General

4.1 Quality System

The Company shall establish and implement an internal prevention-based quality system as a means of ensuring that all products conform to requirements specified by the contract and associated specifications and standards. The acceptability of the quality system is dependent on [redacted]

4.1.1 Quality system plan

The quality system shall be documented and shall be subject to on-site Customer review throughout the contract. It shall include, [redacted]

[redacted]

4.1.2 Prevention-based quality system

The quality system shall demonstrate its prevention-based outlook by meeting the following objectives throughout all areas of contract performance:

[redacted]

4.1.3 Process focus of quality system

To demonstrate a process focus, the Company shall demonstrate that the manufacturing process and its related processes have been studied and are understood, controlled and documented to show that they are:

[redacted]

4.1.4 Objective evidence of quality system implementation and effectiveness

4.1.4.1 Examples of evidence regarding process improvement.

[redacted]

[redacted]

4.1.4.2 Examples of evidence regarding process control.

[redacted]

4.1.4.3 Examples of evidence regarding product conformance

[redacted]

4.2 Validation Overview

It is recognized that sampling inspection alone does not control or improve quality. Product quality comes from [redacted]

4.3 Elements of a Validation Program

A typical validation program includes [redacted]

[redacted]

A. Prospective Validation

Prospective validation includes [redacted] The following are considered as key elements of prospective validation.

[redacted]

[redacted]

A.1.b Process: Performance Qualification

The purpose of performance qualification is to [redacted]

A.1.c Product - Performance Qualification

These steps should be viewed as pre-production quality assurance activities. Before reaching the conclusion that a process has been successfully validated, it is necessary to [redacted]

[redacted]

A.2 System to Assure Timely Revalidation

There should be a quality assurance system in place that requires revalidation whenever there are changes in packaging, formulation, equipment or processes that could impact on product effectiveness or product characteristics, and whenever there are changes in product characteristics. Furthermore, when a change is made in raw material supplier, the manufacturer should [redacted]

A.3 Documentation

The validation program must be documented and properly maintained. Approval and release of the process for use in routine manufacturing should be based upon [redacted]

B. Retrospective Process Validation

In some cases a product may have been on the market without sufficient pre-market process validation. In these cases, it may be possible to validate, in some measure, the adequacy of the process by [redacted]

4.4 Factors that affect product quality

All factors that affect product quality should be evaluated when designing and undertaking a process validation study. These factors may vary considerably among different products and manufacturing technologies and could include, [redacted]

4.4.1 R&D

During the research and development (R&D) phase, the desired product should be carefully defined in terms of its characteristics, such as [redacted]

4.4.2 Changes

Documentation of changes made during development help to provide traceability to information that can later be used to [redacted]

4.4.3 End Use

The product's end use should be a determining factor in the development of product (and component) characteristics and specifications. All pertinent aspects of the product that impact on safety and effectiveness should be considered. These aspects include [redacted]

[redacted]

4.4.4 Acceptance Specifications

The validity of acceptance specifications should be verified through testing and challenge of the product on a sound scientific basis during the initial development and production phase.

4.4.5 Operator Control

It is highly desirable that production operators should make decisions on conformance. They are already in the mainstream of the product flow and are most familiar with the nature of the product characteristics. To require others to make measurements and judge conformance adds costs and delays and reduces the sense of responsibility of the operators. When work is organized in a way that [redacted] To achieve a state of self-control, the operator must be provided with: [redacted]

If all the parameters have been met, the person is said to be in a state of self-control and can properly be held responsible for any deficiencies in performance. If any of the parameters have not been met, the person is not in a state of self-control and cannot be held responsible for deficiencies.

5.0 Process Validation Tools

5.1 Process Improvement

5.1.1 Design of experiments

Design of Experiments (DOE) is a planned strategy to [redacted].

5.1.2 Determining optimum process settings

Statistically designed experiments should be conducted for systematically identifying [redacted]

characteristics with SPC. In order to determine process parameters when unknown, the desired

[redacted]

5.1.3 Quality Function Deployment

A strategic view starts with quality as a part of the overall business plan. This plan identifies how Customer requirements and desires are translated into the design of quality products and production processes. Quality Function Deployment (QFD) is [redacted]

5.1.4 Failure Mode and Effects Analysis

FMEA is a systematic, analytical approach to [redacted]

[redacted]

5.2 SPC

a. SPC is a powerful tool to monitor processes, diagnose process problems and prioritize efforts at quality improvement.
b. SPC can be used as a tool to improve quality by reducing variation in products and processes.
c. Processes that are in statistical control and capable can consistently turn out products that meet or exceed all Customer requirements and expectations.
d. Application of SPC can result in [redacted]
e. SPC enables operator identification of [redacted]
f. Employment of SPC promotes [redacted]

5.2.1 Service and administrative SPC

SPC for service and administrative processes refers to the application of statistical techniques to [redacted]

5.2.2 Customer requirements

"Customer" in this document includes both internal and external Customers.

a. There should be a clear understanding of the Customer's needs and how SPC can help to satisfy them.

[redacted]

Operator Control

[redacted]

[redacted]

To achieve a state of self-control, the operator must be provided with:

[redacted]

5.3 SPC Planning

5.3.1 Approach

Knowledge of statistical procedures alone is not sufficient to ensure improvements in product quality and process productivity. A structured approach for implementing SPC is needed. Organizational team structures, such as [redacted]

5.3.2. Preliminary planning

The following factors contribute significantly to effective SPC implementation:

[redacted]

[redacted]

5.3.2.8 SPC plan

A written SPC implementation plan (SPC Plan) should be developed which does the following:

[redacted]

Procedures should specifically define what decisions (with regard to the product and process) are appropriate and allowable under such conditions and who is authorized to make those decisions. Procedures should also address [redacted]

5.3.2.9 SPC verification

The verification of effective internal and vendor SPC programs has its basis in an effective SPC audit program. Once an effective SPC plan has been established, it is recognized that the full implementation of the events defined in the plan may take a long time. Therefore, at various times during this implementation and practice of SPC, the SPC program should [redacted] Some of the more important aspects of SPC practices to be evaluated during an audit will be:

[redacted]

Some or all of these items will be included in each SPC audit. The intent of the audits is to [redacted].

[redacted]

A typical audit checklist for a production operation:

DATE/SHIFT:							
The operator has provided date, time and initials.							
Sample size is correct.							
Calculations are performed correctly.							
Data is plotted.							
[redacted]							

5.3.3 Training

Initial SPC training should be provided for all supplier personnel who will be involved in the program to impart knowledge of the philosophy and concepts of SPC. Visiting similar facilities that exemplify the type of commitment required can be beneficial. An overall training strategy should be developed and included in the SPC plan. The strategy should consider [redacted]

5.4 Process knowledge

5.4.1 Flow diagramming

In order to optimize and control a process and maximize the benefits from SPC implementation, a thorough knowledge of the process is of paramount importance; therefore, prior to implementing SPC, it is very helpful to [redacted] Flow diagrams may consider:

[redacted]

5.4.2 Additional tools and techniques to gain knowledge of the process

Upon completion of flow diagramming, several other problem solving tools and techniques may also be used to [redacted] nclude:

[redacted]

Inputs for the above techniques may be data from [redacted]

5.4.3 Characterizing variation

There are, in general, three main mechanisms of variation:

[redacted])

It is important that the relative contribution of these sources is investigated - SPC control charting, subgroup formulation and sampling procedures are based on this information. The use of multi-vari charts is very beneficial in tracking down the sources of variation. Multi-Vari charts use [redacted]

[redacted]

5.5 What to measure

5.5.1 Key characteristics to control

The flow diagram may be used as a “road map” in the selection of the most advantageous or key characteristics for SPC application. By following the flow “upstream”, the supplier can [redacted]

5.5.2 Process variables to control product characteristics

While SPC data usually results from the direct measurement of product characteristics, using SPC to control variable process input and environmental conditions is often more beneficial. [redacted]. Common process variables to consider include:

[redacted]

5.6 Normality

5.6.1 When and why normality is important

When using $\overline{X}$ - R control charts, sample means are plotted and the central limit theorem is very helpful. This theorem states that [redacted]

5.6.2 Tests for normality

Methods of testing for normality include:

[redacted]

It is recommended that the first three tests be used when reasonably large amounts of data are available. The Shapiro-Wilk test is recommended for [redacted]

5.6.3 Transformations/Curve-fitting

Many SPC software packages are now available with statistical tools that will determine if a distribution is normal or not. These packages provide the most expeditious way to evaluate distributions. In the event the distribution is non-normal, additional tools provide for a transformation of data or a determination of the best fitting distribution to the data. Once a suitable transformation is made, or a determination has been made as to the actual distribution type, a valid calculation of a process capability can be made, and valid control limits for an individual X chart can be plotted. Some types of transformations that may be used are:

[redacted]

5.7 Control charting

The control chart has been utilized to enhance process control and process improvement capabilities since its introduction in the late 1920's by W.A. Shewhart. It has become the cornerstone of the time proven methods and practices of SPC.

5.7.1 The basic control chart and its use

The control chart is a method to [redacted]

5.7.2 Types of control chart

There are two major types of control charts: [redacted]

5.7.2.1 Variable chart

Variable charts are concerned with three characteristics: [redacted]

Table A – Sample size rules for variables control charts

Control Chart Type	Sample Size (n)
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

The X-bar, mX-bar and X charts indicate [redacted]

[redacted]

5.7.2.2 Attributes charts

Attribute control charts may be applied to quality characteristics that can be observed only as attributes or those that are actually recorded as attributes even though they might have been measured as variables. Attributes charts are concerned with:

[redacted]

Table B – Sample size rules for attributes control charts

Control Chart Type	Sample Size
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

5.7.3 Rationale for subgroup size

The following points should be considered in selecting the subgroup size.

[redacted]

[redacted]

5.7.4 Rationale for sampling frequency

Selecting the appropriate sampling frequency (i.e., the interval between subgroups) is as important a decision as [redacted]. The following factors should be considered:

[redacted]

5.7.5 SPC for short run production

Because current SPC methods require 20-25 subgroups of data (typically 2-5 items per subgroup) to be collected before calculating control limits, many suppliers have difficulty in applying traditional SPC methods. A production run may not produce enough data to generate meaningful control limits. Several SPC concepts that work well with very short production runs (some with a lot size of only one piece) allow every organization to take advantage of the power of SPC methods, even when lot sizes are small. Different part numbers may be monitored on the same chart. Multiple process streams or characteristics can be plotted together on one chart, minimizing paperwork for the operator and maximizing process understanding. Short Run charts work with [redacted]

[redacted]

5.7.5.1 Control charts for short run production - variables data

[redacted]

5.7.5.2 Control charts for short run production - attribute data

[redacted]

5.7.6 Control chart auditing

[redacted]

5.8 Assess stability, capability and performance

5.8.1 Stability

5.8.1.1 Introduction

A process is said to be operating in a stable manner (that is, in statistical control) when [redacted]

[redacted]

5.8.1.2 Criteria (interpretation)

Interpreting control charts involves determining when special causes are present and diagnosing the reasons for them so that they can be removed, or if beneficial, incorporated into the process. Examples of the latter include [redacted]

Other criteria may also be used.

Test 1. [redacted]s

Test 2. [redacted]

Test 3. [redacted]

Test 4. [redacted]

Test 5. [redacted]

Test 6. [redacted]

Test 7. [redacted]

Test 8. [redacted]

5.8.1.3 Verification

A stable process can be verified by [redacted]

5.8.2 Capability

In the past, Cp and Cpk were both called Capability indices. More recent practitioners have labeled Cp as a capability index (which answers the question, "[redacted]") and Cpk as a performance index (which answers the question, [redacted]). This standard follows [redacted].

5.8.2.1 Introduction

Process capability is determined by the variation that comes from common causes. Capability refers to what can be predicted from a stable process. The capability index of a process

compares the process variation to the specification limits. The capability index alone does not [redacted]

5.8.2.2 Process capability index = Cp = (USL-LSL)/(6 sigma)

This index of capability requires two specification limits and assumes a normal distribution of individuals. The calculation of this index does not [redacted]

5.8.2.3 Capability of non-normal distributions

In the strict sense of a capability study, the shape of the distribution is not as important as how it compares to the engineering specification; however, when expressing process capability as a numeric value, like Cp or Cpk, it should be understood that [redacted]

These methods should only be used after an investigation of the special sources (causes) of variation has been conducted and documented:

[redacted]

5.8.2.4 Capability for one-sided specifications

Cp has meaning only for two-sided specifications. Potential capability could be spoken of if [redacted]

[redacted].

5.8.2.5 Verification

The Cp values should be verified as often as is necessary. If the Cp values are equal to or less than [redacted]

5.8.3 Performance

5.8.3.1 Introduction. The performance index determines how well the process is actually performing relative to the specification limits.

5.8.3.2 Index

One common performance index for a normal distribution is [redacted]

5.8.3.3 Performance for non-normal data distributions

Method 1. [redacted]

Method 2. [redacted]

Method 3. [redacted]

[redacted]

5.8.3.4 Verification

Cpk values should be verified as often as is necessary. If the Cpk values are equal to or less than [redacted]

5.8.3.5 Economic positioning of process

Sometimes targeting the process in the middle of the specification limits is not practical. Process owners must often make decisions to target their process where an optimum economic condition is achieved. This decision is sometimes based on the unique characteristics of the process, tooling, requirements, etc. In some situations, geometrical dimensioning and tolerancing may have been applied to a feature. In the case of a hole diameter for a bolt hole pattern, if the process is capable, it is logical to drill the hole to a diameter that approaches the upper specification limit. This allows the process owner to benefit from the bonus tolerance, [redacted]

5.8.3.6 Continuous improvement prioritization

The goal of an organization should be to [redacted]

5.8.4 Other measures

Other indices used in describing capability/performance include [redacted]

5.9 Gaging and measurement

It is very important to have valid measurement studies to ensure that the data and measurements collected are accurate and precise. There are a number of methods used to determine validation of the measuring system. Some of the commonly used techniques are:

[redacted]

[redacted].

5.10 Final Acceptance using SPC

5.10.1 Requirements for acceptance

Prior to utilization of SPC for Final Acceptance of a characteristic, the controlling process(es) should have demonstrated [redacted].

5.10.2 Actions for acceptance by SPC

[redacted].

5.10.3 Customer report generation

A myriad number of SPC activities can be tracked to develop internal metrics and generate statistical reports. Internal metrics are typically [redacted]

Examples of validation reports are as follows:

[redacted]

6.0 Alternate Methods for Process Validation

When SPC is not possible, it is recognized that other product acceptance methodologies are also viable. Examples of these other acceptance techniques include

6.1 Poka-Yoke or mistake-proofing

Poka-Yoke is a Japanese term that generally translated means The types of Poka-Yoke devices are:

.

6.2 Calibrated fixtures as a media of inspection - Production Tooling Used as Media of Inspection

When production jigs, fixtures, tooling masters, templates, patterns and such other devices are used as media of inspection, they shall

6.3 100% automated inspection

This system must be verified as to the accuracy of the inspection and .

7.0 Sampling Inspection

7.1 Sampling

It is through careful design and validation of both the process and process controls that the Company can establish a high degree of confidence that all manufactured units from successive lots will be acceptable. Successfully validating a process may [redacted]

7.1.1 Preferred sampling plans

This standard establishes three sets of matched sampling plans for the sampling inspection of product. These sampling plans provide for inspecting the samples from lots or batches by [redacted].

7.1.2 Formation and identification of lots or batches

The product shall be assembled into identifiable lots, sublots or batches or in such other manner as may be prescribed. Each lot or batch shall, as far as practicable, consist of [redacted]

7.1.3 Determination of sampling plan

A sampling plan is determined by:

[redacted]

For lot acceptance situations (attributes or variables), the occurrence of one or more nonconformances shall result in [redacted]

7.1.4 Sampling of lots or batches

7.1.4.1 Selection of units

Units of product drawn from a lot for a sample shall be [redacted]

7.1.4.2 Representative (stratified) sampling

When appropriate, the number of units in the sample shall be selected in proportion to the [redacted]

7.1.4.3 Process of sampling

A sample may be drawn after all units comprising the lot or batch have [redacted]

7.1.4.4 Non-conforming product

When sample units are drawn during lot or batch assembly and nonconforming units are found, the Company shall [redacted] take the following actions:

[redacted]

7.2 Acceptance using Sampling

7.2.1 Sampling inspection

When acceptance is accomplished using the sampling tables provided in this standard, the following considerations apply.

7.2.1.1 Verification level specification

A VL may be specified for individual characteristics, for a group of characteristics or [redacted]

TABLE I. Code letters (CL) for entry into the sampling tables

Lot or production interval size	Verification Levels						
	VII	VI	V	IV	III	II	I
[redacted]							

7.2.1.2 Sampling procedures

Sampling is performed at one of three stages called [redacted]

7.2.1.3 Switching procedures

The procedures for switching among [redacted] are given as Note (2) in Tables II, III and IV. The switching procedures are independent of the results of any remedial action, such as [redacted]

7.2.1.3.1 Normal to tightened

When normal inspection is in effect, tightened inspection shall be instituted when [redacted]

[redacted]

7.2.1.3.2 Tightened to normal

When tightened inspection is in effect, normal inspection may be instituted when the following conditions are both satisfied:

[redacted]

7.2.1.3.3 Normal to reduced

When normal inspection is in effect, reduced inspection may be instituted when the following conditions are all satisfied:

[redacted]

7.2.1.3.4 Reduced to normal

When reduced inspection is in effect, normal inspection shall be instituted when one of the following conditions occur.

[redacted]

7.2.1.4 Discontinuation of acceptance

If sampling inspection of lots or batches remains in tightened inspection due to discovery of nonconformances or when, on continuous sampling plans, there are long periods of screening due to discovery of nonconformances, the Company must [redacted]

[redacted]

7.2.2 Preferred sampling inspection tables

See the Appendix for methods of computing sampling results, using switching rules and determining compliance with requirements using the attributes, variables and continuous sampling plans contained in this section.

7.2.2.1 Attributes sampling plans for lot or batch inspection

The preferred attributes sampling plans for lots or batches are described in Table II for normal, tightened and reduced inspection.

7.2.2.1.1 Acceptability criterion

The lot or batch shall be considered acceptable only if no nonconforming units are found upon inspection of the random sample of the size listed in Table II.

TABLE II - Attributes sampling plans

Code letter	Verification levels								
	T	VII	VI	V	IV	III	II	I	R
	Sample size (n_a)								
	[redacted]								

NOTES:

(1) [redacted]

(2) [redacted]

7.2.2.2 Variables sampling plans for lot or batch inspection

The preferred variables sampling plans for lots or batches are described in Table III for normal, tightened and reduced inspection.

7.2.2.2.1 Limitations on use

Variables sampling is not [redacted]

[redacted]

7.2.2.2.2 Nonconforming unit

For the purposes of variables sampling, a unit of product shall be considered nonconforming if [redacted]

7.2.2.2.3 Acceptability criteria

The lot or batch shall be considered acceptable if its sample contains no nonconforming units and the applicable "k" and "F" criteria (see Table III) are met. If the sample contains any nonconforming unit or if the sample does not meet the "k" criterion or if the sample does not meet the "F" criterion (when applicable), the lot [redacted].

[redacted]

TABLE III - Variables sampling plans

Code Letter	Verification Levels								
	T	VII	VI	V	IV	III	II	I	R
	K values (one- or two-sided)								
	F values (two-sided)								

NOTES:
(1)
.
(2)

7.2.2.3 Continuous attributes sampling inspection plans
The preferred continuous sampling plans for inspection by attributes are described in Table IV for normal, tightened and reduced inspection.

TABLE IV - Continuous sampling plans

Code Letter	T	Verification Levels VII	VI	V	IV	III	II	I	R
	Screening Phase: clearance number (*i*)								
									A
	Sampling phase: frequencies (*f*)								

NOTES:
(1)
(2)
(3)

7.2.2.3.1 Conditions for continuous sampling procedures
The following conditions must exist before the continuous attributes sampling procedures of this section may be used for inspection.

7.2.2.3.2 Continuous sampling inspection procedure

At the start of production, all units are inspected. Sampling inspection may be initiated at frequency "*f*" when the following conditions are satisfied:

[redacted]

Sampling inspection shall be terminated and 100 percent inspection resumed if either of the following conditions occur:

[redacted]

7.2.2.3.3 Acceptability criterion

In continuous sampling, units of product are determined to be acceptable or not on essentially an individual basis. While 100 percent inspection is being performed, each unit is individually inspected and categorized as a conforming or a nonconforming unit and accepted or not accepted accordingly. While inspection is being performed on a sampling basis, each unit that is inspected is [redacted]

7.2.2.3.3.1 Special reservation for critical nonconforming unit

In addition to the provisions of paragraph 7.5, if a critical nonconforming unit is found while on sample inspection, [redacted]

7.3 Disposition of nonconforming product

All units of product found to be nonconforming shall [redacted]

7.4 Critical characteristics

Unless otherwise specified in the contract or product specifications, the Company is required to [redacted]

7.5 Special reservations for critical nonconformance

When a critical nonconformance is discovered at any phase of production or during any inspection, the following immediate actions are required:

[redacted]

APPENDIX A - EXAMPLES OF SAMPLING PLAN USE

A.1 SCOPE

A.2 General

This Appendix is [redacted]

A.3 Purpose

This Appendix illustrates how to [redacted]

A.4 APPLICABLE DOCUMENTS

This section is [redacted].

A.5 EXAMPLES

A.5.1 Attributes sampling

Wing nuts are to be inspected for missing thread. A verification level IV (VL-IV) has been specified. The producer chooses to use attributes sampling plans from Table II. Lot sizes may vary as a result of production decisions. A segment of the producer's experience is shown in figure 1.

Lot #	Lot Size	Code Letter	Sample Size	Non-conform-ances	Lot Disposition	Stage T/N/R	Action
[redacted]							

FIGURE 1 - Attributes sampling inspection log

A.5.2 Variables sampling (single-sided specification limit case)

The maximum temperature of operation for a certain device is specified as 209 (measured in degrees F). Verification level I (VL-I) has been specified. A lot of 40 items is submitted for inspection according to variables sampling. Table III requires a sample size of $n_v = 4$ for code letter A. Suppose the measurements obtained are as follows: 197, 188, 184, and 205; and compliance with the acceptability criteria is to be determined. Computations are shown in figure 2. The lot is [redacted].

Line	Information Needed	Symbol	Formula	Result	Explanation
[redacted]					

FIGURE 2 - Computations for single specification limit case

[redacted]

A.5.3 Variables sampling (double-sided specification limit case)

The minimum temperature of operation for a certain device is specified as 180 (measured in degrees F). The maximum is 209. Verification level I (VL-I) has been specified. A lot of 40 items is submitted for inspection according to variables sampling. Table III requires a sample of size $n_v = 4$ for code letter A (CL-A). Suppose the measurements obtained are as follows: 197, 188, 184 and 205; and compliance with the acceptability criteria is to be determined. Computations are shown in figure 3. The lot is [redacted].

Line	Information Needed	Symbol	Formula	Result	Explanation
[redacted]					

FIGURE 3 - Computations for double specification limit case

[redacted]

A.5.4 Continuous sampling

A visual inspection of stamped metal parts for the presence of a spot weld will be performed immediately after units pass through a spot welding station. Verification level II (VL-II) has been specified. The product will be submitted for continuous attributes sampling inspection. The production interval size is an 8-hour shift, which initially will consist of between 700 to 800 welded parts. With VL-II and code letter C (CL-C) from Table I, the "*i*" and "*f*" values (Table IV) are found to be 116 and 1/48, respectively. A segment of sampling experience is shown in figure 4.

Product Item Number	Code Letter	Frequency or 100%	Stage T/N/R	Event/Action
[redacted]				

FIGURE 4 - Continuous sampling inspection log

A.5.5 Continuous sampling - plan tailoring

The Company may opt to use another continuous sampling plan instead of the one specified in Table IV. The only restrictions are that such a change is not allowed while [redacted]

[redacted]

Line	Information Needed	Symbol	Formula	Result	Explanation
[redacted]					

FIGURE 5 - Procedure to determine a valid *f*

Therefore, an *i* of 50 may be used in lieu of 116 if *f* is increased from 1/48 to 1/6.
If it is *f* that is pre-selected, the corresponding *i* may [redacted]

[redacted]

APPENDIX B - SPC SOFTWARE CONSIDERATIONS

B.1 SCOPE

This appendix provides some factors that should be considered in the acquisition of SPC software.

B.2 PURPOSE OF SPC SOFTWARE.

B.2.1 Software and management objectives

SPC Software should support the objectives management establishes for the quality and production systems.

B.2.2 Assessing effectiveness

No matter what SPC software a organization uses, the key to assessing its effectiveness is objective evidence that the software supports the organization's management system.

B.2.3 Convenience

SPC software is used for convenience factors, speed, and accuracy.

B.2.4 Successful usage

The key to successful SPC software usage is real time data gathering, analysis, and action. Ultimately, reliance should be placed upon the people and systems which drive quality.

B.3 SOFTWARE EVALUATION

B.3.1 End user. Who will be using it?

B.3.2 End use. How will it be used?

a. Data entry/input
b. Plotting, charting, analysis
c. Recalculating limits
d. Response to process condition
e. Summary reports
f. Overall system (SPC) monitoring/maintenance

B.4 SUGGESTED MINIMUM FEATURES

An excellent reference is the annual software issue of “Quality Progress” magazine.

B.4.1 Control charts

As a minimum, the SPC software should be able to produce these control charts:

a. Variable charts, such as: X-bar and R, X-bar and S, X and moving R
b. Attribute charts, such as: u, c, p, np

B.4.2 Out-of-control conditions

As a minimum, the SPC software should automatically detect out-of-control conditions using common conventions or rules.

B.4.3 Variable size subgroups

The SPC software should have subgroup sizes which are user configurable.

B.4.4 Control limits

Control limits should be calculated using accepted statistical methods and centerline values should be clearly displayed. The user should specify when (and if) to recalculate the limits.

B.4.5 Subgroups used

User should define what subgroups to use and when to perform calculations.

B.4.6 Out-of control conditions

The software should require that Out-of-control conditions be acknowledged by someone.

B.4.7 Histogram

Software should generate histograms using individual data.

B.4.8 Process capability

During a capability study, the system should warn the user if the process is not stable or not normally distributed.

[redacted]

APPENDIX C - SELECTED PROCESS IMPROVEMENT TOOLS

C.1 Scope

This appendix lists some tools that are useful for process improvement.

[redacted]

[redacted]

[redacted]

APPENDIX D – PROCESS MODELING

D.1 Process Qualification Sequence

D1.1 Acceptance Criteria

Develop acceptance criteria such as the maximum allowable nonconformance probability and the net sensitivity.

D1.2 Confidence Limit

Base the acceptance criteria on the 90% upper confidence limit for the fraction nonconforming (tail probabilities).

D1.3 Net Sensitivity

Net sensitivity acceptance should be based on cost according to a Defect per Million (DPM) value, which can be used to establish the maximum allowable increase in nonconformance probability for the process.

D1.4 Control Chart

Produce a control chart to determine the stability of the process.

D1.5 Modeling

Establish a model for the observed process distribution:

Weibull, for a highly skewed population;

Johnson, to predict the potential failure probability risk, which uses the Normal probability distribution to estimate the fraction nonconforming (tail probabilities),

These types of modeling require curve fitting the fraction nonconforming (tail probabilities) and evaluating the effect of changes in the mean and/or standard deviation on the possible variations (net sensitivity) in the fraction nonconforming (tail probabilities).

D1.6 Process Parameters

Determine the effect of possible changes in the mean and/or standard deviation.

D1.7 Projections

Compare the worst-case projections from the model with the acceptance criteria and make a decision on the acceptability of the process.

D.2 Estimating Shift Effects

D.2.1 Left and Right Tail Nonconformances

Determine the left and right tail nonconformance probabilities and the 90% upper confidence limits for each then establish acceptance limits for nonconformances and net sensitivity.

D.2.2 Theoretical Shift

Determine the effect of a shift in the mean and/or a change in the standard deviation from the process distribution model for both fraction nonconforming (tail probabilities) and the average rate of change in the fraction nonconforming (tail probabilities) with respect to a change in the input variable (net sensitivity).

D.2.3 Comparisons

Compare the results of D2.1 and D2.2 with the acceptance criteria. If the results satisfy the criteria then the process is considered robust enough to be released to production.

D.3 Net Sensitivity (NS)

The NS for a Normally distributed process is given by:

$$NS = \frac{\blacksquare}{\blacksquare\sqrt{\blacksquare}}\left(e^{-\blacksquare LSL-\blacksquare} - e^{-\blacksquare USL-\blacksquare}\right)$$

D.4 Process Capability

It should be noted that the classic process capability indices Cpk, Cpl or Cpu can be very insensitive to the true marginality of a process when solely relied upon as [redacted]

[redacted]

[redacted]

Tips:
Double click grey area at top and bottom of page to edit header/footer
Search for the word “your” throughout doc and replace as required

Variation Management of Key Characteristics

Mo/Yr

Revisions		Rev:	
Letter	E.O. Number - Description	Date	
Used On	Contract#:	**Your Company Name**	
Prepared By:	[redacted]	[redacted]	
		YOUR PROGRAM	
		Your Procedure #	
		[redacted]	[redacted] 1 of 16

Your Company Logo

TABLE OF CONTENTS

1.0 Scope

This procedure shall be applicable to all production processes that influence the variation of Key Characteristics. This procedure applies to assemblies and all levels of parts within an assembly, including castings and forgings.

2.0 Applicable Documents

Process Control Document (PCD)
First Article Inspection (FAI)

3.0 Requirements

3.1 Variation management activities must be performed on identified Key Characteristics and [redacted]

3.2 Appropriate documentation of Key Characteristics and manufacturing process elements that influence variation in Key Characteristics shall [redacted] Documentation shall be developed when any of the following occurs:

[redacted]

3.4 The use of other variation control methods to ensure process stability and capability may [redacted]

3.5 Achieving stable and capable Key Characteristics does not relieve compliance to [redacted]

3.6 Exceptions shall be documented and may require Customer approval when [redacted]

3.7 Process Model

The management of Key Characteristics shall begin with [redacted]

APPENDIX A: Variation Management of Key Characteristics

1.0 Understand Key Characteristics and Required Performance

[redacted]

2.0 Plan a Manufacturing Process to Produce Acceptable Performance

[redacted]

2.7 Outputs from planning the manufacturing process

[redacted]

[redacted]

Note:
Without the foresight necessary to design a process that is capable of meeting future needs, the level of variation that is inherent in a process design may [redacted]

3.0 Operate the Process on a Trial-Basis to Generate Data

3.1 Create a data collection plan for all Key Characteristics that reflects the sources of variations. Specify [redacted]

3.2 Manufacture parts according to previously defined work instructions. Manufacture trial parts in a representative production environment.
3.3 Collect data on control charts according to the data collection plan and document any deviation to the plan.

[redacted]

Note:
Operate the process and ensure the method to collect data has [redacted]

4.0 Analyze Data to Identify Appropriate Action

4.1 Review control charts to determine if the process is stable. Calculate process capability and provide evidence to demonstrate [redacted]

4.2 Investigate to determine the root cause using [redacted]

4.3 Prioritize common cause sources of variation to identify the most influential source(s) if the process is [redacted]

4.4 Reevaluate Process Key Characteristics based on the understanding of the observed process behavior to [redacted]

4.5 Update the Process Control Document and include references to associated documentation.

4.6 Outputs from analysis of data [redacted]

5.0 Take Action from Studying the Performance of Key Characteristics

5.1 Take corrective action to permanently remove or minimize the cause, and verify the effectiveness of the corrective action when a process is [redacted]

5.2 Investigate gage variation when a process is [redacted]

5.3 Investigate centering of the process if a process is [redacted].

5.4 Take appropriate actions on sources of variation that [redacted]

5.5 Implement a Product/Process protection plan until [redacted]

5.6 A first article inspection (FAI) may be performed unless [redacted]

5.7 Take appropriate action whenever actions are taken that change the manufacturing process.

5.8 Finalize the Process Control Document (PCD) as soon as the process is stable and capable.

5.9 Outputs from study of the performance of Key Characteristics [redacted]

6.0 Continue to Monitor the Performance

6.1 Periodically verify that the process remains in control and capable after [redacted]

6.2 Continually review business indicators as appropriate to [redacted]

6.3 Outputs from continuing to monitor the process [redacted]

7.0 Process Change Management

7.1 Document any planned change to the manufacturing process.

7.2 Follow the requirements of paragraph 1.0 to 5.0 prior to implementing any planned change to the approved manufacturing process as related to the affected Key Characteristics.

7.3 Outputs from process change management [redacted]

APPENDIX B: Process Control Document

Note: Any equivalent method of documentation is acceptable.

Instructions for completing the form:

1. Process Control Document (PCD) Number

Enter the process control document number used for tracking. It may be made of any combination of letters and/or numbers.

[redacted]

[redacted]

31. Calculations

Enter the calculations for the mean (X-bar), standard, deviation (S, or R/d2) Cp and Cpk. If the process is not stable then enter N/A (Not Applicable) for Cp and Cpk.

32. Action from Study

If there are any actions required from the study, enter <Yes>; otherwise, answer <No>.

33. Ongoing Monitoring Methods

This section identifies the methods used to monitor the process and specifies what the frequency of monitoring:

[redacted]

APPENDIX C

Definitions

ATTRIBUTE DATA
A result from a characteristic or property that is appraised only as to whether it does or does not conform to a given requirement (for example, go/no-go, accept/reject, pass/fail, etc.).

CUSTOMER
An organization that provides Part or System Key Characteristics via engineering drawings, specifications or purchase order/contract requirements. A Customer may be an internal engineering department for a company that has design authority in addition to the external Customer who specifies system Key Characteristics.

DESIGN CHARACTERISTICS
Those dimensional, visual, functional, mechanical and material features or properties that describe and constitute the design of the article as specified by Drawing Requirements Dimensional features include in-process locating features such as target machined (or forged/cast) dimensions on forgings and castings and weld/braze joint preparation necessary for acceptance of finished joint. Material features or properties may include processing variables and sequences, which are specified by the drawing (e.g., heat treat temperature, fluorescent penetrant class, ultrasonic scans, and sequence of welding and heat treat). These provide assurance of intended characteristics that could not be otherwise defined.

DRAWING REQUIREMENTS
Requirements of the drawing (including Parts Lists), specification or purchasing document to which the article is to be made. These include any notes, specifications and lower-level drawings invoked.

EXAMPLE
Guidance Only

FIRST ARTICLE INSPECTION (FAI)
A complete, independent and documented physical and functional inspection process to verify that prescribed production methods have produced an acceptable item as specified by engineering drawings, planning, purchase order, engineering specifications and/or other applicable design documents.

FIRST ARTICLE INSPECTION REPORT (FAIR)
The forms and package of documentation for a part number or assembly, including FAI results.

FIRST PRODUCTION RUN PARTS
The first group of one or more parts that are the result of a planned process designed to be used for future production of these same parts. Prototype parts or parts built using methods different from those intended for the normal production process shall not be considered as part of the first production run.

KEY CHARACTERISTIC (KC):
AS9100/EN-9100/JISQ 9100 definition: The features of a material or part whose variation has a significant influence on product fit, performance, service life or manufacturability.
This definition is further explained as follows:
• Key Characteristics for a part, subassembly or system are those selected geometrical, material properties, functional and/or cosmetic features, which are measurable, whose variation control is necessary in meeting Customer requirements and enhancing Customer Satisfaction.
• Key Characteristics for a process are those selected measurable parameters of a process whose control is essential to manage variation of part or system Key Characteristics.
• Substitute Key Characteristics may be identified when a Customer-defined Key Characteristic is not readily measurable within the production setting and other characteristics may need to be controlled to ensure conformance.

KEY CHARACTERISTIC OWNER
The person or function that defines the Key Characteristics and recognizes the reasons for the selection of the Key Characteristic. Typically, the responsibility is held by Internal or External Customer Design, Quality or Manufacturing Engineering and should be identified by a cross-functional team.

KEY CHARACTERISTIC PROCESS OWNER
The person or function that uses Key Characteristic data to maintain and improve the process.

MULTIPLE CHARACTERISTICS
Identical characteristics that occur at more than one location (e.g., —4 Places“) but are established by a single set of drawing requirements (e.g., rivet hole size, dovetail slots, corner radii, chemical milling pocket thickness).

MUST
Mandatory requirement

PROCESS CONTROL DOCUMENT (PCD)
A written description of a manufacturing plan developed to control variation in Key Characteristics that is updated to reflect the addition / deletion of Key Characteristics.

PRODUCER
An organization that performs any process affecting the manufacture of the part.

PRODUCT
The result of a process that includes finished detailed parts and assemblies and forgings and castings.

REFERENCE CHARACTERISTICS
The characteristics that are used “for information only” or to show relationship. These are dimensions without tolerances and refer to other dimensions on the drawing.

SHALL
Mandatory requirement

SHOULD
Mandatory requirement with some flexibility allowed to exhibit conformance to the intent of this procedure.

SPECIAL CAUSE
The term can be substituted by ‘assignable cause’ and both terms have their usual meanings relative to Statistical Process Control methodology..

STANDARD CATALOG HARDWARE
A part or material that conforms to an established industry or national authority published specification having all characteristics identified by text description, National/Military Standard Drawing or catalog item.

TYPICAL
Guidance Only

VARIABLES DATA
Quantitative measurements taken on a continuous scale. For example, the diameter of a cylinder or the gap between mating parts.

[redacted]

Appendix D: Process Control Document

PROCESS CONTROL DOCUMENT				1 of 2
1. Document Number	6. Process Owner	10. Date (Orig)	11. Date (Rev)	7. Flowchart Created ☐Yes ☐No
2. Part Number / Part Family / Latest Change Level		8. Approval and Date	9. Customer Approval and Date	
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Process Control Document continued…

PROCESS CONTROL DOCUMENT				2 of 2
1. Doc No.	2. P/N – Latest Change	10. Date (Orig)	11. Date (Rev)	

Paragraph 3	Paragraph 4	Paragraph 5	Paragraph 6
21. Preliminary Process Capability Study	Results of Study		33. Ongoing Monitoring Methods

Form # (mo/yr)

Your Co Name Address City-State-Zip Website Phone Fax Email			WARRANTY REPLACEMENT **PRODUCT REVIEW REPORT**
Order Date	Shipped Via	Date Shipped	PRR Number

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Your Form# (mo/yr)

These parts were shipped to you at no charge under the terms of our warranty.

[redacted]

[redacted]

[redacted]

Add to Cart