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MILITARY STANDARD

PRODUCT ASSURANCE PROGRAM REQUIREMENTS FOR CONTRACTORS



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DEPARTMENT OF DEFENSE
Washington, DC 20360

Product Assurance Program Requirements for Contractors

DOD-STD-2107 (Navy)

1. This Military Standard is approved for use by the Department of the Navy and is available for use by all Departments and Agencies of the Department of Defense.
2. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to:

Commanding Officer
Attn: Code 524
Naval Ordnance Station
Indian Head, MD

by using the self-addressed Standardization Document Improvement proposal (DD Form 1426) appearing at the end of this document or by letter.

FOREWORD

This standard includes the requirements for a comprehensive product assurance program for Navy contractors which, when contractually invoked, will assure that procured products achieve a level of quality consistent with operational requirements and approved specifications and can be logistically supported throughout the product's life cycle.

It is intended that this standard be applied primarily to those Navy acquisitions programs designated as major systems by the Department of Defense. The product assurance program, as described herein, incorporates the requirements of MIL-Q-9858 without reference to specific sections or paragraphs. Specific tasks from MIL-STD-470 and MIL-STD-785 are included as basic requirements or alternate requirements in appropriate paragraphs of this standard for consideration in tailoring contractual product assurance programs. MIL-STD-1520 and MIL-STD-1535 are included as alternate requirements for nonconforming material control and supplier quality assurance program requirements respectively. MIL-STD-45662 is included as the basic requirement for calibration systems. Additional calibration system requirements are included also for consideration in tailoring requirements for a specific acquisition. Requirements for such disciplines as configuration management and human engineering are referenced in this standard to provide one comprehensive product assurance program for better management visibility and control and reduced costs.

Effective product assurance programs must be tailored to fit program needs and constraints, including life cycle costs. This document is intentionally structured to facilitate tailoring by the Procuring Activity (PA) by the division of requirements into five major sections and providing, in some cases, alternate requirements. Therefore, this standard cannot be contractually imposed without tailoring.

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1. SCOPE

1.1 General. This standard describes the requirements for a product assurance program applicable to contractors who provide products to the Navy. It provides contractor management with requirements for establishing and maintaining an acceptable product assurance program during the design, development and production of the required products. Product assurance, as defined herein, identifies the collective requirements of this specification. It does not mean the fulfillment of the requirements is the responsibility of any single organizational element, function, or person.

1.2 Application. The requirements of this standard are applicable to contractors engaged in the design, development and production of Navy products to the extent specified in the contract. It is recognized that no single common set of product assurance procedures will meet every Navy need. Appendix A shall be used to tailor the requirements of this standard for each procurement using Appendix B application matrices as aids. Appendix A use is mandatory and shall be included in Navy procurement documents (i.e., RFPs, contracts, etc.) when this standard is referenced.

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2. REFERENCED DOCUMENTS

2.1 Issues of Documents. The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this standard to the extent specified herein.

2.1.1 Military Specifications

DOD-D-1000	Drawings, Engineering, and Associated Lists.
MIL-H-46855	Human Engineering Requirements for Military Systems, Equipment, and Facilities.
MIL-M-85337(AS)	Manuals, Technical: Quality Assurance Program; Requirements for.

2.1.2 Military Standards

DOD-STD-100	Engineering Drawing Practices.
MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-109	Quality Assurance Terms and Definitions.
MIL-STD-143	Standards and Specifications, Order of Precedence of the Selection of.
MIL-STD-280	Definitions of Item Levels, Item Interchangeability, Models, and Related Terms.
MIL-STD-470	Maintainability Program for Systems and Equipment.
MIL-STD-471	Maintainability Verification/Demonstration/Evaluation.
DOD-STD-480	Configuration Control - Engineering Changes, Deviations, and Waivers.
MIL-STD-482	Configuration Status Accounting Data Elements and Related Features.
MIL-STD-490	Specification Practices.
MIL-STD-721	Definitions of Effectiveness Terms for Reliability, Maintainability, Human Factors, and Safety.
MIL-STD-756	Reliability Prediction
MIL-STD-781	Reliability Design Qualification and Production Acceptance Tests: Exponential Distribution.

2.1.2 Military Standards (continued)

MIL-STD-785	Reliability Program for Systems and Equipment Development and Production.
MIL-STD-794	Parts and Equipment, Procedures for Packaging and Packing of.
MIL-STD-961	Outline of Forms and Instructions for the Preparation of Specifications and Associated Documents.
MIL-STD-965	Parts Control Program
MIL-STD-1472	Human Engineering Design Criteria for Military Systems, Equipment and Facilities.
MIL-STD-1520	Corrective Action and Disposition System for Nonconforming Material.
MIL-STD-1521	Technical Reviews and Audits for Systems, Equipments and Computer Programs.
MIL-STD-1535	Supplier Quality Assurance Program Requirements.
MIL-STD-1629	Procedures for Performing a Failure Mode, Effects, and Criticality Analysis.
MIL-STD-1635(EC)	Reliability Growth Testing.
MIL-STD-1679(Navy)	Weapon System Software Development.
MIL-STD-1695	Environments Working, Minimum Standards for.
DOD-STD-2101(OS)	Classification of Characteristics.
DOD-STD-2167	Defense System Software Development.
MIL-STD-45662	Calibration System Requirements.

2.1.3 Military Handbooks

MIL-HDBK-217	Reliability Prediction of Electronic Equipment.
MIL-HDBK-472	Maintainability Prediction.

2.1.4 Publications

OD 45845	Metrology Requirements List.
	Federal Acquisition Regulations - Appendix B.
NPRD-2	Non-electronic Parts Reliability Data.

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Copies of specifications, standards, drawings, and publications required by the contractors in connection with specific procurement functions shall be obtained from the Procuring Activity or as directed by the Contracting Officer.

3. DEFINITIONS

Standard definitions of terms contained in other DOD documents (i.e., FAR, MIL-STD-109, MIL-STD-280, and MIL-STD-721) are applicable to the terms used in this standard. Definitions of unique terms or terms not clearly defined elsewhere are provided to assure a uniform understanding of the requirements of this standard.

a. Establish and Maintain. Plan, develop, approve, implement, document, update, and perform.

b. Government Representative. The cognizant Government Contract Administration Office (CAO), unless otherwise specified in the contract.

c. Item. A non-specific term used to denote any hardware, including systems, materials, parts, subassemblies, sets, accessories, etc.

d. Tailoring. The process by which the individual requirements (sections or paragraphs) of specifications and standards are evaluated to determine which requirement is applicable and, in the case of alternate requirements which is most suitable, for the specific material acquisition and the selection of those requirements needed to ensure that each tailored document invoked includes only the minimum needs of the Government.

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4. GENERAL REQUIREMENTS

4.1 Program Management.

4.1.1 General. The contractor shall establish and maintain an effective product assurance program which complies with the applicable sections and elements of this standard as contractually required by the tailored Appendix A.

4.1.2 Management Policy. A documented policy shall be established and maintained for fulfilling contractual product assurance program requirements. Statements of policy shall form the basic guidelines and the internal company authority for establishing and maintaining the contractors program. The organizational structure and lines of authority shall be described and documented. Specific responsibilities shall be assigned and action authorities clearly delineated. Personnel performing product assurance program functions shall have sufficient, well defined responsibility, authority and organizational freedom to fulfill the requirements of this standard, to identify and evaluate problems and to initiate, recommend or provide solutions. In structuring the organization it should be recognized that the requirements of this standard apply to the total contractor organization and, therefore, are not solely the responsibility of any particular organizational element. However, the product assurance program shall be defined and responsibility identified to assure that all contractual requirements are established and maintained. Management shall regularly review the status and adequacy of the product assurance program for which they have designated responsibility.

4.1.3 Program Planning. The product assurance program shall be established and maintained for each program phase including design, development and production in advance of the necessity for implementation. The planning shall include normal company procedures and instructions augmented as necessary to meet the requirements of this standard. These procedures and instructions shall define the responsibilities and provide the methods and criteria for performing the applicable functions. The planning and documentation shall:

- a. Demonstrate an awareness, recognition, and organized approach to the achievement of product assurance program requirements.
- b. Assure that product assurance program requirements are determined and defined and that adequate controls are established and maintained throughout all phases of contract performance.
- c. Assure timely actions and smooth transition of the program throughout all phases of contract performance.
- d. Assure that required quality, reliability, maintainability, producibility, safety, human engineering, and other performance aspects are inherent in the design, specified in design disclosure and procurement documentation, and maintained during production.

e. Provide for prevention and detection of problems that could result in unsatisfactory performance, and the initiation of timely and effective corrective action.

f. Provide objective evidence of the effective implementation and operation of the product assurance program. Results of program reviews, audits, analyses, examinations, and inspections performed shall be readily available to the Procuring Activity for on-site review.

4.1.3.1 Maintainability Program Plan. Perform in accordance with MIL-STD-470, Task 101.

4.1.3.2 Reliability Program Plan. Perform in accordance with MIL-STD-785, Task 101.

4.1.4 Education, Training and Certification of Personnel.

4.1.4.1 Education and Training. Education and training programs shall be established and maintained for personnel whose activities have an effect on the quality, reliability, maintainability, human engineering, or safety of the product. Education programs shall be oriented toward the integration of existing engineering and management skills to emphasize the design and manufacturing disciplines and techniques by which reliable products are assured. Training, including on-the-job training, shall be conducted when necessary to meet specific requirements. Consideration shall be given to new products and new, sensitive, complex, or hazardous manufacturing processes or materials. Training should include pertinent subjects such as: design techniques, product familiarization, test equipment familiarization, processing and manufacturing techniques and methods, quality control methods and systems, statistical quality control, and packaging and handling techniques. Training programs shall have a means of measuring the effectiveness of the program and shall maintain records of completed courses. Training needs shall be periodically assessed to determine requirements for additional training.

4.1.4.2 Certification of Personnel. Contractor personnel responsible for manufacture, inspection, test or control of processes, operations and equipment which require highly specialized skills shall be certified prior to performing these functions. Certification of personnel for these skills in such functions as nondestructive testing, welding, soldering, bonding, welded circuits, and integrated circuit fabrication shall include a training program and a testing procedure to assure proficiency. Objective evidence of certification shall be maintained. The period of effectivity shall be specified and recertification shall be performed prior to expiration. Persons failing recertification shall be removed from the operation involved until successful completion of the tests and certified proficient in required skills. Results of inspections, surveillance and quality audits shall be used as indicators of the need for additional training and recertification of personnel without regard to established periods. Personnel not performing work for a period in excess of six months which require skills for which they

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were certified shall also require recertification. The contractor shall establish and maintain a list of highly specialized skills and personnel certifications.

4.1.5 Audit of Product Assurance Performance

4.1.5.1 Audit Conduct. The contractor shall audit for compliance with the contractually required sections and elements of this standard. Audits shall be planned and scheduled early in the contract period to provide total audit coverage. The planned audits shall be performed by an independent audit group or by a team of product assurance personnel not having direct responsibilities in the areas to be audited. Personnel performing audits shall be appropriately trained and qualified in product assurance audit techniques, practices and reporting. The audits shall consist of a review of both product assurance program elements and product conformance. Program element audits shall include verification of adequacy and implementation of policies, procedures and instructions controlling the applicable product assurance requirements of this standard. Product conformance audits shall include random reinspection and test of products; checks for availability of required documents and records; determination of familiarity of personnel with required documents; adequacy and compliance with process controls and related procedures; and adequacy of training and certification of personnel. Audits shall be conducted using procedures or checklists to assure complete and consistent evaluations.

4.1.5.2 Audit Report and Corrective Action. The results of each audit shall be covered by a report to affected managers and supervisors. Action shall be taken by management to assure timely correction of deficiencies. Summaries of product assurance audits and the corrective actions taken shall be developed and distributed to contractor management. Follow-up audits shall be conducted to assure that corrective actions are adequate and implemented for each deficiency.

4.1.6 Integrated Data System. An integrated data system shall be established and maintained for the effective collection, control, processing and use of data generated to support the product assurance program. The data system shall identify information needs; coordinate and integrate data inputs and outputs to ensure that information needs are being met in the most economical manner; and ensure the effective distribution, utilization, storage and maintenance of data. The integrated data system shall be documented to include:

- a. Source, purpose, and use of data.
- b. Collection, processing, storage, maintenance, and retrieval systems.
- c. Forms and formats for data reporting.
- d. Data summary reports to be generated and their distribution.

4.1.6.1 Data Collection, Analyses and Corrective Action System. Perform in accordance with MIL-STD-470, Task 104.

4.1.7 Integrated Test Program. An Integrated Test Program (ITP) shall be established and maintained to include planning and performance of all tests to be conducted during the life of the contract and planning for test requirements of the next product life cycle phase (e.g., during the development phase the ITP should establish controls for development tests of paragraph 4.3.10 and 4.3.12 as well as provide planning for the production tests and inspections of paragraph 4.4.4). The purpose of the ITP is to ensure that all tests contribute without overlap or void to the achievement and verification of product requirements within the general program goals of schedule and minimum cost. The integrated test program shall provide for maximum use of all test results to identify and correct potential quality problems as early as possible and to assess the achieved reliability. Program policy, organizational responsibility, and implementing procedures shall provide the following:

- a. A positive management system for effective use and control of all test resources.
- b. Establishment and evaluation of integrated test program objectives, plans, and schedules including requirements for test documentation, test facilities, test equipment, test samples, and acceptance criteria.
- c. Uniform requirements, guidelines and instructions for use in test planning.
- d. Review of test specifications and approval of test procedures.
- e. Monitoring of testing activities and problem solutions.
- f. Technical review and approval of test results.
- g. Incorporation of test data into the integrated data system.
- h. Reporting of program progress.

4.1.8 Problem/Failure Reporting, Analysis, and Corrective Action. A system shall be established and maintained that will assure: reporting of internal problems and failures during all contract phases; integration of externally provided problem/failure data (e.g., subcontractor and product user data); analysis of reports and products; and actions to correct deficiencies to preclude their recurrence. The system shall include problem/failure data from test and inspection activities throughout the contract effort. Recording of problem/failure data shall be complete and comprehensive to provide an accurate data base for investigation and analysis.

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4.1.8.1 Problem/Failure Reporting. Problems/failures shall be documented at the time of their discovery and shall include complete identification of the item and conditions experienced. Problem/failure data shall be reported without regard to cause or probable cause. The system shall provide for the recording of:

- a. Each failure.
- b. Problems resulting from incorrect or inadequate documentation.
- c. Problems discovered during acceptance test and inspection.
- d. Problems which are repetitive in nature and can affect quality, reliability, maintainability and safety.

4.1.8.2 Problem/Failure Investigation and Analysis. Problems/failures shall be investigated to determine seriousness and need for analysis and corrective action.

- a. Investigation shall include:

- (1) Review of the problem/failure to determine the type and extent of analysis required.

- (2) Review of previous data to determine if there have been similar problems or failures and to detect trends.

- b. Analysis shall include:

- (1) Determination of probable cause of the deficiency.

- (2) Examination and test of the deficient item as appropriate.

4.1.8.3 Corrective Action. On problems/failures where corrective action is required, action shall be taken and documented to include:

- a. Action recommended or planned with schedules for accomplishment, verification and close out; and organizational responsibility assignments.

- b. Accomplishment of the necessary action.

- c. Follow-up to assure completion and effectiveness of corrective action.

4.1.8.4 Failure Review Board. Perform in accordance with MIL-STD-785, Task 105.

4.1.8 Alternate Failure Reporting, Analysis and Corrective Action System. Perform in accordance with MIL-STD-785, Task 104.

4.1.9 Configuration Management. A configuration management program shall be established and maintained. The program shall be fully documented to describe the methods and procedures for configuration identification, control, status accounting, and auditing.

4.1.9.1 Configuration Identification. Configuration baselines (functional, allocated, and product) shall provide the basis for configuration management at specified program points. The configuration identification of an item shall consist of the baseline configuration identification documents and all approved changes that provide a full technical description of the characteristics of the item that require control at the time the baseline is established. Controls shall be established to assure compatibility and consistency between functional, allocated, and product identifications.

4.1.9.2 Configuration Control. Configuration items shall be controlled by establishing configuration identification in accordance with paragraph 4.1.9.1 and by controlling all changes, including waivers and deviations, to that identification. Procedures shall be established to assure that:

a. Changes, waivers, and deviations are limited to those which are necessary or offer significant benefit to the Government.

b. Engineering change proposals, waivers, and deviation are prepared, and classified in accordance with DOD-STD-480. Distribution and approval authorities shall be as specified in the contract.

c. Configuration identification documentation is revised to incorporate approved changes. Drawings shall be revised in accordance with DOD-STD-100, and specifications shall, be revised in accordance with MIL-STD-490 or MIL-STD-961, as applicable.

d. There is controlled distribution of all documentation and changes to such functions as manufacturing, engineering, procurement, and logistics.

e. Documentation controlling manufacturing, inspection, and test operations is revised to incorporate approved changes.

f. Changes are incorporated at the specified effectivity points.

g. Item identification is accomplished in accordance with DOD-STD-100.

4.1.9.3 Configuration Control Board. A Configuration Control Board shall be established to evaluate, coordinate, schedule, and control the release of configuration identification documentation and changes thereto. The board shall include representatives of program management, engineering, reliability, quality, manufacturing, logistics, procurement, system safety, and other organizations, as appropriate.

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4.1.9.4 Configuration Status Accounting. A system for configuration status accounting shall be established and maintained which provides for the collection, storage, retrieval, and reporting of configuration data. Configuration status accounting reporting shall be initiated at the time the configuration baseline is approved and maintained until the last unit is delivered. Configuration status accounting records shall, as a minimum, include identification of:

- a. Technical documentation comprising the configuration baseline and other essential configuration item data.
- b. Proposed changes to configuration identification and the status of such changes.
- c. Approved changes to configuration, including the specific number and kind of items to which these changes apply, and the implementation status of such changes.
- d. The as-built configuration of delivered items.

The standard data elements and related features, in accordance with MIL-STD-482, shall be used where applicable.

4.1.9.5 Configuration Audits. Configuration audits shall be conducted to verify compliance with configuration management requirements. Configuration audits shall include Functional Configuration Audits (FCA) and Physical Configuration Audits (PCA).

- a. FCA shall be conducted on configuration items to assure that the technical documentation accurately delineates the functional characteristics (as well as necessary physical characteristics) and that test/analysis data verify that the configuration item has achieved the performance specified in its functional or allocated configuration identification. MIL-STD-1521, Appendix E, shall be used as a guide in conducting the FCA.
- b. PCA shall be conducted to assure that the "as built" configuration of a unit matches the product configuration identification. MIL-STD-1521, Appendix F, shall be used as a guide in conducting the PCA.
- c. Records shall be maintained to provide objective evidence of audit performance and corrective actions taken.

4.1.10 Nonconforming Material Control. A system shall be established and maintained for the identification, segregation, control, review and disposition or disposal of nonconforming material. Effective action shall be taken to correct the nonconforming material and to prevent the recurrence of nonconformances.

4.1.10.1 Identification and Segregation. An item found to depart from drawings, specifications, or other specified requirements shall be identified and documented as nonconforming and segregated from conforming items in manufacturing, and held for preliminary review action. When segregation is not feasible, items shall be clearly identified as nonconforming to preclude unauthorized use.

4.1.10.2 Missed Operations. If the item requires only completion of missed operations, it may be released for such action.

4.1.10.3 Preliminary Review. Nonconforming material offered for preliminary review shall be processed by contractor personnel designated and authorized for this purpose. Appropriate examination and analysis of the nonconformances shall be performed to determine their cause, to classify them as to importance, and to specify disposition. Preliminary review findings, recommendations, and disposition actions shall be recorded on the contractor's nonconformance documentation. These actions are subject to review by the Government Representative. One of the following dispositions shall be made in preliminary review:

a. Return to Subcontractor. Nonconforming material received from a subcontractor may be returned for correction or replacement. The contractor shall provide the subcontractor with nonconformance information and applicable instructions for the resubmittal of corrected products and corrective action report if required.

b. Scrap. Material obviously unfit for use and not economically repairable shall be processed in accordance with approved procedures for identifying, controlling, and disposing of unusable material.

c. Return to Rework. Manufactured material found to be incomplete or which can be corrected to meet specification requirements may be released for correction or completion of operations.

d. Repair to Standard Repair Processes. Return for repair to acceptable condition is permitted provided that a documented standard repair process procedure has been approved by the Procuring Activity and authority for such release action is specifically granted by the Material Review Board. Repair action shall be recorded on the contractor's nonconformance documentation.

e. Submit to Material Review Board. If none of the above dispositions is appropriate, the material shall be submitted to the Material Review Board with supporting documentation. Pending official Material Review Board disposition, such material shall be retained in hold status in a controlled area, or if impractical, otherwise controlled to prevent unauthorized use.

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4.1.10.4 Material Review Board (MRB).

a. Membership. One or more decision-making Material Review Boards authorized to determine or to recommend disposition of material shall be maintained. As a minimum, each Material Review Board shall include one contractor representative whose primary responsibility is design engineering and one contractor representative whose primary responsibility is quality to chair the MRB. A list of contractor personnel designated for membership shall be available to the Government Representative.

b. Responsibility. The Material Review Board shall:

(1) Assure that nonconformances are properly documented, described, and classified.

(2) Evaluate nonconformances to determine disposition of the products involved.

(3) Assure that corrective actions are documented and that there is follow-up to assure accomplishment of such actions.

(4) Provide recommendations concerning dispositions requiring the Procuring Activity consideration and verify implementation if approval is obtained.

(5) Assure that accurate records of Material Review Board actions are maintained and used to verify that effective preventive actions are taken.

c. Disposition. In determining disposition, the Material Review Board shall consider the effect of the nonconformance upon the intended use and review records of previous Material Review Board actions on the same material. The Material Review Board shall specify one of the following:

(1) *Disposition normally made in preliminary review (4.1.10.3).*

(2) *Repair - If repair to a usable condition is considered possible and desirable, a request for approval shall be processed. The request shall include the contractor's proposed repair procedure, and test and inspection procedure to verify acceptability.*

(3) *Use as is - If the nonconforming material is considered usable, a request for approval shall be processed in accordance with established procedures.*

4.1.10.5. Nonconformance Requests for Disposition. Requests for approval for disposition to repair or use as is shall be submitted to the Procuring Activity or his designated representative in accordance with contract requirements.

4.1.10.6 Subcontractor Material Review Board. The contractor may, with the approval of the Procuring Activity and the Government Representative, assign Material Review Board responsibility to selected subcontractors. When this responsibility is assigned, subcontractor's Material Review Board procedures and decisions shall be subject to review by the Procuring Activity and the Government Representative at the prime contractor's plant.

4.1.10 Alternate Nonconforming Material Control. Perform in accordance with MIL-STD-1520.

4.1.11 Sampling Plans. Sampling plans may be used when historical records, inherent characteristics of the item or the application of the item indicates that a reduction in inspection can be achieved without jeopardizing quality or reliability. Sampling inspection shall be in accordance with applicable military standard sampling plans or the Procuring Activity approved alternates. If an alternate sampling plan is used, it shall be documented in detail to show factors such as the lot size, sample size, accept/reject criteria, operating characteristic curves, and criteria for reduced or tightened inspection (MIL-STD-105).

4.1.12 Quality Cost Data. Quality cost data shall be collected, analyzed, summarized, and provided to all levels of management for appropriate action to reduce unnecessary costs and improve end item quality. Quality costs shall include the costs incurred in planning to produce a conforming item, the assessment costs incurred to assure that conforming items are produced and the costs associated with the correction, disposition or replacement of items which have been produced with deficiencies. The specific quality cost data to be collected and used by management shall, on request, be identified and made available for review by the cognizant Government Representative.

4.1.13 Software. Software quality assurance shall be performed in accordance with DOD-STD-2167. A software test program shall be implemented in accordance with MIL-STD-1679 (NAVY).

4.1.14 Technical Data Quality Assurance. A system shall be established and maintained to ensure the adequacy and accuracy of deliverable technical data. For engineering drawings, the system shall be in accordance with the quality assurance provisions of DOD-D-1000. For technical manuals, the system shall be in accordance with MIL-M-85337(AS).

4.2 Procurement Control.

4.2.1 General. The contractor shall establish and maintain a system for assuring that products purchased from subcontractors comply with specification requirements. Technical requirements and acceptance criteria shall be imposed upon subcontractors using military specifications where applicable. Purchase documents shall specify the procurement control requirements and responsibilities applicable at subtier procurement levels. The product

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assurance program shall require surveillance of subcontractors and subcontractor activities at subtiers to assure satisfactory performance, assist in problem solution, and provide feedback for corrective action.

Records of subcontractor performance, including results of contractor source inspections, shall be maintained.

4.2.1.1 Monitor/Control of Subcontractors and Suppliers. Perform in accordance with MIL-STD-470, Task 102.

4.2.1.1 Alternate Monitor/Control of Subcontractors and Suppliers. Perform in accordance with MIL-STD-785, Task 102.

4.2.2 Selection of Procurement Source. A system shall be established and maintained for the evaluation and approval of procurement sources. Among other factors, selection of subcontractors for each product shall be based on one of the following:

a. A record of supplying products of the type being procured with acceptable levels of quality and reliability. These records shall be supported by documented quantitative information.

b. A survey of the facilities and product assurance program of the subcontractor if no previous quality and reliability records are available or if the subcontractor performance has been marginal. Results of this survey shall be documented.

c. Tests and inspections to determine conformance to requirements when products are not designed and produced specifically for the Procuring Activity application. In such cases, the contractor shall document the results of the tests and inspections as the basis for source approval.

4.2.3 Approved Source List. The product assurance performance of each subcontractor shall be objectively evaluated on a continuing basis utilizing available data from on-site surveys, source inspection, receiving inspection, fabrication, and assembly operations. Approved source lists by subcontractor and their product shall be developed and used in the selection of subcontractors. Criteria for maintenance of the approved source list, including the addition and removal of subcontractors, shall be documented. Controls shall be established for procurements from sources other than those on approved source lists.

4.2.4 Surveys of Subcontractor Operations. The contractor shall schedule and conduct periodic on-site surveys of subcontractor operations to assure compliance with product assurance program requirements. The frequency and coverage of each survey shall be based upon criticality or complexity of items being procured, known problems or difficulties, and quality history. The planned coverage of each survey shall be documented and include examination of product assurance program elements, manufacturing operations and processes,

products, and documentation to determine compliance with established requirements. Results of surveys with recommendations for corrective action shall be documented and follow-up performed to assure satisfactory action.

4.2.5 Procurement Document Provisions. The procurement document shall prescribe the applicable product assurance program or inspection system requirements to be imposed on the subcontractor. Specific requirements to be imposed will be contingent upon the type and scope of the procurement. In addition, procurement documents shall include the following as applicable:

a. Drawings, specifications, test and inspection requirements and procedures; process specifications or procedures; and special test and inspection equipment requirements.

b. Specifications for identification and preservation and packaging requirements.

c. Requirements for the subcontractor to notify the contractor of any proposed changes to contractor approved design, products, materials, fabrication methods or processes; and to obtain contractor approval prior to change incorporation.

d. Requirements for the subcontractor to notify the contractor of changes to the design, materials, fabrication methods or processes for functionally disclosed products (i.e., "black box" or proprietary products) that were qualified by the contractor.

e. Detailed provisions, as appropriate, regarding the performance of inspections, maintenance of test and inspection records, and submittal of data.

4.2.6 Procurement Document Review. A system shall be established and maintained for an independent review of procurement documents to assure that adequate requirements are included or referenced. As a minimum, this system shall assure that provisions of paragraph 4.2.5 are incorporated.

Procurement documents and reference data shall be made available to the Government Representative for review to determine compliance to contract requirements and the need for Government inspection at the subcontractor facilities.

4.2.7 Procurement Document Change Control. A system shall be established and maintained for the control and approval of changes to the basic technical requirements and other procurement documents, and for the incorporation and verification of approved changes. For products procured to contractor design, the control shall include assurance of notification of change to the subcontractor, verification of incorporation of the change, and appropriate identification of those items on which the change is incorporated. When subcontractor design, fabrication methods or processes have been approved, or

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qualified by the contractor, controls shall be established to assure that the subcontractor provides notice of proposed changes and obtains contractor approval prior to change incorporation.

4.2.8 Contractor/Subcontractor Coordination and Corrective Action.

Coordination shall be established with subcontractors to provide technical assistance and mutual resolution of product quality problems and to assure compatibility of tests and inspections performed by the contractor and subcontractors. Results of tests and inspections from receiving, in-process, acceptance, shipping, installation and operation shall be reviewed to identify problem areas and adverse trends. The contractor shall provide subcontractors with pertinent information and data concerning failures and deficiencies detected on their product. When corrective actions are required, the contractor shall assure that subcontractors takes prompt action to correct the deficiency and to prevent recurrence. The contractor shall follow-up to evaluate and assure the adequacy and effectiveness of corrective actions taken.

4.2.9 Contractor Source Inspection. The contractor source inspection shall be performed at the subcontractor facilities when one of the following conditions exist:

- a. Products are being procured at a level of assembly which prevents verification of the quality by examination or test of the completed product at the contractor facilities.
- b. Destructive tests are necessary at the subcontractor facilities.
- c. Special test and inspection equipment and environments required cannot feasibly and economically be reproduced or made available at the contractor facilities.
- d. Shipments of completed items are made to destinations other than the contractors facility.
- e. Quality verification is more cost effective when conducted at the subcontractor's facility.

Contractor source inspections shall be planned and documented in accordance with the requirements of paragraph 4.4.3 and performed in accordance with the applicable requirements of paragraph 4.3.12 and paragraph 4.4.4.

4.2 Alternate Supplier Quality Assurance Program Requirements. Perform in accordance with MIL-STD-1535.

4.3 Development. The intent of the requirements in this section is to invoke an approach to product assurance which focuses not so much on measured versus specified values as on the engineering disciplines and controls by which product quality is attained. This approach takes maximum advantage of the

contractor's engineering policies and practices, management procedures and controls, and corporate experience and memory in accomplishing the intended tasks.

4.3.1 Mission/System Analysis. A mission profile shall be developed and documented to provide a time-phased description of the events and environments the system experiences from initiation to completion of a specified mission, including the criteria of mission success or mission failure. The mission phase and combination of environments (including transportation, maintenance, and storage environments) that impose the most severe design constraints shall be identified. An analysis of the mission profile shall result in the generation of qualitative and quantitative factors for reliability, maintainability, availability, human factors, and safety for inclusion in the development specifications and to serve as standards for design evaluation.

4.3.2 Design Analysis. As a part of the design process, analyses and design studies shall be performed to identify, quantify, and qualify product characteristics in terms of attributes, tolerances, and the test and inspection requirements necessary to produce a quality product.

4.3.2.1 Parameter Studies. Establish test attributes, allocate tolerances and record performance capabilities required for mission success to provide preliminary inputs to system, subsystem and equipment specifications and test and inspection requirements. Mission operational conditions, effects of system aging, and test equipment in use at each level of Fleet maintenance must be weighted in defining the proper tolerances, and attributes to be controlled during production. When items other than contractor's items are integrated into a system, such as Government Furnished Equipment (GFE), the contractor shall request parameter values from the Procuring Activity and shall use these values in the design analysis process. If the provided parameter values are incompatible or analysis indicates that the system will not meet specification requirements based on these parameter values, the contractor shall identify the problem areas, advise the Procuring Activity, and propose alternate courses of action.

4.3.2.2 Classification of Characteristics. Perform in accordance with DOD-STD-2107(OS).

4.3.2.3 Sneak Analysis. Identify sneak conditions that may exist in the design.

4.3.2.3 Alternate Sneak Circuit Analysis. Perform in accordance with MIL-STD-785, Task 205.

4.3.2.4 Failure Mode, Effect, and Criticality Analysis (FMECA). Identify failures that degrade system capability. The procedures of MIL-STD-1629 or a Procuring Activity approved alternate procedure shall be used for performing a FMECA. The FMECA provides the disciplined method for proceeding through the

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system to assess failure consequences. The results of this analysis shall provide a basis for design improvement. Common mode and single point failure analysis shall be performed in conjunction with the FMECA, as appropriate.

4.3.2.4 Alternate A Failure Mode and Effects Analysis. Perform in accordance with MIL-STD-470, Task 204.

4.3.2.4 Alternate B Failure Modes, Effects, and Criticality Analysis. Perform in accordance with MIL-STD-785, Task 204.

4.3.2.5 Stress Analysis of Parts and Materials (Electrical, Mechanical, and Thermal). Perform stress analysis of parts and materials to assure compliance with the applicable derating criteria, maximum design constraints and thermal limits.

4.3.2.6 Worst Case Analysis. Examine component tolerances, parasitic parameters (inductance, capacitance etc.), variations in input signal characteristics, circuit mode parameters, and overall circuit characteristics (rise-times, power dissipation, impedance matching, etc.).

4.3.2.6 Alternate Electronic Parts/Circuit Tolerance Analysis. Perform in accordance with MIL-STD-785, Task 206.

4.3.2.7 Maintainability and Reliability Analysis. Provide data for use in assisting the logistics support analysis effort. The pertinent outputs shall include:

- a. The allocated and/or predicated mean-time-to-repair (MTTR) for each maintenance task.
- b. An evaluation of the adequacy of the qualitative maintainability design parameters and a statement of the qualitative requirements for each component of the system under analysis.
- c. The maintenance concept for each system component.
- d. The mean-time-between-failure (MTBF) and mean-time-between-maintenance-action (MTBMA) for each system component.

4.3.2.7 Alternate Maintainability Analysis. Perform in accordance with MIL-STD-470, Task 205.

4.3.2.8 Logistics Analysis. Define and quantify the resources required for maintaining the product. Analysis outputs shall include:

- a. The delineation, by maintenance level, of specific maintenance tasks necessary to sustain the equipment in, or return it to, operating condition.

- b. Task times and frequencies.
- c. Personnel requirements (skill levels and quantities).
- d. Training and training equipment requirements.
- e. Support and test equipment including calibration standards, spares, repair parts, and consumables.
- f. Facility requirements.
- g. Technical data requirements (e.g., technical manuals, repair procedures, calibration procedures, drawing and specifications).

4.3.2.8 Alternate Preparation of Inputs to Detailed Maintenance Plan and Logistics Support Analysis. Perform in accordance with MIL-STD-470, Task 207.

4.3.2.9 Producibility Analysis. Identify actual or potential producibility problem areas.

4.3.3 Design Practices and Documentation. The contractor shall control design practices and documentation to assure the incorporation of performance, quality assurance, reliability, maintainability, producibility, safety, and human engineering requirements in a consistent and uniform manner. The contractor shall use existing Government standards, manuals, and documentation insofar as practicable, or as specified in the contract, supplementing these as necessary to meet contract requirements. To promote uniform and timely application of design standards an index of these standards and guides shall be prepared prior to the initiation of detailed design and provided to design personnel. The index shall be maintained throughout the life of the program and shall include standards and guides for:

- a. Parts selection, application, and standardization.
- b. Assuring producibility, repairability, and inspectability.
- c. Considerations for special tooling and special test equipment.
- d. Design practices in reliability, maintainability, safety, and human engineering.
- e. Tolerancing.
- f. Maintenance engineering.
- g. Environmental and cleanliness control for production and subsequent storage and maintenance.
- h. Selection of test points.

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- i. Production process selection, application, standardization specification.
- j. Packaging, storage, and handling.
- k. Heat generation limits, dissipation, and control.
- l. Providing protection for the product against harmful conditions encountered during manufacture, test, and usage (e.g., electrostatic discharge, human induced contamination).
- m. Computer programming techniques.
- n. Electrical grounding, bonding, and shielding.
- o. Derating criteria.

4.3.3.1 Maintainability Design Criteria. Develop in accordance with MIL-STD-470, Task 206.

4.3.4 Parts and Materials Selection and Identification.

a. Parts and materials selection practices shall provide for the following:

- (1) Selection of parts in accordance with MIL-STD-965 on the basis of suitability of application and qualification to specified requirements using available reliability data.
- (2) Maximum use of previously qualified parts and materials.
- (3) Proper derating of parts and stress analysis.
- (4) Adequate testing requirements.
- (5) Minimization of the total types and numbers of parts and materials.
- (6) Minimum use of limited-life items.
- (7) Selection of parts and materials which will be readily available as long-term supply items.
- (8) Exclusion of toxic materials except when specifically approved by the Procuring Activity.
- (9) Consideration for transportation, handling, storage, and installation limitations.

(10) Availability of multiple procurement sources.

(11) Product producibility.

The order for selection of standards and specifications for parts and materials shall be in accordance with MIL-STD-143 with full consideration of the specified performance, qualification, reliability, safety, and configuration management requirements.

b. A parts and materials list shall be developed prior to initiation of detailed design for use in parts and materials selection and it shall be maintained and updated throughout the development phase. The list shall contain the following:

(1) Item identification by generic name, Government and subcontractor part numbers, national stock number where applicable, or a Government or industry standard in the case of a material or process.

(2) Qualification status, including how qualified (e.g., test, analysis, established reliability part).

(3) Identification of standard parts (authorized for use by contract) and nonstandard parts with status of approval.

(4) Identification of limited-life items.

(5) Identification of subcontractors as recommended by the designer for possible inclusion on the approved source list.

(6) Identification of proprietary and sole-source parts and materials.

c. The contractor shall establish and maintain a system for the collection and dissemination of information such as: approved circuits; approved parts lists; results of products qualification and engineering tests; and reliability reports regarding usage and failure rates. This information shall be provided to the design engineers, and must be current, concise, and accurate.

4.3.4 Alternate Parts and Materials Selection and Identification. Parts and materials selection practices shall be in accordance with MIL-STD-785, Task 207.

4.3.5 Human Engineering Program. An effective human engineering program shall be established and maintained utilizing the precepts of MIL-H-46855 and design criteria of MIL-STD-1472. The extent of the program will be commensurate with the size and cost of the acquisition program. The human engineering program shall be an integrated effort within the total product assurance program and shall be documented.

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4.3.6 Design Review. Contractor internal design reviews shall be performed to evaluate pertinent aspects of the design and to assure that necessary requirements are included in the design documentation. The planning, scheduling, and procedures to be followed in the performance of design reviews shall be documented. Design reviews shall be performed by specialists, other than those performing the original design, familiar with the technical disciplines of design such as: parts application, reliability, maintainability, human engineering, safety, quality, production, programming, and manufacturing procedures as required. The reviews shall be performed on a planned basis as new design documents and changes are generated and at major product design milestones. Advance notification of design reviews, including agenda items and certified data packages sufficient to evaluate the adequacy of design, shall be provided to participants. The result of each design review and subsequent actions shall be documented to include:

- a. A list of documentation reviewed, decisions reached, and design review participants.
- b. Identification of inadequacies, recommendations for corrective actions, and assigned responsibilities.
- c. Actions taken to correct design deficiencies.

The contractor shall monitor the status of all action items resulting from design reviews and assure their timely resolution. Design reviews and required actions shall be completed before approval of design documentation.

4.3.6.1 Program Reviews. Perform in accordance with MIL-STD-470, Task 103.

4.3.6.1 Alternate Program Reviews. Perform in accordance with MIL-STD-785, Task 103.

4.3.7 Key Components. A system shall be established and maintained for the determination, identification and control of key components. Key components are those limited number of critical parts whose failure in operation would most probably be catastrophic to the system performance, and which, because of their past history have a deficiency potential warranting strict processing control and traceability. The system shall provide for:

- a. Determination of the need for and level of traceability required.
- b. Strict processing and handling controls.
- c. Identification of each individual component.

4.3.7 Alternate Reliability Critical Items. Perform in accordance with MIL-STD-785, Task 208.

4.3.8 Control of Key Components. Key components (identified in accordance with paragraph 4.3.7 or 4.3.7 Alternate require strict processing control by

the contractor and the contractor must maintain control, regardless of the location. When a key component is purchased the supplier must submit to the contractor for review and approval of the following information:

- a. Procedures for control of processes to be used.
- b. The location within the processing cycle where inspections and tests will take place.
- c. The attributes of the components which will be inspected at each inspection point.
- d. The materials and methods of preservation and packaging to be used to protect the components.
- e. The handling and transportation precautions necessary to protect the components.

Revision or variation to any of the above listed controls shall not take place until the contractor has accepted the revision.

4.3.9 Effects of Functional Testing, Storage, Handling, Packaging, Transportation and Maintenance. Perform in accordance with MIL-STD-785, Task 209

4.3.10 Development Tests. Development tests provide data to support the design effort and to provide assurance that the design configuration meets specification requirements. The development test program (i.e., design tests, engineering evaluation tests, and qualification tests) shall be structured to include a reasonable assessment of reliability of the product in order to approach the reliability demonstration testing effort with confidence of success. In fact, experience gained in an expanded qualification test program may indicate that a reduction in reliability demonstration testing is feasible.

Development tests shall be performed in accordance with documented test plans and procedures prepared in accordance with ITP requirements. Test data, including test conditions, significant events, and problems, shall be recorded and maintained for all tests.

4.3.10.1 Design Tests. Design tests shall be performed as part of the design function on models, breadboard circuits, parts, components, or other items to establish basic design parameters and determine functional capabilities.

4.3.10.2 Engineering Evaluation Tests. Engineering evaluation tests shall be performed to assess the degree to which the design, parts, and materials meet design objectives; to determine the effects of varying stress levels or combinations and sequence of environments; to identify failure modes and effects; to estimate reliability, maintainability, human factors, and operating life; and to verify safety requirements have been met. Engineering

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evaluation tests shall be performed at the highest assembly levels practicable, on prototype and preproduction items representing intended production items as closely as possible.

4.3.10.3 Environmental Stress Screening (ESS). Perform in accordance with MIL-STD-785, Task 301.

4.3.10.4 Reliability Development/Growth Test (RDGT). Perform in accordance with MIL-STD-785, Task 302.

4.3.10.5 Qualification Tests. Qualification tests shall be performed on items to demonstrate that design specifications have been met. Qualification tests shall be conducted to the environmental extremes demanded by the mission profile (4.3.1) and involve the most severe levels, combinations and sequences of functional stress from design specifications. The qualification test program shall be so structured that upon completion, the risk of failing any reliability demonstration testing can and shall be certified as being very low. This requires that the qualification test results give a positive indication of the reliability of the product, when considered in combination with (a) all other test time and associated problems, (b) failure corrective actions and defined risk of recurrence, and (c) impact of configuration status at production release on previously conducted qualification testing. Qualification tests shall be performed at the highest level practicable on samples of intended production (i.e., manufactured where practicable to production drawings by production tooling, and inspected and tested to production procedures using production measuring devices). Design changes made to correct performance or reliability deficiencies subsequent to item qualification tests shall be requalified by tests equal to the original qualification tests, if portions of the original tests are invalidated. Qualification tests on items procured from different subcontractors shall include samples from every source of each different design configuration. When a family of items is being qualified, the qualification test specimens shall include a sampling of the range of values being considered to satisfy design requirements. The adequacy of qualification tests conducted at locations other than the contractor facilities shall be verified by contractor personnel based on witnessing of the tests or an examination of certified records.

4.3.10.6 Reliability Demonstration Tests. Reliability demonstration shall be performed after completion of all qualification tests and when analysis of engineering data indicates that the specified reliability requirements can be achieved by the product. Test plans in MIL-STD-781 or sampling plans in MIL-STD-105 (for one-shot devices) are applicable.

The contractor shall ensure that the test scoring rules (i.e., failures and test time that counts) are formalized and are representative of service use. The tests shall be conducted under environmental and operational conditions, including preventative maintenance, in accordance with the specified mission profile. (Testing by the Navy or by the contractor using platforms bailed from the Navy are acceptable alternatives to factory test cell mission profile simulation). Results of the test shall be documented in a written report.

4.3.10.6 Alternate Reliability Qualification Test (RQT) Program. Perform in accordance with MIL-STD-785, Task 303.

4.3.10.7 Maintainability Demonstration Tests. Maintainability demonstration shall be performed in accordance with Procuring Activity approved plans and procedures. Test plan outlines in MIL-STD-471 are applicable. The tests shall be conducted under Government witness, and documented in a written test report.

4.3.10.7 Alternate Maintainability Demonstration Tests. Perform in accordance with MIL-STD-470, Task 301.

4.3.11 Reliability and Maintainability Accounting. Reliability and maintainability accounting shall encompass the mathematical techniques and related activities necessary to provide management data to determine compliance with numerical reliability and maintainability requirements.

4.3.11.1 Reliability Modeling. Reliability block diagrams of the product down to the major assembly or replacement level shall be prepared for each mission phase and updated in the evolution of the design. Related mathematical equations shall be developed to exercise the model for predicting, apportioning, and assessing reliability values that will be used to establish design criteria and to support the design analysis. Each block shall include function or item identification in consonance with the design phase, the current predicted or assessed reliability, and the apportioned reliability for the element represented.

4.3.11.1 Alternate Reliability Modeling. Perform in accordance with MIL-STD-785, Task 201.

4.3.11.2 Reliability Prediction. Starting early in the design phase and continuing to the completion of the design effort, reliability predictions shall be accomplished in conjunction with the modeling effort in time for application in design decisions. As a minimum, formal reliability prediction updates shall be accomplished for use in each scheduled design review (4.3.6) or program review (4.3.6.1 or 4.3.6.1 Alternate). Prediction techniques from MIL-STD-756 and MIL-HDBK-217 and failure rate data from MIL-HDBK-217, GIDEP data and NPRD-2 Non-electronic Reliability Data can be used. Predicted values shall reflect applicable experience in previous programs.

4.3.11.2 Alternate Reliability Prediction. Perform in accordance with MIL-STD-785, Task 203.

4.3.11.3 Reliability Apportionment. Quantitative reliability requirements shall be apportioned to product elements, at least down to the major assembly or module replacement level and lower levels as required, and used as design criteria. Rationale for reliability tradeoffs and other reliability apportionment changes shall be documented.

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4.3.11.3 Reliability Allocation. Perform in accordance with MIL-STD-785, Task 202.

4.3.11.4 Reliability Evaluation. The quantitative reliability of the product shall be continually assessed as the development program progresses. The assessment process shall incorporate and integrate the results of reliability analyses, mission/system analyses, design analyses, valid operating data from previous generations and applicable test data for the quantitative measurement of product reliability. As part of the assessment process a reliability growth model shall be generated and exercised to provide program management with a means of monitoring progress as the development program proceeds. Unless otherwise specified, the Duane reliability growth model required in MIL-STD-1635 shall be used. Point estimates and lower confidence limits of achieved reliability shall be computed.

4.3.11.5 Maintainability Modeling. Maintainability block diagrams of the product down to the major assembly or replacement level shall be prepared and updated in the evolution of the design. The design shall designate the levels at which repair is to be accomplished and the level to which fault localization is to be extended. Procedures shall be developed in conjunction with the development of maintainability block diagrams and used for predicting, apportioning, and assessing maintainability values for design application. Each block shall include item identification in consonance with the design phase, the current predicted or estimated maintainability, and the apportioned maintainability goal for the element represented. The modeling effort shall be accomplished in conjunction with the failure mode effect, and criticality analysis and the maintainability analysis.

4.3.11.5 Alternate Maintainability Modeling. Perform in accordance with MIL-STD-470, Task 201.

4.3.11.6 Maintainability Prediction. Starting early in the design phase and continuing to the completion of the design effort, maintainability predictions (e.g., mean-time-to-repair, mean-time-to-restore) shall be accomplished in conjunction with the modeling effort in time for application in design decisions. As a minimum, formal maintainability prediction updates shall be accomplished for use in each scheduled design review (4.3.6) or program review (4.3.6.1 or 4.3.6.1 Alternate). Prediction procedures from MIL-HDBK-472 can be used. Predicted values shall reflect applicable experience in previous programs.

4.3.11.6 Alternate Maintainability Prediction. Perform in accordance with MIL-STD-470, Task 203.

4.3.11.7 Maintainability Apportionment. Quantitative maintainability requirements (e.g., mean-time-to-repair, mean-time-to-restore) shall be apportioned to product elements down to the major assembly or module replacement level and used as design criteria. Rationale for maintainability tradeoffs and other maintainability apportionment changes shall be documented.

4.3.11.7 Alternate Maintainability Allocation. Perform in accordance with MIL-STD-470, Task 202.

4.3.11.8 Maintainability Evaluation. The quantitative maintainability of the product and its elements shall be continuously assessed as the design and test program progresses. The assessment process shall incorporate and integrate the results of maintainability analyses, maintenance analysis, and applicable test and usage data. Point estimates of achieved maintainability shall be computed for quantitative requirements.

4.3.11.9 Availability Evaluation. Availability evaluation shall be established and maintained to provide availability measures which will assist in making reliability/maintainability tradeoff decisions. This effort shall be integrated and conducted in conjunction with the reliability and maintainability assessments.

4.3.12 Test and Inspection During Development. Test and inspection during development shall be an evolutionary process which becomes more controlled and specific as the item design becomes more mature.

4.3.12.1 Demonstration and Validation. Test and inspection of demonstration and validation hardware (i.e., prior to establishment of a configuration allocated baseline) shall be for the purpose of determining and recording critical parameters and the difference between the design as-tested and the design as-intended. The following actions are required for these tests and inspections:

a. Inspection and material control on a variable basis, to the best accuracy reasonably available, shall be conducted on all characteristics (e.g., dimensions, materials, composition, processes, and processing condition), the required limits of the value of which are not precisely known for required functioning. Complete records of these inspections shall be maintained and be available for use.

b. Inspection and material control on a "go/no-go" basis shall be conducted on all attributes, the required limits of the value of which are known for desired functioning.

c. Inspection equipment, special interface gages, techniques, and procedures shall be developed, demonstrated, and exercised during the development phase, in such a manner that they serve the above functions and are determined appropriate to production.

Data obtained during test and inspection shall be utilized to provide a feedback of information for changes in design and in manufacturing processes to permit items to be produced with minimum rejects and rework and to make optimum use of available tolerances. Discrepancies found shall be reviewed and resolved by designated personnel. Test and inspection discrepancies and their resolutions shall be fully documented and maintained for use in establishing requirements for full-scale development and production phases.

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4.3.12.2 Full-scale Development. During full-scale development, commencing with the establishment of a configuration allocated base line, the test and inspection of hardware shall be performed using fully documented and controlled procedures. Receiving, in-process, and final test and inspection shall be performed to determine compliance to engineering released drawings and specification. Products which do not meet drawing and specification requirements shall be considered as nonconforming material and identified and rejected accordingly. As a minimum, the nonconforming products shall be subjected to engineering disposition.

4.3.13 Material Identification and Handling. The contractor shall establish and maintain a system for handling and identifying the intended use of material so that it will be controlled and used only as intended during development. Adequate methods shall be specified for the identification, preservation, packaging, packing, handling, and storage of products to preclude damage, deterioration, or misuse. Requirements for special preservation, packaging, packing, and handling shall be specified during development so that procedures, containers, and fixtures are available as required. The system shall include procedures for the control of non-conforming material.

4.3.14 Manufacturing Control During Development. Manufacturing processing and fabrication operations shall be accomplished under controlled conditions. Controlled conditions include documented work instructions, documented process control procedures, and controlled production equipment and working environments. These instructions and procedures shall provide the criteria for performing the work function and shall be compatible with acceptance criteria for workmanship. The inspection status of products shall be clearly indicated throughout the manufacturing operations.

4.3.15 Readiness Review for Production Operations. The contractor shall conduct readiness reviews prior to the start of manufacture of production hardware. The readiness reviews shall assess the degree that:

- a. The development program has progressed toward readiness for production.
- b. Producibility problems encountered during development have been resolved.
- c. The plans, procedures, materials, facilities, procurement sources, test and measuring equipment, production equipment and tools, software and personnel resources required for the manufacture of production hardware are in place and have been demonstrated to be adequate and complete.

Problems identified during the readiness review shall be documented and corrected.

4.4 Production. The requirements of this section are applicable to production programs and are selectively applicable in full-scale development and pilot production programs.

4.4.1 General. The product assurance program shall be established and maintained with necessary supporting documentation for all contractor produced and procured products to assure that applicable drawings, specifications, requirements, and controls are maintained in the production process. The program and its application to all phases of production shall provide assurance that the quality, reliability, maintainability, producibility, human factors, and safety inherent in the design and configuration are adequately translated into the finished product.

4.4.2 Fabrication

4.4.2.1 Parts and Materials Control. Controls shall be established and maintained to assure that:

- a. Only acceptable parts and materials are released to fabrication operations and that items excess to the operations are controlled to prevent misuse.
- b. Where kitting techniques are employed, accumulation of parts and materials for assembly or fabrication are complete and properly identified.
- c. Items determined to be susceptible to age or environmental degradation are identified with the proper control markings and relevant dates.
- d. Items are protected and controlled during storage, handling, and manufacturing operations by:
 - (1) Providing proper environmental protection.
 - (2) Preventing issue or use of items whose shelf life has expired.
 - (3) Purging items whose shelf life has expired.
 - (4) Periodically inspecting stored items for deterioration and damage.
 - (5) Assuring the use of designated handling equipment.

Independent surveillance of parts and material storage and issue controls shall be conducted to assure that approved procedures are being used and established controls are effective.

4.4.2.2 Process Controls. Manufacturing processes shall be controlled, especially those for which acceptable quality cannot readily be determined by inspection of the finished item. Manufacturing processes shall be evaluated

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to determine which process characteristics either influence or have an effect on the quality of the production item. These manufacturing processes and related equipment shall be identified, and requirements for their control shall be specified in manufacturing process specifications. Process control procedures shall be developed as necessary to supplement process specifications. These procedures shall include: methods for periodically verifying the adequacy of the processing materials, environments, solutions, equipment, and their associated control parameters; and the recording of the results of process verifications performed. Independent surveillance of manufacturing processes shall be conducted to assure that approved methods and procedures are followed.

4.4.2.3 Assembly Operations. Fabrication and assembly operations shall be controlled to assure that characteristics and criteria specified in technical documents are achieved and maintained in the produced items. Detailed fabrication and assembly instructions shall be developed for controlling these operations. These instructions shall include or reference:

- a. Identification of the item.
- b. Equipment or tools required including special handling devices.
- c. Material and parts required including consumables.
- d. Instructions for performing the operation.
- e. Characteristics and tolerances to be controlled.
- f. Procedures for controlling special processes.
- g. Special conditions to be maintained such as material protection, environmental conditions, safety controls and equipment maintenance.
- h. Workmanship standards and manufacturing aids.
- i. Test and inspection points.
- j. Records for indicating completion of each operation.
- k. Safety considerations.

Independent surveillance shall be conducted to assure that approved documented methods and procedures are followed, and that environmental and cleanliness requirements, and applicable workmanship standards are implemented and maintained.

4.4.2.4 Environmental and Cleanliness Control. The contractor shall provide adequate facilities for the fabrication, assembly, and testing of products. Unless otherwise specified, the minimum standards for working environments delineated in MIL-STD-1695 shall apply.

4.4.2.5 Workmanship Standards. Essential workmanship standards (e.g., item samples, visual aids, other clearly defined acceptance criteria) shall be developed to assist in manufacture and inspection. Conditions for acceptance and rejection shall be clearly depicted for characteristics requiring visual inspection.

4.4.3 Test and Inspection Planning. In accordance with the integrated test program requirements (4.1.7), plans and procedures shall be developed and maintained for tests and inspections to be conducted during the production phase. Test and inspection points shall be identified in production flow plans and implemented during manufacturing operations through the identification of these points in production documentation (e.g., travelers, shop order, operations sheet, etc.). Identified tests and inspections shall be conducted prior to work operations that preclude detection and correction of deficiencies or result in excessive cost. The complexity and cost of tests or inspections shall be consistent with the criticality of product characteristics.

4.4.4 Quality Verification. Test and inspections shall be conducted and data recorded in accordance with documented test and inspection procedures. Quality verification to determine compliance with contract requirements shall be performed by personnel independent of those accomplishing fabrication of the product.

4.4.4.1 Receiving Test and Inspection. A receiving test and inspection system shall be established and maintained that provides for the following:

- a. Test and inspection of purchased items to verify compliance to specification and drawing requirements.
- b. Assurance that purchased items have been qualified when required.
- c. Evidence that required test and inspection has been performed and that required data have been provided.
- d. Verification of the acceptability of required test and inspection data.
- e. Assurance that purchased items determined to be subject to age or environmental deterioration include proper control markings and relevant dates.
- f. Earliest practicable inspection of Government-furnished material/equipment.
- g. Clear identification of receipts of items so they may be readily recognized.
- h. Physical segregation of raw materials and purchased items which provides, as a minimum, segregation of items awaiting test or inspection results, acceptable items, and nonconforming items.

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g. Clear identification of receipts of items so they may be readily recognized.

h. Physical segregation of raw materials and purchased items which provides, as a minimum, segregation of items awaiting test or inspection results, acceptable items, and nonconforming items.

i. Identification of purchased items released from receiving inspection to clearly indicate acceptance, nonconforming status, or pending material review action.

4.4.4.2 In-process Test and Inspection. In-process test and inspection shall be performed during fabrication and assembly to verify the adequacy and control of the operations. Tests and inspections shall be performed at production points which will minimize impact resulting from nonconformances. Test and inspections shall be performed at or before the last point at which the acceptability of the item or characteristic may be completely verified. The test and inspection shall provide a measure of product and process quality and shall yield objective data for analysis and timely correction of adverse quality trends.

4.4.4.3 Nondestructive Testing Processes. Controls shall be exercised over nondestructive testing processes (e.g., radiography, holography, infrared, ultrasonic, liquid penetrant, magnetic particle, eddy current). The adequacy of these processes shall be assured by standards, specifications, procedures, certification of personnel, and equipment controls.

4.4.4.4 Configuration Verification. Configuration verification inspections shall be performed to verify that the as-built configuration of the product conforms to the released and controlled production documentation. Records shall be maintained which indicate that inspections have been performed, that changes have been incorporated as required, and that the as built configuration has been compared to the as-designed configuration. Corrective actions shall be taken on all discrepancies noted during the inspection prior to acceptance of the product.

4.4.4.5 Acceptance Test and Inspection. Acceptance test and inspection shall be performed on products to verify compliance with specification requirements using Procuring Activity approved procedures. All such acceptance tests shall include a specific period of failure-free operation immediately prior to termination and acceptance of the test. In the event of failure, requisite corrective action shall be taken and the failure-free portion of the test reinitiated. Testing of electronic items shall also include random pseudorandom, or complex waveform vibration at 6g RMS or qualification test levels, whichever is less, for 10 minutes in the axis deemed most susceptible to vibration excitation. Any failure shall require corrective action and test repetition. The extent and quantity of such acceptance operations shall be sufficient to provide assurance that the product conforms to specification

requirements. Sampling test and inspection shall not be used in verifying performance characteristics for final acceptance of products unless approved by the Procuring Activity.

4.4.4.6 Special Tests and Inspection.

a. First Article Inspection. First article inspection (FAI) shall be performed on selected items (made or purchased) which have significant impact on quality, schedule, or cost. FAI shall be conducted on the first item of the production run and on the first items produced using new or modified manufacturing tooling or processes. FAI shall constitute a detailed inspection to verify manufacturing capability, proper use of materials and parts, process controls, product compliance to specified requirements, and the validity of applicable documentation. Personnel other than those responsible for fabrication of the hardware shall be responsible for conduct of the FAI.

b. Qualification Tests. Qualification tests during the production phase shall be performed in accordance with criteria established in 4.3.10.5. These tests shall be performed on new items, items from new sources or plant relocation, or when changes are made in materials or processes which affect previous qualification. Personnel other than those responsible for qualifying the hardware shall witness the conduct of qualification tests and certify on the test documentation the acceptability or nonacceptability of items being tested. An item or a family of items determined to be unacceptable by the qualification test criteria established and documented in the test specification/procedure shall be clearly identified as nonconforming material. Disposition of this material shall be by material review action.

c. Periodic Production Tests. Periodic production tests shall be performed on a scheduled basis to verify that the required quality, reliability, and safety aspects of the product are maintained throughout production. The nature of the tests, environmental conditions, and number of test samples selected for each assessment shall be compatible with the complexity of the production process and its controls. If an item is produced on more than one production line or procured from more than the source, sample selection shall cover all lines or sources. Determination of items to be tested shall be based upon:

- (1) Susceptibility to environmental conditions.
- (2) Importance of application (effect on mission).
- (3) Normal variability in production relative to specified tolerance.
- (4) Sensitivity to changes in process variables.
- (5) Complexity of production process.
- (6) Population.

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surveillance of the established periodic production test program shall be performed to assure that approved documented methods and procedures are adequately performed, that nonconforming items are identified and dispositioned in accordance with established procedures, and that appropriate corrective actions are identified and implemented in a timely manner.

d. Production Reliability Acceptance Test. Perform in accordance with MIL-STD-785, Task 304.

4.4.4.7 Inspection Indications. A system shall be established and maintained for inspection status indication which includes the following provisions:

a. The inspection status of items shall be clearly indicated throughout the entire production cycle. Documentation accompanying items (e.g., traveler, shop order, operations sheet) shall provide for the indication of inspections performed and reference to inspection discrepancy reports generated.

b. Inspection stamps shall be utilized to indicate that inspections have been performed and that the item is in acceptance, nonconforming, or withheld for material review status. Inspection acceptance identification shall be maintained with the item until incorporated into the next higher assembly. In the case of very small items or where stamping will compromise the quality; an inspection card, tag, or other record shall be attached to the item or its container to indicate inspection status.

c. Inspection stamps shall be traceable to responsible individuals and records maintained to identify the individuals with specific stamps.

d. Stamps shall be of a design distinctly different from government inspection stamps.

4.4.4.8 Test and Inspection Records. Records of test and inspection performed shall be prepared and maintained. The records shall be appropriate for the type, scope, and importance of the test or inspection performed and in sufficient detail to provide objective evidence of extent of conformance to requirements and to permit necessary analysis for further action. Records shall include the inspection status of items, traceability, evidence of performance of required test and inspection, extent of nonconformance, disposition made of nonconforming items, responsibility for corrective action, and sampling plans and data.

4.4.5 Preparation for Delivery

4.4.5.1 Material Protection. Written procedures shall be prepared and implemented for preservation, packaging, handling, transporting, and storage of items subject to damage or deterioration or requiring safety precautions throughout the entire receiving, manufacturing, storage and shipping activities. An appropriate procedure shall be selected from MIL-STD-794 based

on an engineering review of the item and anticipated transportation and storage environments. Special packaging shall be designated when the levels and methods defined in MIL-STD-794 are considered inadequate for the item in the anticipated environments. In addition:

a. Requirements for maintenance of specific internal or external environments such as moisture content, temperatures, or gas pressure shall be clearly detailed on the exterior of the package and pack.

b. Inspection procedures, maintenance policy, certification procedures and intervals, and the associated test equipment for special handling devices shall be documented.

c. All items requiring periodic inspection or test shall be identified. Procedures shall be provided which describe actions required by the stock points when indicators show evidence of adverse conditions or test date is past due.

d. Items which are potentially hazardous to personnel shall be appropriately marked in accordance with Government regulations.

4.4.5.2 Shipping Inspection. Products shall be inspected and controlled prior to shipment to assure that:

a. Products have satisfactorily passed applicable inspections and tests.

b. Products have been identified, preserved, packaged, and packed in accordance with applicable specifications and procedures.

c. Packaging and packing have been marked in accordance with applicable specifications and procedures.

4.4.6 Documentation Control During Production. A system shall be established and maintained to assure documentation control during production, as follows:

a. Documentation utilized in the fabrication, inspection and test operations and applicable changes are under formal control.

b. All pertinent documents are changed when required and effectivity point specified.

c. Documents not required to support processing of approved product configuration are promptly removed and illegible documents replaced.

d. Documents which identify and accompany products through the manufacturing test and inspection operations reference appropriate part number and applicable change level.

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e. Changes are accomplished on affected products at the authorized point and changed products are appropriately marked or identified.

f. Computer software reflects changes that match the hardware changes and can be readily identified to the item to be tested.

4.5 Test and Inspection Equipment and Standards. The contractor shall establish and maintain a system for the definition, design, evaluation, approval, maintenance, calibration and control of basic standards, gages, measuring and test equipment and test support equipment necessary to verify that products presented to the Government for acceptance conform to specification requirements. When production jigs, fixtures, tooling masters, templates, patterns and such other devices are used as media of inspection, they shall be proven for accuracy prior to release for use.

4.5.1 Calibration System. Establish and maintain a calibration system in accordance with MIL-STD-45662.

4.5.1.1 Calibration Procedure Precedence. The order of preference of calibration procedures shall be as follows:

a. Navy standard calibration procedures in accordance with Metrology Requirements List (METRL), UD 45845.

b. METRL procedures modified as necessary by the contractor.

c. Contractor prepared procedures or equipment manufacturer instructions.

METRL procedures modified by the contractor, contractor-prepared procedures, and equipment manufacturer instructions shall include instructions necessary to enable personnel performing calibration functions to determine that the devices are operating properly and within prescribed limits.

4.5.1.2 Initial Intervals of Calibration. METRL shall be used to establish initial calibration intervals.

4.5.1.3 Identification of Standards. Standards used for calibration shall be identified to preclude their use as test and inspection equipment.

4.5.1.4 Sealing. Access to adjustments and adjustable devices affecting the measurement capabilities of measuring and test equipment shall be sealed to deter unauthorized entry. Seals shall be designed to destruct on entry into the measuring device. Following station calibrations, cabinets and consoles shall be secured and sealed.

4.5.1.5 Measuring and Test Equipment Control. Measuring and test equipment which have not been calibrated in accordance with the established schedule shall be immediately removed from service. If physical removal is

impractical, the device shall be impounded by attachment of signs or tags. In addition, provisions shall be made for immediate removal or impounding of measuring and test equipment which have failed in one or more parameters, show evidence of physical damage, or are determined to be or suspected of being outside of their required performance limits. Measuring and test equipment shall not be used when impounded. Approval by the Government Representative is required to continue use of the device if the prescribed date for calibration has been exceeded or the device is found to be outside of established accuracy limits. New or repaired measuring and test equipment shall be calibrated prior to use.

4.5.1.6 Criteria for Recording Calibration Data.

4.5.1.6.1 Qualitative Data Only qualitative (attribute) data need be recorded on measuring and test equipment which are within tolerance when received for calibration.

4.5.1.6.2 Quantitative Data. Quantitative data (variables) shall be recorded when measuring and test equipment are out of tolerance and shall include data on the out-of-tolerance parameters before and after adjustment or rework. Data shall also be recorded as required to determine performance capabilities of nonadjustable or fixed-value devices.

4.5.1.7 Allowable Error of Standards. The error of standards shall not exceed 25 percent of the allowable tolerance for the measuring and test equipment being calibrated. Any departure from this requirement shall be submitted to the Procuring Activity for approval with supporting justification including the proposed method of compensating for the calibration error.

4.5.1.8 Measuring Devices. The scope of MIL-STD-45662 requirements (4.5.1) and paragraphs 4.5.1.1 through 4.5.1.6 as applicable is expanded to include all measuring devices (i.e., test and inspection equipment; standards; equipment controlling special processes; production tools, jigs and fixtures; gages; and personally owned tools used to provide objective evidence of quality conformance).

4.5.2 Test and Inspection Equipment Design and Evaluation. A test and inspection equipment design and evaluation program shall be established and maintained. The program shall be fully documented to describe the methods and procedures to be used.

4.5.2.1 Design. Provisions shall be made for the definition, design, and evaluation of test and inspection equipment used to verify end item conformance to specifications. The total error in any measurement system shall not exceed 10 percent of the specified tolerance of each characteristic being measured. Any departure from this requirement and the proposed method to compensate for its effects, shall be submitted to the Procuring Activity for approval. For single limit parameters, the required test equipment accuracy shall be specified.

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4.5.2.2 Evaluation. Test and inspection equipment shall be evaluated to ascertain that the design, components and instruction specified will provide for the measurement capabilities required for acceptance of the product. Design evaluation shall include a preliminary error analysis prior to release of the design, and verification testing of the equipment as follows:

a. The error analysis shall predict test and inspection equipment errors based on information specified by manufacturers of commercial equipment, data available from previously used unique circuits, and engineering estimates for new design equipment.

b. Verification testing shall be conducted to determine inherent errors in the first units of test and inspection equipment containing new design or critical measurement circuits and to verify errors that cannot be verified during the initial design phase. Verification testing shall be done under required environmental operating conditions. These tests shall be based on a sound statistical plan and shall be of sufficient duration to demonstrate compliance with tolerance requirements. Independent surveillance of verification tests shall be conducted to assure that approved procedures are followed.

Equipment errors obtained from preliminary error analysis or verification testing for each input, stimulus and measurement shall be compared with the respective product tolerances to calculate accuracy ratios.

4.5.3 Test and Inspection Station Operational Proofing and Correlation. A program shall be established and maintained for the operational proofing and correlation of test and inspection stations used to verify product conformance to specification requirements.

4.5.3.1 Operational Proofing. Each test and inspection station shall be subjected to operational proofing tests under actual operating conditions. The station shall include test and inspection equipment, ancillary equipment, support equipment, fixtures, cabling, checkout tapes, operating personnel, and documentation for operating and calibrating the equipment. These tests shall verify completeness and adequacy of the operational and maintenance procedures, calibration procedures, supporting test hardware, compatibility of the station with the product, ease of operation and maintenance and detect any inherent shortcomings. Deficiencies detected during operational proofing shall be corrected, prior to station use for acceptance of products. Operational proofing test procedures shall be developed. Test and inspection station operating personnel shall participate in the operational proofing tests performed in accordance with these procedures. The Government Representative shall be notified prior to the start of operational proofing tests. Operational proofing of duplicate test and inspection stations need only be directed toward proofing of the equipment involved provided the documentation remains unchanged. Operational proofing test results shall be documented to authorize use of the test and inspection stations.

4.5.3.2 Test and Inspection Station Logs. Test and inspection station logs shall be maintained to record station history including station operational proofing, calibrations, broken station seals, equipment servicing, authorized use status, and explanations from all modifications and breaks-of-station. Log entries shall be maintained current and each entry dated and signed by authorized personnel.

4.5.3.3 Test and Inspection Station Correlation. When test and inspection stations are used for verifying conformance to specification requirements of identical type products at more than one facility, the contractor responsible for the test and inspection station design shall conduct a correlation program to detect and correct conditions contributing to significant differences in test results between testing facilities.

A correlation report shall be documented for each test and inspection station correlation delineating problems encountered during testing and corrective actions taken.

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5. DETAILED REQUIREMENTS

Detailed requirements are specified by completing the Product Assurance Program Requirements Matrix (Appendix A).

6. NOTES

6.1 Program Reviews. The Procuring Activity reserves the right to review the product assurance programs at prime contractor and subcontractor levels to determine compliance with the requirements of this standard included in applicable contracts.

6.2 Intended Use

6.2.1 General. The product assurance program will be most effective when properly tailored to the development or production phase. To facilitate program tailoring the general requirements of this standard have been divided into five major sections as follows:

a. Program Management. (Section 4.1)

An accumulation of requirements which are applicable or should be considered during development and production.

b. Procurement Control. (Section 4.2)

Requirements applicable to the procurement of items or products by the contractor from a subcontractor or supplier. These requirements with minor exception, are applicable during development and production.

c. Development. (Section 4.3)

Requirements applicable during development phases (demonstration and validation and full-scale development) and may be applicable to product improvement efforts during production.

d. Production. (Section 4.4)

Requirements are always applicable during production but may be applicable during full-scale development.

e. Test and Inspection Equipment and Standards. (Section 4.5)

Requirements of paragraph 4.5.1 are applicable during development and production. Requirements of paragraphs 4.5.2 and 4.5.3 are normally applicable during development but may be applied during production.

f. Appendix A. Provides the program manager with a tool for systematically reviewing this standard and making decisions as to the applicability of each specific program element for a particular procurement. Appendix A shall be completed for all procurements and included in applicable procurement documents (e.g., RFPs, contracts, etc.).

g. Appendix B. Provides the program manager with application matrices which make specific recommendations regarding the "Applicability" of each product assurance program requirement for each acquisition program phase.

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5.2.2 Special Considerations. Particular attention is invited to the following:

a. The mission profile (4.3.1) of a weapon system is normally provided by the Procuring Activity.

b. Numerical reliability, maintainability and availability requirements, if applicable, must be included in the product specification or elsewhere in the contract.

c. Procurement activity participation must be specified, if desired, in personnel certification requirements (4.1.4.2.), key component selection (4.3.7), special process designation (4.4.2.2) and establishment of environmental and cleanliness standards (4.4.2.4).

e. Test Programs (4.3.10) are notoriously expensive; on the other hand Government participation can be counter productive and cause program delays. Participation (i.e., review/approval of test programs, plans, procedures, results) by the Procuring Activity must be carefully considered and specifically stated.

f. Itemization of Government-furnished or associated contractor supplied material and equipment which is to be integrated into the complete operational system should be included in the contract.

g. Applicability of referenced military standards and, if applicable, the extent of applicability (i.e., the total document, selected plans or procedures, selected methods, etc.) should be explicitly stated in the contract. Particular attention shall be given to "Ordering Data" and "Details to be specified by the Procuring Activity" contained in some military standards and specifications. Required data and information shall be included in applicable contract documents.

h. Appendix A use is mandatory and shall be included in procurement documents when this standard is referenced.

6.3 Contract Data Requirements. When this standard is used in an acquisition which incorporates a DD Form 1423, Contract Data Requirements List (CDRL), the data requirements identified below shall be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved CDRL incorporated into the contract. When the provisions of DoD FAR Supplement 27.410-6 are invoked and the DD Form 1423 is not used, the data specified below shall be delivered by the contractor in accordance with the contract or purchase order requirements. Deliverable data associated with the Military Standards referenced in this document are as follows:

<u>Reference</u> <u>Para. No.</u>	<u>Military</u> <u>Standard</u>	<u>DID Title</u>	<u>DID No.</u>
1.3.1	MIL-STD-470	Maintainability Program Plan	DI-R-7103

<u>DOD-STD-2107(Navy) Reference Para. No.</u>	<u>Applicable Military Standard</u>	<u>DID Title</u>	<u>DID No.</u>
4.1.3.2	MIL-STD-785	Reliability Program Plan	DI-R-7079
4.1.6.1	MIL-STD-470	Data Collection, Analysis and Corrective Action System, Reports	DI-R-7105
4.1.8 Alternate	MIL-STD-785	Report, Failure Summary and Analysis	DI-R-7041
4.1.9.2	MIL-STD-480	Engineering Change Proposals (ECPs) And Requests for Deviations and Waivers	DI-E-2037
4.1.9.2	MIL-STD-480	Notice of Revision/Specification Change Notice	DI-E-1126A
4.1.10 Alternate	MIL-STD-1520	Nonconforming Material Report	DI-R-30517
4.1.13	MIL-STD-1679	Computer Program-Test Plan	DI-T-2142
4.1.13	MIL-STD-1679	Computer Program Test Specification	DI-E-2143
4.1.13	MIL-STD-1679	Computer Program Test Procedure	DI-T-2144
4.1.13	MIL-STD-1679	Computer Program Test Report	DI-T-2156
4.1.14	DOD-D-1000	Drawings, Engineering & Associated Lists	DI-E-7031
4.1.14	MIL-M-8533(AS)	Quality Assurance Program Plan, Technical Manuals	DI-M-21368A
4.3.2.4 Alternate A	MIL-STD-470	Report, Failure Mode, Effects and Criticality Analysis	DI-R-7085
4.3.2.4 Alternate B	MIL-STD-785	Report, Failure Modes, Effects and Criticality Analysis	DI-R-1734
		Report, Failure Mode and Effect Analysis (FMEA)(DI-R-2115A is to be used only when MIL-STD 1629 has been designated as the basis for MIL-STD-785, Task 204)	DI-R-2115A

DOD-STD-2107 (Navy)

<u>DOD-STD-2107(Navy) Reference Para. No.</u>	<u>Applicable Military Standard</u>	<u>DID Title</u>	<u>DID No.</u>
4.3.2.3 Alternate	MIL-STD-785	Sneak Circuit Analysis Report	DI-R-7083
4.3.2.6 Alternate	MIL-STD-785	Electronic Parts/Circuits Tolerance Analysis Report	DI-R-7084
4.3.2.7 Alternate	MIL-STD-470	Maintainability Analysis report	DI-R-7109
4.3.2.8 Alternate	MIL-STD-470	Inputs to the Detailed Maintenance Plan and Logistics Support Analysis	DI-R-7111
4.3.3.1	MIL-STD-470	Maintainability Design Criteria Plan	DI-R-7110
4.3.4	MIL-STD-965	Program Parts Selection List (PPSL) Nonstandard Part Requests/Proposed Additions to an Approved PPSL	DI-E-7027 DI-E-7028
4.3.6.1	MIL-STD-470	Maintainability Status Report	DI-R-7104
4.3.6.1 Alternate	MIL-STD-785	Reliability Status Report	DI-R-7080
4.3.7 Alternate	MIL-STD-785	Plan, Critical Item Control	DI-R-35011
4.3.10.3	MIL-STD-785	Report, Burn-in Test	DI-R-7040
4.3.10.4	MIL-STD-785	Plan, Reliability Test	DI-R-7033
4.3.10.6 Alternate			
4.4.4.6b			
4.3.10.6 Alternate	MIL-STD-785	Procedures, Reliability Test and Demonstration	DI-R-7035
4.4.4.6d		Reports, Reliability Test and Demonstration (final report)	DI-R-7034

<u>DOD-STD-2107(Navy) Reference Para. No.</u>	<u>Applicable Military Standard</u>	<u>DID Title</u>	<u>DID No.</u>
4.3.10.7 Alternate	MIL-STD-470	Maintainability Demonstration Test Plan	DI-R-7112
		Report, Maintainability Demonstration	DI-R-7113
		Plan, Maintainability Demonstration	DI-R-2129
		Report, Maintainability Demonstration (DI-R-2129 and DI-R-2130 are to be used only when MIL-STD-471 is designated as the basis for MIL-STD-470, Task 301)	DI-R-2130A
4.3.11.1 Alternate	MIL-STD-785	Reliability Mathematical Code(s.)	DI-R-7081
4.3.11.2 Alternate	MIL-STD-785	Reliability Predictions Report	DI-R-7082
4.3.11.3 Alternate	MIL-STD-785	Report, Reliability Allocation	DI-R-2114
4.3.11.5 Alternate	MIL-STD-470	Maintainability Modeling Report	DI-R-7106
4.3.11.6 Alternate	MIL-STD-470	Maintainability Predictions Report	DI-R-7107
4.3.11.7 Alternate	MIL-STD-470	Maintainability Allocations Report	DI-R-7108
4.4.1	MIL-STD-45662	Calibration System Description	DI-R-7064
4.4.1	MIL-STD-45662	Equipment Calibration Procedures	DI-R-7065

Notes: (1) Only data items specified in the CDRL are deliverable. Therefore, those data requirements identified in the Statement of Work (SOW) must also appear in the CDRL.

(2) The PA should review all DIDs and assure through tailoring, that the preparation instructions in each DID are compatible with task requirements specified in the SOW.

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6.4 Subject Term (Key Word) Listing.

Acquisition
Analysis
Audit
Calibration
Classification of characteristics
Configuration management
Contractor
Corrective action
Design
Development
Engineering
Human Engineering
Inspection
Maintainability
Management
Manufacturing
Material review board
Navy products
Nonconforming material
Parts control
Planning
Product assurance
Production
Program
Qualification test
Quality assurance
Reliability
Requirements
Software
Tests

Custodian:
Navy - OS

Review Activities:
Navy - AS, MC, OM, SA, SH, TD

Preparing Activity:
Navy - OS
(Project QCIC-N049)

DOD-STD-2107 (Navy)
Appendix A

PRODUCT ASSURANCE PROGRAM
REQUIREMENTS
MATRIX

PRODUCT ASSURANCE PROGRAM
REQUIREMENTS MATRIX

Instruction for Use

1. The requirements of this standard must be tailored for each procurement. In general, requirements in section 4.1 and 4.2 are applicable to all contracts, the requirements of section 4.3 to development contracts, the requirements of section 4.4 to production contracts, and the requirements of section 4.5 selectively applied based on the extent of contractor responsibility for test and inspection equipment.
2. Review each requirement (paragraph) of the standard and determine the applicability of that requirement to the procurement to be made. If the requirement is applicable put an X in the "Applicable" column; if not applicable put an X in the "Not Applicable" column. Appendix B is included as an aid in determining requirement applicability.
3. Where an alternate or alternates for a program requirement are included in the standard (e.g., paragraph 4.1.8 and 4.1.8 Alternate; paragraph 4.3.2.4, 4.3.2.4 Alternate A and 4.3.2.4 Alternate B) only one of these paragraphs shall be marked "Applicable"; the other or others are "Not Applicable".
4. The completed Product Assurance Program Requirements Matrix shall be authenticated (dated and signed by program manager and contracting officer) and attached to the request for proposal, invitation for bid or contract as appropriate.

DOD-STD-2107 (Navy)
Appendix A

Product Assurance Program Requirements

Paragraph	Requirement	Applicable (X)	Not Applicable (X)
4.1.1	General		
4.1.2	Management policy		
4.1.3	Program planning		
4.1.3.1	Maintainability program plan, MIL-STD-470, Task 101		
4.1.3.2	Reliability program plan, MIL-STD-785, Task 101		
4.1.4.1	Education and training		
4.1.4.2	Certification of personnel		
4.1.5.1	Audit conduct		
4.1.5.2	Audit report and corrective action		
4.1.6	Integrated data system		
4.1.6.1	Data collection, analysis and corrective action system, MIL-STD-470, Task 104		
4.1.7	Integrated test program		
4.1.8	Problem/Failure reporting, analysis and corrective action		
4.1.8.1	Problem/Failure reporting		
4.1.8.2	Problem/Failure investigation and analysis		
4.1.8.3	Corrective action		
4.1.8.4	Failure review board, MIL-STD-785, Task 105		
4.1.8 Alternate	Failure reporting, analysis, and corrective action system, MIL-STD-785, Task 104		

Product Assurance Program Requirements

Paragraph	Requirement	Applicable (X)	Not Applicable (X)
4.1.9	Configuration management		
4.1.9.1	Configuration identification		
4.1.9.2	Configuration control		
4.1.9.3	Configuration control board		
4.1.9.4	Configuration status accounting		
4.1.9.5	Configuration audits		
4.1.10	Nonconforming material control		
4.10.1.1	Identification and segregation		
4.10.1.2	Missed operations		
4.10.1.3	Preliminary review		
4.10.1.4	Material review board		
4.10.1.5	Nonconformance requests for disposition		
4.10.1.6	Subcontractor material review board		
4.10.1 Alternate	Nonconforming material control, MIL-STD-1520		
4.1.11	Sampling plans		
4.1.12	Quality cost data		
4.1.13	Software		
4.1.14	Technical data quality assurance		
4.2.1	General		
4.2.1.1	Monitor/control of subcontractors and suppliers, MIL-STD-470, Task 102		

DOD-STD-2107 (Navy)
Appendix A

Product Assurance Program Requirements

Paragraph	Requirement	Applicable (X)	Not Applicable (X)
4.2.1.1 Alternate	Monitor/control of subcontractors and suppliers, MIL-STD-785, Task 102		
4.2.2	Selection of procurement source		
4.2.3	Approved source list		
4.2.4	Surveys of subcontractor operations		
4.2.5	Procurement document provisions		
4.2.6	Procurement document review		
4.2.7	Procurement document change control		
4.2.8	Contractor/Subcontractor coordination and corrective action		
4.2.9	Contractor source inspection		
4.2 Alternate	Supplier quality assurance program requirements, MIL-STD-1535		
4.3	Development		
4.3.1	Mission/System analysis		
4.3.2	Design analysis		
4.3.2.1	Parameter studies		
4.3.2.2	Classification of characteristics, DOD-STD-2101(OS)		
4.3.2.3	Sneak analysis		
4.3.2.3 Alternate	Sneak circuit analysis, MIL-STD-785, Task 205		
4.3.2.4	Failure mode, effect, and criticality analysis		

Product Assurance Program Requirements

Paragraph	Requirement	Applicable (X)	Not Applicable (X)
4.3.2.4 Alternate A	Failure mode and effect analysis, MIL-STD-470, Task 204		
4.3.2.4 Alternate B	Failure modes, effects and criticality analysis, MIL-STD-785, Task 204		
4.3.2.5	Stress analysis of parts and materials		
4.3.2.6	Worst case analysis		
4.3.2.6 Alternate	Electronic parts/circuits tolerance analysis, MIL-STD-785, Task 206		
4.3.2.7	Maintainability and reliability analysis		
4.3.2.7 Alternate	Maintainability analysis, MIL-STD-470, Task 205		
4.3.2.8	Logistics analysis		
4.3.2.8 Alternate	Maintenance plan and logistics support analysis input requirements, MIL-STD-470, Task 207		
4.3.2.9	Producibility analysis		
4.3.3	Design practices and documentation		
4.3.3.1	Maintainability design criteria, MIL-STD-470, Task 206		
4.3.4	Parts and materials selection and identification		
4.3.4 Alternate	Parts and materials selection and identification, MIL-STD-785, Task 207		
4.3.5	Human engineering program		
4.3.6	Design review		

DOD-STD-2107 (Navy)
Appendix A

Product Assurance Program Requirements

Paragraph	Requirement	Applicable (X)	Not Applicable (X)
4.3.6.1	Program reviews, MIL-STD-470, Task 103		
4.3.6.1 Alternate	Program reviews, MIL-STD-785, Task 103		
4.3.7	Key components		
4.3.7 Alternate	Reliability critical items, MIL-STD-785, Task 208		
4.3.8	Control of key components		
4.3.9	Effect of functional testing, storage, handling, packaging, transportation and maintenance, MIL-STD-785, Task 209		
4.3.10	Development tests		
4.3.10.1	Design tests		
4.3.10.2	Engineering evaluation tests		
4.3.10.3	Environmental stress screening, MIL-STD-785, Task 301		
4.3.10.4	Reliability development/growth test, MIL-STD-785, Task 302		
4.3.10.5	Qualification tests		
4.3.10.6	Reliability demonstration tests		
4.3.10.6 Alternate	Reliability qualification test program, MIL-STD-785, Task 303		
4.3.10.7	Maintainability demonstration tests		
4.3.10.7 Alternate	Maintainability demonstration tests, MIL-STD-470, Task 301		
4.3.11	Reliability and maintainability accounting		

Product Assurance Program Requirements

Paragraph	Requirement	Applicable (X)	Not Applicable (X)
4.3.11.1	Reliability modeling		
4.3.11.1 Alternate	Reliability modeling, MIL-STD-785, Task 201		
4.3.11.2	Reliability prediction		
4.3.11.2 Alternate	Reliability prediction, MIL-STD-785, Task 203		
4.3.11.3	Reliability apportionment		
4.3.11.3 Alternate	Reliability allocations, MIL-STD-785, Task 202		
4.3.11.4	Reliability evaluation		
4.3.11.5	Maintainability modeling		
4.3.11.5 Alternate	Maintainability modeling, MIL-STD-470, Task 201		
4.3.11.6	Maintainability prediction		
4.3.11.6 Alternate	Maintainability prediction, MIL-STD-470, Task 203		
4.3.11.7	Maintainability apportionment		
4.3.11.7 Alternate	Maintainability allocations, MIL-STD-470, Task 202		
4.3.11.8	Maintainability evaluation		
4.3.11.9	Availability evaluation		
4.3.12	Test and inspection during development		
4.3.12.1	Demonstration and validation		
4.3.12.2	Full-scale development		

DOD-STD-2107 (Navy)
Appendix

Product Assurance Program Requirements

Paragraph	Requirement	Applicable (X)	Not Applicable (X)
4.3.13	Material identification and handling		
4.3.14	Manufacturing control during development		
4.3.15	Readiness review for production operations		
4.4	Production		
4.4.1	General		
4.4.2.1	Parts and materials control		
4.4.2.2	Process controls		
4.4.2.3	Assembly operations		
4.4.2.4	Environmental and cleanliness control		
4.4.2.5	Workmanship standards		
4.4.3	Test and inspection planning		
4.4.4	Quality verification		
4.4.4.1	Receiving test and inspection		
4.4.4.2	In-process test and inspection		
4.4.4.3	Nondestructive testing processes		
4.4.4.4	Configuration verification		
4.4.4.5	Acceptance test and inspection		
4.4.4.6a	First article inspection		
4.4.4.6b	Qualification tests		
4.4.4.6c	Periodic production tests		
4.4.4.6d	Production reliability acceptance test, MIL-STD-785, Task 304		

Product Assurance Program Requirements

Paragraph	Requirement	Applicable (X)	Not Applicable (X)
4.4.4.7	Inspection indications		
4.4.4.8	Test and inspection records		
4.4.5.1	Material protection		
4.4.5.2	Shipping inspection		
4.4.6	Documentation control during production		
4.5	Test and inspection equipment and standards		
4.5.1	Calibration system, MIL-STD-45662		
	<u>Paragraph</u>		
	4.1. General		
	4.2. Quality assurance provisions		
	5.1. Calibration system description		
	5.2. Adequacy of standards		
	5.3. Environmental controls		
	5.4. Intervals of calibration		
	5.5. Calibration procedures		
	5.6.1. Evaluation of suspect product		
	5.6.2. Evaluation of calibration system accuracy		
	5.7.1. Domestic contracts (calibration sources)		
	5.7.2. Foreign contracts (calibration sources)		

DOD-STD-2107 (Navy)
Appendix A

Product Assurance Program Requirements

Paragraph	Requirement	Applicable (X)	Not Applicable (X)
	5.8 Application and records		
	5.9 Calibration status		
	5.10 Control of subcontractor calibration		
	5.11 Storage and handling		
	5.12 Amendments and revisions		
4.5.1.1	Calibration procedure precedence		
4.5.1.2	Initial intervals of calibration		
4.5.1.3	Identification of standards		
4.5.1.4	Sealing		
4.5.1.5	Measuring and test equipment control		
4.5.1.6	Criteria for recording calibration data		
4.5.1.7	Allowable error of standards		
4.5.1.8	Measuring devices		
4.5.2	Test and inspection equipment design and evaluation		
4.5.2.1	Design		
4.5.2.2	Evaluation		
4.5.3	Test and inspection station operational proofing and correlation		
4.5.3.1	Operational proofing		
4.5.3.2	Test and inspection station logs		
4.5.3.3	Test and inspection station correlation		

DOD-STD-2107 (Navy)
Appendix B

Product Assurance Program
Requirements
Application Matrices

DOD-STD-2107 (Navy)
Appendix B

Product Assurance Program
Application Matrices

Instruction for Use

1. These application matrices are included as aids to the PA in developing an effective and efficient product assurance program for a proposed contract or RFP.
2. The Basic Application Matrix is for each product assurance element of DOD-STD-2107 (Navy), which do not reference MIL-STD-470 or MIL-STD-785 tasks. The classifications are based upon a general evaluation of both the importance of the element and operating experience. In setting up requirements for a product assurance program, elements designated M should normally be included, those designated as C should be carefully reviewed for the specific procurement and procurement phase and those designated NA should not be included.
3. Table B-2 and Table B-3 are applicable only to product assurance elements which reference MIL-STD-470 and MIL-STD-785 tasks respectively. The applicability codes and code definitions are from the referenced military standards.
4. Table B-4, MIL-STD-45662 Applicability Matrix, provides a guide for tailoring the requirements of that military standard for each acquisition. The classifications are as described in paragraph 2 above.

BASIC APPLICATION MATRIX

DOD-STD-2107 (Navy)		Applicability*		
Paragraph No.	Requirement			
4.1.1	General	M	M	M
4.1.2	Management policy	M	M	M
4.1.3	Program planning	M	M	M
4.1.4.1	Education and training	M	M	M
4.1.4.2	Certification of personnel	NA	C	M
4.1.5.1	Audit conduct	M	M	M
4.1.5.2	Audit report and corrective action	M	M	M
4.1.6	Integrated data system	M	M	C
4.1.7	Integrated test program	M	M	M
4.1.8	Problem/Failure reporting, analysis, and corrective action	C	M	M
4.1.8.1	Problem/Failure reporting	C	M	M
4.1.8.2	Problem/Failure investigation and analysis	C	M	M
4.1.8.3	Corrective action	C	M	M
4.1.9	Configuration management	M	M	M
4.1.9.1	Configuration identification	M	M	M
4.1.9.2	Configuration control	M	M	M

*Applicability Codes: C-Conditional; M-Highly Recommended; NA-Not Applicable

DOD-STD-2107
Appendix B

TABLE B-1 (Continued)
BASIC APPLICATION MATRIX

DOD-STD-2107 (Navy)		Applicability*		
Paragraph No.	Requirement	Demonstration & Validation	Full-Scale Development	Production
4.1.9.3	Configuration control board	C	M	M
4.1.9.5	Configuration audits	NA	M	C
4.1.10	Nonconforming material control	NA	C	M
4.1.10.1	Identification and segregation	NA	C	M
4.1.10.2	Missed operations	NA	C	M
4.1.9.4	Configuration status accounting	C	M	M
4.1.10.3	Preliminary review	NA	C	M
4.1.10.4	Material review board	NA	C	M
4.1.10.5	Nonconformance requests for disposition	NA	C	M
4.1.10.6	Subcontractor material review board	NA	C	M
4.1.10 Alternate	Nonconforming material control, MIL-STD-1520	NA	C	M
4.1.11	Sampling plans	NA	M	M
4.1.12	Quality cost data	NA	M	M
4.1.13	Software	C	C	C
4.1.14	Technical data quality assurance	C	M	M

*Applicability Codes: C-Conditional; M-Highly Recommended; NA-Not Applicable

TABLE B-1 (Continued)
BASIC APPLICATION MATRIX

DOD-STD-2107 (Navy)		Applicability*		
Paragraph No.	Requirement	Demonstration & Validation	Full-Scale Development	Production
4.2.1	General	C	M	M
4.2.2	Selection of procurement source	C	M	M
4.2.3	Approved source list	NA	M	M
4.2.4	Surveys of subcontractors operations	C	C	C
4.2.5	Procurement document provisions	M	M	M
4.2.6	Procurement document review	M	M	M
4.2.7	Procurement document change control	M	M	M
4.2.8	Contractor/subcontractor coordination and corrective action	M	M	M
4.2.9	Contractor source inspection	M	M	M
4.2 Alternate	Supplier quality assurance program requirements, MIL-STD-1535	C	M	M
4.3	Development	M	M	C
4.3.1	Mission/system analysis	M	M	NA
4.3.2	Design analysis	M	M	C
4.3.2.1	Parameter studies	M	M	C

*Applicability Codes: C-Conditional; M-Highly Recommended; NA-Not Applicable

DOD-STD-2107 (Navy)
Appendix B

TABLE B-1 (Continued)
BASIC APPLICATION MATRIX

DOD-STD-2107 (Navy)		Applicability*		
Paragraph No.	Requirement	Demonstration & Validation	Full-Scale Development	Production
4.3.2.2	Classification of characteristics, DOD-STD-2101(OS)	M	M	C
4.3.2.3	Sneak analysis	M	M	C
4.3.2.4	Failure mode, effect, and criticality analysis	M	M	C
4.3.2.5	Stress analysis of parts and materials	M	M	C
4.3.2.6	Worst case analysis	M	M	C
4.3.2.7	Maintainability and reliability analysis	M	M	C
4.3.2.8	Logistics analysis	M	M	C
4.3.2.9	Producibility analysis	M	M	C
4.3.3	Design practices and documentation	M	M	C
4.3.4	Parts and materials selection and identification	C	M	C
4.3.5	Human engineering program	M	M	C
4.3.6	Design review	M	M	C
4.3.7	Key components	NA	C	C
4.3.8	Control of key components	NA	C	C

*Applicability Codes: C-Conditional; M-Highly Recommended; NA-Not Applicable

DOD-STD-2107 (Navy)
Appendix B

TABLE B-1 (Continued)
BASIC APPLICATION MATRIX

DOD-STD-2107 (Navy)		Applicability*		
Paragraph No.	Requirement	Demonstration & Validation	Full-Scale Development	Production
4.3.10	Development tests	M	M	NA
4.3.10.1	Design tests	M	M	NA
4.3.10.2	Engineering evaluation tests	C	M	NA
4.3.10.5	Qualification tests	C	M	NA
4.3.10.6	Reliability demonstration tests	NA	C	C
4.3.10.7	Maintainability demonstration tests	NA	M	C
4.3.11	Reliability and maintainability accounting	M	M	C
4.3.11.1	Reliability modeling	C	M	C
4.3.11.2	Reliability prediction	M	M	C
4.3.11.3	Reliability apportionment	M	M	C
4.3.11.4	Reliability evaluation	M	M	C
4.3.11.5	Maintainability modeling	C	M	C
4.3.11.6	Maintainability prediction	C	M	C
4.3.11.7	Maintainability apportionment	C	M	C
4.3.11.8	Maintainability evaluation	M	M	C

*Applicability Codes: C-Conditional; M-Highly Recommended; NA-Not Applicable

DOD-STD-2107 (Navy)
Appendix B

TABLE B-1 (Continued)
BASIC APPLICATION MATRIX

DOD-STD-2107 (Navy)		Applicability*		
		Demonstration & Validation	Full-Scale Development	Production
Paragraph No.	Requirement			
4.3.11.9	Availability evaluation	M	M	C
4.3.12	Test and inspection during development	M	M	NA
4.3.12.1	Demonstration and validation	M	NA	NA
4.3.12.2	Full-scale development	NA	M	NA
4.3.13	Material identification and handling	C	M	NA
4.3.14	Manufacturing control during development	C	M	NA
4.3.15	Readiness review for production operations	NA	M	C
4.4	Production	NA	C	M
4.4.1	General	NA	C	M
4.4.2.1	Parts and materials control	NA	C	M
4.4.2.2	Process controls	NA	C	M
4.4.2.3	Assembly operations	NA	C	M
4.4.2.4	Environmental and cleanliness control	NA	C	M
4.4.2.5	Workmanship standard	NA	C	M

*Applicability Codes: C-Conditional; M-Highly Recommended; NA-Not Applicable

TABLE B-1 (Continued)
BASIC APPLICATION MATRIX

DOD-STD-2107 (Navy)		Applicability*		
Paragraph No.	Requirement	Demonstration & Validation	Full-Scale Development	Production
4.4.3	Test and inspection planning	NA	C	M
4.4.4	Quality verification	NA	C	M
4.4.4.1	Receiving test and inspection	NA	C	M
4.4.4.2	In-process test and inspection	NA	C	M
4.4.4.3	Nondestructive testing process	NA	C	M
4.4.4.4	Configuration verification	NA	NA	C
4.4.4.5	Acceptance test and inspection	NA	C	M
4.4.4.6a	First article inspection	NA	NA	C
4.4.4.6b	Qualifications tests	NA	NA	C
4.4.4.6c	Periodic production tests	NA	NA	C
4.4.4.7	Inspection indications	NA	C	M
4.4.4.8	Test and inspection records	NA	C	M
4.4.5.1	Material protection	NA	NA	M
4.4.5.2	Shipping inspection	NA	NA	M

*Applicability Codes: C-Conditional; M-Highly Recommended; NA-Not Applicable

TABLE B-1 (Continued)
BASIC APPLICATION MATRIX

DOD-STD-2107 (Navy)		Applicability*		
Paragraph No.	Requirement			
4.4.3	Test and inspection planning	NA	C	M
4.4.6	Documentation control during production	NA	NA	M
4.5	Test and inspection equipment and standards	C	M	M
4.5.1	Calibration system, MIL-STD-45662	(See Table B-4)		
4.5.1.1	Calibration procedure precedence	C	C	C
4.5.1.2	Initial intervals of calibration	C	C	C
4.5.1.3	Identification of standards	C	M	M
4.5.1.4	Sealing	C	M	M
4.5.1.5	Measuring and test equipment control	C	M	M
4.5.1.6.1	Qualitative data	C	C	C
4.5.1.6.2	Quantitative data	C	C	C
4.5.1.7	Allowable error of standards	C	C	C
4.5.1.8	Measuring devices	C	M	M
4.5.2	Test and inspection equipment design and evaluation	NA	M	C

TABLE B-1 (Continued)
BASIC APPLICATION MATRIX

DOD-STD-2107 (Navy)		Applicability*		
Paragraph No.	Requirement	Demonstration & Validation	Full-Scale Development	Production
4.5.2.1	Design	NA	M	C
4.5.2.2	Evaluation	NA	M	C
4.5.3	Test and inspection station operational proofing and correlation	NA	C	C
4.5.3.1	Operational proofing	NA	M	C
4.5.3.2	Test and inspection station logs	NA	M	M
4.5.3.3	Test and inspection station correlation	NA	C	C

TABLE B-2

MIL-STD-470 Application Matrix

PARAGRAPH NO.	TASK	TITLE	TASK TYPE	PROGRAM PHASE				
				CON-CEPT	VALID	FSD	PROD	OPERAT SYSTEM DEV (MODS)
4.1.3.1	101	Maintainability Program Plan	MGT	N/A	G(3)	G	G(3)(1)	G(1)
4.2.1.1	102	Monitor/Control of Sub-Contractors and Vendors	MGT	N/A	S	G	G	S
4.3.6.1	103	Program Reviews	MGT	S	G(3)	G	G	S
4.1.6.1	104	Data Collection, Analysis and Corrective Action System	ENG	N/A	S	G	G	S
4.3.11.5 Alt.	201	Maintainability Modeling	ENG	S	S(4)	G	C	N/A
4.3.11.7 Alt.	202	Maintainability Allocations	ACC	S	S(4)	G	C	S(4)
4.3.11.6 Alt.	203	Maintainability Predictions	ACC	N/A	S(2)	G(2)	C	S(2)
4.3.2.4 Alt. A	204	Failure Modes and Effects Analysis (FMEA) Maintainability Information	ENG	N/A	S(2) (3)(4)	G(1) (2)	C(1) (2)	S(2)

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DOD-STD-2107 (Navy)
Appendix B

TABLE B-2 (Continued)
MIL-STD-470 Application Matrix

PARAGRAPH NO.	TASK	TITLE	TASK TYPE	PROGRAM PHASE				
				CON- CEPT	VALID	FSD	PROD	OPERAT SYSTEM DEV (MODS)
4.3.2.7 Alt.	205	Maintainability Analysis	ENG	S(3)	G(3)	G(1)	C(1)	S
4.3.3.1	206	Maintainability Design Criteria	ENG	N/A	S(3)	G	C	S
4.3.2.8 Alt.	207	Preparation of Inputs to Detailed Maintenance Plan and Logistics Support Analysis (LSA)	ACC	N/A	S(2) (3)	G(2)	C(2)	S
4.3.10.7 Alt.	301	Maintainability Demonstration (MD)	ACC	N/A	S(2)	G(2)	C(2)	S(2)

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DOD-STD-2107 (Navy)
Appendix B

TABLE B-2 (Continued)
MIL-STD-470 Application Matrix

CODE DEFINITIONS

- S - Selectively applicable
 - G - Generally applicable
 - C - Generally applicable to design changes only
 - N/A - Not applicable
 - ACC - Maintainability Accounting
 - ENG - Maintainability Engineering
 - MGT - Management
- (1) Requires considerable interpretation of intent to be cost effective.
 - (2) MIL-STD-470 is not the primary implementation document. Other MIL-STDs or Statement of Work requirements must be included to define or rescind the requirements. For example MIL-STD-471 must be imposed to describe maintainability demonstration details and methods.
 - (3) Appropriate for those task elements suitable to definition during phase.
 - (4) Depends on physical complexity of the system unit being procured, its packaging and its overall maintenance policy.

TABLE B-3

MIL-STD-785 Application Matrix

PARAGRAPH NO.	TASK	TITLE	TASK TYPE	PROGRAM PHASE			
				CONCEPT	VALID	FSD	PROD
4.1.3.2	101	Reliability Program Plan	MGT	S	S	G	G
4.2.1.1 Alt.	102	Monitor/Control of Subcon- tractors and Suppliers	MGT	S	S	G	G
4.3.6.1 Alt.	103	Program Reviews	MGT	S	S(2)	G(2)	G(2)
4.1.8 Alt.	104	Failure Reporting, Analysis, and Corrective Action System (FRACAS)	ENG	NA	S	G	G
4.1.8.4	105	Failure Review Board (FRB)	MGT	NA	S(2)	G	G
4.3.11.1 Alt.	201	Reliability Modeling	ENG	S	S(2)	G(2)	GC(2)
4.3.11.3 Alt.	202	Reliability Allocations	ACC	S	G	G	GC
4.3.11.2 Alt.	203	Reliability Predictions	ACC	S	S(2)	G(2)	GC(2)
4.3.2.4 Alt. B	204	Failure Modes, Effects, and Criticality Analysis (FMECA)	ENG	S	S(1)(2)	G(1)(2)	GC(1)(2)
4.3.2.3 Alt.	205	Sneak Circuit Analysis (SCA)	ENG	NA	NA	G(1)	GC(1)

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TABLE B-3 (Continued)
MIL-STD-785 Application Matrix

PARAGRAPH NO.	TASK	TITLE	TASK TYPE	PROGRAM PHASE			
				CONCEPT	VALID	FSD	PROD
4.3.2.6 Alt.	206	Electronic Parts/Circuits Tolerance Analysis	ENG	NA	NA	G	GC
4.3.4 Alt.	207	Parts Program	ENG	S	S(2)	G(2)	G(2)
4.3.7 Alt.	208	Reliability Critical Items	MGT	S(1)	S(1)	G	G
4.3.9	209	Effects of Functional Test- ing, Storage, Handling, Packaging, Transportation and Maintenance	ENG	NA	S(1)	G	GC
4.3.10.3	301	Environmental Stress Screening (ESS)	ENG	NA	S	G	G
4.3.10.4	302	Reliability Development/ Growth Testing	ENG	NA	S(2)	G(2)	NA
4.3.10.6 Alt.	303	Reliability Qualification Test (RQT) Program	ACC	NA	S(2)	G(2)	G(2)
4.4.4.6d	304	Production Reliability Acceptance Test (PRAT) Program	ACC	NA	NA	S	G(2)

TABLE B-3 (Continued)
MIL-STD-785 Application Matrix

CODE DEFINITIONS

TASK TYPE:

- ACC - Reliability Accounting
- ENG - Reliability Engineering
- MGT - Management

PROGRAM PHASE:

- S - Selectively Applicable
 - G - Generally Applicable
 - GC - Generally Applicable to Design Changes only
 - NA - Not Applicable
- (1) Requires considerable interpretation of intent to be cost effective
 - (2) MIL-STD-785 is not the primary implementation requirement. Other MIL-STDs or statement of work requirements must be included to define the requirements.

DOD-STD-2107 (Navy)
Appendix B

TABLE B-4

DOD-STD-45662 Application Matrix

DOD-STD-2107 (Navy)		Applicability*		
Paragraph No.	Requirement	Demonstration & Validation	Full-Scale Development	Production
4.1	General	M	M	M
4.2	Quality assurance provisions	M	M	M
5.1	Calibration system description	C	M	M
5.2	Adequacy of standards	C	M	M
5.3	Environmental controls	C	M	M
5.4	Intervals of calibration	C	M	M
5.5	Calibration procedures	C	M	M
5.6.1	Evaluation of suspect product	C	M	M
5.6.2	Evaluation of calibration system accuracy	C	M	M
5.7.1	Domestic contracts (calibration sources)	M	M	M
5.7.2	Foreign contracts (calibration sources)	C	C	C
5.8	Application and records	C	M	M
5.9	Calibration status	C	M	M
5.10	Control of subcontractor calibration	M	M	M
5.11	Storage and handling	M	M	M
5.12	Amendments and revisions	M	M	M

*Applicability Codes: C-Conditional; M-Highly Recommended; NA- Not Applicable

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER DOD-STD-2107 (NAVY)		2. DOCUMENT TITLE PRODUCT ASSURANCE PROGRAM REQUIREMENTS FOR CONTRACTORS	
3a. NAME OF SUBMITTING ORGANIZATION		4. TYPE OF ORGANIZATION (Mark one)	
b. ADDRESS (Street, City, State, ZIP Code)		<input type="checkbox"/> VENDOR <input type="checkbox"/> USER <input type="checkbox"/> MANUFACTURER <input type="checkbox"/> OTHER (Specify): _____	
5. PROBLEM AREAS			
a. Paragraph Number and Wording:			
b. Recommended Wording:			
c. Reason/Rationale for Recommendation:			
6. REMARKS			
7a. NAME OF SUBMITTER (Last, First, MI) - Optional		b. WORK TELEPHONE NUMBER (Include Area Code) - Optional	
c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional		8. DATE OF SUBMISSION (YYMMDD)	

(TO DETACH - FORM CUT ALONG THIS LINE.)

DD FORM 1426
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PREVIOUS EDITION IS OBSOLETE.