MIL-STD-790D
30 MAY 1986
SUPERSEDING
MIL-STD-790C
18 APRIL 1968

MILITARY STANDARD

RELIABILITY ASSURANCE PROGRAM FOR ELECTRONIC PARTS SPECIFICATIONS

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DEPARTMENT OF DEFENSE
Washington, DC 20301

Reliability Assurance Program for Electronic Parts Specifications

MIL-STD-790D

1. This military standard is approved 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: Commander, Space and Naval Warfare Systems Command, ATTN: SPAWAR 8111, Washington, DC 20363-5100, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FOREWORD

In implementing the Parts Specification Management for Reliability Report (PSMR-1), issued by the Department of Defense in May 1960, it was determined that a manufacturer must provide evidence of (a) adequate production and test facilities, and (b) sound procedures for process control. During the preparation and coordination of the established reliability specifications, the need for guidelines to assure uniform evaluation of manufacturers' reliability assurance programs was recognized. This standard was developed to provide such guidelines.

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1. SCOPE

1.1 Purpose. This standard is for direct reference in electronic parts established reliability (ER) specifications and establishes the criteria for electronic parts reliability assurance program which are to be met by manufacturers qualifying electronic parts to the specifications.

1.2 Application. This standard is applicable when:

a. Referenced in ER specifications where attainment of specified failure rate levels and assurance of homogeneity of parts require control of production facilities, materials, and processes.

b. The qualifying activity evaluates, accepts, and monitors the reliability assurance program as a requisite for electronic part qualification approval.

2. REFERENCED DOCUMENTS

2.1 Government documents.

2.1.1 Standards. Unless otherwise specified, the following standards of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation, form a part of this standard to the extent specified herein.

STANDARDS

FEDERAL

FED-STD-209 - Clean Room and Work Station Requirements, Controlled Environment.

MILITARY

MIL-STD-721 - Definitions of Effectiveness Terms for Reliability, Maintainability, Human Factors, and Safety.

MIL-STD-45662 - Calibration Systems Requirements.

(Copies of the standards required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Order of precedence. In the event of a conflict between the text of this standard and the references cited herein, the text of this standard shall take precedence.

3. DEFINITIONS

3.1 Reliability terms. The definitions of all reliability terms used herein are as provided in MIL-STD-721, with the exception and addition of the following:

a. Assembly plant. A plant established by a manufacturer or operated by a distributor authorized by the manufacturer to perform specified functions pertaining to the manufacturer's identified qualified products in accordance with specified assembly procedures, test methods, processes, controls, and storage, handling, and packaging techniques.

b. Defect analysis. The process of examining technical or management (nontechnical) data, manufacturing techniques, processes, or materials to determine the cause of variations of electrical, mechanical, or physical characteristics outside the limitations established at any manufacturing checkpoint.

c. Distributor, category A. An organization contractually authorized by a manufacturer to store, repack, and distribute completely finished parts. These parts shall have been inspected by the manufacturer to all of the requirements of the ER specification.

d. Distributor, category B. An organization contractually authorized by a manufacturer to perform one or more final operations on uncompleted parts. These parts shall have been inspected by the manufacturer to all of the requirements of the ER specification prior to shipment to the distributor.

e. Distributor, category C. An organization contractually authorized by a manufacturer to perform one or more assembly operations on uncompleted parts which shall be inspected by the distributor to all the requirements of the ER specification. Category C distributors shall be considered as an assembly plant of the manufacturer (see 3.1a), and shall be treated as such on the QPL.

f. Electronic parts. Basic circuit elements which cannot be disassembled and still perform their intended function, such as capacitors, connectors, filters, resistors, switches, relays, transformers, crystals, electron tubes, and semiconductor devices.

g. Established reliability. A quantitative maximum failure rate demonstrated under controlled test conditions specified in a military specification and usually expressed as percent failures per thousand hours of test.

h. Failure activating cause. The stresses or forces, thermal, electrical shock, vibration, etc., which induce or activate a failure mechanism.

i. Failure analysis. The process of examining electronic parts to determine the cause of variations of performance characteristics outside of previously established limits with the end result that failure modes, failure mechanisms and failure activating causes will be identified.

j. Failure mechanism. The process of degradation or chain of events which results in a particular failure mode.

k. Failure mode. The abnormality of an electronic part performance which causes the part to be classified as failed.

l. Inspection lot. A group of electronic parts offered for inspection at one time and in combinations authorized by the applicable ER specification.

m. Manufacturer. The actual producer of electronic parts.

n. Production lot. A group of electronic parts manufactured during the same period from the same basic raw materials processed under the same specifications and procedures, produced with the same equipment, and identified by the documentation defined in the manufacturer's reliability assurance program through all significant manufacturing operations, including final assembly operations. Final assembly operations shall be considered the last major assembly operations such as casing, hermetic sealing, or lead attachment rather than painting or marking.

o. Qualification. The entire procedure by which electronic parts are examined and tested to obtain and maintain approval at specified failure rate levels, and then identified on the qualified products lists.

p. Qualifying activity. The military preparing activity or its government agent delegated to administer the qualification program.

q. Reliability assurance. The management and technical integration of the reliability activities essential in maintaining reliability achievements, including design, production and product assurance.

r. Quality assurance. Activities used to establish a degree of certainty that the quality function was performed adequately.

s. Quality control operations. The regulatory processes during manufacture through which actual quality performance is measured and compared with standards and the difference is acted upon.

t. Reliability. The probability of a military product performing, without failure, its military function under given environmental and load conditions for a specified period of time.

u. Sub-assembly manufacturer. A manufacturing facility, owned by the manufacturer qualifying a product and authorized, by both him and the qualifying activity, to perform manufacturing steps in accordance with processing procedures contained in the program plan.

4. GENERAL REQUIREMENTS

4.1 Reliability assurance program.

4.1.1 General. The reliability assurance program shall integrate all designing, planning, manufacturing, inspecting, and testing functions related to the manufacture and distribution of electronic ER parts. The program shall be tailored to the type of part and the peculiarities of the manufacturer's over-all method of operation, but as a minimum, comply with the requirements specified in section 5 and appendix A.

4.1.2 Program plan.

4.1.2.1 Basic plan. The manufacturer shall document a reliability assurance program plan in a manner adequate to demonstrate compliance with section 5 of this standard or intent to comply prior to receipt of qualification approval. When the program plan indicates intent to comply, the documentation shall include an implementation schedule. One program plan shall be required by a single manufacturing facility. The program plan shall include the manufacturer's interpretation of how each requirement of this standard shall be implemented. The program plan, after acceptance by the qualifying activity, shall constitute the requirements to be met by the manufacturer insofar as they relate to the reliability assurance program.

4.1.2.2 Supplemental plans. If more than one electronic part is to be qualified, supplements to the basic program plan (including subdivisions or deviations) shall be prepared. Where distributors, either categories A, B, or C, are authorized by the manufacturer to market ER parts (see 5.1.6) a supplemental plan shall be prepared which describes in detail the entire function performed by the distributor, the controls invoked by the manufacturer and the methods of implementing and monitoring these controls. The controls and requirements shall be such as to assure the product sold by the distributor is of the same quality and performance as parts acquired directly from the manufacturer. The manufacturer shall be responsible for imposing all ER requirements consistent with this standard on distributors and shall be responsible for all of the manufacturers ER parts sold by the distributor which do not meet specification requirements. The manufacturer shall identify each authorized distributor and the function each distributor is authorized to perform. Supplemental plans shall contain the following information:

a. Category A distributor - The storage, packing, handling, and distribution requirements complying with 5.2.11 and 5.2.14 shall be described.

b. Category B distributor - The following shall be described:

(1) The operations, tests and inspections the distributor is authorized to perform.

(2) Controls to assure that only inspected or tested and qualified parts are marked or processed by the distributor.

(3) Selection and inspection of sample units from each of the authorized distributors by the manufacturer in accordance with the applicable ER specification periodic inspection requirements.

(4) Compliance by the authorized distributor with all requirements of section 5, except 5.1.3, 5.1.4, and 5.2.4b.

(5) Procedures for submission of failed parts and failure reports to the manufacturer.

(6) When the distributor is authorized to mark the part, a code symbol is to be added to the modified part. This shall be developed in conjunction with the original part manufacturer's identification so that the organization making the modification can be identified. The original part manufacturer's identification shall be included to indicate the manufacturer responsible for product failure analysis, corrective action, and lot identification.

c. Category C distributor - The following shall be described:

(1) Requirements imposed on the distributor's assembly plant by the manufacturer as a prerequisite for authorization.

(2) The operations, tests and inspections the authorized distributor's assembly plant shall perform.

(3) Controls to assure that qualified parts marked or processed by the distributor's assembly plant are inspected and to meet applicable specification requirements.

(4) Procedures for incorporating distributor's assembly plant inspection data with that of the manufacturers.

(5) Compliance by the authorized distributor's assembly plant with all requirements of section 5, except 5.1.3, 5.1.4, and 5.2.4b.

(6) Procedures for submission of failed parts and failure reports to the manufacturer.

(7) When the distributor's assembly plant is authorized to mark the part, a code symbol shall be added to the modified part. This shall be developed in conjunction with the original part manufacturer's identification so that the organization making the modification can be identified. The original part manufacturer's identification shall be included to indicate the manufacturer responsible for product failure analysis, corrective action, and lot identification.

4.1.3 Program review and acceptance.

4.1.3.1 Review. The manufacturer shall prepare program documentation as required by this standard and demonstrate to the qualifying activity that the program is being administered in accordance with the documentation, prior to qualification and semi-annually thereafter. The qualifying activity shall audit the manufacturer's compliance with the program prepared to the requirements of this standard. Reaudits can be extended to a 12-month period at the discretion of the qualifying activity provided compliance with program requirements has been satisfactorily demonstrated during the last four previous audits. Any audit of the manufacturer's subsidiaries, authorized distributors, and authorized distributor's assembly plants shall be performed through and in conjunction with the manufacturer only. (The program plan shall indicate that agreements exist between the manufacturer and distributors or distributor's assembly plants authorizing such audits.)

4.1.3.2 Acceptance. The qualifying activity is responsible for determining if the manufacturer's reliability assurance program meets the requirements of this standard. The reliability assurance program, once accepted, must be agreed to with the qualifying activity, as stated in the plan, to retain qualification.

5. DETAILED REQUIREMENTS

5.1 Documentation submission. The reliabilty assurance program documentation specified in 5.1.1, 5.1.2, and 5.1.6 herein shall be submitted to the qualifying activity as a prerequisite for qualification. All documentation specified herein shall be a continuing requirement for retention of qualification approval.

5.1.1 Organizational structure. The responsibility and authority assigned to each organization for reliability assurance shall be defined and documented to include the following:

a. A diagram of the relationship of key organizational blocks. The organization responsible for reliability assurance management shall have a direct line of communication with the top management of the manufacturing facility. (In particular, the chart shall identify the organizational segment responsible to management for overall reliability assurance, and shall clearly define the responsibility and authority for both policy and action. The chart shall show the relationship between line and service organizations, and staff and policy organizations responsible for reliability assurance.)

b. A statement delineating lines of authority and responsibility.

5.1.1.1 Organizational structure changes. Any changes affecting the reliability organizational structure shall be reflected in the corresponding documentation and forwarded to the qualifying activity within 30 days after such an occurrence.

5.1.2 Test facilities. The manufacturer shall identify the test facilities and tabulate a list of equipment used for qualification and quality conformance inspection of the established reliability parts.

5.1.3 Failure analysis reports. A summary of written reports based on the required program covering analyses of failures as defined in 5.2.4b other than those reported by equipment contractors shall be submitted to the qualifying activity on a 6-month basis. For failures reported by equipment manufacturers or in the field, such action shall be taken within 30 days after receipt of parts and supporting data. The analysis of parts which fail while in possession of an equipment contractor shall be by agreement between the manufacturer and the equipment contractor. At the request of the qualifying activity, a detailed failure analysis report shall be submitted to the qualifying activity regarding a particular failure.

5.1.3.1 GIDEP alerts. All pending GIDEP alerts shall be reported to the qualifying activity by the manufacturer prior to issuance.

5.1.4 Corrective action evaluation test procedures and reports. The manufacturer shall submit corrective action evaluation test procedures and test results as appropriate when corrective actions (see 5.2.5) have been initiated.

5.1.4.1 Preparation of evaluation test procedure. The manufacturer shall specify environmental, electrical, mechanical, and numerical studies to be used in evaluating the adequacy of proposed corrective action. The test procedure shall also be designed to reveal any undesirable side effects that may occur as a result of the proposed changes in procedures, manufacturing methods, or controls. The test procedure shall be submitted to the qualifying activity concurrently with the evaluation test report.

5.1.4.2 Evaluation test report. All test results, conclusions, and recommendations shall be submitted to the qualifying activity within 10 working days after completion of the evaluation. The qualifying activity shall notify the manufacturer of acceptance or institute disqualification procedures within 10 days.

5.1.5 Corrective action implementation. The manufacturer shall forward the following information when the proposed corrective action has been accepted by the qualifying activity:

a. The date on which a corrective action becomes effective for the part to be submitted for quality conformance inspection.

b. The identification of the affected documents including the effective revision coding.

c. The first lot number incorporating the corrective action.

5.1.6 Distributor organizations. The manufacturers shall identify each authorized distributor or distributor's assembly plant, the function each organization is authorized to perform, and the authorized address at which the functions are performed. Any change in functions or the addition or deletion of a distributor or a distributor's assembly plant shall be reported to the qualifying activity within 10 days after such an occurrence.

5.2 Program implementation. Documentation specified herein shall be retained in the manufacturer's plant and shall be made available at the manufacturer's plant upon request by the qualifying activity. Documentation shall be dated and shall substantiate that the reliability assurance program, as defined by the manufacturer, has been implemented and is effectively being maintained.

5.2.1 Training. The manufacturer shall describe, conduct, and maintain a reliability-oriented training program to cover all phases of his activity involved in producing reliability assured production parts. The type and extent of training shall be determined by the manufacturer, and shall be related to, and consistent with, the failure rate level for which qualification is sought. Each individual shall be retested or retrained (or both) at the end of a designated period or when personnel performance indicates poor proficiency. Personnel shall not be used in critical processes or inspections until the required level of proficiency has been demonstrated. The training program should include a continual work and workmanship training program for personnel involved with part design, production, inspection, handling, and testing.

5.2.1.1 Training records. Records shall be maintained and reviewed annually to indicate the type of training presented, the dates when training was presented, and the groups represented in the training sessions.

5.2.2 Calibration. Each instrument used to measure or control production process or to measure the acceptability of parts under test shall be calibrated in accordance with MIL-STD-45662. In addition, the following shall apply:

a. A scheduling system shall be maintained to assure that calibration is accomplished according to a predetermined schedule, and that instruments due for calibration are removed for service on or before the calibration due date.

b. Calibration for local primary standards shall not exceed 1 year except when the manufacturer can document a calibration history for each standard which demonstrates stability over a period of not less than 5 years. The qualifying activity will grant a longer calibration period under these conditions of up to 2 years. The extension will apply only to identified local primary standards and the extension will be withdrawn if the standard is damaged, repaired, or replaced. The extension does not apply to secondary or lower standards or any electronic measuring instruments utilized in quality measurements or production. Local primary standards shall be traceable to NBS.

c. Records shall cover the scheduled calibrated intervals as determined for each equipment item, the dates of completion of actual calibration, identification of the group performing the calibration, and certification of the compliance of the equipment with documented requirements after calibration.

5.2.3 Proprietary processes and procedures. The qualifying activity shall have access to all areas of the manufacturer's plant for the purpose of verifying implementation of the program plan. Proprietary processes and procedures shall be documented to include the name, number, release date, and latest revision date. However, the documents need not be submitted to the qualifying activity for review; but upon specific request, the manufacturer's designated official shall certify to the qualifying activity that the proprietary operations are defined and controls are specified.

5.2.4 Failure and defect analysis programs. The manufacturer shall describe and maintain failure and defect analysis programs which should result in corrective action to reduce part failures and defects to an acceptance level. Procedures for such analyses shall include the following:

a. Defect analysis of in-process material or parts when records indicate a critical process is not within the manufacturer's prescribed limits.

b. Failure analysis of parts when failures exceed the number allowed by the specification in qualification and quality conformance inspections or which have failed during field use (see 5.1.3). If, subsequent to identification of a failure mechanism, similar failures occur on a series of parts which are attributed to the same mechanism, analysis is required as a minimum on the first two parts.

5.2.4.1 Failure reporting. The manufacturer shall describe and maintain a failure recording and reporting system for parts which have failed during qualification or quality conformance inspections or while in use in equipment. The system shall provide for at least the following:

a. The operating or test conditions under which the part failed, including environmental exposure levels, if known.

b. The source from which the failed part was received.

c. Verification of the reported condition of the failed part by the manufacturer's personnel responsible for production, inspection, quality, or engineering.

d. The length of time the part has been operating if it failed in life testing. Compliance with ER failure rate levels shall be calculated in accordance with the governing specification.

5.2.4.2 Failure and defect analyses records. The manufacturer shall establish a form to record the results of failure and defect analyses. Records shall be maintained which substantiate the failure and defect analyses performed and shall provide for at least the following:

a. The results of analyses.

b. The probable failure activating cause when possible.

c. Recommended corrective action, if any.

d. Include signature by responsible authority.

Failure analysis records shall be retained in files located in a central facility for a minimum of 3 years following the last similar failure. Defect analysis records shall be held for the period determined by the manufacturer.

5.2.4.3 Failure and defect analysis capabilities and facilities. The manufacturer shall have, either as part of his facilities or as a defined contractual arrangement with qualified laboratories outside of his facilities, the following capabilities, as applicable to the product. Such additional equipment as is required for proper failure and defect analysis shall be available. The following list is furnished as guidance indicating the degree of capability of analysis:

a. Radiographic techniques with adequate photo or electronic magnification.

b. Equipment for dissecting the failed parts without damaging or destroying the internal details or introducing contaminants when opening hermetically sealed electronic parts.

c. Detailed chemical analysis.

d. Microscopic inspection and measuring techniques, including the full range of magnification powers required to satisfactorily evaluate the product.

e. Mass spectrometer, radioactive tracer gas equipment, or similar sensitive leak detection apparatus for performing fine seal-leak tests on those parts which are hermetically sealed.

f. Bubble chamber or similar facilities for performing gross seal-leak tests on those parts which are hermetically sealed.

g. Fluorescent-dye penetrant inspection and detection techniques for gross seal-leak testing of hermetically sealed parts.

h. Polarized-light inspection techniques to detect and analyze strains and incipient failure in glass, glazed surfaces, and similar possible seal defects.

i. Adequate mechanical inspection and measuring equipment to check tolerances and other possible dimensional discrepancies with sufficient precision to prove the assembly of the parts.

j. Electrical-measuring instrumentation necessary to analyze failure characteristics such as electrical leakage.

k. The necessary chemical-extraction equipment to detect foreign ions, or other internal contaminants which may cause degradation of the parts and materials used in the parts.

l. Facilities for metallographic examination, including mounting, grinding, polishing and etching equipment for sample preparation.

5.2.5 Corrective plan-of-action. Where failures or defects are greater than the prescribed limits, the manufacturer shall prepare a plan or recommendation for corrective action. Corrective action recommendations for performance failures shall include failure mode information when established and shall be supported by verifying data, or a proposed evaluation test plan. Corrective actions on parts covered by the specification shall not be made without approval from the qualifying activity, except those actions which consist only of improvements in control procedures. Corrective action affecting control procedures shall not be implemented for production until approved by qualified personnel responsible for the engineering, quality control, and reliability functions of the manufacturer.

5.2.5.1 Production of prototype parts for evaluation. Prototype parts for change evaluation shall be produced on the controlled production line to the point at which the proposed corrective change must be made; the change shall then be effected; and the changed prototype parts shall then be continued through the balance of the normal series of production operations. Changes incorporated in the prototype parts shall be effected in a manner so as not to change production parts or processes until the prototype parts are made and tested, and the change accepted by the qualifying activity.

5.2.6 Clean rooms. Where process controls include the requirements of a clean room, design and operation of the clean room shall be based on Federal Standard 209. The proper class shall be specified by the manufacturer's design activity in the process specification.

5.2.7 Description of production processes and controls. The manufacturer shall prepare and maintain a detailed description of the production processes, steps, and controls applied to parts currently produced and proposed for inclusion in this program. Requirements and tolerances shall be specified for all critical environments and utilities which come in contact with the production and test of established reliability parts. All documentation and its interrelationships shall be identified in flow chart form. When applicable, documentation shall include such items as:

a. List of process control equipment and records of periodic calibrations.

b. Control of chemical purity and ionization of water.

c. Known composition of all gases and chemicals, including degree and type of contamination, used in the processes and control of fabrication.

d. Definition of maximum permissible variations in voltage used in the processes or supplied to the test equipment which may introduce errors or variations in the performance or inaccuracies in test data.

e. Definition of clean rooms or other controlled atmospheric requirements.

f. Process specifications showing process tolerances.

g. Detailed engineering specification requirements covering specific types of parts.

h. Identification of each inspection operation for receiving inspection, inspection during manufacture, inspection of completed parts including related sampling plans, and inspection tolerances.

i. Procedures for forming quality conformance inspection lots which will comply with ER part specification criteria.

j. Procedure for identification of each production lot through all significant manufacturing operations, including final assembly operations such as casing, hermetic sealing, or lead attachment. Alternately, where this procedure is impractical (e.g., where a part cannot be identified until after final assembly and determination of its performance characteristics), the manufacturer shall as a minimum be able to identify the time period during which the final production operation was performed on each item of product prior to final test. The date or lot code marked on each part shall be identified to a production lot.

5.2.8 Acquisition and production control documentation. The manufacturer shall identify by name, number, release date, and latest revision date all documents used in the acquisition and processing of materials, production of parts, and methods of product assurance. This documentation shall include purchase, process, and test specifications, internal procedures, and controls for the application of such documents. These records shall be kept for at least 5 years.

5.2.9 Process control. Records shall cover the implementation of devices such as control charts (e.g., $\bar{X}$ bar and R charts) or other means of indication of the degree of control achieved in the production process. Records shall also indicate the action taken when each out-of-control condition is observed, and the disposition of non-conforming products processed during the period of out-of-control operation. Records associated with non-conforming products shall be kept for a minimum of 3 years.

5.2.10 Inspection of incoming materials and work in-process. Inspection operations shall be documented as to the type of inspection, the materials group inspected, the sampling and test procedures, the date of completion of inspection, the amount of material tested, acceptance rejection criteria and frequency of inspection.

5.2.11 Handling and packaging procedures. Handling procedures shall be established to provide physical protection of material during all sequences of production and inspection. Assembled parts shall be physically protected during testing and quality conformance inspections. Handling and packaging procedures shall be prepared to cover storage of ER parts in a controlled storage area, their removal from the area, and their preparation for shipment.

5.2.12 Materials.

5.2.12.1 Incoming, in-process, and outgoing inventory control. The methods and procedures shall be documented which are used to control storage and handling of incoming materials, work in-process, and warehoused and outgoing product in order to achieve such factors as age control of limited-life materials, and prevent inadvertent mixing of conforming and nonconforming materials, work, or finished product. Each area shall maintain identity of work in-process to facilitate access by Government Source Inspectors. Procedures shall be prepared and maintained for controlling the receipt of acquired materials and supplies. The procedures shall provide the following:

a. Withholding received materials or supplies from use pending completion of the required inspection or tests, or the receipt of necessary reports.

b. Segregation and identification of nonconforming materials and supplies from conforming materials.

c. Identification and control of limited-life materials and supplies.

d. Identification and control of raw materials.

e. Assurance that the required test reports, certification, etc., have been received.

f. Clear identification of materials released from receiving inspection and test to clearly indicate acceptance or rejection status of material pending review action.

5.2.12.2 Conforming materials. The manufacturer shall maintain a positive system of identifying the inspection status by means of stamps, tags, routing cards, or other control devices. In controlling the status of materials, the manufacturer shall establish suitable controls to assure that identification of status is applied under the jurisdiction of authorized inspection personnel.

5.2.12.3 Nonconforming materials. Nonconforming materials shall be controlled by a positive system of identification to prevent their inadvertent use or intermingling with conforming materials.

5.2.12.4 Material traceability. Conforming materials shall be identified upon receipt and, where possible, throughout the production process to the accepted product. Where another basis of ER part production lot identification (e.g., the time period during which certain operations are performed) is used, the accepted product shall be identified with the appropriate production lot, and records of conforming material batches or lots used in each production lot shall be maintained. Completed parts shall be identified to permit positive correlation to the production lot.

5.2.13 Product traceability. The traceability system shall be maintained such that the qualifying activity can trace and determine that the qualified product passed the applicable screening, qualification, and quality conformance inspections.

5.2.14 Controlled storage area. The manufacturers shall describe the procedures and controls which will be used to maintain a separate storage area (e.g., specially marked containers, special cabinets, or stockroom) for parts that have passed the reliability assured production specification quality conformance inspections. Such an area shall be maintained and no other parts shall be permitted in this area.

5.2.15 Quality control operations. Quality control operations shall be documented as to type, procedures, records, and frequency of use.

5.2.16 Quality assurance operations. Quality assurance operations shall be documented as to type, procedures, equipment, judgement and action criteria, records, and frequency of use.

5.2.17 Manufacturing flow chart. The flow chart for all devices shall reflect the complete manufacturing processes being used at the time and shall show all manufacturing, inspection, testing and quality verification points, and the point where all materials or subassemblies enter the flow. The chart will identify all documents pertaining to the production processes, quality control parts, and production controls which were used. The documents will be identified by name and number (see figure 1).

5.2.18 Manufacturer's internal audit activities. The manufacturer's internal audit activity shall be included in the program plan (see Appendix A). This plan shall identify key review areas, their frequency of audit, and the corrective action system to be employed when variations from approved procedures or specification requirements are identified.

5.2.19 Sub-assembly manufacturer. Self-audit program shall be imposed on subcontractors by the manufacturer.

5.2.20 Production line audits. Qualifying activities shall ensure that the conformance of the process flow and control documentation for each production line in a manufacturer's facility are checked by auditing, at least biannually. This does not preclude the performing of reaudits in accordance with 4.1.3.1 herein.

6. NOTES

6.1 General. The information outlined in this section is intended to be explanatory and does not represent direct requirements of the standard.

6.2 Documentation. With regard to the documentation required by section 5, it should be noted that only documentation required by 5.1.1, 5.1.2, 5.1.3, 5.1.4, and 5.1.5 must be submitted to the qualifying activity.

6.2.1 Organizational structure. While the qualifying activity cannot approve an organizational structure, it is essential that the qualifying activity continually be aware of the relationship of the organizations responsible for the management of the reliability assurance program.

6.2.2 Facilities. The applicability of the procedures documented under 5.2 should be identified to the production areas and inspection or test facilities. This may be accomplished by a very simple floor layout plan or similar documentation.

6.2.3 Corrective action evaluation test procedures and reports. In accordance with DoD 4120.3-M, the source listed on the QPL must notify the qualifying activity of any change affecting the design of the qualified product. Availability of test procedures and reports to the qualifying activity will minimize the necessity to require requalification tests.

6.3 Changes from previous issue. Vertical lines or asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

APPENDIX A

SELF-AUDIT REQUIREMENTS

10. SCOPE

10.1 Scope. This appendix contains details for implementation of the minimum requirements to be used in the manufacturer's self-audit program. The intent of this self-audit program is to assure continued conformance to military specification requirements. This appendix is a mandatory part of the standard. The information contained herein is intended for compliance.

20. REFERENCED DOCUMENTS

Not applicable.

30. GENERAL

30.1 Self-audit program. The manufacturer shall have an independent self-audit program under the direction of the quality assurance department to assess the effectiveness of the manufacturer's quality assurance system. The self-audit shall identify any deficiencies for resolution in the processing, testing, or deviations from specification requirements.

30.2 Self-audit representatives. The manufacturer's quality assurance representative or his designated appointees shall perform all self-audits. The designated auditors shall be independent from the areas audited. If an independent auditor is not available or impractical, then another individual should be assigned to participate in the audit or review the results with the auditor from the area. The auditors shall be trained in the area to be audited, in the applicable military specification requirement and provided with an appropriate checklist for annotating deficiencies. Prior to the audit, the assigned auditor shall review the previous checklist to assure corrective actions have been implemented and are sufficient enough to correct the deficiencies.

30.3 Audit deficiencies. All audit deficiencies shall be documented on the appropriate checklist and a copy submitted to the department head for corrective actions. All corrective actions shall be agreed to by the manufacturer's quality department prior to implementation.

30.4 Audit follow-up. All audit reports will be filed and monitored by the quality department. The quality department shall establish a procedure to follow-up on all audit deficiencies to assure the corrective actions have been implemented in a timely manner.

30.5 Audit schedules. The original audit frequency shall be established by the quality department but in no case exceed 1 year for each area, unless authorized by the qualifying activity. Changes to the frequency of audit shall require approval of the quality department.

30.6 Self-audit report. The self-audit report shall be available for review by the government auditor during qualification reaudit. Manufacturer shall keep the self-audit report on file for a minimum of 3 years. The manufacturer shall make available to the qualifying activity, during reaudits, all corrective actions taken as a result of the self-audit. The qualifying activity will require the modification of the frequency of the self-audit or require additional testing based on the data from the self-audit.

APPENDIX A

30.7 GENERAL

30.7.1 Self-audit requirements. The audit shall include, but not be limited to, all of the items on the checklist in table I. The results of any additional items that are assessed shall be added to the checklist for record purposes. The following is an explanation of the minimal requirements that every manufacturer must meet.

a. Manufacturer must have a diagram of their organizational structure, which includes the relationship between key organizations. This chart shall clearly define the responsibility and authority for both policy and action (see 5.1.1).

b. Manufacturer must have a manufacturing flow chart that contains every process performed, every quality control station, and the internal document control number pertaining to each (see 5.2.7).

c. It must be verified that the manufacturer's manufacturing and quality documentation control system is being adequately maintained. This means tracing document status all the way from responsible authority to its location on the production line (see 5.2.8).

d. Incoming inspection area shall be examined to determine that the conforming and nonconforming materials are segregated. Traceability must be from the finished product traveler to the incoming inspection reports (see 5.2.12). Adherence to applicable material specifications and standards in section 2 of the military specification shall be verifiable.

e. Manufacturing travellers must be checked to determine that they are being filled out and signed off at every step of the production and test stages. A sample review of past travellers is necessary to verify they have been doing it all along. Make sure that all significant steps of the process are included on the traveller (see 5.2.7j). If part of group A is performed in production testing, the manufacturer is still required to easily produce data from group A tests for each inspection lot.

f. Logs on voltage and temperature checks in ovens and chambers, life and burn-in start and stop times, etc., must be in place and filled in.

g. Voltages and temperatures must be checked at least once a week on life test ovens.

h. Overvoltage and thermal runaway protections on reliability life test chambers should be utilized (see 5.2.7.d).

i. Environmental controls shall be maintained and monitored as required in the military specification or standard that is applicable.

j. All instructions (e.g., setting equipment, testing, and handling) must be signed, dated, and part of documentation control system. Operators must follow instructions for procedures (see 5.2.8).

k. Process control records will be reviewed to verify that they are being utilized and that process corrections are implemented when a need is indicated by the control charts (e.g., X bar and R charts) (see 5.2.9).

l. Manufacturer must verify that records indicate what actions are to be taken when out-of-control conditions are observed. Records must also show the disposition of non-conforming products (see 5.2.9).

m. Manufacturer shall describe and maintain failure and defect analysis programs which should result in corrective actions to reduce part failures and defects to acceptable level (see 5.1.3, 5.1.4 and 5.2.4).

n. A sample of production processes and controls must be audited to determine that operators are indeed following the steps outlined in the production and test documents (see 5.2.8).

o. It must be determined that distributors are being controlled to assure that the product sold by the distributor is of the same quality and performance as parts acquired directly from the manufacturer (see 4.1.2.2).

p. The calibration system must always be checked (see 5.2.2).

q. Compliance to specification test requirements shall be clearly shown on internal control documents.

r. The manufacturer must be required to demonstrate the ability to perform the tests required by the specificaion. During the demonstration, the auditor should verify that the equipment is producing a readable output.

s. The manufacturer shall describe, conduct, and maintain a reliability-oriented training program to cover all phases of his activity involved in producing reliability assured production parts (see 5.2.1). Training records shall be maintained to indicate the type of training presented, the dates when training was presented, and the groups represented in the training sessions (see 5.2.1.1).

t. Both the original and altered data must be readable. When changes are made the entry must be initiated and all entries must be permanent (ink).

APPENDIX A

TABLE I. Audit requirements check list.

Requirements	Satisfactory	Unsatisfactory	Comments
a. Diagram of organizational structure			
b. Manufacturing flow chart contains:	XX	XX	
(1) Every process performed			
(2) Every quality control station			
(3) Internal document control number pertaining to each			
c. Maintain document control system			
d. Incoming inspection:	XX	XX	
(1) Segregation conforming and nonconforming material			
(2) Traceability			
(3) Adherence to material specifications			
e. Travellers:	XX	XX	
(1) Contains all steps of manufacturing process			
(2) Being filled out and signed off			
(3) Time in and time out must be on each traveller when tests require it			
f. Logs on voltage and temperature checks in ovens and chambers			
g. Voltages and temperatures checked at least once a week on life test			
h. Overvoltage and thermal runaway protectors			
i. Environmental control			

TABLE I. Audit requirements check list - Continued.

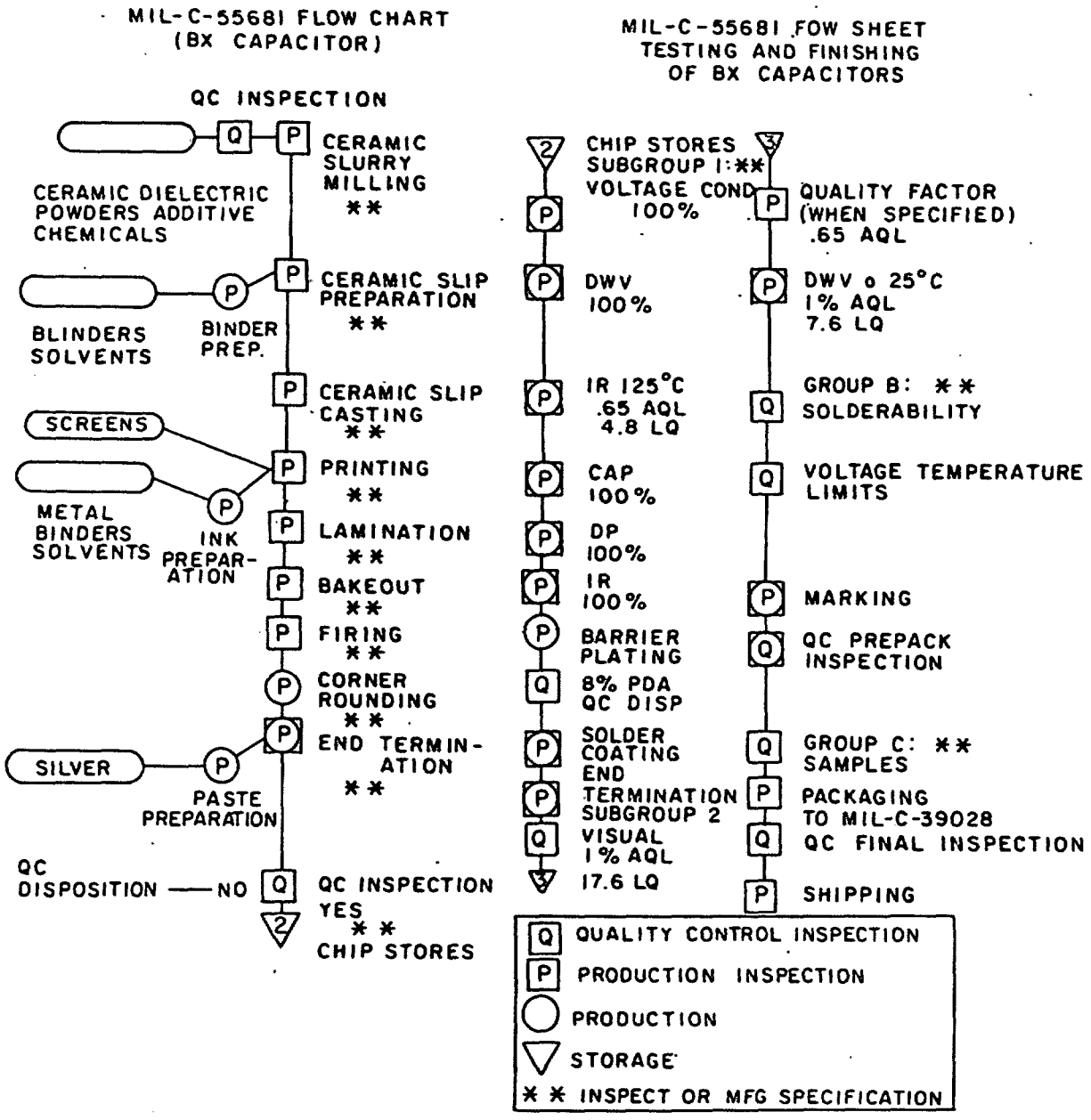
Requirements	Satisfactory	Unsatisfactory	Comments
j. Operating instructions:	XX	XX	
(1) Operators must use controlled document for procedures			
(2) No informal instructions			
k. Review process control records			
l. Records must show actions to be taken during out-of-control conditions			
m. Failure and defect analysis programs:	XX	XX	
(1) Must have documented program			
(2) Written report submitted every six months			
(3) Submit corrective action evaluation			
n. Check that operators are following controlled documents			
o. Distributors are being controlled			
p. Calibration system checked			
q. Cross-reference requirement paragraph onto internal control document			
r. Ability to perform required tests			
s. Training: (1) Training program for production personnel (2) Training records maintained	XX	XX	
t. All original entries readable and initiated when changed			

Signature of Quality Manager_____ Date_____

COMPANY ABC

SPECIFICATION MIL-C-55681 PROCESS FLOW CHART

NUMBER 55681 REV. N/A



NOTES:
1. Specification revisions and dates must be current at the time of audit. This information need not be placed on the flow chart. However, this information must be made available to the verification team during the audit.
2. This flow chart is not complete and is used as an example to show the type of information which shall be included. Different symbols can be utilized if defined.

FIGURE 1. Typical process flow chart.

Custodians:
Army - CR
Navy - EC
Air Force - 11

Review activities:
Army - AR, MI
Navy - AS, OS, SH
Air Force - 17, 19, 99
DLA - ES

User activities:
Navy - CG, MC

Preparing activity:
Navy - EC

Agent:
DLA - ES

(Project RELI-0046)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-STD-790D	Reliability Assurance Program for Electronic Parts Specifications

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR
b. ADDRESS *(Street, City, State, ZIP Code)*	☐ USER
	☐ MANUFACTURER
	☐ 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)*

DD FORM 82 MAR 1426 PREVIOUS EDITION IS OBSOLETE.

(TO DETACH THIS FORM, CUT ALONG THIS LINE.)