MILITARY STANDARD

RELIABILITY ASSURANCE PROGRAM FOR ELECTRONIC PARTS SPECIFICATIONS

TO ALL HOLDERS OF MIL-STD-790D:

1. THE FOLLOWING PAGES OF MIL-STD-790D HAVE BEEN REVISED AND SUPERSEDE THE PAGES LISTED:

NEW PAGE	DATE	SUPERSEDED PAGE	DATE
iv	10 February 1988	iv	Reprinted without change
v	10 February 1988	v	30 May 1986
11	10 February 1988	11	Reprinted without change
12	10 February 1988	12	30 May 1986
20	10 February 1988	20	30 May 1986
21	10 February 1988	New	31 May 1988
22	10 February 1988	New	31 May 1988
23	10 February 1988	New	31 May 1988

2. RETAIN THIS NOTICE AND INSERT BEFORE TABLE OF CONTENTS.

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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 in accordance with 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. For high reliability parts or components, appendix B shall apply in lieu of appendix A.

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.

APPENDIX B

PROCEDURES FOR THE PRODUCT AND QUALITY AUDIT FOR HIGH RELIABILITY COMPONENTS

10. SCOPE

10.1 Scope. This appendix provides detailed instructions to the manufacturer and audit team for the auditing of manufacturing facilities for high reliability components designated for space environment applications. These instructions are to be applied by the audit team in assessing the capability of a manufacturer to produce a consistent baseline QPL device. The information contained herein is intended for compliance when specified in the applicable part or component specification, purchase order, or contract.

20. APPLICABLE DOCUMENTS. This section is not applicable to this appendix.

30. INSTRUCTIONS.

30.1 Baseline documentation. The manufacturer shall complete the baseline document and submit the required information to the qualifying activity prior to scheduling the Product and Quality Audit. The accepted baseline shall be confirmed at the time of the initial survey. Proprietary information necessary to critical processes in the baseline shall be signed and dated by the auditor at the time of the Internal Audit and confirmed as unchanged with each subsequent audit. Documents considered proprietary shall be identified to the qualifying activity. These shall be stamp certified by the auditor but remain on the manufacturer's site as the baseline for subsequent audits. Each manufacturer shall provide a detailed process flow chart which shall include, as a minimum:

a. All significant process steps and measurement and inspection points by descriptive name, document number, revision letter, and revision date.

b. All raw materials, interim, and finished part quality control points; incoming inspection, storage and processing steps by descriptive name, document number, revision letter, revision date, and location in the processing sequence.

c. The identification of all critical (significant to end product properties) manufacturing and inspection steps.

d. The most significant physical properties to be controlled at each process step (pressure, temperature, humidity, etc.) and the control tolerance required to maintain process control along with other forms of control charts.

APPENDIX B

30.1.1 Baseline supplements. The manufacturer shall complete and submit the following documents to the Qualifying Activity prior to scheduling the Product and Quality Audit and a Baseline Revision History prior to each subsequent Audit.

a. Part marking, environmental, packaging, and date requirements, part numbers, design information, critical materials list, manufacturing instructions summary, Q. A. Manual, and Calibration Manual.

b. A summary list of all documents pertaining to the testing of Military Parts, including their type of storage and storage location (example; acceptance test records stored on Personal Computer (PC) disk in test laboratory, building 3). An example of each document and key to explaining any coded information contained in each document.

c. Lot control plan, traceability plan, training plan for QC personnel, acceptance test plan (group A), qualification retention test plan (groups B and C), verification of MIL-STD-790 requirements, equipment calibration, maintenance records, reporting plan, and destructive test plan (if any).

30.1.2 Changes to baseline. The audit team shall compare the latest baseline document to the previous baseline document to assure all changes have been submitted to the qualifying activity and have been approved.

a. Minor changes. Any subsequent departure from the approved flow chart (i.e., additions or deletions) or changes to the revision status of those processes or inspections are allowed, provided they do not violate the changes prohibited by section 30.1.2.b (major changes). The component specification shall identify the major areas. These minor changes shall be described in general terms and submitted to the Qualifying Activity for acceptance and also to the audit team during subsequent audits. This action shall result in an update of the baseline document.

b. Major changes. No changes (i.e., substitutions, additions, deletions or modifications) shall be allowed in major areas without prior review and approval of the Qualifying Activity. Partial or total product requalification may be required as determined by the Qualifying Activity in those areas identified as major areas for control (see 30.3).

30.2 Audits. An initial audit and subsequent periodic audits (every year or as deemed necessary) shall be performed by the audit team reporting to the Qualifying Activity. The audit shall include, but not be limited to, all of the items on the checklist (plus MIL-STD-790) and any GIDEP ALERTS issued against the manufacturer at the facility of interest as deemed necessary by the Qualifying Activity. The results of any additional items that are assessed shall be added to the checklist for record purposes.

APPENDIX B

30.2.1 Duties of the audit team.

a. The audit team shall review the reliability assurance program and the manufacturing flow chart for adequacy and completeness prior to the audit of the manufacturing facilities and which shall be used as a reference during the course of the audit.

b. The audit team shall verify that all measuring and test equipment are functioning and calibrated. They shall also verify that test procedures are within the required tolerances.

c. The audit team shall review the manufacturer's facility and the proposed baseline documentation for adequacy, accuracy and completeness during the audit.

d. The audit team shall check all the records accumulated since the last audit. In addition, the location of the equipment and the thoroughness and adequacy of the operating procedures and instructions shall be checked. Whenever practical, operations utilizing critical equipment and procedures shall be witnessed.

e. The audit team shall insure that adequate documentation, trained personnel, equipment, visual aids and other necessary items are immediately available to perform the inspections specified in the basic specification.

f. The audit team shall confirm completion of corrective actions, review correspondence pertaining to manufacturer and OEM test failures or field failures and their corresponding failure analysis.

g. The audit team shall confirm that adequate trend analysis techniques and procedures are in use for analyzing failure trends resulting from OEM test failures, field failures, and internal test failures at the manufacturer. Pareto analysis or similar techniques must be utilized. An internal review board consisting of the quality control manager, the reliability manager (or equivalent), the engineering manager (or equivalent), the production manager and the failure analysis lab manager (or equivalent), as a minimum shall be in place.

30.3 Requirements to be specified in the component level MIL drawing or specification.

a. Checklist for the audit team.

b. Description of those areas identified as major areas for control (see 30.1.2.).

CONCLUDING MATERIAL

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

Review activities:
Army - AR, ER, 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-0054)

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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.

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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.

Supersedes page 11 of 30 May 1986.

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 in accordance with 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. For high reliability parts or components, appendix B shall apply in lieu of appendix A.

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.

APPENDIX B

PROCEDURES FOR THE PRODUCT AND QUALITY AUDIT FOR HIGH RELIABILITY COMPONENTS

10. SCOPE

10.1 Scope. This appendix provides detailed instructions to the manufacturer and audit team for the auditing of manufacturing facilities for high reliability components designated for space environment applications. These instructions are to be applied by the audit team in assessing the capability of a manufacturer to produce a consistent baseline QPL device. The information contained herein is intended for compliance when specified in the applicable part or component specification, purchase order, or contract.

20. APPLICABLE DOCUMENTS. This section is not applicable to this appendix.

30. INSTRUCTIONS.

30.1 Baseline documentation. The manufacturer shall complete the baseline document and submit the required information to the qualifying activity prior to scheduling the Product and Quality Audit. The accepted baseline shall be confirmed at the time of the initial survey. Proprietary information necessary to critical processes in the baseline shall be signed and dated by the auditor at the time of the Internal Audit and confirmed as unchanged with each subsequent audit. Documents considered proprietary shall be identified to the qualifying activity. These shall be stamp certified by the auditor but remain on the manufacturer's site as the baseline for subsequent audits. Each manufacturer shall provide a detailed process flow chart which shall include, as a minimum:

a. All significant process steps and measurement and inspection points by descriptive name, document number, revision letter, and revision date.

b. All raw materials, interim, and finished part quality control points; incoming inspection, storage and processing steps by descriptive name, document number, revision letter, revision date, and location in the processing sequence.

c. The identification of all critical (significant to end product properties) manufacturing and inspection steps.

d. The most significant physical properties to be controlled at each process step (pressure, temperature, humidity, etc.) and the control tolerance required to maintain process control along with other forms of control charts.

APPENDIX B

30.1.1 Baseline supplements. The manufacturer shall complete and submit the following documents to the Qualifying Activity prior to scheduling the Product and Quality Audit and a Baseline Revision History prior to each subsequent Audit.

a. Part marking, environmental, packaging, and date requirements, part numbers, design information, critical materials list, manufacturing instructions summary, Q. A. Manual, and Calibration Manual.

b. A summary list of all documents pertaining to the testing of Military Parts, including their type of storage and storage location (example; acceptance test records stored on Personal Computer (PC) disk in test laboratory, building 3). An example of each document and key to explaining any coded information contained in each document.

c. Lot control plan, traceability plan, training plan for QC personnel, acceptance test plan (group A), qualification retention test plan (groups B and C), verification of MIL-STD-790 requirements, equipment calibration, maintenance records, reporting plan, and destructive test plan (if any).

30.1.2 Changes to baseline. The audit team shall compare the latest baseline document to the previous baseline document to assure all changes have been submitted to the qualifying activity and have been approved.

a. Minor changes. Any subsequent departure from the approved flow chart (i.e., additions or deletions) or changes to the revision status of those processes or inspections are allowed, provided they do not violate the changes prohibited by section 30.1.2.b (major changes). The component specification shall identify the major areas. These minor changes shall be described in general terms and submitted to the Qualifying Activity for acceptance and also to the audit team during subsequent audits. This action shall result in an update of the baseline document.

b. Major changes. No changes (i.e., substitutions, additions, deletions or modifications) shall be allowed in major areas without prior review and approval of the Qualifying Activity. Partial or total product requalification may be required as determined by the Qualifying Activity in those areas identified as major areas for control (see 30.3).

30.2 Audits. An initial audit and subsequent periodic audits (every year or as deemed necessary) shall be performed by the audit team reporting to the Qualifying Activity. The audit shall include, but not be limited to, all of the items on the checklist (plus MIL-STD-790) and any GIDEP ALERTS issued against the manufacturer at the facility of interest as deemed necessary by the Qualifying Activity. The results of any additional items that are assessed shall be added to the checklist for record purposes.

APPENDIX B

30.2.1 Duties of the audit team.

a. The audit team shall review the reliability assurance program and the manufacturing flow chart for adequacy and completeness prior to the audit of the manufacturing facilities and which shall be used as a reference during the course of the audit.

b. The audit team shall verify that all measuring and test equipment are functioning and calibrated. They shall also verify that test procedures are within the required tolerances.

c. The audit team shall review the manufacturer's facility and the proposed baseline documentation for adequacy, accuracy and completeness during the audit.

d. The audit team shall check all the records accumulated since the last audit. In addition, the location of the equipment and the thoroughness and adequacy of the operating procedures and instructions shall be checked. Whenever practical, operations utilizing critical equipment and procedures shall be witnessed.

e. The audit team shall insure that adequate documentation, trained personnel, equipment, visual aids and other necessary items are immediately available to perform the inspections specified in the basic specification.

f. The audit team shall confirm completion of corrective actions, review correspondence pertaining to manufacturer and OEM test failures or field failures and their corresponding failure analysis.

g. The audit team shall confirm that adequate trend analysis techniques and procedures are in use for analyzing failure trends resulting from OEM test failures, field failures, and internal test failures at the manufacturer. Pareto analysis or similar techniques must be utilized. An internal review board consisting of the quality control manager, the reliability manager (or equivalent), the engineering manager (or equivalent), the production manager and the failure analysis lab manager (or equivalent), as a minimum shall be in place.

30.3 Requirements to be specified in the component level MIL drawing or specification.

a. Checklist for the audit team.

b. Description of those areas identified as major areas for control (see 30.1.2.).