NOT MEASUREMENT SENSITIVE

MIL-STD-790E
15 DEC 1989

SUPERSEDING
MIL-STD-347
27 MAR 1985
MIL-STD-790D
30 MAY 1986

MILITARY STANDARD

PRODUCT ASSURANCE PROGRAM FOR ELECTRONIC AND FIBER OPTIC PARTS SPECIFICATIONS

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AMSC N/A

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

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CONTENTS - Continued.

1. SCOPE

1.1 Purpose. This standard is for direct reference in electronic and fiber optic parts product assurance specifications and establishes the criteria for electronic and fiber optic parts product 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 Established Reliability (ER) specifications where attainment of specified failure rate levels is required. It is also applicable for other product specifications where the assurance of homogeneity of parts requires control of production facilities, materials, and processes.

b. The qualifying activity evaluates and approves the program plan as a prerequisite for qualified approval,

3. DEFINITIONS

3.1 Definitions. The definitions of all product assurance 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. Audit checklist. A form listing specific items which are to be audited.

c. 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 established limitations.

d. 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 applicable requirements of the specification.

e. 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 applicable requirements of the specification prior to shipment to the distributor.

f. 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 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.

g. Electronic and fiber optic 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, semiconductor, and fiber optic devices.

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

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

j. Failure analysis. The process of examining electronic or fiber optic 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.

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

l. Failure mode. The abnormality of an electronic or fiber optic parts performance which causes the part to be classified as failed.

4. GENERAL REQUIREMENTS

4.1 Product assurance program.

4.1.1 General. The product assurance program shall integrate all designing, planning, manufacturing, inspecting, and testing functions related to the manufacture and distribution of electronic and fiber optic 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 applicable requirements specified in section 5 and appendixes A and B.

4.1.2 Program plan.

4.1.2.1 Basic plan. The manufacturer shall document a product 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 product assurance program.

4.1.2.2 Supplemental plans. If more than one electronic or fiber optic 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 the 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 requirements consistent with this standard on distributors and shall be responsible for all of the manufacturers 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 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.

5. DETAILED REQUIREMENTS

5.1 Documentation submission. The product 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 product assurance shall be defined and documented to include the following:

a. A diagram of the relationship of key organizational blocks. The organization responsible for product 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 product 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 product assurance.)

b. A statement delineating lines of authority and responsibility.

5.1.1.1 Organizational structure changes. Any changes affecting the product assurance 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 electronic and fiber optic 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 along with regularly scheduled retention of qualification reports. 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 procedures. The manufacturer shall specify environmental, electrical, mechanical, optical, 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.

5.2.3 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. Procedures for such analyses shall include the following:

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

b. Failure analyses 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 failure rate levels shall be calculated in accordance with the governing applicable product specification.

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

a. The results of analysis.

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 three years following the last similar failure. Defect analysis records shall be held for the period determined by 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 room. 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 electronic and fiber optic parts. All documentation and its interrelationships shall be identified in flowchart 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.

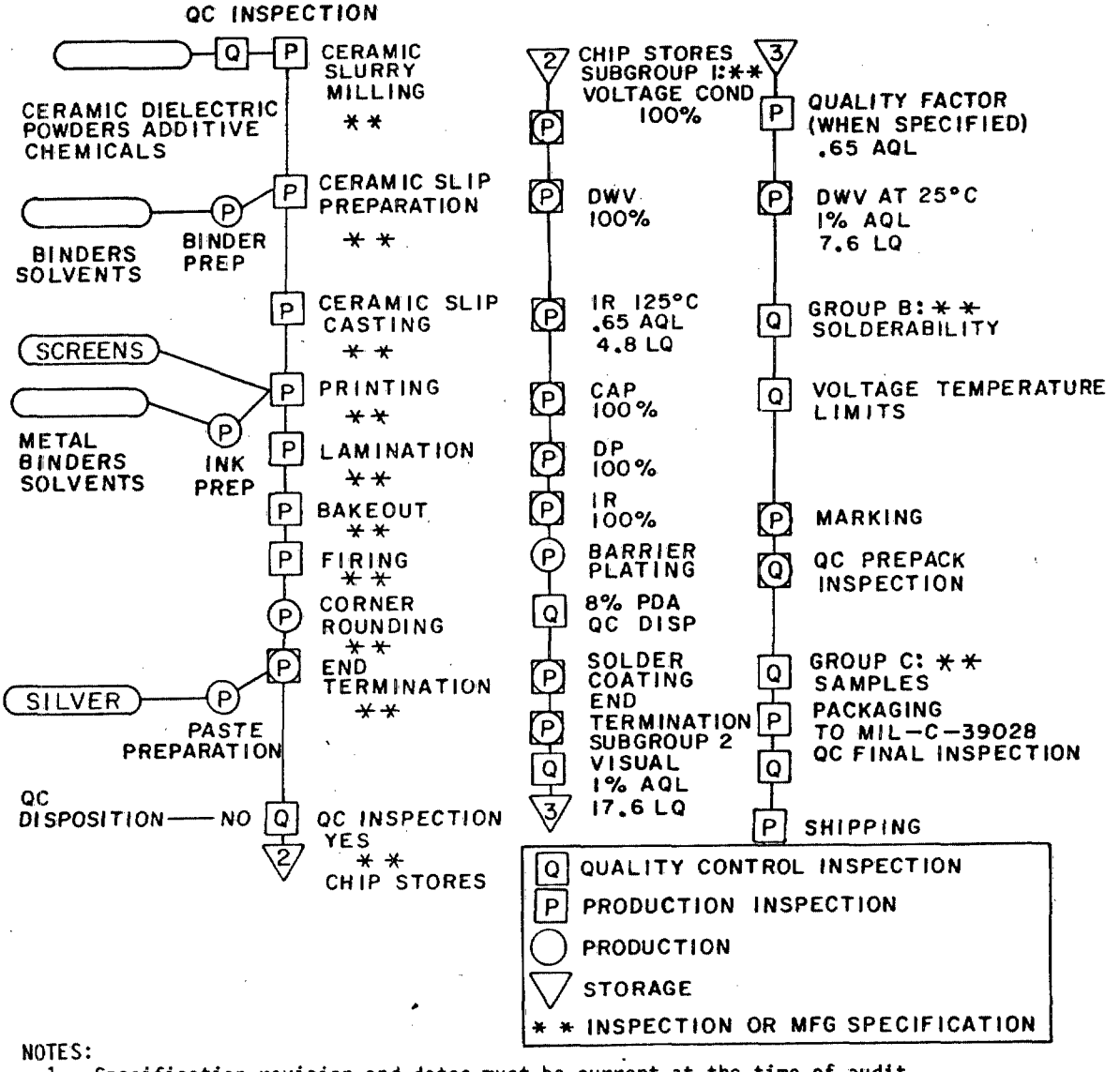
i. Procedures for forming quality conformance inspection lots which will comply with part specification criteria.

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.

COMPANY ABC
SPECIFICATION MIL-C-55681 PROCESS FLOWCHART
NUMBER 55681 REV. N/A

MIL-C-55681 FLOW CHART
(BX CAPACITOR)

MIL-C-55681 FLOW SHEET
TESTING AND FINISHING
OF BX CAPACITORS



NOTES:
1. Specification revision and dates must be current at the time of audit. This information need not be placed on the flowchart. However, this information must be made available to the verification team during the audit.
2. This flowchart 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 flowchart.

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.

5.2.21 Class "S" space level components (NOTE: Not to be confused with ER failure rate level "S"). For class S, space level components, the manufacturer shall implement the procedures and requirements of appendix B in addition to the other program requirements of this standard.

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

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 followup 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 one 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 three 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.

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 specification. During the demonstration, the auditor should verify that the equipment is producing a readable output.

s. The manufacturer shall describe, conduct, and maintain a product assurance-oriented training program to cover all phases of his activity involved in producing product 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 initialed and all entries must be permanent (ink).

TABLE I. Audit requirements checklist - Continued.

Requirements	Satisfactory	Unsatisfactory	Comments
g. Voltages and temperatures checked at least once a week on life test			
h. Overvoltage and thermal runaway protectors			
i. Environmental control			
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 6 months			
(3) Submit corrective action evaluation			
n. Check that operators are following controlled documents			
o. Distributors are being controlled			
p. Calibration system checked			

APPENDIX B

PROCEDURES FOR THE PRODUCT AND QUALITY AUDIT FOR CLASS S, SPACE LEVEL 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 parts 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.

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.

30.2.1 Duties of the audit team.

a. The audit team shall review the reliability assurance program and the manufacturing flowchart 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 evaluate the availability of adequate documentation, trained personnel, equipment, visual aids and other items required to perform the inspections specified in the basic specifications.

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 military drawing or specification.

a. Checklist for the audit team.

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

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-STD-790E	PRODUCT ASSURANCE PROGRAM FOR ELECTRONIC AND FIBER OPTIC 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)*

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NOTE: This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document*(s)* or to amend contractual requirements.

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