

NOTICE OF  
CHANGE

NOT MEASUREMENT  
SENSITIVE

MIL-STD-690C  
NOTICE 1  
6 December 1999

DEPARTMENT OF DEFENSE  
STANDARD PRACTICE

FAILURE RATE SAMPLING PLANS AND PROCEDURES

TO ALL HOLDERS OF MIL-STD-690C:

1. THE FOLLOWING PAGES OF MIL-STD-690C HAVE BEEN REVISED AND SUPERSEDE THE PAGES LISTED:

NEW PAGE	DATE	SUPERSEDED PAGE	DATE
1	26 March 1993	1	Reprinted without change
2	6 December 1999	2	6 December 1999
3	6 December 1999	3	6 December 1999
3a	6 December 1999	New page	
4	26 March 1993	4	Reprinted without change

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

3. Holders of MIL-STD-690C will verify that page changes and additions indicated above have been entered. This notice page will be retained as a check sheet. This issuance, together with appended pages, is a separate publication. Each notice is to be retained by stocking points until the standard is completely revised or canceled.

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

Preparing activity:  
DLA – CC  
(Project RELI-0092)

## MIL-STD-690C

### 1. SCOPE

1.1 Purpose. This standard provides procedures for failure rate (FR) qualification, sampling plans for establishing and maintaining FR levels at selected confidence levels, and lot conformance inspection procedures associated with FR testing for the purpose of direct reference in appropriate military electronic parts established reliability (ER) specifications. Figures and tables throughout this standard are based on exponential distribution. Weibull distribution will be acceptable in certain components such as capacitors. Use of Weibull distribution for any component must be approved by the qualifying activity. This standard also provides guidance to specification writers in the use of this standard (see appendix) and reference material for users of ER parts.

1.2 Application. This standard is applicable for reference in electronic parts ER specification when the following conditions exist:

- a. Electronic parts are essentially the same design and are manufactured under essentially continuous production; the production process is established and controlled in accordance with MIL-STD-790.
- b. The part design and manufacturing processes produce a product whose failure rate can reasonably be assumed to be constant with time over its intended life (i.e., an exponential distribution of failures per unit time).
- c. The qualifying activity administers this standard to provide the consumer with assurance that the qualified FR level is being maintained by a given manufacturer, since these procedures in themselves are not sufficient to assure the qualified FR level.

1.3 Method of reference. This standard can be referenced in ER specifications by specifying the following procedures:

- a. Procedure I, "Qualification at the initial FR level" (see 5.1).
- b. Procedure II, "Extension of qualification to lower FR levels" (see 5.2).
- c. Procedure III, "Maintenance of FR level qualification" (see 5.3).
- d. Procedure IV, "Lot conformance FR inspection" (when specified ) (see 5.4).

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### 2. APPLICABLE DOCUMENTS

#### 2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

#### STANDARDS

##### DEPARTMENT OF DEFENSE

MIL-STD-790 - Standard Practice for Established Reliability and High Reliability Qualified Products List (QPL) Systems for Electrical, Electronic and Fiber Optic Parts Specifications.

(Unless otherwise indicated, copies of the above specification, standards and handbooks are available from the Defense Automated Printing Service, Bldg. 4D (DPM-DODSSP), 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.2 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

SUPERSEDES PAGE 2 OF MIL-STD-690C.

### 3. DEFINITIONS

3.1 Reliability terms. The definitions of reliability terms used herein are as follows:

- a. Burn-in (pre-conditioning). The operation of an item under stress to stabilize its characteristics.
- b. Confidence level. This term denotes the probability of disqualifying a product when the true failure rate of the product is at the failure rate specified for qualification.
- c. Corrective action. A documented design, process, procedure, or materials change implemented and validated to correct the cause of failure or design deficiency.
- d. Derating. (1) Using an item in such a way that applied stresses are below rated values.  
(2) The lowering of the rating of an item in one stress field to allow an increase in another stress field.
- e. Established reliability. A quantitative maximum failure rate demonstrated under controlled conditions specified in a Department of Defense specification and usually expressed as percent failures per thousand hours of test.
- f. Failure. The event, or inoperable state, in which any item or part of an item does not, or would not, perform as previously specified.
- g. Failure analysis. Subsequent to a failure, the logical systematic examination of an item, its construction, application, and documentation to identify the failure made and determine the failure mechanism and its basic course.
- h. Failure rate (FR) level. This term denotes the maximum percentage of failures (per 1,000 unit hours) based on a specified confidence level.
- i. Failure rate (FR) test. This term denotes the test required to accumulate data from which a failure rate is calculated and is used synonymously with the standard specification term "life test".
- j. Higher FR level. This term is a relative term describing a FR level associated with a higher number of failures per unit time.
- k. Inspection lot. A group of electronic parts offered for inspection at one time and in combinations authorized by the applicable ER specifications.
- l. Lower FR level. This term is a relative term describing a FR level associated with fewer number of failures per unit time.
- m. Mean time to failure (MTTF). A basic measure of reliability for non-repairable items: The total number of life units of an item divided by the total number of failures within that population, during a particular measurement interval under stated conditions.

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- n. Predicted. That which is expected at some future time, postulated on analysis of past experience and tests.
- o. Qualifying activity. The military activity or its agent delegated to administer the qualification program.
- p. Reliability. (1) The duration or probability of failure free performance under stated conditions.  
(2) The probability that an item can perform its intended function for a specified interval under stated conditions. (For non-redundant items this is equivalent to definition (1). For redundant items this is equivalent to definition of mission reliability).
- q. Screening. A process for inspecting items to remove those that are unsatisfactory or those likely to exhibit early failure. Inspection includes visual examination, physical dimension measurement and functional performance measurement under specified environmental conditions.
- r. Test, acceptance. A test conducted under specified conditions by, or on behalf of, the Government, using delivered or deliverable items, in order to determine the item's compliance with specified requirements. (Includes acceptance of first production units.)
- s. Test measurement and diagnostic equipment (TMDE). Any system or device used to evaluate the condition of an item to identify or isolate any actual or potential failures.
- u. Test qualification (design approval). A test conducted under specified conditions, by, or on behalf of the Government, using items representative of the production configuration, in order to determine compliance with item design requirements as a basis for production approval. (also known as a "Demonstration.")
- v. True failure rate. This term describes the failure rate that would be measured if all units of a controlled process were, in fact, tested. A "controlled process" is one in which RF variation about it, is due to chance causes.
- w. Truncation. Truncation is a "cutoff" point for life test data, that establishes a precise point in time in which the manufacturer can choose the elimination of previous extended life test data when:
  - (1) A life test failure has occurred and the manufacture has determined the cause and implemented corrective action acceptable to the qualifying activity.
  - (2) The manufacturer seeks an extension of failure rate on the basis of new design improvements, occurring after a life test failure or failures.

The truncation point is not a random event. There must exist a clear distinction between the "old" less reliable and the "new" improved design (see 5.5).

NEW PAGE

#### 4. GENERAL REQUIREMENTS

##### 4.1 FR levels.

- a. FR levels are related to operation of the part at the stress level specified by the applicable ER specification.
- b. Provisions are made for FR levels ranging from 1.0 to 0.001 percent per 1,000 component part hours. In the event the existing FR level of a current product is higher than 1.0 percent, an additional level (level "L") shall be added which will represent the state of the art for the part.
- c. Although the failure is expressed in percent per 1,000 hours (%/1,000 hr) throughout this standard, sampling plans and statistical tables may be used for FR levels expressed either in terms of percent per 1,000 cycles, operations, or in terms of duty cycle and stress level.
- d. Where a FR level is required for periods other than 1,000 hours, an appropriate conversion factor may be applied.

Example: 1%/10,000 hours is equivalent to 0.1%/1,000 hours, or when specifying %/10,000 hours, the unit-hour requirement is to be multiplied by 10.

- e. Tables are provided to show the relationship between true failure rates and selected confidence.

4.1.1 FR level determination. Determination of FR levels shall be based upon data from all FR tests. Data shall be accumulated from:

- a. The qualification FR sample. The specification designates the number of sample units to be inspected, number of permissible failures, duration of FR test, and other criteria that may apply.
- b. Inspection lots which have been submitted for FR conformance inspection during any qualification period or interval. Data accumulated shall meet the specification requirement referenced in 4.1.1a.
- c. Samples subjected to extended FR tests. The data shall be added at the specified time of measurement and not at the end of the FR test.

4.1.2 Qualification approval for higher FR levels. Qualification approval granted on one of the lower FR levels shall include approval for all of the higher established FR levels. For example: Qualification approval for "R" shall include approval for levels "P", "M", and "L" (if "L" is designated in the ER specification).

4.1.3 Supplying to higher ER levels. Parts qualified and marked (color coded or part numbered) to lower failure rate levels are substitutable for higher failure rate level parts with procuring activity approval. A manufacturer may supply to all higher FR levels than that to which he is qualified, and may elect to use the sample size associated with the FR level to be supplied on orders or contracts. Election by the manufacturer to apply this option does not negate the requirement to maintain qualification in accordance with procedure III (see 5.3).

4.1.4 FR marking. All parts shall be marked with the FR level to which they are qualified, except when the contract or purchase order specifies higher FR marking under the substitution criteria of 4.1.3.

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