

NOTICE OF
CHANGE

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MIL-STD-785B
NOTICE 2
5 AUGUST 1988

MILITARY STANDARD
RELIABILITY PROGRAM FOR SYSTEMS AND EQUIPMENT
DEVELOPMENT AND PRODUCTION

TO ALL HOLDERS OF MIL-STD-785B:

1. THE FOLLOWING PAGES OF MIL-STD-785 HAVE BEEN REVISED AND SUPERSEDE THE PAGES LISTED:

NEW PAGE	DATE	SUPERSEDED PAGES	DATE
1	5 August 1988	1	15 September 1980
1a	5 August 1988		
2	15 September 1980	2	Reprinted without change
5	15 September 1980		Reprinted without change
6	5 August 1988	6	15 September 1980
A-3	5 August 1988		15 September 1980
A-3a	5 August 1988		
A-4	15 September 1980		Reprinted without change

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

3. Holders of MIL-STD-785B 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 military standard is completely revised or cancelled.

Custodians:

Army - CR
Navy - AS
Air Force - 11

Preparing activity:

Air Force - 11

Project No. RELI-0057

Review activities:

Army - AR, AV, AT, ME, MI, SC, TE
Navy - EC, OS, SA, SH, YD, TD, MC, CG
Air Force - 10, 13, 17, 18, 19, 24, 95

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RELIABILITY PROGRAM FOR SYSTEMS AND EQUIPMENT DEVELOPMENT AND PRODUCTION

1. SCOPE

1.1 Purpose. This standard provides general requirements and specific tasks for reliability programs during the development, production, and initial deployment of systems and equipment.

1.2 Applicability

1.2.1 Application of standard. Tasks described in this standard are to be selectively applied in DoD contractor-definitized procurements, request for proposals, statements of work, and Government in-house developments requiring reliability programs for the development, production, and initial deployment of systems and equipment. The word "contractor" herein also includes Government activities developing military systems and equipment.

- * 1.2.1.1 For NATO collaborative projects, this standard is to be used in complying with the contractual Reliability Program implementation requirements of STANAG 4174, "Allied Reliability and Maintainability Publications."

1.2.2 Tailoring of task descriptions. Task descriptions are intended to be tailored as required by governing regulations and as appropriate to particular systems or equipment program type, magnitude, and funding. When preparing his proposal, the contractor may include additional tasks or task modifications with supporting rationale for each addition or modification.

1.2.2.1 The "Details To Be Specified" paragraph under each task description is intended for listing the specific details, additions, modifications, deletions, or options to the requirements of the task that should be considered by the procuring activity when tailoring the task description to fit program needs. "Details" annotated by an "(R)" are essential and shall be provided the contractor for proper implementation of the task.

- * 1.2.3 Application guidance. Application guidance and rationale for selecting tasks to fit the needs of a particular reliability program is included in appendix A; this appendix is not to be referenced or implemented in contractual documents.

1.3 Method of reference. When specifying the task descriptions of this standard as requirements, both the standard and the specific task description number(s) are to be cited. Applicable "Details To Be Specified" shall be included in the statement of work.

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2. REFERENCED DOCUMENTS

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

STANDARDS

MILITARY

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-721	Definitions of Terms for Reliability and Maintainability
MIL-STD-781	Reliability Testing for Engineering Development, Qualification and Production
MIL-STD-965	Parts Control Program

NEW PAGE

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PUBLICATIONS

MILITARY HANDBOOK

MIL-HDBK-217 Reliability Prediction of Electronic Equipment

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3. TERMS, DEFINITIONS, AND ACRONYMS

3.1 Terms. The terms used herein are defined in MIL-STD-721.

3.2 Definitions. Definitions applicable to this standard are as follows:

a. Tailoring: The process by which the individual requirements (sections, paragraphs, or sentences) of the selected specifications and standards are evaluated to determine the extent to which each requirement is most suitable for a specific materiel acquisition and the modification of these requirements, where necessary, to assure that each tailored document invoked states only the minimum needs of the Government. Tailoring is not a license to specify a zero reliability program, and must conform to provisions of existing regulations governing reliability programs.

b. Acquisition phases:

(1) Conceptual (CONCEPT) phase: The identification and exploration of alternative solutions or solution concepts to satisfy a validated need.

(2) Demonstration and validation (VALID) phase: The period when selected candidate solutions are refined through extensive study and analyses; hardware development, if appropriate; test; and evaluations.

(3) Full-scale engineering development (FSED) phase: The period when the system and the principal items necessary for its support are designed, fabricated, tested and evaluated.

(4) Production (PROD) phase: The period from production approval until the last system is delivered and accepted.

c. Reliability accounting: That set of mathematical tasks which establish and allocate quantitative reliability requirements, and predict and measure quantitative reliability achievements.

d. Reliability engineering: That set of design, development, and manufacturing tasks by which reliability is achieved.

e. Basic reliability: The duration or probability of failure-free performance under stated conditions. Basic reliability terms, such as Mean-Time-Between Failures (MTBF) or Mean-Cycles-Between-Failures (MCFB), shall include all item life units (not just mission time) and all failures within the items (not just mission-critical failures at the item level of assembly). Basic reliability requirements shall be capable of describing item demand for

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phases of the system/subsystem/equipment acquisition.

4.4 Quantitative requirements. The system/subsystem/equipment reliability requirements shall be specified contractually. Quantitative reliability requirements for the system, all major subsystems, and equipments shall be included in appropriate sections of the system and end item specifications. The sub-tier values not established by the procuring activity shall be established by the system or equipment contractor at a contractually specified control point prior to detail design.

4.4.1 Categories of quantitative requirements. There are three different categories of quantitative reliability requirements: (1) operational requirements for applicable system reliability parameters; (2) basic reliability requirements for item design and quality; and (3) statistical confidence/decision risk criteria for specific reliability tests. These categories must be carefully delineated, and related to each other by clearly defined audit trails, to establish clear lines of responsibility and accountability.

4.4.2 System reliability parameters. System reliability parameters shall be defined in units of measurement directly related to operational readiness, mission success, demand for maintenance manpower, and demand for logistic support, as applicable to the type of system. Operational requirements for each of these parameters shall include the combined effects of item design, quality, operation, maintenance and repair in the operational environment. Examples of system reliability parameters include: readiness, Mean-Time-Between-Downing Events (MTRDE); mission success, Mission-Time-Between-Critical Failures (MTRCF); maintenance demand, Mean-Time-Between-Maintenance Actions (MTEMA); and logistics demand, Mean-Time-Between-Removals (MTEPR).

4.4.3 Statistical criteria. Statistical criteria for reliability demonstrations, Reliability Qualification Tests (RQT), and Production Reliability Acceptance Tests (PRAT) shall be carefully tailored to avoid driving cost or schedule without improving reliability. Such criteria include specified confidence levels or decision risks, "Upper Test MTBF," "Lower Test MTBF," etc., as embodied in statistical test plans. They shall be clearly separated from specified values and minimum acceptable values to prevent test criteria from driving item design. They shall be selected and tailored according to the degree that confidence intervals are reduced by each additional increment of total test time.

4.4.3.1 Electronic equipment. For electronic equipment, the "Lower Test MTRF" shall be set equal to the minimum acceptable MTBF for the item. Conformance to the minimum acceptable MTBF requirements shall be demonstrated by tests selected from MIL-STD-781, or alternative specified by the PA.

4.4.3.2 Munitions and mechanical equipment. For munitions and mechanical equipment, a given lower confidence limit shall be set equal to the minimum acceptable reliability for the item. An adequate number of samples shall be selected per MIL-STD-105, or by other valid means approved by the PA, and tested for performance to reliability requirements as specified by the PA.

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5. TASK DESCRIPTIONS

5.1 The task descriptions following are divided into three general sections: Section 100, Program Surveillance and Control; Section 200, Design and Evaluation; and Section 300, Development and Production Testing.

• 6. NOTES

6.1 International standardization agreements. Certain provisions of this standard (identified by paragraph number or similar manner, if appropriate) are the subject of international standardization agreement (STANAG 4174). When amendment, revision, or cancellation of this standard is proposed which will modify the international agreement concerned, the preparing activity will take appropriate action through international standardization channels including departmental standardization offices to change the agreement or make other appropriate accommodations.

6.2 Key term (key word) listing.

Environmental Stress Screening (ESS)
Failure Reporting, Analysis, and Correction Action Systems (FRACAS)
Failure Review Board (FRB)
Failure Modes, Effects, and Criticality Analysis (FMECA)
Program reviews
Reliability Development/Growth Test (RDGT) program
Reliability Program Plan
Reliability Qualification Test (RQT) program
Production Reliability Acceptance Test (PRAT) program

Custodians:

Army - CR
Navy - AS
Air Force - 11

Preparing activity:

Air Force - 11

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Air Force - 10, 13, 17, 18, 19, 24, 95

TABLE A-I. Application matrix.

TASK	TITLE	TASK TYPE	PROGRAM PHASE			
			CONCEPT	VALID	FSED	PROD
101	RELIABILITY PROGRAM PLAN	MGT	S	S	G	G
102	MONITOR/CONTROL OF SUBCONTRACTORS AND SUPPLIERS	MGT	S	S	G	G
103	PROGRAM REVIEWS	MGT	C	S(2)	G(2)	G(2)
104	FAILURE REPORTING, ANALYSIS, AND CORRECTIVE ACTION SYSTEM (FRACAS)	ENG	NA	S	G	G
105	FAILURE REVIEW BOARD (FRB)	MGT	NA	S(2)	G	G
106	THERMAL MANAGEMENT CONTROL (TMC) PROGRAM	MGT	G	G	G	G
201	RELIABILITY MODELING	ENG	S	S(2)	C(2)	GC(2)
202	RELIABILITY ALLOCATIONS	ACC	S	G	C	GC
203	RELIABILITY PREDICTIONS	ACC	S	S(2)	C(2)	GC(2)
204	FAILURE MODES, EFFECTS, AND CRITICALITY ANALYSIS (FMECA)	ENG	S	S (1)(2)	C (1)(2)	GC (1)(2)
205	SNEAK CIRCUIT ANALYSIS (SCA)	ENG	NA	NA	C(1)	GC(1)
206	ELECTRONIC PARTS/CIRCUITS TOLERANCE ANALYSIS	ENG	NA	NA	C	GC
207	PARTS CONTROL/APPLICATION PROGRAM	ENG	S	S(2)(3)	G(2)	G(2)
208	RELIABILITY CRITICAL ITEMS	MGT	S(1)	S(1)	G	G
209	EFFECTS OF FUNCTIONAL TESTING, STORAGE, HANDLING, PACKAGING, TRANSPORTATION, AND MAINTENANCE	ENG	NA	S(1)	G	GC
210	THERMAL/RELIABILITY DESIGN TRADE STUDIES	ENG	G	G	GC	GC
211	THERMAL/RELIABILITY DESIGN ANALYSIS	ENG	NA	G	G	GC
301	ENVIRONMENTAL STRESS SCREENING (ESS)	ENG	NA	S	G	G
302	RELIABILITY DEVELOPMENT/GROWTH TESTING	ENG	NA	S(2)	G(2)	NA
303	RELIABILITY QUALIFICATION TEST (RQT) PROGRAM	ACC	NA	S(2)	G(2)	G(2)
304	PRODUCTION RELIABILITY ACCEPTANCE TEST (PRAT) PROGRAM	ACC	NA	NA	S	G(2)(3)
305	THERMAL DESIGN VALIDATION TEST (TDVT) PROGRAM	ENG	NA	S	G	GC

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CODE DEFINITIONS

<u>TASK TYPE:</u>	<u>PROGRAM PHASE</u>
ACC - RELIABILITY ACCOUNTING	S - SELECTIVELY APPLICABLE
ENG - RELIABILITY ENGINEERING	G - GENERALLY APPLICABLE
MGT - MANAGEMENT	GC - GENERALLY APPLICABLE TO DESIGN CHANGES ONLY
	NA - NOT APPLICABLE
	(1) - REQUIRES CONSIDERABLE INTERPRETATION OF INTENT TO BE COST EFFECTIVE
	(2) - MIL-STD-785 IS NOT THE PRIMARY IMPLEMENTATION REQUIREMENT. OTHER MIL-STDs OR STATEMENT OF WORK REQUIREMENTS MUST BE INCLUDED TO DEFINE THE REQUIREMENTS.
	(3) - PARTIAL IMPLEMENTATION * TO COST-EFFECTIVELY PREPARE FOR FUTURE PHASES.
	* IMPLEMENTATION ONLY TO THE EXTENT NECESSARY TO ACHIEVE THE DESIRED OBJECTIVE FOR THE PROGRAM PHASE BEING CONSIDERED

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50. RATIONALE AND GUIDANCE FOR TASK SECTIONS

50.1 Task section 100 - Program surveillance and control

50.1.1 Structuring the program requirements

50.1.1.1 Identifying and quantifying reliability needs. The elements of a reliability program must be selected to meet reliability needs. These needs are identified by higher authority through documentation such as the Decision Coordinating Paper (DCP), the Program Management Directive (PMD), and Program Management Plan (PMP). Identifying and quantifying these needs must be accomplished prior to release of an RFP for the appropriate acquisition phase so that tasks and requirements commensurate with the needs may be included in the RFP. The tasks and requirements which are included establish the framework for the continuing reliability dialogue between the procuring activity and the proposing contractors, one or more, of whom will ultimately be selected to develop the hardware. It is essential to make appropriate analyses and exercise mature judgment in determining reliability needs.

50.1.1.1.1 In making this determination, it is necessary to assemble program data concerning mission and performance requirements (preferably at the subsystem level), anticipated environments, and mission reliability and basic reliability requirements. This information is initially gathered in the CONCEPT phase and refined throughout development. It is the base upon which the reliability needs are determined and adjusted as this information is refined. The initial life/mission profile definition shall define, as a minimum, the boundaries of the performance envelope and provide the timeline (environmental conditions and applied/induced stresses versus time) typical of operations within that envelope. The quantitative requirements (basic reliability and mission reliability) shall be determined for the defined life/mission profile.

50.1.1.1.2 Using these data and the information on equipment contemplated to provide the required performance, a separate apportionment or allocation of basic reliability (MTBMA or MTBF) and mission reliability (MCSP or MTBCF) can be made to the equipment level. This apportionment is usually based on available reliability data modified to reflect changes in performance requirements (e.g., greater accuracy), duty cycles, and anticipated environments. If the hardware to be procured is a subsystem or equipment, the allocations discussed herein would apply down to the lowest assembly level in terms of MTBMA, MTBF, or failure rate. The required modifications are largely a matter of judgment, particularly when a new or considerably modified equipment concept must be synthesized to provide a specified function.

50.1.1.1.3 A reliability estimate should be made of each equipment independent of, and reasonably soon after, completing the initial apportionment. The equipment estimates should be combined to provide an initial estimate of basic reliability and mission reliability. During the CONCEPT and VALID phases design details will probably not be available. Therefore, estimates made during these phases and early in FSED will provide "ball park" numbers, which are nevertheless adequate for initial comparisons with, and for establishing the reasonableness of, the initial apportionment. Reapportionment based on a comparison with details of the estimate may be