

MIL-T-24309 (SHIPS)
1 September 1967

MILITARY SPECIFICATION
TECHNICAL SUPPORT PLAN
FOR ELECTRONIC EQUIPMENT

1. SCOPE

1.1 Scope. - This specification requires the development of technical support plans for electronic equipment procured by or for the Naval Ship Systems Command. The plan will be the basis for ensuring timely equipment support; therefore, it shall be developed concurrent with equipment design.

1.2 Application. - This specification is applicable to the acquisition of technical data developed concurrent with the acquisition of shipboard electronic equipment during the research and development and production phases. Data requirements applicable to individual equipment procurements shall be as specified in the contract or purchase order.

2. APPLICABLE DOCUMENTS

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

SPECIFICATIONS

MILITARY

- MIL-E-16400 - Electronic Equipment, Naval Ship and Shore: General Specification.
MIL-R-22732 - Reliability Requirements for Shipboard and Ground Electronic Equipment.

STANDARDS

MILITARY

- MIL-STD-415 - Test Points and Test Facilities for Electronic Systems and Associated Equipment.
MIL-STD-470 - Maintainability Program Requirements (For Systems and Equipments).
MIL-STD-471 - Maintainability Demonstration.

FSC MISC

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- MIL-STD-721 - Definitions of Effectiveness Terms for Reliability, Maintainability, Human Factors, and Safety.
 MIL-STD-756 - Reliability Prediction.
 MIL-STD-785 - Requirements for Reliability Program (For Systems and Equipments).

HANDBOOK

MILITARY

- MIL-HDBK-472 - Maintainability Prediction.

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

3. REQUIREMENTS

3.1 General requirements.- A technical support plan shall be developed by the contractor based on those requirements of MIL-E-16400 which affect the technical support of the equipment, and as specified herein. The technical support plan shall be provided as a report to the procuring activity for review and acceptance, and shall consist of the following elements:

- (a) Maintenance concept.
- (b) Plan for maintenance.
- (c) Reliability design data.
- (d) Maintainability design data.
- (e) Modular construction design data.
- (f) Test point and test equipment data.

3.2 Detail requirements.

3.2.1 Technical support plan elements. The technical support plan report shall be divided into sections as specified hereinafter. The appendix is a sample format for preparation of technical support plan data. The elements of information listed are the minimum for a complete plan. When any of these are not applicable to the contract or the data are unavailable, a suitable notation should be made. Additional information may be provided by the addition of subheadings within applicable sections, or by the addition of one or more new sections.

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3.2.1.1 Maintenance concept.- In Section I, the contractor shall delineate the maintenance concept that will be utilized in the design and fabrication of the equipment. This concept shall reflect the design philosophy which resulted from the reliability and maintainability requirements, and shall be in consonance with the application of modular design to the equipment and the availability of test points and test facilities. The inter-relationship of the elements of the support plan shall be evaluated to allow for trade-offs which will result in a system's having optimum effectiveness and an economical maintenance concept. Trade-offs which are made shall be documented in the technical plan report, and the reasons for the final version of the equipment shall be delineated.

3.2.1.2 Plan for maintenance (PFM).- A plan for maintenance shall be provided in Section II of the technical support plan report. The PFM shall reflect decisions pertinent to detailed maintenance requirements. Specifically, the following requirements shall be covered to the extent information is available to the contractor:

- (a) Preventive maintenance.
- (b) Logistic support.
- (c) Repair facilities.
- (d) Operator and maintenance personnel type, number, and skill level.

3.2.1.3 Reliability design data.- Section III of the technical support plan shall document the results of the reliability program activities required by MIL-STD-785 and as specified in the individual equipment specification.

3.2.1.3.1 The reliability section shall also include the following:

- (a) Reliability prediction in accordance with MIL-STD-756.
- (b) Definition of a failure.
- (c) Design review results delineating problem areas and proposed solutions.
- (d) Identification of critical items.
- (e) Failure reports, in accordance with MIL-R-22732, with analysis of the failures.
- (f) Reliability demonstration plan.
- (g) Reliability demonstration results.

3.2.1.4 Maintainability design data.- Section IV shall document the results of the maintainability program tasks required by MIL-STD-470 and as specified in the individual equipment specification.

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3.2.1.4.1 The maintainability section shall also include the following:

- (a) Maintainability prediction in accordance with MIL-HDBK-472.
- (b) Maintainability demonstration plan in accordance with MIL-STD-471.
- (c) Maintainability demonstration results in accordance with MIL-STD-471.

3.2.1.5 Modular construction design data.- Section V shall consist of the following, and shall reflect the economic limitations on electronic assemblies for nonrepairable design:

- (a) A block diagram of the equipment to the replaceable assembly level, indicating any portions of the equipment not using modular construction or replaceable assemblies.
- (d) Data for approval of modular and other replaceable assemblies, enclosures, and interconnecting techniques as required by MIL-E-16400 (Modular construction for equipment).

3.2.1.6 Test and test facilities data.- Section VI shall consist of the following:

- (a) Test point and test facility data in accordance with MIL-STD-415. The data shall include the contractor's selection of test points for performance monitoring and fault isolation.
- (b) A list of all portable test sets common and peculiar required to adjust and service the equipment, in accordance with MIL-E-16400. (Portable test sets).

3.3 Technical support Planning Meeting.- The meeting required by MIL-E-16400 (Modular construction for equipment) on modular assemblies shall serve to provide for the initial review between Government representatives and contractor personnel of the overall concept to be used in support of the equipment. In addition, the meeting shall also serve as the guidance meeting specified by MIL-STD-415. Unless otherwise agreed to by both Government and contractor, this meeting will be held at the Naval Ship Engineering Center, Washington, D.C.

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3.4 Research and development contracts.- The contractor shall develop a technical support plan based on his concept of the support requirements for production models of the equipment. The plan shall be the result of thorough studies conducted when the developmental model(s) are conceived and during design and construction of such model(s). The plan shall cover the support plan elements for production equipment (see 3.5) to allow for advance procurement planning, and shall be delivered concurrent with the first deliverable equipment. (Development model.)

3.5 Production contracts.- The technical support plan shall be submitted at the following three designated periods:

- (a) Upon completion of design and concurrent with initiation of ordering parts.
- (b) Concurrent with submission of the first equipment for quality conformance testing.
- (c) Concurrent with delivery of the first production equipment.

3.5.1 Each submission of the technical support plan report shall update previously submitted data, as required, and shall summarize data submitted; data overdue, with reasons for the delay and expected delivery dates; and anticipated delays in data submissions. Approval of technical data elements shall be as provided by the referenced documents. (See 3.2.1.3, 3.2.1.4, 3.2.1.5 and 3.2.1.6). When data have been previously submitted to the procuring activity on any of the elements specified herein, the technical support plan shall reference the applicable covering document which forwarded the data to the procuring activity.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection.- Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Inspection.- The technical support plan report shall be inspected to determine compliance with the requirements of this specification.

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5. PREPARATION FOR DELIVERY

5.1 Preparation for delivery shall be in accordance with standard commercial practice.

6. NOTES

6.1 Ordering data.- Procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Applicable data elements.

6.2 Definitions.-

6.2.1 For the purpose of this specification the definitions of MIL-STD-721 will apply.

6.2.2 Technical support plan.- The technical support plan is the delineation of an integrated design concept and a plan for maintenance supported by data that will be used as a basis for establishing levels of repair, provisioning, and other support factors.

Preparing activity:
Navy SH
(Project MISC-N495)

APPENDIX

SAMPLE FORMAT FOR TECHNICAL SUPPORT PLAN REPORT

10. SCOPE

10.1 This appendix describes the type of data required in the technical support plan report. It is recognized that data will be developed throughout the contract period and data on all subelements will not be available concurrently; however, all available data shall be supplied in accordance with the schedule specified.

20. SECTION I - MAINTENANCE CONCEPT

20.1 Section I of the technical support plan report (Maintenance concept) shall provide a brief statement of the overall concept which will be employed as guidance in the design of the equipment so that it may be easily maintained in the Fleet.

20.2 Section I shall indicate how the concept was developed from the operational requirements and expected maintenance environment.

20.3 Section I shall provide information on trade-offs which were made to assure that the reliability and maintainability requirements would be achieved.

30. SECTION II - PLAN FOR MAINTENANCE

30.1 Preventive maintenance.- Section II of the technical support plan report (plan for maintenance) shall provide information on each type of scheduled maintenance action required. It shall include, for each action, the requirements for tools; test equipment, documentation by number and title, which indicates the procedures to follow if the checks are abnormal.

30.2 Logistic support.- Section II shall provide information on the types and number of repairable and replaceable items in the equipment. The number of each type that will require repair or replacement each year shall be estimated. It shall also include recommendations for the range and depth of replaceable and repairable assemblies.

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30.3 Repair facilities.- Section II shall recommend a level of repair for each repairable item of the system with indication for each level, tools, test equipment, and documentation requirements. If the items are not to be repaired at the organizational level the reasons shall be stated.

30.4 Operator and maintenance personnel.- Section II shall provide information on the type, number, and skill level of operators required for the system. Similar information for maintenance personnel requirements at each maintenance level shall be included. Any special training requirements and special training aids or devices shall also be listed.

40. SECTION III - RELIABILITY DESIGN DATA

40.1 Section III - reliability design data shall report the status of each program element in MIL-STD-785 which is applicable to the contract.

40.2 Reliability prediction.- The reliability prediction shall determine the part population of each functional block, determine stress factor for each part, and assign the applicable failure rate to each part. The reliability for each functional block and the reliability of the total equipment shall be computed.

40.3 Definition of a failure.- The definition of a failure shall be based on the reliability model established for the prediction. The relevancy of failures which may occur during system operation shall be indicated. (This item may be included in the demonstration plan.)

40.4 Design review.- The program points at which the design will be reviewed shall be indicated. The progress of the reliability program with respect to predictions of reliability and the results of the design review shall be assessed.

40.5 Critical items.- The reliability design data report (Section III) shall provide information on items such as those that will have a long procurement lead-time, those that can prevent mission accomplishment, and those that impose high maintenance loads.

40.6 Failure report.- The failure report shall indicate the cause of failure and the corrective action taken to eliminate the cause.

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40.7 Reliability demonstration plan.- The reliability demonstration plan shall include environmental conditions imposed during test, number of samples, expected test time, parameters to be monitored, definition of a failure, and accept-reject criteria.

40.8 Reliability demonstration results.- The following information on the reliability demonstration shall be submitted:

- (a) A failure summary and analysis of each failure.
 - (1) Symptom and diagnosis action on each failure.
 - (2) How the equipment was repaired.
 - (3) Parts replaced or adjustments made.
 - (4) Action taken to prevent recurrence of failure.
- (b) Number of equipment failures for each operational mode.
- (c) Analysis of any variation for specified test condition.
- (d) Basis for accept (or reject) decision.

50. SECTION IV - MAINTAINABILITY DESIGN DATA

50.1 Section IV - maintainability design data shall report the status of each program task of MIL-STD-470 applicable to the contract.

50.2 Maintainability prediction.- The maintainability prediction shall estimate quantitatively the maintainability of the planned design configuration. The failure rates from the reliability prediction for the maintainability prediction shall be used and Procedure II, Part A of MIL-HDBK-472 shall be followed, unless otherwise specified in the individual equipment specification.

50.3 Maintainability demonstration plan.- The maintainability demonstration plan shall provide the demonstration plan information required by MIL-STD-471. Method 3 of MIL-STD-471 shall be used for the demonstration, unless otherwise specified in the individual equipment specification.

50.4 Maintainability demonstration results.- The following information on the maintainability demonstration shall be submitted:

- (a) Data collected.
- (b) Factors which influence the data.
- (c) Analysis of data.
- (d) Results of the demonstration.
- (e) Assessment of qualitative factors.

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- (f) Deficiencies.
- (g) Recommendation for the following:
 - (1) To correct deficiencies.
 - (2) For suggested improvements.
- (h) Results of retest (if applicable)

60. SECTION V - MODULAR CONSTRUCTION DESIGN DATA

60.1 In section V, modular construction data shall be reported. Each block of the diagram indicating function, type of construction and repairability shall be labeled. Legends shall be used if necessary.

60.2 A test procedure for each assembly shall be provided which shall include the following:

- (a) Definitions of input and output parameters.
- (b) Accuracy of measurements.
- (c) Tolerances for reject or acceptance of the assembly.
- (d) Input and output impedances.
- (e) Loading of the assembly's input and output for test performance.
- (f) Static and dynamic tests.
- (g) Power requirements.

60.3 A schematic diagram for each assembly shall be provided showing the following:

- (a) Wiring layout.
- (b) Power and signal connections.
- (c) Description of the following:
 - (1) Connector.
 - (2) Test points.
 - (3) Parameters to be measured.

60.4 A complete engineering drawing for each assembly shall be included which shall indicate the following:

- (a) Size.
- (b) Shape.
- (c) General construction features.
- (d) Dimensions affecting interchangeability.

60.5 Drawings for any test jig and special test set-ups shall be provided.

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60.6 Drawings on test equipment set-ups shall be provided.

60.7 When required, the use of modular or other replaceable assemblies not completely repairable aboard ship without special tools shall be justified. Special tools are defined as those tools not listed in the Federal Supply Catalog (copies of this catalog may be consulted in the office of the Government Inspector). A statement of the effects on equipment performance if repairable assemblies were used shall be included.

60.8 The unit production cost for all assemblies, whether repairable or not, shall be provided.

60.9 The reliability mean-time-between-failures (MTBF) of all assemblies shall be computed.

60.10 A data sheet for each nonstandard electronic part shall be furnished in accordance with MIL-E-16400.

70. SECTION VI - TEST AND TEST FACILITIES DATA

70.1 Each area requiring test points and support equipment shall be described as part of test and test facilities data. The following shall be included with each description:

- (a) Parameters to be measured.
- (b) Required frequency of measurement.
- (c) Minimum tolerances and accuracies necessary for proper operation.

70.2 Schematic diagrams.- Schematic diagrams of new or unusual circuits, engineering sketches, or functional block diagrams which will aid in defining and describing areas requiring test points and support equipment shall be provided.

70.3 Unique problems.- Solutions to any unique problem area shall be proposed. The functional requirement of the test and support equipment, the proposed device, or the recommended technique needed to perform the measurement or maintenance operation shall be furnished. A statement as to whether the proposed device is to be built into the equipment shall be furnished. Preferred and alternate items shall be indicated if there is more than one test or support equipment or technique available. The following data concerning the proposed device shall be furnished:

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- (a) Calibration intervals.
- (b) Special equipment required for calibration.
- (c) Need for frequent recalibration.

70.4 Nomenclature. - The nomenclature of Military test or support equipment shall be furnished.

70.5 The name of supplier and catalog number of commercially available test or support equipment proposed for maintaining the equipment shall be provided.

70.6 Modifications. - The nature and extent of all modifications to or changes required for the proposed test or support equipment shall be indicated.

70.7 Proposed test or support equipment. - A technical description of proposed test or support equipment which must be developed to maintain the equipment shall be provided.

70.8 The following information for each test facility recommended for development shall be included:

- (a) Unique measurement requirements.
- (b) Electrical, mechanical, or electronic operational characteristics including the following:
 - (1) Ranges-frequency, output, voltage or power, sensitivity, and scale readings.
 - (2) Accuracy.
 - (3) Special features-significant operational characteristics not previously covered herein.
- (c) Physical characteristics, including the following:
 - (1) Limiting weight and volume factors.
 - (2) Arrangement and coordination of units.
 - (3) Provisions for operation in conjunction with other associated equipment.
 - (4) Restrictive or significant environment conditions.
 - (5) Anticipated power supply considerations.
 - (6) Material requirements.
 - (7) Special features-significant physical characteristics not previously covered herein.
- (d) For nonstandard and special tools, the following shall be submitted:
 - (1) Functional description of and requirement for device.

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(2) Physical characteristics including:

- (a) Description.
- (b) Size and weight.
- (c) Type of material.
- (d) Magnetic properties.
- (e) Special properties not previously covered herein.

70.9 Test points. - A list of all proposed test points shall be provided. The following information for each test point shall be included:

- (a) Parameter being monitored or injected in a circuit.
- (b) Support equipment to be employed.
- (c) Accessories required-cables, adaptors, terminations.
- (d) Special tools or jigs required.
- (e) Classification of test points as specified.
- (f) Description of functional application of test points.
- (g) Proposed physical location of test point.
- (h) Proposed electrical location of test point.

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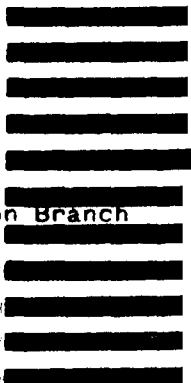


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