

MIL-A-27671B(USAF)

AMENDMENT 3

6 August 1986

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SUPERSEDING

AMENDMENT 2

1 JUNE 1979

## MILITARY SPECIFICATION

AMPLIFIER-INDICATOR GROUP, ALTITUDE-VERTICAL  
SPEED A/A24G-11

This amendment forms a part of MIL-A-27671B(USAF), dated 16 AUG 65, and is approved for use within the Department of the Air Force and is available for use by all Departments and Agencies of the Department of Defense.

PAGE 1

- \* Delete "2.1" and add:  
"2.1 Government documents."
- \* Add:  
"2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation."
- \* Under SPECIFICATIONS, Federal: Delete "QQ-P-416" and add: "PPP-B-601 Boxes, Wood, Cleated Plywood".
- \* Under SPECIFICATIONS, Military: Delete "MIL-E-5272", "MIL-M-26512", "MIL-R-26667" and "MIL-D-70327"; add: "MIL-M-7793/6 Meter, Time Totalizing, Miniature, Digital, 115 Volts, 400 Hz". "MIL-B-27497 Bearing, Jewel, Sapphire or Ruby, Synthetic", and "MIL-C-83488 Coating, Aluminum ION Vapor Deposited".

Add boxed paragraph to bottom center of page.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Oklahoma City Air Logistics Center/MMEDO, Tinker AFB OK 73145-5990 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document.

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- \* Under STANDARDS, Military: Delete MS17322", MS33586" Add:  

"MIL-STD-100	Engineering Drawing Practices
MIL-STD-470	Maintainability Program Requirements (For Systems and Equipments)
MIL-STD-471	Maintainability Demonstration
MIL-STD-781	Reliability Test Exponential Distribution

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AMSC N/A

FSC 6610

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

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MIL-STD-794 Parts and Equipment, Procedures for Packaging and Packing Of  
\* MIL-STD-810 Environmental Test Methods  
MIL-STD-889 Dissimilar Metals"

\* Delete "2.2" and add:

"2.2 Other publications. The following document(s) form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted shall be those listed in the issue of the DODISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS shall be the issue of the nongovernment documents which is current on the date of the solicitation.

ASTM-D3951-82 Packaging, Commercial - 29 Jun 82

(Application for copies should be addressed to: ASTM, 1916 Race St, Philadelphia PA 19103).

(Nongovernment standards and other publications are normally available from the organizations which prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services)."

Delete "3.1" and add:

"3.1 First article. When specified the contract or purchase order, samples shall be subjected to First Article Inspection (see 4.4.1, 4.5.2.4, 4.5.2.5, and 6.1.1).

3.1.1 Change all references "Preproduction" to "First Article".

3.4.2.1 Third line: Delete "MS33586" and substitute "MIL-STD-889".

\* Add:

"3.4.3.1 Recovered materials. Recovered materials shall be used to the maximum extent possible without jeopardizing the end use of the item."

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3.5.4 Line 5: Delete "requirements shall be in accordance with MIL-M-26512" and substitute "program requirements shall be in accordance with MIL-STD-470".

3.5.5 Delete and substitute:

"3.5.5 Mean-time-between-failures (MTBF). The equipment shall have an MTBF of at least 600 hours based on a 90 percent confidence factor."

Add new paragraph 3.5.8:

"3.5.8 Jewel bearings. Jewel bearings shall be in accordance with MIL-B-27497."

\* 3.6.a Delete and substitute: "Vibration - In accordance with MIL-STD-810C, Method 514.2, Procedure I".

\* 3.6.b Delete and substitute: "Acceleration - Method 513.2, Procedure II of MIL-STD-810C".

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- \* 3.6.h Delete and substitute: "Shock - Method 516.2, Procedure I of MIL-STD-810C".

3.7 Line 3: Delete "MIL-D-70327" and substitute: "MIL-STD-100".

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- \* 3.8.17 Line 2: Delete "MS17322" and substitute "MIL-M-7793/6".

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- \* 3.14.2 Delete entirely and substitute:

"3.14.2 Steel parts. Steel parts shall be coated with ion vapor deposited aluminum where practical, in accordance with MIL-C-83488, Type I or II as applicable and of a class that is adequate to achieve the degree of protection required. Other protective coating, in lieu of MIL-C-83488, may be used if demonstrated to be satisfactory and approved by the preparing activity. Cadmium plating must be avoided when satisfactory alternate processes can be used."

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Delete "4.1" and add:

"4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all, inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by 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."

Add:

"4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material."

Delete "4.2" and add:

"4.2 Classification of inspections. The inspections requirements specified herein are classified as follows:

- a. First article inspection (4.4)."

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- \* 4.5.2.2.1.h Delete "Salt spray" and substitute "Salt fog".

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4.5.2.2.1 Delete "i. Reliability".

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\* 4.5.2.2.2.h Delete "Salt spray" and substitute "Salt fog".

4.5.2.2.2: Delete "k. Reliability".

Add new paragraphs 4.5.2.4 and 4.5.2.5:

"4.5.2.4 Sampling plan C. Unless otherwise specified (see 6.2), two systems (indicators and amplifiers) shall be selected at random from the first ten produced and subjected to the test specified in 4.6.5.1. Accept-reject criteria shall be as specified therein.

4.5.2.5 Sampling plan D. Unless otherwise specified, four systems (indicators and amplifiers) shall be selected at random from the first ten of each production quantity of 150 or fraction thereof and subjected to the test specified in 4.6.5.2. Accept-reject criteria shall be as specified therein."

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\* 4.6.1.14 Delete "Procedure IV of MIL-E-5272 at amplitudes of 0.009 to 0.011 inch" and substitute "Vibration Method 514.2 Equipment Category b.1, Procedure I, Table 514.2-II, Figure 514.2-2, Curve B from 5-5Hz".

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\* 4.6.1.18 Delete "Procedure V of MIL-E-5272" and substitute "Method 514.2,

Equipment Category b.1, Procedure I, Table 514.2-II, Figure 514.2-2 Curve C from 5-52Hz".

\* 4.6.1.20 Delete "Procedure III of MIL-E-5272, except the acceleration shall be 7g". and substitute "Method 513.2, Procedure II of MIL-STD-810C. The acceleration shall be 7g along each axis".

\* 4.6.1.21 Delete "Procedure I of MIL-E-5272" and substitute "Method 507.1, Procedure I of MIL-STD-810C".

\* 4.6.1.23 Delete "Salt Spray" and substitute "Salt Fog:". Delete "MIL-E-5272, Procedure I" and substitute "Method 509.1, Procedure I of MIL-STD-810C".

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4.6.1.24 and table VI: Delete.

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Table VII: Delete.

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\* 4.6.2.12 Delete "MIL-E-5272, cycling portion only of Procedure XII, Curve B" and

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substitute "MIL-STD-810C, Method 514.2, Procedure I, cycling test only. The amplifier shall be tested from 5 to 500 cycles per second at an applied double amplitude of 0.010 inch or  $\pm 2g$ , whichever is less".

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- \* 4.6.2.15 Delete "MIL-E-5272, Procedure V" and substitute "MIL-STD-810C, Method 516.2, Procedure I".
  - \* 4.6.2.17 Delete "MIL-E-5272" and substitute "MIL-STD-810C, Method 513.2".
  - \* 4.6.2.18 Delete "Salt Spray" and substitute "Salt Fog". Delete "MIL-E-5272" and substitute "MIL-STD-810C, Method 509.1".
  - \* 4.6.2.19 Delete "Procedure I of MIL-E-5272" and substitute "Method 508.2, Procedure I of MIL-STD-810C".
- 4.6.2.21: Delete.

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4.6.4 Delete and substitute:

"4.6.4 Maintainability demonstration. Maintainability demonstration shall be in accordance with MIL-STD-471, appendix B, Method 2."

Add new paragraph 4.6.5:

"4.6.5 First article. The two systems specified in 4.5.2.4 shall be subjected to a first article reliability test in accordance with MIL-STD-471, test plan I, except as modified herein, which shall demonstrate a contractual MTBF of 600 hours. Each of the indicators and amplifiers shall be tested a minimum of 1,320 hours of actual electrical operation. The cycling time of 5 to 6 minutes per cycle per function display, with a minimum of 13,200 cycles per function, shall include monitor test, self test, and operation of all slew switches. A cycle shall consist of the excursion from the function minimum value to maximum and return to minimum. The test shall begin when rated power is applied to the system. After 4 hours of rated power on, the power shall be turned off for 2 hours. This power-on, power-off procedure shall be repeated until the test is completed. Only the power-on portion of the test shall be used in calculation the total test time required by test plan I. The system shall be tested at room temperature for approximately 64 percent of the test time, at  $-10^{\circ}\text{C}$  for approximately 14 percent of the test time, and at  $+50^{\circ}\text{C}$  for approximately 22 percent of the test time as shown in table VI.

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TABLE VI. RELIABILITY TEST TABLE

CYCLING PERIOD	NUMBER OF HOURS	AMBIENT TEMP (°C)
1	50	25
2	50	50
3	100	25
4	50	-10
5	50	25
6	50	50
7	100	25
8	50	-10
9	100	25
10	50	50
11	50	25

During the fifth cycle the system shall be vibrated in accordance with Method 514.2, Procedure I of MIL-STD-810C. The indicator shall be vibrated at a frequency of 35 Hz at a double amplitude of 0.036 inch. The transition from the fourth to the fifth cycling period shall be completed in the shortest possible time to allow the vibration test to be conducted during a temperature change from -10° to +25° C. After each cycling period of electrical operation shown in table VI, the system shall be subjected to a scale error test of at least three stations per function. Any malfunction, including failure to meet the scale error test, shall be recorded, the test interrupted while repairs are made, and the test then continued from the point of interruption. Upon completion of the reliability test, the system shall again be tested for scale error with a 50 percent increase in tolerances. Failure to meet the increased-tolerance scale error test shall be considered a malfunction. This test may be interrupted for normal weekend shutdown. If a reject decision is reached in accordance with test plan I of MIL-STD-781, or 13 or more failures occur in 3,660 hours of testing, delivery of production units shall be stopped and within 10 days the proposed corrective action shall be submitted to the contracting activity for approval. The equipment under test shall be modified to the approved configuration and the test rerun or continued until an accept or reject decision in accordance with test plan I (except as modified herein) is reached. At the conclusion of the redemonstration test, all equipment produced to date and all equipment subsequently produced shall be modified to the approved configuration (see 6.2). In the event of continue-test decision is reached at the end of 3,600 hours of testing, the test shall be continued until an accept or reject decision in accordance with test plan I (except as modified herein) is reached. If two or less failures occur in 3,600 hours of testing, the test samples and the first production quantity of 150 systems shall be accepted. Between 3,600 and 6,060 hours of testing, the equipment shall be accepted if the accept conditions of test plan I are met, or 6,060 hours of testing with 12 failures will constitute acceptance; 13 failures will constitute rejection. Failure to reach an accept decision in accordance with the criteria specified shall stop all deliveries until an accept decision is reached. Pattern failures as defined in MIL-STD-781 shall require corrective action for all equipment produced to date and produced subsequently regardless of an accept or reject decision. Reporting shall be in accordance with MIL-STD-781.

4.6.5.2 Production. The four systems specified in 4.5.2.5 shall be subjected to a production reliability test in accordance with MIL-STD-781, test plan I, except

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as modified herein, which shall demonstrate a contractual MTBF of 600 hours. Each of the four indicators and amplifiers shall be tested a minimum of 900 hours of actual electrical operation. The cycling time of 5 to 6 minutes per cycle for each indicator function display, with a minimum of 13,200 cycles per function, shall include monitor test, self test, and operation of all slew switches. A cycle shall consist of the excursion from the function minimum value to maximum and return to minimum. The test shall begin when rated power is applied to the system. After 4 hours of rated power on, the power shall be turned off for a period of 2 hours. This procedure of power-on, power-off shall be repeated until the test is completed. Only the power-on portion of the test shall be used in calculation of the total test time required by test plan I. The system shall be tested at room temperature for approximately 64 percent of the test time, at  $-10^{\circ}\text{C}$  for approximately 14 percent of the test time, at  $-50^{\circ}\text{C}$  for approximately 22 percent of the test time shown in table VI. During the fifth cycle, the indicator shall be Vibration Method 514.2 Equipment Category b.1, Procedure I, Table 514.2-II, Figure 514.2-2, Curve B from 5-52Hz. The transition from the fourth to the fifth cycling period shall be completed in the shortest possible time to allow the vibration test to be conducted during the temperature change from  $-10^{\circ}\text{C}$  to  $+25^{\circ}\text{C}$ . After each cycling period of electrical operation shown in table VI, the system shall be subjected to a scale error test of at least three stations per function. Any malfunction, including failure to meet the scale error test, shall be recorded, the test interrupted while repairs are made, and the test then continued from the point of interruption. Upon completion of the reliability test, the system shall again be tested for scale error with a 50 percent increase in tolerances. Failure to meet the increased-tolerance scale error test shall be considered a malfunction. This test may be interrupted for normal weekend shutdown. If a rejection decision is reached in accordance with test plan I of MIL-STD-781, or 13 or more failures occur in 3,660 hours testing, delivery of production units shall be stopped and within 10 days the proposed corrective action shall be submitted to the contracting activity for approval. The equipment under test shall be modified to the approved configuration and the test rerun or continued until an accept or reject decision in accordance with test plan I (except as modified herein) is reached. At the conclusion of the redemonstration test, all equipment produced in the particular production quantity and all equipment subsequently produced shall be modified to the approved configuration (see 6.2). In the event a continue-test decision is reached at the end of the 3,600 hours of testing, the test shall be continued until an accept or reject decision is reached in accordance with test plan I. If two or less failures occur in 3,600 hours of testing, the particular production quantity of 150 systems shall be accepted. Failure to reach an accept decision in accordance with the criteria specified shall stop deliveries of production equipment until an accept decision is reached. Pattern failures as defined in MIL-STD-781 shall require corrective action to all equipment and produced in the particular production quantity and all equipment subsequently produced regardless of an accept or reject decision. This test shall be repeated for each 150 units or fraction thereof produced. Reporting shall be in accordance with MIL-STD-781."

Delete 4.7 and substitute the following:

"4.7 Packaging inspection."

4.7.1 Quality conformance. The inspection of the preservation-packaging and interior package marking shall be in accordance with group A and B quality

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conformance inspection requirements, section 4 of MIL-P-116. The sampling and inspection of the packing and marking for shipment and storage shall be in accordance with the quality assurance provision of applicable container specification and the marking requirements of MIL-STD-129.

4.7.2 First article. When the unit container is capable of serving as the shipping container First Article Inspection, and rough handling tests as outlined in section 4 of MIL-P-116, shall be accomplished followed by a functional test of the unit to insure freedom from operational malfunction."

Delete Section 5 in its entirety and substitute the following:

5 PACKAGING

5.1 Preservation-packaging. Preservation-packaging shall be level A, C, or Industrial as specified (see 6.2).

5.1.1 Level A.

5.1.1.1 Cleaning. Amplifier-indicator shall be cleaned in accordance with process C-1 of MIL-P-116.

5.1.1.2 Drying. Amplifier-indicator shall be dried in accordance with process D-4 of MIL-P-116.

5.1.1.3 Preservation application. Not applicable.

5.1.1.4 Unit packaging. Unless otherwise specified by the contracting activity, each amplifier-indicator shall be packaged in quantity unit packs of one each in accordance with Method 1C1 of MIL-P-116. Overbox completed pack in PPP-B-636 container. Apply sufficient cushioning material between bag and unit container of a type, density, and thickness to insure shock transmission does not exceed peak values in G's established for the amplifier-indicator when completed packs are subjected to the rough handling drop tests of MIL-P-116.

5.1.2 Level C. Amplifier-indicator shall be clean, dry, and individually packaged in a manner that will afford adequate protection against corrosion, deterioration, and physical damage during shipment from supply source to the first receiving activity.

5.1.3 Industrial. The industrial preservation of amplifier-indicator shall be in accordance with ASTM-D-3951-82.

5.2 Packing. Packing shall be level A, B, C, or Industrial as specified (see 6.2).

5.2.1 Level A. Amplifier-indicator packaged as specified in 5.1.1 shall be packed in shipping containers conforming to PPP-B-601, Styles A or B, Class overseas, unless otherwise specified by the contracting activity. Insofar as practical, exterior shipping container shall be of uniform shape, size, minimum tare and cube consistent with the protection required.

5.2.2 Level B. Amplifier-indicator packaged as specified in 5.1.1 shall be



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packed in shipping containers conforming to PPP-B-636, class weather-resistant, unless otherwise specified by the contracting activity. Other requirements as specified in 5.2.1 apply.

5.2.3 Level C. Packing shall be applied which affords adequate protection during domestic shipment from the supply source to the first receiving activity for immediate use. This level shall conform to applicable carrier rules and regulations.

5.2.4 Industrial. The packaged amplifier-indicator shall be packed in accordance with ASTM D3951.

5.3 Marking. In addition to any other markings required by the contract or order (see 6.2), interior and exterior containers shall be marked in accordance with MIL-STD-129.

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\* Add:

"6.1.1 First article. When a first article inspection is required samples shall be selected as specified in 3.1, 4.4, 4.4.1, 4.5.2.4, and 4.5.2.5."

6.2 Add:

"g. When sampling plan C and D tests will not be conducted.

h. That systems modified to an approved configuration will be at no additional contract cost.

i. Selection of applicable levels of packaging and packing."

\* Delete "6.3".

The margins of this amendment are marked with an asterisk to indicate where changes (additions, modifications, corrections, deletions) from the previous amendment were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous amendment.

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