

INCH-POUND

MIL-C-48479C (AR)

30 May 1995

(see 6.4)

MILITARY SPECIFICATION

CIRCUIT CARD ASSEMBLY - SWITCHING REGULATOR

This specification is approved for use by the U.S. Army Armament, Research, Development and Engineering Center (ARDEC) and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification establishes the requirements and quality assurance provisions for the Circuit Card Assembly Switching Regulator, 11732511 (see 6.1).

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 (see 6.2).

SPECIFICATIONS

MILITARY

- MIL-F-13926 - Fire Control Materiel, General
Specification Governing the Manufacture
and Inspection of
- MIL-I-45607 - Inspection Equipment; Acquisition,
Maintenance, and Disposition of

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use to improving this document should be addressed to: Commander, U.S. Army ARDEC, ATTN: AMSTA-AR-EDE-S, Picatinny Arsenal, New Jersey 07806-5000 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 1240

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STANDARDS

MILITARY

MIL-STD-100	- Engineering Drawing Practices
MIL-STD-454	- Standard General Requirements for Electronic Equipment
MIL-STD-810	- Environmental Test Methods
MIL-STD-2000	- Standard Requirements for Soldered Electrical and Electronic Assemblies
MIL-STD-2073-1	- Procedures for Development and Application of Packaging Requirements

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from: DODssp - Customer Service, Standardization Documents Order Desk, 700 Robbins Avenue, Bldg 4D, Philadelphia, PA 19111-5094.)

2.1.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

U.S. Army Armament Research Development and Engineering Center (ARDEC)

DRAWINGS

11732511 - Circuit Card Assembly - Switching Regulator

(Copies of Government drawings required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Order of precedence. In the event of a conflict between the test of this document and the references cited herein (except for related associated detail specifications, specification sheets, or MS standards), the test of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained (see control provisions for additional precedence criteria).

3. REQUIREMENTS

3.1 Fabrication. The switching regulator circuit card assembly, herein referred to as the assembly, shall be manufactured in accordance with Drawing 11732511 and drawing pertaining thereto and, when assembled, shall meet the requirements of this specification (see 4.5.1).

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3.1.1 Function. The assembly shall convert 24 volts direct current (V dc) into 13V dc.

3.1.2 General specifications. (see 4.6.3)

3.1.2.1 Manufacture and inspection. The following provisions of MIL-F-13926 apply:

- a. Dimensions and tolerances
- b. Effect of protective coating on dimensions (Inorganic type coating)
- c. Part identification and marking
- d. Workmanship (Including applicable portions of MIL-STD-2000 and MIL-STD-454, Requirement 9)

3.1.2.2 Standards of manufacture.

3.1.2.2.1 Assembly and soldering. The requirements of MIL-STD-2000 shall apply, as a minimum.

3.1.2.2.2 Interchangeability. The assembly shall be manufactured in accordance with interchangeability requirements as specified in MIL-STD-100.

3.1.3 Ambient conditions. Standard ambient conditions shall be as follows:

- a. Temperature $73^{\circ} \pm 18^{\circ}\text{F}$
- b. Relative Humidity $50 \text{ percent} \pm 30 \text{ percent}$
- c. Atmospheric pressure $28.5 \pm 2.0 \text{ } \bar{-}3.0 \text{ in. Hg.}$

3.2 First Article. When specified in the contract or purchase order (see 6.2), the contractor shall furnish sample units for first article inspection and approval (see 4.4).

3.3 Performance. Unless otherwise specified, the assembly shall meet the performance requirements specified herein under standard ambient conditions of 3.1.3.

3.3.1 13V dc output. With the loads (items 1.1 and 1.2 of Table I), the power source (item 2.1 of Table I), applied, the output at pins P1-1A, 1B, 2A, 2B shall be $12.1 \pm 0.2\text{V dc}$ measured with respect to pins P1-3A, 3B, 4A, 4B. Ripple, if present, shall be equal to or less than 1.5 volts peak-to-peak (see 4.6.1.1).

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TABLE I. Loads and power.

Item	Conditions	Characteristics	Connections
1.0	<u>Loads</u>		
1.1	Resistor	3.3 ohms \pm 5 percent, 100w	Connected between pins P1-1A, 1B, 2A, 2B(+) and pins P1-3A, 3B, 4A, 4B (rtn)
1.2	Capacitor	39 microfarads \pm 10 percent, 50V dc	
2.0	<u>Power Source</u>		
2.1	24V dc	24 \pm 2V dc Ripple 2V peak-to-peak max. Current: 2.5 amperes	Applied between pins P1-17A, 17B, 18A, 18B (+) and P1-5A, 5B, 6A, 6B (rtn)

3.4 Environmental.

3.4.1 Temperature. The assembly shall be capable of operating as specified herein over the operating temperature range of +40°F to 100°F and shall not be damaged when subjected to the storage conditions ranging from -65°F to 160°F (see 4.6.2.1 and 4.6.2.2).

3.4.2 Vibration. The assembly shall be capable of operating as specified herein after withstanding exposure under the conditions of 3.1.3 to a sinusoidal vibration displacement of .03 inch double amplitude, 10 - 55 Hz in accordance with Figure 1. Duration of exposure shall be not less than 80 minutes in each of three mutually perpendicular axes (see 4.6.2.3).

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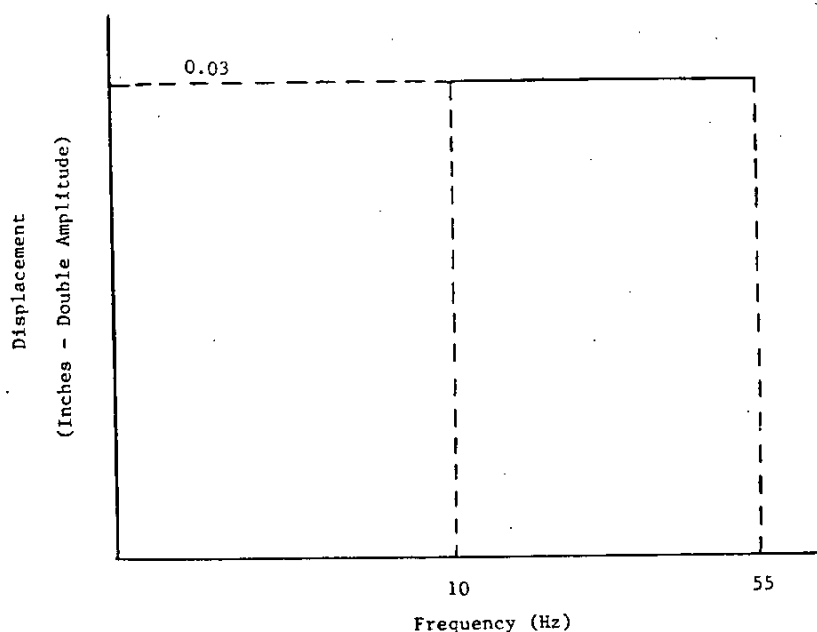


FIGURE 1. Vibration Curve.

3.4.3 Shock. The assembly shall be capable of operating as specified herein after withstanding exposure under the conditions of 3.1.3 to half sine wave shock pulses of 40 ± 4 gravity units (g's) for a duration of 18 ± 3 milliseconds (msec) in accordance with Figure 2. The assembly shall withstand three shock pulses applied in both directions along three mutually perpendicular axes (18 shocks). In addition, the assembly shall be capable of withstanding three half sine wave shock pulses of 100.0 ± 10.0 g's for a duration of 1.5 ± 0.2 msec applied in each direction along three mutually perpendicular axes (see 4.6.2.4).

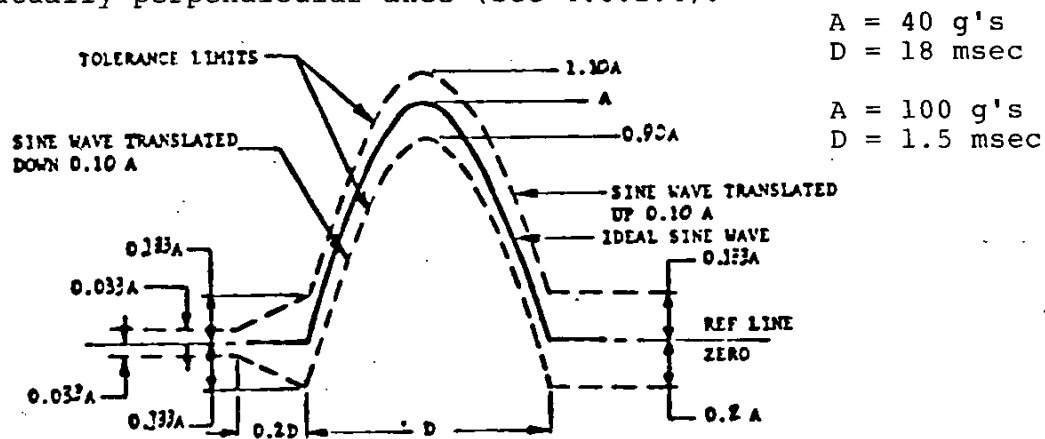


FIGURE 2. Shock Pulse.

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3.4.4 Temperature cycling. The assembly shall be capable of operating as specified herein after withstanding exposure to temperature cycling and soaking between the temperatures of -25°F and 140°F in accordance with Figure 3 (see 4.6.2.5).

4. QUALITY ASSURANCE PROVISIONS

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 (examinations and tests) 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 this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall 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 ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.1.2 Inspection equipment. Unless otherwise specified in the contract, the contractor shall supply, maintain and calibrate inspection equipment in accordance with the provisions of MIL-I-45607 and standard commercial practice. Contractor inspection equipment designs shall be submitted for Government approval as specified in the contract (see 6.5).

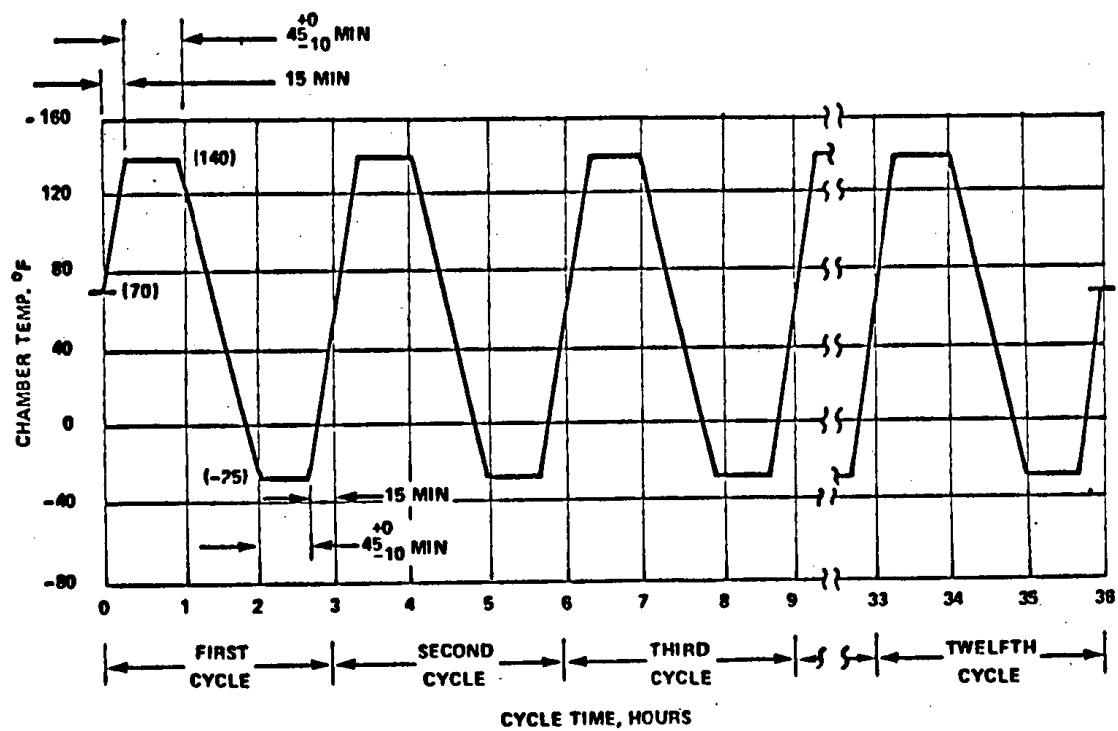
4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. First article inspection (see 4.4)
- b. Quality conformance inspection (see 4.5 and 6.8)

4.3 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the quality assurance provisions of MIL-F-13926 and the conditions 3.1.3.

4.4 First article inspection. The requirements for first article approval and the designation of responsibility for first article

FIGURE 3. Temperature cycling.



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inspection to either the Government or the contractor shall be specified in the contract (see 6.3).

4.4.1 Sample. The contractor shall submit a first article sample as designated by the Contracting Officer for evaluation in accordance with the provisions of 4.4.2. The first article sample shall consist of two assemblies.

4.4.2 Inspection. Two assemblies shall be subjected to all the inspections specified in Tables II, III and IV. Tests 301 and 302 of Table IV shall be performed first.

TABLE II. Performance tests.

Item	Characteristic	Requirement	Test Procedure
101	13V dc output	3.3.1	4.6.1.1

TABLE III. Environmental tests.

Item	Characteristics	Requirements	Test Procedures
201	High temperature	3.4.1	4.6.2.1
202	Low temperature	3.4.1	4.6.2.2
203	Vibration	3.4.2	4.6.2.3
204	Shock	3.4.3	4.6.2.4
205	Temperature Cycling	3.4.4	4.6.2.5

TABLE IV. General tests.

Item	Characteristics	Requirements	Test Procedures
301	Fabrication	3.1	Applicable drawings - Visual
302	General specifications	3.1.2	4.6.3 - Visual
303	Packaging inspection	5.1	4.6.4 - Visual

4.4.3 Failure. Failure of any assembly to meet any requirements shall be cause for refusal to grant first article approval. The Government reserves the right to terminate first article inspection upon any failure of any assembly to comply with any stated requirement.

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4.4.4 Responsibility. The contractor, whether or not responsible, shall inspect the sample for conformance to all contractual requirements and shall submit a record of this inspection with the sample and certificates of conformance for materials. The Government reserves the right to witness inspections performed by the contractor.

4.5 Quality conformance inspection.

4.5.1 Procurement conditions. The following inspection plans shall apply where the assembly is procured for use as a:

<u>Use</u>	<u>Plan</u>
a. Logistics spare assembly apart from the next higher assembly.	A, B and C
b. Component assembly of the next higher assembly.	B and C

4.5.2 Inspection plan A.

4.5.2.1 Environmental sample and tests. One assembly, as a control sample, shall be selected at random by the Government representative from each 50 assemblies produced or from each month's production, whichever occurs first. All the tests in Table III shall be applied separately to the assembly.

4.5.2.2 Acceptance. When the sample assembly of the quantity produced fails to meet any specified requirement, the lot shall be rejected. Rejected lots shall be resubmitted for reinspection only after all assemblies are re-examined or retested and all defective assemblies are removed or defects corrected.

4.5.3 Inspection plan B.

4.5.3.1 Sample and tests. The sample shall be selected by the Government representative. All the tests in Table IV and only the test of item 205 in Table III shall apply. The following sampling plan (except that the visual examination for completeness, improper assembly and evidence of poor workmanship per items 301 and 302 shall be performed 100%) shall be utilized:

100%, c=0 for lot sizes of 10 or less
 n=10, c=0 for lot sizes of 11 to 150
 n=32, c=0 for lot sizes greater than 150

where, n=sample size and c=0 requires zero defects during inspection for acceptance

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4.5.3.2 Acceptance. Where any one assembly in the sample fails to meet any specified requirement, the lot shall be rejected. Rejected lots shall be resubmitted as above.

4.5.4 Inspection plan C.

4.5.4.1 Sample and tests. Each assembly in every lot shall be subjected to all tests in Table II and shall be examined visually for completeness, improper assembly and evidence of poor workmanship per items 301 and 302 of Table IV. The conditions of 3.1.3 apply.

4.5.4.2 Acceptance. Where any one assembly fails to meet any specified requirement, the defective assembly shall be removed from the lot and resubmitted only after all defects have been corrected.

4.6 Methods of inspection.4.6.1 Performance tests.

4.6.1.1 13V dc output. Apply loads and power source per 3.3.1. The output shall be measured and verified to comply with the requirements of 3.3.1.

4.6.2 Environmental tests.

4.6.2.1 High temperature. Subject the assembly to the high temperature test specified in MIL-STD-810, Method 501 except storage temperature shall be 160°F for 48 hours. At the conclusion of the storage temperature test, stabilize the assembly at 100°F and subject it to the performance tests of Table II. After testing, return the assembly to room temperature and subject it to the performance tests of Table II.

4.6.2.2 Low temperature. Subject the assembly to the low temperature test specified in MIL-STD-810, Method 502. Maintain the temperature at -65°F for a period of 12 hours minimum. At the conclusion of the storage temperature test, stabilize the assembly at 40°F and subject it to the performance tests of Table II. After testing, return the assembly to room temperature and subject the assembly to the performance tests of Table II.

4.6.2.3 Vibration. Vibration A as specified in 4.6.2.3.1 shall be conducted only for first article inspection. Vibration B as specified in 4.6.2.3.2 shall be conducted only for quality conformance inspection.

4.6.2.3.1 Vibration A. Mount the assembly in a suitable

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vibration fixture and subject the assembly to the vibration test specified in MIL-STD-810, Method 514, General Procedures, and 3.4.2. The vibration amplitude shall have a tolerance of $\pm 10\%$. The tolerance of the vibration frequency shall be $\pm 2\%$, or $\pm 1/2$ Hz for frequencies below 25 Hz. Vibration sweeps shall be conducted with the duration of exposure not less than 80 minutes in each of three mutually perpendicular axes. At the conclusion of this test, subject the assembly to the performance tests of Table II.

4.6.2.3.2 Vibration B. This test shall be conducted as in 4.6.2.3.1 except that the period of vibration shall be not less than 15 minutes in each axis.

4.6.2.4 Shock. Mount the assembly in a suitable shock fixture and subject it to the functional shock test for ground equipment specified in MIL-STD-810, Method 516, for a total of three half sine wave shock pulses in both directions along three mutually perpendicular axes (18 shocks). Peak amplitude shall be 40 ± 4 g's with a time duration of 18 ± 3 msec in accordance with Figure 2. At the conclusion of this test, subject the assembly to the performance tests of Table II. Repeat this test with peak amplitude of 100.0 ± 10.0 g's with a time duration of 1.5 ± 0.2 msec in accordance with Figure 2.

4.6.2.5 Temperature cycling. With power and loads of Table I applied, subject the assembly to the temperature profile specified in Figure 3. At the conclusion of this test, subject the assembly to the performance tests of Table II.

4.6.3 General specifications. Verification shall be provided by examination, visually or through the use of standard measuring equipment, in accordance with 3.1.2.

4.6.4 Packaging inspection. The sampling and inspection of the preservation, packaging, packing and container marking shall be in accordance with MIL-STD-2073-1.

5. PACKAGING

5.1 Packaging, packing and marking. Packaging, packing and marking shall be in accordance with MIL-STD-2073-1. The level of protection shall be as specified in the procurement document (see 4.6.4 and 6.2d).

6. NOTES

6.1 Intended use. The Switching Regulator circuit card (A2) assembly is used in the Field Test Set, 11733200, which is used in the field to test all of the M21 Computer subsystem components.

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6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this specification.
- b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1).
- c. Inspection provisions for first article (see 6.3).
- d. Applicable levels of preservation, packaging, packing, and container marking (see 5.1 and 6.7)

6.3 First article. The contracting officer should provide specific guidance to offerors for the submission of a first article sample to be tested as specified in 4.4.2. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

6.4 Supersession. Previous revisions of MIL-C-48479(AR) were for the U.S. Army Armament, Research, Development and Engineering Center's internal use only, and were not forwarded to the Naval Publications and Form Center for publication.

6.5 Submission of contractor inspection equipment designs for approval. Submit copies of designs as required to: Commander, U.S. Army ARDEC, Attn: AMSTA-AR-QAC-F, Picatinny Arsenal, NJ 07806-5000. This address will be specified on the Contract Data Requirements List, DD Form 1423 in the contract.

6.6 Drawings. Drawings listed in Section 2 of this specification under the heading U.S. Army Armament, Research, Development and Engineering Center (ARDEC) may also include drawings prepared by, and identified as U.S. Army Armament, Research and Development Command (ARRADCOM), Frankford Arsenal, Rock Island Arsenal or Picatinny Arsenal. Technical data originally prepared by these activities is now under the cognizance of ARDEC.

6.7 Levels of packaging. The following definitions describe the three levels of packaging in accordance with MIL-STD-2073-1.

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- a. Level A - Adequate protection for indeterminate storage and worldwide distribution.
- b. Level B - Adequate protection for known shipment conditions and storage conditions normally not exceeding one year.
- c. Level C - Adequate protection for shipment to a known site for immediate use.

6.8 Alternative quality conformance provisions. Alternative quality conformance procedures, methods, or equivalent, such as statistical process control, tool control, other types of sampling procedures, etc., may be used by the contractor when they provide, as a minimum, the level of quality conformance required by the provisions specified herein. Prior to applying such alternative procedures, methods, or equivalent, the contractor shall describe them in a written proposal submitted to the Government for evaluation. When required, the contractor shall demonstrate that the effectiveness of each proposed alternative is equal to or better than the specified quality assurance provision(s) herein. In cases of dispute as to whether the contractor's proposed alternative(s) provides equivalent assurance, the provisions of this specification shall apply. All approved alternative provisions shall be specifically incorporated into the contractor's quality program or detailed inspection system, as applicable. Unless otherwise specified in the contract, proposed alternative quality conformance provisions will be submitted by the contractor for evaluation by the technical activity.

6.9 Subject term (key word) listing.

Computer, M21
Fire Control
Tank, M60A3

Custodian:
Army-AR

Preparing activity:
Army-AR

(Project 1240-0005)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.

2. The submitter of this form must complete blocks 4, 5, 6, and 7.

3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of 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.

I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER

MIL-C-48479C (AR)

2. DOCUMENT DATE (YYMMDD)

950530

3. DOCUMENT TITLE

CIRCUIT CARD ASSEMBLY - SWITCHING REGULATOR

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets if needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)

b. ORGANIZATION

c. ADDRESS (Include Zip Code)

d. TELEPHONE (Include Area Code)

e. DATE SUBMITTED (YYMMDD)

(1) Commercial

(2) AUTOVON
(If applicable)

8. PREPARING ACTIVITY

a. NAME

U.S. ARMY ARDEC
STANDARDIZATION OFFICE

b. TELEPHONE (Include Area Code)

(1) Commercial
201-724-6629

(2) AUTOVON
DSN-880-6629

c. ADDRESS (Include Zip Code)

ATTN: AMSTA-AR-EDE-S
PICATINNY ARSENAL, NJ 07806-5000

IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:

Defense Quality and Standardization Office
6203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466
Telephone (703) 766-2340 AUTOVON 289-2340