

TINCH-POUND I

MIL-C-39028C

1 Feb 1990

SUPERSEDING

MIL-C-39028B

30 April 1984

MILITARY SPECIFICATION
CAPACITORS, PACKAGING OF

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

* 1.1 Scope. This specification covers the requirements for the preservation, packing, and container marking of all types of capacitors and associated accessories which are primarily in FSC 5910 (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

FEDERAL

QQ-S-781	-	Strapping, Steel, and Seals.
PPP-B-566	-	Boxes, Folding, Paperboard.
PPP-B-601	-	Boxes, Wood, Cleated-Plywood.
PPP-B-621	-	Boxes, Wood, Nailed and Lock-Corner.
PPP-B-636	-	Boxes, Shipping, Fiberboard.
PPP-B-676	-	Boxes, Setup.

MILITARY

MIL-P-116	-	Preservation, Methods of.
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Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Defense Electronics Supply Center, ATTN: DESC-ES, 1507 Wilmington Pike, Dayton, Ohio 45444-5000, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

STANDARDS

FEDERAL

FED-STD-123 - Marking for Shipment (Civil Agencies).

MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-129 - Marking for Shipment and Storage.
MIL-STD-147 - Palletized Unit Loads.
MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.
MIL-STD-1285 - Marking of Electrical and Electronic Parts.
MIL-STD-2073-1 - DoD Materiel, Procedures for Development and Application of Packaging Requirements.
MIL-STD-45662 - Calibration Systems Requirements.

* (Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Naval Publications and Forms Center, (ATTN: NPODS), 5801 Tabor Avenue, Philadelphia, PA 19120-5099.)

* 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.

3. REQUIREMENTS

* 3.1 General. The packaging terms used herein shall be in accordance with the definitions listed in MIL-STD-129 and MIL-STD-2073-1. The following general requirements apply, as applicable, to all levels A, B, and C as well as to shipments to non-Government activities.

3.1.1 Pairs, sets, and kits. Capacitors furnished in pairs, sets, or kits under one national stock number (NSN) shall be unit packed as one pair, one set, or one kit, as applicable. When individual unit packs are used to make up a pair, set, or kit of capacitors, these packs shall not be glued, stapled, or taped together but shall be enclosed within a close fitting container.

3.1.2 Hardware. Hardware accompanying capacitors shall be protected and enclosed within the unit packs in a manner that will not damage the capacitors or packaging materials. When practical, the hardware should be mounted on each capacitor.

* 3.1.3 Physical protection. Capacitors and accessories shall be packaged in a manner that will ensure compliance with the applicable requirements of MIL-P-116 as well as those specified herein. For shipments to non-Government activities, reels and other large quantity unit packs designed for automatic insertion equipment may be used.

3.1.3.1 Lead and terminal protection. Leads and terminals less than 0.015 inch (0.381 mm) in smallest dimension shall be protected by container design, die-cut inserts, or other suitable noncorrosive supporting materials or devices. Leads and terminals shall extend outward and be maintained in the manufactured configuration without causing undue loads or stresses to the packaged capacitors.

* 3.1.3.2 Wrapping and cushioning. When used or specified, wrapping and cushioning materials shall be noncorrosive and dry and shall not crumble, flake, powder, or shed.

3.1.4 Exterior containers. Exterior containers (see 3.3.1, 3.3.2 and 3.3.3) shall be of minimum tare and cube consistent with the protection required and shall contain equal quantities of identical stock numbered or otherwise designated items to the greatest extent practicable.

3.2 Preservation. Preservation shall be in accordance with level A, B, or C, as specified (see 3.1 and 6.2).

* 3.2.1 Level A.

3.2.1.1 Cleaning. Capacitors shall be cleaned in accordance with MIL-P-116, process C-1.

3.2.1.2 Drying. Capacitors shall be dried in accordance with MIL-P-116.

3.2.1.3 Preservatives. Contact preservatives shall not be used.

3.2.1.4 Unit packs.

3.2.1.4.1 Hermetically sealed capacitors except established reliability (ER) capacitors. Hermetically sealed (see 6.4) capacitors shall be unit packed in accordance with MIL-P-116, method III. The quantity per unit pack (QUP) shall be one. When the weight of a capacitor exceeds ten pounds (4.536 kilograms), the unit container shall conform to PPP-B-636, class weather resistant, style optional, special requirements. The requirements for box closure, waterproofing, and reinforcing shall be as specified in 3.3.2.

3.2.1.4.2 Nonhermetically sealed capacitors and all established reliability capacitors. The unit packs for these capacitors shall be as specified in table 1. Except for capacitor chips, the QUP shall be one. Unless otherwise specified in the contract (see 6.2), the QUP for capacitor chips shall be ten.

* 3.2.1.4.3 Accessories (when separately acquired). Accessories, such as mounting brackets, shall be unit packed five each in accordance with MIL-P-116, method III. Unit pack quantities for other than five each shall be as specified (see 6.2).

* 3.2.1.4.4 Supplementary containers. Each capacitor and accessory, unit packed as specified in 3.2.1.4.2 with a unit pack volume exceeding 15 cubic inches (245.85 cubic centimeters), shall be placed in a supplementary container conforming to variety 2 of either PPP-B-566 or PPP-B-676.

* 3.2.1.5 Intermediate packs. When the unit pack is a bag of any type or the unit pack is less than 64 cubic inches (1,049 cubic centimeters), uniform quantities of capacitors or accessories of the same NSN shall be placed in intermediate containers conforming to variety 2 of PPP-B-566, or variety 2 of PPP-B-676; or PPP-B-636, class weather resistant. Alternatively, nonweather or nonwater resistant versions of these containers may be used provided they are overwrapped with waterproof barrier materials. Intermediate containers shall contain multiples of five unit packs not to exceed 100 unit packs. No intermediate packs are required when the total quantity shipped to a single destination will result in only one intermediate pack per shipping container.

* TABLE I. Levels A and B preservation requirements for nonhermetically sealed and all established reliability capacitors.

Type of capacitor	Net weight and cube	Submethod of MIL-P-116		Additional requirements**
		Level A	Level B	
Fixed (including chip) except ceramic case (potted) mica dielectric	0-10 pounds	IA-8*	IC-1* or IC-3*	See 3.2.1.4.4
	Over 10 pounds	IA-14	IC-2	Exterior container shall be in accordance with requirements of 3.3.2.
Fixed, ceramic case (potted) mica dielectric	0-10 pounds	IIC	IC-1 or IC-3	See 3.2.1.4.4.
	Over 10 pounds	Iia or Iib	IA-14 or IA-16	Exterior container shall be in accordance with requirements of 3.3.2.
Variable, without roller or ball bearings	0-10 pounds and 0-125 cubic inches	IA-8	IC-1 or IC-3	See 3.2.1.4.4.
	0-10 pounds but over 125 cubic inches	IIC	IA-8	See 3.2.1.4.4.
	Over 10 pounds	Iia or Iib	IA-14 or IA-16	Exterior container shall be in accordance with requirements of 3.3.2.
Variable, with roller or ball bearings	0-10 pounds	IIC	IA-8	See 3.2.1.4.4.
	Over 10 pounds	Iia or Iib	IA-14 or IA-16	Exterior container shall be in accordance with requirements of 3.3.2.

* Prior to preservation, capacitor chips shall be initially enclosed in transparent, partitioned plastic boxes (or covered trays).

** For level B preservation, any variety or class of the containers specified in the referenced paragraphs may be used.

* **3.2.2 Level B.** Except as specified in table I, the level B preservation for capacitors and accessories shall be identical to that specified for level A. However, any variety or class of the unit, supplementary, and intermediate containers specified may be used.

3.2.3 Level C. The level C preservation of capacitors shall conform to the MIL-STD-2073-1 requirements for this level. Unless otherwise specified in the contract (see 6.2), the quantity per unit pack shall be at the option of the supplier.

3.3 Packing. Packing shall be level A, B, or C, as specified (see 3.1 and 6.2).

* **3.3.1 Level A.** Capacitors and accessories, preserved as specified in 3.2, shall be packed in wood containers conforming to PPP-B-601, overseas type or PPP-B-621, class 2. Closure and strapping shall be in accordance with the applicable container specification except that metal strapping shall conform to QQ-S-781, type I, finish A. The requirements for level B packing shall be used when the total quantity of a stock numbered capacitor for a single destination does not exceed a packed volume of one cubic foot (0.02832 cubic meter).

* **3.3.2 Level B.** Capacitors and accessories, preserved as specified in 3.2, shall be packed in fiberboard containers conforming to PPP-B-636, class weather resistant, style optional, special requirements. The requirements for box closure, waterproofing, and reinforcing shall be in accordance with method V of the PPP-B-636 appendix.

* **3.3.3 Level C.** Capacitors and accessories, preserved as specified in 3.2, shall be packed in fiberboard containers conforming to PPP-B-636, class domestic, style optional, special requirements. Closures shall be in accordance with the PPP-B-636 appendix.

* **3.3.4 Unitized loads.** Unless otherwise specified (see 6.2), unitized loads, commensurate with the level of packing specified in the contract or purchase order, shall be used whenever total quantities for shipment to one destination equal 40 cubic feet (1.1328 cubic meters) or more. Quantities less than 40 cubic feet need not be unitized. Unitized loads shall be uniform in size and quantities to the greatest extent practicable.

3.3.4.1 Level A. Capacitors, packed as specified in 3.3.1, shall be unitized on pallets in conformance with MIL-STD-147, load type I, with a wood cap (storage aid 5) positioned over each load.

3.3.4.2 Level B. Capacitors, packed as specified in 3.3.2, shall be unitized on pallets in conformance with MIL-STD-147, load type I, with a weather resistant fiberboard cap (storage aid 4) positioned over each load.

3.3.4.3 Level C. Capacitors, packed as specified in 3.3.3, shall be unitized as specified in 3.3.4.2 except that the fiberboard caps shall be class domestic.

3.4 Marking. The following marking is mandatory for shipments both to U.S. Government and non-Government activities.

3.4.1 Standard marking. In addition to any special or other identification marking required by the contract (see 6.2), each unit, supplementary, intermediate, and exterior container and unitized load shall be marked in accordance with MIL-STD-129. The complete military or contractor's type or part number, as applicable, including the Commercial and Government Entity (CAGE) code, shall be marked on all unit and intermediate packs in accordance with the identification marking provisions of MIL-STD-129. When specified in the contract (see 6.2), the marking of domestic shipments for civil agencies shall be in accordance with FED-STD-123.

* 3.4.2 Additional unit pack marking of capacitors conforming to FSC 5910 commodity specifications and drawings. Unit packs of capacitors conforming to FSC 5910 commodity specifications and drawings shall additionally be marked with the following:

- a. Date code and (when authorized) JAN marking.
- b. Manufacturer's production lot code.
- c. Aluminum electrolytic capacitors shall be marked as aluminum electrolytic in accordance with MIL-STD-1285.

3.5 First article and quality conformance inspections. First article and quality conformance inspections and tests shall be required as specified in 4.4 and 4.5, respectively. Samples for these tests shall be furnished in accordance with the procedures outlined in 4.4 and 4.5. The performance of the visual and dimensional inspections, rough handling tests, and leakage tests shall conform to the inspections and tests outlined in 4.6.1, 4.6.2.1, and 4.6.2.2, respectively.

3.5.1 Functional requirements.

* 3.5.1.1 Rough handling test (when specified, see 6.2). When packs have been tested in accordance with 4.6.2.1, all materials and components comprising each pack shall be free from damage or evidence of misplacement which might affect the utility of the preservation method or pack. The capacitors and associated accessories within the tested packs shall show no visible signs of damage. When specified in the contract (see 6.2), functional tests in accordance with the group A inspection requirements of the applicable commodity specification or drawing shall be conducted on those capacitors subjected to the rough handling test to determine freedom from operational malfunction. The examination of the capacitors tested under this group A inspection shall be in accordance with visual and mechanical inspection requirements specified in the applicable capacitor commodity specification or drawing.

3.5.1.2 Leakage test (when applicable). When a barrier enclosed unit pack has been tested in accordance with 4.6.2.2, there shall be no evidence of moisture within the unit pack.

3.6 Workmanship. The quality of workmanship shall assure acceptance of the completed preservation, packing, and marking requirements in accordance with the inspections specified in section 4.

4. QUALITY ASSURANCE PROVISIONS

* 4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order (see 6.2), the contractor is responsible for the performance of all inspection requirements (examination 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 such facilities are 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 must meet all requirements of section 3. 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 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality, and quantity to permit performance of the required inspection shall be established and maintained by the contractor. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with MIL-STD-45662.

4.1.3 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in the general requirements of MIL-STD-202.

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

- a. Materials inspection (see 4.3).
- b. First article inspection (see 4.4).
- c. Quality conformance inspection (see 4.5).

4.3 Materials inspection. Materials inspection shall consist of certification supported by verifying data that the materials used are in accordance with the applicable requirements specified herein.

4.4 First article inspection. When specified (see 6.2), first article inspection shall be performed by the contractor, after award of contract and prior to production, at a time and location acceptable to the Government. First article inspection shall not be required:

- * a. When there have been no changes in materials, processes, or packaging design that will adversely affect item protection since the last recorded inspection.
- b. When detailed packaging instructions are furnished by the acquisition activity.
- c. When level C protection is specified.
- d. When a prior successful inspection was conducted on a like item and pack (subject to the approval of the administrative contracting officer).

* 4.4.1 Sample size. One sample unit consisting of a level A or level B pack, as applicable, fully packed shipping container shall be submitted for first article inspection. The sample for the rough handling test shall consist of the pack selected for first article inspection. The sample for the leakage test shall be five unit packs selected at random from the first article exterior pack (shipping container).

4.4.2 Inspection routine. The sample shall be subjected to the inspections specified in tables II and III. The leakage test, when applicable, shall follow the rough handling test.

4.4.3 Failures. One or more failures shall be cause for refusal to grant first article approval.

4.4.4 Resubmission of first article sample. If the sample fails to pass first article inspection, the contractor shall change the preservation and packing processes to correct the cause of the deficiency. First article inspection shall be performed on a corrected sample to prove that the corrective action is acceptable.

4.5 Quality conformance inspection. This inspection shall consist of the inspections and tests specified in tables II and III, respectively.

4.5.1 Inspection lot. An inspection lot, as far as practicable, shall consist of unit or exterior (shipping) packs produced under essentially the same conditions and offered for inspection at one time. For the purpose of selecting samples to be inspected and tested for compliance with the requirements of this specification, either items in process or completed packs except as stated herein, may be combined into lots without regard to individual items, contracts, or the quantities therein. Unit packs of the same size and made from the same packaging materials may be grouped together except when item complexity, item value, or the complexity of the preservation method warrants that the inspection of such items be performed on a separate basis. A separate application of the sampling or inspection procedure shall be made on these items. The combination of items to be subjected to inspection shall be determined by either the Government or the contractor, subject to the approval of the Government.

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* TABLE II. Visual and dimensional inspections.

Major defects	Requirement paragraph	Test paragraph
Preservation and packing materials not conforming to referenced specification requirements - - - -	3.1, 3.2, and 3.3	4.6.1
Punctured or improperly fabricated barrier bag - -	3.2.1.4.2	
Uncleaned or improperly cleaned items- - - - -	3.2.1.1 and 3.2.1.2	
Incorrect preservation method- - - - -	3.2.1.4.1, 3.2.1.4.2, and 3.2.1.4.3	
Wrong quantity per unit pack - - - - -	3.2.1.4.1, 3.2.1.4.2, 3.2.1.4.3, and 3.2.2	
Nonuse or incorrect applications of intermediate containers - - - - -	3.2.1.5	
Improper box closures- - - - -	3.3.1, 3.3.2, and 3.3.3	
Omitted, incorrect, or illegible marking - - - -	3.4	

TABLE III. Functional inspections.

Test	Requirement paragraph	Test paragraph
Rough handling (when specified)- - - - -	3.5.1.1	4.6.2.1
Leakage (when applicable)- - - - -	3.5.1.2	4.6.2.2

4.5.2 Visual and dimensional inspection. Visual and dimensional inspection shall consist of those inspections specified in table II.

4.5.2.1 Sampling plan. Statistical sampling and inspection shall be in accordance with MIL-STD-105 for special inspection level S-4. The acceptable quality level (AQL) shall be 4.0 percent defective for all inspections of table II combined.

* 4.5.2.2 Rejected lots. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units, and resubmit for reinspection. Resubmitted lots shall be inspected using tightened inspection. Such lots shall be separate from new lots and clearly identified as reinspected lots.

4.5.2.3 Disposition of sample units. Sample units which have passed all the inspections specified in table II may be delivered on the contract, provided the lot is accepted.

4.5.3 Functional inspection. Functional inspection shall consist of the tests specified in table III.

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4.5.3.1 Sampling plan. Sampling plans shall be as follows:

- a. One sample unit for the rough handling test shall be selected whenever the design of the item or packaging is changed.
- b. For unit packs requiring waterproof or water-vaporproof barriers, five sample units for the leakage test shall be selected daily at random from the first lot processed each day. Five additional samples shall be selected at random from the day's total production.
- c. The leakage test shall also be performed following the rough handling test on unit packs requiring waterproof or water-vaporproof barriers. Five sample units or the number of units contained within the shipping container (if less than five) shall be selected.

4.5.3.2 Failures. One or more failures shall be cause for rejection of the lot.

4.5.3.3 Disposition of sample units. Sample units which have passed the inspections specified in table III may be delivered on the contract if the lot is accepted and opened packs have been reprocessed.

4.5.3.4 Noncompliance. If a sample fails to pass the inspections specified in table III, ~~the contractor~~ shall take corrective action on the materials or processes or both, as warranted, on all unit, intermediate, and exterior (shipping) packs which can be corrected and which were processed under essentially the same conditions, with essentially the same materials, and which are considered subject to the same failure. Acceptance of the unit, intermediate, and exterior packs shall be discontinued until corrective action has been taken and the applicable inspections specified in table III have been repeated on additional sample units. (All inspections or the inspection which the original sample failed shall be at the option of the Government.) Inspections specified in table III may be reinstated; however, final acceptance shall be withheld until the reinspection in accordance with table III has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure and corrective action taken shall be furnished to the administrative contracting officer.

4.6 Methods of inspections and tests.

4.6.1 Visual and dimensional inspections. Unit, intermediate, and exterior packs shall be examined to verify that the materials, designs, methods, physical limitations, marking, and workmanship are in accordance with the applicable requirements (see 3.1 through 3.6).

4.6.2 Functional tests.

4.6.2.1 Rough handling. Packs shall be subjected to the applicable rough handling tests and the interpretation of results or cause for rejection as specified in 3.5.1.1 and MIL-P-116.

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4.6.2.2 Leakage. When a waterproof or water-vaporproof barrier is required, the unit pack shall be subjected to the applicable leakage test and interpretation of results specified in 3.5.1.2 and MIL-P-116.

5. PACKAGING.

This section is not applicable to this specification.

6. NOTES

* (This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

* 6.1 Intended use. The preservation, packing and marking specified herein are intended for direct shipments to the Government. The general requirements (3.1) and marking requirements (3.4) are applicable for the preparation of military specification capacitors and accessories for shipment from the parts manufacturer to non-Government activities.

* 6.2 Acquisition requirements. Acquisition documents must specify the following:

- * a. Title, number and date of the specification (see 2.1.1).
- * b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1).
- c. Levels of preservation and packing (see 3.2 and 3.3).
- * d. Quantity per unit pack, if other than specified (see 3.2.1.4.2, 3.2.1.4.3 and 3.2.3).
- * e. If a unitized load is not required for shipment to one destination when total quantities are equal to 40 cubic feet or more (see 3.3.4).
- f. If any special or other identification marking is required (see 3.4.1).
- g. If FED-STD-123 is required for civil agency marking (see 3.4).
- h. If a rough handling test is required (see 3.5.1.1).
- i. If capacitor functional tests are required (see 3.5.1.1).
- j. If the contractor is not responsible for the performance of all inspection requirements (see 4.1).
- k. If first article inspection is required (see 4.4).

6.3 First article. The sample pack submitted for first article inspection (when satisfactorily performed as specified in 4.4) will serve as the production standard for subsequent packaging operations. The contractor should inform the procuring activity or the activity administering the contract of the time and location of this specification so that the Government representative will have an opportunity to witness the tests.

6.4 Definition. A hermetic seal is defined as a fusion of metal to metal, glass to glass, or metal to glass.

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6.5 Conditions for use of level B preservation. When level B preservation is specified (see 3.2), ~~this level of protection should be reserved for the acquisition of capacitors under for resupply worldwide under known favorable handling, transportation, and storage conditions.~~

* 6.6 Subject term (key word) listing.

Capacitor accessories
 Capacitor chips
 Fixed capacitors
 Hermetically sealed capacitors
 Marking
 Nonhermetically sealed capacitors
 Packaging
 Packing
 Physical protection
 Preservation
 Variable capacitors

* 6.7 Changes from previous issue. The margins of this specification are marked with asterisks to indicate where changes (additions, modifications, corrections, deletions) from the previous issue were made. This 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 issue.

CONCLUDING MATERIAL

Custodians:
 Army - CR
 Navy - EC
 Air Force - 99
 DLA - ES

Review activities:
 Army - AR, SM
 Navy - AS, SH
 Air Force - 70, 84

User activity:
 Air Force - 11

Preparing activity:
 Navy - EC

Agent:
 DLA - ES

(Project PACK-0891)