

INCH-POUND
MIL-DTL-39028G
9 October 2018
SUPERSEDING
MIL-DTL-39028F
18 October 2013

DETAIL SPECIFICATION

CAPACITOR, 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 that are primarily in FSC 5910 (see 6.1).

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 or 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they meet all specified requirements documents cited in sections 3 or 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 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 cited in the solicitation or contract (see 6.2).

FEDERAL SPECIFICATIONS

PPP-B-566	-	Boxes, Folding, Paperboard
PPP-B-676	-	Boxes, Setup

(Copies of these documents are available online at <http://quicksearch.dla.mil/>.)

FEDERAL STANDARDS

FED-STD-123	-	Marking for Shipment (Civil Agencies)
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(Copies of these documents are available online at <http://quicksearch.dla.mil/>.)

Comments, suggestions, or questions on this document should be addressed to: Defense Supply Center, Columbus, DLA Land and Maritime, ATTN: VAT, Post Office Box 3990, Columbus, OH 43218-3990 or emailed to capacitorfilter@dlamail. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.dla.mil>.



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DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-129	-	Military Marking for Shipment and Storage
MIL-STD-147	-	Palletized Unit Loads
MIL-STD-202	-	Test Method Standard for Electronic and Electrical Component Parts
MIL-STD-1285	-	Marking of Electrical and Electronic Parts
MIL-STD-2073-1	-	Standard Practice for Military Packaging

(Copies of these documents are available online at <http://quicksearch.dla.mil/>.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract (see 6.2).

ASTM INTERNATIONAL (ASTM)

ASTM D1974/D1974M	-	Standard Practice for Methods of Closing, Sealing, and Reinforcing Fiberboard Boxes
ASTM D3951	-	Standard Practice for Commercial Packaging
ASTM D3953	-	Standard Specification for Strapping, Flat Steel and Seals
ASTM D5118/D5118M	-	Standard Practice for Fabrication of Fiberboard Shipping Boxes
ASTM D6251/D6251M	-	Standard Specification for Wood-Cleated Panelboard Shipping Boxes

(Copies of these documents are available on line at <http://www.astm.org/>.)

INTERNATIONAL ORGANIZATION for STANDARDIZATION (ISO)

ISO 10012	-	Measurement Management Systems - Requirements for Measurement Processes and Measuring Equipment
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(Copies of this document are available on line at <http://www.iso.org>.)

NATIONAL CONFERENCE OF STANDARDS LABORATORIES (NCSL)

NCSL Z540.3	-	Requirements for the Calibration of Measuring and Test Equipment
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(Copies of this document are available online at <http://www.ncsl.org>.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein (except for related specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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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 military and commercial packaging.

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 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-STD-2073-1](#) 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 Wrapping and cushioning of leads and terminals. Leads and terminals less than .015 inch (0.381 mm) in dimension shall be protected by container design, die cut inserts, vials, or other suitable noncorrosive supporting materials or devices. Leads and terminals shall extend outward and be maintained in a configuration as manufactured without causing undue loads or stresses capable of causing damage to the capacitors. Materials used to maintain item position and lead configuration shall permit item removal and replacement without bending the leads. Materials used shall be noncorrosive materials and shall not crumble, flake, powder, or shed. These materials shall be in accordance with [MIL-STD-2073-1](#), appendix J, table IV and IVa for wrapping materials, and appendix J, table V and Va for cushioning materials. No special physical protection or lead protection is required for axial leaded capacitors.

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 military or commercial packaging, as specified (see [3.1](#) and [6.2](#)).

3.2.1 Military packaging.

3.2.1.1 Cleaning. Capacitors and accessories shall be clean or be cleaned in accordance with [MIL-STD-2073-1](#), table J II.

3.2.1.2 Drying. Capacitors and accessories shall be dry or be dried in accordance with [MIL-STD-2073-1](#), paragraph 5.2.1.

3.2.1.3 Preservatives. Contact preservatives shall not be used.

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3.2.1.4 Unit packs.

3.2.1.4.1 Hermetically sealed capacitors (non-ER only). Hermetically sealed (see 6.4) capacitors shall be individually unit packed in accordance with MIL-STD-2073-1, method 10, or as specified in the contract or purchase order (see 6.2). 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 ASTM D5118 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 ER capacitors. These capacitors shall be individually unit packed in accordance with the procedures specified in table I. 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-STD-2073-1, method 10. Unit pack quantities for other than five each shall be as specified (see 6.2).

TABLE I. Military preservation requirements for nonhermetically sealed and all established reliability capacitors.

Type of capacitor	Net weight and cube	MIL-STD-2073-1 method	Additional requirements
Fixed (including chip) except ceramic case (potted) mica dielectric	0-10 pounds	1/ 41	See 3.2.1.4.4.
	Over 10 pounds	42	Exterior container shall be in accordance with requirements of 3.3.2.
Fixed, ceramic case (potted) mica dielectric	0-10 pounds	51	See 3.2.1.4.4.
	Over 10 pounds	52 or 53	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	41	See 3.2.1.4.4.
	0-10 pounds but over 125 cubic inches	51	See 3.2.1.4.4.
	Over 10 pounds	52 or 53	Exterior container shall be in accordance with requirements of 3.3.2.
Variable, with roller or ball bearings	0-10 pounds	51	See 3.2.1.4.4.
	Over 10 pounds	52 or 53	Exterior container shall be in accordance with requirements of 3.3.2.

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

3.2.1.4.4 Supplementary containers. Capacitors and accessories 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 PPP-B-566, PPP-B-676, or ASTM D5118. 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.

3.2.2 Commercial packaging. Commercial packaging preservation shall conform to ASTM D3951.

3.3 Packing. Packing shall be military level A, military level B, or minimal packing (see 3.1 and 6.2).

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3.3.1 Military level A. Capacitors and accessories, preserved as specified in 3.2, shall be packed in wood containers conforming to [ASTM D6251](#), overseas type. Closure and strapping shall be in accordance with the applicable container specification except that metal strapping shall conform to [ASTM D3953-97](#). The requirements for military level B packing shall be used when the total quantity of a stock numbered capacitor, or accessory, for a single destination, does not exceed a packed volume of 1 cubic foot (0.02832 cubic meter).

3.3.2 Military level B. Capacitors and accessories, preserved as specified in 3.2, shall be packed in fiberboard containers conforming to [ASTM D5118](#) (class weather resistant, style optional, special requirements). The requirements for box closure, waterproofing, and reinforcing shall be in accordance with [ASTM D1974/D1974M](#) (method V).

3.3.3 Minimal packing. Minimal packing shall conform to [ASTM D3951](#) (class domestic, style optional, special requirements).

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 Military level A. Capacitors, packed as specified in 3.3.1, should be unitized on pallets in accordance with [MIL-STD-147](#) load type I, with a wood cap (storage aid 5) positioned over each load.

3.3.4.2 Military level B. Capacitors, packed as specified in 3.3.2, shall be unitized on pallets as specified in 3.3.4.1 except that weather resistant fiberboard caps (storage aid 4) shall be used in lieu of wood caps.

3.3.4.3 Commercial. Commercial unitized loads shall conform to [ASTM D3951](#).

3.4 Marking. The following marking is mandatory for shipments both to United States 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 Identifying Number (PIN), 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 FSC 5910 commodity specification capacitors. 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 conformance inspections. First article and conformance inspections shall be required as specified in 4.5 and 4.6, respectively. Samples for these tests shall be furnished in accordance with the procedures outlined in 4.5 and 4.6. The performance of the visual and dimensional inspections, rough handling tests, and leakage tests shall conform to the inspections and tests outlined in 4.6.2, 4.7.2.1, and 4.7.2.2, respectively.

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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 4.7.2.1, all materials and components comprising each pack shall be free from damage or evidence of misplacement that 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 Recycled, recovered, environmentally preferable, or biobased materials. Recycled, recovered, environmentally preferable, or biobased materials should be used to the maximum extent possible provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.7 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. VERIFICATION

4.1 Test equipment and inspection facilities. The supplier shall establish and maintain a calibration system in accordance with NCSL Z540.3, ISO 10012, or equivalent, as approved by the Government.

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

- a. Materials inspection (see 4.4).
- b. First article inspection (see 4.5).
- c. Conformance inspection (see 4.6).

4.3 Inspection conditions. All inspections shall be performed in accordance with the test conditions specified in the "General Requirements" of MIL-STD-202.

4.4 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.

4.5 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 acquiring activity.
- c. When commercial packaging 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).

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4.5.1 Sample size. One sample unit consisting of a military level A or military level B, 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).

4.5.2 Inspection routine. The sample shall be subjected to the inspections specified in [table II](#) and [table III](#). The leakage test, when applicable, shall follow the rough handling test.

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

4.5.4 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.

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	4.6.2
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	3.2.1.3	
Wrong quantity per unit pack	3.2.1.4	
Nonuse or incorrect applications of intermediate containers	3.2.1.5	
Improper box closures	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	4.7.2.1
Leakage (when applicable)	3.5.1.2	4.7.2.2

4.6 Conformance inspection. This inspection shall consist of the inspections and tests specified in [table II](#) and [table III](#).

4.6.1 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 that are 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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4.6.2 Visual and dimensional inspection. Visual and dimensional inspection shall consist of those inspections specified in [table II](#).

4.6.2.1 Sampling plan. A sample of five packages shall be randomly selected. If one or more defects are found, the inspection lot shall be screened and the defective packages removed. A new sample of five packages shall be randomly selected. If any defects are found in the second sample, the inspection lot shall be rejected and shall not be supplied to the capacitor specification.

4.6.2.2 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 re-inspection. Such lots shall be separate from new lots and clearly identified as re-inspected lots.

4.6.2.3 Disposition of sample units. Sample units that have passed all the inspections specified in [table II](#) may be delivered on the contract, provided the lot is accepted.

4.6.3 Functional inspection. Functional inspection shall consist of the tests specified in [table III](#).

4.6.3.1 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-vapor proof 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-vapor proof barriers. Five sample units or the number of units contained within the shipping container (if less than five) shall be selected.

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

4.6.3.3 Disposition of sample units. Sample units that 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.

4.6.3.4 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 units, and intermediate and exterior (shipping) packs that can be corrected and that were processed under essentially the same conditions, with essentially the same materials, and that 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 that the original sample failed shall be at the option of the Government). Inspections specified in [table III](#) may be reinstituted; however, final acceptance shall be withheld until the re-inspection in accordance with [table III](#) has shown that the corrective action was successful. In the event of failure after re-inspection, information concerning the failure and corrective action taken shall be furnished to the administrative contracting officer.

4.7 Methods of inspections and tests.

4.7.1 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 [3.7](#)).

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4.7.2 Functional tests.

4.7.2.1 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-STD-2073-1](#).

4.7.2.2 Leakage. When a waterproof or water-vapor proof 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-STD-2073-1](#).

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, packaging, packing, and marking specified herein are intended for direct shipments to the Government. Unless otherwise specified, 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 this specification.
- b. Levels of preservation and packing (see [3.2](#) and [3.3](#)).
- c. Quantity per unit pack, if other than specified (see [3.2.1.4](#)).
- d. 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](#)).
- e. Whether any other standard or special marking is required (see [3.4](#)).
- f. If [FED-STD-123](#) is required for civil agency marking (see [3.4](#)).
- g. If a rough handling test is required (see [3.5.1.1](#)).
- h. If capacitor functional tests are required (see [3.5.1](#)).
- i. If the contractor is not responsible for the performance of all inspection requirements.
- j. If first article inspection is not required (see [4.5](#)).

6.3 First article. The sample pack submitted for first article inspection (when satisfactorily performed as specified in [4.5](#)) will serve as the production standard for subsequent packaging operations. The contractor should inform the acquiring activity or the activity administering the contract of the time and location of this test so that the Government representative will have an opportunity to witness the tests.

6.4 Hermetic seal. 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 Subject term (key word) listing.

Accessories
 Chips
 Fixed
 Hermetically sealed
 Marking
 Nonhermetically sealed
 Packing
 Physical protection
 Preservation
 Variable

6.6 Changes from previous issue. The margins of this specification are marked with vertical lines to indicate where changes from the previous issue 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 issue.

| Custodians:
 Army - CR
 Navy - EC
 Air Force – 85
 DLA - CC

Preparing activity:
 DLA - CC

(Project PACK-2018-007)

| Review activities:
 Army - AR, SM
 Navy - AS, SH

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities change, you should verify the currency of the information above using the ASSIST Online database at <https://assist.dla.mil/>.