

INCH - POUND

MIL-DTL-28786C

31 January 2004

SUPERSEDING

MIL-S-28786B

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## DETAIL SPECIFICATION

## SWITCHES, ELECTRICAL AND FIBER OPTIC, 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 for all types of electrical and fiber optic switches, switch assemblies, and associated accessories that are primarily in FSC's 5930 and 6021. As used in this specification, the term "switches" will also include switch assemblies.

## 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 cited in the solicitation or contract.

## SPECIFICATIONS

## FEDERAL

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

## STANDARDS

## FEDERAL

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

## MILITARY

- MIL-STD-129 - Marking for Shipment and Storage.
- MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.
- MIL-STD-2073-1 - DOD Standard Practice for Military Packaging.

Comments, suggestions or questions on this document should be addressed to Defense Supply Center Columbus, ATTN: VAT, Post Office Box 3990, Columbus, OH 43216-5000, or emailed to [switch@dla.mil](mailto:switch@dla.mil). Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <http://www.dodssp.daps.mil>.

## MIL-DTL-28786C

## HANDBOOKS

## MILITARY

## MIL-HDBK-774 - Palletized Unit Loads

(Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch/> or [www.dodssp.daps.mil/](http://www.dodssp.daps.mil/) or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2 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, which are DoD adopted, are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

## AMERICAN SOCIETY FOR TESTING AND MATERIAL (ASTM)

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

(Copies of these documents are available online at [www.astm.org/](http://www.astm.org/) or from the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, Pennsylvania, 19428-2959.)

2.3 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 military and commercial as well as to shipments of non-Government activities.

3.1.1 Hardware and switch accessories. Unmounted hardware and switch accessories such as boots, caps, filters, lenses, mounting brackets, panel seals, and screws supplied with certain switches shall be physically protected and enclosed in the unit packs in a manner that will not damage the switches or packaging materials. When practical, the hardware should be mounted on each switch.

3.1.2 Physical protection. Switches 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, large quantity unit packs may be used.

3.1.2.1 Protection of fragile and delicate parts. Projecting terminals, ceramic wafers, glass tubes, and other fragile parts of switches shall be protected by means of suitable noncorrosive materials or devices such as die-cut inserts or semi rigid cushioning materials. Die-cut or molded inserts shall be used to securely position delicate air and liquid flow switches and prevent movement of the vanes.

3.1.2.2 Wrapping and cushioning. All wrapping and cushioning materials used shall be noncorrosive and dry. In addition, materials used for fiber optic switches shall be nonstatic generating and shall not crumble, flake, powder, or shed. Cushioning is not required for accessories.

3.1.3 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.

## MIL-DTL-28786C

3.2 Preservation. Preservation shall be in accordance with military or commercial as specified (see 3.1 and 6.2).

3.2.1 Military.

3.2.1.1 Cleaning. Switches shall be cleaned in accordance with MIL-STD-2073-1.

3.2.1.2 Drying. Switches shall be dried in accordance with MIL-STD-2073-1.

3.2.1.3 Preservatives. Contact preservatives shall not be used.

3.2.1.4 Unit packs.

3.2.1.4.1 Switches. The unit packs for switches shall be as specified in table I. The quantity per unit pack (QUP) shall be one.

TABLE I. Military preservation requirements for switches.

Type	Net weight or cube	Military	Additional requirements
Switch capsules and other hermetically sealed switches with wire leads or solderable terminal lugs.	0-10 pounds	10	See 3.2.1.4.3 and 3.2.1.5
	Over 10 pounds	10	Unit container shall be in accordance with the requirements of 3.3.2
Air and liquid flow switches with external vanes.		41	Container shall conform to PPP-B-566 or PPP-B-676 (see 3.1.2.1).
Pressure (without "O" rings) and stepping switches	0-10 pounds	51	Container shall conform to PPP-B-566, PPP-B-676, or ASTM-D1974
	Over 10 pounds	52	Exterior container shall be in accordance with the requirements of 3.3.2.
Box, fiber optic inertia, leaf spring, pressure (with "O" rings), push button, rotary, thermostatic, toggle, and all other switches not otherwise designated in this table	0-15 cubic inches	41	See 3.2.1.4.3 and 3.2.1.5
	Over 15 cubic inches 10 pounds	41	Container shall conform to PPP-B-566, PPP-B-676, or ASTM-D1974.
	Over 10 pounds	42	Exterior container shall be in accordance with the requirements of 3.3.2.

3.2.1.4.2 Accessories (when separately acquired).

3.2.1.4.2.1 Indicator lights and switch housings. Unless otherwise specified in the contract (see 6.2), indicator lights and switch housings shall be unit packed one each in accordance with method 31 pr 32 of MIL-STD-2073-1.

3.2.1.4.2.2 Boots. Unless otherwise specified in the contract (see 6.2), boots shall be unit packed five each in accordance with method 10.

## MIL-DTL-28786C

3.2.1.4.2.3 Other accessories. Other accessories such as caps, filters, lenses, and panel seals shall be unit packed in accordance with method 10. Unit pack quantities for other than one each shall be as specified (see 6.2).

3.2.1.4.3 Supplementary containers. Each switch, unit packed in a bag or envelope as specified in 3.2.1.4.1, with a unit pack volume exceeding 15 cubic inches (246 cubic centimeters) shall be placed in a supplementary container conforming to 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 switches or accessories of the same NSN shall be placed in intermediate containers conforming to variety 2 of either PPP-B-556 or 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. Commercial preservation of switches and accessories shall conform to ASTM-D3951 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 contractor.

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

3.3.1 Level A. Switches 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-D3953-87, type I, finish A. The requirements for level B packing shall be used when the total quantity of a stock numbered switch or accessory for a single destination does not exceed a packed volume of one cubic foot (0.02832 cubic meter).

3.3.2 Level B. Switches 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.

3.3.3 Minimal. Switches and accessories, preserved as specified in 3.2, shall be packed in fiberboard containers conforming to ASTM-D5118, class domestic, style optional. Closures shall be in accordance with ASTM-D1974.

3.3.4 Unitized loads. 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. Switches and accessories, packed as specified in 3.3.1, shall be unitized on pallets in conformance with MIL-HDBK-774, load type I, with a wood cap (storage aid, 5) positioned over each load.

3.3.4.2 Level B. Switches and accessories packed as specified in 3.3.2, shall be unitized on pallets in conformance with MIL-HDBK-774, load type I, with a weather resistant fiberboard cap (storage aid 4) positioned over each load.

3.3.4.3 Minimal. Switches and accessories, 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 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. When specified in the contract (see 6.2), the marking of domestic shipments for civil agencies shall be in accordance with FED-STD-123.

3.5 First article and quality conformance inspections. First article and conformance inspections and tests shall be required as specified in 4.3, 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 test outlined in 4.5.1, 4.5.2.1, and 4.5.2.2, respectively.

## MIL-DTL-28786C

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 4.5.2.1, 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 switches and accessories within the tested packs shall show no visible signs of damage. When specified (see 6.2), functional tests in accordance with the group A inspection requirements of the applicable commodity specification shall be conducted on those switches subjected to the rough handling test to determine freedom from operational malfunction.

3.5.1.2 Leakage test (when applicable). When a barrier enclosed unit pack has been tested in accordance with 4.5.2.2., 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. VERIFICATION

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

- a. Materials inspection (see 4.2).
- b. First article inspection (see 4.3).
- c. Conformance inspection (see 4.4)

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

4.2 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.

4.3 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 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).

4.3.1 Sample size. One sample unit consisting of military level A or 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).

4.3.2 Inspection routine. The sample shall be subjected to the inspections specified in table IV and table V. The leakage test, when applicable, shall follow the rough handling test.

4.3.3 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.

## MIL-DTL-28786C

4.4 Conformance inspection. This inspection shall consist of the inspections and tests specified in table IV and table V.

4.4.1 Shipments to Government activities.

4.4.1.1 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 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.

4.4.1.2 Visual and dimensional inspection. Visual and dimensional inspection shall consist of those inspections specified in table IV.

TABLE IV. Visual and dimensional inspections.

Major defects	Requirement paragraph	Method paragraph
Preservation and packing materials not conforming to referenced specification requirements	3.1 and 3.2	4.5.1
Punctured or improperly fabricated barrier bag	3.1.2.2	
Uncleaned or improperly cleaned items	3.2.1.1	
Incorrect preservation method	3.2.1.3	
Wrong quantity per unit pack	3.2.1.4	
Nonusable or incorrect kind or application of intermediate containers	3.2.1.5	
Improper box closures	3.3	
Omitted, incorrect, or illegible marking	3.4	

4.4.1.3 Sample 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 resistor specification.

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

4.4.2 Shipments to non-Government facilities. Shipments to non-Government facilities shall be for the visual and dimensional inspections specified in table IV.

4.4.3 Functional inspection. Functional inspection shall consist of the tests specified in table V.

## MIL-DTL-28786C

TABLE V. Functional inspections.

Test	Requirement paragraph	Method paragraph
Rough handling (when specified)	3.5.1.1	4.5.2.1
Leakage (when applicable)	3.5.1.2	4.5.2.2

4.4.3.1 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 water-vapor proof barriers. Five containers (if less than five) shall be selected.

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

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

4.4.3.4 Noncompliance. If a sample fails to pass the inspections specified in table IV, the contractor shall take corrective action on the materials or processes or both, as warranted, on all units, 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 IV have been repeated on additional sample units (all inspections or the inspection which the original sample failed, at the option of the Government). Inspections specified in table IV may be reinstated; however, final acceptance shall be withheld until the reinspection in accordance with table IV 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.

4.5 Methods of inspections and tests.

4.5.1 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).

4.5.2 Functional tests.

4.5.2.1 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.

4.5.2.2 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 as specified in 3.5.1.2 and MIL-STD-2073-1.

## 5. PACKAGING

This section is not applicable to this specification.

## MIL-DTL-28786C

## 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. Unless otherwise designated, the general requirements (3.1) and marking requirements (3.4) are applicable for the preparation of military specification switches 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.
- b. Military or commercial preservation and level of packing (see 3.2 and 3.3).
- c. Quantity per unit pack, if other than specified (see 3.2.1.4.1, 3.2.1.4.2, 3.2.1.4.3, and 3.2.2).
- d. If any other standard or special marking is required (see 3.4.1).
- e. If FED-STD-123 is required for civil agency marking (see 3.4.1).
- f. If a rough handling test is required (see 3.5.1.1).
- g. If switch functional tests are required (see 3.5.1.1).
- h. If the contractor is not responsible for the performance of all inspection requirements (see 4.1).
- i. 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 4.3) will serve as the production standard for subsequent packaging operations. The contractor should inform the acquisition 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 Subject term (key word) listing.

Electrical switches  
Fiber optic switches  
Packing  
Physical protection  
Preservation  
Switch accessories

6.5 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

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

Preparing activity:  
DLA - CC  
(Project PACK-1134)

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