MIL-P-116J
8 April 1988
SUPERSEDING
MIL-P-116H
1 December 1980

MILITARY SPECIFICATION

PRESERVATION, METHODS 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 methods of preservation required to protect material against environment induced corrosion and deterioration, physical and mechanical damage and other forms of degradation. This specification provides for routine examination and when specified, test procedures to be employed in verifying conformance (unit pack validation) with the requirements contained herein.

1.2 Classification. Methods and submethods of preservation are classified as follows (see Table I):

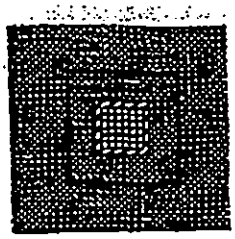
Basic Methods	Submethods
I	None
IA	IA-5, IA-6, IA-8, IA-13, IA-14, IA-15, IA-16
IC	IC-1, IC-2, IC-3, IC-4, IC-7, IC-9, IC-10
II	IIa, IIb, IIc, IId, IIe, IIf
III	None

1.2.1 Characteristics. Protective features of the methods and submethods are described in 3.6. Significant differences in the assembly and protective capability of the six basic methods are diagrammatically depicted in Figure 1. Submethods detail specific procedures for accomplishing required variations of the basic method based on consideration of the item's weight, fragility and configuration characteristics.

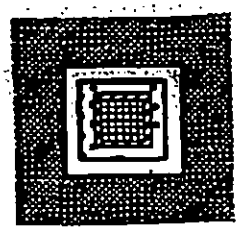
1.2.2 Changes. Relationship of methods and submethods of previous issues of this specification and those of this revision are listed in 6.11.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Systems Engineering and Standardization Department (Code 53), Naval Air Engineering Center, Lakehurst, NJ 08733, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

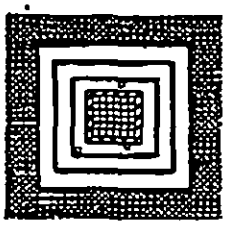
AMSC N/A
AREA PACK



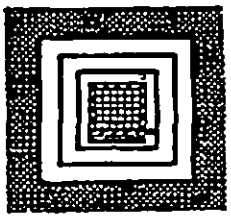
Method I



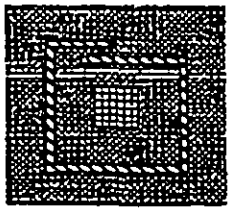
Method IC



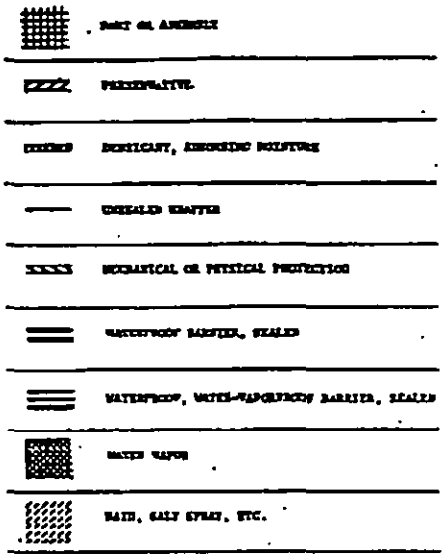
Method IA



Method II



Method III



NOTE: Regardless of the protection from the corrosive elements of the atmosphere provided by the above methods of preservation, all methods and containers specified (3.4) must also provide physical and mechanical function protection to the packaged item. In the interest of clarity, the cushioning, blocking, etc. were not included in all of the above diagrams.

FIGURE 1. Characteristics of basic methods.

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 specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto cited in the solicitation.

SPECIFICATIONS

Federal

L-P-378	Plastic Sheets and Strip, Thin Gauge, Polyolefin
O-T-236	Tetrachloroethylene (Perchloroethylene) Technical Grade
O-T-620	Trichloroethane - 1,1,1 Technical, Inhibited (Methyl Chloroform)
P-C-436	Cleaning Compound, Alkali, Boiling Vat (Soak) or Hydrosteam
P-C-437	Cleaning Compound, High Pressure (Steam) Cleaner
P-C-444	Cleaning Compound, Solvent, Soluble, Grease Emulsifying
P-C-535	Cleaning Compound, Platers Electrocleaning, for Steel
P-D-680	Dry Cleaning Solvent
QQ-A-1876	Aluminum Foil
TT-T-291	Thinner, Paint, Mineral Spirits, Regular and Odorless
VV-L-800	Lubricating Oil, General Purpose, Preservative (Water Displacing, Low Temperature)
PPP-B-636	Boxes, Shipping, Fiberboard
PPP-B-640	Boxes, Fiberboard, Corrugated, Triple Wall
PPP-C-795	Cushioning Material, Flexible, Cellular Plastic Film for Packaging Applications
PPP-C-1752	Cushioning Material, Packaging, Unicellular, Polyethylene Foam, Flexible

SPECIFICATIONS (Continued)

Federal (Continued)

PPP-C-1797	Cushioning Material, Resilient, Low Density, Unicellular, Polypropylene Foam
PPP-C-1842	Cushioning Material, Plastic, Open Cell (for Packaging Purpose)
PPP-D-723	Drums, Fiber
PPP-F-320	Fiberboard, Corrugated and Solid, Sheet Rock (Container Grade) and Cut Shapes

Military

MIL-B-117	Bag, Sleeve and Tubing, Interior Packaging
MIL-B-121	Barrier Material Greaseproofed, Waterproofed, Flexible
MIL-B-131	Barrier Materials, Watervaporproof, Greaseproof, Flexible, Heat Sealable
MIL-S-851	Steel Grit Shot and Cut Wire Shot, and Iron Grit and Shot - Blast Cleaning and Peening
MIL-L-3150	Lubricating Oil, Preservative, Medium
MIL-P-3420	Packaging Materials, Volatile Corrosion Inhibitor, Treated, Opaque
MIL-D-3464	Desiccants, Activated, Bagged, Packaging Use and Static Dehumidification
MIL-C-3955	Cans, Composite, Spirally Wound
MIL-G-5634	Grain, Abrasive, Soft for Carbon Removal
MIL-E-6060	Envelope, Packaging, Watervaporproof, Flexible
MIL-L-6081	Lubricating Oil, Jet Engine
MIL-L-6085	Lubricating Oil, Instrument, Aircraft, Low Volatility
MIL-C-6529	Corrosion Preventive, Aircraft Engine
MIL-I-8574	Inhibitor, Corrosion, Volatile, Utilization of
MIL-C-10382	Corrosion Preventive, Petroleum, Spraying Application for Food Handling Machinery and Equipment
MIL-G-10924	Grease, Automotive and Artillery

SPECIFICATIONS (Continued)

Military (Continued)

MIL-C-11796	Corrosion Preventive Compound, Petrolatum, Hot Application
MIL-G-12803	Gasket Material, Nonmetallic
MIL-C-15074	Corrosion Preventive, Fingerprint Remover
MIL-C-16173	Corrosion Preventive Compound, Solvent Cutback, Cold Application
MIL-D-16791	Detergent, General Purpose (Liquid, Nonionic)
MIL-L-21260	Lubricating Oil, Internal Combustion Engine, Preservative and Break-In
MIL-B-22019	Barrier Materials, Transparent, Flexible, Sealable Volatile Corrosion Inhibitor Treated
MIL-B-22020	Bag, Transparent, Flexible, Sealable, Volatile Corrosion Inhibitor Treated
MIL-I-22110	Inhibitor, Corrosion, Volatile, Crystalline
MIL-B-22191	Barrier Material, Transparent, Flexible, Heat Sealable
MIL-I-23310	Inhibitor, Corrosion, Volatile, Oil Type
MIL-G-23827	Grease, Aircraft and Instruments, Gear and Actuator Screw
MIL-I-26860	Indicator, Humidity, Plug, Color Change
MIL-L-45973	Liner Material, Greaseproof
MIL-P-46002	Preservative Oil, Contact and Volatile Corrosion Inhibited
MIL-C-81309	Corrosion Preventive Compound, Water Displacing, Ultra Thin Film
MIL-G-81322	Grease, Aircraft, General Purpose, Wide Temperature Range (NATO Code Number G-395)
MIL-T-81533	Trichloroethane 1,1,1 (Methyl Chloroform) Inhibited Vapor Degreasing
MIL-B-81705	Barrier Materials, Flexible, Electrostatic Free, Heat Sealable

SPECIFICATIONS (Continued)

Military (Continued)

MIL-P-81997	Pouches, Cushioned, Flexible, Electrostatic-Free, Reclosable, Transparent

STANDARDS

Federal

Fed. Test Method Std. No. 101	Test Procedures for Packaging Materials

Military

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-794	Parts and Equipment, Procedures for Packaging of
MIL-STD-1186	Cushioning, Anchoring, Bracing, Blocking and Waterproofing, With Appropriate Test Methods
MIL-STD-1235	Single and Multilevel Continuous Sampling Procedures and Tables for Inspection by Attribute Lot
MIL-STD-2073-1	DOD Materiel, Procedures for Development and Application of Packaging Requirements
DOD-STD-1686	Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)
MS20003	Indicator, Humidity, Card, Three Spot, Impregnated Areas (Cobaltus Chloride)

HANDBOOKS

DOD-HDBK-263	Electrostatic Discharge Control Handbook for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)

(Copies of specifications, standards, handbooks, drawings and publications required by manufacturers and contractors in connection with specific acquisition functions should be obtained from the contracting activity, or as directed by the contracting officer.)

2.1.2 Other Government documents, drawings and publications. The following other Government document forms a part of this specification to the extent specified herein. Unless otherwise specified, the issue shall be the one in effect on the date of the solicitation.

Occupational Safety and Health Administration (OSHA),
Code of Federal Regulations (CFR), Title 29
1910, General Industry

(Copies of publications required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1008 Watervapor Transmission of Shipping Containers

(Applications for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Unit pack design. Unless otherwise specified in the contract or order, a sample unit pack shall be subjected to the unit pack design validation process (see 4.2.1 and 6.2).

3.2 General. Items shall be preserved in accordance with the applicable method or submethod described herein (see 1.2 and 3.6). The method or submethod selected must adequately protect the item from corrosion, deterioration and physical function damage during storage of not less than one or greater than five years and multiple handlings and shipments associated with the military distribution system. Unit packs shall be designed to minimize weight and volume (cube) to the maximum extent practicable. Unless otherwise specified in the contract, the preservation selection process shall be in accordance with applicable tables of MIL-STD-794, Appendix D, or MIL-STD-2073-1, Appendix C. These tables include necessary cleaning, drying, preservative coating, wrapping, cushioning and environmental barrier as required. The preservation procedure should be accomplished without interruption. When interruptions are unavoidable, temporary wraps, covers or enclosures shall be

provided to insure against contamination or deterioration of the items. The documents referenced in 6.9.1 provide detailed instructions to accomplish the occupational safety and health requirements. Safety and health precautions taken during the performance of this specification must, as a minimum, meet all OSHA and Environmental Protection Agency (EPA) requirements for both contractor and military operations.

3.3 Cleaning. Prior to the initiation of preservation, the item must be determined to be clean and free of foreign matter, when inspected and tested in accordance with 4.4.1. Unless otherwise specified in the contract, items may be cleaned by any suitable process (see 3.3.1) described herein. WARNING: Petroleum based solvents shall not be used in oxygen systems, air intake or vacuum systems, or hydraulic systems except internal combustion engine intake manifolds. Critical surfaces (close tolerance, micro-finish) (see 6.4) must be cleaned to ensure total removal of corrosion, soil, grease, fingerprints, perspiration and all other acid and alkali residues. Oil, grease or graphite packed or impregnated items shall be cleaned by wiping with a clean, dry, lint-free cloth. Care shall be taken when cleaning complex assemblies, requiring internal preservation. Entrapped cleaning fluid must be drained to the drip point prior to proceeding to the next step. Unless otherwise authorized, disassembly of complex items to insure proper cleaning or preservative treatment (see 6.2.1(15)) shall be restricted to the minimum degree necessary and shall in no way infringe or default the manufacturer's implied or expressed warranty on the item.

3.3.1 C-1 Any applicable process. Items shall be cleaned by any process or combination of processes which will accomplish thorough cleaning without damage to the item. This process need not be restricted to the processes listed herein except that compliance with 6.9.1 is mandatory.

3.3.2 C-3 Solvent cleaning. Items shall be initially cleaned in solvent and drained. The initial cleaning, when other than pressure spraying is used, shall be followed by a secondary cleaning in another tank of clean solvent. Solvent shall conform to O-T-236, O-T-620, P-D-680, TT-T-291, Type I or MIL-T-81533. When solvent recirculating systems are used, they shall be equipped with filters for removal of contaminants.

3.3.2.1 Initial cleaning. Initial cleaning shall be accomplished by complete immersion accompanied by such scrubbing and agitation as may be necessary to accomplish thorough cleaning or by scrubbing or wiping with a clean brush or cloth soaked in solvent accompanied by partial immersion when possible or by pressure spray.

3.3.2.2 Second cleaning. Second cleaning shall be accomplished with clean solvent. When possible, this shall be accomplished by complete immersion.

3.3.3 C-5 Solvent cleaning followed by fingerprint remover. Items shall be cleaned in accordance with process C-3 followed by process C-8.

3.3.4 C-7 Vapor degreasing. Cleaning shall be accomplished by subjecting the item to vapors from the degreasing fluid or solvent conforming to O-T-236, O-T-620 or MIL-T-81533, until no further solvent condensation occurs.

This process is applicable to items of simple construction when the contamination consists of oil or grease residues or such other contaminants soluble in or readily removed by solvent and when the temperature heated solvent is not injurious to the item. Care shall be taken to ensure that aluminum surfaces are not adversely effected by the depletion of inhibitors or decomposition of the solvent (6.9.1).

3.3.5 C-8 Perspiration and fingerprint removal. Removal or neutralization of perspiration, fingerprint or similar residues shall be accomplished by immersing and agitating the item for a minimum of two minutes in fingerprint remover conforming to MIL-C-15074. Critical surfaces of large equipment not adaptable to immersion shall be cleaned with a lint free cloth saturated with the fingerprint remover. Items shall be thoroughly rinsed in clean solvent conforming to O-T-236, O-T-620, P-D-680, TT-T-291 Type 1 or MIL-T-81533, to remove residues of the perspiration, fingerprint remover material.

3.3.6 C-9 Alkaline cleaning. Cleaning shall be accomplished by immersion, soaking or subjecting the item to a pressure spray of alkaline cleaner conforming to P-C-436 or P-C-437. The item shall then be thoroughly rinsed in clean water, which has been heated above 180°F.

3.3.7 C-11 Electrocleaning. Cleaning shall be accomplished by immersing the item in a solution and making the item an element of an electro-chemical cell. When alkaline electrocleaning is desired, compounds used in the solution shall conform to P-C-535. The electrocleaning process shall be followed by a thorough clean water rinse in water heated above 180°F.

3.3.8 C-12 Emulsion cleaning. Cleaning shall be accomplished by subjecting the item to a pressure spray of emulsion cleaners or by immersion of the item in a emulsion solution, at room temperature, conforming to P-C-444, unless otherwise specified in the contract (6.2.1(16)). The emulsion cleaning process shall be followed by a thorough clean water rinse in water heated above 180°F.

3.3.9 C-14 Steam cleaning. Cleaning shall be effected by subjecting the items to a spray of steam or to a stream of steam with an added cleaning compound followed by steam alone. Cleaning compound shall conform to P-C-437.

3.3.10 C-15 Abrasive blast. Cleaning shall be effected by subjecting the items to a high velocity stream of abrasive material conforming to MIL-S-851.

3.3.11 C-16 Abrasive blast (honing process). Cleaning shall be accomplished by subjecting the item to a high velocity stream of atomized water combined with a fine particle size inorganic abrasive material and suitable corrosion inhibitor.

3.3.12 C-17 Soft grit blast. Cleaning shall be accomplished by subjecting the items to a high velocity stream of water containing a relatively soft abrasive material with or without a corrosion inhibitor as required. Abrasive material shall conform to MIL-G-5634.

3.3.13 C-18 Vapor degreasing followed by fingerprint removal. Items shall be cleaned in accordance with process C-7 followed by process C-8.

3.3.14 C-19 Ultrasonic cleaning. Cleaning shall be accomplished by subjecting the items, suspended in a cleaning agent, to a force of high frequency (ultrasonic) sound waves. Ultrasonic cleaning is applied to nonabsorbent materials and electronic devices which require "clean room" standards of cleanliness.

3.4 Drying procedures. Immediately after cleaning, items shall be thoroughly dried to remove residual cleaning solutions or moisture. Unless otherwise specified (6.2.1(1)), the required drying of the item shall be accomplished by one or more of the following processes, provided the procedure is not injurious to the item or its function.

3.4.1 D-1 Prepared compressed air. Drying shall be accomplished by subjecting the item to a blast of prepared dry and clean compressed air.

3.4.2 D-2 Oven. Drying shall be accomplished by exposing the item to heated air within a properly ventilated and temperature controlled oven.

3.4.3 D-3 Infrared lamps. Drying shall be accomplished by exposing the item to direct heat rays from infrared lamps.

3.4.4 D-4 Wiping. Drying shall be accomplished by wiping the surfaces of the item with clean, dry, lint free cloths (see 6.8) or specially prepared paper wiping towels.

3.4.5 D-5 Draining. Unless otherwise specified, when the final step in cleaning involves a petroleum solvent and cold application solvent cutback preservatives have been used, thorough draining of the solvent shall be permitted as a drying process (6.5).

3.5 Preservatives.

3.5.1 Preservative applicability. When contact preservatives or volatile corrosion inhibitors are required to protect an item from chemical deterioration, and unless otherwise specified, applicable tables of MIL-STD-794, Appendix D, or MIL-STD-2073-1, Appendix C, shall be used as a guide in determining the applicability and compatibility of the preservative coating selected.

3.5.2 Selection. Preservative compounds used shall conform to Table II, unless otherwise specified (6.2.1(17)). Preservatives selected shall be those whose application use or removal will not damage the item or impair item function (6.2, 6.2.1(1)).

3.5.3 Application of preservatives. Directly after cleaning and drying of the item, the required preservative shall be applied by one or more of the following applicable procedures that will permit the preservative to coat all surfaces or all necessary surfaces as required. The preservative coating must be uniformly applied and must pass inspection criteria of 4.4.2 (see 6.2.1(1)).

3.5.3.1 Dipping. Application shall be accomplished by the complete submersion of the item in a bath of the required/specified preservative, allowing the excess preservative coating to drip off.

3.5.3.2 Flow coating. Preservative application shall be accomplished by pouring the required preservative over all surfaces of the item and allowing the excess to drip off.

3.5.3.3 Slushing. Application shall be accomplished by pouring the preservative into the part to be preserved and rotating, agitating or positioning to insure the complete coverage of internal surfaces. All excess preservative shall be drained.

3.5.3.4 Brushing. Application shall be accomplished by coating the entire item or only those surfaces necessary with the required preservative by means of a bristle brush, similar to that used for painting.

3.5.3.5 Filling or flushing. Application shall be accomplished by completely filling or thoroughly flushing the internal chamber of the item with the required preservative. For items that are to be left filled with the preservative, space must be allowed for thermal expansion, and all ports and openings of the item must be sealed to prevent leakage.

3.5.3.6 Fogging. Application shall be accomplished by injecting the interior of the item with the required preservative as a cloud or mist from a pressurized atomizing gun until the entire enclosed atmosphere is thoroughly coated.

3.5.3.7 Spraying. Application shall be accomplished by spray coating the interior and exterior surfaces of the item (as applicable) with the required preservative.

3.5.3.8 Application and use criteria of volatile corrosion inhibitors (VCI). Volatile corrosion inhibitor preservative treatment shall be applied in accordance with the criteria and procedures of MIL-I-8574.

3.6 Methods. The preservation methods and submethods shall be as specified in the contract or order. In the absence of such requirements, the appropriate method, submethod shall be selected in accordance with the applicable tables of Appendix D, MIL-STD-794 or Appendix C, MIL-STD-2073-1, and accomplished in a manner that will pass the tests specified in Tables III and VI of this specification. Where methods provide both transparent and opaque protection, transparent protection may be furnished at the option of the supplier but is not required unless specifically called for in the contract or order (see 6.2.1(2)). Where applicable, submethod protection shall include the use of packaging materials to counteract electrostatic and electromagnetic field forces (3.6.1.3).

3.6.1 General precautions. Physical and mechanical function protection is required for all methods and submethods of preservation in addition to the specific environment protection provided. When specific submethods require using a bag or container, then preliminary wrapping, cushioning or other dunnage material conforming to PPP-C-1842 and PPP-F-320, shall be applied as

necessary to protect the item as well as the bag and the container from the item's projections and sharp edges as well as to restrict its movement within the unit pack (see 3.6.6). When submethods require chipboard or fiberboard containers within the bag, the corners and edges of the containers shall be blunted prior to enclosing within the bag. When a transparent unit pack is specified (6.2.1(2), 3.6), the preliminary wrapping, cushioning materials, etc., shall also be transparent. When specified in the contract or order, the primary cushioning media, material used to provide physical protection to the item, shall be placed outside of the bag and within the outer box of the unit pack (where applicable) to reduce the volume of the package within the bag. Submethods requiring the use of a bag for the interior packaging shall be subject to the use and fabrication procedure and limitations of MIL-B-117. Bags shall comply with MIL-E-6060 when the size limitations of MIL-B-117 are exceeded (see 6.7). All cushioning and dunnage used shall be as clean and dry as practicable to minimize item susceptibility to corrosion and contaminants. Specific packaging materials such as bags, wraps, cushioning or dunnage or containers or fire retardant materials when required (6.2.1(14),(30),(31)) are to be specified in the contract or order (see 6.2).

3.6.1.1 Surfaces coated with preservative. Preliminary wrapping materials in contact with the preservative coated item shall be greaseproof and shall conform to MIL-B-121, Grade A or C or MIL-B-22191, Type I or II or QQ-A-1876. Preliminary greaseproof wraps applied solely to confine the contact preservative on item surfaces are not necessary when a method/submethod requires a bag as the preliminary container and the bag is made of material conforming to MIL-B-121, Grade A, MIL-B-131, or MIL-B-22191, Type I or II. However, wraps shall not be excluded if necessary to protect the bags from rupture or perforation.

3.6.1.2 Metal surfaces not coated with preservatives. Only noncorrosive wrapping, cushioning and dunnage materials meeting the test requirements of Test Method 3005 of Federal Test Method Standard No. 101 shall be used in contact with metal surfaces of the item. Materials also must be as dry and clean as practicable in accordance with applicable material specification at the time of use (6.6).

3.6.1.3 Field force protection (shielding). Sensitive electronic devices shall be protected by the applicable procedures specified in 3.6.1.3.1 through 3.6.1.3.3, to prevent item damage from electrostatic and/or electromagnetic forces during handling, packaging, shipment and storage from the time of manufacture to end use.

3.6.1.3.1 Electrostatic protection. Electrostatic discharge sensitive (ESDS) devices as defined by DOD-STD-1686 and DOD-HDBK-263 shall be provided electrostatic discharge protection by properly safeguarded packaging work stations and properly outfitted personnel (i.e., grounding devices, etc.) as well as the use of electrostatic discharge protective packaging materials. Electrostatic discharge protective packaging shall be accomplished by initially wrapping the item with material conforming to MIL-B-81705, Type II, or MIL-B-117, Type I, Class A, Style 2, or cushioned with material conforming to PPP-C-1842, Type III, Style A or B, or PPP-C-795, Class 2, or PPP-C-1752, Type VII, Class 4, or PPP-C-1797, Type II. The wrapped or cushioned item

shall then be unit packed in heat-sealed bags conforming to MIL-B-117, Type I, Class F, Style 1 (see 6.2.1(13)). (Note: Reclosable, cushioned pouches conforming to MIL-P-81997, Type I or II, may be used in lieu of initial wrap or cushioning.)

3.6.1.3.2 Electromagnetic protection. Electromagnetic protection shall be provided to electromagnetic sensitive devices by enclosure in heat-sealed bags conforming to MIL-B-117, Type I, Class F, Style 1 (see 6.2.1(13)).

3.6.1.3.3 Electrostatic and electromagnetic protection. Electronic devices requiring both electrostatic and electromagnetic protection shall be unit packed in accordance with 3.6.1.3.1 (see 6.2.1(13)).

3.6.2 Method I - Preservative coating with greaseproof wrap, as required. Method I requires the application of preservative coatings in accordance with procedures of 3.5. The coated item shall be enclosed in a wrap or barrier material conforming to MIL-B-121, Grade A or C or MIL-B-22191, Type II or QQ-A-1876 or bags of the same materials (6.7). Flexible wraps shall snugly enclose the coated part or item and shall be secured by taping, tying or other suitable means to prevent unintentional unwrapping. Parts or items coated with P-1 or P-19 preservative and dried as required may be exempted from the wrap specified. Items treated with P-18, VCI treated barrier material, MIL-B-22019, or bag, MIL-B-22020, and securely taped to make an airtight enclosure, shall be exempted from the wrap specified. Projections, sharp edges or other features of the item, which may damage the barrier wrap, shall be cushioned as required in accordance with 3.6.1. The type of cushioning and barrier material used shall be commensurate with the size, weight and configuration of the preserved part or item. Method I preserved items shall be capable of passing the inspection requirements of 4.4.2.

3.6.3 Method IA - Watervaporproof enclosure with preservative as required. Items protected in accordance with Method IA shall be sealed within the watervaporproof enclosure required by the specific submethod of this group. Projections, sharp edges or other physical characteristics of the item, which may damage the watervaporproof enclosure, shall be cushioned as required in accordance with 3.6.1. The item shall also be cushioned as required to mitigate shock, thereby preventing physical and functional damage to the item. Unless otherwise specified (see 6.2.1(17)), preservative coating requirements shall be determined in accordance with 3.5.1. The trapped air within a flexible bag of the applicable submethods shall be kept to a minimum by compressing the bag or by a mechanical evacuation process to the extent practicable, prior to accomplishing the final seal of the bag. Caution shall be taken to prevent the rupture of the bag. All submethods of this group shall be required to pass the applicable quality conformance tests specified in Table VI.

3.6.3.1 Submethods.

3.6.3.1.1 Submethod IA-5 - Rigid metal container sealed. Items preserved, wrapped and cushioned as required in 3.6.3 shall be snugly enclosed in a sealed, rigid metal container. Any selected type of rigid metal container with machine seamed or reusable gasketed closure may be used if the

container provides a WVTR not exceeding 0.075 grams per 100 square inches per 24 hours, when tested in accordance with ASTM D 1008 unless a specific type of container and closure is specified in the contract or order (6.2.1(3)). When specified in the contract or order or when dictated by the requirements of the item, the metal container may be vacuum sealed. The part or item shall be fully encased or selectively supported by rigid or resilient (or any combination thereof) dunnage as required to insure against free movement and shock transmissibility.

3.6.3.1.2 Submethod IA-6 - Rigid container (items immersed in preservative, oil type) sealed. Item(s) shall be fully immersed in a preservative compound (oil type) within a sealed rigid container. The container shall be constructed of materials which are not affected by the preservative oil. Containers other than all metal must be approved by the acquiring agency prior to use. In filling the container, a five to seven percent void shall be provided to permit thermal expansion.

3.6.3.1.3 Submethod IA-8 - Bag, sealed. Item wrapped and cushioned as required in 3.6.3 shall be enclosed in a close fitting, heat sealed bag, conforming to MIL-B-117, Type I, Class E, F or G, Style 1, 2 or 3 or Type II, Class E, Style 1 or 3 or Type III, Class E, Style 1. (Note: For electrostatic and electromagnetic protection refer to 3.6.1.3.1, 3.6.1.3.2 and 3.6.1.3.3.) When specified in the contract or order (see 6.2.1(19) and (31)) a designated bag, other than noted herein, shall be furnished. When transparent packaging is specified (see 6.2.1(2)) in the contract or order, items shall be initially wrapped and cushioned with MIL-B-22191 or L-P-378 or other transparent materials as applicable. (Note: When specified in the contract or order, a carton or box shall be required to effect the unit container (see 6.2.1(32)), and the primary cushioning specified in the contract or order shall be placed between the outside of the bag and the inside of the carton or box.)

3.6.3.1.4 Submethod IA-13 - Rigid container other than all metal, sealed. Items preserved, wrapped and cushioned, as required in 3.6.3, shall be enclosed in a sealed, snug fitting, rigid container other than all metal. For contents not exceeding 20 pounds fiber containers conforming to MIL-C-3955, Type I, Grade B, Style and Class as applicable, may be used. When a greaseproof liner is required, material shall conform to MIL-L-45973. For heavier items, fiber containers conforming to PPP-D-723, Type III, Grade A, Class 2 may be used. Other sealed rigid containers including reusable plastic or fiberglass containers (other than all metal) listed in MIL-STD-794 or MIL-STD-2073-1 may be used when the container body and closure mating surfaces afford a moisturevaporproof barrier with a watervapor transmission rate (WVTR) not exceeding 0.075 grams per 100 square inches per 24 hours, as established by government specifications or when tested in accordance with ASTM D 1008 as appropriate.

3.6.3.1.5 Submethod IA-14 - Container, bag, sealed, container. Item preserved, wrapped and cushioned, as required in 3.6.3 shall be enclosed in a close fitting inner container, selected from MIL-STD-794 or MIL-STD-2073-1, as applicable, and enclosed in a sealed bag conforming to MIL-B-117, Type I, Class E, F or G, Style 1, 2 or 3 or Type II, Class E, Style 1 or 3, or Type III, Class E, Style 1. Bags in accordance with MIL-E-6060 shall be used for

sizes exceeding MIL-B-117 size limitations. When specified in the contract or order (see 6.2.1(19) and (31)), a designated bag shall be used. The item within the inner container and sealed bag shall then be enclosed within an appropriate outer container, selected from MIL-STD-794 or MIL-STD-2073-1, unless otherwise specified in the contract. When fiberboard containers are selected or specified for the outer container of this submethod, they shall conform to the weather resistant class and grade of PPP-B-636 or PPP-B-640 as applicable (see 6.2.1(9)). When wood, wood cleated plywood, wood cleated containers in combination with paper overlaid veneer, fiberboard, etc., are specified as the outer container of this submethod, 6 mil polyethylene conforming to L-P-378 or equivalent material shall be used as an overwrap (tape sealed) around the sealed bag to prevent chafing or rupture and waterproof the case contents. When the primary cushioning is located between the sealed bag and the outer container, the barrier protective wrap specified herein is not required. Closure, banding, sealing of the outer container shall be performed in accordance with the applicable container specification procedures, making certain that no damage is inflicted on the bag. (Note: When the outer container becomes the shipping container, it shall be marked as a shipping container in accordance with MIL-STD-129; the bag shall be marked as a unit pack in accordance with MIL-STD-129 (see Table V, Note 1/)).

3.6.3.1.6 Submethod IA-15 - Container bag, sealed. Item prepared the same as for submethod IA-14, except that the outer container is omitted. When specified, a protective wrap of heavy duty kraft paper or equivalent material (tape sealed) shall be provided to protect the barrier material during handling and storage (see 6.2.1(33)).

3.6.3.1.7 Submethod IA-16 - Floating bag, sealed. Item preserved, wrapped, cushioned, anchored or shock mounted as required in 3.6.3 and 6.9.3 shall be enclosed in a sealed bag conforming to MIL-B-117, Type I, Class E, F or G, Style 1 or Type II, Class E, Style 1 or 3 or Type III, Class E, Style 1. When specified in the contract or order, a designated bag shall be furnished (see 6.2.1(31)). Bags in accordance with MIL-E-6060 shall be used when the size limitations of MIL-B-117 are exceeded. The bag shall be provided with gasketed holes to permit the installation of the material over, under and around the fastener devices used to secure the item to the internal supports (blocking) of the container or to one face or the skidded base of the container. The gasket material quality, gasket application and performance evaluation shall be in accordance with applicable requirements of MIL-E-6060. Unless otherwise specified gasket material shall conform to MIL-G-12803 (6.2.1(7)) and shall contain no asbestos products. (Note: When the outer container becomes the shipping container, it shall be marked as a shipping container in accordance with MIL-STD-129; the bag shall be marked as a unit pack in accordance with MIL-STD-129 (see Table V, Note 1/)).

3.6.4 Method IC - Waterproof or waterproof-greaseproof enclosure with preservative as required. Items protected in accordance with Method IC shall be sealed within a waterproof or waterproof-greaseproof enclosure required by the specific submethod. Projections, sharp edges or other physical characteristics of the item, which may damage the waterproof or waterproof-greaseproof barrier or container shall be cushioned in accordance with 3.6.1. The item shall also be cushioned as required to mitigate shock, thereby preventing physical and functional damage to the item. Unless otherwise specified,

preservative coating requirements shall be determined in accordance with 3.5.1. The trapped air volume within the bag of applicable submethods shall be kept to a minimum by compressing the bag around the contents prior to effecting the final seal. All submethods of this group shall be accomplished in a manner that will satisfactorily pass the quality conformance tests specified in Table VI.

3.6.4.1 Submethods.

3.6.4.1.1 Submethod IC-1 - Greaseproof-waterproof bag, sealed. Item preserved, wrapped and cushioned as required in 3.6.4 shall be enclosed in a close fitting sealed bag conforming to MIL-B-117, Type I, Class C, Style 1, 2 or 3 or Type II, Class C, Style 1 or bags conforming to MIL-B-22020 as limited by MIL-I-8574 (3.5.3.8). When specified in the contract or order (6.2.1(19) and (4)), a designated bag shall be provided. When transparent packaging is specified (6.2.1(2)) in the contract or order, items shall be initially wrapped and cushioned with MIL-B-22191, L-P-378, or PPP-C-795 or other transparent materials as applicable. (Note: When specified in the contract or order, a carton or box shall be required to effect the unit container (see 6.2.1(32)), and the primary cushioning specified in the contract or order shall be placed between the outside of the bag and the inside of the carton or box.)

3.6.4.1.2 Submethod IC-2 - Container, waterproof bag, sealed. Item preserved, wrapped and cushioned as required in 3.6.4 shall be enclosed in a close fitting container which in turn shall be enclosed in a sealed waterproof bag conforming to MIL-B-117, Type I, Class B or C, Style 1, 2 or 3 or Type II, Class B or C, Style 1. When specified in the contract or order (see 6.2.1(19) and (4)), a designated bag shall be furnished. When specified a protective wrap of heavy duty kraft paper or equivalent material (tape sealed) shall be provided to protect the barrier material during handling and storage.

3.6.4.1.3 Submethod IC-3 - Waterproof bag sealed. Item preserved, wrapped and cushioned as required in 3.6.4 shall be enclosed in a sealed bag conforming to MIL-B-117, Type I, Class B or C, Style 1, 2 or 3 or Type I, Class A, Style 2 or Type II, Class B or C, Style 1 or Type III, Class B, Style 1 or MIL-B-22020 as limited by MIL-I-8574 (see 3.5.3.8). When specified in the contract or order (see 6.2.1(19),(4)), a designated bag or barrier shall be provided. When transparent packaging is specified (see 6.2.1(2)) in the contract or order, items shall initially be wrapped and cushioned with MIL-B-22191 or L-P-378 or other transparent materials as applicable. (Note: When specified in the contract or order, a carton or box shall be required to effect the unit container (see 6.2.1(32)), and the primary cushioning specified in the contract or order shall be placed between the outside of the bag and the inside of the carton or box.)

3.6.4.1.4 Submethod IC-4 - Waterproof, rigid container other than all metal, sealed. Item preserved, wrapped and cushioned as required in 3.6.4 shall be enclosed in a close fitting, rigid container other than all metal, sealed. Fiber containers shall conform to MIL-C-3955, Type I or II, Grade B, Style and Class as applicable. When a greaseproof liner is required for the container, liner material used shall conform to MIL-L-45973.

3.6.4.1.5 Submethod IC-7 - Blister pack, greaseproof-waterproof single or multiple compartment, individually sealed. Item preserved, wrapped and cushioned as required in 3.6.4, shall be enclosed in a sealed individual compartment of a single or multiple compartment container formed from one of the following plastic materials, cellulose acetate butyrate, cellulose acetate or cellulose propionate. The material shall be 15 mil thick prior to forming. When specified in the contract or order (see 6.2.1(4)), a designated plastic material shall be used. When multiple compartment containers are used, they shall be furnished with either perforated or creased tear-apart lines between compartments. (Note: When specified in the contract or order, a carton or box shall be required to effect the unit container (see 6.2.1(32)).

3.6.4.1.6 Submethod IC-9 - Skin pack, greaseproof-waterproof, vacuum formed, sealed. Item preserved, wrapped and cushioned as required in 3.6.4 shall be packaged in a vacuum formed, transparent skin unit container formed from either cellulose acetate, cellulose acetate butyrate or cellulose propionate plastic materials. The material shall be capable of containing the item and still permit the reading of the item identification markings as well as the visual inspection of the item surfaces. After draping the closure sheet, the transparent skin pack shall be sealed. When specified in the contract or order, a designated plastic material shall be required (6.2.1(4)). (Note: When specified in the contract or order, a carton or box shall be required to effect the unit container (see 6.2.1(32)).

3.6.4.1.7 Submethod IC-10 - Skin pack, waterproof, vacuum formed, sealed. Item preserved, wrapped and cushioned as required in 3.6.4 shall be packaged in a vacuum formed skin pack in the same manner as specified for submethod IC-9 (3.6.4.1.6) except that any plastic material capable of being vacuum formed into a waterproof package may be used.

3.6.5 Method II - Watervaporproof enclosure, with desiccant and preservatives, as required. Items protected in accordance with Method II shall be sealed in a watervaporproof enclosure with activated desiccant as required for the specific submethod of this group. Unless otherwise stated in the contract or order (see 3.6.5c and 6.2.1(5)) unit packs of all submethods shall include humidity indicator. Projections, sharp edges, or other physical characteristics of the item which may damage the watervaporproof bag or container shall be cushioned as required in accordance with 3.6.1. The item shall also be cushioned as required to mitigate shock, thereby preventing physical and functional damage to the item. Unless otherwise specified, preservative coating requirements shall be determined in accordance with 3.5.1. The trapped air volume within the flexible bag of applicable submethods shall be kept to a minimum by compressing the bag or expelling the air by a mechanical air evacuation process to the extent practicable prior to accomplishing the final seal of the bag. The bag should contour to the enclosed item container; however, care should be taken that such actions are not excessive and cause a puncture or rupture of the bag. When bags are used, the sealed edge of the bag that would normally be opened for item inspection (final seal) shall be of sufficient surface area to permit two subsequent resealings after item inspection, unless otherwise specified (see 6.2.1(20)). Unless prohibited in the contract or order, carrying cases, housings, etc., which in effect function as a sealed container, may also be used as the watervaporproof enclosure within which the desiccant and humidity indicator will be

placed. Precautions must be prominently noted on the item cases or housings that the desiccant and indicator cards must be removed prior to placing the item into use. All submethods of this group shall be required to pass the applicable quality conformance tests specified in Table VI. The following materials and formulas shall be used to compute the desiccant requirements and the type of humidity indicators to be used:

a. Desiccant (activated). The bagged activated desiccant shall conform to MIL-D-3464. Type I shall be used unless Type II or III is specified (see 6.2.1(6)) or required because of special characteristics of the item. Desiccant shall be in standard unit sized bags. The desiccant shall be located in the pack in a place most accessible to voids in the item or pack interior. Desiccant bags shall be secured within the unit pack by tying, taping, etc., or in specially designed desiccant baskets affixed to the container interior. Desiccant shall be adequately secured so as to prevent its shifting or movement and under no circumstances be permitted to come in direct contact with critical surfaces of the enclosed item. When direct contact is absolutely unavoidable, the desiccant shall be isolated from the item with MIL-B-121, Grade A barrier material. The desiccant shall not be unnecessarily exposed to the ambient environment when removed from the vaporproof desiccant storage container. Removal of the desiccant and its insertion into the unit pack shall be the last action prior to effecting the final seal of the bag or container.

b. Quantity of desiccant. The minimum quantity of desiccant to be used per a unit pack shall be computed in accordance with either Formula I or II as applicable. The various values of "X" take into consideration the quality and types of dunnage, if more than one. The inner container of the submethod (when applicable) must be considered in the dunnage calculations.

Formula I - to find units of desiccant for use within a sealed container other than rigid all metal:

$$U = CA + X_1D + X_2D + X_3D + X_4D$$

Formula II - to find units of desiccant for use within a sealed rigid metal container:

$$U = KV + X_1D + X_2D + X_3D + X_4D$$

Symbols used above are defined as follows:

U = The number of units of desiccant to be used.

C = 0.011 when the area of the barrier material is stated in square inches.

C = 1.6 when the area of the barrier material is stated in square feet.

A = Area of container (barrier) stated in square inches or square feet.

K = 0.0007 when volume is stated in cubic inches.

K = 1.2 when volume is stated in cubic feet.

V = Volume within container in cubic inches or cubic feet.

X_1 = 8.0 for cellulosic material, including wood and any other material not noted below.

X_2 = 3.6 for bound fibers (synthetic or vegetable fibers bound with rubber).

X_3 = 2.0 for glass fibers (fiberglass).

X_4 = 0.5 for synthetic foams and rubber.

D = Pounds of dunnage within the barrier and other than rigid all metal containers.

Note: Formula II may also be used to determine the units of desiccant required for sealed rigid containers other than all metal, when the sealed enclosure provides a WVTR not exceeding 0.001 grams for 24 hours per 100 square inches, tested in accordance with ASTM D1008 as appropriate.

c. Humidity indicators. Humidity indicators shall conform in form and function to MS20003, unless otherwise specified in the contract or order. The humidity indicator, as applicable, shall be firmly secured directly behind the inspection window or immediately within the closing edge, face or cover of the barrier. When specified (see 6.2.1(5)), externally mounted humidity indicating elements or devices shall be installed in the barrier or rigid metal or plastic reusable container used to effect the unit pack. Unless otherwise specified, externally mounted color change humidity indicating devices shall conform to MIL-I-26860.

3.6.5.1 Submethods.

3.6.5.1.1 Submethod IIa - Floating bag, heat sealed. Item preserved wrapped, cushioned, desiccated, anchored or shock mounted as required in 3.6.5 and in accordance with 6.9.3, shall be enclosed in a sealed bag conforming to MIL-B-117, Type I, Class E, F or G, Style 1, 2 or 3 or Type II, Class E, Style 1 or 3 or Type III, Class E, Style 1. When specified in the contract or order (6.2.1(31)), a designated bag shall be furnished. Bags fabricated in accordance with MIL-E-6060 shall be used for sizes which exceed MIL-B-117 size limitations. The bag shall be provided with gasketed holes to permit the installation of the barrier material over, under and around the fastener devices used to secure the item to the internal supports (blocking) or to one face of the container or the skidded base. The gasket material quality,

application and performance shall be in accordance with the applicable requirement of MIL-E-6060. Unless otherwise specified gasket material shall conform to MIL-G-12803 (6.2.1(7)) and shall contain no asbestos products. When specified in the contract or order, a window of material conforming to MIL-B-22191, Type I shall be provided in the bag in accordance with MIL-E-6060 procedures for packs 15 cubic feet or larger. When specified (6.2.1(5)), externally mounted plug type humidity indicators shall be used. A removable inspection port shall be provided in the exterior container body, so situated as to coincide with the location of the inspection window of the bag. (Note: When the outer container becomes the shipping container, it shall be marked as a shipping container in accordance with MIL-STD-129; the bag shall be marked as a unit pack in accordance with MIL-STD-129 (see Table V, Note 1/)).

3.6.5.1.2 Submethod IIb - Container, bag, heat sealed, container. Item preserved, wrapped, cushioned and desiccated as required in accordance with 3.6.5 shall be enclosed in a close fitting inner container selected from MIL-STD-794 or MIL-STD-2073-1, as appropriate, unless otherwise specified. The item within the inner container shall then be enclosed in a sealed bag conforming to MIL-B-117, Type I, Class E, F or G, Style 1, 2 or 3 or Type II, Class E, Style 1 or 3 or Type III, Class E, Style 1. When specified in the contract or order (see 6.2.1(19) and (31)) a designated bag will be used. Bags in accordance with MIL-E-6060 shall be used for sizes exceeding the limitations of MIL-B-117. The item within the inner container and sealed bag shall then be enclosed within an appropriate outer container selected from MIL-STD-794 or MIL-STD-2073-1 unless otherwise specified in the contract. When fiberboard outer containers are used, they shall conform to the weather resistant Class and Grade of PPP-B-636 or PPP-B-640 as applicable unless otherwise specified (6.2.1(8)). When wood, wood cleated plywood or wood cleated fiberboard, paper overlaid veneer, etc., boxes are specified as the outer container, a 6 mil polyethylene film conforming to L-P-378 or equivalent material shall be required as an overwrap on the bag to prevent chafing or perforation. When the primary cushioning is located between the sealed bag and the outer container, the barrier protective wrap specified herein is not required. Closure sealing, banding (as applicable) shall be in accordance with the applicable container specification procedures; making certain that no damage shall come to the bag by procedures thereof. (Note: When the outer container becomes the shipping container, it shall be marked as a shipping container in accordance with MIL-STD-129; the bag shall be marked as a unit pack in accordance with MIL-STD-129 (see Table V, Note 1/)).

3.6.5.1.3 Submethod IIc - Bag, heat sealed. Item preserved, wrapped, cushioned and desiccated as required in 3.6.5 shall be enclosed within a sealed bag conforming to MIL-B-117, Type I, Class E, F or G, Style 1, 2 or 3; or Type II, Class E, Style 1 or 3; or Type III, Class E, Style 1. When specified in the contract or order (see 6.2.1(19) and (31)) a designated bag shall be furnished. When transparent packaging is specified (see 6.2.1(2)) in the contract or order, items shall be initially wrapped and cushioned with MIL-B-22191, L-P-378 or other transparent materials as applicable. (Note: When specified in the contract or order, a carton or box shall be required to effect the unit container (see 6.2.1(32)), and the primary cushioning specified in the contract or order shall be placed between the outside of the bag and the inside of the carton or box.)

3.6.5.1.4 Submethod IId - Rigid metal container, sealed. Item preserved, wrapped, cushioned and desiccated as required in 3.6.5 shall be enclosed within a snugly fitted, sealed, metal container. Any selected type of rigid metal container with machine seamed or welded closure or reusable container with gasketed or threaded closure may be used if the container provides a WVTR not exceeding 0.075 gram per 100 square inches per 24 hours, when tested in accordance with ASTM D 1008, unless a specific type of rigid metal container and closure is specified in the contract or order (see 6.2.1(9)). The item shall be fully enclosed or partially and selectively supported with rigid or resilient dunnage as required to prevent free movement and protect the item from shock damage.

3.6.5.1.5 Submethod IIe - Container, bag, heat sealed. Prepared the same as Submethod IIb (3.6.5.1.2) except that the outer container is omitted. When specified, a protective wrap of heavy duty kraft paper or equivalent material shall be provided to protect the bag during handling and storage (see 6.2.1(33)).

3.6.5.1.6 Submethod IIf - Rigid container, other than all metal, sealed. Item preserved, wrapped, cushioned and desiccated as required in 3.6.5 shall be enclosed in a sealed, close fitting, rigid container other than all metal. For items not exceeding 20 pounds, fiber containers conforming to MIL-C-3955, Type I, Grade B (style and class as applicable) may be used. When a greaseproof liner is required, material shall conform to MIL-L-45973. For heavier items, fiber containers conforming to PPP-D-723, Type III, Grade A, Class 2 may be used. Unless otherwise specified, other sealed, rigid containers other than all metal listed in MIL-STD-794 or MIL-STD-2073-1 may be considered for use as appropriate, as long as the watervaporproofness of the container provides a WVTR not exceeding 0.075 gram per 100 square inches per 24 hours when tested in accordance with ASTM D 1008 as appropriate.

3.6.6 Method III - Physical and mechanical protection only. The unpreserved item(s) shall be tagged, bundled (i.e., tied, taped, strapped, etc.) skin packed, enclosed within wrappings, bags, cartons, boxes or other containers, as applicable to provide protection from physical damage and mechanical malfunction. Cushioning materials, dunnage, blocking and bracing shall be applied as required to protect the item(s) and the enclosing media and restrict the movement of the item within the container. Materials shall be clean and as dry as practicable. Blocking, bracing, etc., shall be accomplished in accordance with MIL-STD-1186.

3.7 Unit pack quantity. The quantity of the item which will constitute a unit pack shall be specified in the contract or order (see 6.2.b). When not specified, the quantity per unit pack shall be computed in accordance with MIL-STD-794 or MIL-STD-2073-1. When unit pack quantity is greater than one, individual items that are damageable should be wrapped for protection.

3.8 Marking. All unit, intermediate and exterior containers shall be marked in accordance with MIL-STD-129 as it concerns the materials used, procedures, format, type and size of marking. The unit pack interior bags or containers, when enclosed within another container, shall also be marked, as specified for unit pack identification marking in MIL-STD-129. In addition

any special markings shall be applied when specified in the contract (see 6.2.d). Marking for all unit packs must pass the inspection criteria of Table V.

3.9 Workmanship. Workmanship shall be such that the unit pack(s) will pass the inspection procedures of Table V.

3.10 Leakage. Unit packs whose enclosures have been prepared in accordance with submethods stipulating waterproofness or watervaporproofness shall meet the following requirements when subjected to the appropriate leakage tests:

a. Vacuum retention technique. The loss of vacuum from a sealed rigid container system shall not exceed twenty-five percent of the original vacuum after remaining undisturbed for ten minutes (see 4.4.3.3.1). The loss of vacuum from a sealed flexible-container system shall not cause the flexible bag to lose its tautness after remaining undisturbed for two hours (see 4.4.3.3.2).

b. Submersion (or immersion) technique. There shall be no evidence of moisture within the bag (see 4.4.3.4).

c. Pneumatic pressure technique. During pneumatic pressure technique test, there shall be no loss of gauge pressure for a period of 30 minutes. When a water solution or immersion is used, there shall be no evidence of air leakage as evidenced by soap bubbles increasing in size or being blown away by the escaping air or by evidence of a steady stream or recurring succession of bubbles from any surface (see 4.4.3.5).

d. Hot water technique. There shall not be a steady stream or recurring succession of bubbles from any surface or seam (see 4.4.3.6).

e. Squeeze technique. There shall not be a leak with bubble-supporting film (see 4.4.3.7).

3.11 Sealed seams. The seams of unit packs whose enclosures include seals, shall not separate at the sealed area during the final three minutes of the sealed seam-strength test (see 4.4.4.3.1).

3.12 Rough handling. Unit packs shall be subjected to the rough handling tests specified in 4.4.5 unless otherwise stated (see 6.2.1(23)) or one or more of the following conditions exist as certified by the contracting activity:

a. The same or similar item has been successfully tested in the same or similarly designed pack.

b. Engineering data is available which verifies that the proposed design will successfully meet the test requirements of 4.4.5.

c. Historical shipping data is available, confirming that adequate protection is provided using the proposed or an upgraded unit pack.

d. Level C protection is specified.

3.13 Unit pack conditions when testing. When testing is required, unit packs shall meet the following conditions:

a. All material and components comprising the unit pack shall be free from damage or evidence of displacement of the preservative that effect the utility of the unit pack.

b. When evidence of damage to an item cannot be determined solely by visual inspection (6.2.1(10)), functional tests shall be conducted to ensure freedom from mechanical/operational malfunction.

3.14 Fire retardant materials. Fire retardant and fire resistant materials, when available, shall be used in lieu of non-fire retardant variety for shipment to ship or stock, unless otherwise specified.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order (see 6.2.1(21)) the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government (see 6.2.1(22)). The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

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 assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.1.2 Alternate test procedure approval. In instances wherein a specified test may necessitate an impossible or impractical manipulation of a mounted packaged item or where the overall size or weight of the item is excessive or the unavailability of required test equipment obviates compliance with the test requirement of the specification, the contractor with the participation, endorsement of cognizant Government Inspector (i.e., Inspector/Packaging Specialist) shall select an appropriate alternate test procedure (see 4.4.3.2 and Table VI) and submit complete test results to the contracting activity for approval. (Note the heat-sealed seam test, 4.4.4,

may be used in lieu of leak test 4.4.3.2 for small or mixed quantities of packaged items (see Table VI, 2/)).

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

1. Unit Pack Design Validation (see 4.2.1).

2. Quality Conformance Inspection (see 4.2.2).

4.2.1 Unit pack design validation. When unit pack design validation is required (see 3.1 and 3.12), a sample unit pack, randomly selected either prior to or during initial production, shall be subjected to all applicable inspections and tests of Tables III, V and VI, with the exceptions noted in 3.12. Cyclic exposure tests when specified (see 6.2.1(29)) and the rough handling tests shall be performed prior to the applicable leakage and preservative retention tests. Unit pack design validation testing shall be performed or repeated when changes in materials, processes or designs have been made to the unit pack. Unit pack validation samples shall be completely representative of the planned production unit pack (see 4.4.5).

4.2.2 Quality conformance inspection. Quality conformance inspection consists of those inspections and tests required to be performed for product acceptance under contract. The inspections shall be those in Table V. Unless otherwise specified (see 6.2.1(24)), applicable tests shall be as indicated in Table VI for selected submethods. When inspections are to be performed prior to the application of preservative coatings, wraps, containers, etc., when advantageous to contractor production methods or in order to preclude the need for destroying completed unit packs, the required quality conformance examinations and tests may be performed at one or more appropriate stages in the actual processing of the item. The Government may perform verification inspection of the completed unit packs, which may destroy the package and require repackaging by the contractor. Except as provided above, all quality conformance examinations and tests of this specification are independent of each other to the extent that they may be performed on the same or different sample unit packs. Whether the examinations and tests are performed progressively during the stages of item processing or upon completion of the unit pack, the results shall show that the method of preservation as accomplished has the capability of withstanding all applicable tests listed in Table VI or in the contract for a selected submethod.

4.2.2.1 Inspection lot. For the purpose of selecting samples to be inspected for compliance with the requirements of this specification, either items in process or completed unit packs may be combined into lots without regard to individual items, contracts or the quantities therein subject to the following:

a. Unit packs of similar size and general configuration made of the same packaging materials may be grouped into a single lot.

b. Unit packs of similar configuration, made with the same packaging materials and not exceeding 5 pounds, may be grouped into a single lot. Also unit packs in this category exceeding 5 pounds but not exceeding 20 pounds, may be grouped provided the ratio of their weights does not exceed approximately 2 to 1. Unit packs exceeding 20 pounds or in excess of a 2 to 1 ratio shall not be grouped unless they are of similar configuration and weight.

c. When item complexity, item value or the preservation method complexity warrants that the inspection of such items be performed on a separate basis, a separate application of the sampling procedure should be made to those items. The combination of items to be subjected to inspection shall be established by the contractor subject to the approval of the Government.

d. Specific inspection lots established for Group A inspection (4.2.2.2.1) may be used for Group B inspection (see 4.2.2.2.2), or new inspection lots may be established for such inspection.

4.2.2.1.1 Inspection lots for in-process inspection, Group A. Items processed under substantially the same conditions may be combined into lots for performance of Group A examinations and tests by the test procedure and the operation being inspected. Such lots established for inspections performed prior to application of preservative, wraps or containers shall include items cleaned and, where applicable, dried by an identical process.

4.2.2.1.2 Inspection lots for final inspection, Group B. For performance of Group B examinations and tests, unit packs may be combined in such a manner as to permit a single application of the sampling or inspection procedures to a grouping of items subject to one of the following:

a. Unit packs processed by the same method and submethod of preservation and subjected to an identical test procedure.

b. Unit packs processed by different methods and submethod of preservation which employ identical flexible barrier materials (type, grade and class) or closures required to be identical and to meet identical test conditions.

4.2.2.2 Grouping of inspections.

4.2.2.2.1 Group A.

Examinations	Requirements
Determination of the cleanliness of the item prior to application of preservative, wrap, cushioning or bag	3.3, 3.4, Table V, and Table VI
Required preservative properly applied	3.5.1 through 3.5.3.8 and Tables V and VI

Examinations	Requirements
Designated wraps, cushioning, flexible bag, containers desiccant, humidity indicators, windows and gaskets properly used in fabrication of the unit pack	3.6.1 through 3.6.6 and Tables V and VI
Required cushioning, blocking, bracing or bolting used in fabrication of the unit pack	3.6 through 3.6.6
Compliance with specific maximum weight and cube and with good workmanship	3.9 and Table V
Comparison of part number with unit pack identification marking, quantity check and designated unit pack markings correct and properly applied	3.7 and 3.8 and Table V

4.2.2.2.2 Group B.

Examinations	Requirements
Containers as required	3.6.1 through 3.6.6
Container marking correct and properly applied	3.8 and Table V

Test	Reference	Test Paragraph
Leakage Tests	Table VI	4.4.3 through 4.4.3.7
Heat Sealed Seam Test	Table VI	4.4.4 through 4.4.4.3.1

4.2.2.3 Sampling for Groups A and B inspections. Sampling procedures shall be in accordance with MIL-STD-105 or MIL-STD-1235. Unless otherwise specified (see 6.2.1(25)), inspection levels and acceptable quality levels shall conform to 4.2.2.3.1 and 4.2.2.3.2.

4.2.2.3.1 Sampling for Group A. Samples shall be selected at random from each lot at inspection level I for MIL-STD-105 and for use under sampling plans CSP-1 or CSP-2 of MIL-STD-1235. Sample units shall be subjected to the group A examinations and tests listed in 4.2.2.2.1. If any sample unit shows deviation(s) from requirements, it shall be rejected. Unless otherwise specified (see 6.2.1(25)), lots shall be accepted or rejected in accordance with acceptable quality level (AQL) 4.0 percent defective for all Group A examinations and tests performed at each inspection station.

4.2.2.3.2 Sampling for Group B. Samples shall be selected at random from each lot at inspection level S-4 under MIL-STD-105 and at inspection level I for use under multilevel sampling plan CSP-T of MIL-STD-1235. Sample units shall be subjected to the Group B examinations and tests listed in 4.2.2.2.2. If any sample unit shows deviation(s) from requirements, it shall

be rejected. Unless otherwise specified (see 6.2.1(25)) the acceptable quality level (AQL) for sample sizes greater than 8 shall be 4.0 percent defective for all Group B examinations and test(s) performed at each inspection station. For lot sizes requiring a sample size of 8 or less, the sample size specified in MIL-STD-105 shall be used without regard to AQL and the acceptance number shall be zero for all Group B examinations and tests performed at each inspection station.

4.2.2.4 Quality control program or inspection system requirements. When contracts include provisions for the establishment by the contractor of a quality control program or an inspection system and the approved program or system includes random sampling and inspection requirements to insure that unit packs meet the requirements of this specification, that program or system shall be used in lieu of the sampling and inspection provisions of 4.2.2.3 (see 6.2.1(27)).

4.2.2.5 Rejection. If any article or unit pack is found nonconforming in one or more respects it shall be rejected whether or not the lot as a whole is accepted.

4.2.2.5.1 Rejection in lot-by-lot inspections. If the number of defective articles or unit packs in any sample equals or exceeds the applicable rejection number, the lot represented by the sample also shall be rejected.

4.3 Procedure in case of failure. Rejected items or lots may be reinspected for acceptance provided the contractor has removed all nonconforming materials, has corrected his procedures, methods or workmanship as necessary. Rejected units shall be corrected or replaced with nondefective units. The contractor shall maintain detailed records of his inspections and indicate all corrective action taken. When corrected lots are reinspected for quality conformance inspection, the sampling procedure to be employed shall conform to the requirements for tightened inspection in accordance with MIL-STD-105 as applicable.

4.4 Test procedures. Tests of the methods of preservation shall be performed in accordance with the applicable tests specified in Table VI and the contract. When a combination of methods of preservation is applied to one item, tests applicable to the various methods of preservation shall be performed.

4.4.1 Determination of cleanliness (not applicable to items subject to clean room processing). Items shall be examined or tested for cleanliness (see 3.3) in accordance with the following techniques of Method 4004 of Federal Test Method Standard No. 101, as applicable:

a. Visual examination.

b. Wipe test.

c. Check for alkalies and acids.

4.4.2 Determination of preservative compound application and retention. The continuity and appearance of preservatives after application shall be determined visually. The retention of preservatives shall be determined by examination (see 3.5.3 and Table V). The surfaces of the items protected by the application of preservatives shall be rejected if the surface coatings are not uniform and show evidence of preservative decrements or corrosion at points of contact of item with barrier.

(Note: Hard preservative films shall be examined closely for breaks in the coating.)

4.4.3 Leakage tests.

4.4.3.1 General. Unit packs shall be tested for leaks in accordance with one of the following techniques (tests) of Method 5009, Federal Test Method Standard No. 101 that are required by Table VI for the applicable method of preservation. All samples shall be conditioned at ambient conditions for at least 4 hours prior to performing the hot water test (4.4.3.6). The time that the item and all processing materials have been maintained at ambient conditions prior to or during the processing period may be considered a part of the conditioning time.

4.4.3.1.1 Wetting agent. As an alternative to the use of the aerosol solution recommended by Method 5009 Federal Test Method Standard No. 101, a solution of 4 grams of water-soluble detergent conforming to Type I of MIL-D-16791 per gallon of test water, may be used to release entrapped air so that actual leakage of air through the barrier may be detected.

4.4.3.2 Selection of technique. The most appropriate technique will depend principally upon the construction, size and weight of the unit pack and the information needed. The hot water technique is appropriate for large unit packs. The squeeze technique is appropriate for small unit packs constructed of flexible materials such as plastic film. The vacuum retention technique does not specifically locate leaks and may not indicate the existence of tiny leaks in a large unit pack. The submersion (or immersion) technique for detecting water leakage is not as sensitive as the air leakage tests, but it is appropriate to reveal whether or not water might leak into the unit packs and, depending upon the duration of the test, gives some indication of the extent to which the materials used in the pack are waterproof. The pneumatic pressure technique is primarily appropriate for rigid containers. Neither the hot water nor the pneumatic pressure techniques are appropriate for rigid containers that are sealed with tapes; the submersion technique must be used.

4.4.3.3 Vacuum retention technique.

4.4.3.3.1 Sealed rigid container. When the air in the sealed system has been evacuated to a constant specified pressure, allow the sealed system to remain undisturbed for 10 minutes. Note the pressure on the vacuum pressure gage (see 3.10.a).

4.4.3.3.2 Sealed flexible bag. Sufficient air shall be drawn from the bag to cause the bag material to cling snugly to the enclosed item. Allow the bag to remain undisturbed for two hours at ambient temperature. Grasp the bag

and draw it away from the item; then release it quickly. The bag shall remain taut and cling to the item. The stretched bag shall retract completely within three seconds (see 3.10.a).

4.4.3.4 Submersion (or immersion) techniques. After submersion and before opening the sealed system, carefully dry the outside. Open the sealed system and note whether leakage had occurred (see 3.10.b).

4.4.3.5 Pneumatic pressure technique. When the sealed system is pressurized to a constant specified pressure and the line to the compressed air supply is closed, read and record the initial pressure. When required to pinpoint leaks, coat surfaces with a soap solution (see 4.4.3.1.1) or submerge the system under water and record the results. Read and record the final gauge pressure. Repeat the test if there is any loss in pressure and no leaks are detected (see 3.10.c).

4.4.3.6 Hot water technique. Observe evolution of air bubbles at each position of the sample. Bubbles which appear on the surface of the unit pack but are not released or are released at a slowly decreasing rate are not to be construed as indication of failure (see 3.10.d).

4.4.3.7 Squeeze technique (applicable only to flexible specimens). During sealing as much air as possible is entrapped within the flexible bag at ambient conditions as for shipment and then is squeezed to increase the internal air pressure as the container is observed to detect the leaks (see 3.10.e).

4.4.4 Heat-sealed seam test.

4.4.4.1 Selection of samples for tests. Sections of the heat seals shall be obtained from sealed unit packs. The number of sealed specimens required shall be in accordance with 4.2.2.3.1 and 4.2.2.3.2.

4.4.4.2 Alternate sampling procedure for heat seal test. When heat seals are made with equipment designed to control the temperature, dwell time and pressure, test samples may be prepared from specimen heat seals in lieu of taking samples directly from heat sealed packs as specified in 4.4.4.1. Specimen heat seals shall all be prepared daily prior to production from sample(s) of each material sealed on each sealing device. Machine settings used in production shall be identical with the settings used in fabrication of test specimens. In cases where any of the alternately prepared heat seal specimens fail the seam strength test, tests of heat seals from actual unit packs shall be performed as necessary to assure that unit pack seals meet the requirements of 4.4.4.3.

4.4.4.3 Performance of heat-sealed seam-strength test. The heat-sealed, seam-strength test shall be performed in accordance with Method 2024 of Federal Test Method Standard No. 101, at normal room (ambient) temperature and the static load weight as specified therein, except that when barrier materials conform to MIL-B-121, the static load weight shall be 36 + 2 ounces. When barrier materials conform to L-P-378, MIL-B-131 or MIL-B-22191, the static load weight shall be 50 ounces. A five percent reduction in static load weight is permitted when the room temperature in the test area exceeds 90°F.

4.4.4.3.1 Interpretation of results. Partial separation of the heat seal is acceptable within the first two minutes of the test. This partial separation concerns the area of partial fusion, adjacent to the actual seal, pulling apart (see 3.11).

4.4.5 Rough handling tests. The unit pack subject to rough handling testing (see 3.12) shall be tested in accordance with Federal Test Method Standard No. 101, using the applicable methods specified in Table III. When specified (see 6.2.1(28)) the drop and impact test heights of Table IV may be substituted for the data shown in the applicable test of Federal Test Method Standard No. 101. When required by the contract or order, the test results data shall be submitted to the contracting or otherwise designated activity for approval, prior to additional unit pack production (see 4.2.1).

4.4.5.1 Applicability of tests (see 3.12).

4.4.5.1.1 Small containers. The free fall drop test, super-imposed loading and vibration tests shall apply to small containers; either one or both vibration tests may be performed at the contractor's option (see Table III). Small containers are those having no one edge or diameter of the container exceeding 60 inches and/or a gross weight of 150 pounds or less. Any container not exceeding the above dimension and weight criteria but equipped with skids shall be considered a large container for testing purposes.

4.4.5.1.2 Large containers. All rough handling tests shall apply to large containers. Either one or both vibration tests shall be conducted at the option of the contractor. However, tipover tests will apply only when specified (see 6.2.1(26)). Either impact test shall be conducted at the option of the contractor. Large shipping containers are those measuring more than 60 inches on any one edge or diameter, those which, when loaded, have gross weights in excess of 150 pounds, or those which have skids.

4.4.5.1.3 Interpretation of results. Any damage resulting from the rough handling tests that would prevent the container from performing its intended function will be cause for rejection.

4.4.6 Cyclic exposure tests. When specified (see 6.2.1(29)), the cyclic exposure test shall be performed on the completed unit packs packed as for shipment. The test specimens shall be subjected to cyclic exposure test A or test B specified in 4.4.6.1 and 4.4.6.2 before final acceptance. Cyclic exposure tests shall precede applicable leakage tests specified in Table VI.

4.4.6.1 Test A.

Approximately 16 hours overnight at 120° to 130°F.

Two hours of water spray at 50° to 60°F.

Two hours at -10° to 0°F.

Two hours of water spray at 120° to 130°F.

Two hours of water spray at 50° to 60°F.

Approximately 16 hours overnight at 35° to 50°F.

Four hours at 120° to 130°F.

Two hours of water spray at 50° to 60°F.

Two hours at 35° to 50°F.

Approximately 16 hours overnight at 120° to 130°F.

Two hours of water spray at 50° to 60°F.

Two hours at -10° to 0°F.

Three hours at 35° to 50°F.

Approximately 16 hours overnight at 120° to 130°F.

4.4.6.2 Test B. The following cyclic sequence shall be repeated on three consecutive days. At the end of the three-day period the unit pack being tested shall then set overnight at 120° to 130°F.

Approximately 16 hours overnight at 120° to 130°F.

Two hours of water spray at 50° to 60°F.

Four hours at 120° to 130°F.

Two hours of water spray at 50° to 60°F.

4.4.6.3 Interpretation of results. The tested unit pack when opened shall show no evidence of moisture nor shall the unit packed item show corrosion.

4.4.7 Disposition of samples after inspection and test. All samples used for examination and test shall be reprocessed as necessary. They may, after reprocessing in accordance with the original method of preservation, be considered a part of the original lot. When the unit packed item may have been damaged as a result of testing, the item shall be inspected and tested as necessary to determine its acceptability.

5. PACKAGING

5.1 Packaging requirements. This section is not applicable to this specification.

6. NOTES

6.1 Intended use. This document will be used to accomplish methods of preservation that pass the quality assurance provisions specified herein. The

appropriate method will be determined as specified in 3.2. This document may be referenced in acquisition documents and Section 5 of other specifications.

6.2 Ordering data. Acquisition documents should specify the following information together with any options desired by the acquiring agency.

a. Title, number and date of this specification.

b. Method of preservation (1.2 and 3.6), type of preservative, when applicable (3.5.1) and when specified (3.5.2) and unit pack quantities for each item (3.7).

c. If unit pack design validation tests are not required (4.2.1).

d. Additional marking if required (3.8).

6.2.1 Options. Options to the provisions/requirements of this specification shall be as specified in the contract or order. The options most commonly exercised are as follows:

(1) Processes of cleaning (3.3), drying (3.4), preservatives use (3.5.1), application procedure of preservatives (3.5.2 and 3.5.3), methods of preservation (3.6). If a specific cleaning, drying, preservative, wrap, cushioning, dunnage, bag, or container is required, then such must be specified in the contract or order.

(2) Specify transparent packaging materials to accomplish the unit pack (3.6) in the contract or order when required.

(3) Submethod IA-5 (3.6.3.1.1). State if a specific rigid metal container is required and type of closure, i.e., vacuum sealed, gasketed, etc.

(4) Submethods IC-1 (3.6.4.1.1), IC-2 (3.6.4.1.2), IC-3 (3.6.4.1.3), IC-7 (3.6.4.1.5), IC-9 (3.6.4.1.6). Specify specific bag or barrier materials required.

(5) Method II (3.6.5 and 3.6.5.c). Specify in the contract or order if other than the spot type humidity indicator (MS20003) is required and specify whether internal or externally mounted.

(6) Method II (3.6.5.a). Specify in the contract or order when MIL-D-3464 Type II or III desiccant is required for item protection.

(7) Submethod IIa (3.6.5.1.1) and IA-16 (3.6.3.1.7). Specify in contract or order the barrier, gasket material if other than stated and also specify if an inspection window is required for Submethod IIa.

(8) Submethod IA-14 (3.6.3.1.5) and submethod IIb (3.6.5.1.2). Specify the container required if other than class weather resistant fiberboard of PPP-B-636 or PPP-B-640 is required for the outer container.

(9) Method IId (3.6.5.1.4). Specify the required type container (i.e., reusable, non-reusable, etc.) and type closure desired.

(10) Functional test (3.13.(b)). If functional testing of items or operation of equipment is required following performance of the tests, so state.

(11) Table III, Note 1. If contractor's option does not apply, specify test.

(12) Table III, Note 3. If both methods do not apply, specify one of the methods.

(13) When Class F of MIL-B-117 shall be used, see 3.6.1.3.2, 3.6.1.3.3, and Table I, Note (1).

(14) When Class G of MIL-B-117 shall be used, see 3.6.1 and Table I, Note (2).

(15) Disassembly other than specified (see 3.3).

(16) Solvent emulsion compound other than specified (see 3.3.8).

(17) Preservatives other than listed in Table II (see 3.5.2).

(18) Preservative compound when used with Method IA (see 3.6.3).

(19) Specify if Style 3 bags of MIL-B-117 are required (see IA-8 (3.6.3.1.3), IA-14 (3.6.3.1.5), IC-1 (3.6.4.1.1), IC-2 (3.6.4.1.2), IC-3 (3.6.4.1.3), IIb (3.6.5.1.2) and IIc (3.6.5.1.3).

(20) When two subsequent sealings of the barrier are not required (see 3.6.5).

(21) Responsibility of inspection when other than contractor (see 4.1).

(22) Use of inspection facilities (see 4.1).

(23) When rough handling tests are not required (see 3.12).

(24) Quality conformance tests other than those specified in Table VI (see 4.2.2) are required.

(25) Inspection and acceptance levels other than specified (see 4.2.2.3).

(26) When tip over tests are required for large containers (see 4.4.5.1.2).

(27) Use of contractor developed quality control programs and/or inspection systems (see 4.2.2.4).

(28) Substitute drop and impact test heights of Table IV (see 4.4.5) for applicable tests of Federal Test Method Standard No. 101.

(29) When cyclic exposure tests (see 4.4.6) are required (4.2.1).

(30) When fire retardant packaging materials are required (see 3.6.1).

(31) Submethods IA-8 (3.6.3.1.3), IA-14 (3.6.3.1.5), IA-16 (3.6.3.1.7), IIa (3.6.5.1.1), IIb (3.6.5.1.2), and IIc (3.6.5.1.3) specify if a designated bag is required.

(32) Submethods IA-8 (3.6.3.1.3), IC-1 (3.6.4.1.1), IC-3 (3.6.4.1.3), IC-7 (3.6.4.1.5), IC-9 (3.6.4.1.6), and IIc (3.6.5.1.3) specify if a designated supplemental carton or box is required.

(33) Submethod IA-15 (3.6.3.1.6) and submethod IIe (3.6.5.1.5) specify a protective wrap of heavy duty kraft paper or equivalent material (tape sealed) be provided to protect the barrier.

6.2.2 Unit packing and testing facilities. The Government contracting activity's invitation for bid (IFB) or request for quote (RFQ) shall include requirements that the bidder/contractor state that he has the necessary facilities and capabilities of performing all or part of the cleaning, preservation unit packing and the testing required or that he will subcontract that which he is unable to perform to a commercial packaging concern with the necessary facilities and identify the specific taskings.

6.3 Subject term (key word) listing.

Classification, basic methods.
Cleaning.
Design, unit pack.
Documents, applicable.
Drying.
Inspection, packaging provisions.
Inspection, quality conform.
Inspection, grouping of.
Leakage.
Precautions, general.
Preservation, methods of.
Provisions, quality assurement.
Tests, cyclic exposure.
Leakage.
Rough handling.
Validation, unit pack design.

6.4 Critical item surfaces.

6.4.1 Critical items. For unit packing purposes, critical items are those which meet one or more of the following criteria.

a. Critical chemically. Items which are of such a nature that any degree of deterioration (in the form of corrosion stain, scale, mold, fungi, bacteria, etc.) caused by oxygen, moisture, sunlight, living organisms, temperature, time and other contaminants, will result in premature failure or malfunction of the item or equipment in which installed or to which the item is related.

b. Critical physically. Items of such a nature that a slight degree of physical action on the items or any integral surfaces thereof renders them unfit for use. This includes items having a surface finish of 63 microinches root mean square or less and require a high degree of cleanliness and freedom from contamination as well as those requiring special protection against shock, vibration, abrasion and distortion damage.

6.4.2 Critical surfaces. Critical surfaces are those which would be harmed functionally if marred in any manner. The function of a critical surface would be impaired by the mildest form of corrosion or other damage.

6.5 Draining. The draining procedure permitted in 3.4.5 for petroleum solvent is not intended for use under methods of preservation such as IA, IC and II when contact preservatives are not required. Prior to approval of this draining procedure for conditions not covered in 3.4.5, precautions should be established to insure that the residual film of petroleum solvent will not reduce the effectiveness of the applied preservative compounds.

6.6 Neutral wraps. When greaseproofness is not a requirement, neutral materials conforming to MIL-P-130, MIL-P-17667, L-P-378 and Type II of UU-P-553 meet the compatibility requirements of this specification and are available at lower cost. These papers are intended as an initial wrap where a noncorrosive, dust protective wrap is required prior to or as a part of unit packing wherein a greaseproof wrap is not required (see 3.6.1.2).

6.7 Bags. Bags conforming to MIL-B-117 are suitable for providing the various methods of preservation specified (see 3.6.1) herein. Bags in accordance with MIL-E-6060 shall be used for sizes larger than can be made in accordance with MIL-B-117. Guidance for the maximum weight of contents in each bag and type-size relationship are provided in MIL-B-117 or in the applicable specification. Bags fabricated of volatile corrosion inhibitor treated material, MIL-B-22019, are covered by MIL-B-22020. When the weight of the item exceeds 20 pounds, the unit pack container required shall be a box or carton as applicable or as specified in the contract.

6.8 Wiping cloth. Linen combed cotton and General Services Administration (GSA) Stores Stock Catalog listed lint free nonwoven fabric cleaning cloths, may be considered lint free for drying and inspection use (see 3.4.4).

6.9 Detailed information.

6.9.1 Environmental and Occupational Safety and Health Act. All cleaning materials must be selected and used in accordance with applicable Environmental Protection Agency regulations, Occupational Safety and Health Standards (OSHA), Code of Federal Regulations (CFR), Title 29 1910, General Industry and Air Pollution Control statutes and regulations in force in the geographic and industrial area where the cleaning is performed.

6.9.2 Cushioning design. Detailed information on cushioning design may be found in Military Standardization Handbook Packaging Cushioning Design, MIL-HDBK-304.

6.9.3 Anchoring, blocking, bracing, cushioning and waterproofing. Detailed information on blocking, bracing, anchoring, cushioning and waterproofing procedures may be found in MIL-STD-1186.

6.10 Inspection and quality assurance handbook. Information on the basic principles of sampling inspection and administration of the sampling inspection procedure may be found in the Department of Defense Quality Reliability Assurance Handbook MIL-HDBK-53-1A. Copy of the handbook may be obtained from the Superintendent of Documents, U. S. Government Printing Offices, Washington, DC 20402.

6.11 Changes in methods of preservation designations. The following are the current and superseded method and submethod of preservation classifications of MIL-P-116.

PRESERVATION METHODS AND SUBMETHOD CLASSIFICATIONS

CLASSIFICATIONS PRIOR TO MIL-P-116H	CLASSIFICATIONS OF MIL-P-116H	CLASSIFICATIONS OF MIL-P-116J	REMARKS
Method 0	Method III	Method III	Redesignated back to Method III by MIL-P-116A
Method I	Method I	Method I	---
Method IA	Method IA	Method IA	---
Submethod IA-1			Deleted by MIL-P-116E
Submethod IA-2			Deleted by MIL-P-116E
Submethod IA-3			Redesigned IC-1 by MIL-P-116A
Submethod IA-4			Redesigned IC-2 by MIL-P-116A
Submethod IA-5	Submethod IA-5	Submethod IA-5	---
Submethod IA-6	Submethod IA-6	Submethod IA-6	---
Submethod IA-7			Deleted by MIL-P-116E
Submethod IA-8	Submethod IA-8	Submethod IA-8	---
Submethod IA-9			Redesigned IC-3 by MIL-P-116A
Submethod IA-10			Redesigned IC-4 by MIL-P-116A
Submethod IA-11			Redesigned IC-5 by MIL-P-116A
Submethod IA-12			Deleted by MIL-P-116C

PRESERVATION METHODS AND SUBMETHOD CLASSIFICATIONS (Continued)

CLASSIFICATIONS PRIOR TO MIL-P-116H	CLASSIFICATIONS OF MIL-P-116H	CLASSIFICATIONS OF MIL-P-116J	REMARKS
Submethod IA-13	Submethod IA-13	Submethod IA-13	---
Submethod IA-14	Submethod IA-14	Submethod IA-14	---
Submethod IA-15	Submethod IA-15	Submethod IA-15	---
Submethod IA-16	Submethod IA-16	Submethod IA-16	---
Method IB	Method IB		Deleted by MIL-P-116J
Submethod IB-1	Submethod IB-1		Deleted by MIL-P-116J
Submethod IB-2	Submethod IB-2		Deleted by MIL-P-116J
Method IC	Method IC	Method IC	---
Submethod IC-1	Submethod IC-1	Submethod IC-1	---
Submethod IC-2	Submethod IC-2	Submethod IC-2	---
Submethod IC-3	Submethod IC-3	Submethod IC-3	---
Submethod IC-4	Submethod IC-4	Submethod IC-4	---
Submethod IC-5			Deleted by MIL-P-116E
Submethod IC-6			Deleted by MIL-P-116E
	Submethod IC-7	Submethod IC-7	Introduced by MIL-P-116E
Submethod IC-8			Deleted by MIL-P-116G
	Submethod IC-9	Submethod IC-9	Introduced by MIL-P-116G
	Submethod IC-10	Submethod IC-10	Introduced by MIL-P-116G
Method II	Method II	Method II	---
Submethod IIa	Submethod IIa	Submethod IIa	---
Submethod IIb	Submethod IIb	Submethod IIb	---
Submethod IIc	Submethod IIc	Submethod IIc	---
Submethod IId	Submethod IId	Submethod IId	---
Submethod IIe	Submethod IIe	Submethod IIe	---
Submethod IIf	Submethod IIf	Submethod IIf	Introduced by MIL-P-116C
Method III	Method III	Method III	Introduced by MIL-P-116A
Method IV			Introduced by MIL-P-116F
Submethod IVa			Int. Amend. (1) - (SM)
Submethod IVb			Cancelled by MIL-P-116H

6.12 Changes from previous issues. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodians:
Army - SM
Navy - AS
Air Force - 69
DLA - ES

Review Activities:
Army - AL, AT, AV, EA, CR, GL, ME, MI, MR, AR
Navy - SA, SH, MC, OS, YD, EC
Air Force - 99, 43
DLA - DH, GS

Preparing Activity
Navy - AS
(Project - PACK-0763)

TABLE I. Methods and submethods.

I	IA	IC	II	III
Preservative coating (with greaseproof) wrap as required) (3.6.2)	Watervaporproof enclosure (with preservatives as required) (3.6.3)	Waterproof or waterproof greaseproof enclosure (with preservative as required (3.6.4)	Watervaporproof enclosure with desiccant and preservative as required (3.6.5)	Physical and mechanical protection only (3.6.6)
	IA-5 Rigid metal container sealed (3.6.3.1.1)	IC-1 Greaseproof, waterproof bag, sealed (3.6.4.1.1)	IIa Floating bag, heat sealed 1/ 2/ (3.6.5.1.1)	
	IA-6 Rigid container (items immersed in preservative, oil type) sealed (3.6.3.1.2)	IC-2 Container, waterproof, bag, sealed (3.6.4.1.2)	IIb Container, bag, heat sealed, container 1/ 2/ (3.6.5.1.2)	
	IA-8 Bag sealed 1/ 2/ (3.6.3.1.3)	IC-3 Waterproof bag, sealed (3.6.4.1.3)	IIc Bag, heat sealed 1/ 2/ (3.6.5.1.3)	
	IA-13 Rigid container other than all metal, sealed (3.6.3.1.4)	IC-4 Rigid container other than all metal, sealed (3.6.4.1.4)	IId Rigid metal container, sealed (3.6.5.1.4)	
	IA-14 Container, bag, heat sealed, container 1/ 2/ (3.6.3.1.5)	IC-7 Blister pack, greaseproof-waterproof single or multiple compartment, individually sealed (3.6.4.1.5)	IIe Container, bag, heat sealed (3.6.5.1.5)	
	IA-15 Container, bag, heat sealed 1/ 2/ (3.6.3.1.6)	IC-9 Skin pack, greaseproof, waterproof, vacuum formed, sealed (3.6.4.1.6)	IIf Rigid container, other than all metal, sealed (3.6.5.1.6)	
	IA-16 Floating bag, heat sealed 1/ 2/ (3.6.3.1.7)	IC-10 Skin pack, waterproof, vacuum formed (3.6.4.1.7)		

NOTES:

1/ When specified (see 6.2.1(13)), Class F of MIL-B-117 shall be used.
2/ When specified (see 6.2.1(14)), Class G of MIL-B-117 shall be used.

TABLE II. Preservatives.

Type	Description 1/	Specification No.	Footnote No.
P-1	Thin film preservative (hard drying, cold application)	MIL-C-16173, Gr. 1	
P-2	Thin film preservative (soft film, cold application)	MIL-C-16173, Gr. 2	
P-3	Thin film preservative, water displacing (soft film, cold application)	MIL-C-16173, Gr. 3	2/
P-6	Light preservative compound (soft film, hot application)	MIL-C-11796, Class 3	
P-7	Medium preservative oil (cold application)	MIL-L-3150	
P-9	Very light preservative oil, water displacing (cold application)	VV-L-800	
P-10	Engine preservative oil	MIL-L-21260, GR 10, 30 and 50	3/
P-11	Preservative grease (application as required)	MIL-G-10924, MIL-G-23827 or MIL-G-81322	
P-14	Corrosion preventive (food handling machinery and equipment), nontoxic	MIL-C-10382	
P-15	Hydraulic preservative oil		4/
P-17	Aircraft instrument preservative oil	MIL-L-6085	
P-18	Volatile corrosion inhibitor		5/
P-19	Thin film preservative (Transparent, nontacky)	MIL-C-16173, Gr. 4	
P-20	Lubricating oil, contact and volative corrosion inhibitor treated	MIL-P-46002	
P-21	Thin film preservative, water displacing (soft film, cold application low pressure steam removable)	MIL-C-16173, Gr. 5	

NOTES:

1/ Descriptions are not specification titles, but merely general descriptions.

2/ For conditions where salt spray is expected to be encountered, use MIL-C-81309.

3/ Specify MIL-C-6529 for aeronautical applications. For Army aircraft turbine engines, the normal operating lubricant is used, except for fuel system, specify MIL-L-6081, Grade 1010.

4/ Specifications for hydraulic preservative oils have not been listed because of variations in system requirements. Synthetic base preservatives should be used in lieu of petroleum base materials when possible. Hydraulic preservatives used shall be subject to approval by acquiring agency.

5/ VCIs: MIL-P-3420, opaque treated barrier; MIL-B-22019 and MIL-B-22020, transparent film treated barrier; MIL-I-22110, crystalline form (see 3.5.3.8).

TABLE III. Rough handling tests.

Test	Methods of FED-STD-101	Special requirements or exceptions
Free-fall drop tests:		See note 1
Corner drop	5007 Procedure E	See note 2
Flat drop	5007 Procedure B	See note 2
Tipover	5018	See note 4
Rotational drop tests:		See note 1
Edgewise	5008	
Cornerwise	5005	
Impact tests:		See note 1
Pendulum	5012	
Incline	5023	
Superimposed load:		See note 3
(Stackability with dunnage)	5016	
(Uniformly distributed without dunnage)	5017	
Vibration:		See note 1
Repetitive shock	5019	
Sinusoidal motion	5020	

NOTES:

1. Unless otherwise specified (see 6.2.1(11)), the contractor shall have the option as to what method is to be applied in accomplishing the freefall, rotational, impact and vibration tests.
2. Containers employing internal shock mitigation systems, cushioning, blocking or bracing shall be subjected to both corner and flat drop tests.
3. Unless otherwise specified (see 6.2.1(12)), both methods shall be applied.
4. Not required unless specified (4.4.5.1.2).

TABLE IV. Graduated drop and impact test heights.*

Gross weight of container and contents	Edgewisedrop (2 drops each end)	Cornerwise-drop test (2 drops on each of 2 diagonally opposite corners of bottom)	Impact tests (1 impact on each of 2 opposite ends) (Use either test)	
Pounds	Height of drop (inches)	Height of drop (inches)	Pendulum impact (inches)	Incline impact (feet)
150-250	30	30	14	7.0
Over 250 thru 500	24	24	11	5.5
Over 500 thru 1000	18	18	8	4.0
Over 1000	12	12	5	2.5

NOTE:

* Excludes Method 5007.

TABLE V. Packaging inspection provisions.

Criteria Major defect, AQL 4.0 percent defective	Method of inspection	Method/Submethod																					
		I	IA-5	IA-6	IA-8	IA-13	IA-14	IA-15	IA-16	IC-1	IC-2	IC-3	IC-4	IC-7	IC-9	IC-10	IIa	IIb	IIc	IId	IIe	IIf	III
Cleaning material contaminated	Visual	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Item not completely cleaned	Visual	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Item damaged by action of cleaning process	Visual	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Item contaminated (handling with bare hands after cleaning)	Visual	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Process incomplete (omission of final rinse)	Visual	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Cleaning materials not as specified	Visual	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Item not completely dry	Visual	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Item damaged by air blast, overheating	Visual	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Contaminated compressed air (moisture)	Visual	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Contaminated wiping cloths	Visual	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Items not thoroughly drained	Visual	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Preservative not as specified	Visual	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Incomplete coverage of preservative	Visual	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Excessive preservative	Visual	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Wrap not as specified	Visual	X	X		X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
Cushioning material and/or thickness not as specified	Visual	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Improper application of cushioning	Visual	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Improper amount of desiccant (formula of MIL-P-116)	Visual																X	X	X	X	X	X	
Desiccant contacting item	Visual																X	X	X	X	X	X	
Unit container not as specified	Visual	X	X	X	X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X
Plastic material not as specified	Visual													X	X	X							
Improper seal or closure of unit containers	Visual	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Interior unit container corners not blunted	Visual						X	X			X							X			X		
Excessive looseness in unit container	Shake	X	X		X	X	X	X		X	X	X	X	X	X	X		X	X	X	X	X	X
Window not as specified	Visual																X						
Excessive air within unit container	Visual				X		X	X		X	X	X		X	X	X	X	X	X		X		
Perforation or tear lines omitted	Visual													X									
Marking omitted, incorrect, or illegible 1/ 2/	Visual	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Humidity indicator not properly placed	Visual																X	X	X	X	X	X	
Closure edge of flexible barrier lacks sufficient material for reclosure	Visual																X	X	X	X	X	X	

NOTES:

1/ When a container for a unit pack is also used as an exterior shipping container, i.e., Methods IA-14, IA-16, IIa and IIb, the marking applicable to the shipping container (as specified in MIL-STD-129) shall be used in lieu of unit pack markings, and the barrier bag of these packs shall be marked as specified for unit pack markings in accordance with MIL-STD-129.

2/ When a box or container is used to effect the unit pack of submethods IA-8, IC-1, IC-3, IC-7, IC-9 and IIc (see 6.7), unit pack markings of MIL-STD-129 shall be applied to the barrier bag as well as the box specified to effect the unit pack.

TABLE VI. Schedule of quality conformance tests.

Method or submethod	Preservative compound application (see 4.4.2)	Leak tests 1/ (see 4.4.3.2)	Heat-sealed seam test (see 4.4.4) 2/
I	Required	----	----
IA-5	Required when preservative is specified	Required	----
IA-6	Required	Required	----
IA-8	Required when preservative is specified	Required	Required
IA-13		Required	----
IA-14		Required	Required
IA-15		Required	Required
IA-16		Required	Required
IC-1	Required when preservative is specified	Required	Required 3/
IC-2		Required	Required
IC-3		Required	Required 3/
IC-4		Required	----
IC-7		Required	----
IC-9		Required	----
IC-10		Required	----

TABLE VI. Schedule of quality conformance tests (Continued).

Method or submethod	Preservative compound application (see 4.4.2)	Leak tests 1/ (see 4.4.3.2)	Heat-sealed seam test (see 4.4.4) 2/
IIa	Required when preservative is specified	Required	Required
IIb		Required	Required
IIc		Required	Required
IId		Required	----
IIe		Required	Required
IIf		Required	----
III	----	----	----

1/ Containers, wraps and cushioning used outside the waterproof or water-vaporproof barrier shall be removed prior to testing.

2/ Heat-sealed seam test, 4.4.4, may be used in lieu of leak test 4.4.3.2 for small or mixed quantities of packaged items (see 4.1.2).

3/ The required cold-sealed seam test for VCI treated bags conforming to MIL-B-22020, Class 2 is given in MIL-B-22020.

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-P-116J	PRESERVATION, METHODS OF

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR ☐ USER ☐ MANUFACTURER ☐ OTHER *(Specify)*: _____
b. ADDRESS *(Street, City, State, ZIP Code)*	

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

(TO DETACH THIS FORM, CUT ALONG THIS LINE.)

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