

INCH-POUND

MIL-I-52211B

9 May 1994

SUPERSEDING

MIL-C-52211A(ME)

5 August 1975

(See 6.10)

MILITARY SPECIFICATION

INDUSTRIAL GAS PRODUCTION EQUIPMENT, ACCESSORIES, AND
SUPPORT ITEMS; PACKAGING OF

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

1. SCOPE

1.1 Scope. This specification covers the requirements for cleaning classifications and packaging (preservation, packing, and marking) of industrial gas (oxygen and nitrogen) production equipment, accessories, and associated support items (see 6.5 and 6.8).

1.2 Classification. Packaging (levels of protection) and cleanliness classifications are as follows, as specified (see 6.2):

1.2.1 Levels of protection.(a) Preservation.

Level A (see 3.6).

(b) Packing.

Level A (see 3.7, 3.7.1, and 3.7.2).

Level B (see 3.7, 3.7.1, and 3.7.2).

Level C (see 3.7, 3.7.1, and 3.7.2).

Commercial (see 3.7 and 3.7.3).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, SEA 03Q42, Naval Sea Systems Command, 2531 Jefferson Davis Hwy, Arlington, VA 22242-5160 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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1.2.2 Cleanliness classification. The cleanliness classification shall be determined by the specific use application of the item. The cleanliness classification applies to the surfaces and passages that, when in use, will be contacted by the industrial gas. Exterior surfaces of items which will not be exposed to the industrial gas shall be cleaned in accordance with procedure C-1 of MIL-P-116 after completion of all other required cleaning, drying, and plugging or capping of all item openings. Items of critically cleaned systems which will have their condition degraded during installation (welding, soldering, brazing, and so forth) shall be initially classified for class E cleanliness and shall be reclassified as applicable and cleaned with the complete system or subsystem after the installation has been completed (for Navy, see MIL-STD-1330). If a cleanliness classification is not specified then class D cleanliness shall apply.

- (a) Class A cleanliness. Class A cleanliness is the class of cleanliness applied to items that employ moving parts that will in use contact liquid or gaseous oxygen. Examples are: compressors, pumps, valves, flow meters, rotometers, and so forth.
- (b) Class B cleanliness. Class B cleanliness is the class of cleanliness applied to items that employ fixed surfaces that will in use contact liquid or gaseous oxygen. Examples are: fixed plumbing fixtures, such as tubing, connectors, fittings, filters, rupture assemblies, and so forth.
- (c) Class C cleanliness. Class C cleanliness is the class of cleanliness applied to pressure-measuring devices using a Bourdon tube or bellows-type movement. Examples are: pressure-monitoring devices and flow or liquid level differential pressure instruments.
- (d) Class D cleanliness. Class D cleanliness is the class of cleanliness applied to items that will in use contact a compressed air atmosphere or a pure product fluid. Examples are: plumbing fixtures, such as tubing, connectors, fittings, filters, and so forth, of pure product circuits, controls, tanks, and so forth.
- (e) Class E cleanliness. Class E cleanliness is the class of cleanliness applied to items that will in use not contact liquid or gaseous oxygen, an oxygen-enriched atmosphere or pure product fluids. An example is the plumbing fixtures of the process air circuit of a gas generating plant. This classification shall also be applied to items that are to be cleaned prior to installation in a system and then cleaned with the complete system or subsystem.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

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SPECIFICATIONS

FEDERAL

- L-P-378 - Plastic Sheet and Strip, Polyolefin.
- O-S-642 - Sodium Phosphate, Tribasic, Anhydrous; Dodecahydrate; and Monohydrate; Technical.
- O-T-634 - Trichloroethylene, Technical.
- P-C-436 - Cleaning Compound, Alkali, Boiling Vat (Soak) or Hydrosteam.
- P-C-437 - Cleaning Compound, High Pressure (Steam) Cleaner.
- BB-N-411 - Nitrogen, Technical.
- PPP-F-320 - Fiberboard: Corrugated and Solid, Sheet Stock (Container Grade), and Cut Shapes.

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- MIL-P-116 - Preservation, Methods of.
- MIL-C-15074 - Corrosion Preventive, Fingerprint Remover.
- MIL-D-16791 - Detergents, General Purpose (Liquid, Nonionic).
- MIL-L-19140 - Lumber and Plywood, Fire-Retardant Treated.
- MIL-B-22191 - Barrier Materials, Transparent, Flexible, Heat-Sealable.
- MIL-C-81302 - Cleaning Compound, Solvent, Trichlorotrifluoroethane.
- MIL-T-81533 - 1, 1, 1 Trichloroethane (Methyl Chloroform) Inhibited, Vapor Degreasing.

STANDARDS

FEDERAL

- FED-STD-595 - Colors Used in Government Procurement.

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- MIL-STD-1330 - Cleaning and Testing of Shipboard Oxygen, Nitrogen and Hydrogen Piping Systems.
- MIL-STD-1359 - Cleaning Methods and Procedures for Breathing Oxygen Equipment.
- MIL-STD-1367 - Packaging, Handling, Storage, and Transportability Program Requirements for Systems and Equipments.
- MIL-STD-1622 - Cleaning of Shipboard Compressed Air Systems.
- MIL-STD-2073-1 - DoD Material Procedures for Development and Application of Packaging Requirements.

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

2.2 Non-Government publications. The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

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AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
MH15.1 - Glossary of Packaging Terms.

(Application for copies should be addressed to the American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
D 996 - Standard Terminology of Packaging and Distribution
Environments.
D 3951 - Standard Practice for Commercial Packaging. (DoD adopted)

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

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection (see 6.4) in accordance with 4.4.

3.2 Definitions or explanation of terms. Definitions or explanations of terms applicable to this specification shall be as stated in the applicable referenced specification and 6.5 and 6.8. For definitions or explanation of packaging terms not specified therein, ANSI MH15.1 and ASTM D 996 shall apply.

3.3 Order of precedence. When an item is acquired in accordance with a commodity specification having detailed packaging or preparation for delivery requirements which differ from this specification, the packaging or preparation for delivery specified in the commodity specification shall apply.

3.4 Material. Material shall be as specified herein and in the applicable specifications and standards. Materials not specified shall be selected by the supplier and shall be subject to all provisions of this specification.

3.4.1 Recovered materials. Unless otherwise specified herein, all equipment, material, and articles incorporated in the products covered by this specification shall be new and may be fabricated using materials produced from recovered materials to the maximum extent practicable without jeopardizing the intended use. The term "recovered materials" means materials which have been collected or recovered from solid waste and reprocessed to become a source of raw materials, as opposed to virgin raw materials. None of the above shall be interpreted to mean that the use of used or rebuilt products is allowed under this specification unless otherwise specifically specified.

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3.4.2 New materials. The use of newly developed packaging materials or procedures are encouraged and recommended and will be permitted under the conditions specified herein, provided they are equal to or better than the specified materials or procedures.

3.4.3 Dry nitrogen. Dry nitrogen shall conform to BB-N-411, type I, class 1, grade A or B.

3.4.4 Navy fire-retardant requirements.

- (a) Treated lumber and plywood. Unless otherwise specified (see 6.2), all lumber and plywood including laminated veneer material used in shipping container and pallet construction, members, blocking, bracing, and reinforcing shall be fire-retardant treated material conforming to MIL-L-19140 as follows:

Level A and B	- Type II - weather resistant
	Category 1 - general use.
Level C	- Type I - non-weather resistant
	Category 1 - general use.

- (b) Fiberboard. Fiberboard used in the construction of interior (unit and intermediate) and exterior containers including interior packaging forms shall conform to the class-domestic/fire retardant or class-weather resistant/fire retardant material requirements as specified (see 6.2) of PPP-F-320 and amendments thereto.

3.4.5 Interior protective packaging materials. Protective packaging materials, wraps, pads, cushioning, filler, dunnage, barrier bags, sealing caps and plugs shall be of the same cleanliness level as required for the item being unit protected. The cleanliness level of the packaging materials shall be maintained from its initial cleanliness level until the final closure of the unit pack is effected. Material used for and in the unit pack shall not have any inked, dyed, or otherwise applied markings and shall be nonhygroscopic and nondusting. Unless otherwise specified (see 6.2), materials that will or come in direct contact with the item unit protected shall be Teflon, Kel-F, Aclar, or material conforming to MIL-B-22191, type optional. The use of excelsior, newspaper, shredded paper (all types), and similar hygroscopic or nonneutral materials and all types of loose fill materials for application such as cushioning, filler, stuffing, and dunnage is prohibited.

3.5 Transportation plan. When required (see 6.2), the system or equipment acquisition or program manager shall establish the transportation plan (see 6.3). The plan shall be tailored to the applicable system or equipment acquisition in accordance with MIL-STD-1367.

3.6 Preservation. Preservation shall be level A.

3.6.1 Clothing and equipment.

3.6.1.1 Clothing. Personnel, including observers and visitors, working in a controlled-atmosphere or clean work area should be clothed as follows:

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- (a) Clean, lint free smocks or overalls, without pockets, buttons, exposed zippers, keys, and similar articles.
- (b) Head covering, which covers the entire head, to avoid item contamination from loose hair or skin flakes.
- (c) Clean, lint-free gloves for handling or while working with clean items.
- (d) Shoe covers, or shoes cleaned or changed before entering the area.
- (e) Clothing is not to be worn open or outside of the clean facility.

3.6.1.2 Tools and equipment. Work benches, tools, and processing equipment shall be maintained free of grease, oil, and other foreign or combustible materials and shall be used only on or for the processing of oxygen and nitrogen components. All tools and equipment should be cleaned before entry into the clean facility to prevent area contamination.

3.6.1.3 Plugs and caps. All caps and plugs shall be of the same cleanliness as the item to be sealed. Temporary plugs or caps shall be used to prevent the entry of contamination into the clean item during and after repair and maintenance work. Plugs shall be mechanically expandable, insert type, with the plug fabricated from Teflon, Kel-F; or Aclar. Wood or plastic plugs are not permitted. Caps shall be fabricated from noncorrodible, nonshreddable metal such as aluminum or corrosion-resistant steel. Tape, plastics, or wood shall not be used as the capping material. Caps shall be secured by bolting or by use of a cleanable, nonshredding, nonadhesive teflon tape used as ribbons or ties. Wood may be used over the metallic caps for purposes of bolting. Items which have been cleaned and tested shall be thoroughly dried prior to plugging or capping. A label (see 3.8.1) shall be affixed to the item identifying it as being cleaned to this specification and for use in the appropriate system (see 1.1).

3.6.1.4 Records. A record of accountability shall be maintained for tool, equipment, plugs, and caps which are small enough to fit inside openings of items, unless the internal surfaces of the item can be visually observed to be satisfactorily clean prior to closure of the involved item.

3.6.2 Facilities. Sources of detailed information are listed in 6.8.

3.6.2.1 Operating procedures. Unless otherwise specified herein, all cleanliness processing shall be performed in a clean work area (see 3.6.2.2.3). Preservation of items shall be performed in a continuous operation. A controlled-atmosphere room (see 3.6.2.2.2) or a clean work area (see 3.6.2.2.3) shall be utilized to complete these operations through sealing of the item in its unit pack (see 3.6.5). When specified (see 6.2), cleanliness classes A, B, and C and items requiring long periods of time for processing shall require a controlled-atmosphere room.

3.6.2.2 Clean facilities. A controlled-atmosphere room or a clean work area shall be used for final cleaning, assembly, testing, packaging, and examinations or disassembly of items. When welding or brazing is performed in a clean work area, precautions shall be taken to control splatter and to remove the welding and brazing smoke from the area before redesignation as a clean work area. Welding and brazing shall not be performed in a controlled-atmosphere room.

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3.6.2.2.1 Anteroom. An anteroom may be provided or established if the controlled-atmosphere room or clean work area is located in a contamination producing area. The anteroom should provide a space for changing and stowing of clothing, wash-up facilities, and, as needed, facilities for maintenance and storage of parts and equipment.

3.6.2.2.2 Controlled-atmosphere room. The controlled-atmosphere room shall be a positively pressurized enclosure having a well-filtered, air-conditioned atmosphere. Walls shall be constructed of standard structural materials, finished, to minimize contamination and facilitate cleaning. Work benches, tools, and processing equipment shall be maintained free of grease, oil, or other contaminants and combustible materials and shall only be used on or for items processed to this specification. The facility shall be maintained neat and orderly, free of dirt and debris. Personnel working in this facility shall maintain themselves and their clothing in a condition which will prevent transferring contaminants to processed surfaces. (Clean white coveralls or smocks without front pockets and cover shoes are recommended attire.) A control level of 40 percent relative humidity and 73 degrees Fahrenheit (°F) is desirable.

3.6.2.2.3 Clean work area. The clean work area shall be isolated from all manufacturing processes and shall contain only the equipment necessary to process the items. Work benches, tools, and processing equipment shall be maintained free of grease, oil, or other contaminants and combustible materials and shall only be used on or for items processed to this specification. Personnel working in this area shall maintain themselves and their clothing in a condition which shall prevent transferring contaminants to process surfaces.

3.6.3 Cleaning and drying. Cleaning and drying shall be in accordance with the requirements specified herein and shall be capable of passing the tests in section 4 for the required cleanliness classification.

3.6.3.1 Cleaning. Surfaces of components and assemblies shall be cleaned to ensure removal of rust, corrosion, soil, oil, grease, residues, and fingerprints, perspiration, or other acid and alkali residues. Internal parts of complex assemblies shall be cleaned prior to assembly and precautions shall be taken to avoid contamination thereafter. The required cleaning shall be accomplished by one or more of the following processes, provided the process is not injurious to the item.^{1/} The process selected shall be determined by the condition and composition of the item and the required class of cleanliness.

3.6.3.1.1 Cleaning agents and processes. In addition to the specific solvents cited herein, other halogenated solvents or solvent mixtures compatible with and non-deleterious to the item and which will ensure cleaning to the specified cleanliness classification may be used (see 3.4.2), if approved by NAVSEA. Any of the following cleaning processes may be selected based on the item condition and composition and the required class of cleanliness. This specification does not differentiate between items constructed of metallic parts, non-metallic parts, or combinations thereof. Therefore, any cleaning process can be selected. Detergent cleaning (see 3.6.3.1.1.5) for non-metallic items is

^{1/} See MIL-STD-1330, MIL-STD-1359 or MIL-STD-1622 for applicable safety precautions.

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considered preferable to solvent cleaning whenever it is possible that the solvent will have a deleterious effect on the item. When solvent cleaning is used for non-metallic or combination items, it is recommended that the cleaning be accomplished with room temperature solvent and the immersion time be limited to 5 minutes. Trichlorotrifluoroethane (R-113) in accordance with MIL-C-81302 is the solvent suggested for non-metallic (see 6.7) items. If cleaning material such as fingerprint remover in accordance with MIL-C-15074 is used, following the application of the fingerprint remover all surfaces shall be thoroughly cleaned with another cleaning agent. Application of MIL-C-15074 material must be followed by a thorough washing of the item to assure removal of undesirable residue from the MIL-C-15074 material.

3.6.3.1.1.1 Vapor degreasing. Cleaning shall be effected by subjecting the item to the vapor from stabilized trichloroethylene conforming to O-T-634 or 1, 1, 1 trichloroethane conforming to MIL-T-81533 until no further solvent condensation occurs. This process shall be followed by a thorough rinse of all surfaces with clean trichlorotrifluoroethane in accordance with MIL-C-81302.

3.6.3.1.1.2 Solvent degreasing. Cleaning shall be effected by washing all surfaces of the item using 1, 1, 1 trichloroethane conforming to MIL-T-81533, trichlorotrifluoroethane, in accordance with MIL-C-81302 at ambient temperatures. Trichlorotrifluoroethane in accordance with MIL-C-81302 or R-11 (trichlorofluoromethane) acquired commercially as Dupont "Freon MF" or Allied Chemical "Gensolv A" are the only approved solvents for oxygen life support systems. For class E cleanliness only, if the cleaning solvent contains more than 1 percent of oil after the item is cleaned and drained of all solvent, the degreasing process shall be repeated with clean solvent. This process shall be followed by a thorough rinse with clean solvent.

3.6.3.1.1.3 Alkaline cleaning (class E cleanliness only). Cleaning shall be effected by immersion, soaking, flushing, or subjecting the item to a pressure spray using alkaline cleaner conforming to P-C-436 or P-C-437 and thoroughly rinsing in clean distilled water at a temperature above 180°F.

3.6.3.1.1.4 Steam cleaning (class E cleanliness only). Cleaning shall be effected by subjecting the item to a stream of steam or to a stream of steam with an added cleaning compound conforming to P-C-437, followed by steam alone.

3.6.3.1.1.5 Detergent cleaning (for O-rings, gaskets, and so forth). Cleaning shall be effected by washing all surfaces of the items using a 4-percent detergent solution (mix 6 ounces of detergent solution to 1 gallon of water) for 30 minutes at 120°F. Washing shall be followed with several rinses using clean distilled water. Detergent shall conform to MIL-D-16791, type 1.

3.6.3.1.1.6 Ultrasonic cleaning. Cleaning shall be effected by subjecting the items to an ultrasonic-cleaning process. Water base detergent solutions or organic solvents shall be used as the cleaning media. Water base detergent solutions shall be used for cleaning simple, unchanneled components. Detergent conforming to MIL-D-16791, type 1, shall be used in preparing a water base solution of 1/2 to 1 ounce of detergent per gallon of demineralized water. Trichloroethane conforming to MIL-T-81533 shall be used as the organic solvent. Organic solvent cleaning shall be followed by several rinses with clean solvent and detergent cleaning by several rinses with clean distilled water.

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3.6.3.1.1.7 Tribasic sodium phosphate (TSP). Cleaning shall be effected by item soaking and agitating in a solution of TSP conforming to O-S-642, type I or II. Cleaning solution shall be maintained at 160 to 190°F. TSP solution cleaning shall be followed by several rinses in hot, clean water at a temperature of 160 to 190°F.

3.6.3.2 Drying procedures. Immediately after cleaning, the items shall be dried by one of the following processes, as applicable.

3.6.3.2.1 Dry nitrogen. Items shall be purged until dry with hot nitrogen (140°F minimum) which has been filtered through a 40 micrometer, absolute-rated filter.

3.6.3.2.2 Oven drying. Items shall be placed in a ventilated circulating-air oven maintained at a temperature of $160 \pm 5^\circ\text{F}$ until dry.

3.6.3.2.3 Infrared. Items shall be exposed to a direct infrared source until dry.

3.6.3.2.4 Vacuum evacuation. Items capable of withstanding a vacuum without damage shall be dried by vacuum evacuation and shall be considered dry when the vacuum is maintained at 0.5 inch of mercury for not less than 5 minutes.

3.6.4 Unit protection methods.

3.6.4.1 Unit pack. Immediately after item cleaning and drying, the items shall be unit packed in accordance with one of the following methods. Items which only require protection on interior surfaces, such as hoses, tubing, and so forth, shall be unit packed method A or D. Items which employ moving parts, such as compressors, pumps, valves, and so forth, shall be unit packed method C. Items which only require protection on outer or exterior surfaces such as O-rings, gaskets, and so forth, shall be unit packed method D. All other items not fitting the above shall be unit packed method B. Methods employing an initial clean barrier bag, an outer barrier bag, or both, shall have the bags of a sufficient size to obtain two subsequent heat seals at the bag end through which the item is inserted and removed. The method selected shall be capable of passing the tests and examinations specified in section 4.

3.6.4.1.1 Method A. Immediately after drying, the interior of the items shall be purged with dry nitrogen. Preservatives shall not be applied to the items. Small threaded openings into the items shall be sealed with corrosion-resisting steel or compatible metal caps or plugs that will ensure an airtight seal. Small unthreaded openings into the items shall be sealed with high-density polyethylene caps or plugs that will ensure an airtight seal. Flanged openings shall be sealed with polyethylene discs not less than 1/16 inch thick and a bolted blank flange of aluminum or corrosion-resisting steel not less than 1/4 inch thick, bolted through each hole, and with lock nuts torqued to avoid warping and to ensure an airtight seal. Like material shall be used for bolts in contact with corrosion-resisting steel. When specified (see 6.2), the interior of the items shall be pressurized at 3 pounds per square inch (lb/in²) with dry nitrogen prior to sealing.

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3.6.4.1.1.1 Alternate method A. When approved (see 6.2), items of excessive size, weight, or irregular configuration and having only internal surfaces and passages in direct contact with the industrial gas or fluid shall be cleaned, dried, plugged, or capped as specified for method A. Upon completion all exterior surfaces of the items which are not exposed to the industrial gas or fluid shall be cleaned in a manner meeting the requirements of process C-1 of MIL-P-116 and dried. Unless otherwise specified (see 6.2), the item shall be enclosed in a bag fabricated from marked, untinted (colorless) barrier material conforming to MIL-B-22191, type I, and shall be heat sealed. This method shall meet the requirements for submethod IA-16 of MIL-P-116.

3.6.4.1.1.2 Method B. The items shall be purged with dry nitrogen. Preservatives shall not be applied to the items. Items having sharp edges or projections shall have these areas wrapped with cushioning as specified herein to protect the bag or barrier from damage. The items shall be heat-sealed in a bag fabricated from barrier material conforming to MIL-B-22191, type II, which shall then be preserved in accordance with MIL-P-116, method IA, submethod as applicable. When submethod IA-16 is utilized, the initial barrier bag shall be constructed in accordance with MIL-P-116 for the floating barrier.

3.6.4.1.1.3 Method C. The items shall be purged with dry nitrogen. Preservatives shall not be applied to the items. Items having sharp edges or projections shall have these areas wrapped with cushioning as specified herein to protect the bag or barrier from damage. The items shall be heat-sealed in a bag fabricated from barrier material conforming to MIL-B-22191, type I, which shall then be preserved in accordance with MIL-P-116, method II, submethod as applicable. The desiccant shall be placed outside the initially sealed bag. When submethod IIA is utilized, the initial barrier bag shall be constructed in accordance with MIL-P-116 for the floating bag.

3.6.4.1.1.4 Method D. The items shall be cleaned, dried, and, if required, plugged or capped. All sharp corners, edges, and protrusions of the item shall be, as required, wrapped or cushioned (same material as the initial, clean, inner bag) to prevent damage to the initial bag. Wraps and cushioning shall be secured with cleanable, nonshedding, nonadhesive (teflon) tape used as ribbons or ties. The initial, clean, inner bag shall be fabricated from minimum 4 mil thickness (6 mils for items over 5 pounds), unmarked, untinted (colorless) polyolefin material conforming to L-P-378, type I or II, grade A, class 1, untreated or barrier material conforming to MIL-B-22191, type III. The outer bag shall be fabricated from minimum 4 mil thickness (6 mils preferred), marked, untinted (colorless) barrier material conforming to MIL-B-22191, type I. Inner and outer bags shall be heat sealed. Heat seals shall pass the heat seal tests of MIL-P-116. The outer bag shall be labeled (see 3.8.1). Double-bagged items shall be placed, with cushioning to prevent bag damage, within an interior container.

3.6.5 Interior containers. Interior (unit and intermediate) containers shall conform to the appendix F table for selection and closure of unit and intermediate containers of MIL-STD-2073-1. Paperboard boxes shall be of the weather or water resistant variety; fiberboard boxes shall be of the fire-retardant, weather-resistant class. Fiberboard box closure shall be in accordance with method V of the appendix to the box specification. Unless otherwise specified (see 6.2), box selection shall be at the option of the contractor.

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3.7 Packing. Packing shall be level A, B, C, or commercial as specified (see 6.2).

3.7.1 General requirements for levels A, B, and C. Containers selected (see 3.7.2) shall be of minimum weight and cube consistent with the protection required, of uniform size, and contain identical quantities of identical items.

3.7.2 Levels A, B, and C containers. Items shall be packed in exterior shipping containers for the level of packing specified (see 3.7), in accordance with the exterior shipping container requirements of MIL-STD-2073-1 and herein. Unless otherwise specified (see 6.2), container selection shall be at the contractor's option.

3.7.2.1 Caseliners, closure and gross weight.

3.7.2.1.1 Caseliners. When specified (see 6.2), level A shipping containers shall be provided with waterproof caseliners in accordance with MIL-STD-2073-1.

3.7.2.1.2 Closures. Container closure, reinforcing, or banding shall be in accordance with the applicable container specification or appendix thereto except that the class weather-resistant including fire-retardant fiberboard boxes shall be closed in accordance with method V and reinforced with non-metallic or tape banding and class domestic, fire-retardant fiberboard boxes shall be closed in accordance with method I using pressure sensitive tape.

3.7.2.1.3 Weight. Wood, plywood, and cleated type containers exceeding 200 pounds gross weight shall be modified by the addition of skids in accordance with MIL-STD-2073-1 and the applicable container specification or appendix thereto.

3.7.3 Commercial. Items shall be packed for shipment in accordance with ASTM D 3951 and herein.

3.7.3.1 Container modification. Shipping containers exceeding 200 pounds gross weight shall have a minimum of two 3-inch by 4-inch nominal wood skids laid flat, or a skid or sill type base which will support the material and facilitate handling by mechanical handling equipment during shipment, stowage, and storage.

3.8 Marking, levels A, B, C, and commercial. In addition to any special marking required (see 6.2) and herein, interior (unit and intermediate) packs and shipping containers shall be marked including bar coding for shipment, stowage, and storage in accordance with MIL-STD-2073-1.

3.8.1 Commercial. Commercial marking shall be accomplished in accordance with ASTM D 3951.

3.8.2 Special marking. Each item, interior pack, and shipping container, as applicable, shall be marked with a warning label herein, as appropriate, for the item. The label shall be a similar color of green to color 14187 of FED-STD-595.

For classes A, B, and C:
 "WARNING - THIS PART HAS BEEN CERTIFIED
 OXYGEN CLEANED FOR OXYGEN SERVICE.
 DO NOT OPEN UNTIL READY FOR USE."

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or

"WARNING - INTERIOR COMPONENTS, PASSAGES AND
CRITICAL SURFACES HAVE BEEN CERTIFIED OXYGEN
CLEANED. DO NOT REMOVE CAPS OR PLUGS
UNTIL INSTALLATION/USE."

or

For classes D and E:

"WARNING - THIS PART HAS BEEN CLEANED TO CLASS _____
CLEANLINESS
REQUIREMENTS OF MIL-I-52211 FOR INDUSTRIAL GAS EQUIPMENT
APPLICATION. DO NOT OPEN UNTIL READY FOR USE"

3.9 Workmanship. Workmanship shall be of a quality compatible with procedures specified to ensure items being cleaned and packaged shall be protected from contamination, damage, corrosion, and deterioration during shipment and prolonged periods of storage and stowage.

4. QUALITY ASSURANCE PROVISIONS

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

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of the manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.2 Classification of inspections. Inspections shall be classified as follows:

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

4.3 Inspection conditions. Unless otherwise specified (see 6.2), all inspections shall be performed in accordance with the test conditions specified in the applicable specification.

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4.3.1 Cleaning, packaging, and inspection. This processing sequence is required to be continuous with the various examinations and tests performed at appropriate points during the process, even though this specification presents the requirements as independent actions, that is, item cleaning, drying, unit protection methods, interior (unit and intermediate) containers, packing (exterior containers), and marking. All requirements are to be accomplished; however, there may be variations among different contractors (and among different items from any single contractor) due to item size, configuration, construction, quantity, facilities, and operating procedures. This specification requires each and every item to be cleaned, examined, and tested for cleanliness in accordance with the required cleanliness classification, and examined and tested for item packaging. In practice, certain requirements could be applied as follows:

- (a) Cleanliness tests which wet the tested item with water or solvent would likely be done in conjunction with cleaning and rinsing, prior to drying. Remaining cleanliness tests would likely be completed after drying and prior to accomplishing the unit protection method.
- (b) Packaging examinations could be performed at the time of completion of the item packaging except for completion of the final closure of the exterior container. However, there is no prohibition against waiting until the lot is entirely packed (except for the final closure of the exterior container) and marked, then drawing a sample of the exterior pack and accomplishing packaging examinations and tests by "regressively" breaking down the exterior pack.

4.3.2 Alternate test procedure approval. In instances wherein a test may necessitate an impossible or impractical manipulation of a mounted preserved item or where the overall size or weight of the item or test equipment availability obviates compliance with a specific test requirement of this specification, the supplier may, through the cognizant Government representative, submit a request, accompanied by detailed justification, for approval of an alternate test procedure.

4.4 First article inspection.

4.4.1 Examination. The first article shall be examined for the defects listed in 4.5.1.1. Presence of one or more defects shall be cause for rejection.

4.4.2 Tests. The first article shall be subjected to the tests applicable to the cleanliness class specified in 4.5.1.2. Results of these tests shall be determined using the criteria as specified in 4.5.1.3. Unless otherwise specified (see 6.2) boxed items shall be subjected to the rough handling test in accordance with MIL-P-116. Tests for unit protection shall be as specified in 4.5.1.4.

4.5 Quality conformance inspection.

4.5.1 Preservation.

4.5.1.1 Examination. Each item preserved as specified herein shall be examined for the following defects. Presence of one or more defects shall be cause for rejection.

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- 101. Materials not as specified.
- 102. Preservation processing not performed in a clean work area or a controlled-atmosphere room.
- 103. Items do not meet or exceed the cleanliness requirements of the specified cleanliness classification.
- 104. Unit protection method not as specified.
- 105. Small items in bags not in an interior container.
- 106. Marking illegible, incorrect, incomplete, or missing.
- 107. Level of packing not as specified.
- 108. Exterior container not in conformance with the level of packing specified.

4.5.1.2 Tests. Each item preserved as specified herein shall be subjected to the applicable tests and test procedures required to verify conformance to the specified cleanliness classification and unit protection. The tests for determining cleanliness classes A, B, D, and E shall be as specified in 4.5.1.2.1 through 4.5.1.2.6. The test for determining cleanliness class C shall be as specified in 4.5.1.2.8. Results of these tests shall be determined using the criteria as specified in 4.5.1.3. Tests for the unit protection shall be as specified in 4.5.1.4.

4.5.1.2.1 Incandescent light inspection. Using a high-intensity light source (minimum 200 watt rating) shining at an oblique angle, carefully examine all surfaces, depressions, inside corners, and crevices of the component or assembly.

4.5.1.2.2 Ultraviolet light inspection. Using an ultraviolet light source with a wavelength of 360 to 370 nanometers, at a distance that will provide maximum light intensity, carefully examine all surfaces, depressions, inside corners, and crevices of the item.

4.5.1.2.3 Wipe test. Using a white, lint-free cloth and a dark, lint-free cloth, wipe portions of the surfaces of the item with the white cloth and the remaining portions of the surfaces of the item with the dark cloth. Examine each cloth.

4.5.1.2.4 Alkalies and acids. Using methyl red pH indicating paper to test for the lower pH limit and red litmus pH indicating paper to test for the upper pH limit or universal pH indicating paper to test for both lower and upper pH limits, wet the cleaned and dried surfaces of the item with a few drops of distilled water and then wet the pH indicating paper with the distilled water from these surfaces. Examine the pH indicating papers. For parts with inaccessible areas, sample the final rinse water.

4.5.1.2.5 Water break. Dip the item in distilled water or, for large items, pour the distilled water onto surfaces using a chemist's flexible wash bottle. Allow the water to drain while observing the flow pattern of the draining water.

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4.5.1.2.6 Solvent rinse. Flush the surface or surfaces of the item with clean solvent and collect the effluent in a clean graduated container. Subject the effluent to an ultraviolet light source as specified in 4.5.1.2.2 and examine the effluent. Filter the effluent through an RA millipore filter and examine the filter and residue. (Note: A 100 mil (approximately 3.5 ounces) sample of flush solvent shall be considered as representing the effluent of 1 square foot of enclosed surface.)

4.5.1.2.7 Test for hydrocarbon extraction with trichlorotrifluoroethane (R-113). Trichlorotrifluoroethane solvent (R-113) conforming to MIL-C-81302, type I, shall be used as the standard cleanliness test agent. The maximum allowable contamination limit for hydrocarbons in new or reclaimed solvent and, the maximum allowable contamination limit of hydrocarbons to certified oxygen cleanliness is specified herein. Alternatively, tribasic sodium phosphate (TSP) solution may be used as the standard cleanliness agent with the R-113 extraction methodology specified herein. Flush surfaces as specified in 4.5.1.2.6 or fill Bourbon tube as specified in 4.5.1.2.8 and collect effluent sample.

4.5.1.2.7.1 R-113 solvent test method. R-113 shall be analyzed to determine if contamination is within allowable limits. Testing for hydrocarbon content by infrared spectroscopy is done since volatile hydrocarbons can be detected. This method is specific for hydrocarbons, sensitive and very rapid once a calibration curve is established. Reagent grade n-hexane shall be used as the hydrocarbon standard material. To prepare calibration standards, densities shall be used to convert milligrams (mg) n-hexane to microliters and grams R-113 to milliliters (mL). Calculated volumes of reagent grade n-hexane shall be measured with a microliter syringe and diluted in volumetric glassware with R-113 which has been certified to meet the residue requirement in accordance with MIL-C-81302, type I. A series of weight per weight standards to establish a calibration curve of parts per million (p/m) n-hexane versus absorbance shall be prepared. On a single beam spectrophotometer, the meter shall be zeroes with a specimen of certified R-113 in a 5 centimeter (cm) pathlength near-infrared silica cell. On a double beam instrument, certified R-113 shall be used in 5 cm cells in the reference and sample beams to zero the chart pen. Replace the R-113 in the sample cell with a calibration standard or sample. The absorbance in the 3.4 micrometer wavelength region shall be determined. For calibration standards, p/m n-hexane versus absorbance shall be plotted. For samples, the calibration curve shall be referred to determine p/m hydrocarbon content corresponding to the absorbance obtained.

4.5.1.2.7.2 Testing with tribasic sodium phosphate (TSP) solution. Components determined to be incompatible with R-113 shall be cleanliness tested with TSP solution as specified herein. Solution is prepared by dissolving 2 pounds of type I, or 4.5 pounds of type II TSP in accordance with O-S-642 per 5 gallons of water. Water shall be heated and agitated to dissolve TSP and the solution maintained at 160°F when used for flushing. When testing with TSP, samples of the solution shall be analyzed for hydrocarbon content to verify item cleanliness. Hydrocarbon content shall be determined by acidifying the solution with sulfuric or hydrochloric acid (to obtain a hydrogen-ion concentration (pH) below 7) and extraction shall be performed in two steps so that the final volume of R-113 extract is equal to the volume of the TSP solution analyzed. The extract shall be analyzed as specified for hydrocarbon content. Alternatively, if an infrared spectrophotometer is not available, the residue test may be used. A

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portion of the used TSP cleaning solution shall be extracted with R-113 in two increments. The extract shall be filtered through medium grade filter paper to remove suspended TSP, evaporated to dryness and the residue weighed. An equivalent volume of unused solution shall be processed in the same manner as the sample. The weight of the residue shall be used to calculate p/m (by weight) concentration in the sample and unused solution. The concentration content of the sample shall not exceed that of the unused solution by more than the specified maximum contamination limit.

4.5.1.2.7.3 Hydrocarbon contamination limit. The maximum contamination limit for hydrocarbons for class A, B, and C cleanliness is 5 p/m by weight which corresponds to 0.0005 mg hydrocarbons as normal hexane per gram solvent or 7.8 mg residue per liter solvent at standard conditions, when analyzed in accordance with this specification. The maximum limit for hydrocarbons for class D cleanliness is 50 p/m by weight.

4.5.1.2.8 Bourdon tube type gauges. Use any method which will ensure complete tube fill, total solvent removal, and allow analysis of effluent. A suggested procedure to accomplish the test is as follows: Place the gauge so that the pressure inlet is facing up; using a hypodermic needle with graduated syringe, completely fill the gauge tube with clean solvent (note: gently tapping the gauge while filling will assist in accomplishing a complete fill); collect the effluent in a clean graduated container; compare the amount of effluent with the quantity used in the fill; subject the effluent to an ultraviolet light source as specified in 4.5.1.2.2 and examine the effluent; filter the effluent through a Whatman No. 44 or equal filter paper and examine the filter surface for particulate quantity and size. Following completion of the test, purge the Bourdon tube with dry nitrogen.

4.5.1.2.9 Solvent removal. Parts cleaned with a halogenated solvent shall be checked for traces of the solvent with a halide detector after drying. No trace of the solvent shall be detected.

4.5.1.3 Acceptance criteria. Results of tests specified in 4.5.1.2.1 through 4.5.1.2.8 shall be determined by the applicable cleanliness classification criteria as follows: nonconformance to the specified criteria shall constitute failure of the test and shall be cause for rejection of the cleaned item.

4.5.1.3.1 Classes A and B.

4.5.1.3.1.1 Incandescent light inspection. Examination shall show no visible evidence of moisture, rust, corrosion, scale, slag, weld spatter, organic materials (oil, grease, crayon, paint, and so forth), or any other foreign matter.

4.5.1.3.1.2 Ultraviolet light inspection. Examination shall show no fluorescence on the item.

4.5.1.3.1.3 Wipe test. Examination shall show no visible deposits on either cloth.

4.5.1.3.1.4 Alkalies and acids test. Examination shall show no red tint on the methyl red paper or blue tint on the red litmus paper. Colors shall show a pH reading within the range of 6.5 to 8.5 using the universal indicating paper.

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4.5.1.3.1.5 Water break test. The flow pattern of draining water shall be an even flow, without film breaking or formation of small droplets.

4.5.1.3.1.6 Solvent rinse test. Examination shall show no fluorescence from the effluent or discoloration of the filter. Residue shall contain no particle larger than 500 micrometers, no more than 25 particles between 175 and 500 micrometers, no fiber in excess of 2000 micrometers in length, and no accumulation of fibers per square foot of surface tested.

4.5.1.3.1.7 R-113 hydrocarbon extraction. The maximum contamination limit for hydrocarbons shall be not greater than 5 p/m.

4.5.1.3.2 Class C.

4.5.1.3.2.1 Test for Bourdon tube type gauges. Examination shall show no fluorescence from the effluent or discoloration of the filter. Residue shall contain no particle larger than 750 micrometers, no more than five particles between 500 and 750 micrometers, no fiber in excess of 2000 micrometers in length, and no accumulation of fibers.

4.5.1.3.2.2 R-113 hydrocarbon extraction. The maximum contamination limit for hydrocarbons shall be not greater than 5 p/m by weight.

4.5.1.3.3 Class D.

4.5.1.3.3.1 Incandescent light inspection. Examination shall show no visible evidence of moisture, rust, corrosion, scale, slag, weld spatter, organic materials (oil, grease, crayon, paint, and so forth), or any other foreign matter.

4.5.1.3.3.2 Ultraviolet light inspection. Examination shall show no fluorescence on the items.

4.5.1.3.3.3 Wipe test. Examination shall show no visible deposits on either cloth.

4.5.1.3.3.4 Solvent rinse test. Examination shall show no fluorescence from the effluent or discoloration of the filter. Residue shall contain no particle larger than 1000 micrometers, no more than 10 particles between 750 and 1000 micrometers, no fiber in excess of 6000 micrometers in length, and no accumulation of fibers per square foot of surface tested.

4.5.1.3.3.5 R-113 hydrocarbon extraction. The maximum contamination limit for hydrocarbons shall be not greater than 50 p/m by weight.

4.5.1.3.4 Class E.

4.5.1.3.4.1 Incandescent light inspection. Examination shall show no visible evidence of moisture, rust, corrosion, scale, slag, weld spatter, organic materials (oil, grease, crayon, paint, and so forth), or any other foreign matter.

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4.5.1.4 Unit protection method tests.4.5.1.4.1 Leakage test, heat-sealed seam test, and cyclic exposure test.

The leakage test, heat-sealed seam test, and, when specified (see 6.2), the cyclic exposure test shall be performed in accordance with MIL-P-116.

5. PACKAGING

This section is not applicable to this specification.

6. NOTES

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

6.1 Intended use. The cleaning classifications and the packaging requirements specified in this specification are intended to ensure proper and safe delivery, storage, stowage, and transportation and protection of item cleanliness against degradation or recontamination of equipment, accessories, and supply support items for direct shipment to the Government activities; for material processed at a military activity; for a reference source in the preparation of section 5 of the commodity specifications; and for the preparation of cleaning and packaging requirements in acquisition documents.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- (a) Title, number and date of this specification.
- (b) Level of protection and cleanliness classification required (see 1.2).
- (c) Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.2).
- (d) When first article is required (see 3.1).
- (e) When fire-retardant lumber and plywood is not required (see 3.4.4).
- (f) Class of fire-retardant fiberboard required (see 3.4.4).
- (g) When interior protective packaging materials are other than as specified (see 3.4.5).
- (h) When a transportation plan is required (see 3.5).
- (i) If a controlled atmosphere room is required (see 3.6.2.1).
- (j) When items shall be pressurized (see 3.6.4.1.1).
- (k) When alternate method A is approved (see 3.6.4.1.1.1).
- (l) When bag material is other than that specified (see 3.6.4.1.1.1).
- (m) Container selection if other than contractor's option (see 3.6.5 and 3.7.2).
- (n) Level of packing required (see 3.7).
- (o) When caseliners are required (see 3.7.2.1.1).
- (p) Special marking required (see 3.8).
- (q) Inspection conditions if other than as specified (see 4.3).
- (r) When rough handling tests are not required (see 4.4.2).
- (s) When cyclic exposure test is required (see 4.5.1.4.1).

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6.3 Consideration of data requirements. The following data requirements should be considered when this specification is applied on a contract. The applicable Data Item Descriptions (DID's) should be reviewed in conjunction with the specific acquisition to ensure that only essential data are requested/provided and that the DID's are tailored to reflect the requirements of the specific acquisition. To ensure correct contractual application of the data requirements, a Contract Data Requirements List (DD Form 1423) must be prepared to obtain the data, except where DoD FAR Supplement 27.475-1 exempts the requirement for a DoD Form 1423.

<u>Reference Paragraph</u>	<u>DID Number</u>	<u>DID Title</u>	<u>Suggested Tailoring</u>
3.5	DI-PACK-80120	Preservation and packing data	----
3.5	DI-PACK-80121	Special packaging instructions (SPI)	When required.
3.5	DI-PACK-80877	Transportation plan	Plan must be tailored to applicable system.

The above DIDs were those cleared as of the date of this specification. The current issue of DoD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DIDs are cited on the DD Form 1423.

6.4 First article. When first article inspection is required, the contracting officer should provide specific guidance to offerors whether the item(s) should be a preproduction sample, a first article sample, a first production item, a sample selected from the first production items, a standard production item from the contractor's current inventory, and the number of items to be tested. The contracting officer should also include specific instructions in the acquisition document(s) regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitation for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

6.4.1 First article changes. Any changes or deviations of the first article sample from the approved first article sample will be subject to approval of the contracting officer. Approval of the first article sample will not relieve the contractor of his obligation to clean and package the equipment, accessories, or support items in accordance with this specification.

6.5 Definitions or explanation of terms.

6.5.1 Levels of protection. The following levels of protection apply equally to preservation and packing:

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- (a) Level A. Level A packaging provides maximum protection. It is needed to protect material under the most severe worldwide shipment, handling, and storage conditions. Preservation and packing should be designed to protect material against direct exposure to extremes of climate, terrain, and operational and transportation environments, without protection other than that provided by the pack. The conditions to be considered include, but are not limited to:
- (1) Multiple handling during transportation and in-transit storage from point of origin to final user.
 - (2) Shock, vibration, and static loading during shipment.
 - (3) Loading on shipdeck, transfer at sea, helicopter delivery, and offshore or over-the-beach discharge to final user.
 - (4) Environmental exposure during shipment or during in-transit operations where port and warehouse facilities are limited or nonexistent.
 - (5) Outdoor storage in all climatic conditions for a minimum of 1 year.
 - (6) Static loads imposed by stacking.

For packing (exterior containers), it has been determined and agreed upon by the joint DoD packaging administrators that fiberboard and paperboard are not an acceptable material for use under level A packing.

- (b) Level B. This packaging provides intermediate protection. It is needed to protect material under anticipated favorable environmental conditions of worldwide shipment, handling, and storage. Preservation and packing will be designed to protect material against physical damage and deterioration during favorable conditions of shipment, handling, and storage. The conditions to be considered include, but are not limited to:
- (1) Multiple handling during transportation and in-transit storage.
 - (2) Shock, vibration, and static loading of shipments worldwide by truck, rail, aircraft, or ocean transport.
 - (3) Favorable warehouse environment for a minimum of 18 months.
 - (4) Environmental exposure during shipment and in-transit transfers, excluding deck loading and offshore cargo discharge.
 - (5) Stacking and supporting superimposed loads during shipment and extended storage.

For packing (exterior containers), weather-resistant grades of fiberboard and paperboard are permitted under level B. Domestic type or grade (non-weather-resistant) fiberboard and paperboard are not acceptable under level B packing. Level B packing as defined covers shipments worldwide by all types of transportation.

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- (c) Level C. This packing provides minimum protection. It is needed to protect material under known favorable conditions. The following criteria determine the requirements for this degree of protection:
- (1) Use or consumption of the item at the first destination.
 - (2) Shock, vibration, and static loading during the limited transportation cycle.
 - (3) Favorable warehouse environment for a maximum of 18 months.
 - (4) Effects of environmental exposure during shipment and in-transit delays.
 - (5) Stacking and supporting superimposed loads during shipment and temporary storage.
- (d) Commercial. Although not specifically defined by any Government regulation or instruction, commercial packaging (preservation and packing) is understood to be those practices by manufacturers and suppliers to protect and identify material and items packaged for retail and wholesale distribution purposes. ASTM D 3951 provides guidance in the application of commercial packaging. It has been determined by joint DoD instructions that commercial (also in some areas addressed as industrial packaging) should only be used or specified when such packaging is known to satisfy the DoD needs. Such use should be determined before a contract for supplies is awarded or within the life cycle of the contract when substantial savings to the Government may result. Commercial (industrial) packaging should not be specified where multiple shipments and handlings are anticipated or desired.

6.5.2 Material, packaging, and supply terms.

6.5.2.1 Assembly. An assembly is any number of parts or subassemblies or any combination thereof joined together to perform a specific function and capable of disassembly (for example, pump-rotating element, fan assembly) (MIL-STD-1561).

6.5.2.2 Cleanliness classification. A designation assigned to an item to specify the cleanliness requirements for that item based on its most critical application.

6.5.2.3 Exterior pack. A container, bundle, or assembly which is sufficient by reason of design and construction to protect material during shipment and storage. This can be the unit pack or a container with any combination of unit or intermediate packs.

6.5.2.4 Fiber. A fiber is defined as a nonmetallic, flexible, threadlike structure with a length equivalent to at least ten times its diameter.

6.5.2.5 Intermediate pack. An intermediate pack is a wrap, box, or bundle which contains two or more unit packs of identical items.

6.5.2.6 Marking. Application of numbers, letters, label, tags, symbols, or colors for handling or identification during shipment and storage.

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6.5.2.7 Meter. A unit of measurement equal to 39.37 inches.

6.5.2.8 Micrometer. A unit of measurement equal to one-millionth of a meter.

6.5.2.9 On board repair parts (OBRP). Assemblies, subassemblies, and parts carried on board a ship for maintenance and repair of shipboard equipment and components.

6.5.2.10 Packaging. The process and procedures used to protect material from deterioration or damage. It includes cleaning, drying, preserving, packing, marking, and unitization.

6.5.2.11 Packing. The assembling of items into a unit, intermediate, or exterior pack with necessary blocking, bracing, cushioning, weatherproofing, reinforcement, and marking.

6.5.2.12 Particle. A particle is defined as any solid matter other than a fiber, the size being determined by its maximum linear dimension or diameter.

6.5.2.13 Preservation. The application of protective measures, including cleaning, drying, preservative materials, barrier materials, cushioning, and containers when necessary.

6.5.2.14 Repair parts. Repair parts are those support items that are coded to be not repairable, that is, consumable items see MIL-STD-1561.

6.5.2.15 Spares. Spares are those support items that are coded to be repairable, that is, repairable items see MIL-STD-1561.

6.5.2.16 Support items. Support items are those items subordinate to, or associated with, an end item (that is, spares, repair parts, tools, test equipment, support equipment, and sundry materials) and required to operate, service, repair, or overhaul an end item (see MIL-STD-1561).

6.5.2.17 Unit pack. A unit pack is the first tie, wrap, or container applied to a single item or quantity thereof, or to a group of items of a single stock number, preserved or unpreserved, which constitutes a complete or identifiable package.

6.6 Environment pollution preventive measures. Environmental pollution preventive measures are contained in the material specifications indicated herein. Refer to the material specifications (or preparing activity) for recommended disposability methods. Where alternative cleaning agents are available, ozone depleting halogenated solvents such as 1, 1, 1 trichloroethane, trichlorofluoromethane should not be used.

6.7 R-113 compatibility. Cleaning agents should not be used on rubber or plastic items or painted or coated items with which it is not compatible. Where specific information with respect to compatibility is lacking, testing should be conducted. Compatibility tests consist of immersion of test specimens in the cleaning solvent at $80 \pm 9^{\circ}\text{F}$ for 16 ± 1 hours. Conditions of immersion and testing should be in accordance with ASTM D 471 and ASTM D 1414. Test specimens

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should be completely surrounded by the solvent during immersion. The solvent volume should be not less than 12 times the total volume of the specimen. Tensile strength, elongation, and hardness should be determined in accordance with ASTM D 471. Test requirements, to establish compatibility, should be as follows:

- (a) Volume change - minus 0 percent, plus 10 percent.
- (b) Retention of tensile strength - minimum 85 percent.
- (c) Retention of ultimate elongation - minimum 85 percent.
- (d) Change in durometer hardness - maximum durometer unit - plus or minus 5 points.

6.8 Detailed information. Detailed information is supplemental information on packaging and contamination control which may be found in the following:

DSAM 4145.2, Vol. I, TM38-230-1, NAVSUP PUB 502, AFP 71-15, MCO P4030.31B, Preservation and Packaging (Volume I) (National Stock Number 0530-LP-050-2073).

DSAM 4145.2, Vol. II, TM38-230-2, NAVSUP PUB 503, Vol. II, AFR 71-16, MCO P4030.21C, Packing (Volume II) (National Stock Number 0530-LP-050-3211).

DSAM 4145.7, TM38-236, NAVSUP PUB 504, AFP 15-01-3, AFP 71-8, MCO P4030.30B, Preparation of Freight for Air Shipment (National Stock Number 0530-LP-050-4001).

DSAM 4145.3, TM38-250, NAVSUP PUB 505, AFT 71-4, MCO P4030.19D, Preparation of Hazardous Materials for Military Air Shipment (National Stock Number 0530-LP-050-5007).

Military standardization handbook MIL-HDBK-304, Package Cushioning Design.

FED-STD-209, Clean Room and Work Station Requirements, Controlled Environment.

MIL-HDBK-407, Contamination Control Technology, Precision Cleaning Methods and Procedures.

(Copies of the listed documents may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.)

Compressed Gas Association, Inc. publication CGA G-4.1, Cleaning Equipment for Oxygen Service.

(Application for copies should be addressed to the Compressed Gas Association, Inc., Crystal Gateway 1, Suite 501, 1235 Jefferson Davis Highway, Arlington, VA 22202.)

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6.9 Subject term (key word) listing.

Cleaning
Contamination
Marking
Packing
Preservation

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

Custodians:

Navy - SH
Army - ME

Preparing activity:

Navy - SH
(Project PACK-0965)

Review activities:

Navy - SUP, SPCC
Army - SM
DLA - GS

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:		1. DOCUMENT NUMBER MIL-I-52211B	2. DOCUMENT DATE (YYMMDD) 9 May 1994
3. DOCUMENT TITLE INDUSTRIAL GAS PRODUCTION EQUIPMENT, ACCESSORIES, AND SUPPORT ITEMS: PACKAGING OF			
4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)			
5. REASON FOR RECOMMENDATION			
6. SUBMITTER			
a. NAME (Last, First, Middle Initial)		b. ORGANIZATION	
c. ADDRESS (Include Zip Code)		d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)
8. PREPARING ACTIVITY			
a. NAME RICHARD DEMPSEY, SEA 03M3 is the technical point of contact.		b. TELEPHONE (Include Area Code) (1) Commercial 703 602-0147 (2) AUTOVON 332-0147	
c. ADDRESS (Include Zip Code) COMMANDER SEA 03R42 2531 JEFFERSON DAVIS HWY ARLINGTON, VA 22242-5160		IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	