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| NOT MEASUREMENT SENSITIVE |
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MIL-DTL-197M
22 November 2016
SUPERSEDING
MIL-DTL-197L
11 October 2011

DETAIL SPECIFICATION

PACKAGING OF BEARINGS, ASSOCIATED PARTS AND SUBASSEMBLIES

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 cleaning, drying, preservation, packaging, and packaging marking requirements for all types and sizes of stock and production bearings, associated parts, and subassemblies (see [6.1](#)).

2. APPLICABLE DOCUMENTS

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

2.2 Government documents.

2.2.1 Specifications and standards. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

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| Comments, suggestions, or questions on this document should be addressed to DLA Aviation VEB, 8000 Jefferson Davis Highway, Richmond, VA 23297-5616, or e-mailed to STDZNMGT@dla.mil . Since contact information can change, you may want to verify the currency of this address information using the ASSIST database at https://assist.dla.mil/ . |
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MIL-DTL-197M

FEDERAL SPECIFICATIONS

| | |
|------------|--|
| QQ-A-1876 | - Aluminum Foil |
| PPP-B-566 | - Boxes, Folding, Paperboard |
| PPP-B-585 | - Boxes, Wood, Wirebound |
| PPP-B-676 | - Boxes, Setup |
| PPP-B-1055 | - Barrier Material, Waterproof, Flexible |
| PPP-C-96 | - Cans, Metal, 28 Gage and Lighter |
| PPP-C-795 | - Cushioning Material, Packaging (Flexible Closed Cell Plastic Film, for Long Distribution Cycles) |
| PPP-C-1120 | - Cushioning Material, Uncompressed Bound Fiber for Packaging |
| PPP-D-723 | - Drums, Fiber |

FEDERAL STANDARD

| | |
|-------------|--|
| FED-STD-791 | - Testing Method of Lubricants, Liquid Fuels, and Related Products |
|-------------|--|

COMMERCIAL ITEM DESCRIPTION

| | |
|----------|-----------------------------|
| A-A-3174 | - Plastic Sheet, Polyolefin |
|----------|-----------------------------|

DEPARTMENT OF DEFENSE SPECIFICATIONS

| | |
|---------------|--|
| MIL-DTL-117 | - Bags, Heat-Sealable |
| MIL-PRF-121 | - Barrier Materials, Greaseproof, Waterproof, Flexible, Heat-Sealable |
| MIL-P-130 | - Paper, Wrapping, Laminated and Creped |
| MIL-PRF-131 | - Barrier Materials, Water-vapor-proof, Grease-proof, Flexible, Heat-Sealable, |
| MIL-D-3464 | - Desiccants, Activated, Bagged, Packaging Use and Static Dehumidification |
| MIL-PRF-6085 | - Lubricating Oil: Instrument, Aircraft, Low Volatility |
| MIL-C-11796 | - Corrosion Preventive Compound, Petrolatum Hot Application |
| MIL-DTL-17667 | - Paper, Wrapping, Chemically Neutral (Non-Corrosive) |
| MIL-B-17931 | - Bearings, Ball, Annular, for Quiet Operation |
| MIL-PRF-20092 | - Rubber or Plastic Sheets and Assembled and Molded Shapes, Synthetic, Foam or Sponge, Open Cell |
| MIL-PRF-22191 | - Barrier Materials, Transparent, Flexible, Heat-Sealable |

MIL-DTL-197M

DEPARTMENT OF DEFENSE SPECIFICATIONS - Continued

| | |
|---------------|--|
| MIL-PRF-26514 | - Polyurethane Foam, Rigid or Flexible, for Packaging |
| MIL-PRF-27617 | - Grease, Aircraft and Instrument, Fuel and Oxidizer Resistant |
| MIL-PRF-32033 | - Lubricating Oil, General Purpose, Preservative (Water-Displacing, Low Temperature) |
| MIL-I-52211 | - Industrial Gas Production Equipment, Accessories, and Support Items; Packaging of |
| MIL-DTL-53131 | - Lubricating Oil, Precision Rolling Element Bearing, Polyalphaolefin Based |
| DOD-L-81846 | - Lubricating Oil, Instrument, Ball Bearing, High Flash Point |
| MIL-PRF-83671 | - Foam-in-Place Packaging Materials, General Specification for |

DEPARTMENT OF DEFENSE STANDARDS

| | |
|----------------|---|
| MIL-STD-129 | - Military Marking for Shipment and Storage |
| MIL-STD-130 | - Identification, Marking of U.S. Military Property |
| MIL-STD-1334 | - Process for Barrier Coating of Anti-Friction Bearings |
| MIL-STD-2073-1 | - Standard Practice for Military Packaging |
| MIL-STD-3004 | - Quality Assurance/Surveillance for Fuels, Lubricants and Related Products |
| MIL-STD-3010 | - Test Procedures for Packaging Materials |

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

2.2.2 Other government documents, drawings, and publications. The following other government documents and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation or contract.

CODE OF FEDERAL REGULATIONS

| | |
|--------|---------------------------------|
| 21 CFR | - Food and Drugs |
| 29 CFR | - Labor |
| 40 CFR | - Protection of the Environment |
| 49 CFR | - Transportation |

(Copies of these documents are available online at <http://www.gpoaccess.gov/cfr/>).

MIL-DTL-197M

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

- | | |
|-----------------|--|
| NASA JPR 5322.1 | - Contamination Control Requirements Manual |
| NASA-STD-6001 | - Flammability, Offgassing, and Compatibility Requirements and Test Procedures |

(Copies of these documents are available online from <https://standards.nasa.gov>).

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

AMERICAN SOCIETY FOR QUALITY

- | | |
|----------|---|
| ASQ Z1.4 | - Sampling Procedures and Tables for Inspection by Attributes |
|----------|---|

(Copies of this document are available online from <http://www.asq.org/>).

ASTM INTERNATIONAL

- | | |
|-------------------|---|
| ASTM D1974/D1974M | - Standard Practice for Methods of Closing, Sealing, and Reinforcing Fiberboard Boxes |
| ASTM D4727/D4727M | - Standard Specification for Corrugated and Solid Fiberboard Sheet Stock (Container Grade) and Cut Shapes |
| ASTM D5118/D5118M | - Standard Practice for Fabrication of Fiberboard Shipping Boxes |
| ASTM D5168 | - Standard Practice for Fabrication and Closure of Triple-Wall Corrugated Fiberboard Containers |
| ASTM D5486/D5486M | - Standard Specification for Pressure-Sensitive Tape for Packaging, Box Closure, and Sealing |
| ASTM D6251/D6251M | - Standard Specification for Wood-Cleated Panelboard Shipping Boxes |
| ASTM D6256/D6256M | - Standard Specification for Wood-Cleated Shipping Boxes with Skidded, Load-Bearing Bases |
| ASTM D6576 | - Standard Specification for Flexible Cellular Rubber Chemically Blown |
| ASTM D6880/D6880M | - Standard Specification for Wood Boxes |
| ASTM D7478/D7478M | - Standard Specification for Heavy Duty Sheathed Wood Crates |
| ASTM F25/F25M | - Standard Test Method for Sizing and Counting Airborne Particulate Contamination in Cleanrooms and Other Dust-Controlled Areas |

MIL-DTL-197M

ASTM INTERNATIONAL - Continued

- | | |
|-----------|---|
| ASTM F50 | - Standard Practice for Continuous Sizing and Counting of Airborne Particles in Dust-Controlled Areas and Clean Rooms Using Instruments Capable of Detecting Single Sub-Micrometre and Larger Particles |
| ASTM F311 | - Standard Practice for Processing Aerospace Liquid Samples for Particulate Contamination Analysis Using Membrane Filters |
| ASTM F312 | - Standard Test Methods for Microscopical Sizing and Counting Particles from Aerospace Fluids on Membrane Filters |

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

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

- | | |
|------------|---|
| ISO14644-1 | - Cleanrooms and associated controlled environments Part 1: Classification of air cleanliness |
| ISO14644-2 | - Cleanrooms and associated controlled environments Part 2: Specifications for testing and monitoring to prove continued compliance with ISO 14644-1 |

(Copies of these documents are available online at <http://www.iso.org/>).

SAE INTERNATIONAL

- | | |
|-------------|--|
| SAE AS6039 | - Bearings, Ball, Rod End, Double Row, Self-Aligning |
| SAE AS7949 | - Bearings, Ball, Airframe, Antifriction, General Standard for |
| SAE AS8976 | - Bearings, Plain, Self-Aligning, All Metal |
| SAE AS39901 | - Bearings, Roller, Needle, Airframe, Antifriction, Inch |
| SAE AS81820 | - Bearings, Plain, Self-Aligning, Self-Lubricating, Low Speed Oscillation |
| SAE AS81934 | - Bearings, Sleeve, Plain and Flanged, Self-Lubricating |
| SAE AS81935 | - Bearings, Plain, Rod End, Self-Aligning, Self-Lubricating, General Specification For |

MIL-DTL-197M

SAE INTERNATIONAL - Continued

| | |
|-----------------|--|
| SAE AS81936 | - Bearings, Plain, Self-Aligning (Cu-Be Ball, CRES Race) General Specification For |
| SAE AMS-G-81937 | - Grease, Instrument, Ultra-Clean, Metric |

(Copies of these documents are available online at <http://www.sae.org>).

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

3. REQUIREMENTS

3.1 General. This procedural document provides the detailed preservation and packaging requirements for bearings, associated parts, and subassemblies. Many of the methods of preservation described herein have been derived from MIL-STD-2073-1. However, the methods specified in this document have been tailored to meet the necessary requirements for the proper protection of bearings. Consequently, the methods specified herein are not identical to those detailed in MIL-STD-2073-1. The general requirements of 3.1.1 through 3.1.4.3 shall apply in performing all methods of preservation in accordance with this document.

3.1.1 Hazardous material. Packaging of hazardous material shall comply with the applicable requirements contained in Code of Federal Regulations (CFR) Titles 29, 40, and 49. Hazardous material shipment documentation shall be provided with the shipment as required.

3.1.1.1 Ozone depleting substances (ODSs). ODSs shall not be used in the performance of the methods or procedures described in this specification.

3.1.2 Loose fill materials. Loose fill materials are prohibited in all military packages.

3.1.3 Facilities. Bearings shall be preserved and packaged in facilities that meet the requirements of this document.

3.1.4 Transfer to a subcontract packaging facility. The following procedure, as specified in 3.1.4.1 through 3.1.4.3, shall be used when transferring the bearings from the manufacturing facility to a subcontract packaging facility:

3.1.4.1 Required information. The packaging facility shall be provided all the necessary information that includes and clearly defines the type bearings and degree of preservation/ packaging required in accordance with this specification. This is to include complete identification of embedded lubricants as may have been applied by the manufacturer during production to meet government contract requirements. When bearings are provided to the packager with required lubrication or an acceptable contact preservative compound applied, and also protected in manufacturer's intimate packs meeting requirements of this specification, this

MIL-DTL-197M

protection shall be maintained and this information shall be fully communicated to the packager. Subsequent required final packaging shall be accomplished as specified herein.

3.1.4.2 Prior to cleaning. Bearings shall be protected against damage and shipped to the packager with a minimum of transport and storage time. The packager shall perform military preservation operations and packaging as specified herein.

3.1.4.3 Prior to packaging. Lubricated bearings (see 3.3.4) and preserved bearings (see 3.3.4.7) scheduled for transfer to a packaging facility shall be placed individually or in bulk in a clean dust-excluding container. Containers and lining shall protect the bearings against damage, corrosion and deterioration when shipped in the protective container. Storage and transport time shall be held to a minimum and intimate wrapping shall be applied in the required packaging environment.

3.2 Packing (intermediate and exterior containers).

3.2.1 Packing level. Unless otherwise specified (see 6.2), all bearings shall employ level A or B packing as defined in section 3 of MIL-STD-2073-1.

3.2.2 Level A packing. Packaged bearings shall be packed in containers conforming to the following:

| <u>Specification</u> | <u>Class/type</u> |
|----------------------|--|
| PPP-B-585 | Class 3, military overseas |
| ASTM D6251/D6251M | Class 2, overseas boxes |
| ASTM D6880/D6880M | Class 2, heavy duty |
| ASTM D5118/D5118M | Class weather resistant, corrugated and solid fiberboard |
| ASTM D5168 | Class weather resistant, not applicable |

Exterior shipping containers shall be multi-application type containers designed to protect bearings and bearing components within a given fragility and size range. Intermediate containers shall provide weather resistant case liners, closed and sealed in accordance with military practices. Alternately, wrapping of unit or intermediate packages with PPP-B-1055 barrier material with all seams sealed with a minimum 2-inch wide tape conforming to ASTM D5486/D5486M is acceptable in lieu of case liners. Boxes shall be closed, strapped, or banded in accordance with the applicable box specification, except that ASTM D5118/D5118M boxes shall be closed, sealed, and reinforced using any method in ASTM D1974/1974M. Unless otherwise specified (see 6.2), the gross weight of wood or wood-cleated boxes shall not exceed 1000 pounds; fiberboard boxes shall not exceed the weight limitation of the applicable box specification.

3.2.2.1 Exterior shipping container. Unless otherwise specified (see 6.2), containers conforming to ASTM D5118/D5118M, ASTM D5168, and PPP-B-566, shall be prohibited as exterior shipping containers under level A.

MIL-DTL-197M

3.2.2.1.1 Exception. Exceptions shall be as follows:

a. For bearing unit protection method 44B (where shipments do not exceed 20 pounds gross weight), the shipping container shall be in accordance with ASTM D5118/D5118M, class weather resistant. Fiberboard separators or other devices of material in accordance with ASTM D4727/D4727M shall be provided to separate unit packages both horizontally and vertically.

b. For bearing unit protection method 20B, shipping containers not exceeding 1000 pounds gross weight shall be in accordance with ASTM D6251/D6251M or ASTM D6880/D6880M. Containers shall have skids applied in accordance with the applicable container specification. Shipping containers exceeding 1000 pounds gross weight shall be in accordance with ASTM D6256/D6256M or ASTM D7478/D7478M. Dunnage shall be used to prevent movement of the bearing relative to the crate. Nylon sling straps shall be used in lifting bearings from the crate.

3.2.3 Level B packing. Bearings shall be packed in containers conforming to the following:

| <u>Specification</u> | <u>Class/type</u> |
|----------------------|---|
| PPP-B-585 | Class 2, normal overseas or Class 3, military overseas |
| ASTM D6251/D6251M | Class 1, domestic boxes Class 2, overseas boxes |
| ASTM D6880/D6880M | Class 2, heavy duty |
| ASTM D5118/D5118M | Class weather resistant, corrugated and solid fiberboard |
| ASTM D5168 | Class weather resistant, not applicable |

Box closures, sealing, and reinforcement shall be as specified in the applicable box specification or as specified in ASTM D1974/D1974M.

3.3 Preservation.

3.3.1 Selection of methods of preservation. The methods of preservation listed in [table I](#) and as described in [3.3.2](#) through [3.9.3](#) shall apply depending upon bearing type, size, and any specific contract requirements included in the procurement item description. The details of these methods are described in this specification (see [3.10.3](#) through [3.10.14](#)). These requirements shall be considered the minimum acceptable.

MIL-DTL-197M

TABLE I. Methods of unit preservation by size or type.

| Size or type | Open/closed bearings ¹ MIL-DTL-197 method |
|---|---|
| Up to and including 1.1811 inches or 30 millimeters (mm) (metric) outside diameter (OD) ² | 41B 44B 46B 52B 55B |
| Over 1.1811 inches or 30 mm (metric) but not exceeding 16 inches OD ^{2, 3} | 20B 40B 41B ⁴ |
| Greater than 16 inches OD or 406 mm (metric) or greater than 10 pounds (lbs.) | 49B 32B |
| Plain bearings, self-aligning bearings, rod end bearings, sleeve bearings, and airframe bearings | 33B |
| Optional methods (see 3.3.1) | 45B 54B |

¹ Cleaning and drying shall apply only to open, non-lubricated bearings.

² Method 40B is required for bearings to MIL-B-17931.

³ Method 20B may be used for bearings with OD over 4.86 inches or over 123 mm.

⁴ No weight limit when used with supporting container (MIL-DTL-117, type I, heavy duty).

NOTE: In the event that a bearing falls into two categories in Table I, the higher packaging method shall be used". i.e. "Bearing, Ball, Rod End shall be packaged method 41B (ball bearing) rather than 33B (rod end bearing)

3.3.2 General preservation process. Unless otherwise specified (see 6.2), all bearings shall be subject to a general preservation procedure. The details of that procedure are determined by bearing type, closure, and contract or purchase order requirements. The general procedure consists of the following steps: demagnetization, cleaning, drying, preservation or lubrication, intimate bagging or wrapping, and unit packaging. These steps are not listed in sequence and additional steps may be required.

3.3.3 Demagnetization, cleaning and drying. Prior to cleaning, the magnetization of instrument precision ball bearings shall not exceed a pole strength of two gauss and the magnetization of all other bearings shall not exceed a pole strength of five gauss. Bearings in excess of the applicable value shall be demagnetized and retested. Bearings shall be cleaned and dried according to type and closure and contract or purchase order requirements. Pre-lubricated bearings shall not be subjected to the cleaning process. Processed bearings shall be free of any chemical or particulate residue that will have detrimental effect on the life of the bearing.

3.3.4 Lubricants and preservative compounds. Lubrication of bearings and actual lubricants used shall conform to government prime contract item description requirements. Any resultant flow-down of item description requirements to a packaging facility shall include the same item description information (see 3.1.4.1). When lubrication is not applicable, then a contact preservative compound shall be applied in accordance with contract or purchase order

MIL-DTL-197M

requirements. When the bearing item description does not specify a contact preservative compound, then the preservative material shall be as specified in [table II](#).

Self-lubricating bearings, as described within this document, shall not have lubricants or preservative compounds applied.

TABLE II. Lubricants and preservative compounds.

| Closed race bearings | | |
|---|--|---|
| Bearing type | Preservative or preservative lubricant ¹ | Precautionary marking |
| General purpose and precision | Preservative same as operational lubricant | 3.12.4(a) |
| Instrument and instrument precision | | |
| Large (Over 16 inches OD or over 10 pounds) | | |
| Airframe bearings | | |
| Rod end bearings | | |
| Needle roller bearings ² | | |
| Cam followers | | |
| Oxygen equipment (free of hydrocarbons) | MIL-PRF-27617 | 3.12.4(d) |
| Open race bearings | | |
| General purpose precision and elements | MIL-C-11796, class 3 ³ ; MIL-PRF-6085; MIL-PRF-32033 ³ | 3.12.4(b) 3.12.4(c) ⁵ |
| Instrument and instrument precision | MIL-PRF-6085, DOD-L-81846, MIL-DTL-53131, MIL-PRF-32033 ⁴ | |
| Large (Over 16 inches OD or over 10 pounds) | MIL-PRF-6085, MIL-PRF-32033 | |
| Needle roller bearings ² | MIL-PRF-6085, MIL-PRF-32033 ⁴ | |
| Oxygen equipment (free of hydrocarbons) | Fluorocarbon grease | 3.12.4(d) |
| Self-aligning bearings | | |
| Plain bearings | Preservative same as operational lubricant | 3.12.4(a) |
| Self-lubricating bearings ⁶ | | |
| Plain bearings | Dry | 3.12.4(e) 3.12.4(a) ⁷ |
| Sleeve bearings | | |
| Rod end bearings | | |
| Cam followers | | |

MIL-DTL-197M

¹ Stored bearings that have been preserved in lubricants or preservatives that have exceeded their rated shelf life shall be tested for lubricant re-certification in accordance with MIL-STD-3004. Bearings with lubricants or preservatives that cannot be re-certified shall be cleaned and re-lubricated, or re-preserved, as required.

² Drawn cup needle roller bearings may use method 33B (see [table I](#)).

³ Bearings shall cool to ambient temperature before packaging.

⁴ MIL-PRF-32033 is recommended in accomplishing method 20B and method 41B preservation for open bearings. Bearings shall cool to ambient temperature before packaging.

⁵ If barrier film coated in accordance with MIL-STD-1334.

⁶ Excludes sintered bearings (powdered metallurgy).

⁷ For rod end bearings that have preserved/lubricated bearing inserts.

3.3.4.1 Contamination levels for oils. When measured in accordance with method 3009.3 (microscopic) of FED-STD-791 or equivalent government-approved method, the number of solid contaminant particles in the lubricating oil shall not exceed the following limits:

a. Oil for general purpose, precision and large bearings:

| <u>Particle size range (micrometers (μm))</u> | <u>Count per 100 milliliters (ml)</u> |
|---|---------------------------------------|
| 5 to 15 | 1785 |
| > 15 to 25 | 265 |
| > 25 to 50 | 78 |
| > 50 to 100 | 11 |
| > 100 | 0 |

b. Oil for instrument and instrument precision bearings:

| <u>Particle size range (μm)</u> | <u>Count per 100 ml</u> |
|---------------------------------|-------------------------|
| 5 to 15 | 150 |
| > 15 to 25 | 45 |
| > 25 to 50 | 23 |
| > 50 to 100 | 10 |
| > 100 | 0 |

3.3.4.2 Contamination levels for grease. Grease for general purpose, precision, and large bearings shall be tested in accordance with FED-STD-791, method 3005.4; no more than 1000 particles per cubic centimeter (cm³) of 25 μm or larger in size and no particles larger than 75 μm shall be allowed. For instrument and instrument precision bearing greases, the contamination requirements of SAE AMS-G-81937 shall apply.

a. Grease for general purpose, precision, and large bearings:

| <u>Particle size range (μm)</u> | <u>Count per cm³</u> |
|---------------------------------|---------------------------------|
| 25 to 75 | 1000 maximum |
| > 75 | 0 |

MIL-DTL-197M

b. Grease for instrument and instrument precision bearings:

| <u>Particle size range (µm)</u> | <u>Count per cm³</u> |
|---------------------------------|---------------------------------|
| 10 to 35 | 1000 maximum |
| > 35 | 0 |

c. The greases shall not contain dirt, crystals, lumps, or particles of gelling agent exceeding the limits. The particle size shall be measured along with the largest dimension of the particle.

3.3.4.3 Receiving inspection test. No receiving inspection tests are necessary on packaged lubricants provided the containers are intact and markings adequately identify the lubricant(s).

3.3.4.4 Shelf life. Bearing shelf life may be determined by the bearing lubricant or preservative used during the bearing's packaging and by the type of packaging employed (see [table II](#)). A detailed description of bearing shelf life requirements is beyond the scope of this specification, however; the following may be used to guide determination of shelf life requirements and actions for the described bearing types. Procuring activities should consult manufacturer documentation for determination of bearing shelf life (see [6.2](#)).

3.3.4.4.1 Closed race bearings. Closed race bearing shelf life may be determined by the manufacturer's installation life (see [6.5.9](#)) to arrive at an overall shelf life value. Typical installation life will vary with the type of preservative or lubricant used and the type of packaging. Procuring activities will consult with manufacturers to determine useable shelf life (see [6.2](#) and [3.12.4\(a\)](#)).

3.3.4.4.2 Open race bearings. Open race bearings are cleaned and lubricated with their operational lubricant prior to placement into service. Open race bearing shelf life may be extended by re-certification if suspected of having exceeded rated shelf life (see [3.12.4\(b\)](#), [6.4.1.1](#), and appropriate end-user maintenance documentation - example: NAVAIR 01-1A-503/U.S. Army TM55-1500-322-24/ USAF T.O. 44B-1-122, "Maintenance of Aeronautical Antifriction Bearings for Organizational, Intermediate and Depot Maintenance Levels").

3.3.4.4.3 Self-aligning bearings. Self-aligning bearing shelf life shall be determined using the same method as described in [3.3.4.4.1](#).

3.3.4.4.4 Self-lubricating bearings. Self-lubricating bearings require no additional lubricant that might affect shelf life (see [3.12.4\(e\)](#)). Procuring activities should consult the manufacturer for determination of shelf life for self-lubricating bearings (see [6.2](#)). Note that sintered (powdered metallurgy) bearings are considered self-lubricating, but they are impregnated with their operational lubricant and should be treated as self-aligning bearings.

MIL-DTL-197M

3.3.4.5 Visual check. A visual check of all lubricants shall be made every 12 months on all containers that have been opened. The visual inspection shall be conducted prior to use. The containers that have been opened shall be checked for: proper color, all forms of visual contamination, evidence of water, and evidence of separation. Any lubricants that show evidence of deterioration because of age or contamination shall not be used (see 6.3.2). Containers that have not previously been opened shall be checked for damage or leaks and shall not be opened unless there is evidence of damage.

3.3.4.6 Lubricant testing. The lubricant shall pass the type B-2 tests for lubricating oils and for greases, semi-fluids, lubricants, and other grease-like materials of MIL-STD-3004. Additional testing of the principal characteristics likely to affect deterioration is optional.

3.3.4.7 Preservative application. Unless otherwise specified (see 3.1.4.1 and 6.2), bearings and bearing parts shall be coated with the lubricant or preservative compound specified in 3.3.4. Bearings shall be completely preserved so as to obtain a continuous coating on all surfaces. During or after preservation with the compound, all internal surfaces shall receive complete coverage. When an operational lubricant (grease or oil) is required, the quantity applied shall conform to the item description or technical data applicable to the assigned national stock number (NSN) (or other identification number when an NSN has not been assigned) (see 6.2). When no quantity is specified, the lubricant shall be in accordance with the manufacturer's standard practice. Non-stainless steel, closed bearings, shall have a thin coating of compatible lubricant on outer surfaces and shall be internally greased. Plain self-lubricating bearings shall be packaged free of oil and grease.

3.3.4.7.1 Self-lubricating bearings. Self-lubricating bearings shall be preserved dry. Cleaning solvents, grease, or oil shall not be used.

3.4 Oxygen equipment bearings.

3.4.1 Separate clean work area for oxygen equipment bearings. A minute deposit of hydrocarbon oil film on an oxygen equipment bearing presents an explosion hazard when installed in the system; for this reason, a separate clean work area shall be designated for the processing of oxygen equipment bearings. This area shall be isolated from all manufacturing processes and shall contain only the equipment necessary to process the oxygen equipment bearings. Workbenches, tools, and processing equipment shall be maintained free of grease, oil, or other combustible materials and shall be used only on or for oxygen equipment. Personnel present in this area shall maintain themselves and their clothing in a condition that will prevent transferring contaminants to bearing surfaces.

3.4.2 Cleaning, drying, and unit preservation of oxygen equipment bearings. The method of cleaning and drying as well as the cleanliness classification that determines the type of inspection shall be as specified in MIL-I-52211. Cleaning and drying of oxygen equipment bearings shall be as specified in MIL-I-52211 and 3.5. Preservation shall be method 41B and shall include the special marking requirements of MIL-I-52211. The environment and processing cleanliness for oxygen equipment bearings shall be the same as that described in 3.5.1 and 3.5.3.

MIL-DTL-197M

3.4.3 Lubricants and preservative compounds for oxygen equipment bearings. The preservative for oxygen equipment bearings shall be the operating grease. Oils and greases shall be fluorocarbon-based only. Hydrocarbon-based oils or greases are prohibited.

3.4.4 Intimate bags for oxygen equipment bearings. Intimate bag material shall be fluorocarbon or chlorofluorocarbon film (at least 2 mils nominal thickness) that meets the liquid oxygen impact compatibility requirements of NASA in accordance with tests specified in NASA-STD-6001. Closure shall be by heat sealing. Bags shall allow for re-closure and shall be leak-proof when resealed.

3.4.5 Unit pack bags for oxygen equipment bearings. Unit pack bags shall be as specified in [3.10.7.3](#).

3.5 Instrument and instrument precision ball bearings.

3.5.1 Environment and process cleanliness of cleaning and drying areas. Cleaning and drying areas are defined as those areas in which bearings are subjected to the cleaning and drying processes. Requirements for class 7 of ISO 14644-1 and ISO 14644-2 for particle count shall be met (see [4.5](#)). The temperature shall be maintained at 73 ± 5 °F (24 ± 3 °C) with a maximum relative humidity (R.H.) of 45 percent.

3.5.2 Cleaning and drying of open non-lubricated instrument and instrument precision ball bearings. The bearings shall be cleaned and dried by any process or processes that are not injurious to the item (see [3.3.3](#)). The use of chlorinated or fluorinated solvents, acetone, aqueous washes, and other suitable non-ozone-depleting solvents is permitted. Solutions used to clean barrier-film-coated bearings shall be stored separate from solutions used to clean non-barrier-film-coated bearings. A barrier-film-coated bearing shall not be processed through the regular bearing cleaning area. Procedures for packaging barrier coated bearings are specified in MIL-STD-1334 and these procedures shall be followed. Bearings shall be thoroughly dried prior to lubrication and intimate wrapping.

3.5.3 Preservation and unit packaging area environment and process. The working area shall be well illuminated and air-conditioned. Requirements for class 7 of ISO 14644-1 and ISO 14644-2 shall be met for cleaning and drying operations (see [3.5.1](#) and [4.5](#)). Once bearings are dry, they shall be preserved, lubricated, and intimate-packaged in a continuous process within a class 5 environment in accordance with ISO 14644-1 and ISO 14644-2. Any transfer out of the class 5 environment after the preservation process has begun shall require that the bearings be placed in clean, dust-excluding containers. The unit packaging area, or secondary bagging, shall be well illuminated, clean, dry, and in an air-conditioned environment. The presence of dust and dirt-producing sources shall be kept to a minimum. When bearings have been intimate wrapped in nylon 6 material, they shall remain in the controlled environment described in [3.5.1](#) until the bearings are enclosed within the unit pack bag.

3.5.4 Method 40B preservation area environment, cleaning and drying areas, and process controls. Working area environment and process control for method 40B bearings shall conform to [3.5.1](#), [3.5.2](#), and [3.5.3](#).

MIL-DTL-197M

3.6 General purpose and precision bearings.

3.6.1 Environment and process cleanliness of cleaning and drying areas. The presence of dust and dirt-producing sources, such as cartons or trash barrels, shall be kept to a minimum. Smoking, eating, and drinking shall not be permitted in the cleaning and drying areas. Cleaning and drying areas are defined as those areas within a 10-foot radius of the cleaning and drying equipment, including aisles.

3.6.2 Preservation and unit packaging area environment and process control. The working area shall be well illuminated. Requirements for class 8 of ISO 14644-1 and ISO 14644-2 shall be met for the preserving, intimate bagging, or intimate wrapping processes (see 4.5). The temperature shall be maintained at 73 ± 5 °F (24 ± 3 °C) with a maximum R.H. of 45 percent. Area control shall be in accordance with 3.6.1. Bearings shall be preserved and transferred to the unit packaging area in a continuous process. Delays shall be minimized. Bearings waiting to be preserved or lubricated shall be kept in covered containers, suitable rust preservatives, or humidity chambers to avoid corrosion. Bearings shall be reprocessed if they become contaminated. Preserved bearings shall immediately be transferred (after insertion of seals or shields) to the unit packaging area in clean, dust-excluding, compatible containers. The unit packaging area, or secondary bagging, shall be well illuminated, clean, dry, and in an air-conditioned environment. The presence of dust and dirt-producing sources shall be kept to a minimum.

3.6.3 Cleaning. Open, non-lubricated bearings shall be cleaned by any process or combination of processes that will accomplish thorough cleaning without damage to the item. Agitation tanks and commercial filtration systems shall be used. Spray washes and ultrasonic cleaning are permitted. Prior to lubrication and wrapping, bearings shall be thoroughly cleaned and shall be free of any chemical or particulate residue that will have a detrimental effect on the life of the bearing. The cleaning system shall be capable of cleaning bearings to the requirements of 4.5.4. Written procedures shall be established for planned maintenance and checks of the cleaning and drying systems. At a minimum, the procedures shall include machinery cleanliness, filter maintenance, cleaning fluid quality and cleanliness, and the frequency of such maintenance actions and checks.

3.6.4 Method 40B preservation area environment, cleaning and drying areas, and process controls. Working area environment and process controls for method 40B bearings shall conform to 3.6.1, 3.6.2, and 3.6.3.

3.7 Bearings, plain, rod end, self-aligning, self-lubricating, SAE AS81935; bearings, sleeve, plain and flanged, self-lubricating, SAE AS81934; bearings, plain, self-aligning, self-lubricating, low speed oscillation, SAE AS81820; and similar airframe products.

3.7.1 Environment and process cleanliness of cleaning and drying areas. The presence of dust and dirt-producing sources, such as cartons or trash barrels, shall be kept to a minimum. Smoking, eating, and drinking shall not be permitted in the cleaning and drying areas. Cleaning and drying areas are defined as those areas within a 10-foot radius of the cleaning and drying

MIL-DTL-197M

equipment, including aisles. The area for the self-lubricating plain bearings shall be maintained at a temperature of 75 ± 10 °F (24 ± 6 °C) with a maximum R.H. of 75 percent. The enclosed atmosphere shall be well ventilated and maintained so that the particle count is 2500 maximum, with a particle size of 5 µm or less, when measured in accordance with ASTM F25/F25M or ASTM F50.

3.7.2 Preservation and unit packaging area environment and process control. The working area shall be well illuminated. The temperature shall be maintained at 75 ± 10 °F (24 ± 6 °C) with a maximum R.H. of 75 percent. Bearings shall be preserved and transferred to the unit packaging area in a continuous process (see 3.10.1). Delays shall be minimized. Bearings shall be reprocessed if they become contaminated. The unit packaging area shall be well illuminated, clean, and dry. The presence of dust and dirt-producing sources shall be kept to a minimum.

3.7.3 Cleaning. The bearings shall be cleaned by any process or combination of processes that will accomplish thorough cleaning without damage to the item. The self-lubricating bearings shall be cleaned using established cleaning procedures. The use of filtered, dry, compressed air or wiping with soft, clean cloth are examples of suitable processes. Cleaning solvents, greases, or oils shall not be used. Prior to wrapping, bearings shall be thoroughly dry and free of any chemical or particulate residue that could have a detrimental affect on the bearing. Written procedures shall be established for planned maintenance and checks of the cleaning and drying systems and the frequency of such maintenance actions and checks.

3.8 Bearings, plain, self-aligning, all metal, SAE AS8976; bearings, plain, self-aligning, (Cu-Be ball, CRES race), SAE AS81936; and similar airframe products.

3.8.1 Environment and process cleanliness of cleaning and drying areas. The presence of dust and dirt-producing sources, such as cartons or trash barrels, shall be kept to a minimum. Smoking, eating, and drinking shall not be permitted in the cleaning and drying areas. Cleaning and drying areas are defined as those areas within a 10-foot radius of the cleaning and drying equipment, including aisles.

3.8.2 Preservation and unit packaging area environment and process control. The working area shall be well illuminated. The temperature shall be maintained at 75 ± 10 °F (24 ± 6 °C) with a maximum R.H. of 75 percent. Area control shall be in accordance with 3.8.1. Bearings shall be preserved and transferred to the unit packaging area in a continuous process (see 3.10.1). Delays shall be minimized. Bearings waiting to be preserved or greased shall be kept covered as necessary to avoid contamination. Bearings shall be reprocessed if they become contaminated. Preserved bearings shall be transferred to the unit packaging area. The unit packaging area shall be well illuminated, clean, and dry. The presence of dust and dirt-producing sources shall be kept to a minimum.

3.8.3 Cleaning. The bearings shall be cleaned by any process or combination of processes that will accomplish thorough cleaning without damage to the item. Agitation tanks and commercial filtration systems may be used. Spray washes and ultrasonic cleaning are permitted. Prior to wrapping, bearings shall be thoroughly cleaned and shall be free of any

MIL-DTL-197M

chemical or particulate residue that could have a detrimental effect on the life of the bearing. Written procedures shall be established for planned maintenance and checks of the cleaning and drying systems. At a minimum, the procedures shall include machinery cleanliness, filter maintenance, cleaning fluid quality and cleanliness, and the frequency of such maintenance actions and checks.

3.9 Bearings, ball, airframe, antifriction, SAE AS7949; bearings, ball, rod end, double row, self-aligning, SAE AS6039; and bearings, roller, needle, airframe, antifriction, inch, SAE AS39901.

3.9.1 Environment and process cleanliness of cleaning and drying areas. The presence of dust and dirt-producing sources, such as cartons or trash barrels, shall be kept to a minimum. Smoking, eating, and drinking shall not be permitted in the cleaning and drying areas. Cleaning and drying areas are defined as those areas within a 10-foot radius of the cleaning and drying equipment, including aisles.

3.9.2 Preservation and unit packaging area environment and process control. The working area shall be well illuminated. The temperature shall be maintained at $75 \pm 10^{\circ}\text{F}$ ($24 \pm 6^{\circ}\text{C}$) with a maximum R.H. of 75 percent. Area control shall be in accordance with [3.9.1](#). Bearings shall be preserved and transferred to the unit packaging area in a continuous process (see [3.10.1](#)). Delays shall be minimized. Bearings waiting to be preserved or lubricated shall be kept in covered containers as necessary, to avoid contamination. Bearings shall be reprocessed if they become contaminated. Preserved bearings shall be transferred to the unit packaging area. The unit packaging area shall be well illuminated, clean, and dry. The presence of dust and dirt-producing sources shall be kept to a minimum.

3.9.3 Cleaning. The bearings shall be cleaned by any process or combination of processes that will accomplish thorough cleaning without damage to the item. Agitation tanks and commercial filtration systems may be used. Spray washes and ultrasonic cleaning are permitted. Bearings shall be thoroughly cleaned and shall be free of any chemical or particulate residue that will have a detrimental effect on the life of the bearing prior to lubrication and wrapping. Written procedures shall be established for planned maintenance and checks of the cleaning and drying systems. At a minimum, the procedures shall include machinery cleanliness, filter maintenance, cleaning fluid quality and cleanliness, and the frequency of such maintenance actions and checks.

3.10 Methods of preservation (see [6.2](#)).

3.10.1 Military preservation. The military preservation procedure shall be accomplished without interruption. When interruptions are unavoidable, temporary covers or enclosures shall be provided to insure against contamination or deterioration of items.

3.10.1.1 Cleaning and drying. Open non-lubricated bearings shall be cleaned and dried by any process or combination of processes that will accomplish thorough cleaning and drying without damage to the item. Closed bearings shall not be subjected to any process injurious to the bearing's internal lubrication.

MIL-DTL-197M

3.10.1.2 Preservative applicability. When contact preservatives are required to protect the bearing, the preservatives shall be as specified in 3.3.4. The required preservative shall be uniformly applied by any applicable procedure that permits the preservative to coat all the necessary surfaces (see 3.3.4.7).

3.10.1.3 Self-lubricating bearings. Bearings shall be cleaned using the manufacturer's established cleaning procedure. The use of cleaning solvents, grease, or oil is prohibited.

3.10.2 Selection of unit preservation. Unit preservation methods shall be in accordance with 3.10.3 through 3.10.14. Method 40B unit preservation is required for MIL-B-17931 bearings. Unit preservation for instrument precision ball bearings shall be by method 41B. The appropriate military methods as specified in table I shall be used for the type and size of bearings being preserved. Bearings shall be packaged individually, in pairs, or as sets. Bearing and bearing components that are bulk-preserved shall be as specified in 3.10.14 and the quantity for each bulk pack shall be as specified in the contract or purchase order (see 6.2). Unit preservation for balls and rollers shall be by method 41B or method 46B.

3.10.3 Method 20B - aluminum foil wrap. After cleaning and drying, the bearings shall be coated as specified in 3.3.4.7 with the materials listed in 3.3.4. Bearings shall be securely wrapped in aluminum foil. The aluminum foil shall be in accordance with QQ-A-1876 and be 0.0015 inches thick for bearings weighing up to and including 5 pounds, and 0.0020 inches thick for bearings weighing more than 5 pounds. Bearings having a bore diameter of 3.5 inches or greater, or weighing over 20 pounds, shall be doughnut-wrapped. Separable bearing assemblies or cup (inner) and cone (outer) combinations that measure over 2.5 inches OD shall have aluminum foil in accordance with QQ-A-1876 placed between each part to prevent brinelling (see 6.5.5). Bearings thus treated shall be cooled to room temperature and hot-dipped with a coating of strippable cellulose acetate butyrate (CAB) compound (Thermo Cote 149, Evans Stripcoat Type II, Eastman™ CAB-500-5, or government-approved equivalent) to a minimum thickness of 0.05 inch, and over-wrapped in a grease-proof barrier material conforming to MIL-PRF-121, type optional. Users should evaluate strippable CAB preservative compounds to determine suitability to their needs prior to use.

3.10.4 Method 32B - container, waterproof bag, sealed. The bearings or bearing components shall be preserved as required in 3.3.4 and 3.3.4.7, and enclosed in a close-fitting container (box), which in turn shall be enclosed in a sealed waterproof bag conforming to MIL-DTL-117, type III, class B, style 1. The net weight limitation shall be 10 lbs. without a supporting container. When A-A-3174 material is used, the net weight is restricted to five lbs. without a supporting container. Any MIL-DTL-117 type, class, and style bag that meets or exceeds the bag specified may be used. A protective wrap of heavy-duty kraft paper or equivalent material (tape sealed) may be provided to protect the barrier material during handling and storage.

3.10.5 Method 33B - greaseproof-waterproof bag, sealed. The bearings or bearing components shall be preserved as required in 3.3.4 and 3.3.4.7, and processed as specified in 3.1. The bearings shall be enclosed in a close-fitting sealed bag conforming to MIL-DTL-117, type II,

MIL-DTL-197M

class C, style 1, 2, or 3. A-A-3174 material may also be used. The net weight limitation shall be 10 lbs. without a supporting container. Any MIL-DTL-117 type, class, and style bag that meets or exceeds the requirements may be used. Projections, sharp edges or other physical characteristics of the item that may damage the greaseproof-waterproof barrier or container shall be cushioned as necessary to mitigate shock and thereby prevent physical and functional damage to the items. If a carton or box is selected as the unit container, the primary cushioning shall be placed between the outside of the bag and the inside of the carton or box (see 3.11).

3.10.6 Method 40B - vacuum-formed plastic skin package. After required cleaning and drying (see 3.3.3), the open, non-lubricated bearings shall be thoroughly coated as specified in 3.3.4.7 and enclosed in a vacuum-formed package. The plastic sheet shall be checked for cleanliness prior to draping over the bearing. If the plastic sheet requires cleaning, it shall be cleaned using best practices to insure that no contaminants or other foreign matter are entrapped with the bearing prior to draping the sheet over the bearing. The packaged bearing shall show no evidence of corrosion (see 4.4.2 and 4.4.3). Material used in forming the package shall be cellulose acetate, CAB, or cellulose propionate (use of polyvinyl chloride (PVC) is prohibited). Material shall be sufficiently transparent to permit ease of reading and identification of bearing marking and visual examination of the exterior bearing surfaces. In packaging bearings up to 6 inches outside diameter, the plastic sheet shall have a minimum thickness of 15 mils prior to forming; the minimum thickness after forming shall be 8 mils single thickness at the outside diameter and 4 mils in the bearing bore. In packaging bearings with outside diameter over 6 inches, the sheet shall have a minimum thickness of 30 mils prior to forming. Doughnut packages shall be limited to bearings with bore diameter one inch or larger. Dimpling at bore shall be acceptable for all bearings and may be used as an alternate to the doughnut type pack, except that dimpling holes shall not be permitted between the inner and outer rings of any bearing.

3.10.6.1 Vacuum forming. A transparent plastic sheet shall be vacuum formed over the bearing. Single seal and single shield bearings shall be oriented with the bearing seal or shield up under the first drape. Bearings with snap rings on the outside diameter shall be oriented so that the snap ring is on the side opposite to the final seal.

3.10.6.2 Sealing. Plastic shall be sealed at the base edge with a cellulose acetate base in acetone. Flange type seals are not permitted. The seal shall be positive and shall not impair the transparency of the package. Small air bubbles formed in the closing shall not be cause for rejection.

3.10.7 Method 41B - water-vaporproof bag, sealed. After required cleaning and drying (see 3.3.3 and 3.5), the bearings or bearing components shall be coated as specified in 3.3.4.7. Bearings shall then be wrapped or bagged with the material specified in 3.10.7.1 or 3.10.7.2 as appropriate, and closure completed by means of heat-sealing. The bearings shall then be placed individually into a water-vaporproof bag in accordance with MIL-DTL-117, type I or II, class E, style 1, 2, or 3. Entrapped air shall be exhausted from the bag by any suitable means, but not to the point where undue stress is placed upon the barrier. The bag shall then be heat-sealed. The strength of the heat seals shall be as specified in 4.4.1, based upon samples made on production packaging equipment. A carton or box shall be used to complete the unit container (see 3.11).

MIL-DTL-197M

3.10.7.1 Intimate bags for instrument and instrument precision ball bearings for method 41B. All intimate bags for instrument and instrument precision ball bearings shall be nylon 6 at least two mils nominal thickness, certified as meeting Food and Drug Administration requirements for direct contact with food, in accordance with 21 CFR 177.1500, transparent, and cleaned to NASA JPR 5322.1, level 100. Alternate bags in accordance with MIL-DTL-117, type I or II, class E, any style, cleaned to NASA JPR 5322.1, level 100, may be used. Intimate bags shall be heat sealed so as to prevent free movement of the bearing inside the bag. Sealing shall take place in an environment meeting the requirements of ISO 14644-1 and ISO 14644-2, class 5. Bags shall allow for re-closure and shall be leak-proof when resealed. Nylon 6 bags are moisture sensitive and all unused bags shall be stored in the clean room with temperature and humidity controls (see 3.5.1). Once bearings are sealed within nylon 6 bags, they shall remain in the temperature and humidity-controlled class 7 area until closure is made within the unit pack bag (see 3.10.7.3).

3.10.7.2 Intimate bags for general purpose and precision bearings for method 41B. The intimate bag material shall be two mils nominal thickness nylon 6 or at least four mils nominal thickness polyethylene in accordance with A-A-3174, type I or II. When A-A-3174 material is used, the net weight is restricted to five lbs. Transparent materials are desirable, but not mandatory. Intimate bags for general purpose and precision bearings shall be cleaned to the requirements of NASA JPR 5322.1, level 100. Alternate bags in accordance with MIL-DTL-117, type I or II, class E, any style, cleaned to NASA JPR 5322.1, level 100, may be used. Bags shall allow for re-closure and shall be leak-proof when resealed. Nylon 6 bags are moisture sensitive and all unused bags shall be stored in the clean room with temperature and humidity controls (see 3.6.2). Once bearings are sealed within nylon 6 bags, they shall remain in the temperature and humidity-controlled area until closure is made within the unit pack bag (see 3.10.7.3).

3.10.7.3 Unit pack bag for method 41B. Unit pack bags for instrument, instrument precision, and general bearings shall be MIL-PRF-22191, type I, heat-sealable material. Alternate bags meeting the requirements of MIL-DTL-117, type I or II, class E, any style, may be used. Bags shall allow for re-closure and shall be leak-proof when resealed. A carton or box shall be used to complete the unit container (see 3.11).

3.10.8 Method 44B - vials (plastic), sealed. Bearings or bearing components shall be fully immersed in preservative compound as required in 3.3.4 and 3.3.4.7, and enclosed within a sealed rigid container of extruded plastic (use of PVC is prohibited) resistant to the particular lubricant or preservative being used. The container wall thickness shall be 0.030 inch minimum and length shall not exceed 10 inches. The size of the vial shall be such as to provide minimum weight and cube, permitting not less than 0.010 inch play between bearings or bearing parts and inside diameter of the vial. In filling the container, a five-percent minimum void shall be provided to permit thermal expansion. Vials shall be initially closed by a secure leak-proof closure. Vials shall allow for re-closure and shall be leak-proof when re-closed.

3.10.9 Method 45B - rigid metal container, sealed. The bearings, preserved, wrapped, and cushioned as specified in 3.10.6, shall be snugly enclosed in a sealed rigid metal container.

MIL-DTL-197M

Any selected type of rigid metal container listed in PPP-C-96 may be used if the container meets one of the test requirements of method 5009 in MIL-STD-3010. When specified in the contract or purchase order, the metal container may be vacuum sealed (see 6.2).

3.10.10 Method 46B - vials (plastic), sealed. After cleaning and drying, the bearings, balls, or rollers shall be coated as specified in 3.3.4.7. Bearings or balls shall be separated by nylon 6 spacers or tightly wrapped with nylon 6 material. Wraps shall be made secure either by heat sealing or folding, followed by insertion into vials specified in 3.10.8. Each vial shall have been cleaned with a blast of dry nitrogen, by vacuum, or solvent-washed before inserting the contents. Additional dunnage of nylon 6 shall be used when necessary to prevent movement of the bearings, balls, or rollers within the vial. The vial closure seal shall provide a water vapor transmission rate equal to the vial material. Vials shall allow for re-closure and shall be leak proof when re-closed.

3.10.11 Method 49B - greaseproof spiral wrap, hot wax coating. After cleaning and drying, bearings shall be dip-preserved or lubricated with the bearing operating fluid. The bearings shall be wrapped in a greaseproof spiral inner wrap and over-wrapped with self-adhering greaseproof spiral wrap. The external surface of the over-wrap shall be coated with hot wax. The unit shall be cushioned and unit packaged in a container of fiberboard or wood (see 3.11).

3.10.11.1 Intimate wrapping of large bearings either 16 inches outside diameter or greater than 10 pounds for method 49B. The bearing shall be wrapped with an intimate wrap of material in accordance with MIL-PRF-121, type I or II (greaseproof), and shall be wound in a spiral fashion from inside diameter to outside diameter to inside diameter. An over-wrap of material in accordance with MIL-PRF-121, type I or II, shall be applied in a spiral fashion and in the opposite direction of the intimate wrap. Hot wax shall be applied to the entire surface of the wrapped bearing. The hot wax shall be applied with a brush to form a seal as water-vaporproof and waterproof as possible. Method 41B is an acceptable alternative to method 49B, however; the intimate wrap bag shall be at least four mils nominal thickness (type, spun bonded polyolefin); and the unit pack bag shall be MIL-DTL-117, type I, heavy duty.

3.10.12 Method 52B - container, water-vaporproof bag, sealed container. The bearings or bearing components shall be preserved as specified in 3.3.4 and 3.3.4.7 and comply with the requirements of method 50 of MIL-STD-2073-1. The bearings shall also be wrapped and enclosed in a close-fitting box conforming to PPP-B-566 or PPP-B-676. The box shall be desiccated with activated desiccant conforming to MIL-D-3464, type I. The quantity of desiccant shall be determined in accordance with section 5 of MIL-STD-2073-1. The desiccant shall not be permitted to come in direct contact with critical surfaces of the bearings. The desiccant shall be located as to not be load-carrying. The box shall be enclosed in a heat-sealed bag conforming to MIL-DTL-117, type I or II, class E, style 1, 2, or 3. A-A-3174 material may also be used. The sealed bags shall be enclosed in an outer container conforming to ASTM D5118/D5118M or ASTM D5168, as applicable. Closure of the container shall be in accordance with ASTM D1974/D1974M.

MIL-DTL-197M

3.10.13 Method 54B - rigid container, non-metallic, sealed. Bearings or bearing components shall be preserved as specified in 3.3.4 and 3.3.4.7, processed in accordance with 3.1 and comply with the requirements of method 50 of MIL-STD-2073-1. Bearings not exceeding 20 pounds, preserved, wrapped, cushioned, and desiccated as required in 3.10.14, shall be enclosed in a sealed, close-fitting, rigid, non-metallic container. For heavier items, fiber containers conforming to PPP-D-723, type III, grade A, class 2, may be used. Sealed, rigid, non-metallic containers may be used if the container meets one of the test requirements of method 5009 in MIL-STD-3010. The container may be vacuum sealed.

3.10.14 Method 55B - bulk quantities only. In addition to the requirements of method 50 of MIL-STD-2073-1, bearings or bearing components shall be packaged using the container specified in 3.11. Bearings shall be coated as specified (see 3.3.4.7) prior to intimately wrapping each bearing with nylon 6 or other suitable clean material in accordance with MIL-PRF-131 Class I, MIL-PRF-121, or MIL-PRF-22191. Prior to wrapping, the bearings shall be drained of all excess preservative. Bearings shall be secured in place in a manner devised by the contractor. Activated desiccant shall be used as required and shall be evenly distributed among the bearings. Desiccant shall not come in direct contact with the bearing surfaces (see 3.10.14.1). The size of the container shall be minimized, consistent with the quantity and weight of the bearings packed therein. The quantity of bearings shall be such that the gross weight shall not exceed 70 lbs. Additional over-packing is not required. All unit packs shall include a humidity indicator.

3.10.14.1 Desiccant (activated). The bagged activated desiccant shall conform to MIL-D-3464. Type I shall be used unless type II or type III is specified or required because of special characteristics of the item (see 6.2). 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 designated 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-PRF-121, type I or II 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 performing the final seal of the bag or container.

3.10.14.2 Quantity of desiccant. The minimum quantity of desiccant to be used per unit pack shall be computed in accordance with either formula I or II as specified in section 5 of MIL-STD-2073-1.

3.10.14.3 Humidity indicators. Humidity indicators shall be as specified in section 5 of MIL-STD-2073-1.

3.11 Containers for bearings. Container selection shall be determined by the size and weight of the bearings, examples include fiberboard box, cleated plywood, nailed box, metal drum, or wood crate. Containers for large bearings shall have sufficient strength to withstand the forces exerted on the container during handling. Dunnage shall be used to prevent movement of the bearing within the container.

MIL-DTL-197M

3.11.1 Unit containers. Bearings and components larger than 1.625 inches or 40 mm OD and unit-protected in accordance with methods 20B, 40B, and 41B shall be individually packaged in a unit container. Any bearing with a unit weight greater than one pound, regardless of preservation method, shall be packaged in a unit container. The quantity unit pack for large bearings shall be one each due to their fragile nature (brinelling). Items packed in vials in accordance with preservation methods 44B or 46B may have more than one item in a vial. Items in kits shall indicate one each, regardless of the quantity of items contained in the kit. Bearings 1.625 inches OD and smaller shall not be packaged with more than 25 per unit container. The specified QUP of the contract or purchase order shall govern. Unit containers shall conform to PPP-B-566 or PPP-B-676 for contents not exceeding five pounds and ASTM D5118/D5118M for contents in excess of five pounds.

3.11.2 Closure and sealing of unit container. Unit packs shall be closed as specified in the appendices or notes of the applicable container specifications by use of tape, stitching, staples, or fasteners. When level A packaging is specified and ASTM D5118/D5118M class weather resistant or class domestic boxes are intermediate pack, weather-resistant boxes shall be closed by any method in accordance with ASTM D1974/D1974M. Boxes shall be sealed with tape applied over all external seams, corners, staples, and joints of the box. The tape shall be centered over the seams and extend over the corners and edges of the box. Vial closures shall be in accordance with [3.10.8](#) and [3.10.10](#).

3.11.3 Intermediate container. Unless excepted by [3.11.4](#) or unless otherwise specified (see [6.2](#)), unit packs shall be intermediate packed. Intermediate containers shall provide a snug fit for contents and shall contain identical items only. The applicable container specification or a limit of 20 pounds shall govern gross weight of intermediate packs, whichever is smaller. Unit packs shall be placed in the intermediate containers in an upright position, or a position that will preclude possible brinelling of the packed bearings. For methods 44B and 46B, fiberboard separators of material conforming to ASTM D4727/D4727M shall be provided to separate unit packs both horizontally and vertically. Intermediate packs shall be marked to indicate the top of the container.

3.11.4 Exceptions. Intermediate containers shall not be required when any of the following apply:

- a. Commercial packing is required.
- b. Shipments do not exceed 20 pounds gross weight.
- c. Packs include a carton conforming to ASTM D5118/D5118M as the unit package.

3.11.5 Intermediate container when level A packing is specified. Intermediate containers shall be as specified in [3.11.3](#). Containers shall conform to ASTM D5118/D5118M, class weather resistant. Containers shall be closed and sealed using any method specified in ASTM D1974/D1974M and [3.11.2](#).

3.11.6 Intermediate container when level B packing is specified. Intermediate containers shall be as specified in [3.11.3](#). Containers shall conform to PPP-B-566, ASTM D5118/D5118M,

MIL-DTL-197M

class domestic, or PPP-B-676. Container closure shall be in accordance with the applicable specification and ASTM D1974/D1974M.

3.11.7 Cushioning and dunnage materials. The use of excelsior, newspaper, shredded paper (all types), and similar hygroscopic or non-neutral materials and all types of loose fill materials for applications such as cushioning, fill, stuffing, and dunnage is prohibited. The following materials are acceptable for use for cushioning and dunnage for bearing containers: PPP-C-795, PPP-C-1120, MIL-P-130, MIL-DTL-17667, MIL-PRF-20092, MIL-PRF-26514, MIL-PRF-83671, and ASTM D6576. The acceptable material thickness shall be found in MIL-STD-2073-1. Additional materials listed in MIL-STD-2073-1 may be selected for cushioning and dunnage as acceptable alternate materials.

3.12 Marking for shipment and storage.

3.12.1 Levels A and B. Interior (unit and intermediate) packages, exterior shipping containers, and palletized unit loads shall be marked in accordance with MIL-STD-129.

3.12.2 Method 41B marking. Bearings unit-protected in accordance with method 41B shall have the barrier bag and unit container marked in accordance with MIL-STD-129.

3.12.3 Bar coding. Unless otherwise specified (see 6.2), bar code markings shall be applied on interior (unit and intermediate) packs, exterior shipping containers, and palletized unit loads, in accordance with MIL-STD-129.

3.12.4 Precautionary marking. One of the following markings (less quotes) shall appear on one side of each unit, intermediate, and exterior packing as applicable (see [table II](#) and [3.3.4.4](#)):

- a. For lubricated (open or closed race) bearings (see [3.3.4.4.1](#)):

"PACKAGED MIL-DTL-197
LUBRICATED WITH (SPECIFICATION NUMBER)"

- b. For preserved (open race) bearings (see [3.3.4.4.2](#)):

"PACKAGED MIL-DTL-197
PRESERVED WITH (SPECIFICATION NUMBER)
CLEAN AND LUBRICATE PRIOR TO USE OR AS REQUIRED"

- c. For barrier-film-coated bearings:

"PACKAGED MIL-DTL-197
LUBRICATED WITH (SPECIFICATION NUMBER) BARRIER FILM COATED"

- d. For oxygen equipment bearings:

MIL-DTL-197M

"PACKAGED MIL-DTL-197
LIQUID OXYGEN/GASEOUS OXYGEN SYSTEM"
(Special marking and labeling in accordance with MIL-I-52211 also required)

e. For self-lubricating bearings (see [3.3.4.4.4](#)):

"PACKAGED MIL-DTL-197
SELF LUBRICATED BEARING
DO NOT LUBRICATE WITH OIL OR GREASE"

3.12.5 Special marking requirement bearings. Special circumstances may require special marking. For example, bearings may be acquired for a special project code or a shelf life may be required for the lubrication in the bearing. Such bearings or bearing components, as identified in the contract or purchase order, would require marking in accordance with contract requirements (see [6.2](#)).

3.12.6 Method 20B labeling. In addition to the required markings on containers, bearings unit-protected to method 20B shall be labeled as follows:

- a. A label shall be affixed to the outermost circumference (tapered rollers may be packed separately) of the bearing after the bearing has been foil wrapped.
- b. Printing on the label shall be readable through the strippable compound applied at the hot dip operation.

3.12.7 Method 40B labeling. In addition to required markings on containers, bearings unit-protected to method 40B shall be permanently marked with the NSN and date packaged. The marking may be printed directly onto the plastic or may be applied as a label. The label, if used, shall be compatible with the plastic and shall not be affected by the lubricant or preservative compound. Labels shall be sealed between layers of the transparent material around the outer circumference of the bearing. If the label obscures more than 50-percent of the outer circumference of the bearing, it shall be of a transparent material.

3.12.8 Workmanship. Workmanship shall be such that when the proper process and procedure are followed, materials and items shall be protected against corrosion, deterioration, and damage during handling, shipment, storage, and require minimum processing for service.

3.12.9 Lot numbers. Bearing manufacturers' lot numbers shall be shown on the unit and exterior container labels for every lot of packaged bearings. Lot numbers are not required when bearings are serialized (see [3.12.10](#)).

3.12.10 Serial numbers. Bearing serial numbers shall be shown on the unit-marking label per MIL-STD-129 as well as on the bearings per MIL-STD-130.

3.12.11 Matched sets. Individually packaged bearings constituting a set shall be taped together with transparent pressure-sensitive tape before the insertion into the unit package, heat sealed together as a set, or the individual unit package of a set shall be taped together so

MIL-DTL-197M

markings are not obscured. In all cases, the unit package shall be marked with the following caution: "MATCHED SET, DO NOT SEPARATE". These bearings shall not be separated for individual issue, but shall be issued and used as a single unit.

3.12.12 Bearing nomenclature marking. The bearing nomenclature, as specified in the contract or purchase order, shall be included on the packaging and packing container (see 6.2).

3.12.13 Preservation method marking. The preservation method code shall be marked on the unit pack label in accordance with MIL-STD-129.

3.13 Recycled, recovered, or environmentally preferable or bio-based materials. Recycled, recovered, or environmentally preferable or bio-based materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

4. VERIFICATIONS

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

- a. Conformance inspections (see 4.2).
- b. Quality system (see 4.3).
- c. Test methods (see 4.4).

4.2 Conformance inspections. Conformance inspections shall consist of inspections and examinations for the characteristics described in paragraphs 4.2.2 through 4.2.9 and table III.

TABLE III. Examinations.

| Examination | Requirement paragraph |
|-------------------------|-----------------------|
| Visual examination | 4.2.3 4.2.4 |
| Marking examination | 4.2.5 |
| Method of preservation | 4.2.6 |
| Level of packing | 4.2.7 |
| Magnetism | 4.2.8 |
| Requirements for method | 4.2.9 |

4.2.1 Lots. A lot shall consists of one day's production or processing of bearings, regardless of bearing dimensions, subject to the same packaging method and cleanliness level.

4.2.1.1 Sampling. As a minimum, the contractor shall randomly select a sample quantity from each lot of completed packages in accordance with general inspection level I of ASQ Z1.4. The acceptable quality level (AQL) shall be as identified in the contract or purchasing order (see 6.2). In addition, the following sampling shall be accomplished:

MIL-DTL-197M

4.2.1.1.1 Sampling for heat seal test (see [4.4.1](#)). Samples from each heat sealer shall be tested daily with each type of material used. If the heat sealer is dedicated to a specific material and the temperature setting is not changed, the sealer may be tested monthly. The monthly testing shall not be started until thirty days of continuous testing results with no failures. A log shall be maintained for recording the results of this test by heat sealer. Sealers tested shall be selected from intimate pack, primary, and secondary pack areas. Any failure shall require return to daily testing until subsequent 30-day period has been met without failure.

4.2.1.1.2 Sampling for fingerprint corrosion and cleanliness test. A daily sample shall be tested for fingerprint corrosion and cleanliness in accordance with [4.4.2](#) (not applicable to ceramic materials). Daily samples shall consist of one day's production or processing of bearings, regardless of bearing dimensions and subject to the same packaging method and cleanliness level and shall be one of the following:

- a. Five panels fabricated of the same material as the bearing outer ring and having the same surface finish as the bearing outer ring. Tests shall be conducted only for like kinds or types of steel with high-chromium content (CRES or chrome).
- b. Five bearings, bearing outer rings, or bearing inner rings with ground outer diameters, selected at random which are classified as "scrap" or "reject", but whose surfaces are adequate for the purpose of this test.

4.2.1.1.3 Sampling for corrosion test (method 40B). Two packages prepared by the same production procedures as the packages being offered for acceptance shall be selected at random at a minimum of once per week for the test of [4.4.3](#). Material contained in the packages may be as specified in [4.2.1.1.2](#). This shall be a continuous test and packages shall be examined daily. A new set of test packages shall be placed under test every week (168 hours) unless a failure is noted prior to the end of the 168-hour period. If a failure (any corrosion) is noted prior to the end of the 168-hour period, a new package, or packages, as applicable, shall be placed under test immediately and packaging by the method represented by the failure shall be stopped. All items packaged by the method represented, which have not already been shipped, shall be rejected. After the correction of procedural deficiencies, the rejected material shall be reprocessed, repackaged, re-sampled, and re-tested. This test is for process control only and shall not affect material already shipped.

4.2.2 Materials. All materials to be used in packaging, including lubricants, shall be inspected in accordance with the applicable material specification and the cleanliness levels of this specification. If direct inspection is not specified under the terms of the contract or purchase order, certified inspection and laboratory test reports shall be provided which verify that the materials as furnished conform to the detailed specification (see [6.2](#)).

4.2.3 Visual examination. Each of the sample packages selected in accordance with [4.2.1.1](#) shall be visually examined to verify compliance with the requirements of this specification.

MIL-DTL-197M

4.2.4 Visual examination under magnification. Instrument and instrument precision ball bearings packaged in transparent materials shall be visually examined under a 10X magnification through the package for contamination within the bearing or the package prior to shipment. Other bearings as applicable shall be examined visually through the transparent package for contamination. If the transparent packaging material is so cloudy that a 10X examination is not possible, then the bearings need to be repackaged.

4.2.5 Marking examination. Unit, intermediate, and exterior packages shall be examined to determine compliance with the marking requirements specified in 3.12.1 through 3.12.13.

4.2.6 Method of preservation. The military method used shall be in accordance with contract or purchase order requirements and the requirements of this specification (see 6.2).

4.2.7 Level of packing. The level of packing shall be A or B, as specified in the contract or purchase order (see 6.2).

4.2.8 Magnetism. The measured magnetism of a bearing shall not exceed the specified level for the preservation method used (see 3.3.3).

4.2.9 Requirements for method. Verify the requirements of section 3 have been accomplished for the preservation method used.

4.3 Quality system. The contractor shall implement and maintain a quality system that satisfies program objectives and meets the test, examination, and inspection requirements contained in this specification.

4.4 Test methods. Table IV shows the tests required for each applicable method. The sampling requirements are also identified.

TABLE IV. Tests applicable to each method of unit preservation.

| Inspection/test | Method number | | | | | | | | | | | Sampling paragraph | Reference paragraph |
|-------------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|--------------------|---------------------|
| | 20B | 32B | 33B | 40B | 41B | 44B | 45B | 46B | 49B | 52B & 55B | 54B | | |
| Leakage | - | X ¹ | X ¹ | - | X | X | - | - | - | X ¹ | X | 4.2.1.1 | 4.4.1 |
| Heat-sealed seam | - | X | X | - | X | - | - | - | - | X | X | 4.2.1.1.1 | 4.4.1 |
| Fingerprint corrosion & cleanliness | X ² | X ² | X ² | X ² | X ² | X ² | X ² | X ² | X ² | X ² | X ² | 4.2.1.1.2 | 4.4.2 |
| Corrosion | - | - | - | X | - | - | - | - | - | - | - | 4.2.1.1.3 | 4.4.3 |

¹ Leakage test is not required for bulk quantities.

MIL-DTL-197M

² Plain self-lubricating bearings, sleeves, and rod ends shall not require the fingerprint corrosion test.

4.4.1 Leakage and heat-sealed seam tests. Sample specimens shall be selected in accordance with 4.2.1.1.1. The leakage and heat-sealed seam test shall be in accordance with methods 5009 and 2024 of MIL-STD-3010. Bag heat seals shall be checked or tested daily.

a. The leakage tests shall be performed in accordance with method 5009 of MIL-STD-3010. The requirement for the technique used for this test shall depend on the method of preservation used in the packaging process. It is possible that the contractor will use one or more techniques in performing the leakage test.

b. The heat seal seam test shall be conducted in accordance with method 2024 of MIL-STD-3010. In addition, the test shall be performed at room temperature using a static load weight as specified herein. When the barrier materials conform to A-A-3174, MIL-PRF-121, MIL-PRF-131 Class I, or MIL-PRF-22191, the static load weight shall be 56 ± 0.5 ounces. Heat seals shall not separate during the final 3 minutes of the test. Partial separation in the area of partial fusion adjacent to the actual seam is acceptable within the first 2 minutes of the test. The weight shall be allowed to act for a minimum of 5 minutes.

4.4.2 Fingerprint corrosion and cleanliness test. Sample specimens shall be selected in accordance with 4.2.1.1.2. Samples shall be cleaned and dried in accordance with 3.3.3, 3.4.2, 3.5.2, and 3.6.3 along with the production lot. The test shall be performed by suspending the unpacked samples in the air over the water in a static humidity chamber at 75 ± 5 °F (24 ± 3 °C) for 24 hours. If no corrosion (such as pitting, cracking, or material discoloration) is seen without visual aid at the conclusion of the test, satisfactory cleanliness has been achieved.

4.4.3 Corrosion test. Packaged bearings selected in accordance with 4.2.1.1.3 shall be exposed for 1 week (168 hours) to 90 ± 5 percent R.H. at 120 ± 5 °F (50 ± 3 °C). If no corrosion (such as pitting, cracking, or material discoloration) is seen without visual aid at the conclusion of the test, satisfactory preservation and packaging has been achieved.

4.5 Atmosphere in workrooms.

4.5.1 Temperature, humidity, and airborne particle count. Relative humidity and temperature for workrooms shall be tested daily for conformance to 3.5.1, 3.6.2, 3.6.4, 3.7.1, 3.7.2, 3.8.2, and 3.9.2. Recorders shall be installed to record the temperature and humidity on a continuous basis. Testing for airborne particle count shall be performed on a quarterly basis in accordance with class 5, class 7, and class 8 of ISO 14644-1 and ISO 14644-2. Applicable workrooms shall be tested in accordance with 4.5.3.1 quarterly to determine conformance to these requirements.

4.5.2 Equipment calibration. Equipment used to control and monitor clean room and workstation conditions shall be calibrated annually.

4.5.3 Environment and process cleanliness tests.

MIL-DTL-197M

4.5.3.1 Clean room environment test (airborne particle counting methods). This test shall be conducted in accordance with ISO 14644-1 and ISO 14644-2.

4.5.4 Cleanliness of general purpose and precision bearings manufactured to ABEC or RBEC 3 or better, excluding 5T for torque and extra-thin bearings (see 6.5.1). Contamination on cleaned or preserved bearings visible to the unaided eye is unacceptable. Verification of abrasive or metal (except silver) particles may be accomplished by the following or equivalent method. Flush the bearing with solvent capable of dissolving the preservative or lubricant. The solvent used to flush the bearing shall be filtered through a 1-inch diameter 0.5- μ m absolute filter, or finer, marked in 3.10 by 3.10 mm grids in accordance with ASTM F311. The filter shall be inspected in accordance with ASTM F312, method B, for particle abrasive or metal (except silver) contamination to the acceptability limits below. Cause and corrective action is required for any failure of this test.

| <u>Particle size range (mm)</u> | <u>Maximum allowable number of particles</u> |
|---------------------------------|--|
| 0.051 to 0.127 | 15 max allowable per 4 random grid squares |
| > 0.127 to 0.254 | 10 entire filter |
| > 0.254 | 0 entire filter |

5. PACKAGING. Requirements of MIL-DTL-197 apply.

6. NOTES

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

6.1 Intended use. This specification is intended for use as a reference in section 5 of bearing commodity specifications and for direct reference in acquisition documents. It is intended to furnish direction in the packaging of bearings at military and other government activities and at plants of commercial subcontractors. The packaging requirements specified herein are intended to ensure proper and safe transportation, storage, and stowage of bearings for shipment to government activities.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Exceptions to packaging, if required (see 3.2.1).
- c. Exceptions to packaging, if required (see 3.2.2 and 3.2.2.1).
- d. Preservation, if different than general preservation procedure (see 3.3.2).
- e. Manufacturer's shelf life, if available (see 3.3.4.4 and 6.5.22).
- f. Lubricant or preservative compound (see 3.3.4.7).
- g. Operational lubricant (grease or oil), if required (see 3.3.4.7).
- h. Preservation method (see 3.10 and 4.2.6).
- i. Bulk pack quantity, if required (see 3.10.2).
- j. Vacuum-sealing for rigid metal containers, if required (see 3.10.9).
- k. Type II or III desiccant, if required (see 3.10.14.1).

MIL-DTL-197M

- l. Unit packs, if different than intermediate (see [3.11.3](#)).
- m. Bar coding, if different (see [3.12.3](#)).
- n. Special markings, if required (see [3.12.5](#)).
- o. Bearing nomenclature (see [3.12.12](#)).
- p. AQL (see [4.2.1.1](#)).
- q. Direct inspection requirements, if required (see [4.2.2](#)).
- r. Level of packing (see [4.2.7](#)).

6.3 Cleanliness.

6.3.1 Cleaning the exterior of the bearing package before opening. This note is directed particularly toward instrument precision ball bearings, although it can apply generally to all types. After the bearings have been properly packaged under clean room conditions, the exterior of the package may become dirty. Containers and packages frequently generate small amounts of static electricity that attract dirt and dust particles, and contamination adheres to the package. Particularly for instrument precision ball bearings, control should be established to clean the exterior parts of the package before entry into the processing area. A recommended method is to have the package blasted with absolutely clean dry air or remove static electricity charge with an appropriate solvent. Once entering the processing area and placed in a laminar flow hood, the package should be washed again with the appropriate solvent for approximately 5 to 10 seconds to remove exterior contaminants before being placed in a clean container ready to be cut open. The package should be opened carefully so that there will be no chips of the packaging material generated and the bearing should be removed with tweezers, or suitable handling tools. Bearings should never be handled with bare hands or fingers.

6.3.2 Visual inspection of bearings before installation. The bearings should be inspected under suitable lighting conditions to assure that bearings are free from contamination, corrosion, and rust prior to installation. Bearings should be handled in a manner that does not result in contamination.

6.3.3 Bearing cleanliness. Cleaning is a most important part of bearing preservation. It is essential that the cleaning method not leave residues that may either react unfavorably with the preservative, lubricant, or packing material; or that may be unstable and decompose to form corrosive residues.

6.3.4 Bearing (support item). When bearings are acquired by equipment contractors for subsequent delivery to the Government as spares, proof of conformance to the provisions of this document by the bearing manufacturer, including the environment and process cleanliness provisions of [4.5.4](#), may serve as the basis for government acceptance.

6.3.5 Air cleanliness classes. The information contained in ISO 14644-1 and ISO 14644-2 should be used to the fullest extent in achieving and maintaining the air cleanliness classes required herein for clean rooms and workstations.

MIL-DTL-197M

6.3.6 Oxygen-use bearings. Oxygen-use bearings must be free of any contamination by hydrocarbons. Hydrocarbons in the form of oil, grease, lint, debris, or combustible foreign matter create explosion hazards in the presence of oxygen.

6.4 Lubricant information. Item description requirements include lubrication requirements as may be cited in the bearing item description, original equipment manufacturer or military drawing, military/federal specification, commercial item description, or bearing manufacturer's part number (see 3.3.4).

6.4.1 Lubricant certification. Lubricants used to preserve bearings in accordance with this document should be certified to meet all requirements of the appropriate lubricant specification. Recertification should occur in accordance with manufacturer's recommended periodicity (see 3.3.4.4 and 6.2) or, in the absence of same, every 2 years for organic-based oils, 3 years for organic-based greases, and 5 years for silicone and perfluorinated oils and greases. MIL-STD-3004 provides the test requirements for re-certification of most lubricants (see 6.5.22).

6.4.1.1 Lubricant re-certification. For bearings in storage that are suspected of having exceeded the rated shelf life (see 6.5.21) of their preservative, those bearings will be sampled and the lubricant or preservative tested in accordance with MIL-STD-3004 to certify/re-certify that they meet all of the requirements of the appropriate lubricant or bearing specification or standard (see footnote 1 of table II, 3.3.4.6, 6.4.1, and 6.5.22). Bearings that are found to have exceeded their shelf life (*i.e.*, that cannot be re-certified only through testing) will be cleaned, inspected, re-lubricated, and repackaged in accordance with this specification. The bearings will then be returned to stock with a shelf life re-certification date marked clearly on the new packaging.

6.5 Definitions.

6.5.1 Annular Bearing Engineers Committee (ABEC). The class or degree of precision of ball bearings. See ABMA Standard 20, "Radial Bearings of Ball, Cylindrical Roller and Spherical Roller Types Metric Design"; ABMA Standard 12.1, "Instrument Ball Bearings Metric Design"; and ABMA Standard 12.2, "Instrument Ball Bearings Inch Design".

6.5.2 ABMA. American Bearing Manufacturers Association.

6.5.3 Barrier coating. A fluoropolymer or other coating applied to selected surfaces of open race bearings to prevent migration of lubricating oil from the bearing by rendering selected bearing surfaces unwettable to oil. Barrier coatings keep a metered amount of oil lubricant inside the bearing both in operational use and during shelf storage (see table II, 3.5.2, and 3.12.4(c)).

6.5.4 Bearing closure. Bearing closure is defined in accordance with 6.5.6 and 6.5.12.

6.5.5 Brinelling. Damage to a bearing in which metal is deformed without removal in the bearing race after the bearing has been subjected to prolonged or excessive load (as when dropped). Brinelling may be observed as a series of dents, or "peens", along the inner surface of a bearing's race where contacted by the rollers or balls. "False brinelling" occurs when an abrasive

MIL-DTL-197M

contaminant is introduced between the rollers/balls and the race and the bearing is subjected to vibration, resulting in polished areas that resemble brinelling, but do not deform the race surface.

6.5.6 Closed race bearings. Closed race bearings are those having either seals, shields, bands, or retainment plates, or other devices completely closing both sides of bearings, or a single contact seal on one side only, rendering cleaning and re-lubrication difficult.

6.5.7 General purpose bearings. General purpose bearings are bearings which fall into the following tolerance classification: Tolerances coinciding with those of unground bearings up to and including the ABMA tolerances of ABEC 1 or RBEC 1.

6.5.8 Intimate bag or wrap. The inner bag or wrap used directly against the bearing or bearing component.

6.5.9 Installation life. The time, from initial lubrication, preservation, and packaging of a closed race bearing, to a time in the future that the bearing can be estimated to be installable without issue, based on the type of lubricant or preservative used. Installation life is determined by the manufacturer or overriding industry standard (see 3.3.4.4.1).

6.5.10 Instrument bearings. Instrument bearings are ball bearings with outside diameter not over 30 mm or 1.1811 inches and an ABEC tolerance of ABEC 3 or better.

6.5.11 Instrument precision bearings. Instrument precision bearings are ball bearings with outside diameters not over 30 mm or 1.1811 inches and ABEC tolerances of ABEC 5P, 5T, or better.

6.5.12 Large bearings. Large bearings are those bearings exceeding 16 inches outside diameter or greater than 10 pounds in weight.

6.5.13 Open race bearings. Open race bearings are those having a single seal, or shield, or those having no seals or shields, or those that are separable.

6.5.14 Operational lubricant. The lubricant identified by specification, standard, or contract applied as a protective film to provide lubrication to a bearing that is installed and in service. Operational lubricants may also be specified as preservative lubricants (see table II, 3.12.4(a), 6.5.18, and 6.5.19).

6.5.15 Oxygen equipment bearings. Oxygen equipment bearings are those bearings used in gaseous or liquid oxygen systems and high-pressure, submersible, life support systems. They must be free from combustible materials, lubricants, or debris.

6.5.16 Precision bearings. Precision bearings are bearings manufactured to, or better than, the following ABMA tolerances:

- a. ABEC 3 and RBEC 3 for metric ball and roller bearings.
- b. ABEC 5T for torque tube and extra thin type bearings.

MIL-DTL-197M

- c. Class 3 for inch-tapered roller bearings.

6.5.17 Preservation (unit protection). Preservation (unit protection) is the application of protective measures, barrier materials, cushioning, and containers when necessary. Preservation is the process and procedures used to protect material from deterioration and damage. It includes cleaning, drying, preserving, packing, marking, and unitization.

6.5.18 Preservative. A compound identified by specification, standard, or contract applied as a protective film on a bearing that is packaged, in storage, or in transit. Preservative compounds are not lubricants; bearings preserved in preservative compound will require cleaning and lubrication with their operational lubricant prior to use (see [table II](#) and [3.12.4\(b\)](#)).

6.5.19 Preservative lubricant. A lubricant identified by specification, standard, or contract applied as a protective film on a bearing that is packaged, in storage, or in transit. Preservative lubricants may be the same as, or differ from, operational lubricants. If different, preservative lubricants will be cleaned from the bearing, and the bearing will be lubricated with its operational lubricant prior to use (see [table II](#), [3.12.4\(b\)](#), [6.5.12](#), and [6.5.18](#)).

6.5.20 Roller Bearing Engineers Committee (RBEC). The class or degree of precision of radial roller bearings (see ABMA 20).

6.5.21 Self-lubricating. A bearing with a self-lubricating liner such as Teflon® or a powder metallurgy (sintered) bearing that has been permanently impregnated with a lubricating oil, neither of which require the application of a lubricant. Self-lubricating bearings will be packaged and stored without preservative or preservative lubricant (see [table II](#)).

6.5.22 Shelf life. The total period of time beginning with the date of manufacture, assembly, preservation, packaging, or after visual inspection/certified laboratory test or restorative action, that a bearing may remain in storage inventory and still remain suitable for issue or placement into service by the end user. Bearing shelf life as described in this specification relates only to the preservative or preservative lubricant used to preserve the bearing. The lubricant-preserved bearings assigned a type II shelf life code may have their shelf life extended by testing and re-certification of the lubricant or preservative in accordance with MIL-STD-3004 (see [table II](#), [3.3.4.4](#), [6.2](#) and [6.4.1](#)).

6.5.23 Small bearings. Small bearings are those bearings that do not exceed 16 inches outside diameter or less than 10 pounds in weight.

6.6 Cross-reference table. [Table V](#) contains cross-reference data for military bearing preservation methods.

MIL-DTL-197M

TABLE V. Military preservation methods cross-reference.

| Description of method | Method MIL-DTL-197 | Method MIL-P-197 | Method MIL-P-116 |
|---|-----------------------|---------------------|---------------------|
| Physical protection of bearing | - | - | III |
| Bearing dipcoated with preservative, or operating lubricant followed by intimate aluminum wrap then greaseproof wrapped (see 3.10.3) | 20B | A | IB2 |
| Waterproof or waterproof-greaseproof with preservation | - | - | IC |
| Container, waterproof bag, sealed (see 3.10.4) | 32B | - | IC2 |
| Greaseproof-waterproof bag, sealed (see 3.10.5) | 33B | - | IC1 |
| Vacuum formed plastic skin package, bearing dipcoat preserved or lubricated (see 3.10.6) | 40B | L | IA19 |
| Bearing preserved or lubricated; wrapped; placed in water-vaporproof bag, sealed (see 3.10.7) | 41B | G | IA8 |
| Container, water-vaporproof bag, sealed container | - | - | IA14 |
| Floating water-vaporproof bag, sealed | - | - | IA16 |
| Vials (transparent plastic), bearings, balls or rollers immersed in preservative oil, sealed (see 3.10.8) | 44B | F | IA6 |
| Metal rigid container, sealed (see 3.10.9) | 45B | - | IA5 |
| Vials (transparent plastic), bearings, balls, or rollers dipcoat preserved or lubricated; wrapped, cushioned, sealed (see 3.10.10) | 46B | H | IA13 |
| Bearing preserved with operating fluid; wrapped in greaseproof spiral inner wrap, overwrapped with self adhering greaseproof spiral wrap; external surface coated with hot wax, cushioned, and unit packed in a container of fiberboard or wood (see 3.10.11) | 49B | M | IA20 |
| Water-vaporproof protection with desiccant | - | - | II |
| Water-vaporproof bag, sealed | - | - | IIc |
| Container, water-vaporproof bag, sealed container (see 3.10.12) | 52B | B | IIb |
| Floating water-vaporproof bag, sealed | - | - | IIa |
| Rigid container, non-metallic, sealed (see 3.10.13) | 54B | - | II f |
| Bulk quantities (see 3.10.14) | 55B | B | II d |

MIL-DTL-197M

6.7 Subject term (key word) listing.

Barrier film
 Brinelling
 Cellulose acetate
 Clean room
 Closed race
 Contamina
 Corrosion
 Demagnet
 Dunnage
 Fingerprint
 Foil wrap
 Heat seal
 Intermediate pack
 Intimate wrap
 Open race
 Operational lubricant
 Packing
 Preservation
 Preservative
 Recertification
 Self aligning
 Self lubricating
 Shelf life
 Unit pack

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

Custodians:

Army - AR
 Navy - SH
 Air Force - 99
 DLA - GS

Preparing Activity:

DLA - GS4

(Project PACK-2016-013)

Review Activities:

Army - AT, SM
 Navy - AS, OS, SA
 Air Force - 70, 71, 84

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