

MIL-B-8942A (ASG)

15 NOVEMBER 1965

Superseding

MIL-B-8942 (ASG)

16 March 1964

MILITARY SPECIFICATION

BEARINGS, PLAIN, TFE LINED, SELF-ALIGNING

This specification has been approved by the Department of the Air Force and by the Bureau of Naval Weapons.

1. SCOPE

1.1 This specification covers plain spherical bearings which are self-aligning and self-lubricating by incorporating tetrafluoroethylene (TFE) in a liner between the inner ring (ball) and outer ring (race) for use in the temperature range -65° F to +250° F.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

SPECIFICATIONSFederal

QQ-C-320	Chromium Plating (Electrodeposited)
TT-S-735	Standard Test Fluids; Hydrocarbon

Military

MIL-B-197	Bearings, Anti-Friction, Associated Parts and Sub-Assemblies, Packaging of
MIL-H-5606	Hydraulic Fluid, Petroleum Base, Aircraft, Missile, and Ordnance
MIL-L-7808	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base
MIL-A-8243	Anti-Icing and Deicing-Defrosting Fluid
MIL-D-70327	Drawings, Engineering and Associated Lists

STANDARDSFederal

FED. TEST METHOD	Paint, Varnish, Lacquer, and Related Materials; Methods
STD. NO. 141	of Inspection, Sampling, and Testing

FSC 3120

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Military

MIL-STD-10	Surface Roughness, Waviness and Lay
MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129	Marking for Shipment and Storage
MS21230	Bearing; Plain, Self-Aligning, Grooved Outer Ring, TFE Lined, Wide
MS21231	Bearing, Plain, Self-Aligning, TFE Lined, Wide
MS21232	Bearing, Plain, Self-Aligning, Grooved Outer Ring, TFE Lined, Narrow
MS21233	Bearing, Plain, Self-Aligning, TFE Lined, Narrow

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

2.2 Other publications.-- The following document forms a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

Uniform Classification Committee

Uniform Freight Classification Rules

(Application for copies of the above publication should be addressed to the Uniform Classification Committee, 202 Chicago Union Station, Chicago, Ill., 60606.)

3. REQUIREMENTS

3.1 Qualification.-- The bearing furnished under this specification shall be a product which is in accordance with the applicable Military Standard (MS) and which has been subjected to and which has passed the qualification tests specified herein, and which has been listed on or approved for listing on the applicable Qualified Products List.

3.1.1 Product design change.-- Any change in product design or description will require requalification of the product to an extent determined by the qualifying activity.

3.2 Materials.-- The ball and outer race shall be in accordance with the applicable MS. TFE shall be included in the liner in such manner that the bearing will conform to all requirements of this specification.

3.2.1 Plating.-- Plating of the ball will be permitted, at the option of the manufacturer, and shall be in accordance with QQ-C-320.

3.3 Design.-- Bearing design shall conform to that shown on MS21230, MS21231, MS21232, and MS21233.

3.4 Construction.-- The liner shall be so secured that all relative motion will be between the liner and the ball. The bearing shall not have loading slots. Except as otherwise specified, the details of the working parts shall be optional.

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3.4.1 Dimensions and tolerances.- Dimensions and tolerances shall be as specified on the applicable MS. Dimensions not shown shall be at the option of the manufacturer.

3.4.2 Surface finish.- The spherical surface of the ball shall have a finish of roughness height rating (RHR) 8 maximum in accordance with MTL-STD-10. The bore, ball face, and outer race periphery shall have a finish of RHR 32 maximum. All other surfaces shall have a finish of RHR 125 maximum. Bearings shall be free of any surface defects which may be detrimental to satisfactory installation, performance, or bearing life as defined in this specification.

3.4.3 Lubrication.- Initial lubrication by the manufacturer will be permitted. Relubrication will not be permitted.

3.5 Performance.-

3.5.1 Radial static limit load.- After the radial load listed on the applicable MS has been applied as specified in 4.6.1, the total deflection of the bearing and fixture shall be less than 0.010 inch for bearings with a bore of 3/8 inch or less, 0.015 for 7/16 and 1/2 inch, 0.017 for 9/16 and 5/8 inch, and 0.020 for 3/4 inch and up. The permanent set shall be less than 0.003 inch.

3.5.2 Axial static limit load.- After application of the axial load listed on the applicable MS, the permanent set shall be less than 0.005 inch.

3.5.3 Ultimate load.- No fracture of the race or ball, or push-out of the ball shall occur when 1.5 times the radial or axial load limit is applied, as specified in 4.6.1 or 4.6.2.

3.5.4 Oscillation radial load.- The total liner wear of the bearing shall not exceed 0.006 inch when tested in accordance with 4.6.3 with the radial unidirectional load listed on the applicable MS.

3.5.5 Self-alignment.- The bearing shall be self-aligning and permit the angular displacement specified on the applicable MS.

3.5.6 No-load breakaway torque.- When tested in accordance with 4.6.4, the no-load breakaway torque shall be within the limits of the values specified on the applicable MS.

3.5.7 Fluid compatibility.- When tested in accordance with 4.6.5, the bearings shall be compatible with the fluids listed in 4.6.5 and the total liner wear shall not exceed 0.006 inch.

3.5.8 Corrosion resistance.- Corrosion resistance shall be determined in accordance with Method 6201 of Fed. Test Method Std. No. 141. Superficial tarnish which can be removed with a damp cloth will not be cause for rejection.

3.5.9 High temperature.- When tested in accordance with 4.6.7, under the oscillating load specified on the applicable MS, the total liner wear shall not exceed 0.006 inch.

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3.5.10 Low temperature.-- When tested in accordance with 4.6.8, the no-load breakaway torque shall be not more than twice the maximum value specified on the applicable MS.

3.6 Interchangeability.-- All parts having the same manufacturer's part number shall be directly and completely interchangeable with each other with respect to installation and performance. The drawing number requirements of MIL-D-70327 shall govern changes in the manufacturer's part numbers.

3.7 Identification of product.-- Each bearing shall be permanently and legibly marked with the MS number and manufacturer's part number, name, or trademark. Where practicable, identification shall appear on the side face of the outer race; otherwise, identification shall appear on the periphery of the bearing outer race. Metal impression stamping is prohibited.

3.8 Workmanship.-- The bearing shall be free of toolmarks, chatter waves, rust, grinding scratches, pits, or any other defects that may adversely affect their serviceability.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection.-- Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any other commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Qualification test records.-- The manufacturer shall maintain a record showing quantitative results for all tests required by this specification. This record shall be available to the purchaser and shall be signed by an authorized representative of the manufacturer or the testing laboratory, as applicable.

4.2 Classification of tests.-- The inspection and testing of the bearings shall be classified as:

- (a) Qualification tests (4.3)
- (b) Quality conformance tests (4.4)

4.3 Qualification tests.--

4.3.1 Sampling instructions.-- Qualification test samples shall consist of 30 bearings of MS21232-8 and 9 each of all other sizes upon which qualification is desired. All bearings necessary for tests specified herein shall be furnished by the manufacturer. Samples shall be identified as required and forwarded to the activity designated in the letter of authorization from the activity responsible for qualification (see 6.3).

4.3.2 Certified test report.-- The manufacturer shall furnish a certified test report showing that the manufacturer's product satisfactorily conforms to this specification. The test report shall include, as a minimum, actual results of the tests specified herein. When the report is submitted, it shall be accompanied by a dated drawing which completely describes the manufacturer's product by specifying all dimensions and

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tolerances, composition of the ball and outer race material, lubricant if used, coating or plating, and heat treatment. The manufacturer's part number for each size shall be included on the drawing.

4.3.3 Tests.-- Qualification tests shall include all the examinations and tests of this specification. The minimum number of samples per test shall be in accordance with table I.

TABLE I. Qualification test samples

Examination and tests	Paragraph number	Samples to be tested
Examination of product	4.5.1	5
Preparation for delivery	4.5.2	5
Axial static limit load	4.6.2	3
Radial static limit load	4.6.1	3
Oscillating radial load	4.6.3	3
No-load breakaway torque	4.6.4	3
Fluid compatibility	4.6.5	<u>1</u> / 3
Corrosion resistance	4.6.6	<u>1</u> / 3
High temperature	4.6.7	<u>1</u> / 3
Low temperature	4.6.8	<u>1</u> / 3

1/ Half-inch size only.

4.4 Quality conformance tests.-- The quality conformance testing of the bearings shall consist of the following examinations and test to determine conformance of the bearings to the requirements of this specification and the applicable MS with regard to:

- | | | |
|-------------------------------|---------|---------|
| (a) Dimensions | (3.4.1) | (4.5.1) |
| (b) Identification of product | (3.7) | (4.5.1) |
| (c) Workmanship | (3.8) | (4.5.1) |
| (d) Preparation for delivery | | (4.5.2) |
| (e) No-load breakaway torque | | (4.6.4) |

4.4.1 Tests.-- The bearing manufacturer shall be responsible for accomplishing the quality conformance tests specified herein.

4.4.2 Lot.-- The lot definition, formation, and size shall be in accordance with MIL-STD-105.

4.4.3 Sampling.-- The sample bearings shall be selected in accordance with MIL-STD-105, inspection level II, acceptable quality level of 1.0 percent, except that inspection for no-load breakaway torque (3.5.6) shall be 100 percent.

4.5 Examinations.--

4.5.1 Examination of product.-- The bearings shall be examined to determine conformance to the requirements of this specification and the applicable MS for material, plating, dimensions, finish, identification of product, workmanship, and requirements not covered by tests.

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4.5.2 Preparation for delivery.- Preservation, packaging, packing, and marking shall be inspected to determine conformance to section 5.

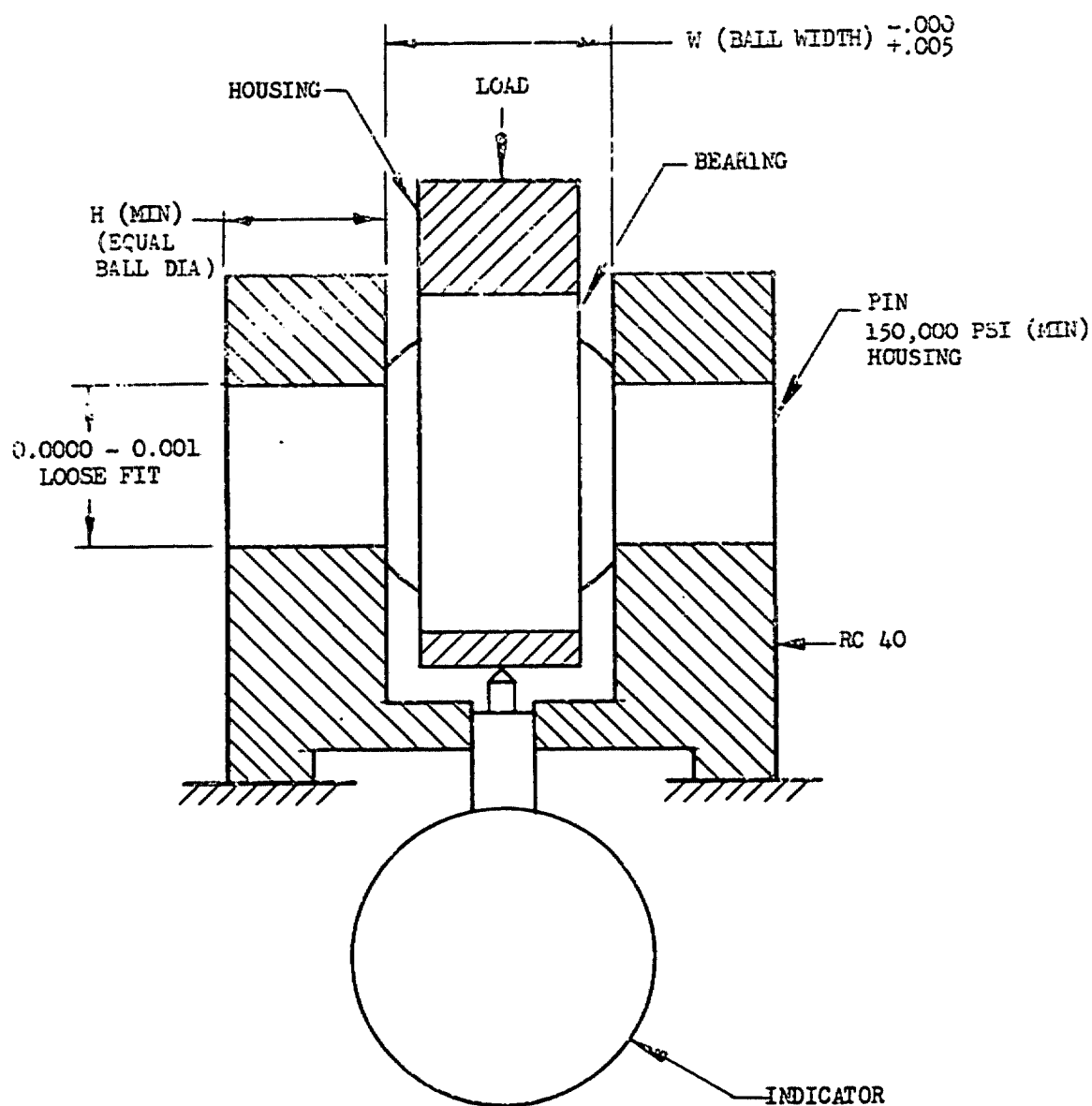
4.6 Test methods.- Unless otherwise specified, all tests shall be conducted at room temperature.

4.6.1 Radial static limit load.- The bearings shall be installed in a test fixture as shown on figure 1, using a 0.000- to 0.001-inch loose fit for the shaft and the housing. The use of differential temperatures for installation will not be allowed. A preload of 4 to 6 percent of the radial static load shall be applied to the bearing for 3 minutes, and the measuring device set at zero. The load shall then be increased at the rate of 1 percent of the specified load per second until it equals the radial static load limit. The total deflection shall be the reading at the radial static load limit after 2 minutes. The load shall then be reduced at the same rate to the preload value. The permanent set shall be the reading at preload. The ultimate radial load (see 3.5.3) shall be applied at the rate of 1 percent of the specified load per second.

4.6.2 Axial static limit load.- The test bearing shall be installed in a test fixture as shown on figure 2. Bearings shall fit in the housing with a 0.000- to 0.001-inch loose fit. The hole in the support fixture for clearance of the ball shall be the nominal diameter of the ball plus double the thickness of the liner. The bearing shall be preloaded between 4 to 6 percent of the axial load limit. After holding for 3 minutes, the measuring device shall be set at zero. The load shall be increased at the rate of 1 percent of the specified load per second until it equals the axial static load limit. It shall be held for 2 minutes, then reduced at the same rate to the preload value. The permanent set shall be the reading at preload. The ultimate axial load shall be applied at the rate of 1 percent of the specified load per second.

4.6.3 Oscillating radial load.- The bearing shall be installed in a steel housing, using a slip fit and hardened shaft (RC50 minimum) pressed into the bore with 0.0000-inch loose fit to 0.0005-inch interference fit. The bearing shall be so gripped as to place the shaft in double shear with a minimum of shaft bending. A dial indicator or electronic pickup shall be so mounted that any radial movement of the shaft or the bore of the bearing with respect to the outer race can be measured. The oscillating load specified on the applicable MS shall be applied and held for 15 minutes statically; at the end of this time, the indicating device shall be set at zero and the oscillating test shall be started. Wear readings shall include the wear from the first cycle on. The test shall be run in such manner that the ball is oscillated ± 25 degrees (50 degrees total) at 10 cycles per minute for 5,000 cycles. One cycle shall consist of rotation from zero degrees to $+25$ degrees, return through zero degrees to -25 degrees and return to zero degrees. The wear within the bearing shall not exceed 0.006 inch at the end of 5,000 cycles. Sufficient intermediate readings during the test shall be recorded to plot a graph of wear (thousandths of an inch) vs. life (cycles). In addition, upon completion of the test, the loaded breakaway torque shall be as specified in table II.

4.6.3.1 High speed oscillation.- A bearing shall be installed in a fixture as specified in 4.6.3. The test shall be run in such manner that the ball is oscillated ± 10 degrees (20 degrees total) at 200 cycles per minute for 1,000,000 cycles while the bearing is loaded to one-third the oscillating load specified on the applicable MS.



PIN SHALL BE RC50 MINIMUM
DIMENSIONS IN INCHES

FIGURE 1. Radial test fixture

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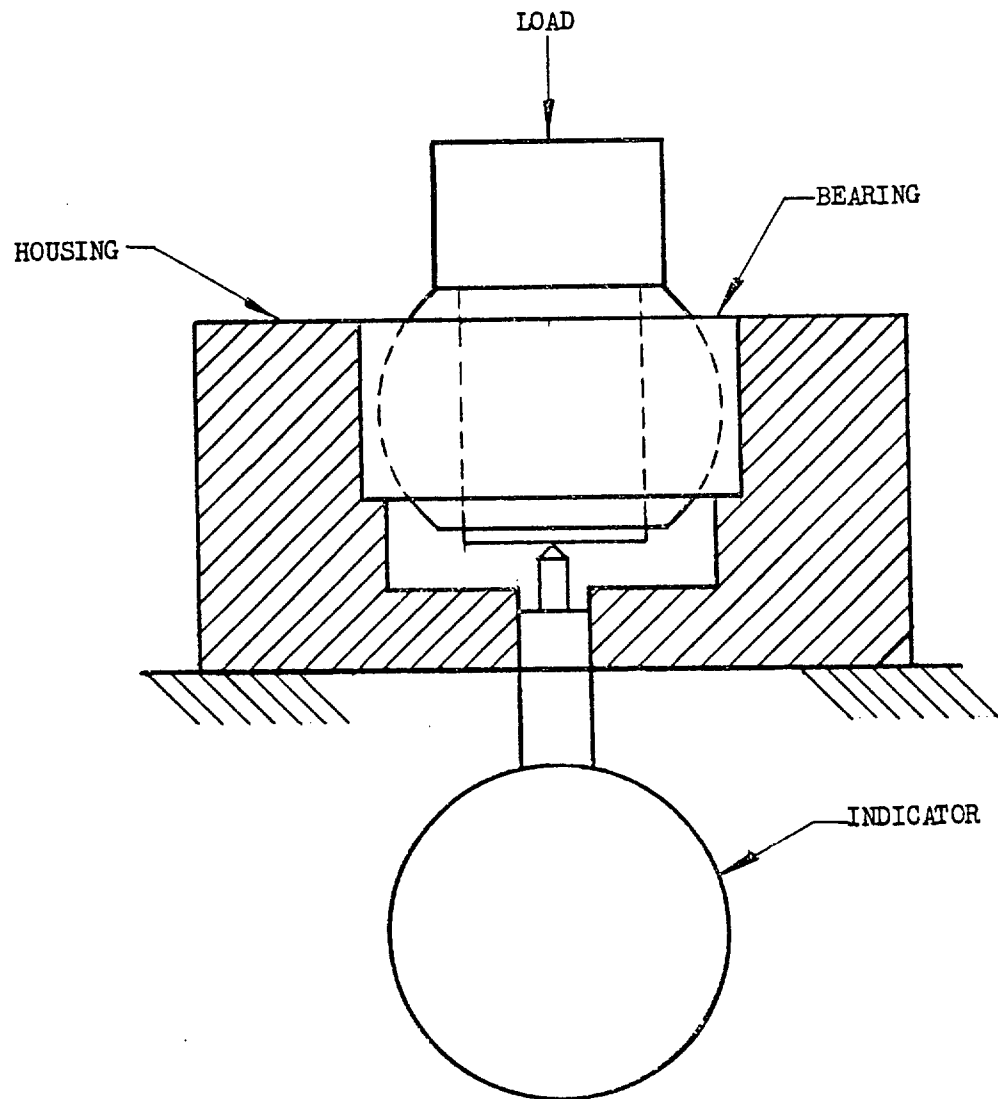


FIGURE 2. Axial test fixture

TABLE II. Test torque (in. lb. max.)

Size	MS21230	MS21232
	MS21231	MS21233
-3, 4	50	30
5	70	50
6	115	70
7	185	105
8	265	160
9	375	235
10	445	345
12	690	630
14	970	900
16	2550	1525

4.6.4 No-load breakaway torque.— The no-load breakaway torque shall be determined by holding the outer race of the bearing fixed while rotating the ball about the bearing axis. The outer race shall be held in such manner as to minimize bearing distortion and the resultant effect on the bearing preload. Torque shall be applied gradually to the ball; the maximum torque required to start the ball moving shall be recorded. The no-load breakaway torque shall be as specified on the applicable MS. The ball may be hand rotated through several revolutions immediately prior to testing.

4.6.5 Fluid compatibility.— Fifteen bearings (3 for each fluid) shall be immersed for 24 hours in each of the following fluids at $160^{\circ} \pm 5^{\circ}$ F, except for (b) which shall be at $110^{\circ} \pm 5^{\circ}$ F:

- (a) Skydrol 500A hydraulic fluid
- (b) TT-S-735, type VII standard test fluid
- (c) MIL-L-7808 lubricating oil
- (d) MIL-H-5606 hydraulic oil
- (e) MIL-A-8243 anti-icing fluid

Within 1/2 hour after removal from the test fluid the bearing shall be tested in accordance with 4.6.3. The load for (e) shall be 80 percent of that listed on the applicable MS.

4.6.6 Corrosion resistance.— The bearing shall be tested in accordance with Method 6201 of Fed. Test Method Std. No. 141. Exposure shall be at $120^{\circ} \pm 5^{\circ}$ F for 96 hours at 95 percent relative humidity. Within 4 hours after completion of the test the bearing shall be tested in accordance with 4.6.3.

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4.6.7 High temperature.-- The bearing shall be subjected to the test of 4.6.3, except that the fixture shall be placed in an air circulating oven at a temperature of $250^{\circ} \pm 2^{\circ}$ F. The fixture shall be held at this temperature long enough to stabilize at the test temperature before start of the test.

4.6.8 Low temperature.-- The bearing shall be soaked in a cold box at $-65^{\circ} \pm 5^{\circ}$ F for 4 hours, and while at this temperature, the no-load breakaway torque shall be recorded (see 4.6.4).

5. PREPARATION FOR DELIVERY

5.1 Cleaning, preservation, and packaging.--

5.1.1 Level A.-- Cleaning, preservation, and packaging shall be in accordance with level A of MIL-B-197.

5.1.2 Level C.-- Cleaning, preservation, and packaging shall be in accordance with the contractor's commercial practice.

5.2 Packing.--

5.2.1 Level A.-- Bearings, cleaned, preserved, and packaged as specified in 5.1.1, shall be packed for overseas shipment in accordance with MIL-B-197.

5.2.2 Level B.-- Bearings, cleaned, preserved, and packaged as specified in 5.1.1, shall be packed for domestic shipment and storage in accordance with MIL-B-197.

5.2.3 Level C.-- Bearings, cleaned, preserved, and packaged as specified in 5.1.2, shall be packed in a manner to insure carrier acceptance and safe delivery at destination. The containers shall be in accordance with the Uniform Freight Classification Rules or regulations of other carriers, as applicable to the mode of transportation.

5.3 Marking of shipments.-- Interior packages and exterior shipping containers shall be marked in accordance with MIL-STD-129. The nomenclature shall include:

BEARINGS, PLAIN, TFE LINED, SELF-ALIGNING

6. NOTES

6.1 Intended use.-- The bearings are intended primarily for use in applications where moderate friction and bearing play at low rotational oscillatory speeds are not objectionable.

6.2 Ordering data.-- Procurement documents should specify:

- (a) Title, number, and date of this specification.
- (b) MS part number (see 3.3).
- (c) Applicable levels of preservation, packaging, and packing (see 5.1 and 5.2).

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6.3 Qualification.-- With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set for opening of bids, been tested and approved for inclusion in the applicable Qualified Products List, whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Bureau of Naval Weapons, Navy Department, Washington, D. C. 20360; however, information pertaining to qualification of products may be obtained from the Naval Air Engineering Center, Philadelphia, Pennsylvania 19112, Attention: Code XM-62.

6.3.1 Qualification tests will be authorized only upon presentation of certified test reports and drawings indicating that the bearings conform to this specification.

Custodians:

Navy - WP

Air Force - (11)

Preparing activity:

Navy - WP

Reviewer activities:

Navy - WP

Air Force - (11)

SPECIFICATION ANALYSIS SHEET

Form Approved Budget
Bureau No. 119-ROO4INSTRUCTIONS

This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity.

SPECIFICATION

MIL-E08942A(ASG) Bearings, Plain, TFE Lined, Self-Aligning

ORGANIZATION

CITY AND STATE

CONTRACT NO.

QUANTITY OF ITEMS PROCURED

DOLLAR AMOUNT

\$

MATERIAL PROCURED UNDER A

☐ Direct Government Contract☐ Subcontract

1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?

A. GIVE PARAGRAPH NUMBER AND WORDING

B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES

2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID

3. IS THE SPECIFICATION RESTRICTIVE?

☐ YES☐ NO

IF "YES" IN WHAT WAY?

4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity.)

SUBMITTED BY (Printed or typed name and activity)

DATE