

INCH-POUND  
MIL-B-81936  
AMENDMENT 4  
17 November 1989  
SUPERSEDING  
AMENDMENT 3  
10 October 1985

MILITARY SPECIFICATION

BEARINGS, PLAIN, SELF-ALIGNING (BeCu BALL, CRES RACE)  
GENERAL SPECIFICATION FOR

This amendment forms a part of Military Specification MIL-B-81936, dated 28 September 1973, and is approved for use by all Departments and Agencies of the Department of Defense.

PAGE 1

Title line; after (BeCu BALL, CRES RACE), add "GENERAL SPECIFICATION FOR."

\* After 1.1 add "Scope."

\* Delete existing 2.1 in its entirety and substitute "2.1 Government documents."

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

In SPECIFICATIONS, Military, delete "MIL-D-1000" and substitute "DOD-D-1000."

\* IN SPECIFICATIONS, Military, after MIL-B-81936/2 entry, add the following:

<p>" Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Naval Air Engineering Center, Systems Engineering and Standardization Department (Code 53), Lakehurst, NJ 08733-5100, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.</p>	"
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PAGE 2

Delete in its entirety

" <u>Federal</u> FED TEST METHOD STD. NO. 151	Metals; Test Methods"
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\* In STANDARDS, Military, delete

"MIL-STD-129	Marking for Shipment and Storage"
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MIL-B-81936  
AMENDMENT 4

\* Delete "(Copies for 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.)" and substitute: "(Unless otherwise indicated, copies of military specifications and standards are available from the Naval Publications and Forms Center, (ATTN: NPODS), 5801 Tabor Avenue, Philadelphia, PA 19120-5099.)"

\* Delete "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." and substitute:

"2.2 Non-Government publications. The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the document which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 0.2)."

\* In 2.2 delete in its entirety:  
"Uniform Classification Committee

Uniform Freight Classification Rules

(Application for copies should be addressed to the Uniform Classification Committee, 202 Chicago Union Station, Chicago, IL 60606.)"

\* In 2.2 add the following:

"AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E18

Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials (DoD adopted)"

"(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103-1187.)"

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

\* After 2.2, insert the following new paragraphs:

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

"2.4 Streamlining. This document has been streamlined. Appendix A to MIL-B-81936 lists those documents required for MIL-B-81936 acquisition and is a mandatory part of MIL-B-81936. Those documents listed in Appendix A have the same status as those referenced directly in MIL-B-81936 (first tier documents). All other documents, referenced through tiering, may be used as guidance and information to supplement MIL-B-81936. MIL-B-81936 is a streamlined document."

PAGE 3

\* 3.1, last line, delete "6.2" and substitute "6.3."

After 3.1.1, insert the following new paragraphs:

\* "3.1.2 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between the requirements of this specification and the specification sheet, the latter shall govern."

\* "3.1.3 Product Manufacture. Except for the assembly operation, the manufacturer is permitted to sub-contract manufacturing operations without violating the requirements of 3.1.1. The assembly operation shall be performed in the plant listed on the Qualified Products List."

3.4.2, line 2, delete and substitute "rating (RHR) in accordance with ANSI B46.1 and not in excess of the values shown on the applicable military specification sheet."

After 3.4.4 add the following new paragraph:

"3.4.5 Conformity. The conformity between the ball and race shall be checked in accordance with 4.6.6. Measurements shall be taken at a minimum of six positions, three uniformly spaced positions on each side of the lubrication groove. Ten percent of the race width on each edge shall be excluded from measurement and in addition, for sizes -12 and greater, 5% of the race width on each side of the lubrication groove shall be excluded. Variation between measured values shall not exceed 0.001 inch. Overforming within 10% of each side face (H/10) is not permitted. Underforming is not controlled."

3.5.1, line 1, delete title "Radial static load" and substitute "Radial static limit load."

3.5.2, line 1, delete title "Axial static load" and substitute "Axial static limit load."

PAGE 4

3.6, line 4, delete "MIL-D-1000" and substitute "DOD-D-1000."

PAGE 5

3.8, line 2, delete "griding" and substitute "grinding."

\* 4.1, line 3, after "requirements," add "(examinations and tests)."

\* 4.1, lines 2 and 4, delete "supplier" and substitute "contractor."

\* 4.1, line 7, delete "the specification" and substitute "this specification."

\* 4.1, line 8, delete "assure" and substitute "ensure."

After 4.1, add the following new paragraph

\* "4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection

MIL-B-81936

AMENDMENT 4

system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material."

4.3, delete existing TABLE II and substitute:

TABLE II. Qualification tests.

Examinations and tests	Paragraph no.	Samples to be tested <u>1/</u>
Examination of product	4.5.1	5
Radial static limit load	4.6.1	3
Axial static limit load	4.6.2	3
Mode I dynamic test	4.6.3.1	3
Mode II dynamic test	4.6.3.2	3 <u>2/</u>
Conformity	4.6.6	3

1/ Sizes M81936/1-6, -12 and -20 only.

2/ At manufacturer's option, the Mode II tests may be performed with M81936/1-6R, -12R and -20R bearings."

\* 4.3.1, line 2, delete "fifteen (15)" and substitute "twenty (20)."

PAGE 6

\*Delete existing "4.3.4 Retention" and its paragraph in its entirety and substitute:

"4.3.4 Retention of qualification. The continued listing of a product on the Qualified Products List is dependent upon a periodic verification of the manufacturer's continued compliance with the requirements of this specification and with standardization regulations. As part of that verification process, each manufacturer must complete DD Form 1718 during October of each odd numbered year. This form, supplied by the qualifying activity, is to be signed by a responsible official of management and sent to the Naval Air Engineering Center, SESD Code 5311, Lakehurst, NJ 08733-5100."

\* 4.4, delete "(d) Preparation for delivery" and substitute "(d) Packaging."

PAGE 7

\* Delete existing "4.5.3 Inspection of preparation for delivery" and substitute "4.5.3 Inspection of packaging."

\* 4.6.1, delete title "Radial static load" and substitute "Radial static limit load."

MIL-B-81936  
AMENDMENT 4

\* 4.6.2, delete title "Axial static load" and substitute "Axial static limit load."

PAGE 8

\* 4.6.5, line 2, delete "in new Federal Test Method, Standard No. 151" and substitute "in ASTM E18."

After 4.6.5, add the following new paragraph:

"4.6.6 Conformity. Encapsulate the bearing in plastic material, as used in metallurgical mounts, to prevent motion of the ball with respect to the race. Section the bearing on a diameter and normal to the race side face to produce a surface as in figure 4(A) or 4(B). Grind and polish the face to obtain a true view of the edges of the curved portions of the ball and race. By use of a microscope with XY table or other suitably accurate technique, measure dimension "t" radially from the ball to the outer race in a minimum of six positions (three uniformly spaced positions on each side of the lubrication groove). The measurements need not be taken closer to the race face than 10% of "H". In addition, for bearing sizes -12 and greater, readings need not be taken in the area within 5% of the race width on each side of the lubrication groove. Overforming of the outer race is defined as the condition when the side portions of the outer race are in closer proximity to the ball surface than the middle portion of the outer race. Overforming within 10% of each side face ( $H/10$ ) is not permitted. Underforming is not controlled."

Add figures 4(A) and 4(B):

PAGE 11

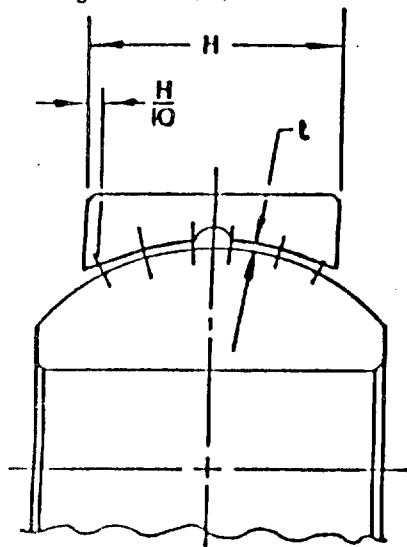


FIGURE 4(A). Conformity sizes thru -10.

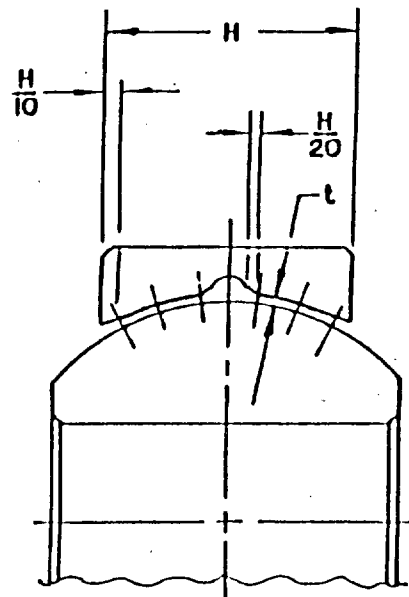


FIGURE 4(B). Conformity sizes -12 and greater.

## NOTES:

1. Overforming in the  $H/10$  region is not allowed. Underforming is not controlled.
2. For sizes -3 through -10, location of the two conformity measurements adjacent to the grease groove shall be within 0.0050 inch of the groove edge.

MIL-B-81936  
AMENDMENT 4

PAGE 12

\* Delete "5. PREPARATION FOR DELIVERY" and substitute "5. PACKAGING."

\* 5.1, line 2, after "MIL-B-197" add "(see 6.2)."

5.2, line 4, delete "Antifriction, Type (I, II, II, IV)."

Below "6. NOTES" add:

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

6.1, line 4, add "For specific design information on the capability of these bearings under particular load, speed and motion conditions, the user is referred to MIL-STD-1599."

6.2, delete in its entirety and substitute:

\* "6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of the specification.
- b. Military part number (see 3.7).
- c. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.2).
- d. Quantity.
- e. Selection of applicable levels of packaging and packing (see 5.1).

\* 6.3, line 3, after "Qualified Products List" add "QPL No. 81936."

\* 6.3, line 5, delete "suppliers is called to this requirement" and substitute "contractors is called to these requirements."

\* 6.3, line 8, delete "orders" and substitute "purchase orders."

\* 6.3, lines 9 and 10, delete "Systems Command, Navy Department, Washington, DC 20360" and substitute "Engineering Center, Systems Engineering and Standardization Department, Code 5311, Lakehurst, NJ 08733-5100."

\* 6.3, line 12, delete "30211" and substitute "60611."

6.3, delete line 13.

\*After "6.3.1" add "Authorization."

PAGE 13

\* After 6.3.1, add the following new paragraphs:

"6.4 Subject term (key word) listing:

Axial play  
Axial static limit load  
Radial play  
Radial static limit load"

MIL-B-81936  
AMENDMENT 4

"6.5 Streamlining. For MIL-B-81936 acquisitions, the required portions of all MIL-B-81936 tier reference documents shall be limited to the portions described in the "Applicability" column in Table III in Appendix A."

"6.6 Tailoring. When MIL-B-81936 is tailored in an acquisition, Appendix A must be tailored accordingly. In particular, when Appendix A is tailored, specific attention must be given to the chain of referencing. For example, if a first tier reference document in MIL-B-81936 is tailored out, all of the reference documents which are tiered to that first tier reference document must be tailored out."

PAGE 14

\* Add "APPENDIX A" on a new page as follows:

## APPENDIX A

## STREAMLINING INFORMATION

## 10. SCOPE

10.1 Scope. This Appendix is a list of documents referenced in MIL-B-81936 or tiered to documents referenced in MIL-B-81936. These documents have the same status as those referenced directly in MIL-B-81936 (first tier documents). This Appendix is a mandatory part of this specification. The information contained herein is intended for compliance.

10.2 Application. This Appendix identifies the applicability of the documents referenced in MIL-B-81936 or tiered to documents referenced in MIL-B-81936 through the third tier. Only that portion(s) of a document listed in Table III of this Appendix and described in the "Applicability" column, is pertinent in the use of MIL-B-81936. If MIL-B-81936 is tailored in acquisition, this Appendix must also be tailored.

## 20. DOCUMENTS

20.1 Documents. The documents listed herein and corresponding applicability data have been identified as required. All other documents referenced through tiering are not considered required and may be used for guidance and information.

\* TABLE III. Required documents and corresponding applicability data.

DOCUMENT NUMBER:	DOCUMENT TITLE:	APPLICABILITY:	REFERENCED BY:
<u>First tier (1 of 9 documents)</u>			
MIL-B-197	Bearings, Antifriction; Associated Parts and Sub- assemblies; Preparation for Delivery of	Due to the extensive number of variables associated with packaging, applicable sections of packaging documents cannot be identified prior to acquisition. All packaging requirements of the zero tier document must be met, unless otherwise specified in the contract.	MIL-B-81936
<u>First tier (2 of 9 documents)</u>			
DOD-D-1000	Drawings, Engineering and Associated Lists	Requirements and quality assurance	MIL-B-81936
<u>Second tier</u>			
DOD-STD-100	Engineering Drawing Practices	Item identification and part numbering, changes requiring new identification, changes not requiring new identification	DOD-D-1000
The remaining second tier references, tiered to DOD-D-1000, are for guidance and information.			
<u>First tier (3 of 9 documents)</u>			
MIL-G-81322	Grease, Aircraft, General Purpose, Wide Temperature Range	Any Qualified Products List (QPL) item	MIL-B-81936
<u>First tier (4 of 9 documents)</u>			
MIL-B-81936/1	Bearings, Plain, Self- Aligning, BeCu Ball, CRES Race (with Staking Groove), -65°F to 350°F	Entire document	MIL-B-81936

MIL-B-81936  
AMENDMENT 4



TABLE III. Required documents and corresponding applicability data.

DOCUMENT NUMBER:	DOCUMENT TITLE:	APPLICABILITY:	REFERENCED BY:
<u>Second tier</u>			
MIL-H-6875	Heat Treatment of Steel, Process for	Entire document for Class D precipitation- hardening steel, Table ID, 17-4PH condition H 1150	MIL-B-81936/1
MIL-G-81322	Grease, Aircraft, General Purpose, Wide Temperature Range	Any QPL item	MIL-B-81936/1
MIL-B-81936	Bearings, Plain, Self-Aligning (BeCu Ball, Cres Race) General Specification for	Entire document	MIL-B-81936/1
AMS 5643	Steel Bars, Forgings, Tubing, and Rings, Corrosion Resistant, 16Cr-4.0Ni-0.30(Cb+Ta)-4.0Cu, Solution Heat Treated	Composition, condition	MIL-B-81936/1
ASTM B196 (Replaces QQ-C-530)	Copper-Beryllium Alloy Rod and Bar	Entire document	MIL-B-81936/1
<u>Third tier</u>			
ASTM E3	Standard Methods of Preparation of Metallographic Specimens	Entire document	MIL-H-6875
ASTM E8	Standard Methods of Tension Testing of Metallic Materials	Test specimens, procedures	MIL-H-6875
ASTM E18	Standard Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials	General description and test procedure for Rockwell hardness test, general description and test procedure for Rockwell superficial hardness test	MIL-H-6875

MIL-B-81936  
AMENDMENT 4

TABLE III. Required documents and corresponding applicability data.

DOCUMENT NUMBER:	DOCUMENT TITLE:	APPLICABILITY:	REFERENCED BY:
<u>Third tier</u> (continued)			
ASTM E384	Standard Test Method for Microhardness of Material	Test procedure	MIL-H-6875

The remaining third tier references, tiered to MIL-B-81936/1, are for guidance and information.

First tier (5 of 9 documents)

MIL-B-81936/2	Bearings, Plain, Self-Aligning, BeCu Ball, Cres Race, -65°F to +350°F	Entire document	MIL-B-81936
<u>Second tier</u>			
MIL-H-6875	Heat Treatment of Steel, Process for	Entire document for Class D precipitation-hardening steel, Table ID, 17-4PH condition H1150	MIL-B-81936/2
MIL-G-81322	Grease, Aircraft, General Purpose, Wide Temperature Range	Any QPL item	MIL-B-81936/2
MIL-B-81936	Bearings, Plain, Self-Aligning (BeCu Ball, Cres Race) General Specification for	Entire document	MIL-B-81936/2
AMS 5643	Steel Bars, Forgings, Tubing, and Rings, Corrosion	Composition, condition	MIL-B-81936/2
ASTM B196 (Replaces QQ-C-530)	Copper-Beryllium Alloy Rod and Bar	Entire document	MIL-B-81936/2

TABLE III. Required documents and corresponding applicability data.

DOCUMENT NUMBER:	DOCUMENT TITLE:	APPLICABILITY:	REFERENCED BY:
<u>Third tier</u>			
ASTM E3	Standard Methods of Preparation of Metallographic Specimens	Entire document	MIL-H-6875
ASTM E8	Standard Methods of Tension Testing of Metallic Materials	Test specimens, procedures	MIL-H-6875
ASTM E18	Standard Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials	General description and test procedure for Rockwell hardness test, general description and test procedure for Rockwell superficial hardness test	MIL-H-6875
ASTM E384	Standard Test Method for Microhardness of Materials	Test procedure	MIL-H-6875

The remaining third tier references, tiered to MIL-B-81936/2, are for guidance and information.

First tier (6 of 9 documents)

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes	Inspection level II	MIL-B-81936
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First tier (7 of 9 documents)

MIL-STD-130	Identification Marking of U.S. Military Property	Permanency and legibility, type of lettering, parts, Table I, Table II	MIL-B-81936
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TABLE III. Required documents and corresponding applicability data.

DOCUMENT NUMBER:	DOCUMENT TITLE:	APPLICABILITY:	REFERENCED BY:
<u>First tier (8 of 9 documents)</u>			
ASTM E18 (Replaces FED-STD-151)	Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials	General description and test procedure for Rockwell hardness tests	MIL-B-81936
<u>First tier (9 of 9 documents)</u>			
ANSI B46.1	Surface Texture, Surface Roughness, Waviness and Lay	Roughness Average ( $R_a$ ), roughness average value ( $R_a$ ) from continuously averaging meter readings, designation of surface characteristics, stylus type instruments	MIL-B-81936

MIL-B-81936  
AMENDMENT 4

MIL-B-81936  
AMENDMENT 4

The margins of this amendment are marked with an asterisk to indicate where changes (additions, modifications, corrections, deletions) from the previous amendment were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous amendment.

Custodians:

Army - AV  
Navy - AS  
Air Force - 99

Preparing activity:

Navy -AS  
(Project No. 3120-0698)

Review activities:

Army - AR  
Air Force - 84  
DLA - IS