

INCH-POUND

FF-B-187B/GEN  
10 September 1993SUPERSEDING  
FF-B-187A July 1, 1960FEDERAL SPECIFICATION  
BEARINGS, ROLLER, TAPERED

This specification is approved by the Administrator,  
Federal Supply Service, General Services Administration,  
for the use of all Federal Agencies.

## 1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers tapered roller bearings for general purpose use that conform to boundary dimensions and tolerances as defined in American National Standards Institute (ANSI)/Anti-Friction Bearing Manufacturers Association (AFBMA) STD 19. These bearings are not intended for use in special precision applications such as on aircraft, precision ordnance or submarine equipment.

1.1.1 Federal specification coverage. This specification does not include all types of tapered roller bearings, but is intended to cover only those types generally used by the Federal Government.

1.2 Classification. Bearings, tapered roller furnished shall be of the following types, as specified (see 6.2.1):

## TYPES

- |          |                                                                    |
|----------|--------------------------------------------------------------------|
| Type TS  | - Bearing, roller, tapered, single row, normal angle.              |
| Type TSF | - Bearing, roller, tapered, single row, normal angle, flanged cup. |
| Type TSS | - Bearing, roller, tapered, single row, steep angle.               |

AMSC N/A

FSC 3110

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Type TSSF	- Bearing, roller, tapered, single-row, steep angle, flanged cup.
Type TDI and Type TDIS	- Bearing, roller, tapered, double row, one double cone, two single cups.
Type TDO	- Bearing, roller, tapered, double row, normal angle, two single cones, one double cup.
Type TDOS	- Bearing, roller, tapered, double row, steep angle, two single cones, one double cup.
Type TNA	- Bearing, roller, tapered, double row, normal angle, two single cones, one double cup, nonadjustable.
Type TNAS	- Bearing, roller, tapered, double row, steep angle, two single cones, one double cup, nonadjustable.
Type TNASW	- Bearing, roller, tapered, double row, straight bore, two single cones with contacting front faces slotted and chamfered for lubrication, one double cup with lubrication holes and groove.
Type TNASWE	- Bearing, roller, tapered, double row, straight bore, two single cones, cone back face rib ground on the outer diameter for sealing purposes, one double cup with lubrication holes and groove.

## 2. APPLICABLE DOCUMENTS

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

## FEDERAL SPECIFICATIONS

(See Supplement 1 for list of associated specifications)

## MILITARY SPECIFICATIONS

MIL-P-197 - Packaging of Antifriction Bearings, Associated Parts and Subassemblies

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### MILITARY STANDARDS

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes
- MIL-STD-109 - Quality Assurance Terms And Definitions
- MIL-STD-129 - Marking For Shipment And Storage
- MIL-STD-130 - Identification Marking of U.S. Military Property

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Department of Defense Single Stock Point DODSSP - Customer Service, Standardization Document Order Desk, 700 Robbins Avenue, Bldg. 4D, Philadelphia, PA 19111-5094).

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal shall apply.

#### AMERICAN NATIONAL STANDARD INSTITUTE (ANSI)/ANTI-FRICTION BEARING MANUFACTURERS ASSOCIATION (AFBMA)

- (A) ANSI/AFBMA STD 4 - Tolerance Definitions and Gaging Practices for Ball and Roller Bearings
- (B) ANSI/AFBMA STD 11 - Load Ratings and Fatigue Life for Roller Bearings
- (C) ANSI/AFBMA STD 19 - Tapered Roller Bearings Radial Inch Design

(Application for copies should be addressed to the American Bearing Manufacturers Association, Inc., 1101 Connecticut Avenue, N.W., Suite 700, Washington, DC 20036.)

#### AMERICAN SOCIETY OF TESTING AND MATERIALS (ASTM)

- A295 - Standard Specification for High-Carbon and Roller Bearing Steel
- A534 - Standard Specification for Carburizing Steels for Anti-Friction Bearings
- A535 - Special Quality Ball and Roller Bearing Steel
- E18 - Standard Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
- E112 - Standard Methods for Determining Average Grain Size

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

### 3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheets.

3.2 Materials. Materials for the bearing component parts shall meet the requirements of 3.2.1 through 3.2.6.

3.2.1 Inner and outer ring material. Bearing rings shall be made of case carburized or through hardened steel produced in accordance with ASTM-A295, A534 or A535. The steel shall show a fine fracture grain size in accordance with ASTM-E112.

3.2.2 Roller material. Rollers shall be made of bearing quality steel produced by the electric furnace process or any other steel making process that produces steel in accordance with ASTM-A295, A534 or A535. The steel shall show a fine fracture grain size in accordance with ASTM-E112.

3.2.3 Cage material. Materials shall be compatible with and shall be resistant to deterioration due to lubricant, preservative, hydraulic fluid, solvents or other substances and chemicals that can be expected to come into contact with the bearing and shall cause no deterioration of the same. Bearings with non-metallic cages shall meet the same inspections and performance requirements as conducted on bearings with metallic cages. Materials shall operate from  $-65^{\circ}$  to  $230^{\circ}\text{F}$ .

3.2.4 Preservative compound. Unless otherwise specified (see 6.2.1), bearings shall be supplied with preservative compound as specified in MIL-P-197.

3.2.5 Recovered materials. The offeror/contractor is encouraged to use recovered materials in accordance with Public Law 94-580 to the maximum extent practicable.

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3.2.6 Hazardous waste. Hazardous wastes shall be disposed of in accordance with current local, state and federal regulations.

3.3 Visual requirements. Bearings furnished under this specification shall conform to the following visual requirements relative to surface quality, marking and workmanship (see 4.4.3).

3.3.1 Surface quality. The surface quality of the bearings shall be such that the manufactured bearing shall be uniform in appearance and free of visible defects (see 4.4.3).

3.3.2 Marking. Each bearing shall be permanently marked with the bearing manufacturer's name or symbol and part number or the complete National Stock Number (NSN) in accordance with MIL-STD-130.

### 3.4 Metrology.

3.4.1 Metrology of assembled bearings. The dimensions of bearings shall conform to tolerance classes as tabulated in accordance with ANSI/AFBMA STD 19. As a minimum, the parameters in the specification sheet tables shall be checked for compliance. Calibration of test equipment required (see 4.5.1).

3.4.1.1 Tolerance class. The tolerance limits for bearings shall conform to tolerance class 4 as tabulated in ANSI/AFBMA STD 19.

3.5 Heat treatment. The heat treatment processes shall be such that the finished rings and rollers meet the requirements as specified in 3.5.1 through 3.5.2.

3.5.1 Hardness of rings. Measured hardness of rings shall be within 58 to 64 HRC as measured in accordance with ASTM-E18. Measured hardness of rings shall not vary more than three points on the Rockwell C scale on any one ring.

3.5.2 Hardness of rollers. Measured hardness of rollers shall be within 58 to 64 HRC as measured in accordance with ASTM-E18. Work hardened rollers are not acceptable.

3.6 General assembly requirements. Unless specified herein, the details of the component parts shall be optional with the contractor. Bearings shall be manufactured using new/unused component parts only.

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3.6.1 Cage. Bearings shall have cages for spacing the rollers in their proper relationship within the bearings. Cages shall be bearing. The cage shall admit the lubricant freely to the raceway and roller surface of the bearing (see 4.4).

3.6.2 Assembly. Bearings shall be assembled correctly utilizing the components and requirements specified herein (see 4.4).

3.7 Dynamic load rating. Dynamic load rating for all bearings covered by this specification shall be in accordance with ANSI/AFBMA STD 11. Bearing performance shall meet or exceed the dynamic load rating tabulated in each individual specification sheet (see 4.3).

3.8 Workmanship. Bearing surfaces shall be free of contamination, foreign particle debris, rust, and dirt. Additionally, all functional surfaces shall be free from mechanical and physical damage which would be detrimental to satisfactory performance of the bearing. Such damage would include but not be limited to tool and grinding marks, scratches, pits, indentations, and cracks visible to the unaided eye (see 4.4.3).

#### 4. QUALITY ASSURANCE PROVISIONS

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

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

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4.1.2 Inspection terms and definitions. Inspection terms and definitions shall be as defined in MIL-STD-109.

4.1.3 Measurement standards calibration. Measurement standards used by the contractor for calibrating measuring and test equipment (M&TE) and other measurement standards shall be traceable and shall have accuracy, stability, range and resolution required for the intended use.

4.1.4 Environmental controls. M&TE and measurement standards shall be calibrated and used in an environment controlled to the extent necessary to assure continued measurements of required accuracy, giving due consideration to temperature, cleanliness, and other controllable factors.

4.1.5 Gaging practices. A standard gaging method must be developed and used by the manufacturer to verify product conformance to the requirements of this specification. The gaging methods shall be acceptable to the authorized government representative. In areas of dispute ANSI/AFBMA Standard 4 shall referee.

4.1.6 Test records. The manufacturer shall maintain a record showing quantitative results of all tests performed to requirements of this specification. The records shall be available to purchaser and shall be signed by an authorized representative of the manufacturer or the testing laboratory as applicable.

4.2 Classification of examinations and tests. The examination and test requirements specified herein are classified as follows:

- (a) Certification of performance (see 4.3)
- (b) Quality conformance inspection (see 4.4)

4.3 Certification of performance. Manufacturer shall certify in writing that bearing performance shall meet or exceed the dynamic load rating listed in specification sheet as calculated in accordance with ANSI/AFBMA STD 11.

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4.4 Quality conformance inspection. Quality conformance inspection shall be conducted at the contractor's facility under the surveillance of the Government quality assurance representative. Quality conformance inspection shall be in accordance with 4.4.1 through 4.6.

4.4.1 Lot. A lot shall consist of assembled bearings of a particular part number assembled at the same time on the same assembly set-up and processed through all final assembly operations as a single group submitted for delivery at the same time.

4.4.2 Sampling for quality conformance inspection. Samples shall be drawn from each lot of bearings and shall to be inspected to evaluate the characteristics specified in Table I . Sampling shall be conducted in accordance with the single sampling plan of MIL-STD-105 using inspection level II and the applicable quality level as specified in Table II.

4.4.3 Visual examination. All sample bearings submitted shall be subjected to visual examination to verify conformance with this specification regarding surface quality, workmanship, and marking. Irregularities may be observed under magnification to establish identification. Defects shall be classified as specified in Table I.



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TABLE I. CLASSIFICATION OF DEFECTS

CATEGORY	DEFECTS	INSPECTION METHOD
CRITICAL:		
1	Bearings are not of the part number specified	Visual
2	Broken or cracked components (see 3.8)	Visual
3	Bearings not assembled or improperly assembled (see 3.6.2)	Visual
4	Bore diameter, inner ring is not within required limits - measured (see 4.5.1)	<u>1/</u>
5	Outside diameter, outer ring is not within required limits - measured (see 4.5.1)	<u>1/</u>
6	Hardness of each roller is not within required limits - measured (see 4.5.3)	<u>1/</u>
7	Hardness of inner ring is not within required limits - measured (see 4.5.3)	<u>1/</u>
8	Hardness of outer ring is not within required limits - measured (see 4.5.3)	<u>1/</u>
MAJOR:		
101	Bearings are not of the material specified. (see 4.4)	<u>1/</u>
102	Individual bearing shows evidence of corrosion (see 3.8)	Visual
103	Individual bearing shows evidence of Contamination (see 3.8)	Visual
104	Width, (individual) inner ring is not within required limits for grade specified - measured (see 3.4.1)	<u>1/</u>
105	Width, (individual) outer ring is not within required limits for grade specified - measured (see 3.4.1)	<u>1/</u>
106	Corners, inner ring, at intersections of bore and side surfaces, are not within required limits - measured (see 3.4.1)	<u>1/</u>
107	Corners, outer ring, at intersections of outside diameter and side surfaces, are not within required limits - measured (see 3.4.1)	<u>1/</u>

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TABLE I. CLASSIFICATION OF DEFECTS

CATEGORY	DEFECTS	INSPECTION METHOD
MAJOR: 108	Cage is not of adequate construction, interferes with rotation of bearing or impedes entrance of lubricant (see 3.6.1)	Visual
109	Bearing is not marked as required (see 3.3.2)	Visual
110	Lubricant or preservative is missing or is not as specified (see 3.2.4)	Visual
111	Packaging is not as specified (see 4.4.4)	Visual
112	Improper disposal of hazardous waste (see 3.2.6)	Visual
MINOR: 201	Radial runout, inner ring is not within required limit for grade specified - measured (see 4.5.1)	<u>1</u> /
202	Radial runout, outer ring is not within required limit for grade specified - measured (see 4.5.1)	<u>1</u> /
203	Surface quality, inner ring is not in accordance with requirements (see 3.3.1)	Visual
204	Surface quality, outer ring is not in accordance with requirements (see 3.3.1)	Visual
205	Surface quality, each roller is not in accordance with requirements (see 3.3.1)	Visual
206	Outside cylinder surface runout with reference side, outer ring is not within required maximum limit - measured (see 4.5.1)	<u>1</u> /
207	Raceway runout with reference side, outer ring, is not within required maximum limit - measured (see 4.5.1)	<u>1</u> /

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4.4.4 Inspection of packaging. The preservation, packing, and marking shall be inspected for compliance with Section 5 of this document, and as specified in the packaging requirements of the solicitation document.

4.5 Test methods. Descriptions of the tests and procedures of analysis for quality conformance shall be as specified in 4.5.1.

4.5.1 Hardness test. The hardness of bearing rings and rollers shall be verified per ASTM-E18. Test shall be carried out prior to bearing assembly.

4.6 Acceptance and rejection for quality conformance inspection. Acceptance or rejection of the lot and parts or assembled bearings procedures of MIL-STD-105 using Inspection Level II and the applicable Acceptance Quality Level (AQL) as specified in table III. Defects shall be classified as listed in table I. Defects observed in each classification shall apply to that classification only for purposes of acceptance or rejection and defects shall be noncumulative, i.e., critical defects shall not be included in the major or minor defect count.

TABLE II. CATEGORIES OF DEFECTS AND AQL'S

DEFECT CATEGORY	AQL (PERCENT DEFECTIVE)
CRITICAL:	0.010
MAJOR	1.0
MINOR	4.0

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## 5. PACKAGING

5.1 Preservation. Preservation shall be in accordance with MIL-P-197, Level A, C or commercial as specified.

5.2 Packing. Packing shall be in accordance with MIL-P-197, Level A, B or commercial as specified.

5.3 Marking. Marking shall be in accordance with MIL-P-197 and MIL-STD-129.

## 6. NOTES

6.1 Intended use. This specification is to be used in the acquisition of tapered roller bearings for general purpose use by the U.S. Government. Roller bearings will be suitable for operating temperature extremes from  $-65^{\circ}\text{F}$  ( $-54^{\circ}\text{C}$ ) to  $230^{\circ}\text{F}$  ( $110^{\circ}\text{C}$ ). The dynamic load carrying capacity of these bearings will be based on the principles presented in ANSI/AFBMA STD 11. This specification covers tapered roller bearings of bore sizes from 0.375 to 12.00 inches. This specification does not cover stainless steel general purpose bearings. This specification does not include all types of general purpose tapered roller bearings, but is intended to cover only those types generally used by the Federal Government.

6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

- (a) Title, number and date of this specification.
- (b) Complete specification sheet part number.
- (c) Cage material (see 3.2.3).
- (d) Lubricant/preservative (see 3.2.4).
- (e) Levels of packaging (see 5.1 and packing 5.2).

6.3 Definitions. Nomenclature and terminology. The nomenclature of the various parts, surfaces and other features of tapered roller bearings shall be as shown in Figure 1.

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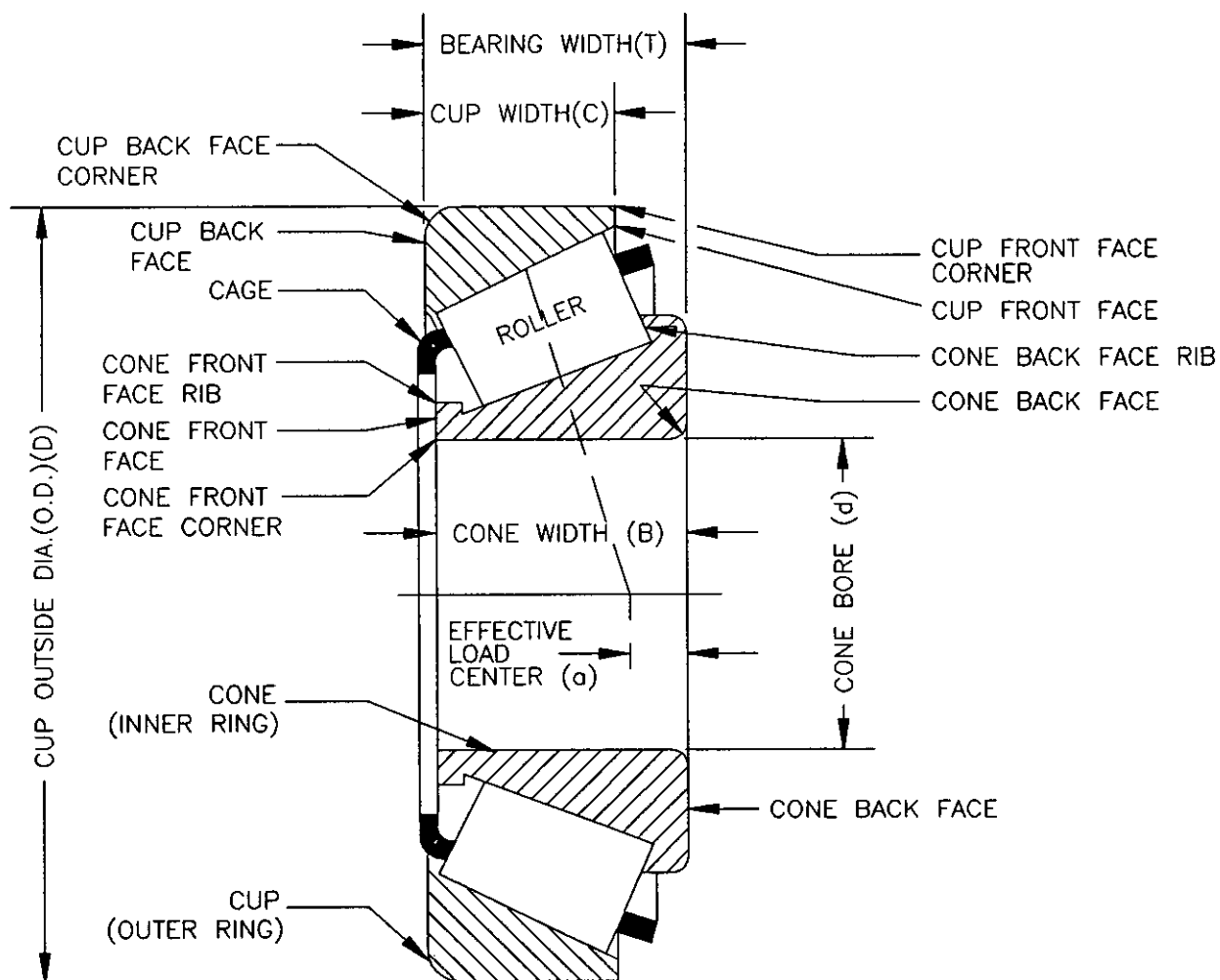


FIGURE 1.

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6.4 Cross reference to FF-B-187A.

CROSS REFERENCE TABLE

FF-B-187A	FF-B-187B	AFBMA TYPE
Type 751	Specification Sheet 1	TS
Type 755	Specification Sheet 2	TSF
Type 753	Specification Sheet 3	TSS
Type 759	Specification Sheet 4	TSSF
Types 757 & 770	Specification Sheet 5	TDI & TDIS
Type 761	Specification Sheet 6	TDO
Type 763	Specification Sheet 7	TDOS
Type 764	Specification Sheet 8	TNA (Normal Angle)
Type 767	Specification Sheet 9	TNAS (Steep Angle)
Type 765	Specification Sheet 10	TNASW
NONE	Specification Sheet 11	TNASWE

## MILITARY INTERESTS

Military Coordinating Activity:  
DLA - IS

Custodian :  
Air Force - 11

Review Activities:  
Army - AR, MI  
Navy - OS  
Air Force - 99

User Activities:  
Army - GL, ME  
Navy - MC, YD

Civil Agency Coordinating  
Activity:

GSA - FSS

Preparing Activity:  
DLA - IS

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