



*Accredited Standards  
Committee B3*

# Load Ratings And Fatigue Life For Ball Bearings ANSI/ABMA 9:1990

**Secretariat**

**American Bearing  
Manufacturers Association**

**ANSI/ABMA 9:1990**

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## Load Ratings and Fatigue Life For Ball Bearings

### 1. INTRODUCTION

#### 1.1 Purpose of Standard

Ball bearing performance is a function of many variables. These include the bearing design, the characteristics of the material from which the bearings are made, the way in which they are manufactured, as well as many variables associated with their application. The only sure way to establish the satisfactory operation of a bearing selected for a specific application is by actual performance in the application. As this is often impractical, another basis is required to estimate the suitability of a particular bearing for a given application. This is the purpose of this standard.

This standard specifies the method of calculating the basic dynamic load rating of rolling bearings within the size ranges shown in the relevant ANSI/ABMA standards, manufactured from contemporary, commonly used, good quality hardened steel in accordance with good manufacturing practice and basically of conventional design as regards the shape of rolling contact surfaces.

This standard also specifies the method of calculating the basic rating life, which is the life associated with 90% reliability, with commonly used material and manufacturing quality, and with conventional operating conditions. In addition, it specifies the method of calculating adjusted rating life, in which various reliabilities, special bearing properties and specific operating conditions are taken into account by means of life adjustment factors.

Furthermore, this standard specifies the method of calculating the basic static load rating and the static equivalent load for ball bearings within the size ranges shown in the relevant ANSI/ABMA Standards, manufactured from good quality hardened steel, in accordance with good manufacturing practice and basically of conventional design as regards the shape of rolling contact surfaces.

#### 1.2 Life Criterion

Even if roller bearings are properly mounted, adequately lubricated, protected from foreign matter, and are not subjected to extreme operating conditions, they can ultimately fatigue. Under ideal conditions, the repeated stresses developed in the contact areas between the ball and the raceways eventually can result in fatigue of the material which manifests itself as spalling of the load carrying surfaces. In most applications the fatigue life is the maximum useful life of a bearing. This fatigue is the

criterion of life used as the basis for the first part of this standard.

Fatigue life calculated in accordance with this standard does not represent the maximum that can be attained by applying all known technology to ball bearing design and application. Neither does it represent the minimum that should be expected of a bearing made by a producer lacking skill and experience in the design and manufacture of ball bearings, even though the bearing meets the geometric parameters given below. The calculated fatigue life represents the performance normally expected from high quality bearings made by reputable manufacturers. Manufacturers can supply longer lived bearings by the application of advanced materials and manufacturing processes. The present standard has evolved as a means for bearing users to specify a reasonable standard of performance for the bearing they wish to purchase.

#### 1.3 Static Load Criterion

A static load is a load acting on a non-rotating bearing. Permanent deformations appear in balls and raceways under a static load of moderate magnitude and increase gradually with increasing load.

It is often impractical to establish whether the deformations appearing in a bearing in a specific application are permissible by testing the bearing in that application. Other methods are therefore required to establish the suitability of the bearing selected.

Experience shows that a total permanent deformation of 0.0001 of the rolling element diameter, at the center of the most heavily loaded ball/raceway contact, can be tolerated in most bearing applications without the subsequent bearing operation being impaired. The basic static load rating is, therefore, given a magnitude such that approximately this deformation occurs when the static equivalent load is equal to the load rating.

Tests indicate that a load of the magnitude in question may be considered to correspond to a calculated contact stress of

4600 MPa (667,000 psi) for self-aligning ball bearings, and

4200 MPa (609,000 psi) for all other ball bearings

at the center of the most heavily loaded rolling element/raceway contact. The formulae and factors for the calculation of the basic static load ratings are based on these contact stresses.