



## Issue 21: Preload

### Preload

During a recent event the topic of preload was brought up. After my discussion it was pretty clear that the topic is confusing. I researched available articles on preload and I concluded that every site and catalog uses the same general confusing engineering terms. In this article I am **not** going to talk about how to apply or set preload. The goal is to explain what preload is.

### Definitions:

Pre-: prior, before, in advance of, etc...

Load: quantity of weight (unit of measure.)

Clearance: distance between two objects (gap.)

Compression: two objects being squeezed together.

### Relationship of Clearance and Preload:

The best way to explain preload is to look at the interaction between rolling elements (balls, rollers) and the raceway surfaces. In a clearance situation you have a gap or space between the rolling elements and raceway surface. This clearance can be either radial or axial, shown below in figure 1.

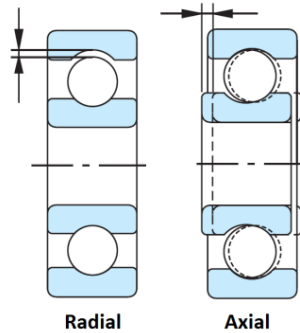


Figure 1: Internal Clearance

In a preload situation the clearance is reduced to zero and the rolling elements become pressed or compressed into raceway surfaces, see figure 2.

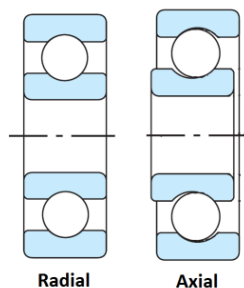


Figure 2: Zero Clearance

### Purpose of Preload:

Axial preload is common in angular contact ball bearings (ACBB) and tapered roller bearings (TRB.) Below are some typical reasons for using a preloaded bearing:

- Reduce running noise/vibration
- Improve running accuracy
- Enhance bearing stiffness
- Reduce bearing slippage/smearing

### Preload and Bearing Life:

Most bearings operate with an amount of clearance. In theory the maximum bearing life is slightly longer in a preloaded condition. The reason clearance is employed is due to the difficulty in setting negative clearance (preload) without adversely effecting bearing life. Too much preload may result in less bearing life.

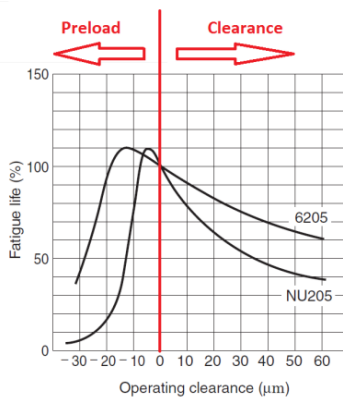


Figure 3: Preload Chart

### Bud's Definition of Preload:

I danced around with engineering terms without providing a definition of preload. *Preload is compression (load) between rolling elements and raceway surfaces that are generated by fitting (including springs, washers, and fitting practice), internal geometry, and heat prior to additional loading applied by any outside source.*

### Conclusion:

Preload can be positive or negative. Preload can be intentional for best operation. Preload can be part of a failure mechanism such as radial preloading. The goal of this article was to gain understanding that preload is self-imposed compression between rolling elements and the raceway surface.



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