Issue 1: Bud's Take on Precision and Clearance

Bearing nomenclature can be tricky at times and cause communication error leading to incorrect quotes and the possibility of shipping the wrong product. This type of error can cost in both dollars and extended down time. At Midpoint Bearing we train our customer service and sales force to go beyond the nomenclature.

One of the most confusing relationships is between precision and clearance. Some quick definitions are necessary to best explain:

Tolerance: The permissible range of variation in a dimension of an object.

Precision: The quality of accuracy, exactness or correctness.

Clearance: The distance between two objects.

The best way to explain is to use an example; I'll use a 6210 with a bore of 50 mm (1.9685 in) and outside diameter (OD) of 90 mm (3.5433 in.)

Based on the application a precision grade is specified during the design stage, in most applications ABEC1 is acceptable. An ABEC1 bearing specific dimension could fall within ABEC7 tolerance, but unless all dimensions meet the ABEC7 criteria the bearing is labeled ABEC1. For example, on our 6210 if the bore measures 1.9684 mm and the OD measures 3.5427 mm, although the bore is ABEC7 the bearing is an ABEC1, see chart 1.

Dimensions in inches					
6210 bearing		ABEC1 (P0)	ABEC3 (P6)	ABEC5 (P5)	ABEC7 (P4)
Bore	1.9685	1.9679 - 1.9685	1.9680 - 1.9685	1.9682 - 1.9685	1.9683 - 1.9685
Outside Diameter	3.5433	3.5427 - 3.5433	3.5428 - 3.5433	3.5429 - 3.5433	3.5430 - 3.5433

Chart 1: Tolerances shown in actual numbers

Manufacturing today so advanced that many manufactures claim that they manufacture all bearings at an ABEC3 precision, but they do not verify, so the bearing remain ABEC1. The measuring process to verify high precision dimensions is time consuming and can be very difficult, so it is only completed when necessary.

Looking at numbers in a chart can be confusing, so I tried to give a visual representative using a half-bell curve, see chart 2. Not a 100% accurate, but the visual representation is correct; all ABEC7 numbers would fall into an ABEC1 range, but not the reverse.

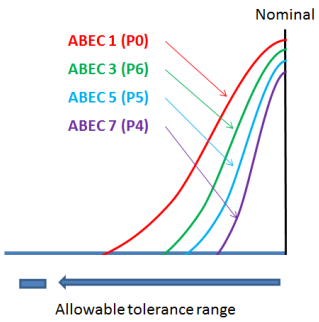

Chart 2: Example of tolerance

Now you may be asking how does clearance fit into all this. In actuality, clearance is independent of tolerance. A Bearing's radial internal clearance is the amount of clearance measured radially between rolling elements and the raceway, see figure 1.

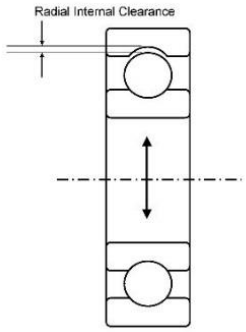

Figure 1: Radial Internal Clearance

When speaking with customers the confusion comes when any other than C3 clearance is necessary. The measurement of the gap has is its own tolerance that can be express linearly, see chart 3.

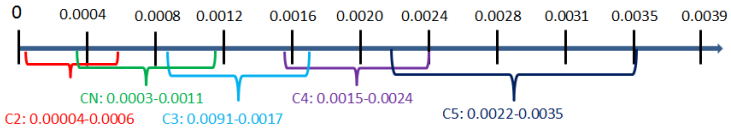

Chart 3: Radial Internal Clearance of 6210 expressed in inches

Based on your application you may need to change your clearance, for example in a high heat application you may need a larger clearance of C4 or C5, but in a spindle application you might need tighter clearance such as C2 or CN (sometimes referred to as C0.)

In nomenclature, precision and clearance are called out independently. See examples below:

Koyo 6210ZZC3P5GXM; C3 and ABEC5, Koyo 6210ZZC3GXM; C3 and ABEC1, FAG 6210-2Z-P4-C3; C3 and ABEC7 FAG 6210-2Z-C3; C3 and ABEC1.

Conclusion:

In the end, both precision and clearance are critical to bearing performance, at Midpoint we want to insure you are installing the correct bearing for your application. If any questions arise please call your Midpoint representative and we'll be happy to help.

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