# Issue 12: Bud's Take on How to Justify the Cost of Ceramic Ball Bearings

Over the years one of the most difficult tasks is to convince a customer that using a ceramic ball bearing is a cost effective solution to a problem. The customer sees the high price tag for the components and asks the obvious question, "How much longer is the life of the ceramic ball bearing?"

**By the Book**

By the book the theoretical life of a ceramic ball bearing and a steel ball bearing are equal. The basic life or L10 equation uses the basic dynamic load ratings to determine bearing life. In some cases manufacturers manipulate the numbers to show life exceeding L10, a topic for another day.

$$L_{10} = \frac{10^6}{60 * n}\left(\frac{C}{P}\right)^p$$

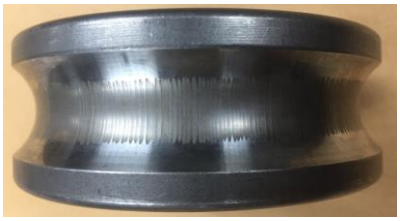
**Equation 1: Basic L10 Life Equation**

L10 = basic rating life P = dynamic equivalent load C = basic dynamic load rating n = rotational speed (rpm)
p = constant: ball bearing 3, roller bearing 10/3

The ceramic ball and steel ball bearing have same basic dynamic load ratings, so when the other inputs are the same the result will be identical.

**Nuts and Bolts**

You have a motor in the shop that has two 6213ZZC3 bearings. Your inspection finds the bearings failed due to electrical current discharge (fluting, pitting.) Based on the data plate you determine it is running 1800 rpm and you estimate the max load per bearing would be 750 lbs radial load and negligible thrust (axial) load. A simple L10 calculation results in 44,089 hrs (5+ years.)



**Picture 1: Electrical Discharge Damage (Fluting)**

You put together two quote packages for the repair. The first one you simply replace the bearings costing $75 each, $150 for the set.

On your second quote you address the electrical discharge damage, bearing cost approximately $750 each, $1,500 for the set. You add the appropriate AEGIS grounding ring and strap for an additional $500.

**Food for Thought**

Many have questioned how much current is too much? Extremely difficult question, and in my opinion this is similar to walking a tightrope. Even low current could cause a short coming, once damage is present it only cascades and causes further damage.

Then you question how much damage is too much damage? Another dangerous path.

With today's sensitive monitoring equipment, at what level do you shut down the system?

**The Breakdown**

On the surface, cost difference appears to be hefty: Bearing cost $150 to $1,500 plus the additional components approximately another $500. We would never suggest using a ceramic unless it was necessary, in this case electrical discharge damage was discovered. Although bearing life is equal, the steel ball may not reach bearing life. We have seen electrical discharge damage occur in a matter of minutes or prolonged over a period of months.

So let's play with some numbers, let's say the customer goes the steel ball path and the motor fails 2 time in a year (initial and 2 rebuilds.)

Bearing cost: $150 x 3 = $450

Shop rate: $75 x 3 = $225

Shipping cost: $50 x 3 = $150

Buyer's time: $50 x 3 = $150

Accounting time: $50 x 3 = $150

Install: $75 x 3 = $225

Uninstall: $75 x 3 = $225

Lost production cost: varies

Cost of an unhappy customer: unlimited

**Added Benefits**

Since we are on the topic of ceramic ball bearings we should point out a few of the additional benefits. Ceramic is approximately 60% lighter than steel, allowing for up to 50% higher speeds. In relation to this lower mass, we also see a lower temperature rise at higher speeds. Ceramic is also non-conductive, which along with the lower temperature rise improves grease life. A few other features include higher rigidity, longer seizure life.

In my opinion the biggest benefit is the fact that no special modification is required, drop in fix.

**Unknown True Cost**

I didn't use true bearing cost, but we have found that in most cases ceramic ball bearings are about 10 times the cost of a steel ball bearing. Other viable options are coated bearings, although they can be limited by size.

I don't run a motor shop, but just playing with the numbers I believe one or two premature failures would be enough to justify the cost. My numbers are only focusing on the first year. L10 was 5 years on my example, which means the bearings could exceed 5 years.

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