How do we calculate bearing life?

Once you know the bearing you are interested in and its Basic Dynamic Load Rating, you still need to know the speed and load to be applied to the bearing. Although bearing life is affected by numerous application factors, the following formula can be used to calculate L_{10} bearing life in hours.

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$$L_{10h} = a_1 \bullet a_2 \bullet a_3 \bullet \frac{16{,}667}{n}\left(\frac{C}{P}\right)^p$$

where:

L_{10h} = Basic rated life, hours
a_1 = Life adjustment factor for reliability (for L_{10}, a_1 = 1)
a_2 = Life adjustment factor for material (typically a_2 = 1)
a_3 = Life adjustment factor for operating conditions (for good lubrication conditions, a_3 = 1)
n = Rotational speed, RPM
C = Basic Dynamic Load Rating
P = Equivalent dynamic load
p = 3 for ball bearings, $\frac{10}{3}$ for roller bearings

Several manufacturers have special life adjustments and variations in their life calculations based on their research of special manufacturing, material and lubrication factors.