Welcome back to Power Transmission Engineering's Ask the Expert—a new, continuing reader resource for design engineers, component specifiers, systems integrators, quality assurance, maintenance personnel and more. Each issue, our esteemed industry experts will address the every-day—and the more complex—making-things-move challenges that never cease to materialize—from drafting table to factory floor. Have a question? Simply e-mail your question with your name, job title and company name to: Jack McGuinn at: *jmcguinn@powertransmission.com.*

Or, submit your question by visiting us at *www.powertransmission.com.*

THE QUESTION

How can I calculate the diameter of the inner race in bearings?

The inner race diameter for a rolling element bearing is a design parameter, and it is chosen by the bearing producer based on various criteria such as rolling element distance, number and diameter of rolling elements, and what interference fit is supposed to be used for a given bearing type. Different (manufacturers) have different ways and targets when optimizing bearing performance, and hence there is no common way to calculate the diameter the inner race for a given, existing bearing.

Without knowing the need for the inner race diameter, a potential use of that measure is to calculate the frequencies related to the different contacts between rolling elements and raceways, as well as the rotational frequency of the cage with rolling element set. These basic frequencies are typically used when analyzing vibration measurements of machines as a way to trace bearings that become damaged. Since the calculation of these basic frequencies requires the actual pitch and rolling element diameters—as well as the actual contact angle for a given bearing—the internet homepages of the larger bearing producers usually provide help. One example is the SKF bearing frequencies calculator, available online or as freeware via *iTunes*.

The frequencies delivered by such "bearing frequency calculators" are based on basic formulae where the bearing-specific pitch and rolling element diameters are used. By tradition, the four frequencies are often called: "BPFO" (ball pass frequency–outer ring); "BPFI" (ball pass frequency–inner ring); "BSF" (ball spin frequency), referring to the ball. The formulae are, however, valid for roller bearings as well, so the term rolling element diameter is more (precise). The fourth frequency derived from the same data is the "FTF" (fundamental train frequency), which is the rotational frequency for the cage with rolling elements.

With a given and disassembled bearing available, the rolling element and the inner race diameters are, typically, relatively easy to measure; the pitch diameter is then the sum of the inner race diameter and one rolling element diameter. If the bearing has a contact angle, however, this is more difficult to measure—in particular for bearings with curved raceways; e.g.—angular contact ball bearings.

Regards,

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