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BEARING JOURNAL

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Determining the bore of tilting pad journal bearings

Babbitted journal bearings come in two basic designs: sleeve and tilting pad. Sleeve bearings have a fixed geometry (no moving parts) so the bore can usually be measured directly. Tilting pad bearings have babbitted pads (or shoes) which can tilt to accommodate the oil film. Because these pads can tilt, determining their bore is a complicated process. There are two major subcategories of tilt pad bearings: rocker back and spherically seated (ball & socket). These procedures apply to bearings with bores up to 10 inches.

Rocker back bearings

The pads in this bearing have a pivot on their backside. This pivot can be a radius, a rib, a hardened button, or some other pivoting mechanism, hence the term rocker back. These pads are assembled into the outer shell, which has a tightly toleranced bore where the pivots act. The procedure to determine the bearing bore is as follows:

"The most critical aspect of journal bearing operation is the proper clearance bore over the journal"

1. Measure the inside diameter (ID) of the outer shell.
2. Measure the individual pad thicknesses (they should all be within .0005" of each other).
3. Average the pad thickness and multiply this average by two.
4. Subtract this from the shell ID to determine the bearing bore.

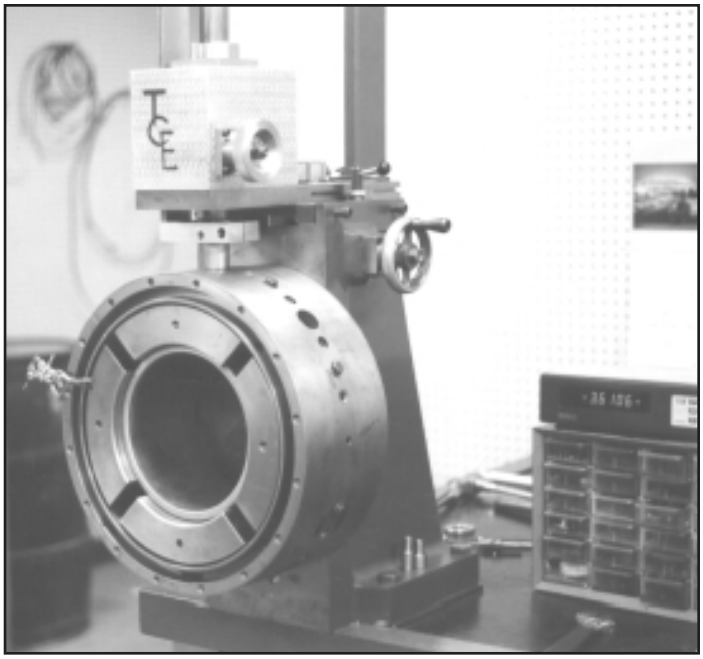
The bore of the outer shell can be measured with an inside micrometer (mic). Measuring the pad thickness (or stack) is a little trickier. The easiest way is to use a ball or tubing mic and carefully measure the pad thickness; it is important that the pad is measured at its thickest location. Another method is to use a shaft sized mandrel, put the pad on top of the mandrel and measure the distance from the top of the mandrel to the back of the pads.

There are some rocker back bearing designs that can not easily be measured this way, but a modified procedure or the "bump check" method can be used.

Bump check: Another way to measure the bore is to assemble the bearing around a vertical shaft sized mandrel and "bump" the bearing through its clearance (*Fig. 1*). By bumping from on pad to between pads (in a bearing with an odd number of pads) the bearing is not only going through the clearance but also outside of it (when between pads). The procedure here is as follows:

1. Measure the mandrel.
2. Assemble the bearing around the mandrel.
3. Locate an indicator reading outer shell movement at the first pad location.
4. Zero the indicator with that bearing pad hard against the mandrel.
5. Push (or pull) the bearing through the clearance. Note that if going between pads the indicator will read greater than the bearing clearance. This reading needs to be multiplied by a "bump" factor (.8944 for 5 pad bearings).
6. Repeat for the other pads and average, add to the mandrel size to determine the true bore.

Note that although you need to re-zero the indicator at each pad location, the difference between all pad locations should be no more than .0005". Also note that any out of roundness of the bearing shell can cause some readings to be out of spec, but the averaged clearance should be in spec.



TCE's bearing set machine (FIGURE 2, above) with nine-inch bore, four-pad bearing installed. Note digital readout on the right. Figure 1 (below) shows the setup for the bump check method.

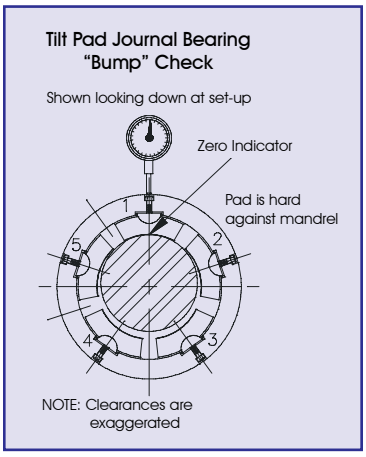


FIGURE 1

Ball and Socket Bearings

Again, the bump check method can be used to measure the bores of these bearings. Using radial measurements, however, is more accurate. At TCE, we use a set machine (*Fig. 2*) to obtain radial measurements. The set machine uses a horizontal mandrel to hang the bearing and a digital scale to measure the distance between the mandrel and the bearing OD. The procedure is

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Bore

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roughly as follows:

1. Measure the bearing shell outside diameter (OD).
2. Install the mandrel on the set machine.
3. Zero the scale at the mandrel.
4. Load the bearing onto the mandrel.
5. Record at each pad location the distance from the mandrel to the bearing OD (all readings should be within .0005 of each other).
6. Average these readings, multiply by two, and subtract from the shell OD. This is the bearing bore.

This procedure can also be used with rocker back bearings. At TCE we use two independent methods that measure the set bore of tilting pad journal bearings: the bump check and the set machine.

We hope this quick coverage will help with your understanding of measuring tilt pad journal bearing bores. If you are interested in a more in-depth discussion on this particular topic please let us know; we may want to write up a more detailed procedure with photographs and illustrations.

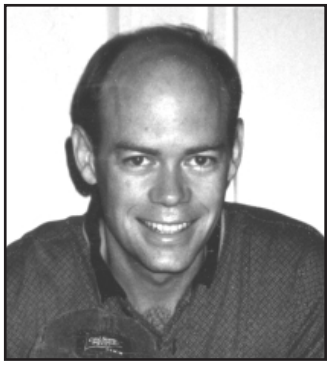
Make sure your babbitted bearings function properly

Our featured paper this quarter is *Babbitted Bearings: Instrumentation, Inspection, and Installation*. The paper starts with an introduction to different types of babbitted bearings such as sleeve bearings, then progresses through pressure dam bearings, other geometry sleeve bearings, and tilt pad journal bearings. Thrust bearings are then presented and include flat plate designs, taper land, tilt pad and the fully equalized style. Topics covered include critical areas to be aware of, design "rules of thumb," and installation concerns. The paper has over twenty figures including such things as lift check multipliers, how to perform a "bump" check, how to do a crush check for journal bearing fit, and field lift check procedures. Also included are drawings of different kinds of babbitted bearings, how to check and adjust rotor position and float on thrust bearings, and proper locations to install RTD's or thermocouples. Send us an E-mail or give us a call if you would like a copy of this paper.

Recent Orders of Note:

1. Designed, manufactured and delivered six upgraded "inactive" thrust bearings for GE Frame 5 gas turbine engines.
2. Delivered spare Torlon seals for five centrifugal compressors in an ethylene plant.
3. Refurbished all bearings for two GE Frame 7 turbine generator sets and two Westinghouse 501 turbine generator sets.
4. Shipped a "bearing set machine" to a customer who wants to check bearings as described in this issue's feature article.
5. Worked with Kaydon on rebuilding four Kaydon seal assemblies for two ammonia compressors.

Meet the TCE team



Clark Maloney

In the first issues of *Bearing Journal*, we introduced you to John, Larry, and a couple of new employees. Now, every quarter, we will acquaint you with another member of the team. We will begin with Clark Maloney. Clark joined us in July of 1992 and works in outside sales and service. He graduated from Texas A&M University in 1989. His territory covers parts of Texas, the Mid-West, Louisiana, Canada, the Caribbean, and accounts in several other states. Since joining TCE, Clark has been involved in many complete bearing and seal rerates on compressors, steam and gas turbines, and pumps. His product knowledge, attention to detail and ability to interface with others at all levels makes Clark a real asset to TCE. Outside of work, Clark has been busy this year with his first child, Adam, who was born in January. In addition to keeping up with his new little one, Clark enjoys hunting, fishing, snowskiing, and working on his hotrod.

Happy Holidays

As we approach the holiday season and the end of this century, TCE would like to thank all our valued customers and vendors we have had the privilege of working with since our inception in 1991. The next century will surely produce even greater challenges for our customers and, in turn, for TCE and our vendors. Everyone at TCE wishes all our customers and vendors the very best of the coming holiday season.

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