

Stumped? Stymied? Short-Circuited?

Ask the Expert!

Welcome 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 and troublesome—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 (if you wish to remain anonymous, no problem) to: Jack McGuinn at: jmcguinn@powertransmission.com.

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

You'll be glad you did!

QUESTION

Regarding bearings for a gearbox—between a gas turbine—13 MW@8,000 rpm—and a centrifugal compressor—11 MW@12,000 rpm: Can we use sleeve bearings instead of tilting pad bearings for radial bearings?

Rosli Abu Bakar, mechanical engineer
Worley Parsons

EXPERT NO. 1

The answer is that every application needs to be separately analyzed. In real machinery, steady-state conditions do not exist. There is relative motion between the fluid film bearing and the shaft as in starting, in stopping or changing the bearing load suddenly. Changes in bearing loads may result from meshing gears, engaging clutches, etc., or may be periodic as in reciprocating machinery. In addition, rotating loads superimposed on unidirectional loads result from shaft unbalance. The other issue is that whirl of the shaft can result in half-frequency whirl and loss of the hydrodynamic film thickness separating the shaft from the bearing and failure of the operating system.

My guess is that the original design using the tilting pad bearing was based on inhibiting whirl in the bearing system as a real or anticipated problem. My recommendation is if the system is working and not causing a problem by using the tilting pad bearing, continue to use it. However, if a straight sleeve bearing is to be substituted in the application, the entire system needs to be analyzed including a heat balance if the bearing behavior is to be predicted with any accuracy. In summary, you cannot substitute one bearing type for another without performing an engineering design analysis and parametrically testing the new design.

Bottom line: *Don't fix it if it is not broke.*"

Erv Zaretsky



The Kingsbury EQH equalizing thrust bearing is the product of many years of design refinement and application experience. Based on Albert Kingsbury's original hydrodynamic bearing design, this example is just one of many tilting-pad thrust bearings manufactured by Kingsbury.

Erwin V. Zaretsky, noted lecturer, writer and consultant to both government and industry, has over 45 years of experience in mechanical engineering related to rotating machinery and tribology. He has conducted pioneering research in rolling element fatigue, lubrication and probabilistic life prediction, with that work resulting in the first successful three million DN bearing and four IR-100 awards. Zaretsky, now retired from his position as chief engineer for materials and structures at Cleveland-based NASA Glenn Research Center, previously served as head of the NASA Bearing, Gearing and Transmission Section, with responsibility for most of the NASA mechanical component research for air-breathing engines and helicopter transmissions. Zaretsky has penned scores of technical papers and books, and has lectured extensively around the world.



EXPERT NO. 2

Yes, it is possible to use sleeve bearings for this. Bearing selection for an application such as this—or any other—depends on a number of factors and desired performance results. Some of those include:

- Rotor-dynamic performance and stability
- Pad temperature limits
- Misalignment capabilities and requirements
- Overall safety margin

Tilting pad bearings generally outperform sleeve bearings in all of these categories, but are more expensive, larger in size, and may require more oil flow. A bearing expert can determine which bearing is most suitable, based on the requirements of the application.

Joseph Wilkes,
vice-president engineering
Kingsbury, Inc.

Joseph J. Wilkes, Kingsbury vice president of engineering, is currently responsible for overseeing all aspects of the engineering department, including bearing design, analysis, troubleshooting, research and development, and testing. Wilkes has traveled around the world to give technical presentations and troubleshoot bearing problems. Prior to the 20 years he has worked at Kingsbury, Wilkes worked 10 years for Philadelphia Gear Corp., progressing to the position of manager of high-speed engineering.



CALLING ALL EXPERTS

If you have expertise in a power transmission related field, and you are interested in participating in this column, we would welcome your contribution. Just send a note to Jack McGuinn, senior editor (jmcguinn@powertransmission.com), outlining the subjects you'd feel comfortable covering. We'll send you some questions!

HIGH PRECISION



DELTA GEAR



DELTA INSPECTION



DELTA RESEARCH



Aerospace Precision

As an AS 9100 & ISO 9001 Registered Company, Delta Gear provides aircraft quality gears and machined components at automotive prices. Since 1964, Delta Gear (formerly Tifco Gage & Gear) has been producing precision parallel-axis gears. It is our continued passion to expand our capabilities in high precision gears, machined components, assemblies and inspection – giving you the highest quality, convenience and on-time delivery.

Inspection & Testing

Our newest addition to the Delta Family of Companies is Delta Inspection. Inspired on the understanding that the industry needs expert abilities for contract gear inspection services, Delta Inspection has been introduced to meet your gear inspection and testing needs. Our abilities range from gear inspection up to 39 inches (1 meter) to prismatic inspection of machined components, roundness, laser guided concentricity analysis, surface testing, material testing, Nadcap certified magnetic particle inspection, nital etch and much more.

Automotive Quality & Speed

Delta Research is a world class provider of CNC 3-Axis, 4-Axis and 5-Axis precision machining, jig grinding, cylindrical grinding, precision gears and complete assemblies for automotive, aerospace and industrial applications. From complete automotive prototype transmissions or components, to defense, to aerospace machining and assembly, you will be impressed by our capabilities and commitment to quality.



Delta Family Of Companies

1-734-261-6400 | 1-734-261-0909 Fax | ISO 9001 & AS 9100 Registered

www.delta-gear.com www.deltainspection.co www.deltaresearch.com