



Thrust Bearings

Vertical or Horizontal Orientation

Upgrades ♦ Retro-fit ♦ Site Service ♦ Repairs

Applications

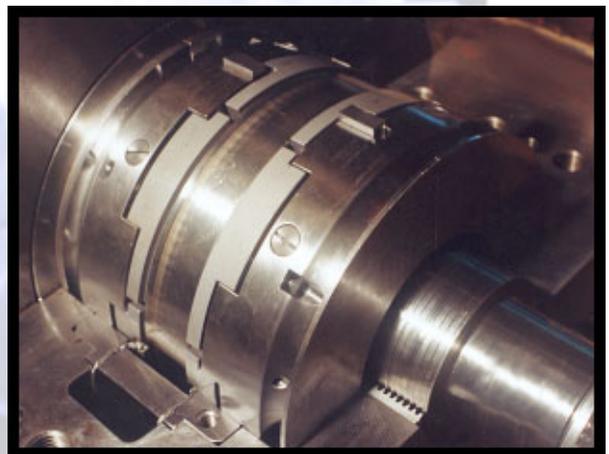
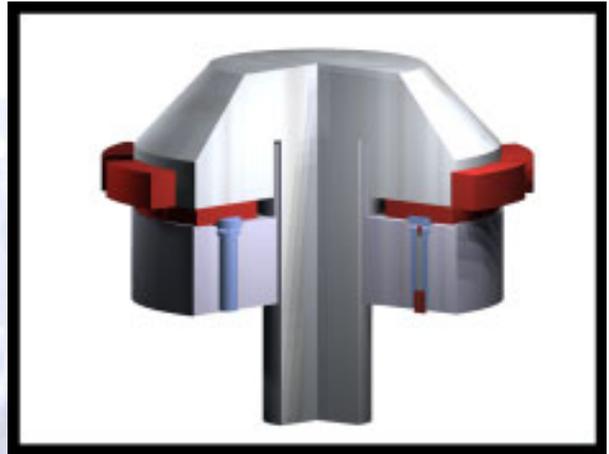
*Hydro
Steam
Gas
Other*

Upgrades

*New or retro-fit
Increased load capabilities
Improved load sharing
Fully equalizing
Circulating oil systems: pumps, coolers, filters
HP lift oil systems: pumps and grooving*

Site Service & Repairs

*Problem identification and resolution
Rebabbit/Replace shoes
On-site resurfacing
Repair, replace or adjust shoe support and
pivot structures
Recondition radial guide bearings
Balance difficult cases, including dual rotation*



TRI Catalog: Model TVH Bearings

**TRI Transmission
& Bearing Corp.**

A Division of Turbo Research, Inc.

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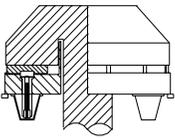
Thrust Bearings & Radial Bearings

for large vertical hydro turbine-generators

New Applications and Retro-fit: Westinghouse, A-C, GE, Hitachi and others

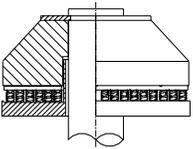
For Maximum Performance and Minimum Maintenance **Common bearing designs, features and characteristics**

Westinghouse Design: *Non-equalizing, adjustable, torque tube or load cell type.*



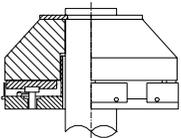
Each shoe rests on a high vertical stack of components that gall and wear. This design requires a very careful stack-up and alignment. It is easy to overload the individual components during assembly and alignment. High pressure oil modifications will help the assembly and maintenance problems, as well as extend the life of the bearing.

GE Spring-bed Design: *Partially equalizing via compliance.*



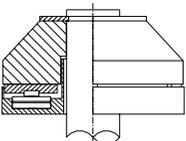
This design features a single babbitted plate, or individual shoes supported by a multitude of springs. The springs are known to break, fatigue, or relax over the life of the bearing yielding uneven loading. Occasionally the thrust runner is slotted on this type of bearing leading to babbitt fatigue from the pressure oscillations when the slots pass over the load carrying portions of the bearings. This type of bearing has proven itself problematic when re-building following inspections or generator upgrades. High pressure oil modifications can help some, but not all of these designs.

Early Kingsbury Design & Variations: *Individual shoes, non-equalizing.*



Each shoe is supported by its own adjusting screw, by individual pairs of tapered wedges, or in rare cases, is non adjustable. Slugged arc, or equivalent methods must be used to equalize loading, making assembly and adjustment time consuming. Shifting of the concrete foundations and sagging of bearing brackets require re-adjustment of the bearing. High pressure oil modifications and the addition of load cells will help with assembly and maintenance, as well as extend the bearing life.

Perferred Design:



Fully dynamic equalizing thrust bearing & preloaded radial guide bearing.

TRI can convert almost every hydro bearing to this design. During installation, no time is required to equalize loading. Lift oil is preferred for easy starting and for hot starts.

Repairs and Site Service

for large vertical hydro turbine-generators

Westinghouse, A-C, General Electric, Hitachi and others

*Why did
it happen?*



*What should be
done to prevent
it from happening
again?*

TRI experts work with owners, operators and maintenance personnel to identify “root causes” of rotor vibration and bearing damage problems. A comprehensive plan of short term and long term solutions to repair and upgrade required elements are implemented. TRI works from the initial analysis stage to redesign, manufacture and supply, through start-up.

- ◆ **Rebabbitt, recondition and replace existing thrust shoes and guide bearings**
- ◆ **Resurface thrust bearings to mate with thrust runners in shop or at site.**
- ◆ **Replace, recondition shoe support structure with improved design or materials.**
- ◆ **Repair, runners or replace them with upgraded materials, fasteners and designs.**
- ◆ **Design and install circulating lube oil systems: pumps, coolers, filters, controls**
- ◆ **Redesign radial guide bearings, including tilting shoe design with “preload” to minimize vibration, pivot wear and wear of babbitted surfaces.**
- ◆ **Design and install high pressure lift oil systems: pumps, lifting pockets, grooving**
- ◆ **Install instrumentation for temperature sensing of bearing metal and lube oil**
- ◆ **Install vibration and rotor position instrumentation.**

Circulating Oil Systems and HP Lift Oil Systems for Thrust Bearings

for large vertical hydro turbine-generators

Westinghouse, A-C, General Electric, Hitachi and others

TRI offers expert services for designing or upgrading oil systems. After an inspection and review of existing oil systems, TRI will make upgrade recommendations or work with you to design and install a new system.



Cooling Oil Systems

Circulating lube oil systems improve the cooling of shoes and runner to minimize crowning.

- ◆ Pumps: AC and DC emergency
- ◆ Coolers: oil to water, oil to air
- ◆ Filters: single element or duplex
- ◆ Reservoirs and piping as required

HP Lift Oil Systems

The use of high pressure lift oil aids a properly designed thrust shoe lift oil pocket, separating the bearing surfaces during start-up or shut-down.

- ◆ Easier starting
- ◆ Reduced torque
- ◆ Minimizes wiping of babbitt

TRI High Speed Journal Bearings

TRI manufactures a complete line of fixed bore and tilting pad journal bearings for high speed rotating machinery (to 24" journal diameter at 3600 rpm). Contact TRI Transmission & Bearing Corp. to receive the Align-A-Pad® Bearing catalog and other detail specifications.