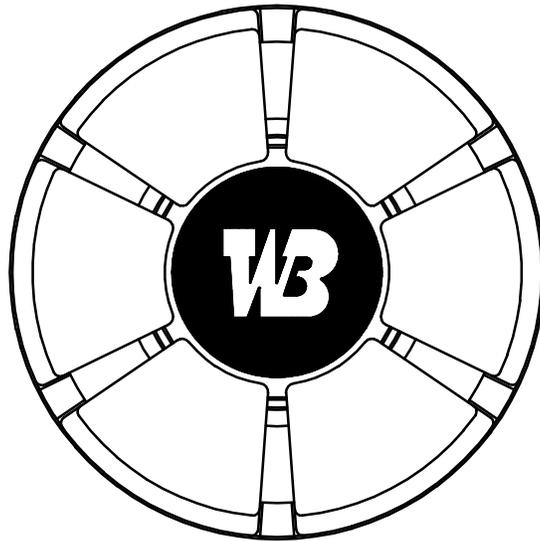


INSTRUCTIONS
FOR
INSTALLING & OPERATING
HORIZONTAL TYPE SELF EQUALIZING
TILTING PAD THRUST BEARINGS
WITH FORCED LUBRICATION



WAUKESHA BEARINGS CORPORATION

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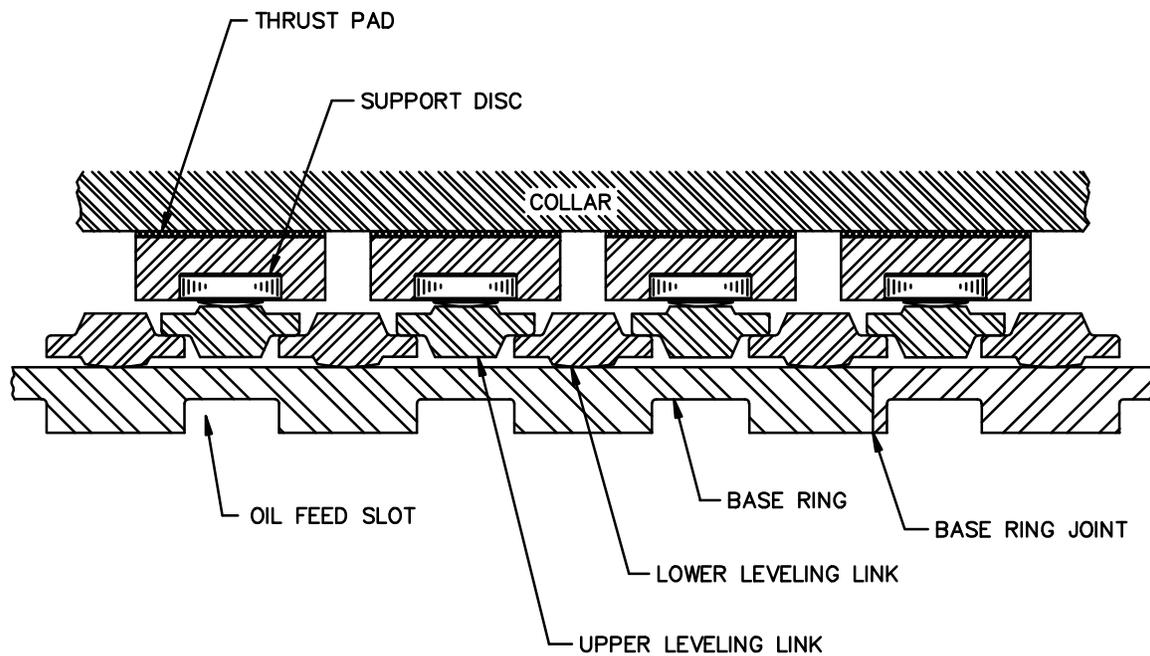
I. GENERAL DESCRIPTION

This is a tilting pad type thrust bearing consisting of a number of load carrying thrust pads retained within a base ring and incorporating a means of load equalization among the thrust pads. The bearing is designed to transmit rotor axial thrust from a collar (either integral to the rotor shaft or a separate piece secured to the shaft) to the machine stator. At the interface of rotating collar and stationary thrust pads, the thrust load is carried by and transmitted through a hydrodynamic oil film, thus avoiding solid rubbing contact and providing for extended bearing life.

The thrust load may be in either direction in which case a double (e.g. 6 x 6) bearing is used. Even with no thrust load in one direction a double bearing is common on horizontal shaft machines to maintain rotor position.

The number of thrust pads used is commonly six but may be most any number from two up. For two pad bearings equalization of load is obtained simply by pivoting the supporting base ring on a central rocker, thus achieving a "teeter-totter" effect. For three pad bearings a spherical seat finds some use for limited equalization. For four or more pads the "equalizing link" arrangement is common. Here, each thrust pad rests on an "upper leveling link." These upper leveling links are positioned between and bear upon "lower leveling links," which in turn transmit the thrust load to the base ring. The leveling links are each individual levers, which, acting together in their circular arrangement, result in the transmitted thrust load being equally shared by all the pads.

This arrangement of parts and their interaction can be visualized in the diagram below.



DEVELOPED VIEW OF SELF EQUALIZING TYPE
TILTING PAD THRUST BEARING

II. DETAILED DESCRIPTION

The thrust pads are assemblies of a sector shaped steel backing, a tin base babbitt facing and a hardened steel support disc. For some applications the steel backing is replaced by a high strength copper material. And some applications use pads in which the backing and the facing are replaced by bearing aluminum.

The support discs incorporate a spherical surface at the point of contact with its supporting piece, commonly the upper link. This spherical surface, bearing on a flat surface, provides the freedom for the pad to tilt and form the carrying hydrodynamic oil film wedge between the pad and the thrust collar.

The thrust pads are positioned by the base ring and are retained radially either by the bore of the bearing housing into which the complete bearing is assembled; or, in some designs, by the base ring itself. In the former arrangement, pad clips are sometimes used simply to retain the pads during handling and installation of the bearing assembly.

The leveling links are positioned within the base ring as shown in the above drawing and are retained either by screws or dowel.

The base ring is commonly split to permit the assembly of the bearing radially around a shaft. Where assembly can be made axially over the end of the shaft, a solid base ring may be used.

Each base ring is provided with an anti-rotation device, commonly a key secured in a keyway on the OD (outside diameter) of the base ring. Alternately, this may be a dowel pin either on the OD or back face of the base ring. Whatever is used, it must be accommodated by a corresponding cavity in the bearing housing.

Lubricating and cooling oil of the proper viscosity, inlet temperature and flow rate is to be supplied to the annular groove at the OD of the base ring, axially opposite the thrust pads. From here the oil flows radially inward through slots or holes in the base ring, then axially towards the collar either through holes in the base ring or through clearance space between the base ring and the shaft. At the collar this oil flows circumferentially with the rotation and radially outward between the thrust pads where it is available for generation of the hydrodynamic oil film between each pad and the collar. At the collar OD the oil is discharged into the surrounding housing.

This surrounding housing normally uses a top oil discharge to insure that the bearing is flooded at startup. For high speed bearings this top discharge is commonly tangential to aid in efficient removal of the oil once it has passed through the bearing. For low speed bearings a radial discharge is satisfactory.

III. INSTALLATION

These bearings are processed with a rust inhibitor and preservative prior to shipment from the factory. The thrust pads are dip coated with a protective plastic compound which protects against both mechanical and corrosive damage. These protective coatings should not be removed until installation.

At that time, the bearing should be disassembled and all parts thoroughly cleaned with a lint-free cloth and a solvent such as acetone or mineral spirits.

IMPORTANT

Cleanliness and burr-free surfaces are vital to the proper performance of the bearing. Remove any burrs or raised edges on the pad faces with a scraper. Remove any light burrs or fine rust on the collar with a fine oil stone. Deep rust or bruising will require refinishing.

On reassembly, oil all parts to protect against corrosion. Check that the leveling links are properly installed. The radiused central surface of the lower link is placed down so it is in contact with the base ring. The ground flat surface of the upper links faces up, with the radiused wing surfaces of all links in contact. The flat on the upper links is then in position to contact the support disc of the pad, when assembled. When all links are assembled, check to see that all are free to operate.

In a retained pad construction, the thrust pads may then be assembled and secured by the retaining screws or clips.

For split bearings the assembled retainer halves are rotated into position in the bearing housing, inserting thrust pad concurrently. When joining the two retainer halves, insure that the leveling links at the joints interlock properly. Oil all mating surfaces during the assembly procedure. Align the anti-rotation key (or pin) so the housing can be then assembled.

After assembly of the housing check the axial end clearance in the bearing by jacking the shaft fore and aft and measuring its movement. To adjust the end clearance and/or to obtain the desired axial position of the rotor, adjust or machine the shim packs or plates as necessary. (Note: These filler pieces may be an integral part of the bearing package or may be supplied by the manufacturer of the machine.)

IV. OPERATION

These bearings are designed for forced lubrication with outside cooling of the oil. Oil should be supplied prior to rotation of the rotor and at all times during rotation. The flow must be controlled to the rate specified and this is normally accomplished with a suitable orifice in the supply line. Maintenance of a clean oil supply is critical to the satisfactory operation of the bearing. A suitable filter system is generally essential. A high quality turbine type oil with rust and corrosion inhibitors is recommended for most applications.

As the bearing surfaces are separated completely by an oil film during operation there is virtually no wear and thus no periodic adjustments or maintenance procedures are specified. The only attention normally required is to maintain the proper flow of clean oil at the proper temperature.

The use of thermocouples or RTDs embedded into the thrust pads is often made to provide a monitor on machine and bearing performance. Such sensors, if used, provide a responsive and accurate check on bearing operation. Normal operating temperatures are established and then alarm and/or shutdown signals may be set.

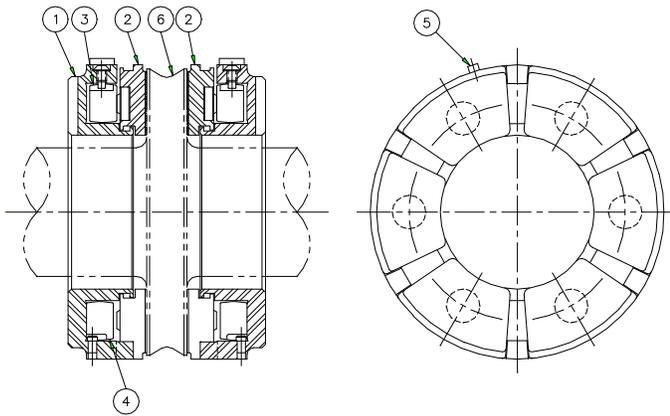
Thrust measuring load cells are also used in applications where an indication of the actual load on the bearing is required. These load cells are integral with the thrust pad(s) replacing the supporting disc. They are strain gauge type transducers, the leads of which, as with the temperature sensors, must be connected to suitable readout instrumentation.

V. SERVICE

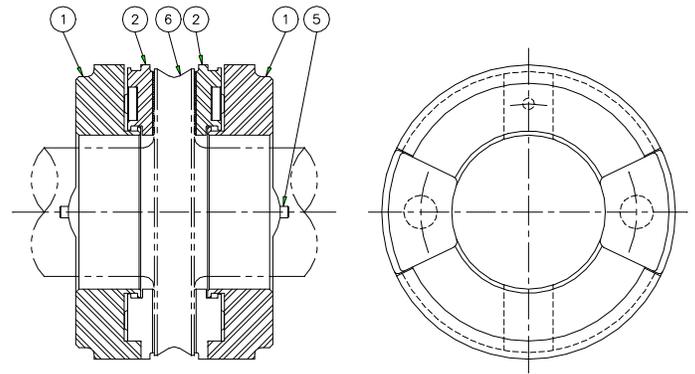
Disassembly procedures generally follow from the assembly procedure for the specific bearing and machine under consideration.

If replacement or repair of parts are required, prompt attention will be given by Waukesha Bearings Corporation to supply the necessary service. Refer to the specific bearing drawing and item number when ordering parts. If repairs are necessary in the field or at other than WBC facilities, particular care should be taken in two areas.

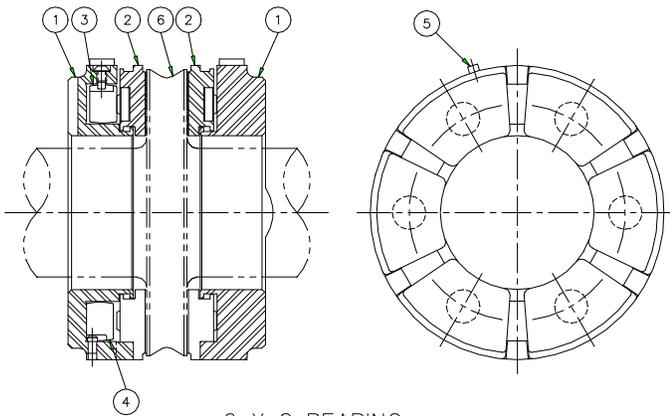
- a. Collar faces must be flat, parallel and square with the shaft. Refinishing by lapping, or grinding and lapping is recommended.
- b. Use a quality high tin babbitt for any rework of the pad faces. Refinish, preferably by lapping, flat and smooth.



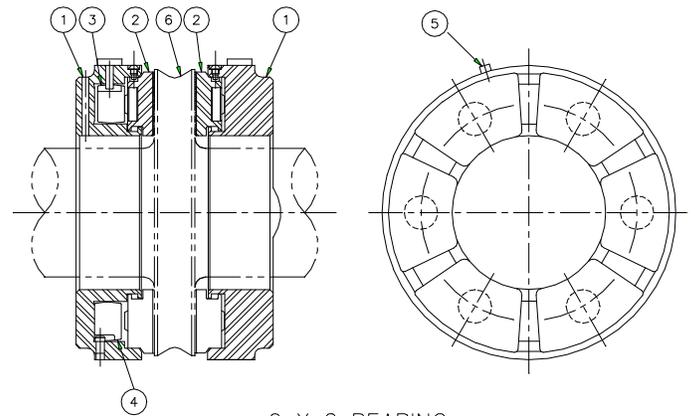
6 X 6 BEARING



2 X 2 BEARING



6 X 2 BEARING



6 X 2 BEARING
RETAINED PAD DESIGN

Item	Description
1	Base Ring (Retainer)
2	Thrust Pad
3	"Upper" Leveling Link
4	"Lower" Leveling Link
5	Anti-Rotation Key (Pin)
6	Thrust Collar