INSTRUCTIONS

FOR

INSTALLING & OPERATING

TILTING PAD TYPE JOURNAL BEARINGS

WITH FORCED LUBRICATION

WAUKESHA BEARINGS CORPORATION

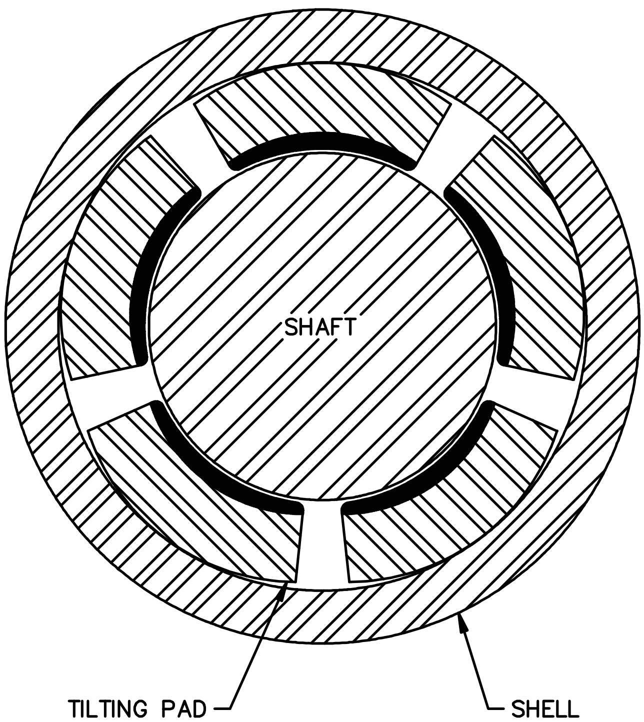
WAUKESHA, WISCONSIN 53186 U.S.A.

I. GENERAL DESCRIPTION

This is a tilting pad type journal bearing consisting of a number (generally five) of arcuate journal pads retained within an annular shell and associated end plates. The bearing will accept radial load in any direction and is particularly useful under high speed, light load conditions where bearing instability may be encountered with other types of journal bearings.

Several basic types are produced, all based around the same journal pads. (These variations are shown on page 4.) The differences in these basic types are in the housing seat configuration and whether a thrust face is incorporated.

The journal pads are constructed so they are free to tilt in the bore of the shell. This action assists in the generation of the hydrodynamic oil film at each pad and is basic to the inherent stability characteristics of this type bearing.



TILTING PAD
JOURNAL BEARING

II. DETAILED DESCRIPTION

The journal pads consist of a steel backing on which has been centrifugally cast a babbitt layer. The babbitt surface is bored to provide the desired "pad clearance" (C_p) of the shaft diameter. The radial thickness of the pad (at the pad center) is held close tolerance to establish the desired "bearing clearance" (C_b) when the pads are assembled to the housing. The relationship of "bearing clearance" and "pad clearance" establishes the "bearing preload."

Preload in a tilting pad journal bearing is normally defined as follows:

$$preload = m = 1 - \frac{C_b}{C_p}$$

The preload used for a particular bearing will depend on the application. Preload values are generally between 0.0 and 0.5, with values of 0.2 to 0.3 common. Negative values are undesirable. Design clearance values are given on the bearing assembly drawing.

The journal pads are retained loosely in the bearing shell by pins or dowels which prevent circumferential movement. The bearing end plates position the pads axially.

Split housings and end plates are used where radial assembly of the bearing to the shaft is required. Where axial assembly is permitted, solid shells (and end plates) may be used and this is common with the flanged housing types. These use cap screws through the flange and into the bearing housing to maintain axial and circumferential position. An anti-rotation pin, to locate in a corresponding hole or slot in the bearing housing, is used on the non-flange types.

Lubricating and cooling oil of the proper viscosity, inlet temperature and pressure is to be supplied to the annular groove in the OD (outside diameter) of the bearing shell. From here the oil flows radially inward through the oil feed holes (located between the journal pads) and fills the pad cavity where is used for lubrication and heat removal. The oil then flows axially along the shaft through the clearance at the bore of the end plate seals.

If a thrust face is used, the oil discharge from that end of the pad cavity is used to lubricate the thrust bearing.

The radial oil feed holes in the bearing shell and the end plate seal bore clearances are sized for the particular application to establish the proper oil flow through the bearing.

III. INSTALLATION

These bearings are processed with a rust inhibitor and preservative prior to shipment from the factory. This protection 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. The bearing is then reassembled (in halves, if a split bearing). Oil all parts at reassembly to protect against corrosion. The journal pads are all interchangeable as to circumferential position except as may be dictated by instrumentation, such as pad mounted thermocouples.

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.

Prior to installation of the bearing assembly, inspect the bearing cavity and cover for cleanliness. Remove any debris or dirt from the journal area, the bearing fit and the oil sump areas of the bearing case. The rotor should be held in place by an overhead hand hoist.

Coat the journal and the bearing fit in the lower half of the case with oil or STP. Place the lower half of the bearing shell on top of the journal. Check alignment of the oil supply hole in the case with the position of the oil supply in the bearing shell.

Align the bearing fit in the case with the shell O.D. and roll the bearing into the lower half of the case. It may be necessary to lift the rotor slightly to allow the bearing shell to roll in easily. Monitor the position of the temperature sensor lead wires when rolling in the bearing to insure that the wire is not crimped or twisted.

With the bearing in the lower half of the bearing case, use a rubber head mallet to align the bearing shell split with the housing split. Both sides of the bearing should align flat with the case. Once the bearing to case split lines are correct, lower the shaft onto the bearing.

Verify that the anti-rotation dowels in the bearing shell lower half are aligned with the dowel holes in the shell upper half. Gently lower the top half of the bearing onto the lower half. Check for any stand off between the two bearing halves. Do not attempt to tighten the split line bolts if the two halves are not flush. Check for the cause of the standoff and correct. Install the bearing split line bolts and tighten securely.

It is recommended that a crush check be done to verify a proper bearing to case fit. Place shims .005"/.010" thick along the case split line on either side of each bolt location. Lay a strip of plastigage or lead wire parallel to the axis of the machine on the top of the bearing shell. The standard design specification for the bearing shell crush is metal-to-metal to .002" interference. The plastigage should be chosen such that the thickness of the shims at the case split line falls in the middle of the plastigage range.

Install the bearing cap or strap and tighten all split line bolts. After the bearing cup has been seated, remove the cap and inspect the plastigage. The plastigage should indicate a thickness equal to or less than the shim thickness used at the split line. The amount of interference is equal to the difference between the indicated clearance and the shim thickness.

Once the proper crush is confirmed, the bearing clearance should be checked. Place the base of two dial indicators on a portion of the machine unaffected by rotor or bearing movement, such as the bearing case horizontal joint. Place one of the indicator's styluses on top of the shaft near the bearing. It is important that this stylus be placed at the top dead center of the shaft to obtain an accurate reading. Place the other indicator's stylus on top of the bearing shell. Slowly lift the rotor noting the shaft rise on the appropriate indicator. Be careful not to raise the rotor into an internal obstruction. Do not lift the rotor more than twice the set clearance.

Observe the indicator on the bearing as the shaft is slowly lifted. Once the bearing lifts, as indicated by the dial indicator, stop lifting the shaft. The lift is the difference between the two indicator readings. Note that the lift with tilt pad bearings will always be more than the actual bearing set clearance due to shaft movement between pads. Multiply the indicated lift clearance by the following values, depending on the configuration of the bearing:

Bearing Configuration	Lift Check Correction Factor
3 Pad	.667
4 Pad	.707
5 Pad	.894
6 Pad	1

After the clearance has been checked, install the bearing cap and tighten the split line bolts on the bearing.

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 supply pressure must be controlled to the level specified. Maintenance of a clean oil supply is critical to the satisfactory operation of the bearing. A suitable filter in the system is generally essential. A high quality turbine type oil with rust and corrosion inhibitors is recommended for most applications.

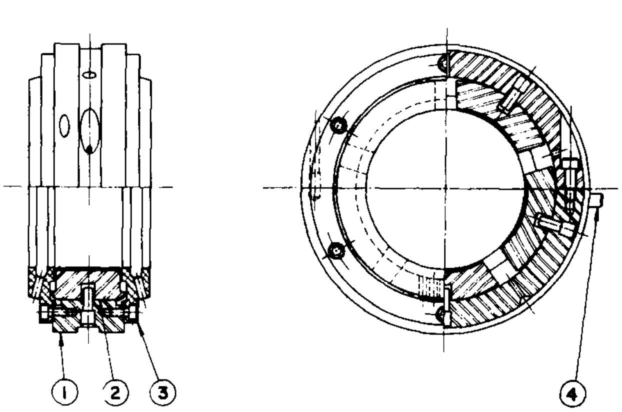
As the bearing surfaces are separated completely by an oil film during operation there is virtually no wear and thus no periodic adjustments or maintenance procedures are specified. The only attention normally required is to maintain the proper supply of clean oil at the proper temperature.

The use of thermocouples or RTDs embedded into the journal pads is often made to provide a monitor on bearing and machine 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.

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.



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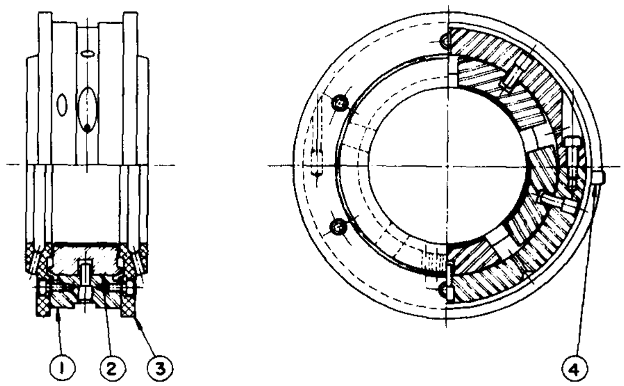

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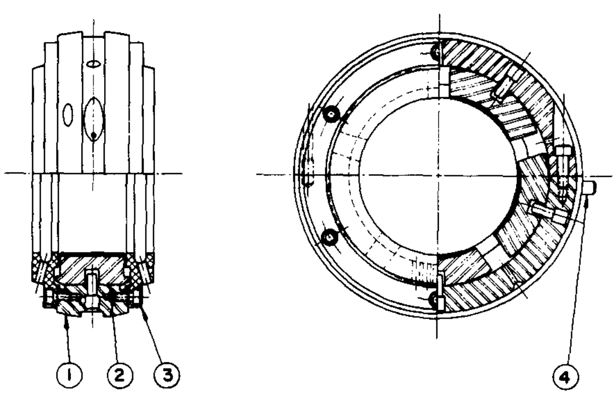

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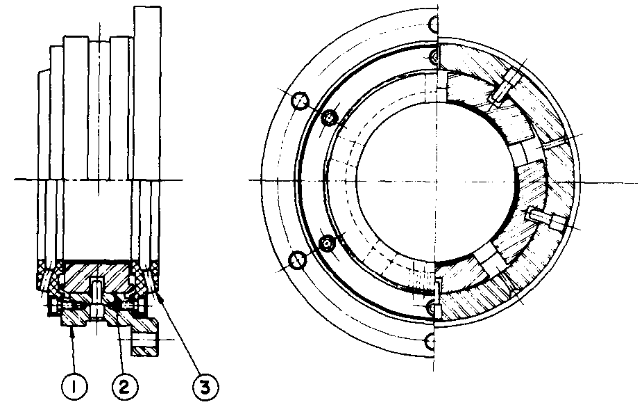

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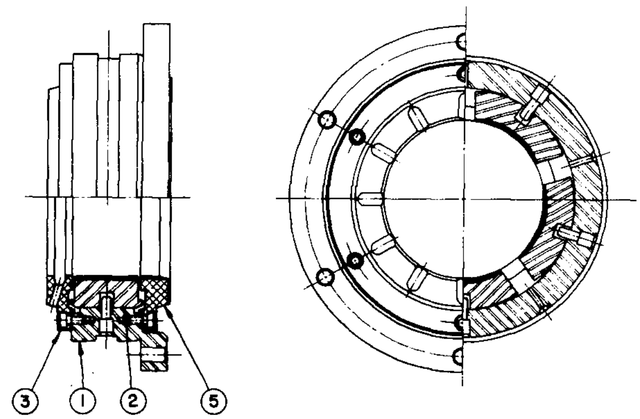

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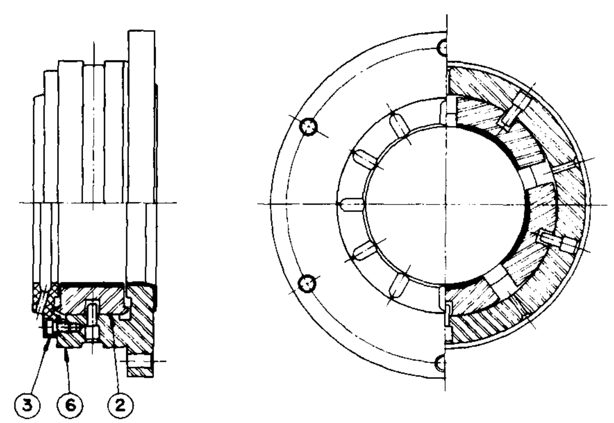

TYPE 085

Item	Description
1	Shell
2	Journal Pad
3	End Plate
4	Anti-Rotation Pin
5	End Plate w/Thrust Face
6	Shell w/Thrust Face