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CARBON PRODUCTS  
GROUP

## PRODUCT CATALOGUE

Mfg. By :



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## Mfg. of Carbon Thrust Bearing Assembly

For Submersible Pump

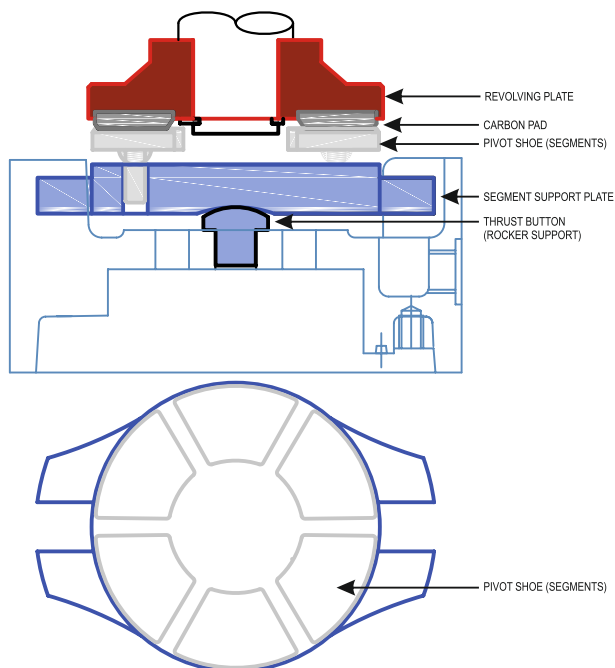
### Using Carbon Thrust Bearing in Sub Motor

- Saves electricity upto 10%
- Increases Pump efficiency upto 5%
- Starts & runs the Pump even at low/fluctuating voltage
- Motor runs at full RPM
- Gives upto 10% more output of water in LPM as compared to fibre/polymer/metal
- Makes pump rotate freely & silently
- The motor does not get locked even after prolonged rest

## Understanding Thrust Bearings in Submersible Motors

### Principle

The Hydrodynamic thrust bearing transmits the rotating shaft's axial thrust load to the frame of the motor, which is mechanically supported in the well. The axial thrust load is transmitted through the bearing on a self-renewing film of lubricant, which is water in most Submersible motors. The pressure in the fluid film supports the load without the thrust disc or pivot shoes making contact.



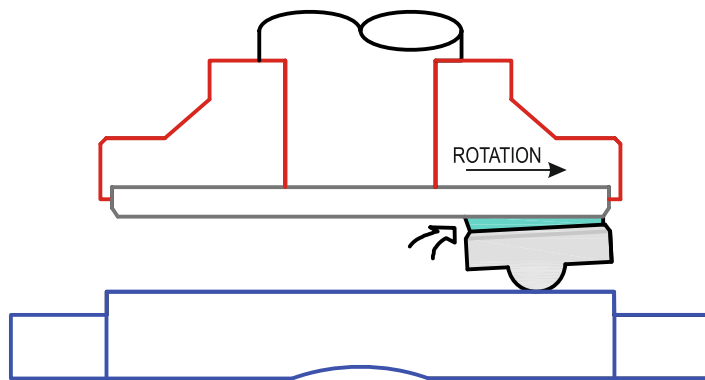
*Hydrodynamic Self Adjusting Tilting Shoe Thrust Bearings*

### Theory

Fluids tend to stick to most surfaces due to viscosity, and in the case of tilting shoe type thrust bearing, we rely on the fluid sticking to the surface on the rotating thrust disc. This fluid is then dragged between the thrust bearing disc and the face of the pivot shoe by centrifugal force, and forms a wedge shaped film. This wedge shaped film is essential for the successful operation of the thrust bearing. When the bearing is operating correctly there is no contact between the disc and the face of the pivot shoe. The only time there is contact is when the motor is stopping or starting. This means there should be only negligible wear between the faces – and no wear while the motor is operating. The sketch right shows how the pivot shoe tilts over and allows the fluid to be forced between the carbon thrust disc and the face of the pivot shoe by a combination of rotational drag and centrifugal force. The pivot point should be spherical which allows the shoes to rotate or pivot so that the fluid can form a wedge. The shoes need to be loosely constrained while still free to pivot.

Surface of the carbon thrust bearing disc is machined flat and exactly perpendicular to the shaft with negligible runout on the face. The surface is lapped to give a very smooth flat finish. The surface of the face of the pivot shoes is also ground and lapped to give a very smooth flat finish, and in addition the height of each pivot shoe in a set is identical and the base of the pivot is spherical so that the pivot shoes are free to pivot and share the load equally. Due to mechanical tolerances there will always be some variations in dimensions, but in general they are tightly controlled. The design of the thrust bearing allows the whole thrust bearing assembly to swivel on the thrust button, which also allows the pivot shoes to share the load more evenly.

Submersible motors are fitted with Hydrodynamic Self Adjusting Tilting Shoe Thrust Bearings to take the axial 'down thrust' from the pump. These are a complex and clever part of a reliable submersible motor and probably not understood very well. These thrust bearings will take a surprisingly heavy axial 'down thrust' load and provided that they have been installed correctly, rated correctly, and looked after properly, they will provide many years of trouble free operation. (Submersible motors also have an 'up thrust' bearing to take up thrusts – usually these occur for a very short time at start up. These are a fairly simple device, which consist of a resin/cloth fibre ring, which rubs against the underside of Thrust Bearing revolving plate. These bearings are not continuously rated and only take light loads.)



## Issues that need to be considered during the design of a hydrodynamic thrust bearing

Maximum total loads, load per mm<sup>2</sup> on the bearing surface, number of shoes, thrust disc surface speed, fluid viscosity, and maximum allowable fluid temperature. Hydrodynamic thrust bearings commonly have 6 or 8 pivot shoes because of the difficulty of ensuring that all the shoes share the load evenly. More shoes increase the likelihood of uneven loading because of variations in dimensions due to mechanical tolerances. The thrust-bearing disc transmits the axial thrust load from the rotating shaft (rotor) through the fluid film to the stationary pivot shoes. A typical film thickness under rated thrust load can be 0.03 mm for a high performance thrust bearing.

### Other Issues



**Cleanliness** It is very important the inside of the motor is very clean with no loose material that could circulate in the water. Any foreign material, larger than the film thickness, that passes through the thrust bearing can damage the surface of the carbon surface of the thrust disc and can get imbedded in the surface of the carbon. (It is unlikely to scratch the face of the pivot shoes as these are specially hardened). Any water that is used to top up inside the motor should also be clean.



**Speed of Rotation** It is important that thrust bearings are not operated at low speeds, or speeds well below their design operating speed. At the low speeds there will not be enough rotational speed to force the fluid through between the pivot shoe faces and the thrust disc, so the faces will be in contact as the motor rotates and this will lead to wear and heat generation due to friction. This can be a problem when using VVVF drives or soft starters and we recommend a maximum run up time of 4 seconds. It can also be a problem when the motor is switched off as the water in the column could flow back down through the pump in the reverse direction and cause the pump to rotate which will cause the bearing to rotate at a low speed. In most installations a check valve is fitted just above the pump, which will prevent this from happening, even though it is quite common for a small drain hole to be drilled in the check valve to allow the column to drain slowly after the motor/pump is switched off.



**Temperature** The temperature of the fluid inside the motor can have a big influence on the performance of the bearing because the viscosity of the fluid will change with temperature and if the water temperature gets close to boiling point the water will lose all its viscosity and the bearing will fail.



**Lubrication and Film Thickness** For the bearing to operate properly the lubricating fluid must always be present between the carbon thrust disc and the faces of the pivot shoes. This fluid heats up as it passes through between the 2 faces of the bearing and needs to be cooled and recirculated before it passes through the bearing again. The fluid entering the bearing should always be reasonably cool before it enters between the bearing faces so it can cool the bearing as it passes through.



**Shock Loading** This can occur when a pump starts to cavitate. These bearings will tolerate some shock loading, provided the peak shock load does not exceed the maximum load the bearing can take. If the maximum load is exceeded the carbon will make contact with the pivot shoes and high wear and high temperatures will result. In extreme cases the carbon will be pounded onto the pivot shoes and will then disintegrate.



# Infrastructure



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Lapping & Polishing



Laboratory



Packing & Dispatch



# Our Products

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- CARBON THRUST BEARINGS



Manufacturing Plant & Regd. Office



008



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