



## Fluid Pivot® JS Tilting Pad Journal Bearings: Dynamic Support for Your Static Excitation Upgrades.

DESIGN • MANUFACTURE • INSTALLATION



## The Problem

**When upgrading generator excitation systems to electronic static exciters, operators of power plants must address the mechanical equipment left behind.**



In the case of a generator with collector rings, one option is to leave the old mechanical rotating elements in place. If left in place, they provide no benefit yet can be expensive nuisances to maintain. On the other hand, a brushless generator does not possess collector rings so the upgrade must include a new collector shaft. If both cases, the overhung slip ring shaft must be considered.

While in theory an overhung collector shaft could be left unsupported, this has proven to be an operational nightmare in all but very small generating units. Another possibility is to relocate the existing exciter bearing to support the overhung collector shaft, but this has met with limited success. Old exciter bearings have difficulty with the misalignment and loading conditions that are present with the new rotor configuration for which they were not designed.

The preferred objective is a single, steady-rest bearing carrying the overhung collector shaft. Ordinary mechanically-pivoted tilt pad exciter bearings offer only a partial solution to the problems at hand. It is true that, by design, a tilting pad radial bearing will handle the load variations that are present in a steady rest application. Yet unfortunately, they are largely unable to accommodate the variations in alignment that are typically associated with this application. Moreover, over time fretting of the mechanical pivots changes bearing clearances over time. These factors have limited the successful application of conventional tilting pad bearings as exciter steady rest bearings and explain why they are a source of common concern among end users.

## The Solution

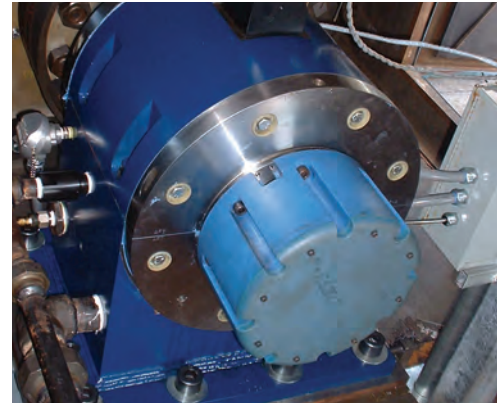
**Pioneer Motor Bearing’s proprietary Fluid Pivot® JS Tilt Pad Bearing is an ideal design to support overhung shafts and accommodate severe misalignment. Our original Fluid Pivot JC Tilt Pad Bearing has proven itself over 30 years in rotating equipment. Now, our advanced Fluid Pivot JS design offers a vastly enhanced ability to accommodate misalignment.**

Simply put, there’s no other fluid film bearing on the market that can handle static and continuous dynamic misalignment as well as Pioneer’s Fluid Pivot JS Tilt Pad Bearing.



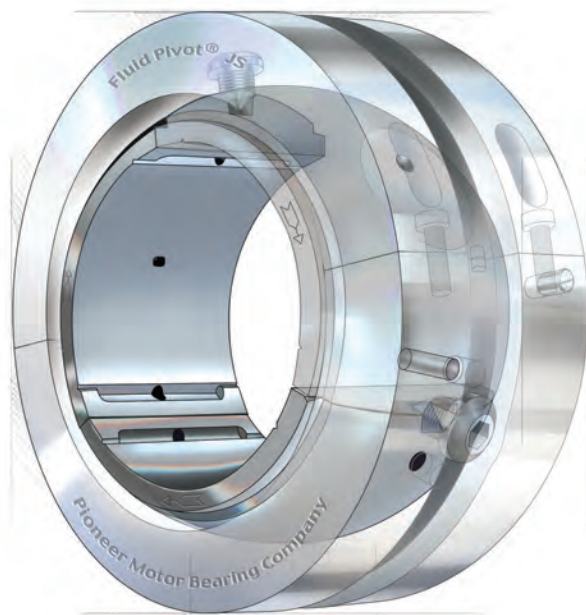
Our Fluid Pivot JS bearing features spherically-seated pads. The result? Fluid Pivot JS can extend misalignment capability to an astonishing 0.250” in 12 inches, or 5.0°. That means that our Fluid Pivot JS bearing provides unprecedented dynamic alignment, not alignment merely for the limited purpose of installation.

But the secret of Fluid Pivot bearings isn't just spherically seated pads. It's the combination of the pad design with what's unique about Fluid Pivot technology — pads continuously floated by self-generated hydrostatic oil films (not by external pressure requiring a separate pump, oil lines, etc.). Supported by a hydrostatic film of oil, the pads have more tolerance for operational misalignment, thermal distortion and load stresses than conventional, essentially dry ("arthritic"), spherical bearing seats, including ball and socket bearings



## How it Works

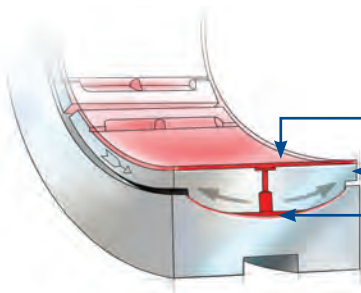
**The Fluid Pivot Tilting Pad Journal Bearing consists of freely-floating pads restrained only by anti-rotation stops. In operation, each pad develops a hydrodynamic oil film to support the shaft.**



In turn, a self-generated hydrostatic oil film – not a mechanical anchor or pivot - supports each pad. This film is created by tapping off a small portion of the pad's hydrodynamic oil flow to pressurize a recess on the back of each pad.

The pads are free to respond to the action of the oil films acting on them.

The formation of a hydrostatic film on the back of each pad allows each pad to lift and pitch, and tilt axially and circumferentially in response to misalignment, with force and moment equilibrium attained for any particular operating condition. This pad action is predicted using Pioneer's proprietary computer programs and has been verified by test stand data. More importantly, Fluid Pivot is proven technology based on 30 years' experience in customers' machines, and the successful operation of Fluid Pivot JS Tilt Pad Bearings in rotating equipment today as large as steam turbine-generators rated at 850 MW.



High Pressure Hydrodynamic Oil Film

Spherical Pad

Self-Generated Hydrostatic Oil Film

Fluid Pivot JS: journal bearing with spherical pads

Fluid Pivot JC: journal bearing with cylindrical pads

## Fluid Pivot® JS Tilt Pad Bearing

### A Turnkey Package of Engineering Services and Hardware



To provide the customer with a complete turnkey package and undivided responsibility, we start by performing a careful rotordynamics and shaft elevation investigation for each application. We'll consider the foundation and, as necessary, perform a finite element analysis in order to design an appropriate supporting fabrication. A supporting pedestal with instrumentation and lubrication connections completes the mechanical package where the collector shaft already exists. A skid-mount, collector-shaft, brush-rigging, and Fluid Pivot JS bearing provide the mechanical package for a brushless-exciter replacement.

Pioneer's turnkey solution to replace an end-user's existing exciter mechanical components with a full mechanical upgrade includes:

- On-site investigation, including operations and maintenance logs
- Rotordynamics evaluation
- Finite element analysis
- Removal of old exciter mechanical components
- Delivery of hardware:
  - Fluid Pivot JS Tilting Pad Journal Bearing
  - Housing with Seals
  - Pedestal (with instrumentation and lubrication connections)
  - Collector shaft, brush rigging, and skid, as needed
- Shaft Instrumentation
- Installation of pedestal, housing, bearing and shaft (by qualified overhaul specialist sub-contractors)
- Technical oversight during start up

Contact us to find out why electric utilities such as **Southern California Edison, Los Angeles Department of Water and Power, Arizona Public Service, Reliant Resources** and others successfully operate our exciter bearing packages in their power plants today.



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