



# ADVANCED MATERIALS

## Polymer Bearing Technology

The engineers at Waukesha Bearings® combine high-performance polymer materials with a collection of optimized design features to expand the operating limits and improve the reliability of fixed profile and tilt pad bearings. The result is a custom fluid film bearing solution – and a machine with the best possible performance over its life.

Let Waukesha Bearings put 40 years of advanced materials testing and field experience to work for you.

### HIGH-PERFORMANCE POLYMERS

Engineered polymers increase bearing capacity and reliability as direct replacements for babbitt components or in new designs for your most demanding applications.

#### Thinner Hydrodynamic Films

Surface properties and the mechanical strength of engineered polymers allow bearings to operate with thinner films than traditional babbitt bearing materials, providing:

- High load capacity – up to 10 MPa (1500 psi)
- Reduced power loss – up to 30% savings
- Operation with low-viscosity lubricants

#### Higher Temperature Capability

Polymer materials have higher operating temperature capabilities – up to 250°C (482°F) – and retain their mechanical properties at higher temperatures than babbitt, allowing exceptional performance at elevated temperatures.

#### Corrosion Resistance

Engineered polymers are resistant to most chemicals, including hydrogen sulfide and ammonia, preventing bearing damage associated with chemical attack by the working fluid.

#### Embedability

Polymers, in a similar way to babbitt, will embed dirt that enters the fluid film, preventing damage to the journal or collar.

#### Electrical Insulation

The high electrical resistance of polymers is utilized in motor and generator applications to prevent damaging currents from passing through the bearing and housing to ground. This characteristic eliminates the need for a separate insulating layer.

#### Reduction of Start-up Torque

Polymer bearing materials have lower coefficients of friction than babbitt and can be used to reduce torque and wear at start-up, eliminating the need for hydrostatic lift systems in some applications.

#### Lubricant Compatibility

Advanced materials are compatible with even the most challenging lubricants and process fluids:

- Mineral/synthetic oils – VG5 to VG680
- Water/seawater
- Water-glycol
- Freon
- Toluene
- Amine
- Crude oil
- Hydrocarbon condensates
- Liquid O<sub>2</sub>
- Liquid CO<sub>2</sub>
- Methane
- Propane
- Butane
- Hexane



*Polymer-lined tilt pad thrust bearing*

## OIL LUBRICATION

### Subsea Pumps and Motors

Polymer-lined thrust and journal bearings, widely used in multi-phase booster pumps and water injection pumps, operate on very thin hydrodynamic films to meet the demand for high load capacity and long life.

### Gas Turbines

Polymer-lined tilt pad thrust and journal bearings can replace babbitt bearings to withstand high temperatures resulting from heat soak. This high-temperature capability provides additional safety in the event the back-up lubrication system fails or can even eliminate the need for a back-up system, saving on both weight and cost.

### Electric Submersible Pumps (ESPs)

Polymer-lined tilt pad thrust bearings are the standard for ESP operating temperatures up to 200°C (392°F) and loads up to 8 MPa (1160 psi). They are used in the motor to account for thermal expansion and in the seal/protector section to withstand the pump load. The high temperature and load capabilities of the polymer lining are complemented by the Hidrax™ tilt pad design's tolerance for misalignment. As an additional benefit in the motor, the bearings provide electrical insulation.

## WATER AND PROCESS LUBRICATION

### Pumps

Polymer bearings can use process fluids as the lubricant, requiring fewer seals in a pump and eliminating the need for a separate oil lubrication system.

Solid polymer bearings provide a solution for load capacities up to 10 MPa (1500 psi) in clean water and have been used successfully in reverse osmosis pumps, boiler feed pumps and mine-dewatering pumps.

### Water-Filled Motors

Thrust bearings with polymer surfaces support high pump loads in water-filled motors and are lubricated by the water cooling the motor.



*Engineered polymers provide proven bearing solutions for demanding applications, whether in oil, water or process lubrication (top image courtesy of GE; bottom image courtesy of OneSubsea)*

### Water-Lubricated Compressors

Using polymer bearings with water lubrication in compressors eliminates oil contamination of the compressed product and simplifies the sealing components.

### Organic Rankine Cycle (ORC) Turbines

ORC turbines use solvents such as toluene and hexane as both the working fluid and the lubricant for the bearings. Polymer journal and thrust bearings can sustain the thin films associated with these low-viscosity fluids. The sealing and the flow path of the lubricant are key design considerations for successful operation.

*The proper design and configuration of the lubrication system is necessary to ensure sufficient cooling of bearing surfaces and formation of the optimum hydrodynamic film.*

