New Way
Porous Gas Bearings as Seals

Bearings

Seals
New Way Overview

- Aston, Pa. 15 miles south of Philadelphia
- 54 employees
- 35,000 sq ft facility, Environmentally Controlled Precision Machining, Manufacturing, and Test
- Privately owned
- Market Leader in Modular Air Bearings
New Way Facility
New Way Air Bearings Products

Air Bushings
The New Way air bushing is designed to make air bearing technology readily available to engineers with pre-existing designs based on round shaft guides. These components run on standard precision steel shafting and are available in Metric or English sizes.

Air Bars
New Way offers a line of modular air bearing components specifically designed to meet the non-contact glass-handling requirements of the Flat Panel Display and Solar Module manufacturing processes, including the new low-cost, high performance Transition Zone Air Bar.

Air Bearings
The ideal components for building frictionless linear motion, New Way Flat Air Bearings were the original standard, off-the-shelf, porous media air bearing product line, developed by New Way in the 1980s. They are now available in round or rectangular configurations.

Radial Air Bearings
The ideal components for building frictionless rotary motion, New Way Radial Air Bearings provide a fast, made-to-order solution. In either concave or convex configurations, this new product line gives you all the differential advantages of New Way standard air bearings.

VPL Air Bearings
For applications where pre-loading is difficult or impossible, Vacuum Preloaded Air Bearings add vacuum to New Way Porous Media™ Technology. Simply then, these bearings hold themselves down while simultaneously lifting themselves from the guide surface.

www.newwayairbearings.com
Flat Round Air Bearings

F r i c t i o n l e s s M o t i o n™
Air Bushings
Bushings And Bushing Slides

NEWWAY air bearings

www.newwayairbearings.com
Spherical Air Bearings
Spindles
Rotary Tables

ZERO FRICITION
EASY TO USE
HIGH PERFORMANCE
SILENT AND SMOOTH

NEWWAY
air bearings

www.newwayairbearings.com
Large Slewing Ring Gas Bearings

ZERO FRICITION
ROBUST
EASY
TO USE
INEXPENSIVE
HIGH
PERFORMANCE
SILENT
SMOOTH
LUBRICANT

Frictionless Motion™
New Way Radial Gas Bearings

ZERO FRICTION  EASY TO USE
ZERO WEAR  INEXPENSIVE
ROBUST  HIGH PERFORMANCE
SILENT AND SMOOTH  LUBRICANT

www.newwayairbearings.com
Radial Air Bearings

www.newwayairbearings.com
Figure 1: New Way gas bearings mounted on a 700 lb, 2m long, flexible test rotor were run at 4X the first bending critical speed.
New Way Radial Gas Bearings

Zero Friction, Zero Wear, Easy to Use, Robust, High Performance, Silent, Smooth
Overview Of Technology

www.newwayairbearings.com
Air Bearing Technical Benefits

- Zero Friction
- Zero Wear
- Smooth & Silent Motion
- Eliminate Lubrication
- Straighter Motion
- Higher Damping
- High Speed
- Acceleration
Types Of Air Bearings

- Aerostatic
  - Externally Pressurized
  - Also called Hydrostatic

- Aerodynamic
  - Self Acting
  - “Foil Bearing” or “Tilting Pad”
  - Also called Hydrodynamic
What Is An Aerostatic Bearing?

Input Pressure 60 PSI

Restriction $R_2$ Gap

Restriction $R_1$ Orifice
The ideal air bearing design would supply air pressure equally across the whole face of the bearing, and automatically restrict and damp the air flow to the face at the same time.
Porous Media Technology

Frictionless Motion™

NEWWAY®
air bearings
Compensation Pressure Profiles

**Multiple orifices with no grooves**

**Multiple orifices with distribution grooves**

**Single orifice no grooves**

**Single non-restrictive input port with depth and width of grooves providing restriction**
Compensation Pressure Profiles

Full Porous Media Face.
Millions of sub-micron sized pores evenly spaced across the bearing surface.
Orifice vs. Porous Media

When grounded, only the area of the orifice and grooves contribute to lifting force. A gap is necessary to create flow to distribute pressure.

When grounded, millions of pores across the face make the whole face contribute to lifting force without gap or flow.
Air Quality

<table>
<thead>
<tr>
<th>QUALITY CLASS</th>
<th>DIRT (Particle size in micron)</th>
<th>WATER Pressure Dew Point °F @ 100 PSIG</th>
<th>OIL (including vapor mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.1</td>
<td>-94</td>
<td>0.01</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>-40</td>
<td>0.1</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>-4</td>
<td>1.0</td>
</tr>
<tr>
<td>4</td>
<td>15</td>
<td>+37</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>40</td>
<td>+45</td>
<td>25</td>
</tr>
<tr>
<td>6</td>
<td>-</td>
<td>+50</td>
<td>-</td>
</tr>
</tbody>
</table>

**Recommended:**

**Minimum Specs:**

*NEWWAY air bearings*

www.newwayairbearings.com
Flow Into Hydrodynamic vs. Hydrostatic Gap

AERODYNAMIC
(Choked Flow – No Adjustability)

THE FLOW INTO THE GAP
MUST COME THROUGH THE EDGE
AREA OF 2MM. SQ.

AEROSTATIC
(Free Flow – Adjustable)

THE FLOW INTO THE GAP
BLEEDS THROUGH THE WHOLE FACE
AREA OF 14568MM. SQ.

www.newwayairbearings.com
Why Restriction Is Needed
Why Restriction Is Needed
Why Restriction Is Needed
Why Restriction Is Needed
Why Restriction Is Needed
Why Restriction Is Needed
Why Restriction Is Needed
Why Restriction Is Needed

GAP GETS BIGGER PRESSURE DROPS

GAP GETS SMALLER PRESSURE RISES

ORIFICE COMPENSATION
Why Restriction Is Needed
Why Restriction Is Needed
Why Restriction Is Needed
Why Restriction Is Needed
Overview Of Technology: Seals

Aerodynamic dry gas seals:
- Fluid tolerant, works under water, see video. Natural stability, Non contact even at zero RPM, Seal gas exits both sides of gap (no flow across the gap),

Mechanical face seals:
- No Friction, No ware, Forces can be balanced between the faces, No coking, Higher speeds for contact faces.
Overview Of Technology: Bearings

Tilting pad hydrodynamic oil bearings:
- No oil, No temperature restrictions, Direct replacement, Adjustable stiffness, Zero friction stops and starts.

Magnetic bearings:
- No electricity, No back up bearings necessary, Gas bearings are very simple.

Tilting pad or foil aerodynamic:
- Zero friction stops and starts, Better damping, Better cooling, Laminar flow at higher speeds, Higher load capacity, Higher stiffness.
Gas Bearing Seal Technologies

Modern Gas Bearing technology when applied to Turbo equipment has very interesting applications for replacing conventional bearings and seals (eliminating oil, improving efficiency).

Important take a ways;
1. Combine sealing and bearing functionality
2. Operate at the most extreme temperatures
3. Do so using the process gas in the bearing gap

- Air bearings as bearings and seals have the potential to revolutionize the fundamental design of Turbo equipment.

www.newwayairbearings.com
Target Markets For Seals

Markets that Air Bearing Seals could be used in include: oil and gas, power generation, aero turbines, chemical processing, and other process industries.

Air Bearing Seals could be used on: pumps, compressors, turbines, generators, motors, turbo expanders, turbo chargers, mixers, and refiners.

Examples of conventional seals that could be replaced with Air Bearing Seals;

- Packing Seals
- Labyrinth Seals
- Brush Seals
- Abradable Seals
- Bearing Isolators
- Injection Type Seals
- Mechanical Seals
- Dry Gas Seals
- Hydrogen Seals
Runner On A Rotating Shaft Between Opposed Stationary Air Bearing Seal Faces

www.newwayairbearings.com
Runner On A Rotating Shaft Between Opposed Stationary Air Bearing Seal Faces

ABSTRACT
In order to effect a seal; an air bearing preferably employing porous material which comprises two opposing stationary surfaces between which a runner, which couples to the shaft and rotates with it, is compressed by the hydrostatic pressure existing in the air bearing films. The air bearing is designed with porous media material to restrict and damp the flow of pressurized fluid, gas, liquid, steam etc. This flow of fluid is further restricted by the gap itself creating hydrostatic pressure which forces the surfaces apart creating a noncontact barrier or seal which is impervious to anything at a lower pressure. Such surfaces may have relative motion with friction being determined by the relative speed and viscosity of the fluid.

www.newwayairbearings.com