MAGSOAR superconducting magnetic bearings prevent contact, friction and wear. They do not need lubrication and can operate in extreme conditions: vacuum, cryogenics and at high speeds with maximum efficiency.

**Patented** MAGSOAR superconducting bearing **technology** achieve unprecedented loads and stiffness capabilities too.

MAGSOAR provides **turnkey superconducting bearings** tested at cryogenic temperatures. **Detailed design, manufacturing, testing and magnetic characterization** are among our capabilities.

### MAGSOAR Superconducting Bearings

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load</td>
<td>Up to 100 kg</td>
</tr>
<tr>
<td>Maximum speeds</td>
<td>Up to 60 000 rpm</td>
</tr>
<tr>
<td>Efficiency</td>
<td>Up to 99.9%</td>
</tr>
<tr>
<td>Maintenance free</td>
<td></td>
</tr>
<tr>
<td>Temperature range [4 to 90 k]</td>
<td></td>
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<tr>
<td>Very low outgassing</td>
<td></td>
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</tbody>
</table>

**APPLICATIONS**

- Contactless cryogenic suspension systems
- Vibration isolation
- Thermal Disconnect
- Flywheels
- Reaction wheels
- Extended life bearings
- Feed-through power transmission

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ROOTATIONAL SUPERCONDUCTING BEARINGS

JOURNAL BEARINGS
Journal bearings provide maximum axial and radial stiffness while minimize weight and cost.

THRUST BEARINGS
Thrust bearings provide maximum load capability and can be easily designed to operate through-wall, isolating two different environments.

HYBRID BEARING
Hybrid bearings provides a mixture of the advantages of both journal and thrust bearings in a compact and robust configuration.

LINEAR BEARINGS
Linear motion bearings are also available. Linear bearings provide a friction-free solution for high precision positioning in cryogenic and vacuum environments.
High load conveyors and though-wall transportation lines can be customized under request.
SUMMARY OF BEARINGS PERFORMANCE (measured at 77K)

**ROTATORY BEARINGS**

- Load capability [kg]
  - Size 15 to 30: 5
  - Size 30 to 100: 10
  - Size 100 to 500: 50

- Allowable displacement [mm]

**AXIAL STIFFNESS** per unit mass

**RADIAL STIFFNESS** per unit mass

**LINEAR BEARINGS**

- Load: Up to 100 kg
- Travel distance: Up to 5 meters
- Resolution: < 1 μm*
- Run outs: Below mrad range

*Active position control available up to the nm range.

Other configurations are available. Please contact info@magsoar.com for a customized design for your application.
TESTING FACILITIES

MAGSOAR owns a High Vacuum Chamber with a High Power Cryohead. The facility is provided with a unique set-up which allow testing of superconducting bearings and suspensions, thermal-vacuum cycling, bake out and current density evaluation.

- Vacuum chamber volume: Ø500xh1000mm
- Pressure: from \(1 \cdot 10^4\) to \(1 \cdot 10^{-8}\) mbar
- Temperature: from 373 K to 4 K
- Linear actuation capacity:
  - Max. force: 600 N
  - Max. frequency: 100 Hz
  - Max. stroke: 15 mm
- Rotatory actuation capacity:
  - Max. speed: 60,000 rpm
  - Max. torque: 50 Nm

UNIQUE SUPERCONDUCTING BULKS

MAGSOAR in collaboration with its partner CAN SUPERCONDUCTORS supply special YBaCuO and other high temperature superconductor bulks with up to twice the load capability and stiffness of their competitors in the market, saving weight, space and cooling power for your application. To know more about this product line, please ask our engineering department.
PREVIOUS EXPERIENCE AND PROJECTS

MAGSOAR has a large and unique experience in magnetic levitation and superconducting systems. Thanks to an intensive research during the last years, we have gathered a unique know-how on the technology which allow us to reach fields where never any other company has been, like space.

**Vibration isolation and thermal disconnect:** MAGSOAR supplies the European Space Agency with a cryostat suspension for the ATHENA large mission to be launch in 2028, an advanced X-ray telescoped designed to address the Cosmic Vision gas structures. High Temperature Superconducting Bearings are designed to provide the desired vibration isolation and a perfect thermal disconnect.


**Superconducting Magnetic Harmonic Drive:** First Magnetic Gearbox supported by High Temperature Superconducting Bearings

http://www.magdrive.eu/

**Superconducting Nanopositioner Actuator** MAGSOAR has being part of the development of a nanopositioner for far infrared interferometry in the ESA/JAXA Spica Mission. The prototype achieved unprecedented resolution for this short of technology.
SCIENTIFIC CONTRIBUTIONS

Fruit of our experience, we have provided numerous contributions to improve knowledge in the field. Also several developments have been patented and are currently exploited. Know more:

Related Papers

- Performance of Magnetic-Superconductor Non-Contact Harmonic Drive for Cryogenic Space Applications, Machines 2015
- Improving Resolution and Run Outs of a Superconducting Noncontact Device for Precision Positioning, IEEE-ASME TRANSACTIONS ON MECHATRONICS, 2015
- Dynamics of a Superconducting Linear Slider, JOURNAL OF VIBRATION AND ACOUSTICS, 2015
- Design and analysis of a non-hysteretic passive magnetic linear bearing for cryogenic environments. PROCEEDINGS OF THE INSTITUTION OF MECHANICAL ENGINEERS PART J- JOURNAL OF ENGINEERING TRIBOLOGY, 2014,
- Superconducting Noncontact Device for Precision Positioning in Cryogenic Environments, IEEE-ASME TRANSACTIONS ON MECHATRONICS, 2014,
- Force relaxation and hysteresis in a frictionless superconducting magnetic bearing, INTERNATIONAL JOURNAL OF SURFACE SCIENCE AND ENGINEERING, 2014,
- Non-contact linear slider for cryogenic environment, MECHANISM AND MACHINE THEORY, 2013
- Alignment effect between a magnet over a superconductor cylinder in the Meissner state, JOURNAL OF APPLIED PHYSICS , 2011

Videos

https://www.youtube.com/watch?v=l_2JbDd-NyY
https://www.youtube.com/watch?v=2EaZCaH0t78