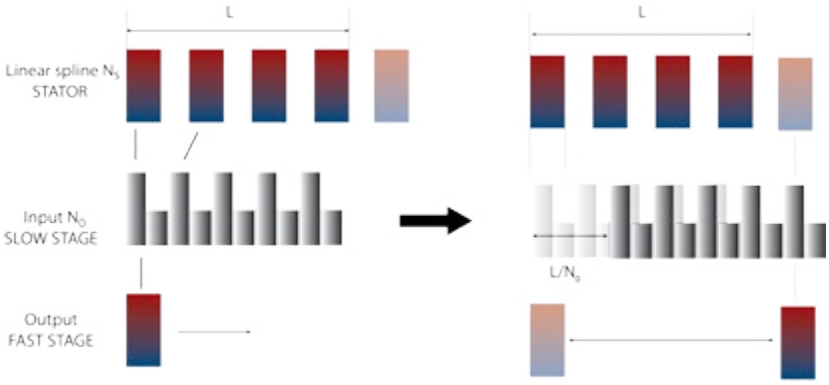
MAG SOAR

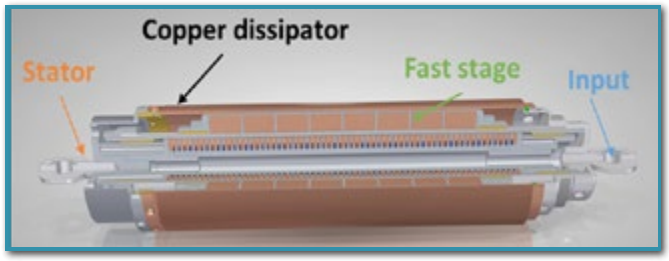
# Z-DAMPER

Z-Coupled Full System for Attenuation of Vibrations

**Z-DAMPER** is a breakthrough technology for vibration damping. This device developed by MAG SOAR is a magneto mechanism matching mechanical impedances and providing a multiplier effect to damp vibrations of both low and high frequency ranges more effectively.

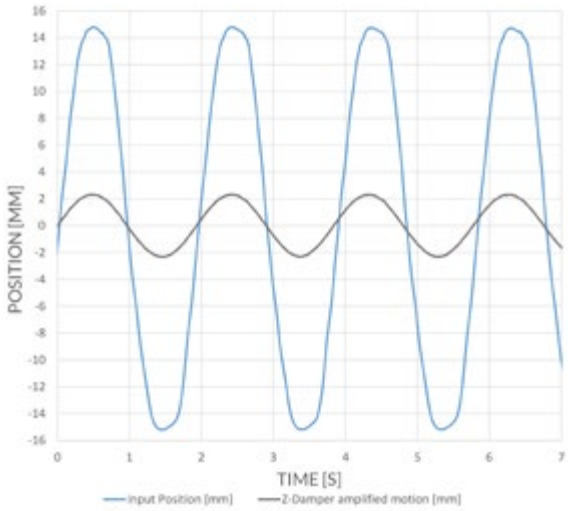



- Motion multiplification of an input vibration by a contactless linear magnetic gear.
- For a gear ratio n the fast stage moves n times faster than the input/slow stage.
- Highly effective even for low frequency and sub-millimetre amplitude.




## COMPETITIVE ADVANTAGES

- Very efficient resonance killer, no isolation penalty at high
- Vibration damping even at sub-Hz frequencies and low speed
- Suitable for very high g´s vibration and shock damping
- Operational Temperature Range from -200ºC to 500ºC
- Extended lifetime with minimum maintenance costs
- Maximized damping, minimum weight and volume
- No damping fluids, elastometers or lubricants
- Suitable for Microvibration Control
- Reduced noise




Depending on the relation between the magnetic teeth, the “fast stage “ moves up to 10 times faster than the “slow stage”. Simultaneously, the force exerted by the slow stage is up to 10 times larger than that of the fast stage.

$$X_{FAST}=n \cdot X_{SLOW}$$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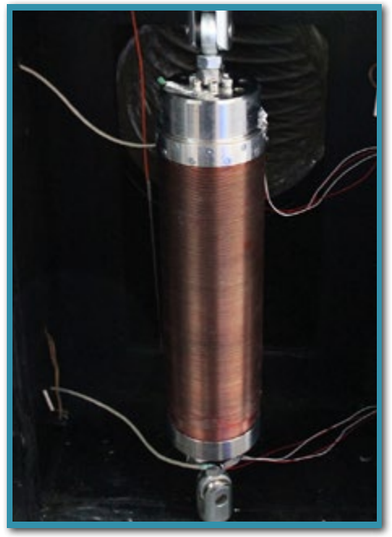
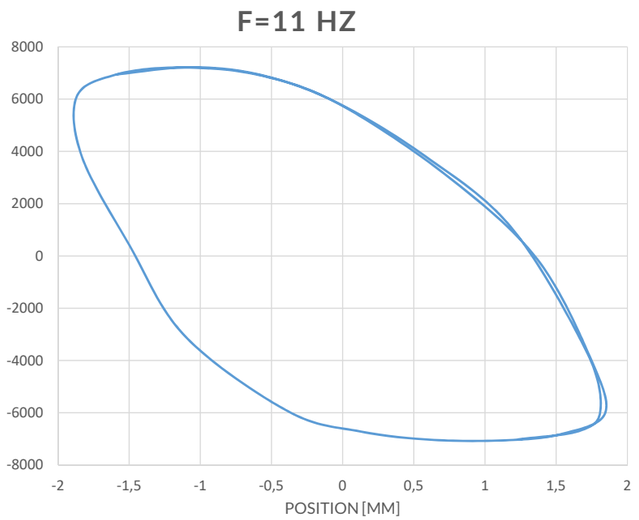
## Z-DAMPER LIGHT ULTRA-EFFICIENT VIBRATION DAMPER



| | |
|---|---|
| **Operational Temperature Range** | -50ºC to 250ºC |
| **Survival Temperature Range** | -70ºC to 300ºC |
| **Max. Damping Force at 25ºC** | 8 kN |
| **Max. Input vibration amplitude** | 5 mm |
| **Gear ratio (n)** | 7: 1 |
| **Natural Frequency (most efficient operational point)** | 12 Hz |
| **Equivalent viscous damping coefficient (200ºC,12Hz)** | 35Ns/mm |
| **Maximum dissipated power** | 600 W |
| **Envelope (DxL)** | 100 x 490 mm |

**Z-Damper** is especially optimized for damping aircraft and aerospace mecahnisms vibrations. Z-Damper is provided with a finned copped shell where heat is generated by eddy currents and released into the air.




**Applied force vs. the slow stage displacement** in Z-Damper-250 prototype at 11Hz and at a temperature of 250ºC. The extraordinary large area of the hysteresis cycle is a good indicator of Z-DAMPER unique damping effectiveness.

## APPLICATIONS

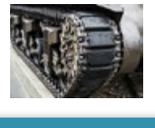
AERONAUTICS & SPACE

INDUSTRY

ANTISEISMIC

LARGE STRUCTURES

DEFENCE



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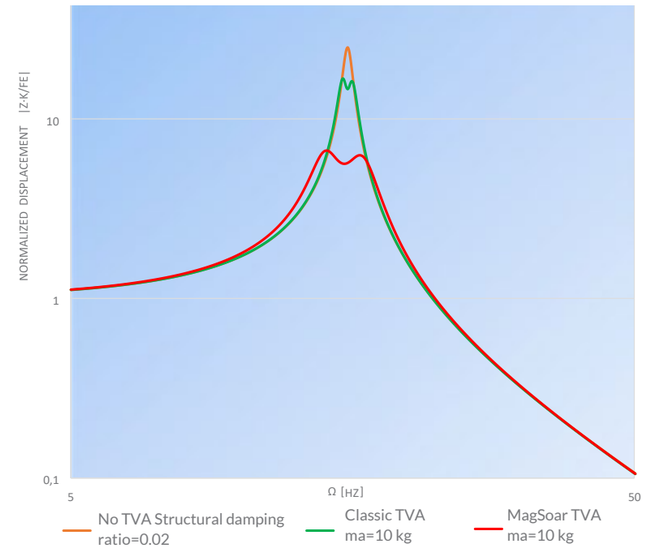
## Z-TVA LIGHT ULTRA-EFFICIENT TUNED VIBRATION ABSORBER

| | |
|---|---|
| **Operational Temperature Range** | -50ºC to 80ºC |
| **Survival Temperature Range** | -70ºC to 300ºC |
| **Max. Damping Force at 25ºC** | 5 kN |
| **Max. Input vibration amplitude** | 5 mm |
| **Gear ratio (n)** | 7: 1 |
| **Natural Frequency (most efficient operational point)** | 19 Hz |
| **Equivalent viscous damping coefficient (200ºC,12Hz)** | 2200N/mm |
| **Maximum dissipated power** | 60 g´s |
| **Envelope (DxL)** | 80x 490 mm |
| **Weight** | 9 Kg |
| **Inertial mass** | 3 kg |
| **Potential Weight Saving (with regard to classic TVA)** | 90% |

**Z-TVA** takes advantage of the impedance matching to increase the inertial mass acceleration proportionally to the amplification factor.




A harmonically excited elastic system without TVA, with classic TVA and with Mag Soar TVA

## APPLICATIONS

EARTHQUAKE PROTECTION

LARGE STRUCTURES

ENGINES

WIND POWER GENERATORS

SPACECRAFTS

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## Related Papers

- **High-performance magnetic gears development for space applications**, ESMATS, 2017
- **Mechanical Impedance Matching Using a Magnetic Linear Gear**, Shock and Vibration, 2017
- **Z-Damper: A new Paradigm for Attenuation of Vibrations**, Machines 2016
- **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
- **Characterization and Improvement of Axial and Radial Stiffness of Contactless Thrust Superconducting Magnetic Bearings**, ENGINEERING TRIBOLOGY, 2014.

  **Force relaxation and hysteresis in a frictionless superconducting magnetic bearing**, INTERNATIONAL JOURNAL OF SURFACE SCIENCE AND ENGINEERING, 2014
- **Contactless Mechanical Components: Gears, Torque, Limiters and Bearings,** Machines, 2014.

## Videos

**Z-DAMPER - A breakthrough vibration damping technology: https://www.youtube.com/watch?v=hswcmO7wiBA&t**


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