Seismic Isolation Device

abserver®

Based on traditional Japanese seismic isolation technology

protect your important assets from an earthquake

Fundamental Characteristics

1. Coexistence of damping and restoring forces
2. Research of the industry-university cooperation
3. Maintenance-free and long-term protection
4. Simple Structure, Low cost and Easy Setting
5. Protecting computer server, cultural assets, medical equipment and the valuable properties

Comes from Japanese traditional construction technique

Bamboo in a mud wall

The wall of a Japanese traditional house is made with bamboo. The bending of bamboo was a seismic isolation innovation discovered by ancient Japanese people. Conventional isolation devices cannot absorb a giant earthquake well because they rely on rigid bearings that do not have such bending power.

Sliding of granite

You can see that pillars of a main gate of a Buddhist temple rest on granite sills. During an earthquake the pillars slide over the granite and a moderate damping force is born.
The abserver® replicates this sliding and friction to produce its damping force.
The birth of abserver just comes from traditional technique of Japanese ancient people.

Abserver acquires many patents and public authorization.

Acquisition patent

- PAT No.2878626 Damping Force by rolling marble bearing
- PAT No.3249451 Restoring Force by rolling marble bearing
- PAT No.3340707 Seismic Isolation by Damping Seat Pad
- PAT No.2006-283959
  Seismic Isolation Device by marble bearing

Public authorizations

- Ministry of Economy, Trade and Industry
- Authorized business of the Tokyo Metropolitan Government
- Support project of the association of medium and small-sized business groups society.
- Industry-university co-operation joint development

Oblate spheroid bearing enabling both of damping and restoring forces

Damping and Restoring forces necessary for seismic base isolation

Restoring force to return to the original position

The restoring force is one of the required ability as isolation device.
Abserver® is using a change of the potential energy with the marble bearing to make it possible to go back up immediately at the original position.

Damping force to decrease a seismic response

Damping force is the ability to stop vibration immediately at the time of the earthquake end.
Seismic Isolator with no damping force may cause a very dangerous state due to the resonance by the second wave.
Abserver® realizes damping force using the friction between two bodies, the top-bottom plate and marbles, that are in sliding contact. The bearing effect with abserver® can changes an earthquake input wave from every direction into wide exercise, and gradually add to frictional resistance to damp shaking.

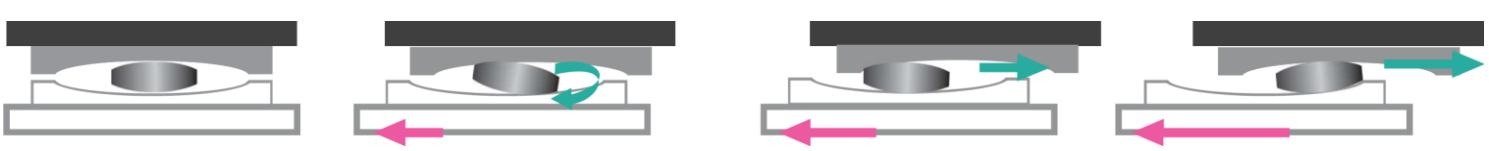
Coexistence of damping and restoring forces

Damping and restoring forces are typically in an inverse relationship

Ball bearing or gliding plate-type devices have strong restoring force and weak damping force such that they continue shaking like a pendulum after an earthquake and may become subject to resonance during aftershocks, whereby vibration is amplified when the direction of aftershocks coincides with the direction of the restoring force.
Abserver® is engineered to provide both damping and restoring forces and can prevent such resonance and restore itself to its original position immediately after an earthquake.
Thus, when evaluating a seismic isolation device it is important to consider both the damping force to absorb vibrations and the restoring force to return the load to an original state.

The greater the damping force the larger the earthquake the device can withstand and the larger the restoring force the more consecutive shakes it can withstand.

Motion image of abserver® during an earthquake



① before earthquake　② during an earthquake (floor and lower plate is sliding)　③ ④ frictional motion from "sliding"

①: Oblate spheroid at original state. The floor and lower plate begin sliding as an earthquake's first wave arrives.
②: The longitudinal movement of the bearing absorbs the initial shock.
③: As the shaking continues, the bearing not only absorbs the shock through horizontal movement but also shifts the force slightly vertically by acting as a wedge.
Finally the restoring force acts to bring the device and its load to their original positions.
④: The stronger consecutive shaking, the bigger restoring force.

Performance result of abserver® by shaking experiment

By shaking experiment in the Japanese public institution, it is proved that abserver® can decrease to up to 90% for a giant earthquake wave.

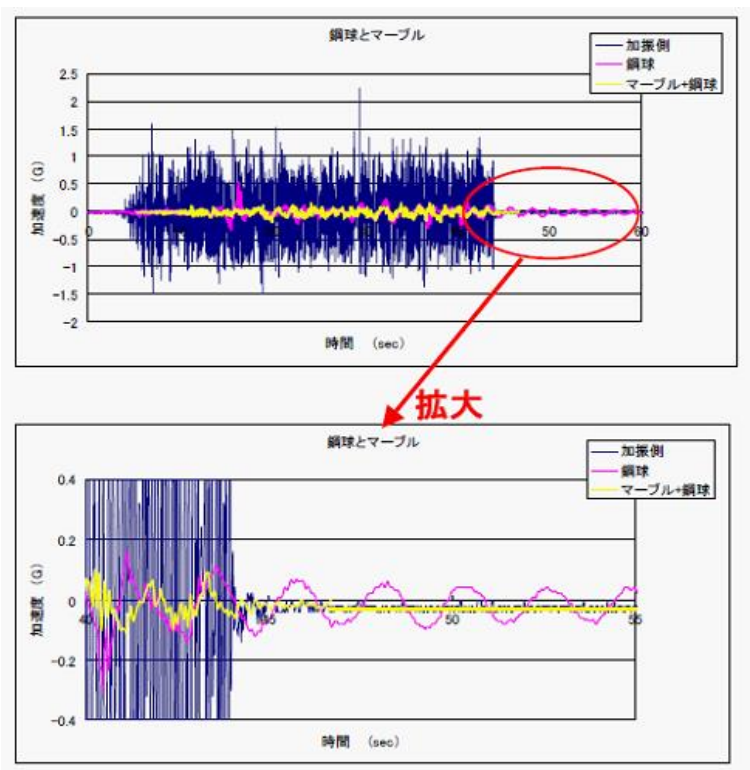
When an earthquake is happened, the isolation device of marble type can be damping the vibration by a friction effect of the marble bearing.
Abserver® is able to gradually add to resistance without suddenly producing frictional resistance by means of the isolated plate of the polyhedron covering a marble bearing.
By this proof experiment, abserver® was able to reduce input wave of 1100gal (seismic intensity of 7 super class) to 140gal (seismic intensity 4 to 5).

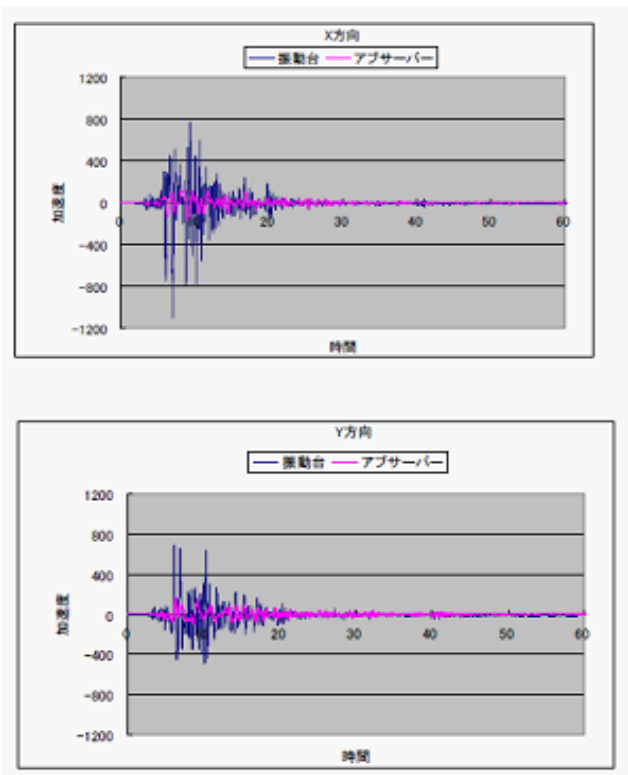
Acceleration on vibrator	East-west direction 1100 gal	North-south direction 692 gal
maximum acceleration on abserver	140 gal	149gal
maximum displacement of abserver	13.6 cm	11.1cm

Comparison with a ball-type base isolation stand

As the result of vibration experiments, the normal ball-type continued to shake, and the problem not to come back to an original position occurred even after the vibration stand stopped.

Because the ball-type device has low damping force, it may cause a resonant amplification and big shaking more than expected when matching the direction of the earthquake wave with the direction where a isolation stand was restored.





Product Specifications

We have lineup that can be customized according to the size, shape and weight of the load.
In addition, we provide optional sucker-type rubber mats to provide resistance against epicentral earthquakes and to control the amount of floor stroll during seismic events.

Free-size model

Suitable for large sculptures and heteromorphic loads.
You can install this model discretely on a per-load basis.

Size : 350 / 400mm
Height : 6mm

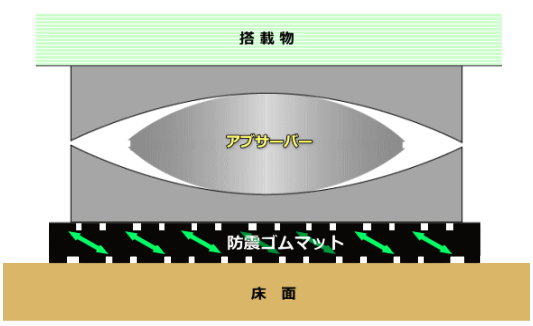
Fixed-size interlink model

Suitable for rectangular loads such as a computer server racks.
You can easily link multiple abserver® units according to the number of racks.

Size : W 944/1044/1144mm
D 1000/1180mm
H 6mm

Optional rubber mat for epicentral earthquakes

Our mats have a unique arrangement of large and small protrusions the absorb floor stroll, allowing for a more stable installation of abserver®.

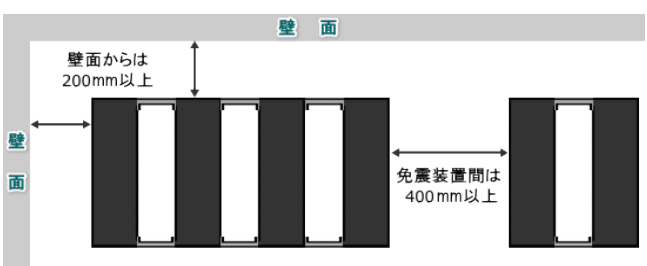


Can be installed by anybody

Installation of the abserver® is simple.
Advanced technical training is not required.
Each unit is lightweight and portable and has a height of only 63mm, allowing for high workability.

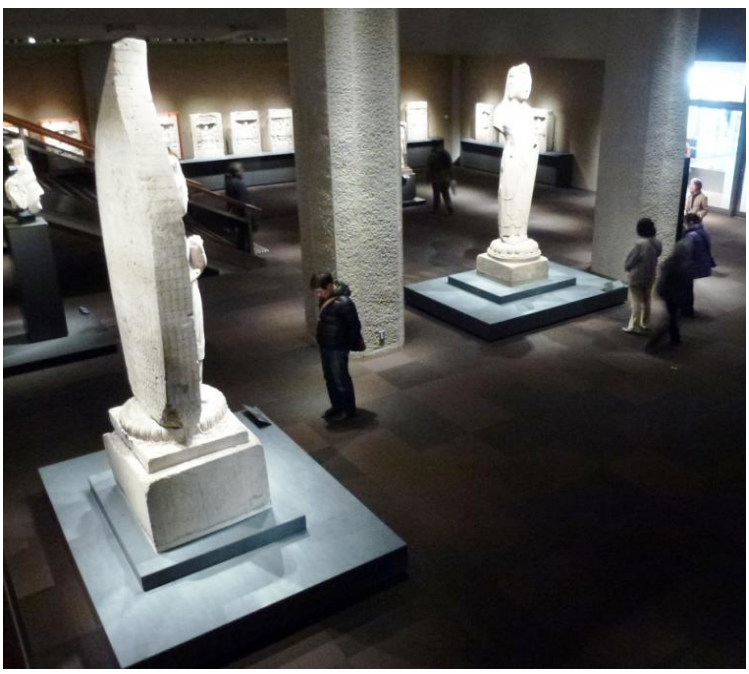
Not necessary to mind minor irregularities of the installation surface. Optional rigid rubber mat protects against thrust-up vibration from floor and against surface irregularities.

We offer standardized units for server racks.
You only have to interlink standard abserver® units with the attached connector according to the number of server racks.



●Each abserver® moves a maximum of around 200mm horizontally in all directions during an earthquake. Secure a space more than 200mm from the obstacles such as a wall or the pillar and the side of abserver® or its load (depending on which is extrudes the most horizontally).
●While abserver® is designed to oscillate at the same frequency and direction, regardless of load weight, during an earthquake, we nonetheless recommend an allowance of 400mm between adjacent abservers®.

Recent installations



Excellent performance which was proved with a Japanese eminent three-dimensional vibration experimental device.
It has met and exceeded stringent standards to be used by leading automobile manufacturers, the National Museum of Japan, and leading data center providers to protect their important assets.

Comparison of Seismic Isolation Methods

	abserver® Frictional Sliding Bearing	Ball bearing	Sliding Plate	Rail and Pulley
Max. loading weight	1.2ton / 0.8㎡	1ton / 1㎡	2ton / 1㎡	2ton / 0.8㎡
Height of device	63mm	78mm	6mm	108~213mm
Allowable Response Displacement(mm)	±200mm (omni-direction)	±210mm (omni-direction)	±250mm (omni-direction)	±200mm (right angle)
Max. Response Acceleration	100gal output for 818gal input	100gal output for 818gal input	100gal output for 818gal input	207gal output for 770gal input
Residual Displacement (Restoring Force)	almost zero (Has restoritive force)	0 to 100mm (No Restoring Force)	0 to 250mm (No Restoring Force)	0 to 200mm (No Restoring Force)
Behavior during earthquake of unanticipated magnitude	Designed to inhibit resonance by considering the natural vibrating frequency of the load and geological properties of the foundation beneath.	Risk of load collapse and detachment of ball bearings due to resonance.	Risk of detachment of the top and bottom plate.	Risk of detachment of the rail and pulley
Damping Force	Damping force provided by the friction between oblate spheroid bearing and top and bottom boards	No Damping Force	No Damping Force	Damping force provided by the friction between rail and pulley
Return capability to the origin	Almost complete return to origin (employs principle of pendulum)	almost return to the origin (bearings move freely at a slope regardless of load weight)	No return capability	Almost complete return to origin (employs principle of pendulum) but ability depends on load weight
Vertical vibration protection	Optional Rubber mat for vertical vibration protection	None	None	None
Maintenability	maintenance free	maintenance free	Need apparatus to restore to original position after each seismic event. The exchange of the plate board is necessary due to natural degredation of resin on its surface.	Periodical maintenance to required to maintain fluid movement.
Weak points	Decreased seismic isolation of standard model for loads exceeding 4,000 kg due to excessive friction. Customization required for such loads.	• Possibile resonance during aftershocks since bearings continue to move after primary quake. Bearings may detach since there is no damping force. Risk of load collapse since these devices are highly unstable under repeated quake scenarios. • Special training required for installation.	• No return capability, requiring additional systems and labor to add this capability. • Surface of plates degrades, decreasing seismic isolation capability. • Requires technicians to install.	• Movement of device is not as fluid as other technologies and may lead to shockwaves being tranferred to load. • High installation height. Heavy.
Notable characteristics	• Simple structure utilizing oblate spheroids and ball bearings, allowing for high seismic isolation regardless of load. • Coexistence of damping and restorative forces allows for smooth movement in all directions. • Easy installation and maintenance-free if installaed under proper environmental conditions.	• Effective even with weak earthquakes due to lack of damping force. • Restorative force provided by free movement of ball bearings on a slope. • Largest number of installations worldwide. • Simple Structure	• Relies only on friction between its two plates. • Lower height since its structure consists only of two plates on top of each other.	• Damping force provided by friction at interlinkage of rail and pulley. Damping force corollates with load. • Damping force provided by principle of pendulum when pulley travels rail.

* Information of this table is reference only. It depends on our investigation, and cannot guarantee the contents.

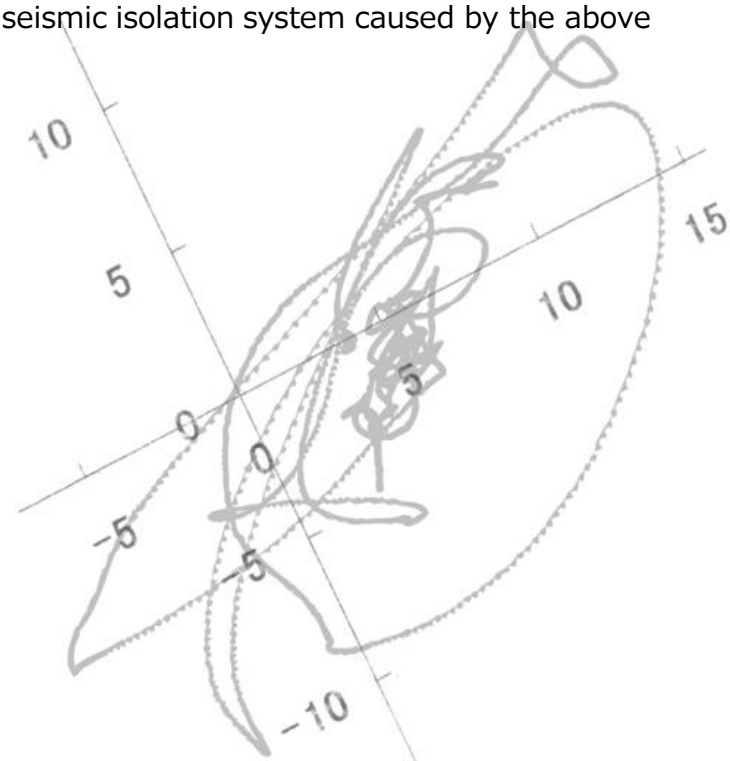
Notes

Although we are making every effort in regard to the contents described in this catalog, we are not responsible for any damage, so please understand in advance.

Disclaimer:

- In the event of a disaster such as a tsunami, lightning, or water, fire, other accidents in case of a disaster
- In the event of a disaster due to damage or collapse of the building caused by an earthquake
- Failure caused by customer's intent or negligence or misuse due to third party's conduct, or other abnormal conditions
- Used for purposes other than those stated in the specifications, or failures caused by placing anything other than the loaded weight
- When there is more earthquake input than described in the specification
- When there are obstacles that hinder movement of the seismic isolation device, and others that interfere with other functions
- When correct installation as described in the instruction manual has not been done
- When loading objects of size and weight exceeding the limit

We shall not be liable for any malfunction of the seismic isolation system caused by the above items.



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