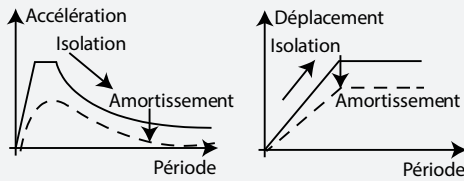


## General description

The ISOSISM® PS (Pendulum System) is an isolator designed using one or two spherical surfaces and a slider. It is designed in accordance with EN 15129 and AASHTO.

The stiffness of the isolator is determined by the radius of the spherical surfaces, while the damping is provided by the friction between the sliding surfaces. The PS isolator is a bearing that typically provides a fivefold reduction in the horizontal force exerted on the structure during an earthquake:



- Increasing the lateral flexibility by installing the isolator between the foundations and the superstructure greatly increases the natural period, which leads to a reduction the acceleration and therefore the seismic force;
- By dissipating the energy during seismic movement, the ISOSISM® PS limits displacement.



Golden Ear Vancouver – Canada

## Applications

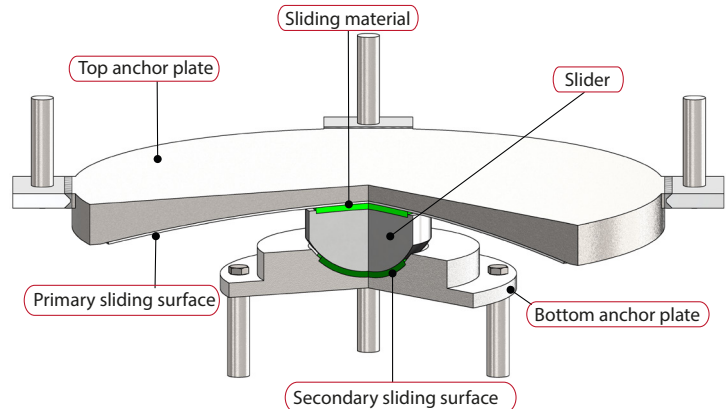
The ISOSISM® PS is suitable for all types of bridge and building. It has the property of aligning the centre of stiffness and the centre of gravity of the isolated structure. It therefore naturally prevents twisting movements of the structure in the event of an earthquake and thus reduces the shear demand.

## Main properties

- Moderate recentering capability;
- High damping capacity ( $\xi \leq 35\%$ );
- High relative displacement.

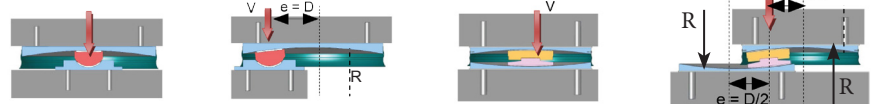
## Design

In addition to their isolating qualities, these isolators bear the vertical loads of the structure and recentre it after dynamic stress.



R: Radius V: Vertical force e: Eccentricity D: Displacement

There are two types of isolator:



PS 1: Single sliding surface bearing. The eccentricity is only applied on the side of the spherical surface.

PS 2: Made up of two main spherical sliding surfaces with a slider located in between them. The eccentricity is distributed on both sides of the bearing.

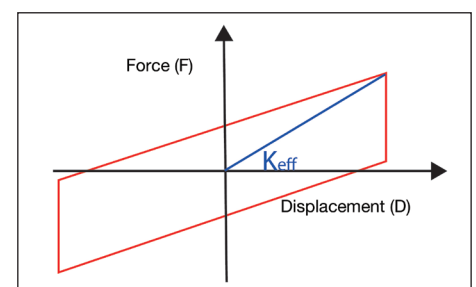
## Behaviour

### Behaviour law

The behaviour law of the ISOSISM® PS can be modeled as follows:

$$F = V(\mu + D/R)$$

F: Horizontal force  
V: Vertical force  
 $\mu$ : Dynamic coefficient of friction  
D: Displacement  
R: Radius  
 $K_{eff}$ : Effective stiffness



### Graphic representation

The device can be shown using the following graphic representation in accordance with EN 15129:

Graphic representation of an ISOSISM® PS plan view



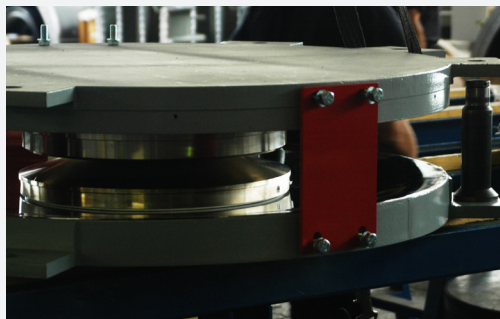
Graphic representation of an ISOSISM® PS elevation



PS isolators are shown in their deformed position in order to emphasise their lateral flexibility.

## Tests

ISOSISM® PSs have undergone numerous dynamic tests to guide and validate Freyssinet's technical development process.



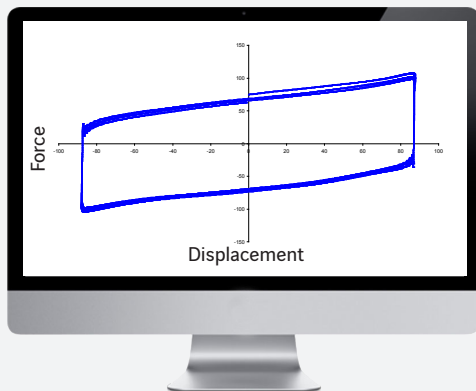
Dynamic testing of an ISOSISM® PS with two spherical surfaces



Dynamic testing of an ISOSISM® PS

## CE marking

ISOSISM® PS isolators can be supplied with CE marking.



Standard dynamic test curve

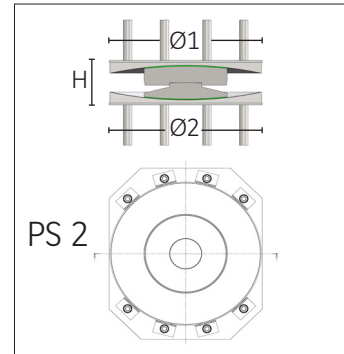
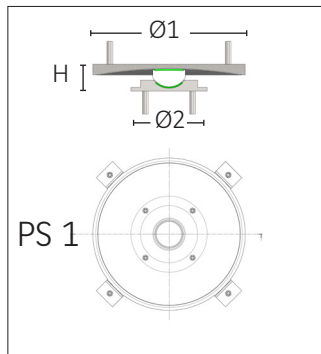
## Freyssinet Services

Freyssinet can produce structural designs with earthquake protection devices, including PS isolators.

## Local sales contact

## Range

The type of PS isolator chosen depends on the nature of the structure to be isolated, the permitted displacement and the space available.



$D_{max}$  : Maximum displacement     $N_{Ed,max}$  : Maximum seismic force     $N_{Sd}$  : Maximum non-seismic force  
 $\varnothing 1$ : Diameter 1     $\varnothing 2$ : Diameter 2    H: Height

Type	$D_{max}$ ± mm	$N_{Ed,max}$ kN	$N_{Sd}$ kN	PS1			PS2		
				$\varnothing 1$ mm	$\varnothing 2$ mm	H mm	$\varnothing 1$ mm	$\varnothing 2$ mm	H mm
PS 1000/300	± 150	1000	800	450	205	100	345	345	180
PS 1000/500	± 250	1000	800	680	220	105	450	450	180
PS 1500/300	± 150	1500	1140	490	250	105	385	385	205
PS 1500/500	± 250	1500	1140	720	265	120	490	490	205
PS 2000/300	± 150	2000	1540	510	285	115	415	415	235
PS 2000/500	± 250	2000	1540	750	310	130	520	520	235
PS 2500/300	± 150	2500	1940	530	315	125	445	445	260
PS 2500/500	± 250	2500	1940	780	340	135	555	555	260
PS 3000/300	± 150	3000	2280	560	345	135	490	490	295
PS 3000/500	± 250	3000	2280	800	375	150	600	600	295
PS 4000/300	± 150	4000	3080	600	395	145	530	530	335
PS 4000/500	± 250	4000	3080	850	430	165	640	640	335
PS 5000/300	± 150	5000	3820	640	445	160	555	555	355
PS 5000/500	± 250	5000	3820	890	475	180	670	670	360

Range given for guidance. ISOSISM® PS isolators can be produced for larger vertical loads and displacements.

## Structural connections



Venice motorway extension  
Belluno - Italy



Retrofitting of PS isolators

The ISOSISM® PS can be installed in new or existing structures. Various connection systems can be used.