JARRET STRUCTURES

PRELOADED SPRING DAMPERS

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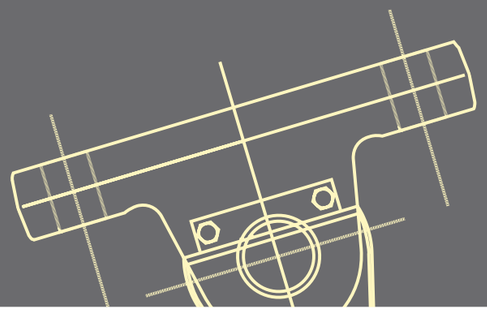
www.jarretstructures.com

73 Avenue Charles de Gaulle
95700 Roissy en France - FRANCE
Tél.: +33 / (0) 3 22 74 31 08 - Fax : +33 / (0) 3 22 74 78 43
E-mail: afleroy@jarretstructures.com

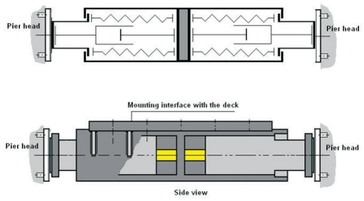
Preloaded Spring Damper

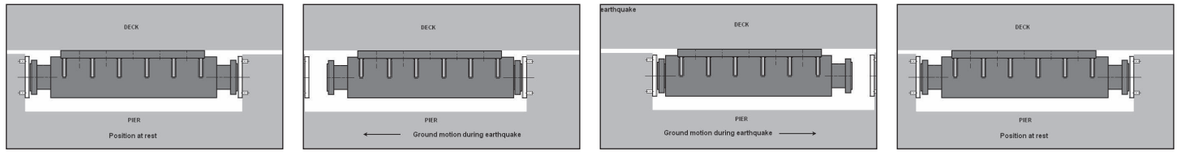
A Preloaded Spring Damper (PSD) is a unit designed to dissipate seismic energy on structures such as bridges. The PSD reduces longitudinal and transverse displacement of the deck. JARRET STRUCTURES can provide two types of PSD: working in tension/compression, or acting only in compression. JARRET STRUCTURES can install the PSD compression type longitudinaly between the deck and the abutment, or install a PSD tension/compression unit in transverse between the deck and the pier structure. The PSD acts as a shear key which has the possibility to regenerate itself automatically after a dynamic event. The seismic energy is dissipated in the PSD unit instead of being dissipated in a steel or concrete structure. JARRET STRUCTURES can accommodate transverse and longitudinal seismic displacement, and at the same time take into account longitudinal displacement such as creep shrinkage and thermal expansion or contraction.



Working Principle

The PSD works on the principle that the rapid passage of viscous fluid through a narrow orifice or port generates high resistance, which then dissipates a large amount of energy. In order to avoid the displacement before reaching a certain force level, JARRET STRUCTURES can define a preload value, F0. Before reaching this value it is not possible to compress the unit. After the dynamic compression of the PSD, the unit has the ability to return to its original position due to the integrated spring function. For example, this return force value is defined in order to overcome the friction force of the sliding pot bearings. In order to generate this damping and spring function in two directions, a double-acting PSD is used.



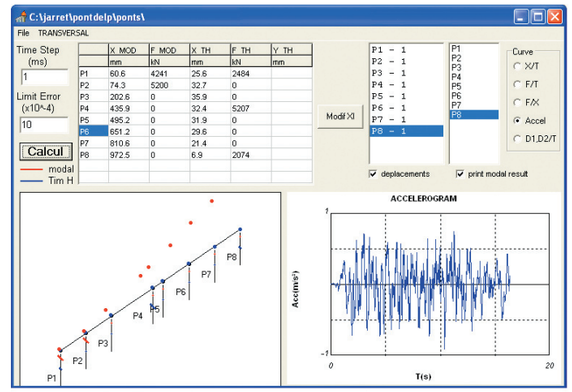


Before Earthquake — During Earthquake — After Earthquake

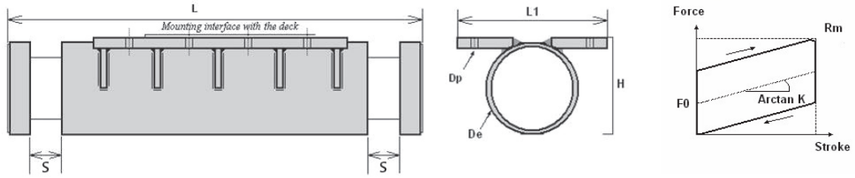
Preloaded spring dampers are installed between pier head and deck in transverse.

Selection of Unit

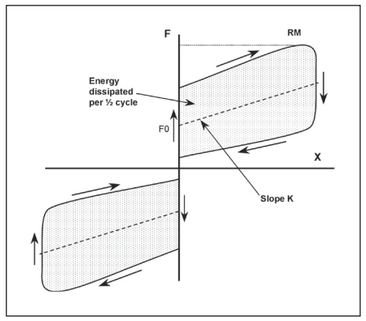
The selection of the appropriate unit must be done by implementing the behavior law of the unit into dynamic analysis software. The behavior law of a JARRET STRUCTURES Preloaded Spring Damper is = F0 + K.x + C.v. This is a non-linear behavior law. The value of alpha can vary from 0.1 to 0.4. A modal analysis will not be possible with a non-linear model. It is necessary to run a time-step analysis. In order to assist its customers, JARRET STRUCTURES is able to run such a pre-sizing analysis in order to determine the most appropriate unit to protect the structure. This pre-selection will have to be validated afterwards by the designer. In order to do such analysis, JARRET STRUCTURES needs to receive the main geometrical data of the structure and of the ground. The result of the analysis will provide the energy capacity required to protect the structure, and the specifications of the units required. All information such as force induced to the structure and displacement is also provided.



Dimension of Units



Unit	L (mm)	De (mm)	Dp (mm)	L1 (mm)	H (mm)	S (mm)	F0 (kN)	K (MN/m)	RM (KN)
BC60S100-25	426	120	18	190	125	25	100	4.4	300
BC60S100-50	573	120	18	190	125	50	100	2.2	300
BC60S200-40	640	150	22	230	155	40	210	4.5	580
BC60S200-80	927	150	22	230	155	80	210	2.25	580
BC60S400-40	795	185	30	350	190	40	390	9.4	1200
BC60S400-80	1120	185	30	350	190	80	390	4.7	1200
BC60S600-45	930	230	33	430	235	45	580	13.0	1650
BC60S600-90	1335	230	33	430	235	90	580	6.5	1650
BC60S850-90	1660	265	36	486	270	90	850	7.2	2300

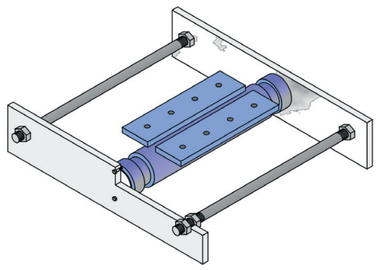


Performance

This graph shows the performance generated by the PSD during a dynamic event at nominal velocity V= 0.2m/sec. The value F0 is the preload value and K is the stiffness value of the spring. The value F0 is defined in order to overcome the friction of the pot bearings during a dynamic event. The unit is designed to be used in compression in both directions.

Temperature and Aging

A variation of temperature, from -55°C to +80°C, does not change the amount of energy dissipated per cycle. There is no aging of the silicone fluid. The JARRET STRUCTURES units have been tested in very severe environmental conditions, including fire.



Installation

Preloaded Spring Dampers are delivered with stainless steel plates which hold the PSD in the correct position for concreting. The PSD unit has to be bolted to the lower face of the deck and then the temporary holding bars connecting the stainless steel plates are removed by cutting them. A complete installation manual is provided.

Maintenance

Preloaded Spring Dampers are maintenance free. A regular visual inspection can be done on a periodic basis in order to check the corrosion protection system.