Bridge Accessories

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MAURER Hydraulic Damper (MHD)

1. Introduction

In the past years, seismic engineering went through some noticeable developments. This progess can be greatly owed to the development and introduction of new project strategies (e.g., seismic isolation). It is based on the notion that energy dissipation can be a very effective tool in the hands of a project engineer, to be able to control the seismic response of structures that are exposed to strong winds and earthquakes.
Due to investigations that were made public in almost all countries after seismic events of big magnitude, it is already well known what earthquakes consist of and which are the mechanisms that lead to earthquake.
Yet, still today not all seismic engineers show a clear understanding to which extent the catastrophic natural phenomenons cause havoc to our engineering structures.
The idea that spontaneously comes to mind to an applicant of seismic engineering is to interprete an earthquake in terms of forces and deformations that a structure is exposed to.
Consequently, the tendency is to concentrate only on an increase of the resistence of a structure. In reality however, forces and displacements constitute only one manifestation of a seismic attack, but are not its pure essence.
Earthquakes are essentially energetic phenomenons, to which defensive strategies have to be developed in a way that their intrinsic characteristics have to be taken into account.
However, newly devised project strategies have not been applied in practice for lack of earthquake devices that should have been developed in parallel for implementation.
For this reason, various scientific research laboratories and other industrial pioneers have decided to enter into substantially new territory in this field. The objective is to invent and perfectionate a range of earthquake devices that make use of the well known physical phenomenons and adapt these devices for the sake of protection of a structure.
Among those pioneers in industry, certainly Maurer Söhne has to be mentioned, which in the recent years perfected 2 types of devices, namely

- Shock Transmitters - MSTU
- Hydraulic Dampers - MHD

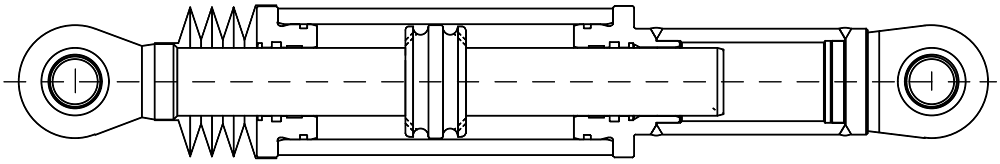
On the world market, these elements represent the devices that in this field are most advanced in respect to performance, reliability and durability.

Pot Bearing with Shock Transmission Unit MSTU

Stura di Demonte Viaduct, Italy

MAURER Hydraulic Damper (MHD)

2. Damper MHD



Damper MHD

2.1 Concept and Design

Seen from outside, an MHD looks like many other available devices on the market.
In effect, seen from a constructional point of view, we have a classical hydraulic cylinder, in which the reaction force is obtained as a function of the flow of a fluid that passes from one chamber into another. It is exactly this control mechanism where this MHD can be distinguished from others. For this system allows to maintain a reaction force nearly constant and independent from the externally introduced speed and the temperature. This way, the capacity to dissipate mechanical energy that is introduced by earthquake into the structure will be maximised, which guarantees a major degree of protection of the structure.

The hydraulic damper MHD of Maurer Söhne can be understood as a device that has the capacity to absorb the volumetric variations of the hydraulic fluid which are generated by the change of the temperature of the environment and, before all, those even more important variations that are created during earthquake. This above mentioned compensation device represents an integral and internal part of the total hydraulic damper. The MHD is conceptionally absolutely compact and does not employ any external and vulnerable part.

2.2 Corrosion Protection

The outer surface is protected by 100 µm zinc primer and 2 layers of each 80 µm additional cover painting. The piston rods of the MHD are treated with a special protection developed by Maurer.
The protection of the surface is very resistant and ideal for the application in aggressive environment, such as maritime environment. This surface protection employs a long service life without the necessity of maintenance.
Upon special request of the customer and / or in order to comply to other specifications, nearly every kind of corrosion protection treatment is available.

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2.3 Maintenance

The selection of the components, the design of the individual parts, the adoption of certain precautions and finally the available types of protection guarantee that any kind of maintenance can be ruled out. Nevertheless we recommend a visual check every 3 years.

2.4 Hydraulic fluid

The hydraulic fluid belongs to the family of silicon oils and contains some additional additives against natural aging and corrosion. In regard to a wide range of temperature, the viscosity of this type of fluid shows a nearly constant charasteristic. This characteristic facilitates the mechanical system to be thermically compensated.

2.5 Sealing

Obviously, the sealing represents the critical element of the total hydraulic system. The selected sealing for the damper MHD demonstrates a quasi zero natural wear and an absolute physical-chemic compatibility with the adopted hydraulic fluid.

2.6 Temperature

The MHD dampers are designed for an operating temperature range of -20°C to +50°C. In addition, this damper is constructed and designed to survive temperatures of more than 200°C , temperatures that can be observed at the time of energy dissipation during a seismic event.

2.7 Conclusions

The MHD damper is designed to cater to the most advanced specifications in respect to anti-seismic behaviour. Our MHD dampers are designed around a maintenance free service life. The high quality of material and components employed and the selected protective system secure a service life of at least 30 years.

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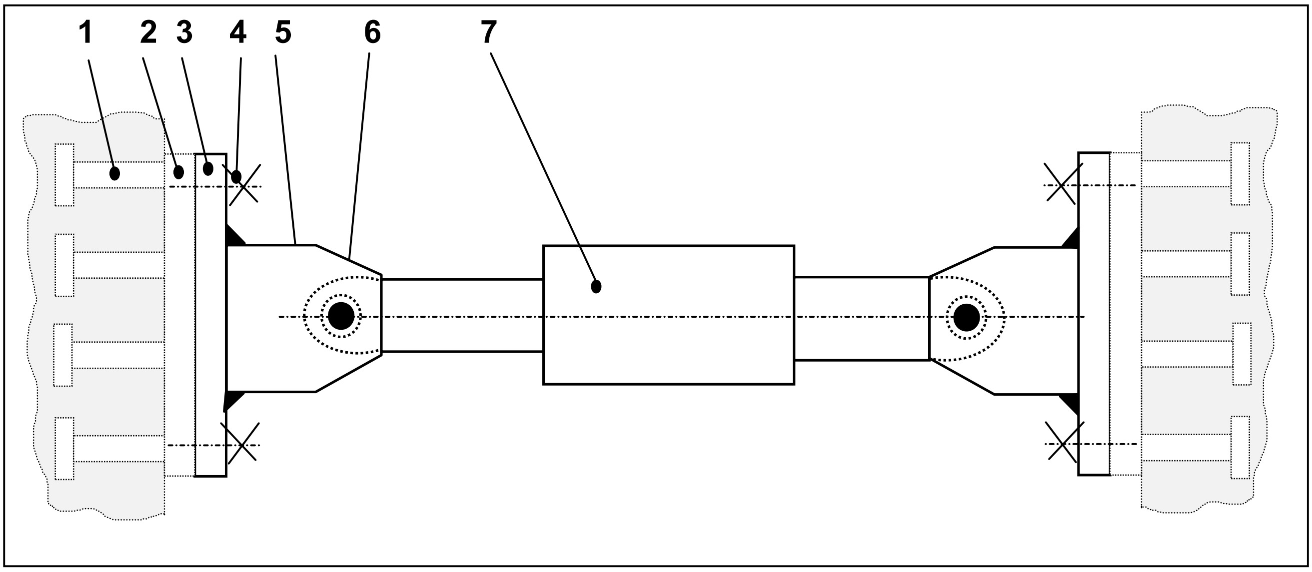
3. Anchorage of the MHD

Example of an anchorage shown in a schematic sketch



Principle of an MHD anchorage

Description of elements:

1 = Tension elements connected to existing reinforced concrete

2 = Anchor plate that is cast in by means of tension elements

3 / 5 = Support shoe

4 = Bolts for fixation of the support shoes to the anchor plates

6 = Spherical hinge being fixed to the support shoe by means of a bolt

7 = Damper MHD.

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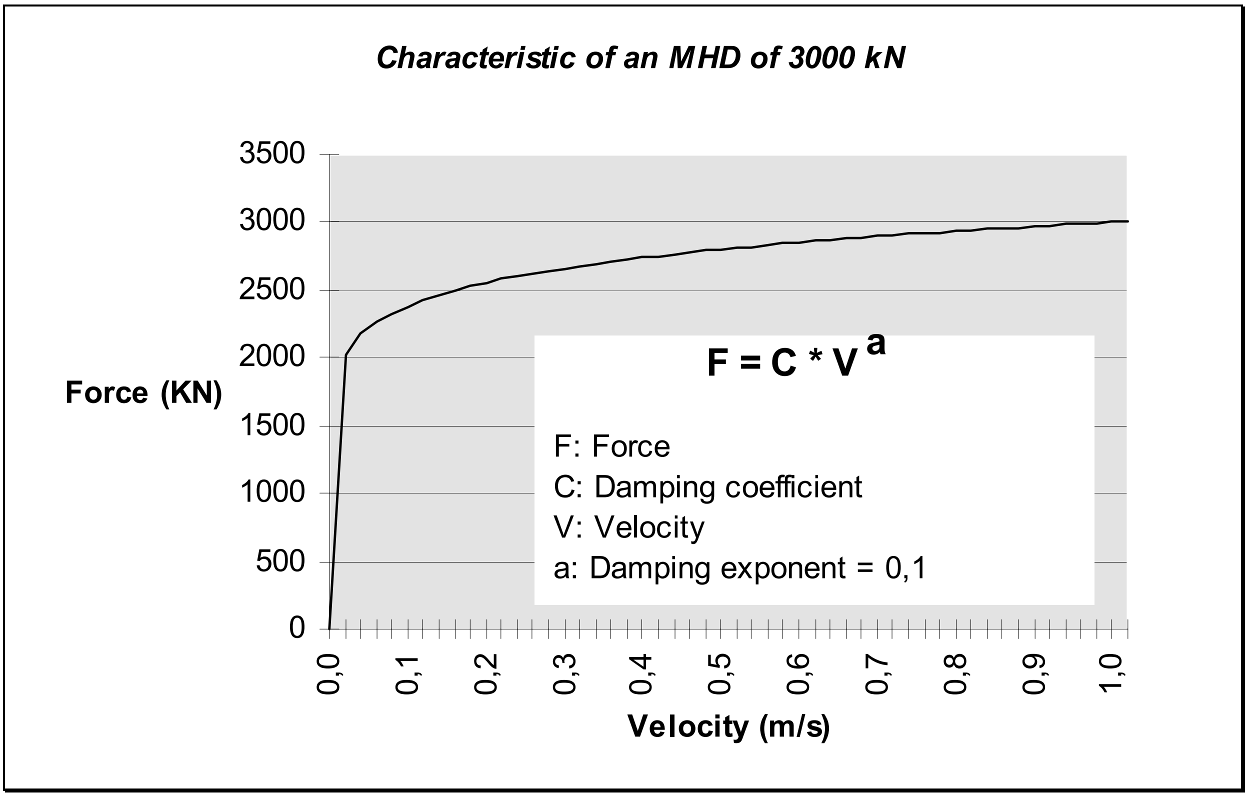
4. Characteristic of an MHD



Force - velocity diagram of an MHD

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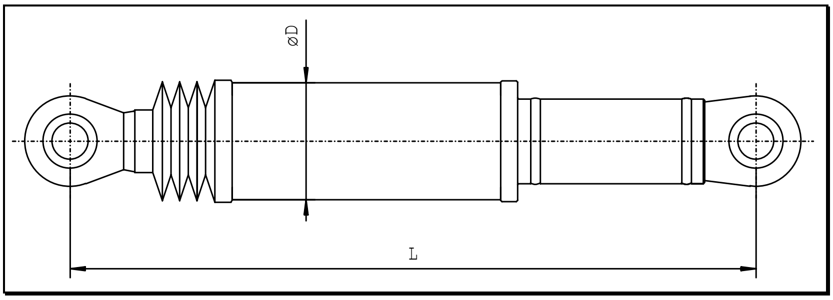
5. Dimensions of an MHD



Axial Force (kN)	Maximum Displacement s (± mm)															
	100		150		200		250		300		350		400		450	
	D	**L**	**D**	**L**	**D**	**L**	**D**	**L**	**D**	**L**	**D**	**L**	**D**	**L**	**D**	**L**
700	220	1230	220	1480	245	1730	245	1980	245	2230	245	2480	-	-	-	
1000	265	1285	265	1535	265	1785	270	2035	290	2285	290	2535	290	2785	-	
1500	320	1390	320	1640	320	1890	320	2140	320	2390	355	2640	355	2890	-	
2000	355	1450	355	1700	355	1950	370	2200	370	2450	405	2700	405	2950	405	3200
2500	405	1560	405	1810	405	2060	405	2310	405	2560	420	2810	455	3060	455	3310
3000	405	1570	420	1820	420	2070	455	2320	455	2570	455	2820	455	3070	505	3320
3500	455	1680	455	1930	455	2180	455	2430	505	2680	505	2930	505	3180	560	3430
4000	505	1785	505	2035	505	2385	505	2535	505	2785	505	3035	505	3285	-	-

Dimension L in mid position of the damper's piston $L_{max} = L + S$

$L_{min} = L - S$