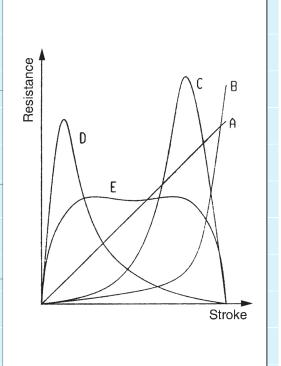


Principles of Soft Absorbers

What is a Soft Absorber?

In order to increase the productivity of industrial machines, such as automatic assembling machines, various transportation machines, machines tools, and so on, their operating parts have been made to work faster. However, the resulting impact, vibration, and noise have caused adverse effects on the machine's performance and on the working environment. A soft absorber is an extremely convenient hydraulic buffer that can solve such problems. There are similar devices made of rubber, springs, or devices that use pneumatic pressure, but none of them rival the impact absorption characteristics of the hydraulic type, as illustrated below.

Rubber	The rubber's elastic deformation captures the impact energy, and this energy is then accumulated in the rubber. As a result, the accumulated energy works as a repulsive force, and there is a high risk of a rebound being tenerated. Therefore, it is not an efficient impact absorber. On
	the other hand, it is extremely affordable and its installation is easy.
Spring A	Like the rubber type, it captures the impact through elastic deformation and stores it as elastic energy. Once the impelling force is diminished, the stored energy is likely to repel as it does
	in the rubber type, causing a rebound.
Pneumatic pressure	It uses pneumatic pressure to absorb impact similar to the rubber and spring types, but because the compressed air is released to the
В	atmosphere through an orifice, the energy does not accumulate. However, unless the rapid compression and releasing action through the orifice is well balanced, a rebound occurs as it does in the spring type.
Hydraulic pressure	It uses oil's velocity-squared resistance as well as viscosity resistance to absorb the energy, which is then converted into heat energy and released into the atmosphere. As a result, extremely efficient impact absorption is possible. A
	relatively compact design is capable of absorbing large impacts, and depending on its structure, the impact absorption characteristics can be modified as well.



<Principles of Energy Absorption>

As shown below, when an object hits the piston rod, the motion is transferred to the oil in the pressure chamber through the piston rod. As a result, the oil inside the pressure chamber flows out of the orifices located in the inner tube. This causes compression in the pressure chamber. The product of this hydraulic pressure and the pressure-applied area of the piston is resistance, which acts on the colliding object. Soft absorbers use this resistance to apply the brake to the colliding object, slowing it down. The hydraulic pressure generated inside the pressure chamber is proportional to the square velocity of the colliding object, as long as the orifice size, oil viscosity, etc. are constant. This is called velocity-squared resistance.

