

GMC Motorhomes International

Shock Absorbers

Manny Trovao
2008 Santa Rosa, CA

WHAT SHOCKS DO

- First and foremost, despite what many people think, the shock absorbers on our GMC motorhomes do not support vehicle weight. Instead, the primary purpose of the shock absorber is to control spring and suspension movement. This is accomplished by turning the kinetic energy of suspension movement into thermal energy, or heat energy, to be dissipated through the hydraulic fluid.

Shock absorbers are basically oil pumps. A piston is attached to the end of the piston rod and works against hydraulic fluid in the pressure tube. As the suspension travels up and down, the hydraulic fluid is forced through tiny holes, called orifices, inside the piston. However, these orifices let only a small amount of fluid through the piston. This slows down the piston, which in turn slows down spring and suspension movement.

The amount of resistance a shock absorber develops depends on the speed of the suspension and the number and size of the orifices in the piston. All modern shock absorbers are velocity sensitive hydraulic damping devices - meaning the faster the suspension moves, the more resistance the shock absorber provides. Because of this feature, shock absorbers adjust to road conditions. As a result, shock absorbers reduce the rate of:

- Bounce
- Roll or sway
- Brake dive and Acceleration squat
- Shock absorbers work on the principle of fluid displacement on both the compression and extension cycle. A typical car or light truck will have more resistance during its extension cycle than its compression cycle. The compression cycle controls the motion of a vehicle's unsprung weight, while extension controls the heavier sprung weight.
- On our motorhomes, the front shock has more resistance on the compression cycle than on the extension cycle. On the rear, it's the opposite, it has more resistance on the extension cycle than on the compression cycle.

SHOCK ABSORBER DESIGN

- There are two shock absorber designs in use today for our GMC Motorhomes:
- Twin Tube
- Mono-Tube



This is the original AC/Delco that came with the Motorhome. It's a twin tube design. Inner tube chamber. It is no longer made



This is an aftermarket twin tube design by Caspro

AC/Delco



Caspro



Basic Twin Tube Design

- The twin tube design has an inner tube known as the working or **pressure tube** and an outer tube known as the **reserve tube**. The outer tube is used to store excess hydraulic fluid.

Notice that the piston rod passes through a rod guide and a seal at the upper end of the pressure tube. The **rod guide** keeps the rod in line with the pressure tube and allows the piston to move freely inside. The **seal** keeps the hydraulic oil inside and contamination out.

The base valve located at the bottom of the pressure tube is called a **compression valve**. It controls fluid movement during the compression cycle.

Bore size is the diameter of the piston and the inside of the pressure tube. Generally, the larger the unit, the higher the potential control levels because of the larger piston displacement and pressure areas. The larger the piston area, the lower the internal operating pressure and temperatures. This provides higher damping capabilities.

Ride engineers select **valving** values for a particular vehicle to achieve optimal ride characteristics of balance and stability under a wide variety of driving conditions. Their selection of valve springs and orifices control fluid flow within the unit, which determines the feel and handling of the vehicle.



This is one of two aftermarket mono tube high pressure gas shock made by KYB and widely used by the GMC community.



This is another aftermarket shock, mono tube high pressure gas shock by Bilstein. It is also widely used by the GMC Motorhome community.

KYB



Bilstein



Mono-tube design

- These are high-pressure gas shocks with only one tube, the ***pressure tube***. Inside the pressure tube there are two pistons: a ***dividing piston*** and a ***working piston***. The working piston and rod are very similar to the twin tube shock design. The difference in actual application is that a mono-tube shock absorber can be mounted upside down or right side up and will work either way. In addition to its mounting flexibility, mono-tube shocks are a significant component, along with the spring, in supporting vehicle weight.

Another difference you may notice is that the mono-tube shock absorber does not have a base valve. Instead, all of the control during compression and extension takes place at the piston.

The pressure tube of the mono-tube design is larger than a twin tube design to accommodate for dead length. This however makes it difficult to apply this design to passenger cars designed OE with a twin tube design. A free-floating dividing piston travels in the lower end of the pressure tube, separating the gas charge and the oil.

The area below the dividing piston is pressurized to about 360 psi with nitrogen gas. This high gas pressure helps support some of the vehicle's weight. The oil is located in the area above the dividing piston.

During operation, the dividing piston moves up and down as the piston rod moves in and out of the shock absorber, keeping the pressure tube full all times.

In Conclusion

- Tests have shown that driving with 50% worn shocks can increase emergency braking by 2.6 meters.

In addition, worn shock absorbers can increase a driver's reaction time by up to 26%, cause uneven headlights – which can dazzle oncoming drivers – increase the risk of the vehicle aquaplaning by nearly 10% and can cause the vehicle to lose control when cornering or caught in a cross wind.