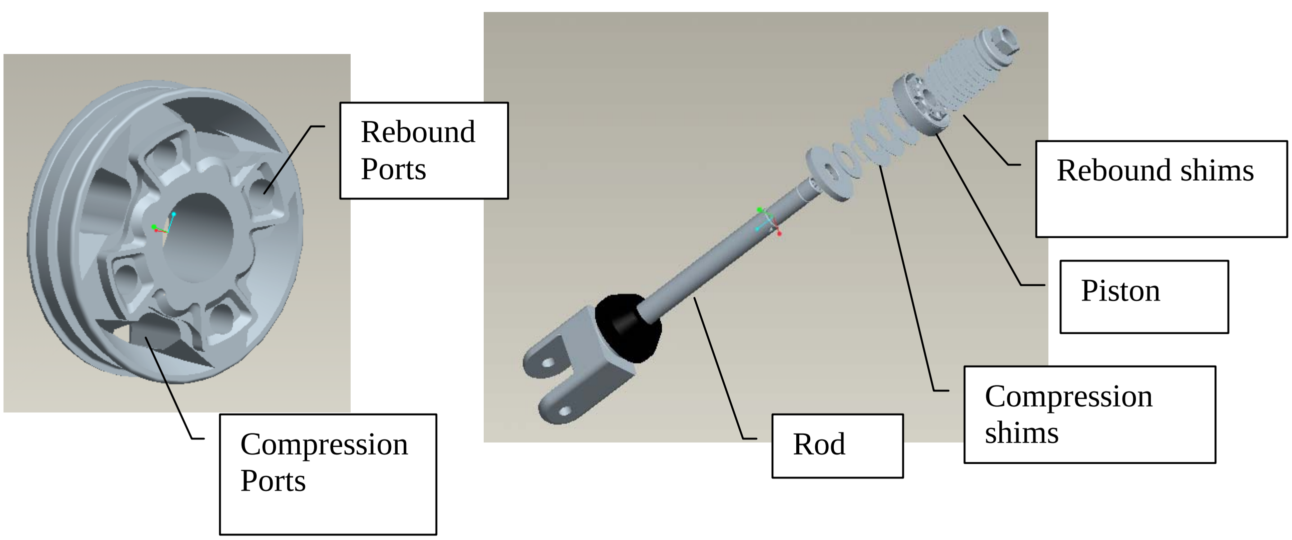
SUSPENSION ADJUSTMENTS AND HOW THEY WORK

In today’s world of DH biking there are many things riders and racers alike tend to worry about. From tire pressure, angle adjustments, tire selection and now suspension systems are coming into play in a very complex way. How so you might ask? Well adjustments have gone from rebound, compression, and preload to the now overwhelming:
Rebound, Preload, Low Speed Compression, High Speed Compression, and air chambers.

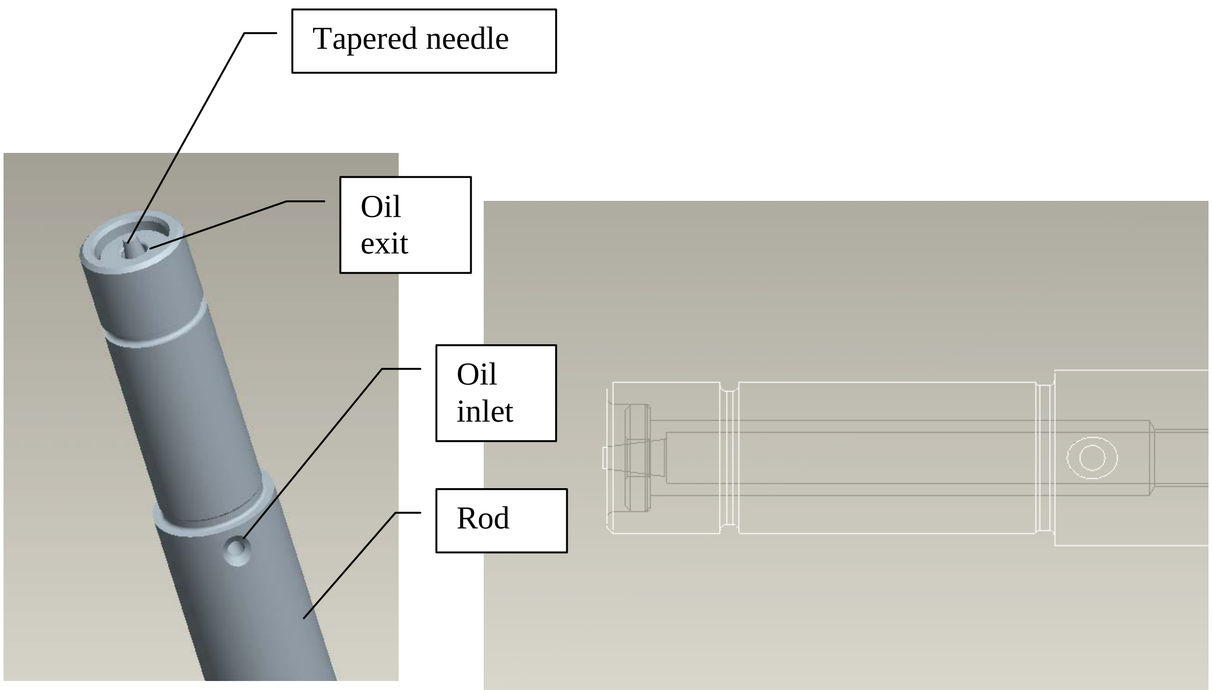
All of these are designed to make you the rider faster, but for the most part they may actually do just the opposite. This is mainly due to many people have the improper set up on their bikes. This article will help clear up just what each adjustment does internally in the shock and the effect it will have on the bikes overall feel on the hill.

To help answer all these questions we have turned to some of the best in the business, and that would be an American Showa engineer. If you don’t recognize the name from their years of motocross involvement, then maybe you knowing that the Honda DH team is using their suspension should clue you in.

As the damper or shock is compressed a rod is pushed into the damper body. At the end of this rod is a piston that gets forced through oil that is contained within the damper. The oil is then forced through ports in the piston. When the shock is compressed the oil flows through the compression ports. When the shock returns to the extended position oil flows in the opposite direction through the rebound ports. The direction that the oil flows through these ports is determined by the bending valve shims that are located on either side of the piston. They create a check valve on either side of the piston and keep the oil from flowing in both directions in the ports. When the shock is compressed the oil forces the rebound shims against the surface of the piston and blocks off the rebound ports. At the same time the oil bends back the compression shims from the surface of the piston and flows through the compression ports. This process is reversed as the shock returns to its extended length. The damping force that the shock produces at different piston velocities in either direction is determined by oil viscosity and the diameter, thickness & number of these valve shims.



A certain amount of oil is also allowed to bypass the piston during compression & rebound as well. There is a small port at the end of the rod that leads to just below the compression valve stack. The size of this port, and how much oil can flow through it, is controlled by a tapered needle that runs through the center of the rod. A screw near the bottom of the rod controls the position of the needle. This screw is known as the rebound adjuster. In this system this screw will affect compression and rebound oil flow. However it is still called a rebound adjuster screw because it has a much larger effect on the rebound than on the compression. Some systems have a check valve in this circuit as well and only allow oil to flow during rebound. However the check valve design has a slow response to small repetitive bumps (like the wash board effect that can develop on fire roads) and is not usually used. The rebound adjust is used to control how quickly the shock returns to its extended length. Turning the screw in makes it return slower and turning it out quicker. The rebound screw should be adjusted out enough so that the rear wheel can follow the contours of the terrain. However not so far out that the rear wheel feels like it is springing back and wanting to throw the rider over the bars after a bump or jump.



As the rod enters the damper body its volume displaces the oil in the shock. This displaced oil must go somewhere so it flows into the shock reservoir. The shock reservoir contains a sliding piston or a bladder. The piston or bladder separates a high pressure gas, usually nitrogen, from the oil. As the oil flows into the reservoir it compresses this gas even more. The gas is separated from the oil to keep it from mixing with the oil and causing the oil to foam. If the oil were to foam the damping would decrease and be difficult to control. The shock is kept under high pressure to keep the oil from reaching its vapor pressure and cavitating as it flows from one side of the piston to the other. Cavitation is when the oil begins to vaporize or boil. This happens when its pressure becomes too low. If the oil was to cavitate this once again would severely affect damping. Before the oil enters the reservoir it must flow through an orifice that separates the reservoir from the shock body. Once again the size of this hole is controlled by a tapered needle connected to a screw. This screw is called the low speed compression adjuster. Turning the screw in and out controls the cross-sectional area of the orifice. Turning the screw out increases the area that the oil can flow through. This allows more oil to flow quicker into the reservoir and keeps the pressure lower in the shock. Lower internal shock pressure means that there is less damping force acting against the rod as it tries to enter the shock body. By adjusting the low speed compression adjuster the way the shock reacts to small bumps and lower speed events (Such as G-outs) can be manipulated.

Some higher end shocks also have a high speed compression adjustment as well. This adjustment allows the user to adjust the way the shock reacts during a high speed event. A good example of this type of event would be hitting a square curb while riding fast. The high speed compression system works by allowing oil displaced by the rod to bypass the slow speed compression adjuster. Turning the high speed adjuster in and out controls the amount of preload that is placed on a heavy spring inside of the adjuster. The spring forces a valve closed and oil is not able to travel through the high speed circuit. All of the oil displaced by the rod must travel through the slow speed compression circuit. However the quicker the shock is compressed the higher the internal pressure gets. When the pressure gets high enough to overcome this spring the valve cracks opens and oil can go through. By properly manipulating the high speed compression adjuster how stiff the shock feels during a high speed event can be controlled.

Another important adjustment that is often over looked is the main spring preload. The way the bike handles and turns is greatly affected by this adjustment. Correctly adjusting preload is quick and easy as well.

The shock spring preload is adjusted by rotating the spring preload adjuster at the top of the spring. For a proper setup the bike should sag approximately 33% of the rear wheel's total travel when the rider is seated on it. So if the bike has 6 inches of travel at the rear wheel it should sag approximately 2 inches with the rider seated on it. If the bike is sagging more than this then the preload adjuster should be turned clock wise to add more preload to the spring. Be careful that the spring preload adjuster is not turned down so far that the spring reaches solid height before the shock travels through its entire stroke. If proper sag can't be achieved without this happening then the spring rate is too soft and you need to go to a higher one. On the other hand if the bike is not sagging enough, even with the preload adjuster almost completely loose, then the spring rate is too high. To properly measure the sag it is usually easiest to get two friends to help. While you are seated on the bike have one person hold you upright while the other takes the measurement. The measurement should be taken from the rear axle to some point vertically above the axle. The fork should also sag 33% of their travel with the rider aboard. However many forks do not have a preload adjuster. You can get around this buy adding washers with the same OD as the fork springs between the spring and the fork cap. You need to be careful that you do not add too many shims and cause the springs to reach solid height before the fork can go through its entire travel. Once again if you can not achieve the proper sag with your current springs you will need to go up or down with the spring rate. When measuring the sag in the front use the same procedure as the rear only this time measure along the axis of the fork.

Downhillnews would like to thank the knowledgeable suspension engineer from SHOWA USA for giving a solid insight into suspension systems. With new suspension claims coming out almost every year it is good to have a good grasp on the fundamentals. So next time you are talking compression and rebound with someone hopefully you can visually picture what is going on as the suspension compresses and rebounds. For those looking to breed some new life into their shocks we recommend contacting Cortina Cycles of Santa Barbara. They are now selling shim stacks and modification kits for most rear shocks, and some fork kits may be just around the corner. These shim kits will make the shock work that much better and can be custom valved to the needs of you bike and the terrain you ride. Look back soon for more articles from industry experts.