

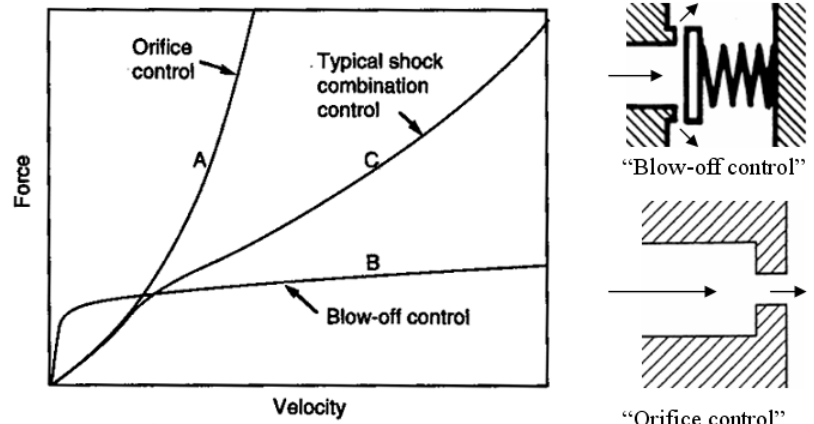
**VALVING** is a general term for “The orifices and valves that resist the movement of the shock piston as it travels through hydraulic fluid”. This resistance creates damping forces in a shock absorber.

**BACKGROUND** - Suspension movement is controlled by coil spring and shock damping forces. The suspension “compresses” when contacting a bump and “rebounds” after the bump. The resistance to the compression stroke and the controlled release of the springs stored energy on the rebound stroke are determined by the “valving”. If the “valving” is too stiff the rider will get tired too quickly. If the valving is too soft, the bike will bottom and wallow on compression or kick back on rebound.

**TUNERS CAN CHANGE THE SHAFT VELOCITY Vs DAMPING FORCE WITH “VALVING”**

A simple orifice “valve” generates a damping force which is progressive as shown in curve A. If a tuner chooses a small enough orifice to control low speed suspension movements, the suspension would become too stiff and spike the rider on high speed (square edge) bumps.

Valves covering piston openings generate damping forces which are digressive. The valves remain closed until increasing shaft speeds cause the valves to “blow-open” reducing further pressure rises as shown in curve B. These two types of “valving” complement each other since their damping characteristics are inverse. A good suspension tuner can achieve a typical overall damping curve like C. This curve offers enough low speed damping control without making the suspension spike on high speed bumps.

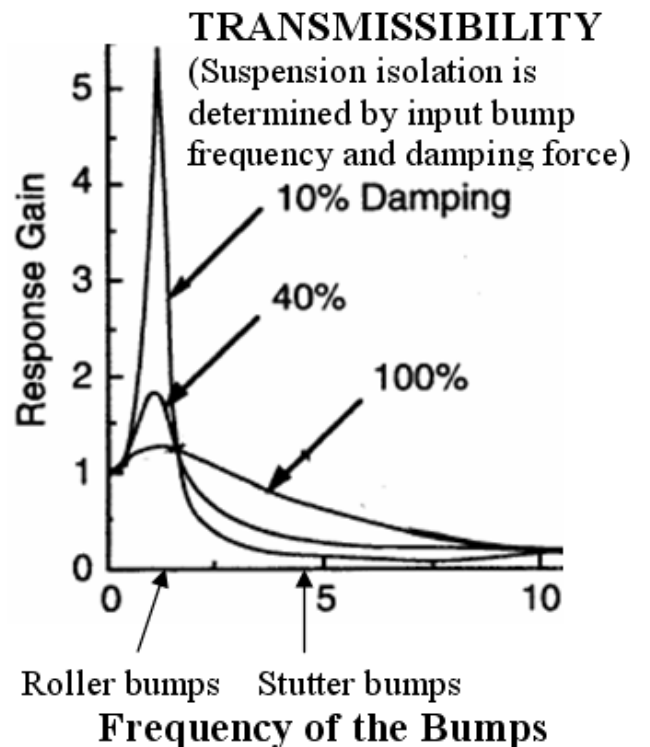


*Force-velocity properties of shock absorber valving.*

**SUSPENSION PERFORMANCE TRADE-OFFS**

A good suspension tuner can come close to the goal of plush suspension in the chop that never bottoms or wallows in the rollers. The final adjuster settings chosen by the rider are based on a compromise between plush corner entrances and exit (high frequency bumps) Vs wallow in the rollers (low frequency bumps).

This trade-off is shown in this transmissibility graph. The input is assumed to be a bump of constant magnitude 1 unit on the vertical Y axis. The output (Response Gain) to the dirt bike frame is determined by following the curve. Note that with only 10% damping at a frequency of about 2 cycle/second, the Response Gain to the chassis is 5 times greater than the input (suspension in resonance). The same 10% damping at 4-6 cycles/second provides a Response Gain to the chassis of 0.2 times (suspension provides isolation). This 10% damping setting isolates the chassis and rider from



the stutter bumps but causes wallowing and bottoming in the rollers.  
 Conversely with 100% damping, the chassis does not wallow or bottom but does not isolate the rider from high frequency stutter bumps.  
 Different tracks have different obstacles allowing the rider to choose different adjuster settings & tradeoffs.

### CONFUSION OVER WHICH DIRECTION TO TURN THE ADJUSTERS

The most confusing part of making a suspension adjustment is determining which way to turn the adjuster. Too Tech recommends that the rider forget about Hard and Soft!! Think about the adjuster as a 'needle and seat' like your water faucet. Turning the adjuster clockwise 'in' will restrict the flow of oil. This will increase the damping force and slow down the motion.

**REBOUND;** Turn the adjuster clockwise 'in' to add damping. This causes the rebound stroke to return more slowly. If you go too far the wheel will not return fast enough and the suspension will "pack" down.

**COMPRESSION;** Turn the adjuster clockwise 'in' to add damping. This causes the compression stroke to slow down which prevents bottoming. If you go too far the bike will get too stiff causing arm pump and fatigue.

In stock form, many factory suspensions do not respond well to adjuster changes made by the rider. This is an indication that the factory "valving" does not meet the needs or expectations of the rider. By listening closely to the rider complaints and analyzing the factory valving techniques, Too Tech Racing is able to develop a "valving" style to satisfy a wide variety of rider expectations.

Please go to [www.tootechracing.com](http://www.tootechracing.com) for a more in-depth explanation of these subjects.

### THREE DIMENSIONAL DRAWING OF THE 1986 SHOWA COMPRESSION ADJUSTER

Flow through the shock adjuster is similar to flow through a shock piston. The oil encounters orifices and valve stacks that restrict the flow based on shaft speed.

This shock compression adjuster had an adjustable orifice circuit, a low speed valve stack, a high speed valve stack, and an adjustable high speed stack spring. This was the best, and probably most expensive, compression adjuster I have seen. It is no longer used on any of the current dirt bikes.

### 1996 CR 250 HIGH & LOW SPEED ADJUSTER

