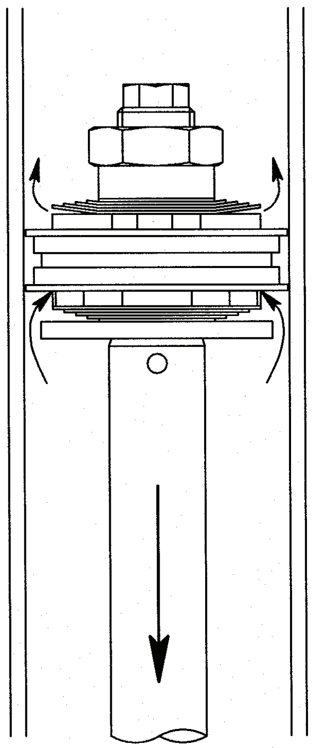
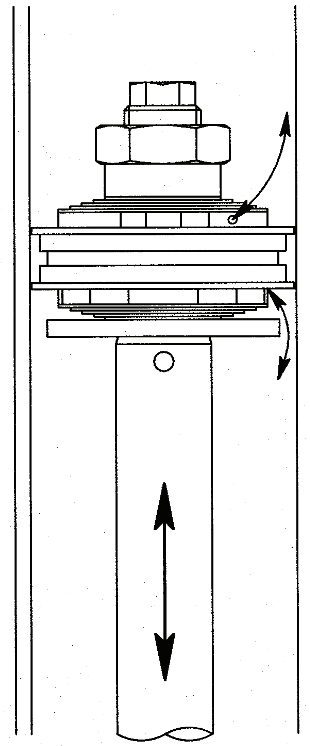
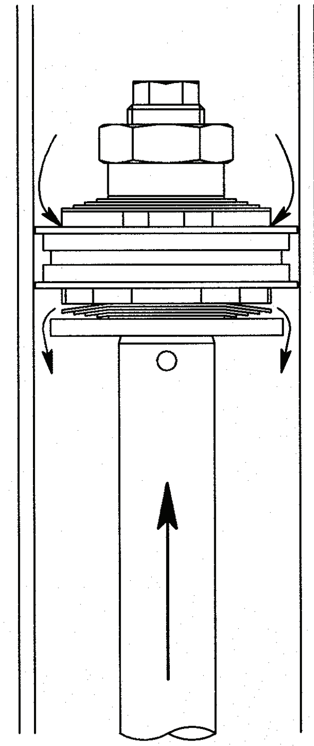
General Valving Characteristics



High Speed
Rebound



Low Speed*
Compression and Rebound



High Speed
Compression

The damping characteristics of your shock are determined by the compression and rebound valve stacks located on the main piston.

The valve stacks are made up of a series of high quality shims, which are made to flex under the force of oil flowing through the piston ports and then return to their original state.

The thickness of the individual shims determines the amount of damping force the shock will produce. By changing the thickness of the individual shims, damping forces will be altered. For example, if you are running an “A” compression valving, where all the shims in the stack are .006 thick and you replace them with a “B” compression valving, which consists of all .008 thick shims, the compression damping will increase.

* When the shaft is moving very slowly oil passes through the bleed hole, if there is one, before it passes to the shims.

A Guide To Damper Tuning

The ultimate purpose of a shock is to work together with the spring to keep the tire on the track. In compression (bump) to help control the movement of the wheel and in rebound to help absorb the stored energy of the compressed spring.

Breaking down the shaft speeds to chassis movement can be done from the data taken from on board data acquisition and/or actual test sessions.

Where we find the biggest advantages with low speed adjusters is looking at the chassis in the plane of the four wheels in relation to chassis movement in roll and pitch and how quickly weight is transferred to each corner in order to load the tire sooner or later, depending on track conditions.

Usually in rain or low grip situations allowing more bleed or less low speed damping is desirable to delay tire loading upon initial roll.

In dry high grip conditions adding damping or restricting bleed will load the tire sooner upon initial roll increasing platform stability.

In pitch situations on smooth surfaces under braking, increasing low speed damping or restricting bleed will help load the tires for entry or mid corner. If the tire begins bouncing under braking usually an increase in high speed compression will calm this down.

If the chassis feels like it is moving around too much relative to the track, increasing low speed damping or restricting bleed will overall firm up the chassis and give it a crisp feel or a better sense of feel in the car. This is why most drivers like this adjustment; as increasing low speed compression seems to give the driver better or quicker feedback from the chassis, resulting in a higher confidence in the car.

A car with too much low speed damping will usually lack grip in change of directions, cannot put power down in slower corners (wheel spin) and lack overall grip after initial turn in.

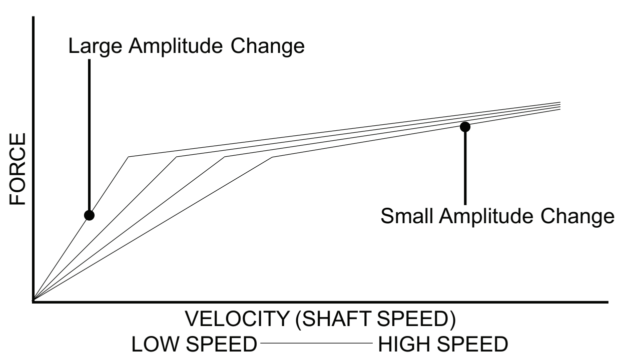
If traction is a problem coming off slow corners, reducing low speed damping or adding more bleed will help weight transfer at the rear thus increasing traction.

We like to look at high speed adjustments as individual movements at any of the four corners, caused by an input from the circuit or an exaggerated action by the driver. This adjustment is less forgiving than low speed, because of its large range of adjustment which can help or hurt the balance of the car. It is straight forward on how to adjust from simple driver's inputs, in regards to if the car feels too soft or stiff in the bumpier sections of the circuit.

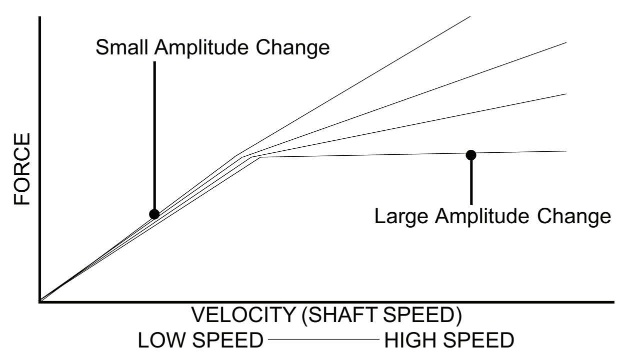
One of the most important things to know about these adjusters is their relative position to one another. If for instance you have the low speed set at 25 to 30 clicks (soft), the range of high speed adjustment will be lessened. Or in the opposite direction, if the high speed is set at 0 to 1 (off soft), the low speed adjustment range will be lessened.

Also, when making a big adjustment in high or low speed, the change will affect the other in a small percentage. As an example, the high speed is set at (+4) and the low speed at (-6). Now you want to set the low speed to (-2), this will also increase a percentage of the high speed force figure. By dropping the high speed from (+4) to (+3) would compensate for this low speed change so the overall "damper curve" would remain intact.
The more experience you have with these the easier it will become to recognize what changes can occur in relation to different valvings. The tendency of these circuits to "cross talk" is greatly reduced in our new digressive CD piston (part # AS-76DIGCDUP).

The rebound adjuster consists of a needle metering flow across a hole. This metered flow bypasses the main piston/shim assembly until flow is choked off. The shims then modulate the flow.



LOW SPEED ADJUSTMENT EXAMPLE



HIGH SPEED ADJUSTMENT EXAMPLE

A Guide To Damper Tuning

The range of adjustments will have a relation to high or low shaft velocity depending on what main piston is being used:

1) Linear Piston 1° - adjustment through range

2) Linear Piston 2° - greater change in low speed adjustment

3) Velocity Dependent Piston - adjustment through range with greater change in low speed

4) Digressive Piston - range primarily in low speed

Also depending on valving, there will be an affect on adjustment range. The softer the valving (A - B), the less force range it will have. This is due to a lower pressure required to blow the valves on the main piston. Obviously the heavier the valving (C - E), the more effective the bleed becomes. On digressive pistons, pre-load also affects the range of adjustment.

Rebound adjustments are usually indicated by the driver asking for more stability. By increasing low speed damping, stability will be enhanced; decreasing damping will allow more movement in the car, but will result in a little better tire wear.

Also, the amount of rebound can have a great influence on weight transfer. Less front rebound allows weight transfer to the rear under acceleration. Less rebound in the rear allows for a greater amount of weight transfer to the front under braking and turn in.

When a car is over damped in rebound it can pack down in a series of bumps and a driver will recognize this as too stiff and usually will think it is compression damping. Too much rebound can cause lack of grip on cornering.

When making a large spring change keep in mind where the rebound adjuster is and do you have enough range to compensate. Sometimes a spring change will bring a better balance to the damping values after the spring change. If the spring/shock combination was balanced, the rule of thumb is a stiffer spring requires lower compression and higher rebound. A softer spring requires higher compression and lower rebound.

Basic Start-up Procedure

The following setup procedures are basic recommendations for reaching an initial starting point using double adjustable Penske Racing Shocks. This procedure is ideal for use on an open test schedule. A race weekend may not allow enough time. Start by making the compression adjustments as described below, until it feels right, then move to the rebound adjustments.

COMPRESSION

The idea is to set the compression damping forces to suit the bumps in critical areas, such as corners, corner exits and braking zones.

Increasing or lowering cannister pressure (range 150 to 300 psi) can have an influence on support under braking, acceleration, and tire loading on turn in, and on mid-corner grip.

Step 1 - Set the rebound adjuster at full soft.

Step 2 - Starting with the compression setting at full soft, drive a lap then return to increase the bump settings. Continue this process of adding bump control to minimize the upsets until the car becomes harsh, loses tire compliance and traction. At this point you know that you have gone too far on the compression settings; back off one click.

REBOUND

The idea is to tighten up the car, stabilize the platform and eliminate the floating "Cadillac feeling". This will also reduce the rate of body roll.

Step 1 - With the rebound setting at full soft, add 5 flats (8100) or clicks (8760) of rebound adjustment at a time, then return to continue the process until the car becomes "skittish" or the rear wheels hop under braking. At this point you know you have gone too far on the rebound settings, back off one flat at a time for final balance.

Once again, this is a basic procedure for finding your initial setup for a given track. If you find that you are at the end of your adjustment range and feel that the car is feeling better, you will need to revalve the shocks to allow for further adjustment in the given direction.