# DtM Consultants

## Deltatechnic Motorsport Consultants

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## How To Set Up Race Car Adjustable Dampers

**SPRINGS (springs are shock absorbers)**

Springs are fitted to absorb the shock loads from the wheels and to prevent the transfer of the majority of that instantaneous load to the chassis. The spring absorbs the energy of the shock by compressing and storing that energy as potential energy in the compressed spring. When the spring is able to return to it's free length this energy is released as kinetic energy, and the spring extends with as much force as it took to compress it in the first place. This can be enough to push the wheel assembly past the ride height position and on to full droop. It will then continue to oscillate at the natural frequency of that corner of the vehicle.

**DAMPERS (dampers are not shock absorbers)**

The damper is fitted to control the movement of the spring. It does this by converting the spring's kinetic energy (movement) into heat energy by forcing oil through small holes and heating it up. The heat energy is then lost into the airflow past the damper body. So it is important not to mount the damper where it can be heated, as it will make enough of its own heat without any help.

The gas in a damper is only there to enable the volume of the piston rod to be accommodated as it is pushed into the damper body. This displaces a free piston in the reservoir and moves a small amount of oil into the reservoir, if there is one. The movement of this oil can be controlled and provides the bump adjustment. Rebound adjustment and the majority of the bump damping are carried out on the main piston assembly at the end of the piston rod.
A nice bi-product of having a pressurised gas pocket in the damper is that it will dramatically cut down oil cavitation during the higher speed rebound operations as the oil should never be subjected to a pressure less than atmospheric.

**BUMP DAMPING**

Bump damping controls the unsprung parts of the vehicle. It controls the upward movement of the suspension as when hitting a bump in the track. It should not be used to control the downward movement of the chassis in roll or to prevent bottoming out in dips. The ideal bump setting is achieved when side hopping in bumpy turns is minimal and the ride is not too harsh. At any point other than the ideal setting either side hopping will be pronounced or the ride will be harsh. A harsh ride in a race car (for the car, not the driver) results in the tyre not being able to use its full tractive effort to the maximum, and is illustrated by a lack of grip.

**PROCEDURE FOR SETTING BUMP CONTROL**

1. Set all four dampers to minimum bump and rebound.
2. Drive several laps. Disregard roll and turn-in characteristics. Concentrate solely on how the car feels over bumps in turns. See if the car side hops in rough corners.
3. Increase bump setting two clicks at a time on all four corners until a setting is reached where the car won't side hop, but feels harsh and begins to slide more.
4. Back off the setting one click.

The back off point will probably be reached at one end of the vehicle before the other. When this happens keep increasing the end that is still gripping until it too slides, back off one click.

**REBOUND DAMPING**

Rebound damping controls the transitional roll when entering a corner. It does not, and should not be used to limit the total roll angle. It will control how quickly the roll angle is achieved. The total roll angle is controlled by the springs and anti-roll bars, and the roll moment (the distance between the mass centroid and the roll centre axis).

Too much rebound control will cause an initial loss of lateral adhesion at the end of the car that is over damped giving turn-in oversteer or understeer. Too much rebound in relation to bump will cause the car to "jack down".

Only when the optimum bump settings have been found for both ends of the car are you ready to adjust the rebound control.

**PROCEDURE FOR SETTING REBOUND CONTROL**

1. With the rebound set at full soft and bump set from the previous procedure, drive the car and pay attention to how the car rolls into the corners.
2. Increase two clicks at a time all round until the car enters the corners smoothly without any sudden attitude changes. Again the optimum point will be reached at one end of the car before the other, so continue with the other end until that too is behaving smoothly.

Any increase in rebound damping beyond this point is not necessary, and may detract from grip. It is often used to overcome deficiencies in other parts of the suspension system, but this should not be allowed to happen.

The preferred characteristic of the car is: positive turn-in leading to a slight understeering attitude through the corner which can be balanced by inducing a small amount of power oversteer though the apex and on through to the exit. The car should go through the corner with an absolute minimum of steering lock applied, and hopefully all of the throttle.

This full procedure should be used at every track before racing on it. Some compromises will be required as individual corners may ideally need different damper settings to others, an overall optimum set-up can quite swiftly be arrived at with some practice and a little driver training.