



VAS 161MT-615

VariShock 1979-2004 Mustang/Fox Chassis Rear Coil-Over Conversion Installation and Tuning Guide

Part Number	Qty.	Description
VAS 161MT-615	1 (pair)	VariShock QuickSet 1 Coil-Overs, Ball Stud Upper, COM-8 Lower
VAS 21-12XXX	1 (pair)	VariSprings, 12" Length, Selected Spring Rate
899-012-201	1	Spanner Wrench (Included with C/O Conversion Kit Only)

Shock Specifications

Part Number	Valving	Mounting		Total Travel	Compressed Length*	Extended Length*	Ride Height*		Spring Length
		Upper	Lower				Min.	Max.	
VAS 861MT-615	Single	Spherical Stem	1/2 Eye	6.15	12.78	18.93	15.25	16.50	12

* Shock length is measured from between washers of upper stem to lower bearing pivot center.

Spring Selection Guidelines

The baseline spring rate for Fox Mustangs seeing regular street use is 175-200 lbs/in., depending upon desired ride quality. Spring rate affects ride quality, ride height and roll rate characteristics. Differences in vehicles such as performance application, weight reduction and chassis stiffening should be taken into consideration. Additional springs can be purchased for tuning purposes.

12" Baseline Spring Rate

Rear Vehicle Weight (lbs)	Rate (lb/in)	Spring Travel (in)	Maximum Preload (in)	Part Number
820-925	80	8.63	2.36	VAS 21-12080
925-1025	95	8.28	2.01	VAS 21-12095
1025-1125	110	7.91	1.64	VAS 21-12110
1125-1225	130	8.43	2.16	VAS 21-12130
1225-1350	150	7.61	1.34	VAS 21-12150
1350-1500	175	7.60	1.33	VAS 21-12175
1500-1750	200	7.45	1.18	VAS 21-12200
1750-2025	250	7.00	0.73	VAS 21-12250
2025-2300	300	7.07	0.80	VAS 21-12300
2300-2600	350	7.00	0.73	VAS 21-12350
2600-2900	400	6.35	0.08	VAS 21-12400
2900-3200	450	6.24	0.00	VAS 21-12450

INSTRUCTIONS

1. Begin by assembling the coil-over shock.
2. Apply anti-seize to threads of lower spring seat and shock body, then screw spring seat onto shock until nearly in contact with adjustment knobs (Figure 2-1). The spanner wrench notches in spring seat should face toward lower shock eye. Ball-locks may need to be loosened to easily turn spring seat.



Figure 2-1

3. Install optional spring seat thrust bearing (PN 899-020-217) onto shock at this time. Bearings must be lightly greased before use. (Figure 2-2)



Figure 2-2

4. Install spring onto shock, then place upper spring seat into position. The threaded lower spring seat will need to be very near its lowest setting. (Figure 2-3)
5. Once upper spring seat is in place, thread lower seat upward until spring just starts to compress. Installed spring length should measure 12". (Figure 2-4)



Figure 2-3



Figure 2-4

(Removal and installation of shock will be completed for one side of vehicle before proceeding with second shock for safety purposes.)

6. Raise rear of vehicle off ground and place jack stands under chassis so rear suspension hangs freely.
7. Remove rear wheels.
8. Place a jack under rearend housing at the end on which you are currently working. The jack supports the housing as shocks are disconnected and enables housing to be safely raised or lowered as necessary.
9. Apply coil-spring compressor with adequate tension to hold spring at current length. The spring will be more easily removed once shock is disconnected in the following steps.
10. Unbolt and remove quad shock. The factory stud plate can also be unbolted from the frame rail. These components will not be reused. (Figure 3-1)
11. Remove mounting hardware at lower eye of shock. (Figure 3-2)
12. Remove nut at upper shock stem mount. Image shown is exposed hatchback access panel. Coupes/Convertible shock access is in the trunk. (Figure 3-3)
13. Using the jack, slowly lower end of housing until coil spring can be easily removed. The spring may need to be further compressed for safe removal. **USE EXTREME CAUTION WHEN REMOVING COIL SPRINGS.**

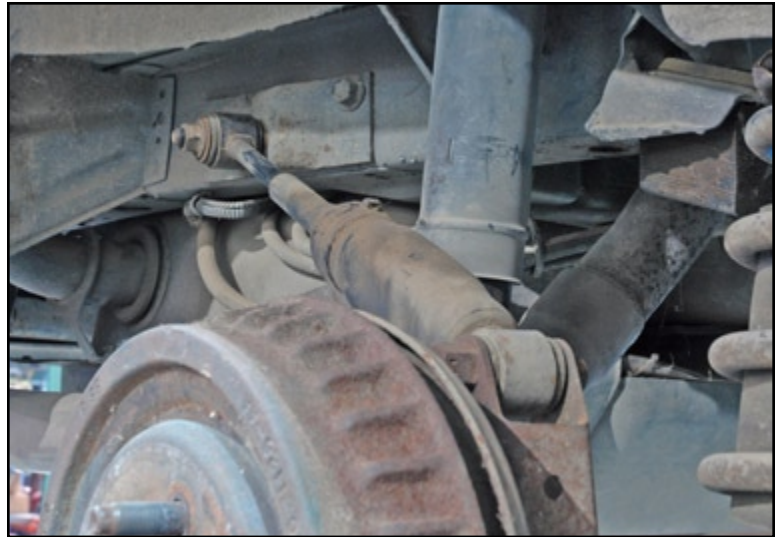


Figure 3-1



Figure 3-2



Figure 3-3

14. Place one stem washer onto the shock stud, then insert stem into upper chassis mounting location. The shock will need to be held in position for the following step. (Figure 4-1)



Figure 4-1

15. From inside the trunk or hatchback area, place second stem washer over stem, then thread locknut onto stud. (Figures 4-2 and 4-3)



Figure 4-2



Figure 4-3

16. Tighten upper stud mounting hardware. (Figure 4-4)

Hatchback Installation (shown): The locknut can be held with an open end wrench and the stem turned counter-clockwise using a 7/16" deep-socket.

Coupe/Convertible Installation: Hardware is more easily accessed and can be tightened with wrenches.



Figure 4-4

17. Install adjustable lower mount (5811-M40 or 5811-M41) as described in lower mount installation guide.

18. Bolt lower shock mount eye in between mounting tabs using 1/2-20 x 2" hex head bolt and locknut. Tighten to 55-60 lb/ft.

To begin setting ride height, the tabs must be installed in the highest position possible. (Figures 5-1 and 5-2)

19. Verify all mounting hardware is correctly installed and tightened to specifications.

20. Repeat steps for opposite side of vehicle.

21. Figure 5-3 shows the completed installation on an OEM rearend housing.



Figure 5-1

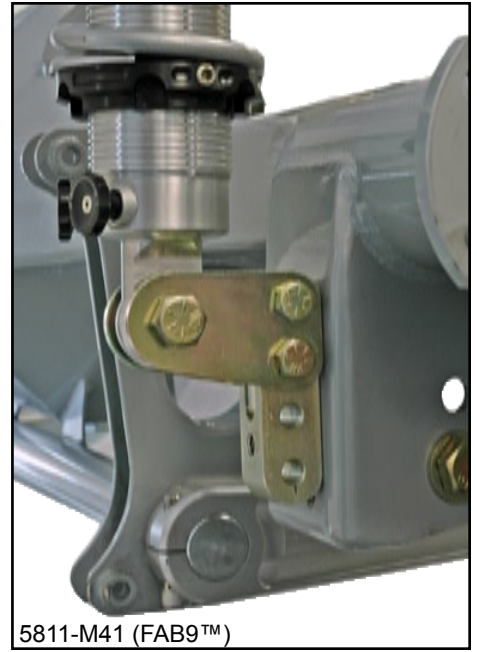


Figure 5-2



Figure 5-3

RIDE HEIGHT SETUP

Wheels can remain off for the following procedure.

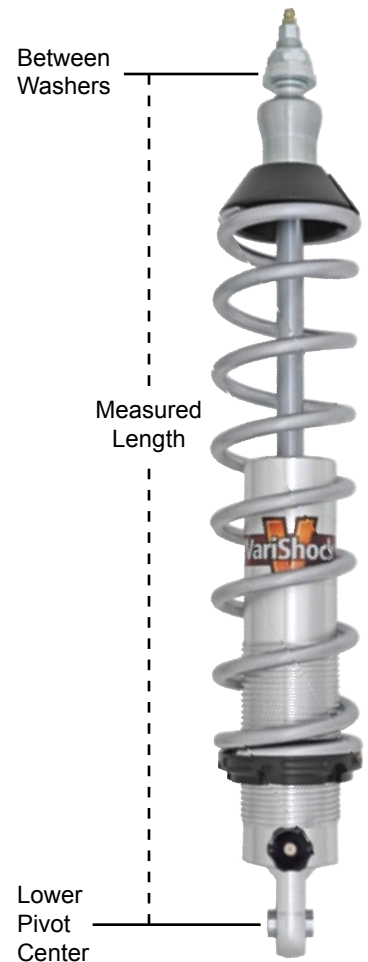
1. The lower end of the coil-over shock should be mounted in the highest possible position.
2. Axle should be supported by a jack stand under each axle tube so that suspension is carrying the full rear weight of the vehicle.
3. Measure length of the shock and compare to Shock Specifications chart to ensure you are within the Ride Height range. Preload will need to be adjusted until both shocks measure equal to each other and are at the correct length.

SUSPENSION MUST BE AT FULL EXTENSION BEFORE ADJUSTING LOWER SPRING SEAT.

Drag racing applications should typically be set at 15-1/4".

Street applications should be closer to 15-7/8".

4. Once spring preload has been correctly set, the lower shock mounts can be repositioned to set the vehicle at the desired ride height.
5. Preload can be adjusted to fine tune ride height and corner balance the vehicle.



Shock Specifications

Part Number	Valving	Total Travel	Compressed Length*	Extended Length*	Ride Height*	
					Min.	Max.
VAS 861MT-615	Single	6.15	12.78	18.93	15.25	16.50

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VariShock Adjustment and Tuning Guide - QuickSet 1

This guide covers adjustment features and tuning procedures for VariShock QuickSet 1, single-adjustable, shock absorbers. The information contained has been greatly simplified and is only intended to get you started in the right direction. Suspension tuning involves multiple variables such as: spring rates, antiroll bar rates, vehicle weight distribution, tire sizes, tire pressures, suspension geometry, and track conditions. We highly recommend thoroughly researching suspension tuning and vehicle dynamics, or consulting an experienced professional.

Travel Limiters

Shocks are not to be used as travel limiters. An extension travel limiter, such as a strap or cable, should be used to prevent topping out and damaging the shocks. The installed compression bumper protects the shock if bottomed out during normal use. If the bumper shows signs of wear or damage it must be replaced immediately. Never operate a vehicle with a missing or damaged bumper. Vehicles that consistently bottom out shocks or land harshly from wheel stands should use a higher rate spring along with some form of suspension stop to limit compression travel without directly impacting the shock body. Any shock will be damaged if the car is dropped from a wheel stand.

Ride Height

When a shock is at ride height a certain amount of travel is available in either direction. Depending upon performance application, shock travel will be reserved in different percentages for compression or extension.

Street Baseline: 60-percent Bump, 40-percent Rebound

Street vehicles require more available compression (bump) travel for improved ride quality and unexpected road hazards. At baseline ride height, the shock and spring should collapse 40-percent from their installed heights. This results in 40-percent of travel available for extension and 60-percent for compression travel.

Handling Baseline: 50-percent Bump, 50-percent Rebound

Handling performance applications are usually limited to smooth prepared road-course- or autocross-tracks, therefore less compression travel is required. Suspension geometry or track conditions may require the travel percentages to be shifted to prevent topping- or bottoming-out the shock.

Drag Race Baseline: 40-percent Bump, 60-percent Rebound

Drag race vehicles generally require more extension (rebound) travel to help weight transfer, and because the drag strip is very flat, less compression travel is needed. The amount of extension travel available in the shock will drastically affect how the car works. At baseline ride height, the shock and spring should collapse 60-percent from their installed heights. This results in 60-percent of travel available for extension and 40-percent of compression travel.

Baseline Spring Rate Selection

Spring rate affects ride quality, ride height, stored energy, weight transfer and how effectively the front suspension handles downward movement after drag race launches. Differences in vehicles such as specific performance application, weight reduction and chassis stiffening should be taken into consideration. Additional springs can be purchased for tuning purposes. The recommended spring rates are based on the combination of weight of the car and baseline ride height.

Spring Preload

The threaded lower spring seat is used to adjust spring preload. Compressing the coil spring to any length shorter than its free height, with the shock fully extended, is considered preloading the spring. If you adjust the spring seat to change the vehicle's ground clearance, be aware that you will be adding or subtracting travel in the shock. Usually when lighter-than-baseline spring rates are used it is necessary to add preload to achieve the correct balance of travel and ride height. If preload has been added make sure there is adequate spring travel remaining to prevent coil bind before the shock is fully collapsed.

Tuning Front Suspension with Spring Rate (Drag Race)

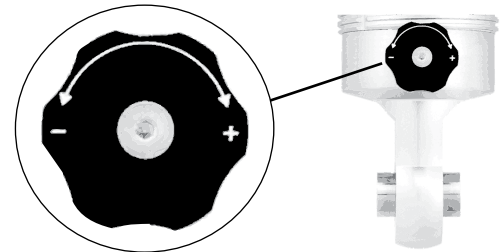
A drag race car should run the lightest front spring rate possible, without letting the shocks bottom out when making a pass. As a general guideline, lighter springs allow the car to easily transfer weight, and settle faster down track. Changing spring rate affects ride height and the rate at which weight is transferred to the rear tires. A softer rate

makes the front easier to raise during acceleration. A stiffer rate makes the front harder to raise during acceleration. If you are having trouble getting the front end to rise, you can soften shock valving or change to a softer spring. When using lighter rate springs preload must be added by screwing the lower spring seat upward, compressing the spring to achieve proper ride height. In general terms, the worse a car hooks the more shock extension travel it will need. If you need more extension travel, preload can be removed to lower ride height. Using this method will cause the car to have less ground clearance and reduce the amount of compression travel. If you are going to operate the shock at a ride height shorter than recommended, the upper chassis mounts must be relocated to correct any major vehicle ride height issues. It may take some work with spring rates and upper mount relocation to get the correct combination of vehicle ride height and front suspension travel for your application.

Adjustment Features

The QuickSet 1 valve system features a single adjustment knob that controls overall damping stiffness of the shock. Knobs are clearly etched indicating the correct direction of rotation to decrease (-), or increase (+) damping stiffness. There are a total of 16 specific adjustment positions.

Position 1, the softest setting, is found by turning the knob in the counter-clockwise direction until the positive stop is located. Rotating the knob in the clockwise direction increases damping stiffness. Each of the 16 settings is indicated by a detent that can be felt when turning the knob, and an audible click as the knob gently locks into position. Only very light force is necessary to rotate the knob past each detent. If access to the adjustment knobs is limited, a 5/64 or 7/64 (depending upon model) ball-drive Allen wrench can be used to adjust the knob. Do not force the knob beyond its intended stop, doing so will damage the valve mechanism.



Symbol	Direction	Effect
+	Clockwise	Increase Stiffness
-	Counter-Clockwise	Decrease Stiffness
Note:	Adjusts overall damping stiffness for Bump and Rebound simultaneously.	

Note: VariShocks have a substantial range of adjustment with very little bypass or internal bleed. Due to our minimal-bleed design, shocks will feel extremely stiff at some settings when operated by hand, whereas other shocks with excessive bleed will move more freely. Manual comparison should not be performed. A person cannot manually operate the shock at a rate anywhere near real life conditions and any results found in this manner will be meaningless. Prior to shipping, every VariShock is dynamometer (dyno) tested and calibrated throughout an accurate range of shaft speeds and cylinder pressures found in real-world operation.

The Truth About 16- vs. 24-Clicks

Don't be fooled by shocks offering more adjustment clicks. They are actually 1/2-click adjustments. The manufacturer merely added more detents to the mechanism without increasing the range of adjustment. This practice gives more clicks, but the adjustment is so slight that your vehicle will not respond to the change. A 16-position VariShock actually has a broader range of adjustable force with the added benefit of a more manageable number of adjustments to try.

Tuning Procedures - QuickSet 1

VariShock shock absorber's broad range of adjustment is suitable to the three categories of suspension tuning: ride quality, handling performance, and drag racing. All three tuning categories have the common goal of controlled weight transfer, but have greatly differing vehicle-dynamic requirements. Each will be discussed in the following text. Before proceeding, verify that all suspension components, such as control arms, balljoints, and bushings are in acceptable condition and that tire pressures are correctly set.

Tuning for Ride Quality - QuickSet 1

Tuning for ride quality generally involves lighter spring rates matched with softer shock settings to achieve a smooth and comfortable ride. Testing and adjustment is required to attain desirable results. When properly adjusted the vehicle should feel settled without continued bouncing (too soft), excessive harshness (too stiff), or fore/aft pitching.

Prior to Testing

Begin with the shocks adjusted to the number 3 position. The first two settings are generally too soft for street use and are normally used in drag racing applications.

Find Harshness Threshold

Noticable ride harshness is generally rapid upward movement of the suspension as the tire travels over rough or bumpy surfaces. Increase shock stiffness by one, then test again. Continue increasing stiffness and testing until the vehicle begins to feel harsh over bumps. From this setting, decrease shock stiffness by two. The harshness threshold setting may differ from front to rear.

Excessive Chassis Movement	Increase Stiffness	If vehicle exhibits rapid weight shifts or continues to oscillate more than one suspension cycle before settling, increase shock stiffness by one, then test again. As stiffness is increased, road noise and vibration will also increase. Note: Stiffening the shock does not reduce the amount of lean or dive in a sustained turn or braking maneuver, but does slow the rate of weight transfer to minimize unexpected changes in the cars handling.
Harshness and Vibration	Decrease Stiffness	If excessive road noise, vibration, or harshness is experienced decrease shock stiffness by one, then test again.
Fore/Aft Pitching (constant speed 50-70 mph)	Alter Front-to-Rear Stiffness Difference	If vehicle exhibits fore/aft pitching at highway speeds, the rear shocks should be stiffened or conversely the front shocks softened. Ideally the rear suspension should oscillate at a slightly quicker rate than the front to minimize pitching.

Tuning for Handling Performance - QuickSet 1

Heavier spring rates matched with stiffer shock settings generally contribute to improved handling performance by reducing chassis movement. Stiffer tuned suspension increases vibration transferred to the vehicle and passengers, but is usually tolerated for performance gains. When properly adjusted the vehicle should feel responsive, exhibit balanced cornering grip, and maintain traction over irregular surface conditions. Extensive testing and adjustment is critically important when operating your vehicle at or near its performance limits. Testing must be done in a safe and controlled environment, such as a dedicated motorsports facility.

Prior to Testing

Begin with the shocks adjusted to the number 5 position. The first four settings are generally too soft for performance applications and are normally used in drag racing or street applications.

Find Harshness Threshold

Harshness is vibration transferred to the chassis by rapid upward movement of the suspension as the tire travels over rough or bumpy surfaces. Increase shock stiffness by one, then test again. Continue increasing stiffness and testing until the vehicle begins to feel harsh over bumps, or a reduction of traction, cornering, braking or acceleration ability is experienced. From this setting, decrease shock stiffness by one. The harshness threshold setting may differ from front to rear.

Excessive Chassis Movement	Increase Stiffness	If vehicle exhibits rapid weight shifts, increase shock stiffness by one, then test again. Note: Stiffening the shock does not reduce the amount of lean or dive in a sustained turn or braking maneuver, but does slow the rate of weight transfer to minimize unexpected changes in the cars handling.
Reduced Traction or Skipping	Decrease Stiffness	If a reduction in traction during acceleration, braking, or cornering is experienced decrease shock stiffness by one, then test again. This will be most noticeable on rough track surfaces.

Shocks Bottoming Out (body roll, brake dive or squatting)	Increase Stiffness	If chassis movement during cornering or braking allows shocks to bottom out, increase shock stiffness by one, then test again. The urethane bump stop can be used to gauge shock bump travel by sliding it down the piston rod, against the shock body, then checking its position after testing. If increasing bump stiffness cannot extend weight transfer duration long enough a higher rate spring should be installed.
Understeer Condition (Neutral throttle) Car turns less than expected; commonly referred to as push, plow, or tight.	Change Stiffness Bias Toward Rear	If vehicle exhibits understeer when cornering at neutral throttle, rear shock should be stiffened or conversely, front shock softened. A slight amount of understeer is considered safe and reduces the chances of spinning.
Oversteer Condition (Neutral throttle) Car turns more than expected; commonly referred to as tail-happy or loose.	Change Stiffness Bias Toward Front	If vehicle exhibits oversteer when cornering at neutral throttle, front shock should be stiffened or conversely, rear shock softened. Oversteer increases the vehicles tendency to spin when cornering and requires driver experience and skill to manage safely. This condition should be avoided by novice drivers.

Tuning for Drag Racing - QuickSet 1

Required settings for drag racing applications vary greatly depending upon, vehicle weight, weight distribution, suspension geometry and travel, horsepower, and available traction. A properly tuned drag race suspension enables the vehicle to launch straight while transferring weight to the rear tires in an efficient, controlled manner. Extensive testing and adjustment is critically important when operating your vehicle at or near its performance limits. Testing must be done in a safe and controlled environment, such as a dedicated motorsports facility. It is generally better to tune shocks according to improvements in ET's (Elapsed Times) rather than for specific occurrences such as the amount of wheel stand. Due to differences in weight distribution, wheel base, tire size, and horsepower, not all vehicles leave the starting line in the same manner once their suspension has been optimized. Watch your ET's and if your times start to get slower return to the prior adjustment. Once you have completed the following procedures, only fine adjustments may be needed to tune for specific track conditions.

Prior to Testing

Make certain that wheelie bars are raised as high as possible while maintaining control and eliminating their influence as much as possible on damper settings. Begin with shocks adjusted to the number 3 position.

Initial Testing

First verify that the vehicle tracks straight before aggressively launching from the line. Begin with light acceleration and low speeds. If the vehicle tracks and drives acceptably at this level, make incremental increases in acceleration and top speed until the vehicle is safe at higher speed. Vehicles not tracking straight at speed should verify all chassis settings including but not limited to alignment, bump steer, tire pressures, etc. Once the vehicle drives in a safe manner at speed, move on to test launching.

Test launches should consist of only the initial launch with no subsequent gear changes. Begin with low rpm launches and gradually increase rpm and severity if the car launches acceptably. At this time we are only determining that the car launches in a controlled manner to avoid damaging components or the vehicle. The vehicle should leave in a straight line without extreme wheel standing or harsh bounces. Sudden, uncontrollable front end lift should be corrected by making suspension instant center adjustments, if possible. More gradual front end lift can be corrected by adjusting the shock valving. If the car gradually wheel stands or bounces violently, adjust front suspension first, then rear. If there is rear tire shake, wheel hop or excessive body separation, adjust rear suspension first, then front. If your car is launching severely to the right or left, first check that the rear end is centered and there is no preload adjusted into the rear suspension. If the car still launches severely to the right or left, you will have to add preload to the rear suspension. If everything checks out okay and the car only minimally drives to the right or left, you can stagger the rear shock valving to correct this.

When a vehicle launches slightly toward the right, rear shock stiffness is increase on the driver side and shock stiffness is decreased on the passenger side. A vehicle launching slightly toward the left would make the opposite adjustments. It is not recommended to have more than two clicks difference side to side. Rear shock adjustments are only applicable to correcting the launch and will have little to no affect on down track performance.

After the car has been adjusted to launch straight, test launch and include the first gear change. Make any required adjustments and add the next gear change. Repeat until the car can be launched straight and driven at speed safely. The car is now ready for fine tuning to optimum results.

Front Shock Adjustment

Pay close attention to what is happening to the front end during launch. Your goal is to eliminate all jerking or bouncing movements during launch and gear shifts. Ideally the front end should rise in a controlled manner, just enough to keep the rear tires loaded, then continue the pass with smooth transitions at all times. Front end rise without any appreciable traction gain is wasted energy that should be used to propel the vehicle forward instead of up. While testing, document your ET's along with any changes made. If ET does not improve, return to previous settings.

Single-Adjustable Shock Limitations

The use of a single-adjustable shock will have limited tuning capability. When adjusting the shock to improve rebound (extension) travel issues you are also adjusting bump (compression) stiffness. This may worsen or create bump travel issues. As an example using a soft shock setting that improves front end rise and weight transfer, may be too soft to prevent the shocks from bottoming out as the front end lands. You must decide which correction will best improve component reliability, driveability, and ET. This performance trade-off relationship is unavoidable with a single-adjustable shock. To truly maximize tuning capability a double-adjustable shock should be used.

Front Rebound (Extension) Adjustment Overview

Too light of a shock setting allows excessive front end chassis separation and may result in the front wheels jerking violently off the ground during launch. Also, during gear change, too light a setting allows the car to bounce off its front rebound travel limiter and then bottom out in an oscillating manner. Too firm a setting will prevent the front end from rising sufficiently, limiting the amount of weight transferred to the rear tires. Adjust shock stiffness in one click increments to control the rate at which the front end rises at launch and during gear changes. While testing, document your ET's along with any changes made. If ET does not improve, return to previous settings.

Front Wheels Lose Contact with Ground	Increase Stiffness	Violent chassis separation and may result in jerking the front wheels off the ground. Increase shock stiffness by one, then test again.
Rear Tires Hook Then Lose Traction	Increase Stiffness	If weight transfer occurs too quickly the rear tires may hook then lose traction as the front end begins to travel downward. Slowing the rate at which the front end rises prevents the shocks from topping out too quickly and increases the duration of time that the rear tires benefit from the weight transfer. Increase shock stiffness by one, then test again. If ET does not improve, return to previous setting.
No Front End Rise	Decrease Stiffness	Too firm of a shock setting limits the amount of weight transferred to the rear tires, resulting in poor traction. Decrease shock stiffness by one, then test again. If ET does not improve, return to previous setting.

Front Bump (Compression) Adjustment Overview

After the launch or during a gear change, too firm of a setting will cause the chassis to bounce off the front tire as the chassis settles down. Too light of a setting allows the shock to bottom out and bounce off the stop travel bumper. Adjust shock stiffness in one click increments to control the amount and rate at which the front end settles during gear change. While testing, document your ET's along with any changes made. If ET does not improve, return to previous settings.

Front “Bottoms Out” After Launch	Increase Stiffness	If front suspension settles too fast after launch or gear change it may cause the front suspension to bottom out at the end of its downward travel. If the suspension bottoms out hard enough, rear traction may be lost. Increase shock stiffness by one, then test again. If increasing shock stiffness cannot extend weight transfer duration long enough, a higher rate spring should be installed.
Hard Front End Bounce (After Launch or Gear Change)	Decrease Stiffness	If the tires cause the front end to bounce upon landing, the shocks are too stiff. The front end should settle in a single, smooth motion. Decrease shock stiffness by one, then test again. This can be a very subtle problem. Watch the front tire sidewall as it contacts the ground.

Rear Shock Adjustment (Single Adjustable)

Maintain traction by controlling the rate at which torque and weight is transferred to the rear tires. Ideally the rear suspension should be as firm as possible before a loss of traction occurs. Changes to the vehicle such as ride height, tire size, weight distribution, or suspension link adjustments will alter the instant center location in relation to the vehicle’s center of gravity. Any shift of either the instant center or center of gravity will usually require a shock setting adjustment to optimize traction. While testing, document your ET’s along with any changes made. If ET does not improve, return to previous settings.

Rear End Squats	Increase Stiffness	Some vehicles will squat during launches instead of pushing the vehicle forward. To assist in planting the tires, increase shock stiffness by one, then test again. If ET does not improve, return to previous setting.
Vehicle Separates from Rear End	Increase Stiffness	Some suspension geometries plant the tires so forcefully that the rear end of the vehicle rises away from the housing too rapidly. The vehicle may hook initially, then spin the tires once the shocks are topped out. Slowing the rate at which the rear end rises increases the duration of time that the rear tires benefit from the improved traction. Increase shock stiffness by one, then test again. If ET does not improve, return to previous setting.
Loss of Traction with Minimal Chassis Movement	Decrease Stiffness	A suspension system that is too stiff can hit the tires too hard, causing a loss of traction. Softening the suspension slows the transfer of weight and reduces the initial tire shock. Decrease shock stiffness by one, then test again. If ET does not improve, return to previous setting.

Completion of Testing

When all adjustments have been completed, reset your wheelie bars as low as possible without affecting your ET.

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