READ ALL INSTRUCTIONS COMPLETELY AND THOROUGHLY UNDERSTAND THEM BEFORE DOING ANYTHING.
CALL TOTAL CONTROL PRODUCTS TECH SUPPORT (916) 388-0288 IF YOU NEED ASSISTANCE.

INSTALLATION GUIDE

TCP FCOC7D2Q

Front Coil-Over Conversion
1968-73 Mustang and Cougar, Big-Block

Part Number	Description	PDF Page
TCP COLVF-10	Upper Coil-Over Mount	2
TCP COCQ2-16.30	VariShock QS2 Double-Adjustable, COM-8 Eye Coil-Over	18
TCP EE-02	Eccentric Eliminators	26
TCP LCA-06-SVH	Lower Control Arms	28
TCP STRD-07-SVH	Strut Rods	36
TCP UCA-09-SVH	Upper Control Arms	44
VAS 21-09550	9” Coil Springs, 550 lb/in	56
Instructions included for components listed in chart.		

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INSTALLATION GUIDE

TCP COLVF-10

Front Coil-Over Conversion

Description: Upper and lower coil-over shock mounts with mounting hardware

Applications: Cougar ‘68-73, Cyclone ‘68-71, Fairlane ‘68-71, Falcon ‘68-70, Montego ‘68-71, Mustang ‘68-73, Ranchero ‘68-71, Torino ‘68-71

IMPORTANT: The outer shock tower reinforcement plate and suspension bump stop must be reinstalled prior to operating the vehicle. Worn or damaged suspension bump stops must be replaced. Failure to provide a proper compression-travel suspension stop will cause unwarrantable damage to the shock absorber and possible structural damage to the chassis.

PARTS LIST

Qty	Part Number	Description
2	7909-032	Shock Tower Backup Plate
1	7909-048	Upper Shock Mount Assembly 4-5/8” Driver Side
1	7909-049	Upper Shock Mount Assembly 4-5/8” Passenger Side
1	7909-051	Spot Weld Removal Bit, 3/8” Diameter
2	7909-054	Lower Shock Mount Mark II #3

7918-044 - Hardware Bag

Qty	Part Number	Description
2	3100-050F2.75Y	Bolt 1/2-20 x 2-3/4” Hex Head Cap Screw Grade 8 Yellow Zinc
2	3100-050F3.00Y	Bolt 1/2-20 x 3” Hex Head Cap Screw Grade 8 Yellow Zinc
6	3101-038-16C	Locknut 3/8-16 Nylon Insert Clear Zinc
4	3101-050-20C	Locknut 1/2-20 Nylon Insert Clear Zinc
6	3104-038C1.75C	Button Head 3/8-16 x 1-3/4” Cap Screw Clear Zinc
4	3108-044L-C	Lock Washer 7/16” Regular Clear Zinc
4	3108-050L-C	Lock Washer 1/2” Regular Clear Zinc
12	3120-038S-Y	Washer 3/8” Hardened Flat SAE Yellow Zinc
8	3120-050S-Y	Washer 1/2” Hardened Flat SAE Yellow Zinc

INSTRUCTIONS

NOTE: A 1965 Mustang was used for the following images and may show slight differences from your vehicle. The installation procedure is identical.

Installation of the upper control arms, lower control arms, and strut rods should be complete before proceeding. The lower arms and strut rods must be attached to the chassis, but not bolted to each other. Specific procedures are described in their individual installation guides. Illustrations show driver’s side suspension. All steps must be repeated for passenger side installation. *Do not install springs onto coil-over shocks until after the suspension has been checked for adequate travel clearance.*

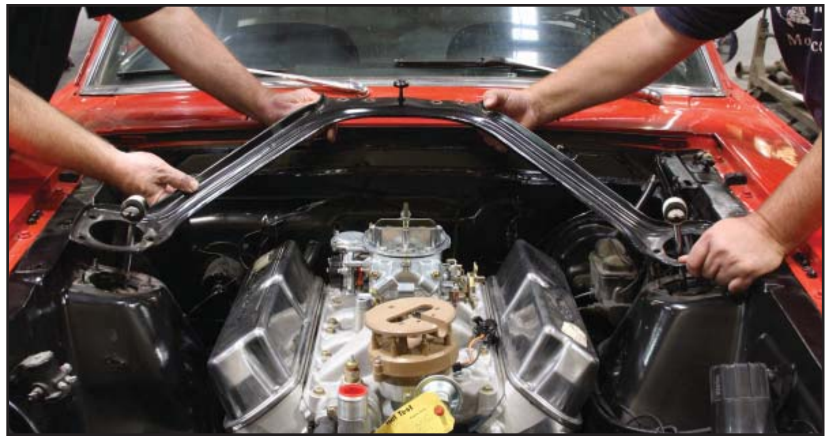
Chassis Inspection

With the factory components out of the way, this is a good time to inspect sheet metal for signs of fatigue. Clean the area to remove any grease or dirt, so that metal and welds are clearly visible. Look for cracks along welds or tearing of mounts in any way. If there is any damage present, repairs must be made before proceeding.

Remove Factory Shocks and Mounts

1. Raise front end of car and secure with jack stands. Wheels must not be in contact with ground.
2. Remove wheels, making note of which side of the vehicle they were removed from.
3. Unbolt the factory shock mount from the shock tower.
4. Unbolt the upper shock crossbar from factory shock mount and remove the stamped shock mount from the vehicle.

5. Once the upper shock mounts are out of the way, unbolt the factory tower brace at the firewall and lift it out of the way. It can be reinstalled after the coil-over kit has been installed or replaced with our replacement tower brace kit (TCP TWRB-01 or TCP TWRB-04).



6. Remove the outer shock tower reinforcement plate and set it aside. This component will be reinstalled later.

At this point the coil spring must be removed from the vehicle as explained in the upper control arm instructions.

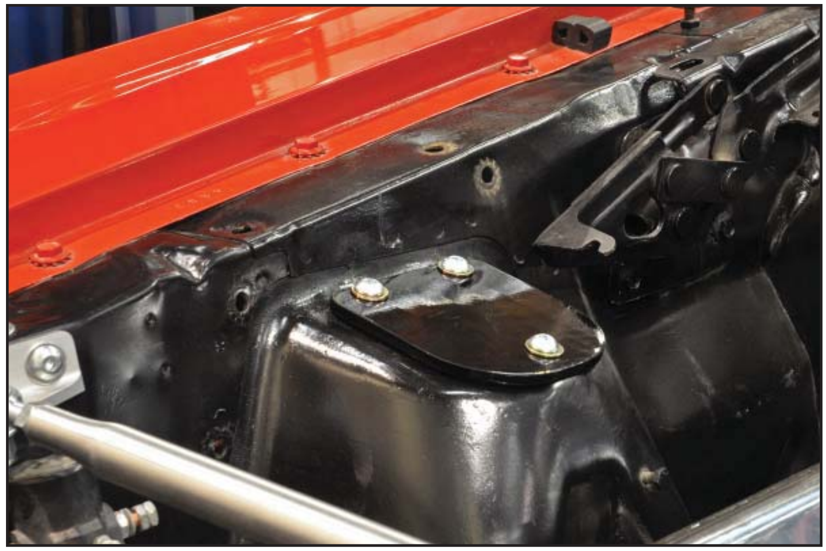
7. Remove the OEM coil-spring isolator, positioned on the upper spring seat of the shock tower.

8. Using the supplied bit, drill out the three spot welds securing the upper spring seat to the shock tower (Figure 2-1). Once you have drilled through the spring seat material, use a pry bar to break the remaining bit of material. Any remaining material must be ground flush and painted.

9. Place the new passenger-side upper shock mount on the shock tower and use it as a guide to enlarge the three factory holes in the shock tower.

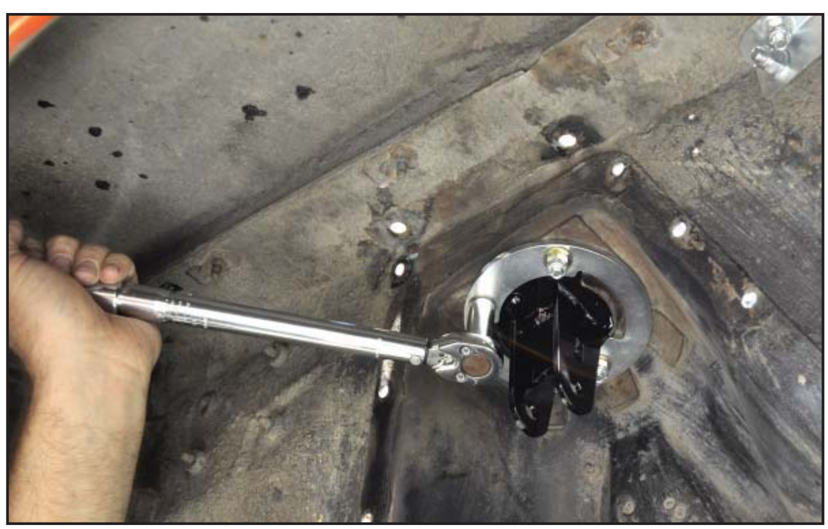
   NOTE: Some applications will require two new holes to be drilled. Line up the centered holes and use the mount as a drill jig to drill the new holes.

10. Insert the 3/8-16 x 1-3/4" button head bolts and flats washer through the shock mount plate. The radiused edge of the top plate faces the centerline of the vehicle.



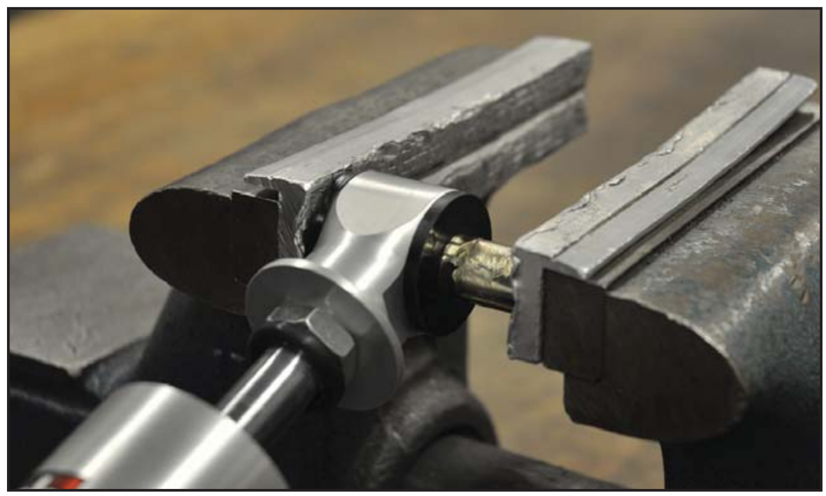
11. Slide the shock tower backup plate onto the three bolts and around the factory spring seat.

12. Install the 3/8 flat washers and locknuts. Tighten to 30 lb-ft.



13. Press one bushing into each side of the bushing eyes.
14. Apply a small amount of poly lube to the inside bore of the busings.

15. Press the steel sleeve into the bushings, using a vise or press.



16. Position the billet mount over the holes in the strut rod/lower control arm and secure with the socket head cap screws, flat washers (included with the strut rod kit), and lock washers.

    The arrow on the bottom of the billet shock mount faces toward the front of the car when installed.

17. Tighten the socket heads to 50 lb-ft.

    IMPORTANT: The bolts must be loose when adjusting length of the strut rod during front end alignment to prevent binding.

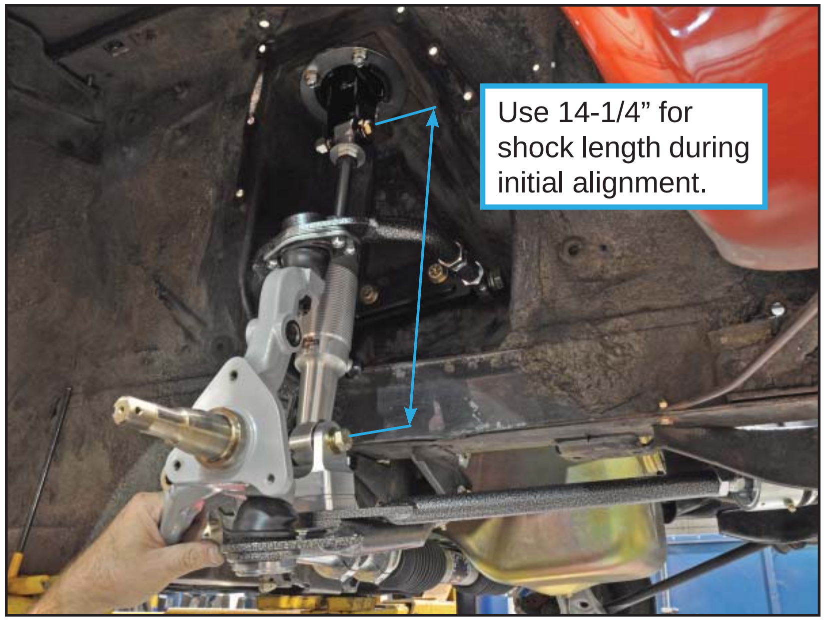
18. Apply poly lube to the flat surface of the bushings where they will contact the shock mounts.
19. Next, the shocks are temporarily installed to verify clearances and set the alignment.
20. Bolt the upper end of the shock into its mount, using a 1/2-20 x 2-3/4" bolt, two flat washers, and a locknut. Thread the nuts on by hand so that the bolts do not slip out during the following steps.

21. To make the shock easier to work with, adjust the shocks to their softest setting by rotating the knobs counter-clockwise.
22. Slide the shock eye into the billet lower mount. Secure the shock with a 1/2-20 x 3" hex bolt, two flat washers and a locknut. Thread the nuts on by hand so that the bolts do not slip out during the following steps.

23. Using a jack placed under the lower control arm, raise the suspension to its ride-height position.

    Ride Height = 14-1/4” eye-to-eye

24. With the suspension at correct ride height, the alignment can be set using a digital protractor placed against flat or ‘square’ features of the spindle.

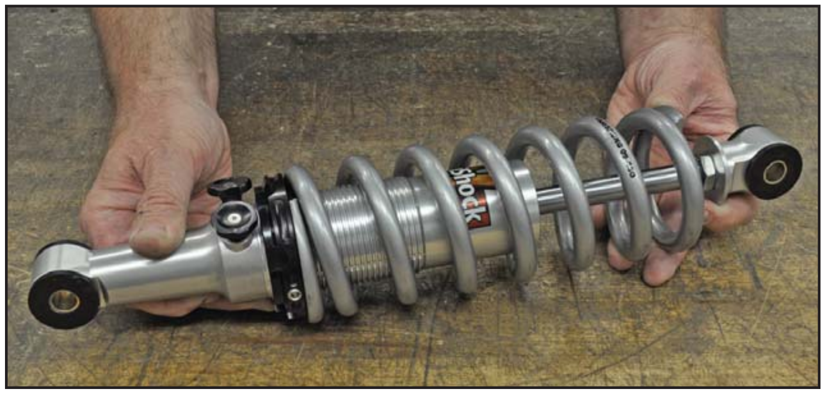


25. Once adjusted, cycle the suspension through its full range of travel to check for possible clearance issues. You will need to estimate the area taken up by the spring; 3/4” around the shock body.

26. Check to make sure the strut rod does not contact the frame rail when the suspension is fully compressed. The lip of the frame rail can be ground or bent for clearance, if needed.

27. Once clearance has been verified, remove the shocks to install the spring seats and coil spring.
28. Thread the lower spring seat onto the shock body as far as possible to allow the spring to be installed. The notches for the spanner wrench must face toward the adjustment knobs.
29. Apply a thread lubricant, such as Anti-Seize™ onto shock-body threads just above the lower spring seat.

30. Extend the shock and slide the rubber O-ring bumper down the shaft a couple of inches.
31. Place the spring over the top mounting eye and onto the lower spring seat.



32. Slip the upper spring collar around the piston and seat it between the spring and upper shock eye. You may have to compress the spring slightly.

33. Thread lower spring seat upward until it holds the spring and upper spring seat in place without any free play and is resting at one of the half-turn detents. Make sure the upper collar is correctly seated onto base of upper mounting eye.

34. Tighten the lower spring collar an additional one-half turn.

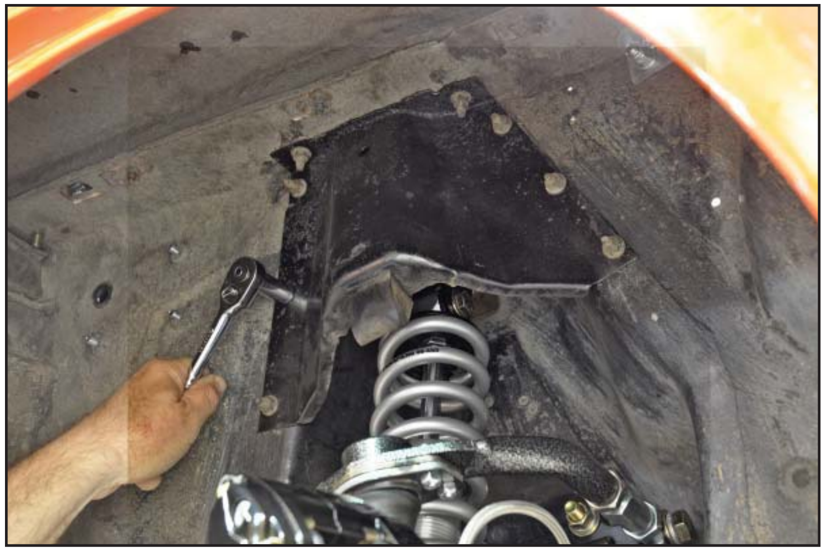
35. Tighten the lower-seat ball-locks into their grooves.

36. Install the shocks onto the vehicle. Generally there is clearance for the knobs with the shock facing in either direction. Depending upon wheel backspacing it may be easier to face the shock toward the vehicle. Install the shock facing the direction which is most comfortable for you to access for later adjustment.

37. Tighten the shock mounting hardware to 55 lb- ft.

38. Verify all mounting hardware is correctly installed and correctly torqued.

39. Reinstall the outer shock tower reinforcement plate.
40. Replace worn or damaged upper-control-arm bump stops.
41. Install wheels to their original location and torque lug nuts.
42. Lower vehicle.
43. Adjust the shock's lower spring collars to achieve the correct ride-height shock length with weight of vehicle carried by the suspension. Vehicle must be raised and safely supported when adjusting spring collars.



Torque Specifications

Fastener Description	Location	Torque Value
Button Head 3/8-16 x 1-3/4"	Upper Shock Mount to Shock Tower	30 lb. ft.
Socket Head 7/16-14 x 1-1/4"	Lower Shock Mount to Lower Arm Assembly	50 lb. ft.
Hex Head 1/2-20 x 2-3/4" and 3"	Shock Mounting Eyes	60 lb. ft.

Alignment

The vehicle must be professionally inspected and aligned prior to regular use.
If a trailer is not available, your alignment will need to be somewhat close to final specs in order to safely drive your vehicle to the alignment shop. Visually determine if the front wheels look straight. They should not appear to "toe" (left to right) -in or -out. The outside of the wheels should be very close to vertical. A few degrees of negative camber (leaning in) is acceptable.

	Street Performance		Road Course		Drag Strip	
	Manual	Power	Manual	Power	Manual	Power
Caster	2-1/2° to 3° pos.	3-1/2° to 4° pos.	2-1/2° to 3° pos	3-1/2° to 4° pos	4° to 6° pos	4° to 6° pos
Camber	0° to 1/2° neg	0° to 1/2° neg	1-1/2° to 2° neg	1-1/2° to 2° neg	0°	0°
Toe (total)	1/16" to 1/8" in	1/16" to 1/8" in	1/16" out to 1/16" in	1/16" out to 1/16" in	1/16" to 1/8" in	1/16" to 1/8" in

Our recommended alignment specs serve as a starting point for your particular application. Installed components, driver preference, and specific application will have a great affect on the correct settings for your vehicle.

VERIFY RIDE HEIGHT

After all suspension clearances have been checked and the shocks installed onto the vehicle with the springs, you must verify that the shocks rest at ride height within their allowable range of operation.

- The suspension must carry the full weight of the complete vehicle, including interior and passenger weight, with the wheels on the ground during measurement.
- Measure the length of the shock and compare to Shock Specifications chart to ensure you are within the Ride Height range. Spring preload will need to be adjusted at the lower spring seat until both shocks measure equal to each other and are at the correct length.
- SUSPENSION MUST BE AT FULL EXTENSION AND THE VEHICLE SAFELY SUPPORTED WHILE ADJUSTING THE LOWER SPRING SEAT.
- With the vehicle weight carried by the suspension, it is easier to get an accurate measurement from the bottom of the upper spring seat to the center of the lower mounting bolt.
- DO NOT THREAD THE LOWER SPRING SEAT UPWARD MORE THAN 1/2” FROM IT’S LOWEST POSITION.
- If more than 1/2” of preload is needed to raise the vehicle into the correct ride height range, you must step up to a heavier spring rate. Failure to increase the spring rate will allow the spring to abruptly coil-bind before full shock compression, limit suspension travel, and damage the shock and related chassis and suspension components.

Shock Ride-Height Specifications

Part Number	Mounting		Total Travel	Compressed Length*	Extended Length*	Ride Height*		Spring Length
	Upper	Lower				Min.	Max.	
TCP COPQ2-16.30	Poly Eye	Poly Eye	4.25”	10.47”	14.72”	12-1/8”	13”	9”

* Shock length is measured from the top of the coil spring to the center of the lower mounting-eye bolt. It is easiest to measure between these two points once the shock has been mounted to the vehicle.

Spring Selection Guidelines

A good spring rate baseline for vehicles equipped with an iron small block would be 450 lb./in.

Differences that alter desired spring rate:

Weight Reduction -50 lbs (fiberglass hood)
Aluminum Heads -50 lbs
Big Block +100 lbs
Road Race +50 lbs (better handling)
Drag Race -50 lbs (more stored energy)

Spring rate effects ride quality, ride height and roll rate characteristics. Differences in vehicles such as aluminum engine components, fiberglass body parts and chassis stiffening should be taken into consideration. Additional springs can be purchased for tuning purposes.

9” VariSprings

Rate (lb/in)	Part Number
450	VAS 21-09450
500	VAS 21-09500
550	VAS 21-09550
600	VAS 21-09600
675	VAS 21-09675
750	VAS 21-09750
850	VAS 21-09850

Determining Your Baseline Spring Rate

Determining the correct spring rate and correctly adjusting your suspension is very important to achieving the best possible and most reliable performance from your components. In fact, the vast majority of problems people experience with coil-over shocks can be attributed to using the wrong spring rate or incorrect adjustment of the shocks many settings.

What is the Baseline Spring Rate?

“Baseline spring rate” is defined as the pound-per-inch rate (lb/in) at which the spring supports the corner weight of the vehicle with the coil-over shock at the correct installed height without the need to preload the spring. Once the baseline spring rate has been established, the vehicles performance goals and further testing will reveal the correct final spring rate for each installation. Differences such as how the spring is mounted (installation motion ratio), vehicle weight reduction, chassis stiffening, specific performance application, and driver preference and skill level all have a bearing upon the correct final spring rate.

Where to Begin? (Initial Spring Rate)

Based on our experience with vehicles and performance applications similar to your own, Chassisworks can recommended an “initial spring rate” to install on your vehicle, from which the correct baseline spring rate can be derived. In many cases our recommended initial spring rate will be the correct baseline spring rate. However, due to the sheer number of variables, it is impossible for our technical staff to predict the precise baseline spring rate for each and every installation scenario. To assist you in obtaining the correct spring rate, a second set of springs can be purchased at a discount.

Taking Measurements

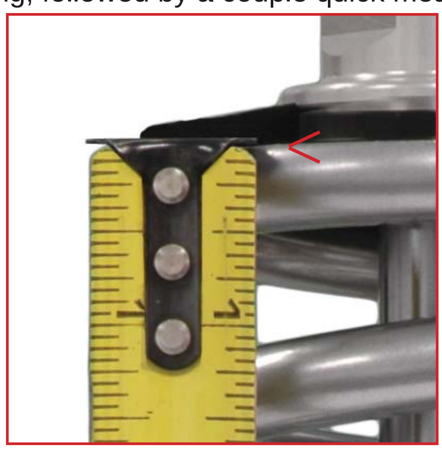
Chassisworks has developed a simple method to determine the correct baseline spring rate. This method requires installation of our initially recommended spring, followed by a couple quick measurements and some simple calculations. Before getting started, the vehicle must be 100% complete. This includes interior, glass, fluids, weight ballasts, and sand bags or free weights to substitute as the weight of the driver. At this point, the springs should already be installed on the shocks with NO PRELOAD and ready to go onto the vehicle. *Lower spring seats should be just tight enough to remove free play from the spring.*

1. Record the initial spring rate as value “R” in the calculation table that follows. Most VariSprings will have the rate printed directly on them.

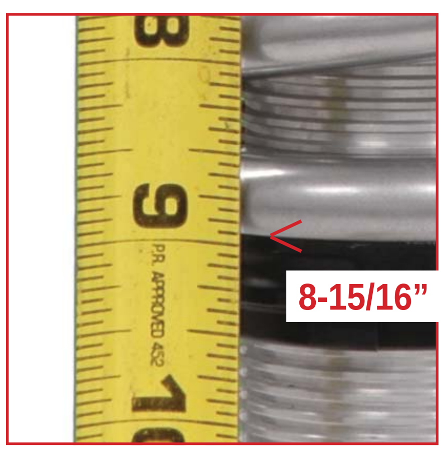
2. With the shock fully extended, measure the installed free-length of the spring. At the upper-spring-seat slot, hook the end of the tape measure against the spring and measure, with one sixteenth-of-an-inch accuracy, the distance to the ground bottom edge of the spring. Record this dimension as value “F” in the calculation table that follows.

   NOTE: The measured length may differ slightly from the nominal spring length. In our example the 9” VariSpring actually measures 8-15/16” when correctly installed.

3. Install all shocks and springs onto the vehicle and lower it to the ground.



Hook the tape measure against the spring at the upper spring seat slot.



Measure the bottom end of the spring.

1. Verify that the springs are supporting the full weight of the vehicle. Any chassis or shock bump stops that are in contact must be temporarily removed. Make sure to replace bump stops when finished.
2. Measure the springs again at their newly collapsed installed height to within one sixteenth-of-an-inch accuracy from the same spring reference points used previously. Record this dimension as value "L" in the calculation table that follows.

Installed Height by Performance

When a shock is at installed length (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 bump (shock compressing) and rebound (shock extending). Use the Reserved Shock Travel Percentage Guidelines and appropriate chart to determine the amount of bump travel required to collapse the shock to the correct installed length for your performance application. Record this dimension as value "T" in our calculations.

NOTE: In our example calculation, a handling performance application with a 4.25"-travel coil-over shock lists a "T" value of 2.13.

Perform the Calculations

Calculation Table

The leftmost column in the calculation table gives you a place to record your values. Use a pencil in case you make a mistake.

Record Values	Variable	Description
___ ___.___ ___	**F**	measured initial Free length of installed unloaded spring
___ ___.___ ___	**L**	measured Loaded spring compressed length
F - L	Answer 1	Subtract L from F
___ ___ ___ lb/in	**R**	initial spring Rate in pounds per inch
Answer 1 x R	Answer 2	Multiply Answer 1 by R
___ ___.___ ___	**T**	spring Travel to achieve desired ride height (from chart on pg. 13)
Answer 2 ÷ T	BASELINE SPRING RATE	Divide Answer 2 by T

Example:

Measured free length (F) 8-15/16" or 8.94

Minus measured loaded length (L) 6-1/2" or 6.50

8.94F - 6.50L = 2.44

Multiply that answer by the current spring rate 500 lb/in

2.44 x 500R = 1220

Divide that answer by the correct (T) value in chart

1220 ÷ 2.13T = 572.77B

Round the final answer up or down to a suitable spring rate.

$$\frac{(F - L)\,R}{T} = \textbf{Baseline Spring Rate}$$

Reserved Shock Travel Percentage Guidelines

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.

Optionally, it is acceptable to adjust the shock's installed height to any length between the minimum and maximum spring-length value shown in the chart. This range allows you to adjust the vehicle ride height a small amount by using the threaded lower spring seat.

VariShock Coil-Over Shocks

Coil-Over Shock Travel	Street	Handling	Drag	Spring Free Length	Street	Handling	Drag
	60/40	50/50	40/60		Max.	Center	Min.
	(T) Spring Travel Used At Ride Height				*Installed Spring Length At Ride Height*		
4.25	1.70	2.13	2.55	9	7.30	6.88	6.45

Ride Heights Outside of Designed Range

If you wish to set vehicle ride height beyond the designed 7/8" range, the following options are available.

Higher:

- Taller tire
- Relocate upper mount to underside of shock tower ('67-73 only)
- Purchase/install taller upper shock mount
- purchase/install 1" extended top shock eye (PN: VAS 400-202).

One-inch taller shock mounts and 1" extended top shock eyes each increase ride height by roughly 1-1/4".

Lower:

- Lower profile tire
- Dropped spindle
- Add spacer between top surface of shock tower and upper shock mount
- Purchase/install shorter upper shock mount.

Modification to shock mount configuration or mounts themselves requires the entire steering and suspension system be checked for binding and/or clearance issues. (Ball-joint and tie-rod misalignment angles, frame clearance of lower arm and strut rod, brake caliper clearance, sufficient fastener length, etc.)

Ride heights outside of our designed range have NOT been tested by our engineering department for correct clearances, geometry, performance, or reliability. Modifications are made at your own risk and must be throughly researched and executed in a professional manner for obvious safety reasons.

Refer to coil-over shock installation guide for specific instructions regarding adjusting spring preload and valve adjustment.

Shock Extended Eye

To raise ride height above the standard TCP coil-over-system configuration, one-inch extended top shock eyes are available for separate purchase. The mounts simply screw onto the top of the shock's piston rod and are secured by a jam nut. Installation increases ride height approximately 1-3/8", measured from the ground to the fender opening. From center of shock travel, ride height can also be increased or decreased approximately 1/2" by adjusting the lower spring seat. Proper suspension travel and clearance must be verified prior to operating the vehicle.

VAS 515-2-2

WARRANTY NOTICE:
There are NO WARRANTIES, either expressed or implied. Neither the seller nor manufacturer will be liable for any loss, damage or injury, direct or indirect, arising from the use or inability to determine the appropriate use of any products. Before any attempt at installation, all drawings and/or instruction sheets should be completely reviewed to determine the suitability of the product for its intended use. In this connection, the user assumes all responsibility and risk. We reserve the right to change specification without notice. Further, Chris Alston's Chassisworks, Inc., makes **NO GUARANTEE** in reference to any specific class legality of any component. **ALL PRODUCTS ARE INTENDED FOR RACING AND OFF-ROAD USE AND MAY NOT BE LEGALLY USED ON THE HIGHWAY**. The products offered for sale are true race-car components and, in all cases, require some fabrication skill. **NO PRODUCT OR SERVICE IS DESIGNED OR INTENDED TO PREVENT INJURY OR DEATH**.

Total Control Products
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CHRIS ALSTON'S Chassisworks
THE HOME OF HIGHER TECHNOLOGY

VariShock QuickSet 2 Coil-Over Installation and Tuning Guide

Part Number	Qty.	Description
Various	2	Coil-Over Shock with Threaded Body (pair)
899-002-200	2	Lower Coil-Over Spring Seat
899-002-201	2	Upper Coil-Over Spring Seat

Valving

- **QuickSet 2 (double-adjustable)** - Features dual adjustment knobs that control bump (compression) and rebound (extension) stiffness independently.

Mounting Eyes - Two Styles

- **Spherical Bearing** - *1/2" bore x 1" wide Teflon lined bearing*
  This style of mount is primarily used for racing or off-road applications for reduced friction. They are generally mounted between two frame tabs with a 1/2" diameter bolt. The inside width between the tabs should be 1-1/16" to 1-3/16" wide. Replacement bearings are available separately.
- **Polyurethane Bushing** - *5/8" bore bushings with 1/2" bore sleeve x 1-1/4" wide pressed-in sleeve*
  Poly eye coil-overs are generally used in street applications for reduced vibration and noise. They are generally mounted between two frame tabs with a 1/2" diameter bolt. The inside tab width should be 1-1/4" to 1-5/16" wide. By removing the 1/2" sleeve, the poly eye coil-overs can also be mounted to VariShock 5/8" pin mounts (optionally available). Replacement bushings are available separately.

Lengths - Six

VariShock coil-overs are available in six different lengths, ranging from 11.35" to 20.10", fully extended. Each provides a specific amount of total travel (see chart) that must match the requirements for your particular application.

Part Number	Total Travel	Compressed Length[1]	Extended Length[1]	Minimum[2] Ride Height	Maximum[3] Ride Height	Spring Length	Usage
VAS 112XX-280	2.80	8.55	11.35	9.67	10.23	7	Front
VAS 112XX-350	3.50	9.30	12.80	10.70	11.40	7	Front
VAS 112XX-425	4.25	10.05	14.30	11.75	12.60	9	Both
VAS 112XX-515	5.15	10.95	16.10	13.01	14.04	12	Rear
VAS 112XX-615	6.15	11.95	18.10	14.41	15.64	12	Rear
VAS 112XX-715	7.15	12.95	20.10	15.81	17.24	14	Rear
Footnotes:							
1	Length of shock is the measured distance between centers of mounting eyes.						
2	Minimum Ride Height: 40% of travel available for compression (bump), 60% of travel available for extension (rebound)						
3	Maximum Ride Height: 60% of travel available for compression (bump), 40% of travel available for extension (rebound)						

Spring Rate Selection

Springs are a tuning item, therefore VariShock does not accept exchanges. If you are unsure of the correct spring rate, check with your chassis builder or component supplier for a recommendation. Mathematical formulas are also available to find an accurate baseline rate from which to start. All formulas will require individual weights for the front and rear of the vehicle. As an aid to help you select the correct spring rate, VariShock offers a discount on a second set of springs if purchased with the shocks.

Front Baseline Spring Rate

Determining the front spring rate requires knowledge of the installation or motion rate for calculation. If you are unsure of this procedure, check with your chassis builder or component supplier for a recommendation.

Baseline Spring Rate (REAR ONLY)

Rear Vehicle Weight (lbs)	Rate (lb/in)	Part Number
820-925	80	VAS 21-XX080
925-1025	95	VAS 21-XX095
1025-1125	110	VAS 21-XX110
1125-1225	130	VAS 21-XX130
1225-1350	150	VAS 21-XX150
1350-1500	175	VAS 21-XX175
1500-1750	200	VAS 21-XX200
1750-2025	250	VAS 21-XX250
2025-2300	300	VAS 21-XX300
2300-2600	350	VAS 21-XX350
2600-2900	400	VAS 21-XX400
2900-3200	450	VAS 21-XX450

Installation

Read these instructions in their entirety before begin installation.

1. Verify you have the correct length shock, and eye mount style for your application before proceeding. If there is any question regarding correct fit please consult with your chassis builder or component supplier before contacting Chassisworks directly.

2. Trial fit the shock absorber onto the chassis prior to installing the spring. This allows you to easily move the suspension throughout its entire range of travel.

3. Place your vehicle on four jack stands so that the suspension hangs freely and the tires do not touch the ground.

4. Use a floor jack under the A-arms or rear end to raise and lower the suspension. Check for binding in every joint of the suspension, including the coil-over mounting eyes. Check front suspension travel with the tires straight, and then again with them turned to full lock in each direction. If everything checks out, the springs can be installed onto the shocks.

5. 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. 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.

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

7. 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. In most cases, the spring must be slightly compressed to slide the top seat into position.

8. Once upper spring seat is in place, thread lower seat upward until spring just starts to compress. Make sure both lower spring seats are screwed on equal amounts to prevent preloading the spring.

Figure 2-1

Figure 2-2

9. Install the assembled coil-over on the vehicle. Verify there is no binding and plenty of clearance around the shock and spring. There must be ample clearance around the spring which was not on the shock during your first travel check. Remove the jack stands and place your car on the ground again checking clearances. While remaining at a safe distance from the car and any moving suspension components, have someone bounce the vehicle at each of its four corners to verify there are not spring clearance issues.

VariShock Adjustment and Tuning Guide - QuickSet 2

This guide covers adjustment features and tuning procedures for VariShock QuickSet 2, double-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.

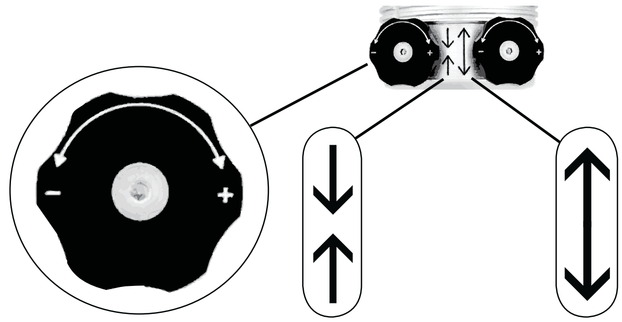
Spring Preload

The threaded lower spring seat is used to adjust spring preload. Compressing the coil spring to any length shorter than it’s 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 rebound 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 2 valve system features dual adjustment knobs that independently control bump- and rebound-damping stiffness of the shock. Dual-arrow symbols engraved into the shock body demonstrate the function of each knob. Arrows pointing toward each other designate bump (compression) adjustment; the shock collapsing. Arrows pointing away from each other represent rebound (extension) adjustment; the shock extending. Knobs are clearly etched indicating the correct direction of rotation to decrease (-), or increase (+) damping stiffness. There are 16 specific adjustment positions for each knob, with a total of 256 unique combinations possible.

Symbol	Direction	Effect
+	Clockwise	Increase Stiffness
-	Counter-Clockwise	Decrease Stiffness
↓↑	Bump (compression) Adjustment	
↕	Rebound (extension) Adjustment	

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.

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 2

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 2

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 for both bump and rebound. The first two settings are generally too soft for street use and are normally used in drag racing applications.

Find Harshness Threshold

The bump setting mainly controls the rapid upward movement of the suspension as the tire travels over rough or bumpy surfaces. Increase shock bump 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 bump stiffness by two. The harshness threshold setting may differ from front to rear.

Excessive Chassis Movement (compression)	Increase Bump Stiffness	The bump setting also affects larger downward chassis movements such as brake dive, squatting, and body roll. Increase shock bump stiffness by one, then test again. Note: As bump stiffness is increased, road noise and vibration will also increase.
Excessive Chassis Movement (extension)	Increase Rebound Stiffness	The rebound setting mainly controls vehicle weight transitions such as front end rise during acceleration, rear end rise during braking, body roll. If vehicle exhibits rapid weight shifts or continues to oscillate more than one suspension cycle before settling, increase shock rebound stiffness by one, then test again. Note: Stiffening rebound 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.
Fore/Aft Pitching (constant speed 50-70 mph)	Alter Front-to-Rear Stiffness Difference	If vehicle exhibits fore/aft pitching at highway speeds, rear shock rebound should be stiffened or conversely, front shock rebound softened. Ideally the rear suspension should oscillate at a slightly quicker rate than the front to minimize pitching.

Tuning for Handling Performance - QuickSet 2

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 for both bump and rebound. The first four settings are generally too soft for performance applications and are normally used in drag racing or street applications.

Find Harshness Threshold

The bump setting mainly controls the rapid upward movement of the suspension as the tire travels over rough or bumpy surfaces. Increase shock bump 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 bump stiffness by one. The harshness threshold setting may differ from front to rear.

Excessive Chassis Movement **(compression)**	Increase Bump Stiffness	The bump setting also affects larger downward chassis movements such as brake dive, squatting, and body roll. Increase shock bump stiffness by one, then test again. Note: As bump stiffness is increased, road noise and vibration will also increase.
Excessive Chassis Movement **(extension)**	Increase Rebound Stiffness	The rebound setting mainly controls vehicle weight transitions such as front end rise during acceleration, rear end rise during braking, and body roll. If vehicle exhibits rapid weight shifts or continues to oscillate more than one suspension cycle before settling, increase shock rebound stiffness by one, then test again. Note: Stiffening rebound 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.
Shocks Bottoming Out **(body roll, brake dive or squatting)**	Increase Bump 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 Bump Stiffness Bias Toward Rear	If vehicle exhibits understeer when cornering at neutral throttle, rear shock bump should be stiffened or conversely, front shock bump 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 Bump Stiffness Bias Toward Front	If vehicle exhibits oversteer when cornering at neutral throttle, front shock bump should be stiffened or conversely, rear shock bump 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 2

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 for bump and rebound.

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, rebound (shock extension) stiffness is added to the driver side and bump (shock compression) stiffness is added to 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 for either bump or rebound. 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.

Front Rebound (Extension) Adjustment Overview

Too light of a rebound (extension) 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 the rebound setting 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 Rebound Stiffness	Violent chassis separation and may result in jerking the front wheels off the ground. Increase shock rebound stiffness by one, then test again.
Rear Tires Hook Then Lose Traction	Increase Rebound 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 rebound stiffness by one, then test again.
No Front End Rise	Decrease Rebound Stiffness	Too firm of a shock setting limits the amount of weight transferred to the rear tires, resulting in poor traction. Decrease shock rebound stiffness by one, then test again.

Front Bump (Compression) Adjustment Overview

After the launch or during a gear change, a firm bump setting will cause the chassis to bounce off the front tire as the chassis settles down. Too light of a bump setting allows the shock to bottom out and bounce off the stop travel bumper. Adjust bump 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 Bump 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 bump stiffness by one, then test again. If increasing bump 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 Bump 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 bump 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 (Double 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 Bump Stiffness	Some vehicles will squat during launches instead of pushing the vehicle forward. To assist in planting the tires, increase shock bump stiffness by one, then test again.
Vehicle Separates from Rear End	Increase Rebound 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 rebound stiffness by one, then test again.
Loss of Traction with Minimal Chassis Movement	Decrease Bump/ Rebound 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. Minimal chassis movement makes if very difficult to visually tell if the bump or rebound needs to be decreased. We suggest adjusting bump first and watch for a gain or loss in the ET. If ET does not improve, return to previous setting, then adjust rebound instead and test again.

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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Phone: 916-388-0288
Technical Support: tech@cachassisworks.com

CHRIS ALSTON'S Chassisworks
THE HOME OF HIGHER TECHNOLOGY

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A Chris Alston's Chassisworks, Inc. Brand
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Technical Support: tcptech@cachassisworks.com

INSTALLATION GUIDE

Eccentric Eliminator

For '66 – early 70's Fords
with OEM eccentric method camber adjustment
(For use with TCP Rack-&-Pinion)

P/N: TCP EE-02

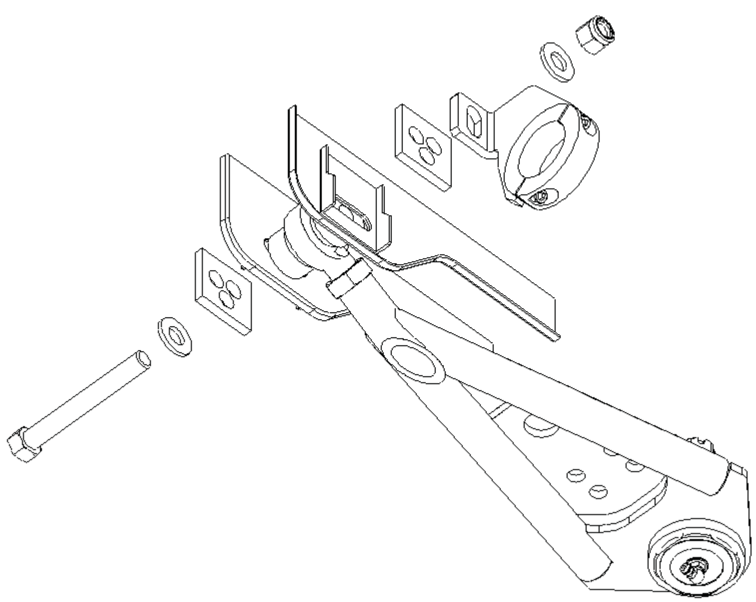
DESCRIPTION:
ECCENTRIC ELIMINATOR PLATES ONLY FOR LOWER CONTROL ARMS 1.70 x 1.70 WITH 1/2 HOLES x 3"; PROVIDES 11 OFFSET COMBINATIONS

APPLICATIONS:
FITS '66 – EARLY 70's FORDS WITH OEM ECCENTRIC CAMBER ADJUSTMENT AND 1/2" LOWER CONTROL ARM MOUNTING BOLTS

PARTS LIST

Part Number	Description	Qty
7900-092	Eccentric Eliminator Plate	4

Orientation of rack-&-pinion mounting bracket will differ by application.



Additional hardware shown is included with the TCP Rack-&-Pinion and TCP Lower Control Arms.

INFORMATION

- Our Eccentric Eliminators' three-hole design provides 11 different mounting positions for the lower control arm, with a total camber adjustment range of 5 degrees.
- Each position is equal to roughly 1/2 degree of movement.
- The bolt must pass through the same hole of the fore and aft eliminator plates.
- The eliminator plates must have matching orientation.
- Negative camber will need to be initially set toward the negative side of the intended adjustment spec.
    - Example: Desired -1.5°, Initial Setting -2°
- TCP adjustable upper control arms or adjustment shims will be needed to make precise alignment settings.
- The split collar clamp for the rack-&-pinion is left loose to allow the clamp assembly to slide along the rack tube (not pictured).
- Tighten split collar clamp when initial camber setting has been achieved.
- Torque 1/2" Lower Control Arm bolts to 65 lb.ft.

READ ALL INSTRUCTIONS COMPLETELY AND THOROUGHLY UNDERSTAND THEM BEFORE DOING ANYTHING.
CALL TOTAL CONTROL PRODUCTS TECH SUPPORT (916) 388-0288 IF YOU NEED ASSISTANCE.

INSTALLATION GUIDE

TCP LCA-06
Lower Control Arms

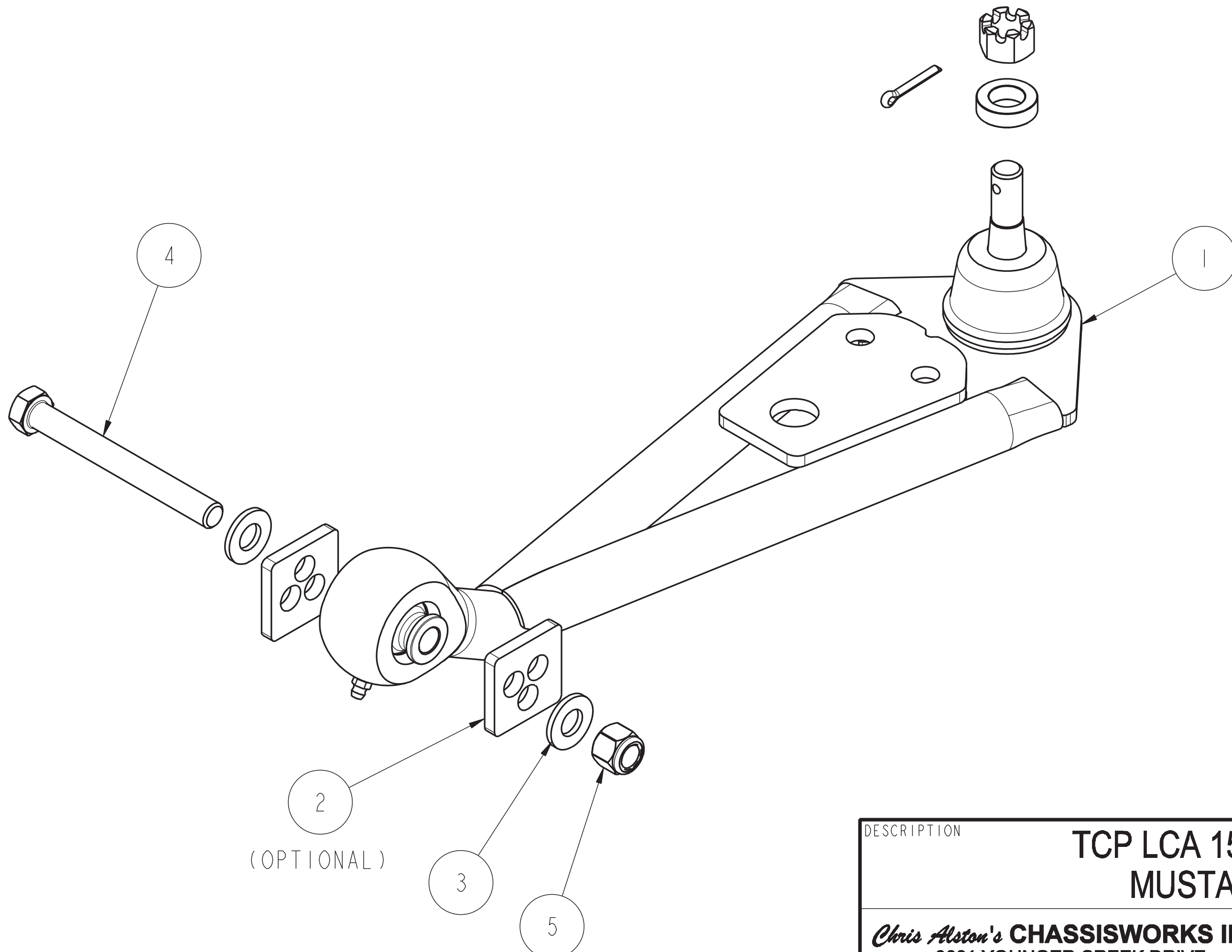
Description: Direct replacement lower control arms for use with OEM or TCP strut rods.

Applications: Comet ‘71-77, Cougar ‘68-73, Cyclone ‘68-71, Fairlane ‘68-71, Falcon ‘68-70, Maverick ‘70-77, Montego ‘68-71, Mustang ‘68-73, Ranchero ‘68-71, Torino ‘68-71

Note: Must upgrade to V8 spindle.

FITS:
COMET 71-77
COUGAR 68-73
CYCLONE 68-71
FAIRLANE 68-71
FALCON 68-70
MAVERICK 70-77
MONTEGO 68-71
MUSTANG 68-73
RANCHERO 68-71
TORINO 68-71

ITEM	QTY	PART NO.	DESCRIPTION
1	1	7904-075	CONTROL ARM ASSEMBLY LOWER 15 3/4, 2-HOLE, 2nd DESIGN
2	2	7900-092	ECCENTRIC ELIMINATOR PLATE
3	2	3120-050S-Y	FLAT WASHER, 1/2 SAE, HARDENED
4	1	3100-050C4.50Y	HEX BOLT, GRADE 8 1/2-13 x 4 1/2
5	1	3101-050-13C	LOCKNUT 1/2-13 NYLON INSERT PLATED



DESCRIPTION
TCP LCA 15-3/4" 2-HOLE
MUSTANG 68-73

Chris Alston's CHASSISWORKS INC.
8661 YOUNGER CREEK DRIVE
SACRAMENTO, CA 95828
(916) 388-0288 FAX 388-0295

PART NO.
TCP LCA-06

7/22/05 | DWG: 7903-LCA-06

PARTS LIST

TCP LCA-06-SVH - Lower Control Arms, 15.75" 2-Hole

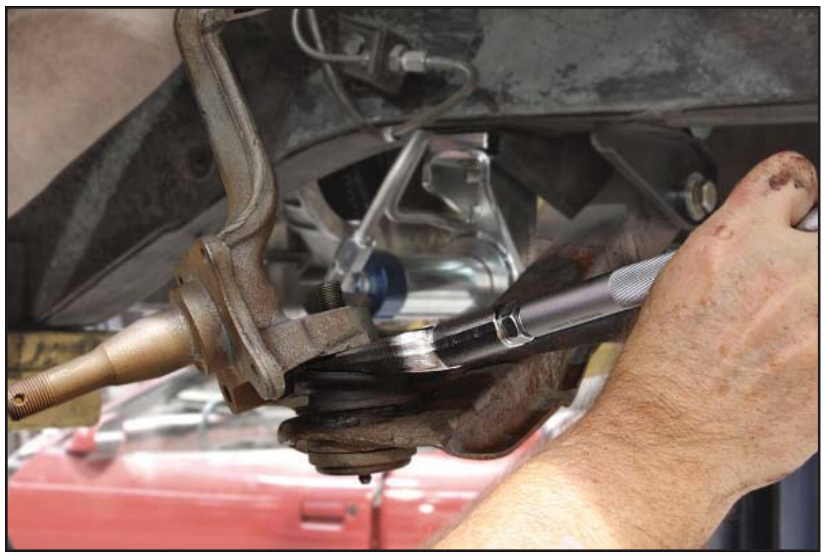
Qty	Part Number	Description
2	7904-075-SVH	Lower control arm assembly, 15.75"
1	7918-020	Hardware bag

7918-020 - Hardware Bag

Qty	Part Number	Description
2	3100-050C4.50Y	Bolt 1/2-13 x 4-1/2" hex head cap screw
2	3101-050-13C	Locknut 1/2-13, nylon lock, plated
2	3120-050S-Y	Washer 1/2" flat SAE, hardened

INSTRUCTIONS

NOTE: A 1965 Mustang was used for the following images and may show slight differences from the later Mustang suspension. The installation procedure is identical.



Remove OEM Components

1. Raise the front end of the car and secure with jack stands. Wheels must not be in contact with the ground.
2. Remove wheels, making note of which side of vehicle they were removed from.
3. Unbolt the anti-roll bar from the lower control arm.
4. Remove the cotter pin and castle nut from the lower-balljoint stud.
5. Using a pickle fork or similar tool, separate the lower balljoint from the spindle. A large hammer can also be used to strike upright near balljoint and unseat the balljoint stud.
6. Unbolt the strut rod from the lower control arm.

7. Unbolt the lower control arm from the frame mounting point.

Chassis Inspection

8. Clean the area to remove any grease or dirt so the metal and welds are clearly visible.
9. Look for cracks along the welds or tearing of the mounts in any way. If there is any damage present, repairs will have to be made before proceeding.

10. Install the TCP lower arm and secure using the 1/2” bolt and flat washer. The bolt should be inserted from the front side of the control arm mount.

The eccentric eliminator TCP EE-02 should be installed with the lower control arms.

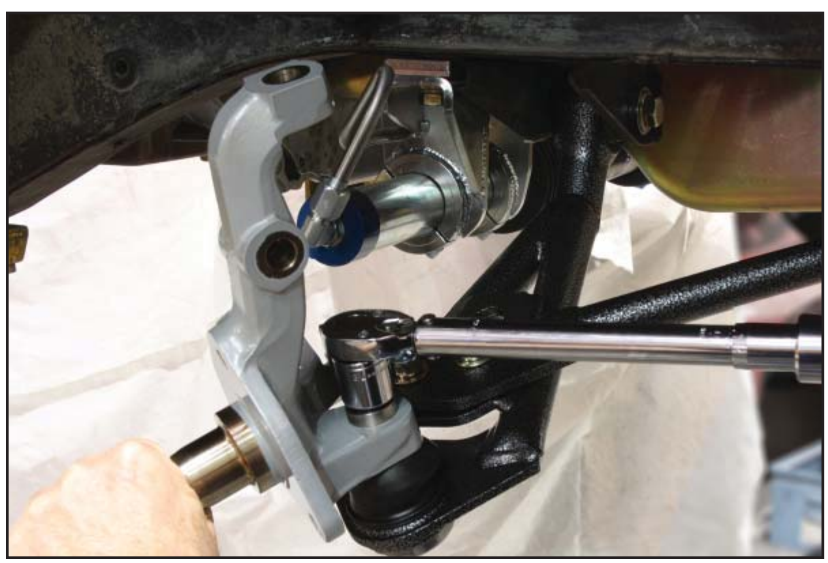
11. Tighten hardware to 65 lb-ft.

12. Loosely bolt the strut rod to lower control arm using the socket-head screws, flat washers, and locknuts.

13. Remove cotter pin, castle nut, and spacer from balljoint stud, and then insert balljoint stud into tapered seat of the spindle. The stud should seat firmly with no looseness or rocking.
14. Place the spacer over the stud followed by the castle nut.

15. Tighten the castle nut to 60 lb-ft., and check the alignment with the cotter pin hole. Tighten the castle nut until the cotter pin can be inserted through the slots and the hole in the ball joint stud. Do not exceed 75 lb-ft.

    DO NOT LOOSEN THE CASTLE NUT TO ALIGN THE COTTER PIN.



16. Insert the cotter pin and bend the ends over flat against the threads.
17. If using TCP adjustable strut rod, see strut rod installation guide for information regarding initial adjustment.
18. Once the strut rod length has been adjusted, the socket head screws can be torqued to 60 lb-ft.

19. Install the anti-roll-bar end-link assembly.
20. Check all mounting hardware.

Torque Specifications

Fastener Description	Location	Torque Value
Hex Head Cap Screw, 1/2-13 x 4-1/2	Pivot Assembly to Frame Mount	65 lb-ft.
Lower Balljoint Castle Nut	Balljoint to Lower Spindle	60-75 lb-ft.
Hex Head Cap Screw, 1/2-13 x 1-1/2	Strut Rod Adapter Plate to Lower Control Arm	60 lb-ft.

Alignment

The vehicle must be professionally inspected and aligned prior to regular use.
If a trailer is not available, your alignment will need to be somewhat close to final specs in order to safely drive your vehicle to the alignment shop. Visually determine if the front wheels look straight. They should not appear to "toe" (left to right) -in or -out. The outside of the wheels should be very close to vertical. A few degrees of negative camber (leaning in) is acceptable.

	Street Performance		Road Course		Drag Strip	
	Manual	**Power**	**Manual**	**Power**	**Manual**	**Power**
Caster	2-1/2° to 3° pos.	3-1/2° to 4° pos.	2-1/2° to 3° pos	3-1/2° to 4° pos	4° to 6° pos	4° to 6° pos
Camber	0° to 1/2° neg	0° to 1/2° neg	1-1/2° to 2° neg	1-1/2° to 2° neg	0°	0°
Toe (total)	1/16" to 1/8" in	1/16" to 1/8" in	1/16" out to 1/16" in	1/16" out to 1/16" in	1/16" to 1/8" in	1/16" to 1/8" in

Our recommended alignment specs serve as a starting point for your particular application. Installed components, driver preference, and specific application will have a great affect on the correct settings for your vehicle.

WARRANTY NOTICE:
There are NO WARRANTIES, either expressed or implied. Neither the seller nor manufacturer will be liable for any loss, damage or injury, direct or indirect, arising from the use or inability to determine the appropriate use of any products. Before any attempt at installation, all drawings and/or instruction sheets should be completely reviewed to determine the suitability of the product for its intended use. In this connection, the user assumes all responsibility and risk. We reserve the right to change specification without notice. Further, Chris Alston's Chassisworks, Inc., makes **NO GUARANTEE** in reference to any specific class legality of any component. **ALL PRODUCTS ARE INTENDED FOR RACING AND OFF-ROAD USE AND MAY NOT BE LEGALLY USED ON THE HIGHWAY**. The products offered for sale are true race-car components and, in all cases, require some fabrication skill. **NO PRODUCT OR SERVICE IS DESIGNED OR INTENDED TO PREVENT INJURY OR DEATH**.

Total Control Products
A Chris Alston's Chassisworks, Inc. Brand
8661 Younger Creek Drive
Sacramento, CA 95828
Phone: 916-388-0288
Technical Support: tcptech@cachassisworks.com

CHRIS ALSTON'S Chassisworks
THE HOME OF HIGHER TECHNOLOGY

READ ALL INSTRUCTIONS COMPLETELY AND THOROUGHLY UNDERSTAND THEM BEFORE DOING ANYTHING.
CALL TOTAL CONTROL PRODUCTS TECH SUPPORT (916) 388-0288 IF YOU NEED ASSISTANCE.

INSTALLATION GUIDE

TCP STRD-07

Adjustable Strut Rods

Description: Direct replacement strut rods for use with OEM or TCP lower control arms.

Applications: Comet ‘71-77, Cougar ‘68-73, Cyclone ‘68-71, Fairlane ‘68-71, Falcon ‘68-70, Maverick ‘70-77, Montego ‘68-71, Mustang ‘68-73, Ranchero ‘66-67, Torino ‘68-71
Note: Must upgrade to V8 spindle

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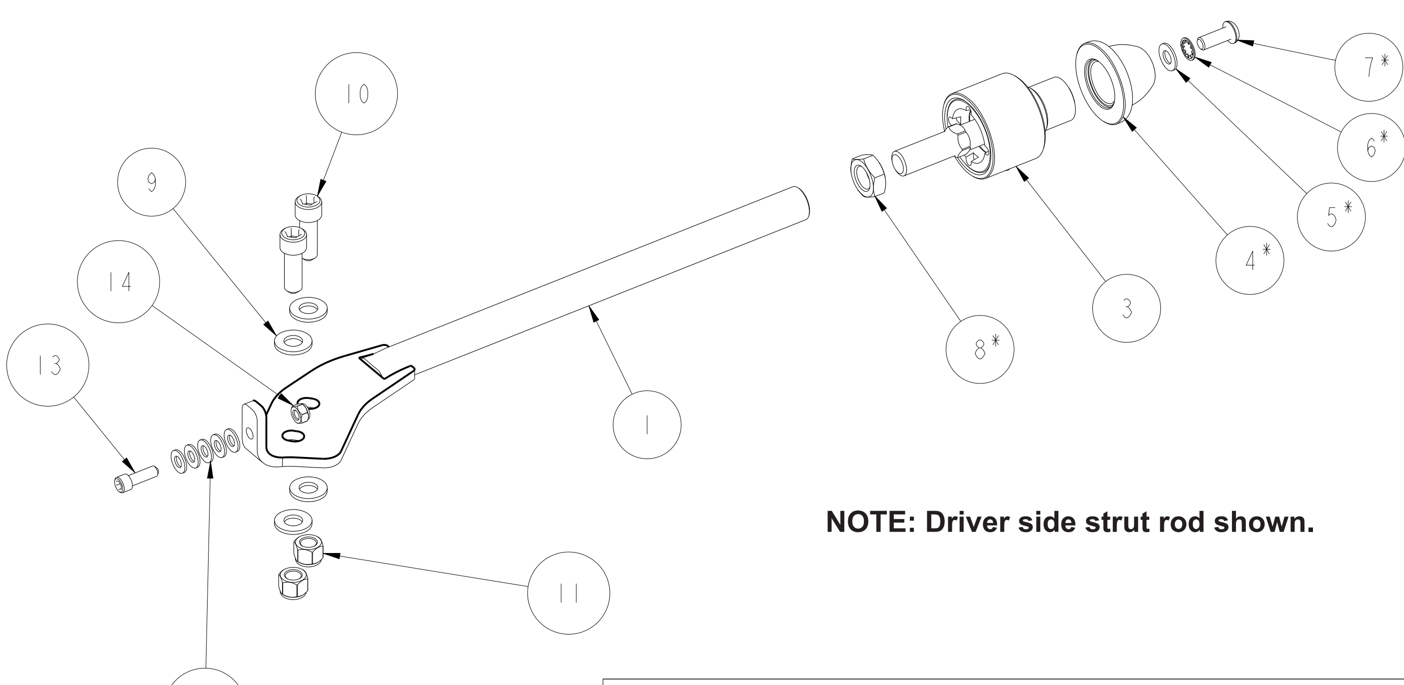
ITEM	QTY	PART NO.	DESCRIPTION
1	1	7906-049	STRUT ROD CONTROL ARM ADAPTER 05 WELDMENT, 2nd DESIGN
2	1	7906-050	STRUT ROD CONTROL ARM ADAPTER 06 WELDMENT, 2nd DESIGN
3	2	7906-062	PIVOT HOUSING ASSY, ∅1.45 MOUNT STRUT PIVOT, MUSTANG
4	1	7906-058	BACKUP NUT STRUT PIVOT, MUSTANG
5	1	3157-038S-S	WASHER, 3/8 SAE, STAINLESS, .812 OD x .406 ID x 1/16 THICK
6	1	3108-0381-S	INTERNAL TOOTH LOCK WASHER, 3/8 STAINLESS 410
7	1	3104-038F1.00C	BUTTON HEAD CAP SCREW, 3/8-24 x 1, CLEAR ZINC
8	1	3102-075-16RC	JAM NUT, 3/4-16 RIGHT, CLEAR ZINC
9	8	3120-050S-Y	FLAT WASHER, 1/2 SAE, HARDENED
10	4	3103-050C1.50C	SOCKET HEAD CAP SCREW, 1/2-13 x 1 1/2, CLEAR ZINC
11	4	3101-050-13C	LOCKNUT 1/2-13, GRADE 5, NYLON INSERT, CLEAR ZINC
12	10	3157-031S-C	WASHER, 5/16 SAE, ZINC PLATED, 11/32 ID x 7/8 OD x 1/16 THICK
13	2	3103-031C1.00C	SOCKET HEAD CAP SCREW, 5/16-18 x 1, CLEAR ZINC
14	2	3101-031-18C	LOCKNUT 5/16-18, GRADE 5, NYLON INSERT, CLEAR ZINC



SPACERS AS NEEDED
5 MAX PER SIDE

NOTE: Driver side strut rod shown.

* PART OF 7906-062

DESCRIPTION	PART NO.
LCA STRUT ROD 19 15/16 INLINE	TCP STRD-07
Chris Alston's **CHASSISWORKS INC.** 8661 YOUNGER CREEK DRIVE SACRAMENTO, CA 95828 (916) 388-0288 FAX 388-0295	8/26/10 DWG: 7903-STRD-07

PARTS LIST

TCP STRD-07-SVH - Strut Rod 19- 15/16” OAL

Qty	Part Number	Description
1	7906-049-SVH	Strut rod weldment driver side
1	7906-050-SVH	Strut rod weldment passenger side
2	7906-062	Strut pivot mount 1.45” mount bore
1	7918-003	Hardware bag

7918-003 - Hardware Bag

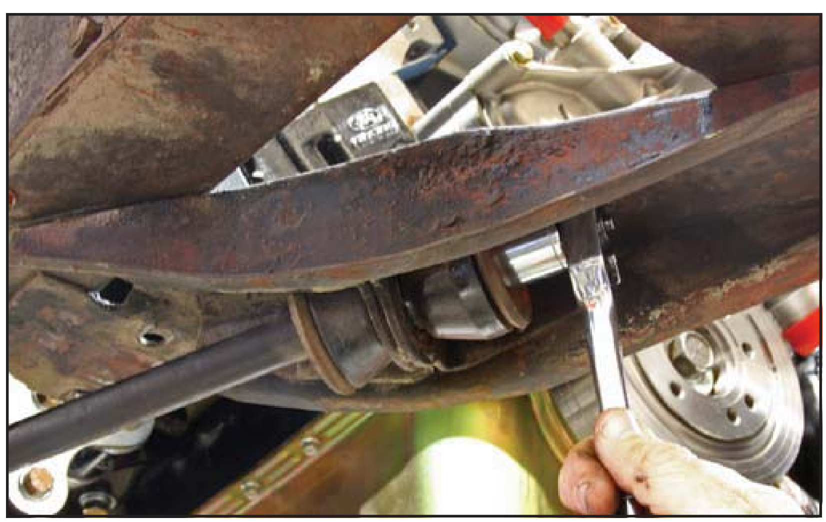
Qty	Part Number	Description
2	3101-031-18C	Locknut 5/16-18 nylon insert
4	3101-050-13C	Locknut 1/2-13 nylon insert
2	3103-031C1.00C	Socket head 5/16-18 x 1” socket head cap screw
4	3103-050C1.50C	Socket head 1/2-13 x 1-1/2” socket head cap screw
8	3120-050S-Y	Washer 1/2” flat SAE, hardened
10	3157-031S-C	Washer 5/16” flat SAE

INSTRUCTIONS

NOTE: A 1965 Mustang was used for the following images and may show slight differences from the later Mustang suspension. The installation procedure is identical.

Remove OEM Components

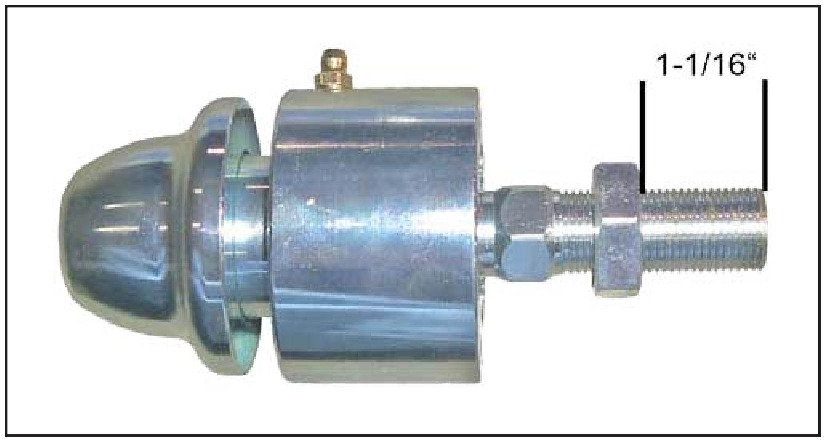
1. Raise front end of car and secure with jack stands.
2. Wheels must not be in contact with ground.
3. Remove wheels, making note of which side of vehicle they were removed from.
4. Remove the two bolts and nuts that attach the factory strut rod to the lower control arm.
5. Remove the large nut on the forward side of the strut-rod frame mount that retains the rubber bushing.
6. Remove the factory strut rod from vehicle.
7. Discard factory hardware and parts.



8. Remove the steel sleeve from the frame mount with a chisel. This may not on all vehilcles.
9. With the strut rod out of the way, inspect sheet metal for signs of fatigue.

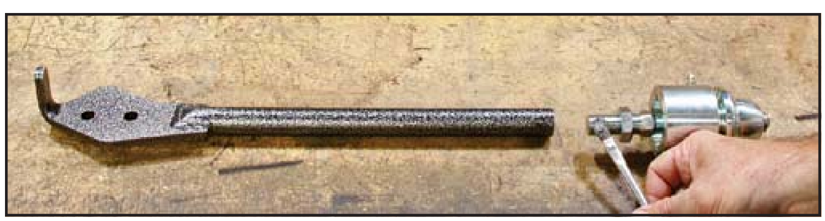
   Clean the area to remove any grease or dirt so metal and welds are clearly visible. Look for cracks along welds and/or tearing of the mounts in any way. If there is any damage present, repairs must be made before proceeding.

10. Thread the 3/4-16 RH jam nut onto the stud of the pivot assembly 1-1/16”.



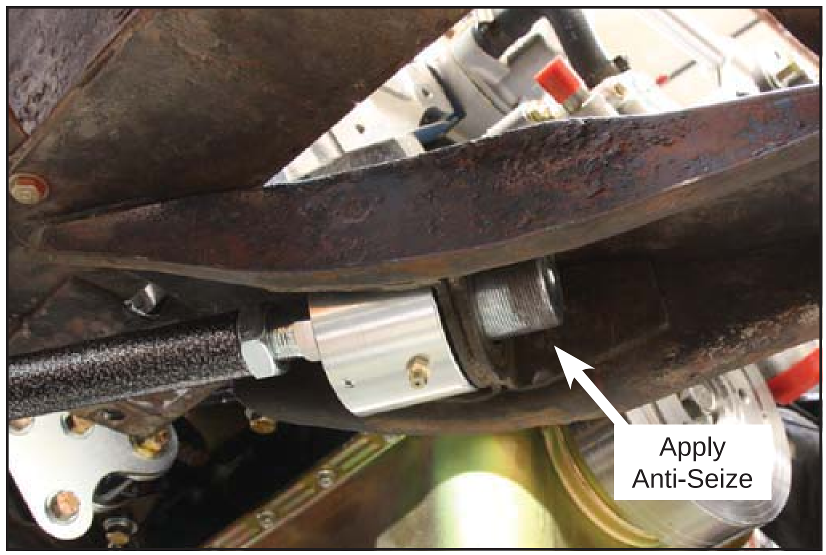
11. Apply anti-seize to threads on the pivot stud.

12. Screw pivot assembly into strut rod.



13. Remove button-head screw and backup nut from the pivot assembly.

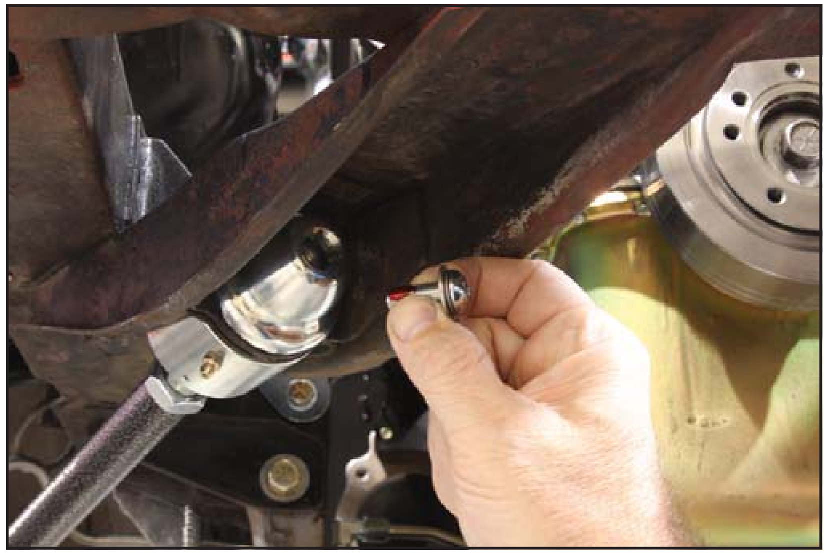
14. Rest the strut rod plate on top of the lower control arm before inserting the pivot housing into the factory frame mount.
15. Rotate the pivot housing so that the zerk fitting is pointing down and can be easily accessed with a grease gun.
16. Apply anti-seize onto the threads and the screw the backup nut onto the pivot housing.



17. Tighten the backup nut using a 1/2”-drive ratchet; torque to 150 lb-ft.

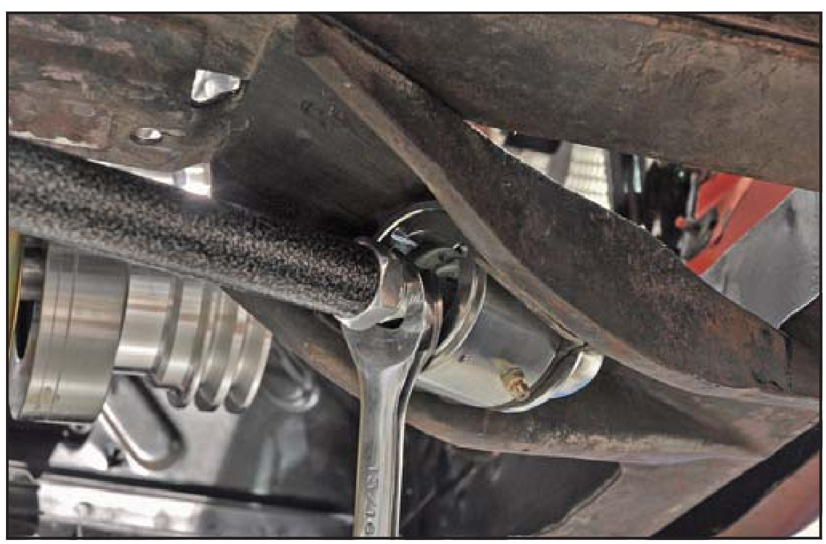
Do not use an impact gun .

18. Apply Loctite™ threadlocker to the 3/8” button-head screw, and then install with a flat washer and lock washer.
19. Tighten the button head to 30 lb-ft.



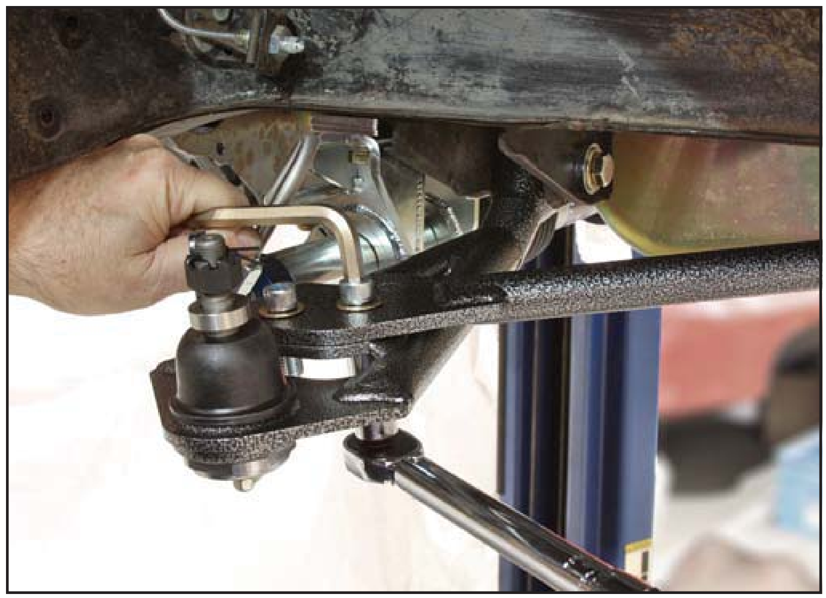
20. Loosely bolt the strut-rod plate to the lower control arm using hardware shown.
21. The adapter plate steering stop must be pointing up.

22. Using the pivot stud hex, adjust the length of strut rod to position lower control arm square to frame rail.



23. Once adjustment is complete, tighten the jam nut against the strut rod. Hold the pivot stud hex with a wrench to prevent from adjusting the strut rod length.

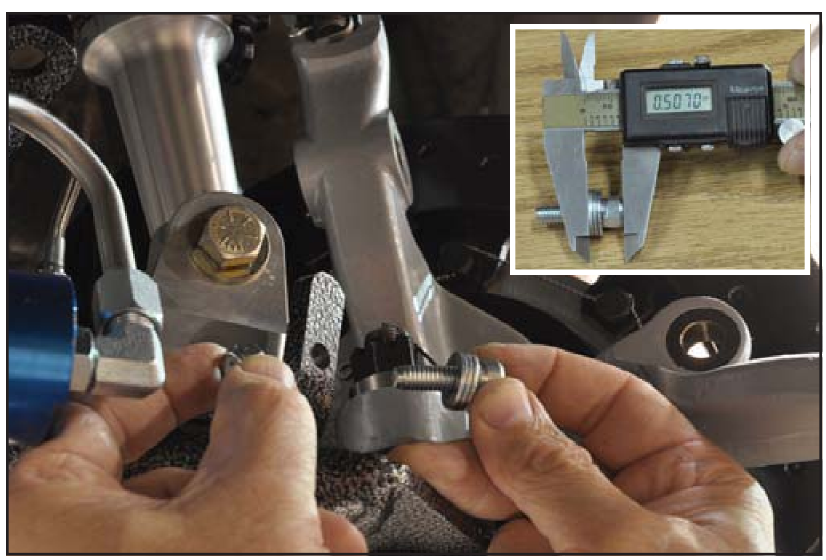
24. Tighten the socket-head cap screws to 60 lb-ft.
25. Grease the pivot assemblies using a standard grease gun.



Steering Stop Installation

Due to variations in chassis and common spindle swaps we have included an adjustable hardware stop to limit steering travel, preventing the tie-rod assemblies from contacting the rack body..

26. With the suspension at ride height turn the steering to full lock.
27. Measure the distance from the strut-rod tab to the flat contact area of the steering arm.
28. Place as many flat washers as needed onto the bolt to be slightly thicker than the measured distance (including the socket head of the bolt).



29. Thread the locknut onto the bolt and tighten to 25 lb-ft.
30. With the steering at full lock, verify there is clearance between all components as the suspension is moved throughout its range of travel. Add washers to the stop, if needed.
31. Install wheels to their original position and torque lug nuts.

Torque Specifications

Fastener Description	Location	Torque Value
Backup Nut, 1/2 drive (Item 3)	Strut Rod Frame Mount	150 ft lbs
Button Head Cap Screw, 3/8-24 x 1	Backup Nut (Jam Bolt)	30 ft lbs
Jam Nut, 3/4-16	Pivot Assembly to Strut Rod	80 ft lbs
Hex Head Cap Screw, 1/2-13 x 1-1/2	Strut Rod Adapter Plate to Lower Control Arm	60 ft lbs

Alignment

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	Street Performance		Road Course		Drag Strip	
	Manual	Power	Manual	Power	Manual	Power
Caster	2-1/2° to 3° pos.	3-1/2° to 4° pos.	2-1/2° to 3° pos	3-1/2° to 4° pos	4° to 6° pos	4° to 6° pos
Camber	0° to 1/2° neg	0° to 1/2° neg	1-1/2° to 2° neg	1-1/2° to 2° neg	0°	0°
Toe (total)	1/16" to 1/8" in	1/16" to 1/8" in	1/16" out to 1/16" in	1/16" out to 1/16" in	1/16" to 1/8" in	1/16" to 1/8" in

Our recommended alignment specs serve as a starting point for your particular application. Installed components, driver preference, and specific application will have a great affect on the correct settings for your vehicle.

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INSTALLATION GUIDE

TCP UCA-09-SVH

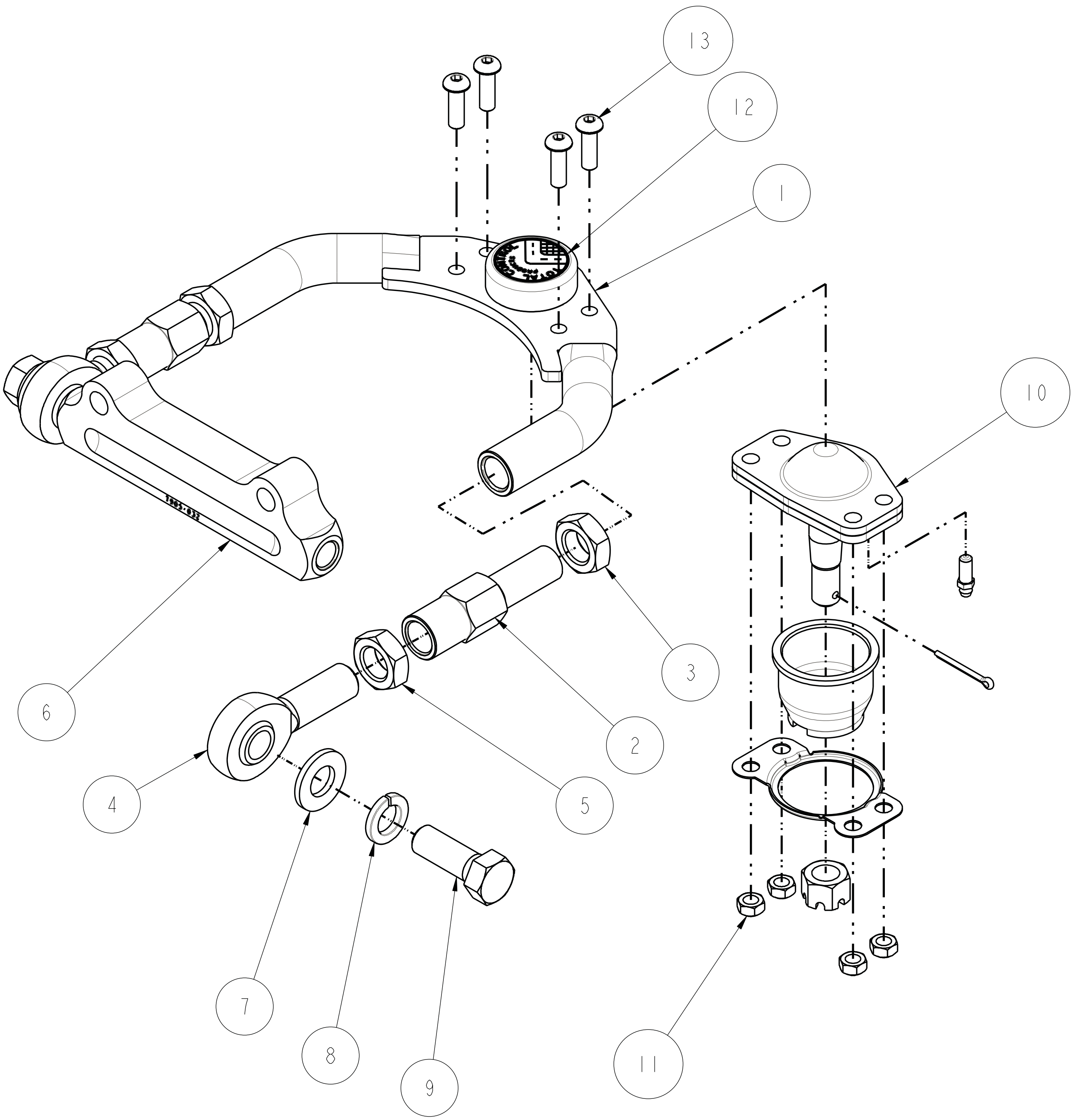
Coil-Over Upper Control Arm
with Dropped Pivot Shaft
1967-73 Mustang

Description: Adjustable length upper control arm for 4.75” bolt pattern with offset pivot shaft for camber gain improvement. For use with TCP front coil-over conversion.

Applications: Comet ‘66-77, Cougar ‘67-73, Cyclone ‘66-71, Fairlane ‘66-71, Falcon ‘66-70, Maverick ‘70-77, Montego ‘68-71, Mustang ‘67-73, Ranchero ‘66-71, Torino ‘68-71

Note: Must upgrade to V8 spindle

IMPORTANT: The outer shock tower reinforcement plate and suspension bump stop must be reinstalled prior to operating the vehicle. Worn or damaged suspension bump stops must be replaced. Failure to provide a proper compression-travel suspension stop will cause unwarrantable damage to the shock absorber and possible structural damage to the chassis.

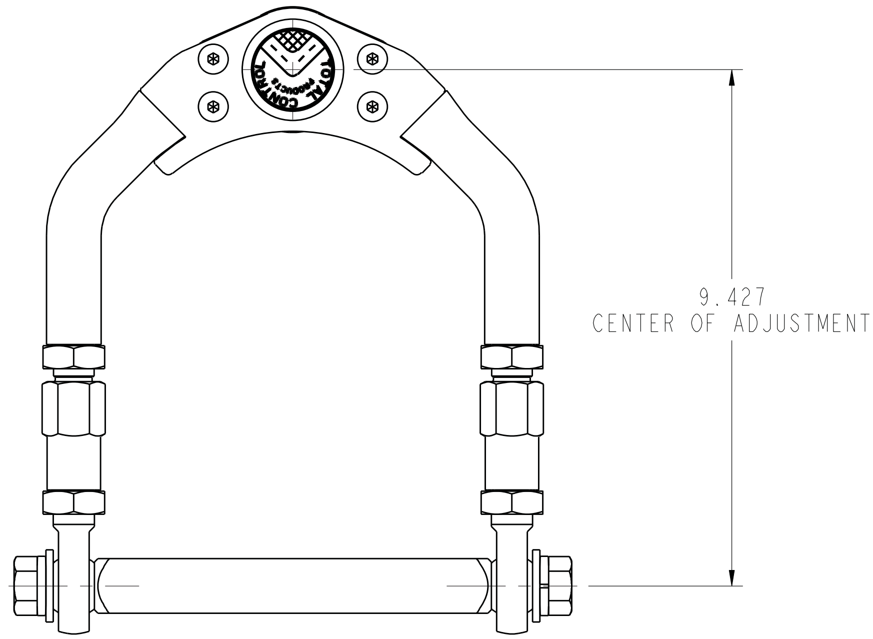


DISCARD SCREW, NUT AND LOCK WASHER
INCLUDED WITH BALLJOINT

PART NO. 7905-038 | SHEET 1 | REV. 1

REVISIONS

ZONE	REV	DESCRIPTION	DATE	APPROVED
	1	CHANGE BALLJOINT SCREW AND NUT	11/23/07	S. RIEGER



ITEM	QTY	PART NO.	DESCRIPTION
1	1	7905-016	UPPER ARM WELDMENT, NO TABS, TCP
2	2	7905-003	ADJUSTMENT COUPLER 3/4-16 RIGHT & LEFT
3	2	3102-075-16LY	JAM NUT, 3/4-16 LEFT, YELLOW ZINC
4	2	3112-075X063-R	ROD END 3/4 x 5/8 BORE, 4130 RIGHT, NYLON KMX12-10
5	2	3102-075-16RC	JAM NUT, 3/4-16 RIGHT, CLEAR ZINC
6	1	7905-032	PIVOT SHAFT, DROPPED 1", 4.75 SPACING, UPPER CONTROL ARM
7	2	3120-063S-Y	FLAT WASHER, 5/8 SAE, HARDENED
8	2	3108-063L-C	LOCK WASHER ∅5/8, SPRING
9	2	3100-063F1.75Y	BOLT, 5/8-18 x 1 3/4 HEX HEAD, GRADE 8
10	1	7905-023	BALL-JOINT KIT W/HARDWARE 4-BOLT STYLE 1964/1970 MUSTANG
11	4	3129-031-18C	5/16-18 HEX TOP LOCK NUT GRADE C (5) CLEAR ZINC
12	1	7903-DECAL-R1.5	DECAL, ROUND ∅1 1/2, TOTAL CONTROL PRODUCTS
13	4	3104-031C1.00C	BUTTON HEAD SOCKET CAP SCREW 5/16-18 x 1, CLEAR ZINC

UNLESS OTHERWISE SPECIFIED	APPROVALS	DATE	DESCRIPTION
DIMENSIONS ARE IN INCHES TOLERANCES FRACTIONS ±1/16 ANGLES ±.5° ±.05 ±.005 DECIMAL ±.1 ±.01 ±.005 ±.0010	DRAWN BY: S. RIEGER	9/21/07	**A-ARM ASSEMBLY, UPPER, NO TABS, 4.75 DROPPED MNT, MUSTANG**
	CHECKED BY: S. RIEGER	10/23/07	Chris Alston's CHASSISWORKS INC. 8661 YOUNGER CREEK DRIVE SACRAMENTO, CA 95828 (916) 388-0288 FAX 388-0295
	DWG RELEASE LEVEL: WIP		
FINISH: NONE			SIZE: B — PART NO. 7905-038 — PART REV. 1
MATERIAL: ASSEMBLY			SCALE: 5:16 — DWG: 7905-038 REV: 1 — SHEET 1 OF 1

PARTS LIST

TCP UCA-09-SVH - Coil-Over Upper Control Arms, 4.75” Bolt Pattern

Qty	Part Number	Description
2	7905-027	UCA shim .10 x 4.75” spacing
2	7905-038-SVH	UCA assembly 4.75” with tabs, dropped shaft
1	7918-022	Hardware bag

7905-038 - Upper Control Arm Assemblies

Qty	Part Number	Description
2	3100-063F1.75Y	Bolt 5/8-18 x 1-3/4” hex head cap screw
2	3102-075-16LY	Jam nut 3/4-16 LH, 1-1/8” hex x .42” tall
2	3102-075-16RC	Jam nut 3/4-16 RH, 1-1/8” hex x .42” tall
4	3104-031C1.00C	Button head 5/16-18 x 1” cap screw
2	3108-063L-C	Lock washer 5/8” regular
2	3112-075X063-R	Rod end RH 3/4”-thread x 5/8”-bore
2	3120-063S-Y	Washer 5/8” flat SAE, hardened
4	3129-031-18C	Top lock nut 5/16-18 all steel
2	7905-003	Coupler male-female 3/4-16 x 3/4-16 x 3-3/4” length
1	7905-016-SVH	Upper arm weldment no tabs
1	7905-023	Upper balljoint, 4-bolt
1	7905-032	Dropped pivot shaft, 1/2” holes, 4.75 apart

7918-022 - Hardware Bag

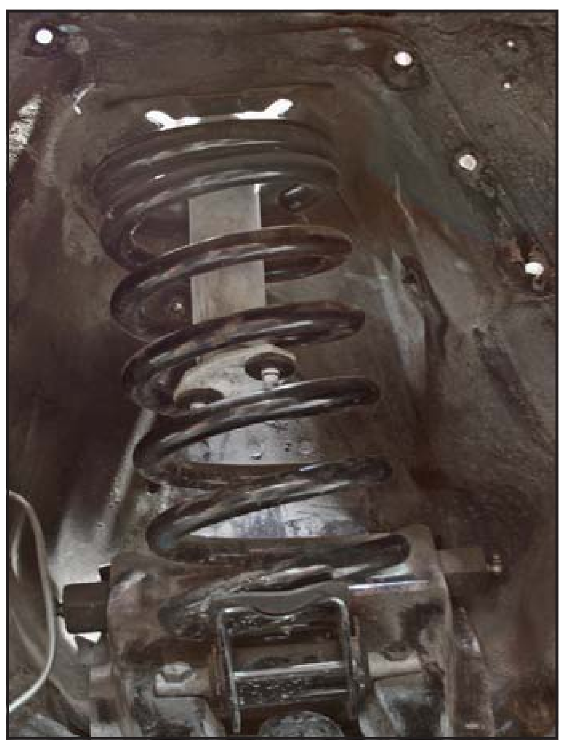
Qty	Part Number	Description
4	3100-050C2.50Y	Bolt 1/2-13 x 2-1/2” hex head cap screw
4	3108-050L-C	Lock washer 1/2” regular
4	3110-050-13-8C	Nut 1/2-13 standard 3/4” hex x .44” Tall
8	3120-050S-Y	Washer 1/2” flat SAE, hardened

INSTRUCTIONS

NOTE: A 1965 Mustang was used for the following images and may show slight differences from the later Mustang suspension. <u>The installation procedure is identical.</u>

1. Raise front end of car and secure with jack stands. Wheels must not be in contact with the ground.
2. Remove wheels, making note of which side of the vehicle they were removed from.
3. Unbolt the upper shock crossbar from factory shock mount. If installing the TCP coil-over conversion, the factory shock mount must also be unbolted and removed.

4. Unbolt the shock from the coil-spring perch. The nuts are accessed from underneath the control arm.



5. Remove the shock through the top of the shock tower.

6. Using a spring compressor, remove the coil spring. Follow the tool manufacturer's instructions for proper use of the spring compressor.

7. Remove the cotter pin at the upper balljoint and unscrew the castle nut, **leaving 3-4 threads still engaged.**
8. Use a pickle fork to separate the balljoint from the spindle.
9. Finish unscrewing the castle nut and remove the spindle.

   If the lower control arm is also being replaced, remove spindle from the lower arm following the same procedure.

   If you intend on leaving the brake assembly bolted to the spindle, the spindle must be secured to the inner fender using a wire or strap to avoid damaging the brake line.

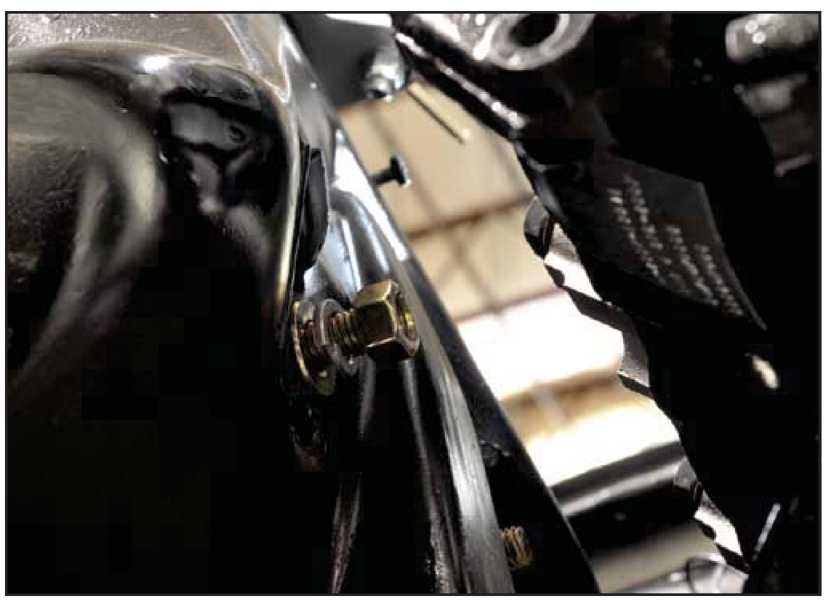
10. Remove upper arm pivot shaft nuts from engine side of shock tower, and remove upper arm.

11. Verify that you have the correct arm assembly for the side of the vehicle that you are working on.
    - The arrow engraved into the pivot shaft must point toward front of the vehicle.
    - The balljoint stud must point down.
    - The raised pivot shaft humps must point up.

12. OPTIONAL USE: Mounting shims (7905-027) are only needed to compensate for variances in shock tower alignment. Their purpose is to keep the adjusted length of both control arms relatively close and prevent different suspension geometries at opposite sides of the car. It may be necessary to use both on one side or none for the installation. This determination is made during the alignment process.
13. Place a single 1/2” flat washer over each 1/2” mounting bolt.
14. Raise control arm into its mounting position, insert two bolts through the pivot shaft, and then through the shock tower mounting holes.

    Shims are placed between the pivot shaft and shock tower, if needed.

15. Secure the bolts on the engine side of the shock tower using 1/2” flat washers, lock washers, and hex nuts. Torque hardware to 55 lb-ft.



16. Place the upper balljoint stud into the spindle upright. Tighten the castle nut to 50 lb-ft., and check the alignment with the cotter pin hole. Tighten the castle nut until the cotter pin can be inserted through the slots and the hole in the ball joint stud. Do not exceed 65 lb-ft.

    DO NOT LOOSEN THE CASTLE NUT TO ALIGN THE COTTER PIN.

17. Install the cotter pin and bend the ends in opposite directions around the stud.
18. Check all mounting hardware.
19. Using a standard grease gun, lubricate the balljoints.
20. Install wheels to their original position and torque lug nuts.
21. This completes installation.

Alignment

The vehicle must be professionally inspected and aligned prior to regular use.
If a trailer is not available, your alignment will need to be somewhat close to final specs in order to safely drive your vehicle to the alignment shop. Visually determine if the front wheels look straight. They should not appear to "toe" (left to right) -in or -out. The outside of the wheels should be very close to vertical. A few degrees of negative camber (leaning in) is acceptable.

Our recommended alignment specs serve as a starting point for your particular application. Installed components, driver preference, and specific application will have a great affect on the correct settings for your vehicle.

	Street Performance		Road Course		Drag Strip	
	Manual	**Power**	**Manual**	**Power**	**Manual**	**Power**
Caster	2-1/2° to 3° pos.	3-1/2° to 4° pos.	2-1/2° to 3° pos	3-1/2° to 4° pos	4° to 6° pos	4° to 6° pos
Camber	0° to 1/2° neg	0° to 1/2° neg	1-1/2° to 2° neg	1-1/2° to 2° neg	0°	0°
Toe (total)	1/16" to 1/8" in	1/16" to 1/8" in	1/16" out to 1/16" in	1/16" out to 1/16" in	1/16" to 1/8" in	1/16" to 1/8" in

Adjusting the Arm

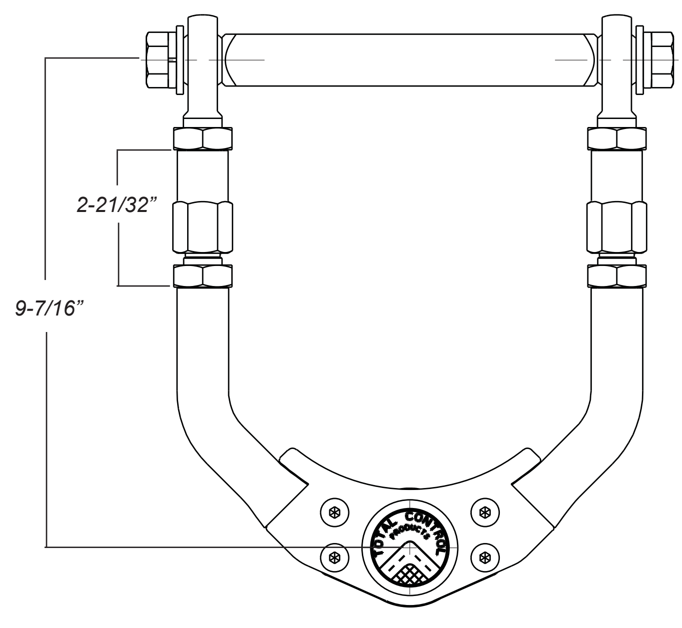
- Loosen jam nuts to allow adjustment of the couplers.
- A thread lubricant is recommended to make adjusting easier and to prevent damage to threads.
- Both Camber and minor Caster adjustments can be made at upper arm.
- Turning adjustment couplers in same direction equal amounts will adjust camber.
- Turning adjustment couplers in opposite direction equal amounts will adjust caster.
  Do not turn the adjusters more than two turns different side to side or binding will occur from side loading the rod ends. If you need more caster adjustment, the TCP strut rod can be shortened or lengthen to achieve the same results.

Shortest adjustment length is achieved with the rod end and adjustment coupler threaded completely into their female counterparts.

Center of adjustment is four complete turns of the adjustment coupler from the shortest adjustment length. With the jam nuts threaded to the base of the male threads, there should be four threads visible at each end.

Longest adjustment length is four complete turns of the adjustment coupler from center of adjustment travel. With the jam nuts threaded to the base of the male threads, there should be eight threads visible at each end. If longer adjusted length is needed, use shim/s (7905-026) between pivot shaft and shock tower.
Minimum thread engagement is 3/4".

Center of Adjustment Dimensions



Adjustment range is + or - four threads.

NOTES:

NOTES:

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Total Control Products
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CHRIS ALSTON'S Chassisworks
THE HOME OF HIGHER TECHNOLOGY

VariSpring Installation and Tuning Guide

Tools and Accessories

The following items are available from the Chassisworks' product line, or local auto parts or hardware retailer.

VariShock Spring Compressor – Recommended to aide installation of heavy-rate springs onto shocks and ease lower spring-seat adjustment.

VAS 200

VariShock Spanner Wrench – Non-slip four-tang spanner wrench designed specifically for leveraged adjustment of VariShock lower spring seats.

VAS 513-100

VariShock Thrust Bearings – Installs between the spring and lower seat to allow the spring to twist freely during preload adjustment and normal operation.

899-012-201

Anti-Seize Thread Lubricant – Reduces friction and chance of thread galling during preload adjustment.

Spring Specifications

Part Number	Free Length (in)	Solid Length (in)	Total Travel (in)	Spring Rate (lb/in)
VAS 21-07400	7	2.85	4.15	400
VAS 21-07450	7	2.83	4.17	450
VAS 21-07500	7	2.95	4.05	500
VAS 21-07575	7	3.42	3.58	575
VAS 21-07650	7	3.49	3.51	650
VAS 21-09210	9	3.36	5.64	210
VAS 21-09240	9	3.43	5.57	240
VAS 21-09275	9	3.54	5.46	275
VAS 21-09310	9	3.43	5.57	310
VAS 21-09350	9	3.83	5.17	350
VAS 21-09400	9	3.93	5.07	400
VAS 21-09450	9	4.10	4.90	450
VAS 21-09500	9	4.23	4.77	500
VAS 21-09550	9	3.94	5.06	550
VAS 21-09600	9	4.59	4.41	600
VAS 21-09675	9	4.20	4.80	675
VAS 21-09750	9	4.76	4.24	750
VAS 21-09850	9	5.26	3.74	850
VAS 21-12080	12	3.37	8.63	80
VAS 21-12095	12	3.72	8.28	95
VAS 21-12110	12	4.09	7.91	110
VAS 21-12130	12	3.57	8.43	130
VAS 21-12150	12	4.39	7.61	150
VAS 21-12175	12	4.40	7.60	175
VAS 21-12200	12	4.55	7.45	200
VAS 21-12250	12	5.00	7.00	250
VAS 21-12300	12	4.93	7.07	300
VAS 21-12350	12	5.00	7.00	350
VAS 21-12400	12	5.65	6.35	400
VAS 21-12450	12	5.76	6.24	450
VAS 21-14080	14	3.72	10.28	80
VAS 21-14095	14	4.62	9.38	95
VAS 21-14110	14	4.09	9.91	110
VAS 21-14130	14	4.94	9.06	130
VAS 21-14150	14	4.99	9.01	150
VAS 21-14175	14	5.07	8.93	175

Bump Stops

VariShock shocks and struts, and ShockWave air springs come equipped with a standard bump ring or pad to prevent harsh impacts when the shock bottoms out. The standard bump ring (see image) is a light-duty bumper and should not be subjected to repeated or severe contact. To better protect the shocks from It is best to install a chassis-to-axle housing (at the rear) or a chassis-to-control arm (in the front) hard-rubber or urethane bump stop. VariShock also offers a progressive-rate foam-construction bump stop for use on shock absorber and strut piston shafts. In addition to softening the impact the foam bump stop progressively increases the effective spring rate, avoiding an instant shift to an infinitely stiff rate that can severely alter how the vehicle handles. It is important to remember that all bump stops are a service part and need to be replaced if worn. Their service life will vary considerably based on the frequency and how hard they are used.

Standard VariShock Bump Ring

Standard VariStrut Bump Stop

Progressive-Rate Foam Bump Stop

VariSpring Installation

1. Prior to spring installation, all shocks must be test fitted on the vehicle to verify there is no binding and a minimum of 1/2” of clearance around the shock and spring throughout the full range of suspension travel.
2. Verify the travel length of your coil-over shock by fully extending the shock and measuring the distance from the top of the reservoir to the bottom of the jam nut under the top mount eye. Ignore any travel reductions caused by bump stops.
3. Refer to the chart to verify that you have the correct length spring for your coil-over.
4. Adjust the threaded lower-spring-seat setscrew locks so that a single thread is visible.
5. Apply anti-seize to the inside threads of the lower spring seat.
6. With the spring-seat spanner-wrench notches facing toward the shock, place the spring seat over the top eye and piston shaft, and thread it onto the shock body as far as it will go without hitting the adjustment knob(s).

   NOTE: After final spring seat adjustments have been made, tighten the setscrews to lock the lower seat in place. Always make sure the threads on the reservoir body are clean of any dirt before adjusting the spring seat.

   DO NOT adjust the lower spring seat without first jacking up the car to remove the vehicle’s weight from the spring; even with spring-seat thrust bearings installed.
7. Install optional spring-seat thrust bearing onto the shock at this time. Bearings must be lightly greased prior to installation.
8. Place the coil spring over the top eye and piston shaft, and then onto the lower spring seat.
9. Install the upper spring seat onto the shock. The 1-3/4” diameter counter bore in the upper spring seat goes against the top eye, and the 2-1/2” diameter ledge goes into the spring.

   NOTE: In most cases, you will have to compress the spring slightly to slide the spring seat between the spring and top eye. Holding the shock by the lower eye in a soft-jaw-equipped vise or use of a spring compressor will make installation easier with higher rate springs.
10. Once the upper seat is in place, screw the lower seat upward until it holds the spring and upper seat in place without free play. DO NOT screw the lower seat more than one-half turn past the point at which free play is taken up and the spring cannot rattle.
11. Prepare each coil-over shock as instructed above.
12. DO NOT install the shocks onto the vehicle at this time.

Determining Your Baseline Spring Rate

Determining the correct spring rate and correctly adjusting your suspension is very important to achieving the best possible and most reliable performance from your components. In fact, the vast majority of problems people experience with coil-over shocks can be attributed to using the wrong spring rate or incorrect adjustment of the shocks many settings.

What is the Baseline Spring Rate?

“Baseline spring rate” is defined as the pound-per-inch rate (lb/in) at which the spring supports the corner weight of the vehicle with the coil-over shock at the correct installed height without the need to preload the spring. Once the baseline spring rate has been established, the vehicles performance goals and further testing will reveal the correct final spring rate for each installation. Differences such as how the spring is mounted (installation motion ratio), vehicle weight reduction, chassis stiffening, specific performance application, and driver preference and skill level all have a bearing upon the correct final spring rate.

Where to Begin? (Initial Spring Rate)

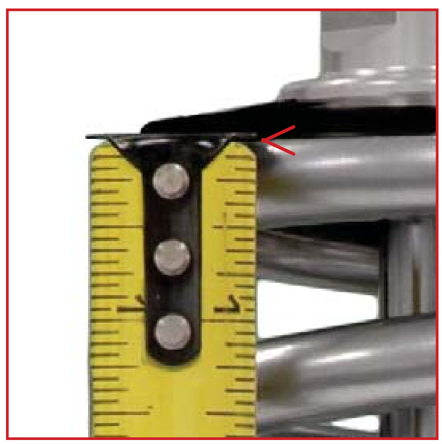
Based on our experience with vehicles and performance applications similar to your own, Chassisworks can recommended an “initial spring rate” to install on your vehicle, from which the correct baseline spring rate can be derived. In many cases our recommended initial spring rate will be the correct baseline spring rate. However, due to the sheer number of variables, it is impossible for our technical staff to predict the precise baseline spring rate for each and every installation scenario. To assist you in obtaining the correct spring rate, a second set of springs can be purchased at a discount.

Taking Measurements

Chassisworks has developed a simple method to determine the correct baseline spring rate. This method requires installation of our initially recommended spring, followed by a couple quick measurements and some simple calculations. Before getting started, the vehicle must be 100% complete. This includes interior, glass, fluids, weight ballasts, and sand bags or free weights to substitute as the weight of the driver. At this point, the springs should already be installed on the shocks with NO PRELOAD and ready to go onto the vehicle. *Lower spring seats should be just tight enough to remove free play from the spring.*

1. Record the initial spring rate as value “R” in the calculation table that follows. Most VariSprings will have the rate printed directly on them.
2. With the shock fully extended, measure the installed free-length of the spring. At the upper-spring-seat slot, hook the end of the tape measure against the spring and measure, with one sixteenth-of-an-inch accuracy, the distance to the ground bottom edge of the spring. Record this dimension as value “F” in the calculation table that follows.

   NOTE: The measured length may differ slightly from the nominal spring length. In our example the 9” VariSpring actually measures 8-15/16” when correctly installed.



Hook the tape measure against the spring at the upper spring seat slot.

Measure the bottom end of the spring.

3. Install all shocks and springs onto the vehicle and lower it to the ground.
4. Verify that the springs are supporting the full weight of the vehicle. Any chassis or shock bump stops that are in contact must be temporarily removed. Make sure to replace bump stops when finished.
5. Measure the springs again at their newly collapsed installed height to within one sixteenth-of-an-inch accuracy from the same spring reference points used previously. Record this dimension as value "L" in the calculation table that follows.

Installed Height by Performance

When a shock is at installed length (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 bump (shock compressing) and rebound (shock extending). Use the Reserved Shock Travel Percentage Guidelines and appropriate chart to determine the amount of bump travel required to collapse the shock to the correct installed length for your performance application. Record this dimension as value "T" in our calculations.

NOTE: In our example calculation, a handling performance application with a 4.25"-travel coil-over shock lists a "T" value of 2.13.

Perform the Calculations

Calculation Table

The leftmost column in the calculation table gives you a place to record your values. Use a pencil in case you make a mistake.

Record Values	Variable	Description
___ ___.___ ___	**F**	measured initial Free length of installed unloaded spring
___ ___.___ ___	**L**	measured Loaded spring compressed length
F - L	Answer 1	Subtract L from F
___ ___ ___ lb/in	**R**	initial spring Rate in pounds per inch
Answer 1 x R	Answer 2	Multiply Answer 1 by R
___ ___.___ ___	**T**	spring Travel to achieve desired ride height (from chart)
Answer 2 ÷ T	BASELINE SPRING RATE	Divide Answer 2 by T

Example:

Measured free length (F) 8-15/16" or 8.94

Minus measured loaded length (L) 6-1/2" or 6.50

8.94F - 6.50L = 2.44

Multiply that answer by the current spring rate 500 lb/in

2.44 x 500R = 1220

Divide that answer by the correct (T) value in chart

1220 ÷ 2.13T = 572.77B

Round the final answer up or down to a suitable spring rate.

$$\frac{(F - L)\,R}{T} = \textbf{Baseline Spring Rate}$$

Reserved Shock Travel Percentage Guidelines

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.

Optionally, it is acceptable to adjust the shock's installed height to any length between the minimum and maximum spring-length value shown in the chart. This range allows you to adjust the vehicle ride height a small amount.

VariShock Coil-Over Shocks

Coil-Over Shock Travel	Street	Handling	Drag	Spring Free Length	Street	Handling	Drag
	60/40	50/50	40/60		Max.	Center	Min.
	(T) Spring Travel Used At Ride Height				*Installed Spring Length At Ride Height*		
2.80	1.12	1.40	1.68	7	5.88	5.60	5.32
3.50	1.40	1.75	2.10	7	5.60	5.25	4.90
4.25	1.70	2.13	2.55	9	7.30	6.88	6.45
5.15	2.06	2.58	3.09	12	9.94	9.43	8.91
6.15	2.46	3.08	3.69	12	9.54	8.93	8.31
7.15	2.86	3.58	4.29	14	11.14	10.43	9.71
	Use above values for "T" in calculation table.				Compressed spring length will be close to above values when using the correct baseline spring rate.		

VariStrut OEM Bolt-In Struts

Strut Travel	Street	Handling	Drag	Spring Free Length	Street	Handling	Drag
	60/40	50/50	40/60		Max.	Center	Min.
	(T) Spring Travel Used At Ride Height				*Installed Spring Length At Ride Height*		
6.50	2.60	3.25	3.90	12	9.40	8.75	8.10
7.00	2.80	3.50	4.20	12	9.20	8.50	7.80
	Use above values for "T" in calculation table.				Compressed spring length will be close to above values when using the correct baseline spring rate.		

VariStrut Integral Spindle Suspension Systems

Integral-spindle struts are designed for drag-race use only and are set-up to provide the maximum amount of extension travel.

Strut Travel	*(T) Spring Travel Used At Ride Height*		Spring Free Length	*Installed Spring Length At Ride Height*	
	Max.	Min.		Max.	Min.
4.00	2.5	2.75	9	6.50	6.25
6.00	3.5	4.5	12	8.50	7.50
	Use above values for "T" in calculation table.			Compressed spring length will be close to above values when using the correct baseline spring rate.	

VariSpring Adjustment and Tuning Guide

Once the baseline spring rate has been determined, you are better prepared to make decisions with regards to changing spring rates for the purpose of tuning the suspension. Suspension tuning involves multiple variables such as: spring rates, anti-roll-bar rates, vehicle weight distribution, tire sizes, tire pressures, suspension geometry, and track conditions. The information contained in this tuning guide covers basic tuning procedures and has been greatly simplified to get you started in the right direction. We strongly recommend researching suspension tuning and vehicle dynamics, or consulting an experienced professional for further understanding of the pros and cons of making each adjustment.

Tuning Categories

VariSpring's broad range of spring rates and lengths are 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.

Correcting Shock Installed Length

Threaded spring seats allow installation of spring rates that differ from the baseline spring rate for the purpose of performance tuning. With the spring free from the weight of the vehicle and the shock at full extension, spring seats can be threaded up or down to keep the shock at the correct collapsed install height. Raising the spring seat to compress the coil spring to any length shorter than it's free height, with the shock fully extended, is referred to as preloading the spring. During the tuning process if you elect to use a coil spring that is lighter than the calculated baseline spring rate, it may be 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.

Raising or Lowering Ride Height

The spring seats are not intended to alter the vehicle's ground clearance beyond the allowed range of ride-height shock lengths. Altering ride height in this manner, risks damaging the shocks due to the lack of reserved travel in either direction. Other options for altering the vehicle's ground clearance must be empolyed. Then include moving the upper or lower shock mount, changing to a different length shock, or changing tire diameter.

Adjustable Shock Mounts

Chassisworks manufactures many different styles of adjustable shock mounts to accommodate coil-over installation on both aftermarket and OEM chassis. If an adjustable shock mount cannot be used, then a longer or shorter coil-over will be required. Keep in mind that a shorter coil-over does lower the vehicle, but with a reduced amount of travel and a stiffer spring, making spring selection much more exacting and the possibility of a good ride more difficult. We do offer an optional 1"-extended upper shock eye to increase the length of any poly-eye VariShock without the need of an adjustable mount. (See photo)

1"-Extended Shock Eye

Appropriate Shock Lengths

As a general rule, never use anything shorter than a 5"-travel rear shock. You also want to have at least 5 inches of front end travel. You can accomplish this with a 3.50" or 4.25" travel shock depending on the motion ratio of the front lower a-arm. As a practical matter a 4.25" travel front shock will give between 5.75" to 7.0" of front travel on most A-arms and has a lot broader selection of spring rates. As it has more travel, your installed length range varies up to .80" which will equate to a 1.25" range at the wheel to help you adjust your vehicle ride height without modifying the shock mount. That is why most Chassisworks designs use the 4.25" shock. It is clearly a better choice for performance cars.

Tuning for Ride Quality

Tuning for ride quality generally involves spring rates that are at or slightly below the baseline spring rate, matched with softer shock settings to achieve a smooth and comfortable ride. Use of adjustable shocks allows softer settings for regular street use that can easily be changed to a stiffer setting for mild performance use. When properly adjusted for street use the vehicle should feel settled without continued bouncing (too soft), excessive harshness (too stiff), or fore/aft pitching. The vehicle's cornering ability can be improved with the addition of a moderately-sized front anti-roll bar. A moderate-size anti-roll bar will reduce body roll during cornering without increasing ride harshness over uneven surfaces. We feel that this general approach yields a comfortable driving vehicle that can be easily moved toward more performance oriented driving when used with adjustable shocks. Testing and adjustment is required to attain desirable results.

Shocks Topping- or Bottoming-Out	Increase Stiffness	If the shocks are within their allowed installed-height range and repeatedly exceed the travel limits of the shock, increase spring rates or shock stiffness to reduce the amount of suspension travel.
Excessive Chassis Movement	Increase Stiffness	If vehicle exhibits rapid weight shifts or continues to oscillate more than one suspension cycle before settling, increase spring or shock stiffness, 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 spring or shock stiffness, 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 springs or shocks should be stiffened or conversely the front springs or shocks softened. Ideally the rear suspension should oscillate at a slightly quicker rate than the front to minimize pitching.

Tuning for Handling Performance

Corner Weighting for Handling Performance

Threaded spring seats also enable available traction to be maximized by corner weighting the vehicle. In corner weighting, the spring seats are threaded up or down to change the height of the spring, thereby increasing or decreasing the percentage of total vehicle weight carried by that spring. Ideally, the total weight that each diagonal pair of wheels shares should be equal to the opposite diagonal pair. The diagonal balance is ideal for vehicles requiring equal cornering performance in both left- and right-hand turns. Offsetting the balance can be used as an additional tuning aid if desired.

Digital scale sets are available specifically for corner balancing and provide the most accurate information. Before corner balancing, all tires must be at their correct pressure level and the vehicle must be 100% complete. This includes interior, glass, fluids, weight ballasts, and sand bags or free weights to substitute as the weight of the driver.

Example 1

Left Front	110 lbs	Right Front	110 lbs	**= 200 lbs**
Left Rear	90 lbs	Left Rear	90 lbs	**= 200 lbs**

Example 2

Left Front	115 lbs	Right Front	105 lbs	**= 200 lbs**
Left Rear	95 lbs	Left Rear	85 lbs	**= 200 lbs**

Handling Performance Tuning Strategy

Our preferred setup strategy for handling performance involves a modest spring rate, at or above the calculated baseline spring rate, adjustable shocks, and heavier-rate anti-roll bars to help control chassis movements. Generally, as the driver's and vehicle's ability to generate cornering and braking forces increases, spring rates should be increased to minimize the body roll and brake dive. Stiffer tuned suspension increases vibration transferred to the vehicle and passengers, but is usually tolerated for performance gains. There are alternate tuning approaches, but we feel that this strategy allows rapid adjustments without the requirement of multiple spring rate changes to find the correct combination of components.

As a vehicle approaches its cornering traction limit the handling characteristics of understeer and oversteer will become more apparent to the driver. Cornering balance is a result of the relationship between a multitude of factors including weight distribution, tire sizes and pressures, specific suspension geometries, spring rates, anti-roll-bar rates, and shock bump and rebound stiffness. Chassisworks' tuning strategy is to use front and rear anti-roll-bar adjustments and shock stiffness adjustments to bring the vehicle into balance. As a very basic rule of thumb; the softer end of the vehicle will have more grip, and the stiffer end of the vehicle will have less grip. So, if the vehicle has understeer, soften the front suspension or stiffen the rear. Or, if the vehicle exhibits oversteer, soften the rear suspension or stiffen the front. For our purposes, softening or stiffening the suspension will consist of adjustments or changes to shock valving and/or anti-roll bar spring rates.

When properly adjusted the vehicle should feel responsive, exhibit balanced cornering grip, and maintain traction over irregular surface conditions. As previously stated, there are a multitude of additional adjustments that can be made to adjust cornering balance. A very basic chart is provided but the pros and cons of making each adjustment is beyond the scope of this document. If you intend to operate your vehicle at or near its performance limits, it is extremely important that extensive testing and adjustment be conducted in a safe and controlled environment, such as a dedicated motorsports facility.

Excessive Chassis Movement	Increase Stiffness	If vehicle exhibits rapid weight shifts, increase spring or shock stiffness, 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 spring or shock stiffness, 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 spring or shock stiffness, 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 springs, shocks, or anti-roll bar should be stiffened. Or conversely, front springs, shocks, or anti-roll bar, 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 springs, shocks, or anti-roll bar should be stiffened. Or conversely, rear springs, shocks, or anti-roll bar, 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.

Additional Tuning Adjustments

The chart to the right provides a very basic view of how a given adjustment will affect the level of traction at the end of the vehicle on which the adjustment was made. We strongly recommend researching suspension tuning and vehicle dynamics, or consulting an experienced professional for further understanding of the pros and cons of making each adjustment.

Adjustment	More Grip	Less Grip
Spring Rate	Softer	Stiffer
Shock Valving	Softer	Stiffer
Anti-Roll Bars	Softer	Stiffer
Weight Distribution	Lighter	Heavier
Tire Size	Wider	Narrower
Tire Pressure	Lower	Higher
Roll Centers	Lower	Higher
Aerodynamic Downforce	More	Less

NOTE: For shock absorber tuning instructions see tuning guide shipped with shocks.

Drag Race Tuning

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 suspension 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.

What Happens During Launch?

As a drag vehicle front suspension separates (the front of the car comes up) more weight is transferred to the rear tires to aid traction. How fast the front end rises is mostly controlled by the spring rate and front shock force. As the rebound valving of the shocks is softened it will be easier for the front end to lift. Not so obvious is if the car had a softer front spring, the front suspension will lift easier also. The explanation is quite simple. A heavier rate front spring will take more force to lift the front end a fixed vertical distance, than a lighter spring. If you have 500-lb/in front springs and the acceleration force transfers 1000 pounds of front end weight to the rear; 500 from each front spring, the front end lifts one inch. With 250-lb/in front springs, the same 1000 pound weight transfer will lift the front end a total of two inches. The lighter 250-lb/in rate benefits a drag car in two ways. The front end will move faster and farther because less force is required to initially extend the spring. And, it will rise higher, transferring more weight as the center of gravity rises, further assisting traction. However, too much weight transfer can hurt your ET by causing excessive wheel stands and lost forward motion.

Tuning Front Suspension with Spring Rate

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 rise during acceleration. A stiffer rate makes the front harder to rise during acceleration. If you are having trouble getting the front end to rise, you can soften shock rebound 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 will store energy in it. This is the very simple theory behind stored energy front drag-race springs. If you preload a spring, it is imperative that you verify that the spring has enough travel to not coil bind before the shock bottoms out. VariSprings feature a very high strength steel that allows them to be wound more coarse then traditional springs, which makes VariSprings travel farther before coil bind.

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.

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 suspension settings.

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 possible. 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.

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.

Front Rebound (Extension) Adjustment Overview

Too light of a spring rate or shock rebound (extension) 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 spring rate or shock setting allows the car to bounce off its front rebound travel limiter and then bottom out in an oscillating manner. Too firm a spring rate or shock setting will prevent the front end from rising sufficiently, limiting the amount of weight transferred to the rear tires. Spring rates should only be changed if the shock valving range is not great enough to correct the issue. 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 Rebound Stiffness	Violent chassis separation and may result in jerking the front wheels off the ground. Increase spring or shock stiffness, then test again.
Rear Tires Hook Then Lose Traction	Increase Rebound 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 spring or shock stiffness, then test again.
No Front End Rise	Decrease Rebound Stiffness	Too firm of a shock setting limits the amount of weight transferred to the rear tires, resulting in poor traction. Decrease spring or shock, then test again.

Front Bump (Compression) Adjustment Overview

After the launch or during a gear change, a firm spring or shock setting will cause the chassis to bounce off the front tire as the chassis settles down. Too light of a spring or bump setting allows the shock to bottom out and bounce off the stop travel bumper. Spring rates should only be changed if the shock valving range is not great enough to correct the issue. 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 spring or shock stiffness, 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 Bump 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 spring or shock stiffness, then test again. This can be a very subtle problem. Watch the front tire sidewall as it contacts the ground.

High Rate Rear Springs

It is common in drag race rear springs to use a spring rate higher than the baseline spring rate. There are two primary reasons. One is to overcome some of the additional weight loading due to weight transfer. The second is not very well understood, and has to do with the way the rear suspension affects how the suspension moves.

As the car is initially launched, many suspensions will actually compress at launch for a fraction of a second, slightly reducing traction. Higher rate springs will resist harder against compression and help prevent the loss of traction. VariShock also manufactures a unique line of specially valved shocks that more precisely remedies this situation.

As always, there are practical limits to how stiff of a spring can be used. If the spring gets too stiff, a very dangerous condition develops. The suspension essentially prevents any compression travel, making the tire sidewalls the effective springs, and eliminating much needed damping that helps to stabilize the vehicle. This can potentially be a catastrophic problem if the vehicle gets out of shape at high speed. As weight shifts to the outside of the vehicle, the tire side wall compresses then rapidly unloads throwing the vehicle in the opposite direction. In a properly setup vehicle, shock damping slows the dramatic side-to-side weight shift, allowing the driver more time to react.

Rear Shock Adjustment (Double Adjustable)

The goal is to 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 Bump Stiffness	Some vehicles will squat during launches instead of pushing the vehicle forward. To assist in planting the tires, increase shock bump stiffness by one, then test again. Spring rates should only be increased if the shock valving range is not great enough to correct the issue.
Vehicle Separates from Rear End	Increase Rebound 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 rebound stiffness by one, then test again. Spring rates should only be increased if the shock valving range is not great enough to correct the issue.
Loss of Traction with Minimal Chassis Movement	Decrease Bump/ Rebound 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. Minimal chassis movement makes if very difficult to visually tell if the bump or rebound needs to be decreased. We suggest adjusting bump first and watch for a gain or loss in the ET. If ET does not improve, return to previous setting, then adjust rebound instead and test again. Spring rates should only be decreased if the shock valving range is not great enough to correct the issue.

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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