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)

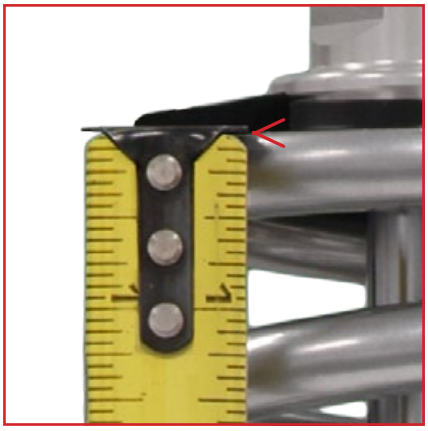
Based on our experience with vehicles and performance applications similar to your own, Chassisworks can recommended an "initial spring rate" to install on your vehicle, from which the correct baseline spring rate can be derived. In many cases our recommended initial spring rate will be the correct baseline 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

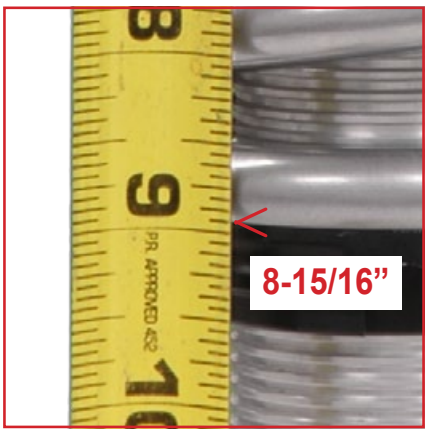
Chassisworks has developed a simple method to determine the correct baseline spring rate. This method requires installation of our initially recommended spring, followed by a couple quick measurements and some simple calculations. Before getting started, the vehicle must be 100% complete. This includes 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.

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.	

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