HOT RODDING 101

Modifying Your Vehicle the Right Way

Many students want to customize their ride to make it cool and uniquely their own. Many people go about this the wrong way, making their car dangerous and illegal. What I am presenting here is the information I have learned through study and experimentation. Many of these I've tried and lived to tell about them. I've also learned the engineering behind what is done so I could further understand "why."

My hope is that this section might help you make the right choices for your vehicle, and enjoy safe and responsible cruising!

Lowering

LOWERING: Can I cut the coils to lower my car?

Cutting coils involves using a cutoff wheel, angle grinder, or acetylene torch to cut off a coil or portion of a coil from the end of a coil spring. Illegal modification.

PROS	CONS
☐ Very cheap method of lowering a car. ☐ Increases spring rate slightly.	☐ Sometimes difficult to keep drop equal. ☐ Springs may not stay seated through full suspension movement. ☐ Springs may not increase stiffness sufficiently.

• Take a coil spring with a spring rate of 100 lb/in that has 10 active coils
• If we place 500 lbs on that spring, the spring will compress 5”
    • Travel = (Load)/(Spring Rate) Travel = (500 lbs)/(100 lb/in) Travel = (5”)
• Each of the 10 active coils are contributing 0.5” to the load
    • Contribution = (Travel)/(# of Coils) Contribution = (5 in)/(10) Contribution = (0.5”)
• If we cut two coils off the spring, there will be 8 coils remaining, lowering the car 1in
• 8 coils, contributing 0.5” each, would compress 4” under the same load
    • Compression = (Contribution)x(Coils) Compression = (0.5)x(8) Compression = (4”)
• New spring rate would be 125 lbs/in, which is 25% stiffer
    • New Rate = (Load)/(Compression) New Rate = (500 lbs)/(4in) New Rate = (125 lbs/in)
	• Take a coil spring with a rate of 100 lb/in, and a suspension travel of 3”
	• If we place 500 lbs on that spring, the spring will compress 5”
	    • (500 lbs)/(100 lb/in)=(5”)
	• If we lower a car 1” the spring must still reach the same full load as before in order to prevent bottoming. Therefore the spring rate must be higher.
	• ORIGINAL SPRING:
	    • Bump Load = (Spring Rate)*(Travel) Bump Load = (100 lb/in)*(3in) Bump Load = (300 lbs)
	• LOWERING SPRING:
	    • Req’d Rate = (Bump Load)/(Travel) Req’d Rate = (300 lbs)/(2in) Req’d Rate = (150 lb/in) (20% more than cut springs!)
	• Aftermarket springs are generally designed using this formula
	• The engineers usually do not take into account increased body roll due to the lower center of gravity and the significantly lower roll center ~ most aftermarket lowering springs are too soft!!!

CONCLUSION:

While cutting coils can be cost effective, the increase in spring rate does not increase sufficiently for the amount of lowering cutting will do.

Since lowering springs are often shorter, spring manufacturers often wind springs with a “dual rate,” that is, the coils are spaced differently at one end than the other. Tighter coil spacing is usually much softer, and allows the spring to take up any “slack” in the assembly so the springs stay seated at all times.

These tighter coils are compressed fully (“stacked”) and are no longer “active” (called “dead” coils) when the vehicle is at rest, allowing the car to ride on the “real” spring rate of the wider spaced coils.

Without these “dead” coils, the shorter springs may fall out when going over bumps, or raising the car to change a tire.

On a scale of 1-10, cutting coils is a 2.

LOWERING: Can I heat the coils to lower my car?	
Heating coils involves using an acetylene torch to soften the springs, allowing the weight of the vehicle to settle lower. Illegal modification.	
PROS	CONS
☐ Very cheap way to lower a car	☐ Heating the springs ruins them. ☐ Springs become softer, and continue to deteriorate afterward. ☐ Spring rate decreases significantly. ☐ Load capacity of spring decreases significantly. ☐ Life expectancy of spring decreases significantly. ☐ Spring assembly may not stay seated. ☐ Very difficult to keep drop evenly.
CONCLUSION	
Heating coils is butchery. Although it is fast and cheap, there are MANY disadvantages to heating coils.	
On a scale of 1-10, heating coils is 1.	

Should I even lower my car?

Lowering involves modifying the suspension with the intention to reduce the center of gravity, thus improving cornering. Most people lower a vehicle so that it looks cool, or to emulate race cars.

PROS	CONS
☐ A lower center of gravity can improve handling, as the center of gravity is closer to the frictional surface of the tires ☐ Good looks	☐ Spring rates MUST be increased proportional to the amount the car is lowered ☐ Ride quality will suffer ☐ Risk of bottoming suspension or chassis • Bottoming results in dramatic and violent changes in handling • Bottoming should be avoided at all costs ☐ MUST be aligned afterward ☐ May be impossible to align properly ☐ Significant tire wear on independent suspensions (due to control arm arcs of motion dragging tires sideways over every bump) ☐ Induced bump steer (due to tie rod end arc of motion vs. control arm arc of motion) ☐ Increased constant velocity or universal joint wear (due to unusual driveshaft/driveaxle angles) ☐ Body roll may increase due to roll center dropping more than center of gravity (law of levers) ☐ Tire clearance problems