Spohn Performance | Support Center

I'm looking for more information about coil springs, spring rates, spring types, etc.

- Some Good General Information About Coil Springs

  Spring rate refers to the amount of weight needed to compress a spring an inch (Example: 200 lb. per inch). To understand and properly check a spring for rate you need to know the factors that determine the rate of the spring. Fortunately, there are only three things that affect spring rate:

  Spring Rate Factors:

  1. Wire diameter: This affects rate since greater diameter wire is stronger than lesser diameter wire. So, when wire diameter is increased, spring rate increases.

  2. Mean diameter of spring - Mean diameter is the overall outside diameter of the spring less one wire diameter. When mean diameter increases, the spring rate decreases.

  3. Active coils - Determination of the number of active coils varies according to spring design. Count the total coils minus two for springs with both ends closed. Count the total coils minus one for springs with one end closed and one end open. As the number of active coils increases, the spring rate decreases.

  Linear Rate Springs:

  If a spring's rate is linear its rate is not affected by the load put onto the spring. For example, a linear rate spring rated at 200 lb. per inch will compress 1" when a 200 lb. weight is placed onto the spring. If another 200 lb. weight is put onto the spring the spring will compress another inch. At this point the load on the spring has increased to 400 pounds. The rate of the spring, however, remains constant at 200 lb. per inch.

  Progressive Rate Springs:

  If the load put onto a spring increases the rate of the spring, the spring is said to have a progressive rate. Keep in mind that the load put onto a progressive rate spring can greatly increase the rate of the spring. Progressive rate springs are made by varying the spacing between the springs' active coils. During compression the close coils bottom out and deaden. This reduces the amount of active coils and spring rate increases as a result.
  Springs that are designed to include coils of different diameter or are wound using a tapered wire will also produce a progressive rate.

  Dynamics of Coil Springs:

  There are basically three different spring designs presently used in cars. They are:
  Closed and ground on both ends (Coil-overs and rear conventional springs are this type) Closed both ends but ground one end only (Conventional front springs are normally this type) Closed and ground on one end and open on the other end (Similar to a conventional spring that has been cut).

- The three spring types are used in different situations and provide different effects to rate. Since the designs are so varied, it only follows that the dynamics of each design are also varied. Remember,

however, the only factors that affect spring rate are wire diameter, mean diameter and number of active coils.

How Spring Rates Change Dynamically:

As a coil spring compresses, the inactive (dead) end coils gradually contact adjacent, active coils. The contact causes the active coils to deaden which increases the rate of the spring. The rate creep that results usually stops after the first inch of spring travel and does not appear again until spring travel approaches coil bind. Generally speaking, this type of rate creep is of little consequence with springs softer than approximately 500 lb. per inch. When you use springs stiffer than 500 lb. per /inch, rate creep becomes more pronounced.

It is important to realize that springs will pick up rate during compression. Consequently, the rate marked on a spring can differ from the rate as seen by the chassis. This is especially true whenever a spring is rated based on the first inch of compression.

Spring Stress:

The rate of a spring is determined by its diameter, the number of its active coils, and the diameter of its wire. Since most springs are built to a fixed diameter, a spring designer must decide on the diameter of wire and the correct number of active coils needed to produce the desired rate.

If the designer chooses a smaller than normal diameter of wire (which tends to soften rate), he will have to compensate by using fewer active coils (which tends to stiffen rate) to achieve the desired rate. There are two possible reasons for a spring designer to use a smaller than normal wire diameter for a specific rate spring:

1. The ideal diameter wire may not be made and using the next larger wire (which requires more active coils) would produce a spring with insufficient spacing between its coils. This could cause the spring to bind during normal operation.

2. Cost could be the prime consideration and by using a smaller diameter wire and fewer coils (shortening the length of wire used) material cost is reduced. Unfortunately, many springs are built this way and these springs can cause a multitude of problems for the chassis tuner that we will cover.

Many people mistakenly believe extra spacing between the coils of a spring indicates a preferable spring. While a spring must have sufficient stroke capacity it also must have sufficient material to absorb the load put onto it. If the spring's material is not sufficient for the load put onto the spring, the material will become over stressed and the spring will take a set (lose height). Handling, of course, is affected and the reason is not always apparent to you unless you pay close attention to your springs.

What if a spring "sets"?

When a spring takes a set it will normally stabilize at its new height. The rate effectively remains the same since no appreciable changes have been made to any of the three factors that determine the spring's rate. Other than creating a need to readjust the chassis (to restore the original set-up and ride heights) the spring should provide satisfactory performance. It is not uncommon for even well designed and properly manufactured springs to settle up to 1% of their free height.

What is Coil Bind?

Coil bind occurs whenever a spring is compressed and one or more of the springs active coils contacts another coil. The rate of the spring increases whenever a coil binds since the bound coil or coils are no

longer active (this changes one of the three rate-determining factors). Of course, handling is affected whenever a coil binds. If the spring is compressed to solid height (all coils touching) during suspension movement, the suspension will cease to work. You can, and should, check for evidence of coil bind by examining the finish between the active coils. If any coils have bound the finish between them will show contact marks that appear as though they were drawn with a lead pencil. Normally any spring that is binding should be replaced with a taller spring.

Why Springs Bow:

Springs that have lengths greater than 4 times their diameter will have a natural tendency to bow when loaded. Consequently, tall springs tend to bow more than short springs, and small diameter springs tend to bow more than large diameter springs. Generally, the more a spring is compressed the more it will tend to bow. Keep in mind the rate of a spring will increase if an active coil rubs another part of the car. Here are some tips to minimize bowing:

Use correctly fitting coil-over hardware or install weight jack assemblies so that the spring mounting surfaces are kept as parallel as possible during suspension travel. Use springs that do not lean excessively (when positioned on a flat surface). This indicates that the ends are ground parallel to each other. This reduces the tendency for a spring to bow. You should check both ends. If a coil-over spring is rubbing the shock, try reversing the spring so the bowed part of the spring is around the shaft where there's more clearance. Use coil-over springs that have straight sides rather than an hour glass shape. This maximizes the clearance between the shock and spring. Use springs that are wound straight. You can roll the spring on a flat surface to check for straightness.

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