

Racing Performance Services

Basic Spring and Sag Setup

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As we discussed in the previous installment of the “tech tips”, there are three components to suspension setup...Geometry, Spring setup (sag/preload), and Compression/Rebound damping. Since most riders/racers need to have their geometry setup by a professional, we will not discuss this in depth. We will however discuss how to set your basic spring and sag settings.

As mentioned in our previous article, springs are simple components that offer minimal to no tuning value independently. Tuning changes with springs are generally made by changing springs. Again, this goes back to the fact that the vast majority of springs are “straight rate” springs that provide the same amount of resistance to the suspension in the first inch of travel as the third inch of travel.



Once you properly setup your sag, you usually only cause a negative result if you dramatically add or reduce preload on the fork or shock spring(s). To preface the remainder of this article, we will cover the terms associated with setting static, rider, and total sag on your motorcycle.

- ❖ **Preload** – This is the amount of static tension that is applied to the fork or shock springs. There are two ways to modify the preload. The first is the internal spacer inside the fork that a suspension builder will cut down or add to that provides your adjustment range for your external preload adjusters. Many times when the external preload adjuster will not allow proper sag to be achieved, it is because the suspension builder improperly cut the internal preload spacer. The second preload adjustment is the external adjuster(s) that are located on the top of your forks. (This is what riders actually adjust with) Usually, it is the large knob that requires a 14mm or 17mm socket or wrench to adjust. On a shock, preload is adjusted via the collar that is on the topside of your spring.
- ❖ **Free Sag** – This is the amount of travel used by the motorcycle under its own weight. Free sag is derived by measuring the difference between the bike fully lifted up (suspension top out) and the bike at rest.



- ❖ Rider Sag – This is the amount of travel used by the motorcycle when a rider is placed on it. Rider sag is derived by measuring the difference between the bike at rest and with the rider sitting on the motorcycle in a full race position.
- ❖ Total Sag – The combined travel used when the Free Sag and Rider Sag are added together.
- ❖ Rebound Damping – This is the adjustment on your shock or forks that controls how fast/slow the motorcycle “comes up/rebounds”. On the forks, this will be the small adjuster on the cap of the forks
- ❖ Compression Damping – This is the adjustment on your shock or forks that controls how fast/slow the motorcycle “goes down/compresses”
- ❖ Stiction – This is typically the measured difference of the “at rest” position of forks. To measure stiction, compress the forks and slowly let them come back up. Measure the position of the fork dust seal. Next, lift the front end up and slowly let the forks return to the at rest position. Measure the position of the fork again. The difference of the two “at rest” positions is your stiction. Excessive stiction can be caused by improper wheel installation, bent forks, bent triple clams, and forks that need to be serviced.

Getting Started

The goal of setting your sag on your racebike is two-fold. The first goal is to allow the springs to work at an optimal level relative to their design. The second goal is to discover if you indeed have proper springs for your motorcycle. The most important item you need to measure sag correctly will be 2 people in addition to yourself. Having enough people to help will ensure proper measurement. To begin, take a zip tie and secure it around the inner fork leg. Tighten the zip tie enough so that it will stay in place on the fork, but not so tight that it is difficult to slide up and down on the fork leg.



Measuring Free Sag and Rider Sag – Free sag (also called static sag) is critical. Free sag provides “give” when the rider encounters elevation changes, abrupt transitions, or in fast sections where allowing the motorcycle to move without actually taxing the suspension is a benefit. Rider Sag is set so that the rider does not overtax the spring on the shock or fork. To measure sag, use the following process:

Measuring the forks

- Free Sag
 - Bounce on the front forks several times to promote free movement. Let the forks settle out.
 - Place the zip tie flush with the dust seal.
 - Carefully have the two helpers lift up on the handlebars until the forks “top out”.

- Measure the distance between the zip tie and the top of the dust seal.
- The measured difference is your “Free Sag”
- Typical free sag for the forks is 15mm to 35mm depending on tuning strategy and bike model.

- Rider Sag

- Have one of your helpers hold the back of the motorcycle to steady it.
- Have the rider sit on the motorcycle in a race tuck position.
- Bounce on the front of the motorcycle to promote free movement.
- Place the zip tie flush with the dust seal.
- While the rider is still in the tuck position, lift up on the handlebars as the rider gets off the motorcycle. **DO NOT ALLOW** the motorcycle forks to compress the zip tie down from rider movement.
- Measure the difference between the zip tie and the dust seal. This is your rider sag.
- Typical rider sag for the forks is 10mm to 30mm depending on tuning strategy and bike model.



Measuring the shock

- Free Sag
 - Bounce on the rear of the motorcycle several time to promote free movement. Let the rear settle out.
 - Find a secure point on the sub-frame that is at a 12 O'clock position relative to the rear axle on the swingarm. Hold the measuring tape at a secure spot on the sub-frame and measure to the top of the axle.
 - Continue to hold the measuring tape exactly in the same position.
 - Next, have your two helpers lift up the rear of the motorcycle to “top it out” and observe the measured difference.

- Typical free sag for the shock is 5mm to 15mm depending on tuning strategy and bike model.
- Rider Sag
 - Have one of your helpers hold the front of the motorcycle to steady it.
 - Have the rider sit on the motorcycle in a race tuck position.
 - Bounce on the rear of the motorcycle to promote free movement.
 - Find a secure point on the sub-frame that is at a 12 O'clock position relative to the rear axle on the swingarm. Hold the measuring tape at a secure spot on the sub-frame and measure to the top of the axle.
- Continue to hold the measuring tape exactly in the same position.
- Next, have the rider get off the motorcycle and allow the bike to come to rest.
- The measured difference is the rider sag.
- Typical rider sag for the shock is 20mm to 35mm depending on tuning strategy and bike model.



Compression and Rebound damping – This is the most difficult item to set on your racebike and almost impossible to teach in a text document. These are also the “money” settings as proper compression and rebound settings enable the motorcycle to move up and down in unison so that the rider has a “balanced” motorcycle. Again, it is hard to teach and because virtually no two motorcycles have exact fork or shock assembly and it is therefore irresponsible to put “baseline” settings together. To put this final statement into perspective, a half turn of difference in tightening the locknut on the fork cap will result in the actual rebound adjuster being more than a turn off! Because of this, we will not discuss specific tuning on compression and rebound damping in this article.

Total sag and putting it all together – Now that you have measured your free sag and rider sag, you can now see what your total sag is. Typically, you would want to see a total sag number of 35mm-45mm. Again, different tuning strategies and bike model will dictate the final desired number. Total sag becomes important, as most riders do not have the properly installed spring(s) on their racebike. When this is the case set the total sag for both ends of the motorcycle to 35mm-45mm. This will promote a state of tune that will allow enough

travel for the rider to be able to comfortably ride on the racetrack and at the same time not be so stiff that the suspension cannot absorb bumps.

Final thoughts – There are many tuning strategies with spring rates and sag. Some highly skilled tuners will use variations of sag to actually enhance geometry characteristics. This article is designed to help you understand the basics of measuring and setting sag. It is my desire that after reading this that you will be able to set your motorcycle sag in a manner that promotes safer operation.

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