

## Setting The Sag

Setting the sag on your bike is the first step in correctly adjusting your suspension. We here at MotorPsycle.com want you to have a safe, great-handling bike. A suspension set up too hard will not let your tires grip the road like they should. Suspension that is too soft will feel vague and can "bottom-out" during hard turns. A correct suspension set up will make your bike handle better and increase your confidence.

We've gathered up a few tutorials on setting the sag. Read them over and decide which one makes the most sense to you.

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Following article from [www.biketweakers.com](http://www.biketweakers.com) (edited)

The following is a simple how-to guide that should help in setting your static sag. These numbers should work for most any sportbike, although you should check your shop manual for any recommended settings.

### FRONT SAG

1. Place a tie-wrap around your fork tube just above the dust cap (or just below depending on what type of forks you have). Make it snug but not too tight so it can move freely but stay in place.
2. Sit on the bike (in full gear for exact measurement) with someone holding it up in the riding position. This will move the tie-wrap up (or down) to its most compressed position.
3. Get off the bike (easy), put down kickstand, pull the bike onto the kickstand and back so the front wheel is off the ground (you can do this with a little practice) and have someone measure the distance between the tie-wrap and the dust cover.
4. This measurement is your front sag based upon your weight. It should be ~34mm-38mm (34-track 38-street).
5. Adjust your front preload as needed to make this correct (see owner's manual).

### REAR SAG

1. Place a small piece of tape on the side of your tail section (sprocket side) straight up from your rear axle. This will be your reference point so make sure it is as straight up/down from the axle as possible and maybe mark a dot or something with a pen for accuracy.
2. Sit on the bike (in full gear for exact measurement) with someone holding it up in the riding position.
3. Have someone measure the distance from the marker down to the rear axle.
4. Get off the bike (easy), put down the kickstand, pull the bike onto the kickstand and forward so the rear wheel is off the ground (you can do this with a little practice) and have someone measure the distance from the marker down to the rear axle.

5. Subtract the first measurement from the second measurement and that is your rear sag based upon your weight. It should be ~26mm-32mm (26-track 32-street).
6. Adjust your rear preload as needed to make this correct (see owner's manual).

If the ideal sag measurement is unachievable then you might consider upgrading your suspension.

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Following article from Brian Igo at [www.epinions.com](http://www.epinions.com)

### **Sag Me Baby!**

Setting the sag is the next step, and it is the first step in dialing in the bike to fit you. Sag is how far the suspension compresses with the weight of you and the bike forcing down on it. Because the suspension can unload (extend upwards) while you are riding you have to get the bike off the tires to determine the maximum extended travel. This-not the position of the shock and forks when the bike is at rest-is your baseline for measuring the sag. To measure the sag at the forks get the front tire off the ground, wrap a nylon zip tie around the stanchion, and slide it up against the slider tube. Lower the bike and, with a friend holding the rear to keep it from falling over, get on the bike gently (so you don't bounce it) and sit on it in a riding crouch so the bike is supporting your weight, as it will be when you are riding. Then get off the bike (gently, again) and jack the front tire off the ground again. The fork slider has pushed the zip tie down and the distance between these two points is the sag. You should aim for 30-33mm as a starting point. If your reading is greater than that increase the spring preload adjustment in the top of the forks and, conversely, backing off the preload will make the bike sink farther onto the suspension if you need more sag. Once you get it dialed in leave the zip tie in place, you'll need it later.

To adjust the sag at the rear you need to get the tire off the ground again. But the shock being surrounded by the spring makes it impossible to use a zip tie around the shock rod. You'll need to attach a measuring device to the swingarm and the easiest way is to use more zip ties to temporarily attach a long, draftsman's quality, ruler to the swingarm near the rear axle, and make a pointer from a coat hanger and attach it to a static point on the seat cowl. Lift the rear tire off the ground (as easy as putting the bike on the centerstand if you have one, if not use a strong friend to lift the rear) and note the number on the ruler the pointer is on when the rear wheel is fully extended. With the ruler and pointer in place, lower the bike and get on board as you did and record the number the pointer is at now. The difference between the two is the sag for the rear and like the front you should aim for 30-33mm. The preload adjuster for the shock is at the top of the spring and either uses a cam that locks the preload in increments or a lock nut atop the adjustment nut to keep the adjustment in place. If your bike has the second type, it is essential to make sure it is snugged down to keep the adjustment nut from backing out. It is the only thing holding your spring in place and if it comes loose you will be in for a big and unpleasant surprise.

Sag is important for many reasons. If it is too high or too low you have greatly reduced the amount of room the suspension will have to work. Too little sag will cause severe traction problems and create a bone-jarring ride. Too much will make the bike wallow in corners and in the transitions of acceleration and braking. Sag isn't effected by temperature or track conditions so you can set it up in your garage before heading to the track, and it only has to be checked a couple of times a year if you are racing. (Once annually is enough for street use.)

If you are finding that you need to use most of the preload adjustment to achieve the correct level of sag, you will need stiffer springs. This is most common in forks, where the factories use a softer spring rate to create a smoother ride. Replacement springs are available from several sources, in both progressive and straight rate. The spring rate on progressive springs increases as they are compressed and straight rate springs maintain a constant compression rate throughout their travel. For street use I recommend progressive springs for their greater versatility. But for track-bound machines

you should use a straight spring to ensure you aren't chasing a damping problem when the spring rate changes.

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Following article from: Sport Rider Magazine August 1995

## Suspension and Springs

**W**hat's all this ruckus about suspension these days? It seems everyone is clued in that suspension setup can be a key to riding fast and safely, but how do you do it? No matter what shock or fork you have, they all require proper adjustment to work to their maximum potential. Suspension tuning isn't rocket science, and if you follow step-by-step procedures you can make remarkable improvements in your bike's handling characteristics.

The first step to setting up any bike is to set the spring sag and determine if you have the correct-rate springs. Spring sag is the amount the springs compress between fully topped out and fully loaded with the rider on board in riding position. It is also referred to as static ride height or static sag. My company, Race Tech, (909/594-7755) has an advanced method of checking spring sag that I'll describe.

If you've ever measured sag before, you may have noticed that if you check it three or four times, you can get three or four different numbers without changed anything. We'll tell you why this occurs and how to handle it.

REAR END

**Step 1:** Extend the suspension completely by getting the wheel off the ground. It helps to have a few friends around. On bikes with sidestands the bike can usually be *carefully* rocked up on the stand to unload the suspension. Most race stands will not work because the suspension will still be loaded by resting on the swingarm rather than the wheel. Measure the distance from the axle *vertically* to some point on the chassis (metric figures are easiest and more precise). Mark this reference point because you'll need to refer to it again. This measurement is L1. If the measurement is not exactly vertical the sag numbers will be inaccurate (too low).

**Step 2:** Take the bike off the stand and put the rider on board in riding position. Have a third person balance the bike from the front. If accuracy is important to you, you *must* take friction of the linkage into account. This is where our procedure is different: We take *two* additional measurements. First, push down on the rear end about 25mm (1") and let it extend *very slowly*.

Where it stops, measure the distance between the axle and the mark on chassis again. If there were no drag in the linkage the bike would come up a little further. It's important that you do not bounce! This measurement is L2.

**Step 3:** Have your assistant lift up on the rear of the bike about 25mm and let it down very slowly. Where it stops, measure it. If there were no drag it would drop a little further. Remember, don't bounce! This measurement is L3.

**Step 4:** The spring sag is in the middle of these two measurements. In fact, if there were no drag in the linkage, L2 and L3 would be the same. To get the actual sag figure you find the midpoint by averaging the two numbers and subtracting them from the fully extended measurement L1: static spring sag =  $L1 - [(L2 + L3) / 2]$ .

**Step 5:** Adjust the preload with whatever method applies to your bike. Spring collars are common, and some benefit from the use of special tools. In a pinch you can use a blunt chisel to unlock the collars and turn the main adjusting collar. If you have too much sag you need more

preload; if you have too little sag you need less preload. For road race bikes, rear sag is typically 25 to 30mm. Street riders usually use 30 to 35mm. Bikes set up for the track are compromise when ridden on the street. The firmer settings commonly used on the tract are generally not recommended (or desirable) for road work.

You might notice the Sag Master measuring tool (available from Race Tech) in the pictures. It's a special tool made to assist you in measuring sag by allowing you to read sag directly without subtracting. It can also be used as a standard tape measure.

Measuring front-end sag is very similar to the rear. However, it's much more critical to take seal drag into account on the front end because it is more pronounced.

#### FRONT END

**Step 1:** Extend the fork completely and measure from the wiper (the dust seal atop the slider) to the bottom of the triple clamp or lower fork casting on inverted forks. This measurement is L1.

**Step 2:** Take the bike off the sidestand, and put the rider on board in riding position. Get an assistant to balance the bike from the rear, then push down on the front end and let it extend *very slowly*.

Where it stops, measure the distance between the wiper and the bottom of the triple clamp again. Do not bounce. This measurement is L2.

**Step 3:** Lift up on the front end and let it drop *very slowly*. Where it stops, measure again. Don't bounce. This measurement is L3. Once again, L2 and L3 are different due to stiction or drag in the seals and bushings, which is particularly high for telescopic front ends.

**Step 4:** Just as with the front, halfway between L2 and L3 is where the sag would be with no drag or stiction. Therefore L2 and L3 must be averaged and subtracted from L1 to calculate true spring sag: static spring sag =  $L1 - [(L2 + L3) / 2]$ .

**Step 5:** To adjust sag use the preload adjusters, if available, or vary the length of the preload spaces inside the fork.

Street bikes run between 25 and 33 percent of their total travel, which equates to 30 to 35mm. Roadrace bikes usually run between 25 and 30mm.

This method of checking sag and taking stiction into account also allows you to check the drag of the linkage and seals. It follows that the greater the difference between the measurements (pushing down and pulling up), the worse the stiction. A good linkage (rear sag) has less than 3mm (0.12") difference, and a bad one has more than 10mm (0.39"). Good forks have less than 15mm difference, and we've seen forks with more than 50mm. (Gee, I wonder why they're harsh?)

It's important to stress that there is no magic number. If you like the feel of the bike with less or more sag than these guidelines, great. Your personal sag and front-to-rear sag bias will depend on chassis geometry, track or road conditions, tire selection and rider weight and riding preference.

Using different sag front and rear will have huge effect on steering characteristics. More sag on the front or less sag on the rear will make the bike turn more slowly. Increasing sag will also decrease bottoming resistance, though spring rate has a bigger effect than sag. Racers often use less sag to keep the bike clearance, and since roadraces work greater than we see on the street, they require a stiffer setup. Of course, setting spring sag is only first step of dialing in your suspension, so stay tuned for future articles on spring rates and damping.

-Paul Thede