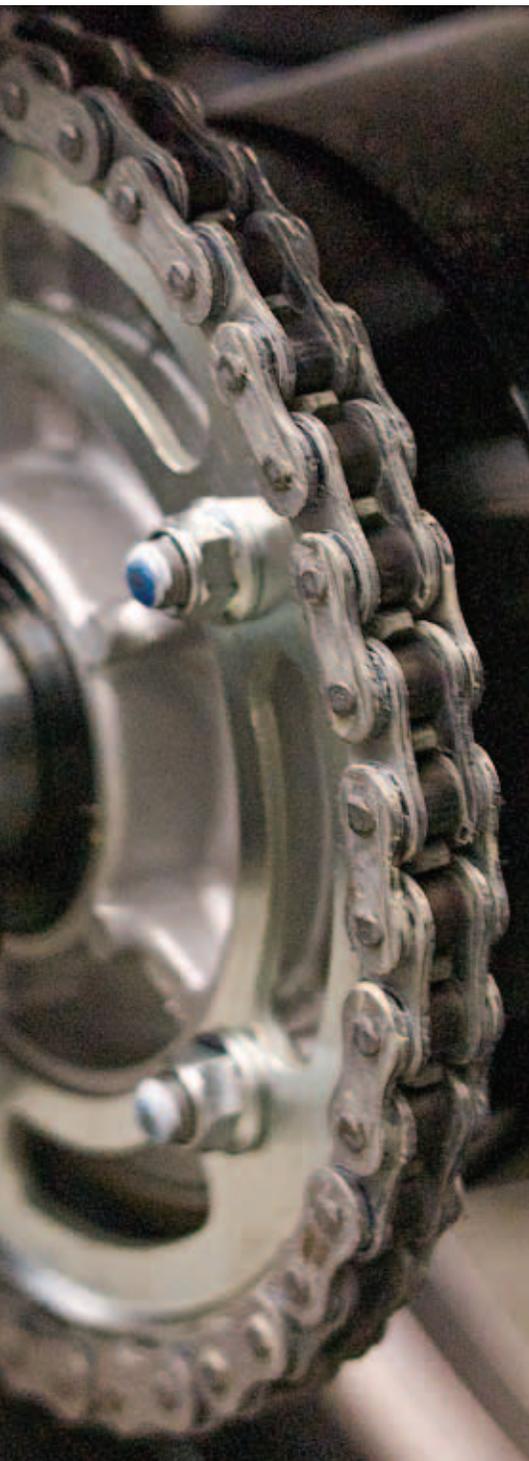


Chain Adjustment and Wheel Alignment



WE'VE NOTICED THAT the chain on nearly every chain-driven bike we've inspected in the parking lots of long-distance events, including the Iron Butt Rally, is incorrectly adjusted. They are almost always adjusted too tight. Even if the chain is lubricated properly and the rear wheel is aligned correctly, running a chain with too little slack leads to premature wear of the chain and sprockets, suspension binding, and can even result in damage to the bearings supporting the countershaft and sprocket carrier in the rear hub.

At the other extreme, running the chain with too much slack can create excessive drivetrain lash. This makes smooth throttle transitions and shifting more difficult, adds higher shock loads to the rear hub and gears in the transmission, and, in extreme cases, can actually "saw" into the swingarm or frame. A mal-adjusted chain is also more prone to failure, which could leave you stranded. In extreme cases, it could wrap around the rear axle and sprocket and lock the rear wheel, leading to a crash. Which begs the question: Since the consequences of an improperly maintained chain can be so costly, why don't more riders ensure that their chains are adjusted correctly?

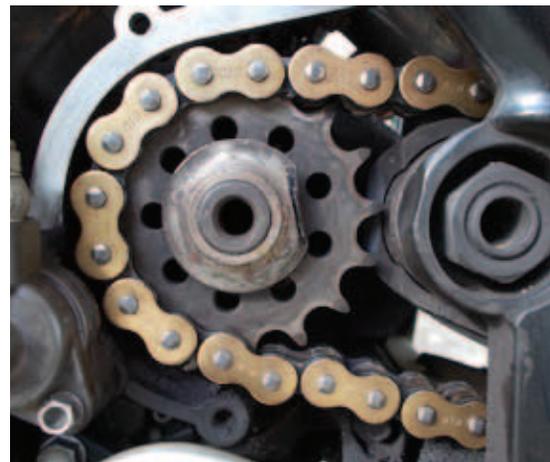
We suspect the main reason for chain problems is the result of owners not taking the time to thoroughly inspect their drivetrain or understand the procedure behind properly adjusting the chain on their bike. This article is for those riders who fall into the latter category — adjusting the chain is not difficult, but it does require some patience to set everything up correctly the first time.

Chain Maintenance

Before explaining the procedures required to properly adjust the chain, the

accumulated dirt, grime, and caked on lube must first be removed and the chain cleaned. There are a number of cleaners that are safe for O-ring chains, including several "green" cleaning products. In a pinch, you can even use something like WD-40. After elevating the rear wheel, place some paper towels or cardboard under the chain to catch the dirt and cleaner — this reduces the mess on the ground or garage floor.

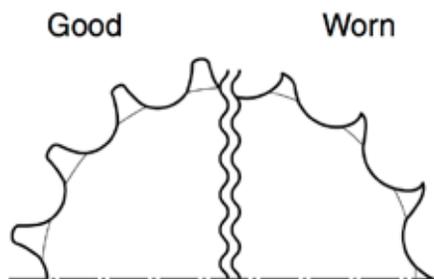
Spray the chain with your cleaner of choice while rotating the rear wheel by hand. We do not recommend using a running engine with the bike in gear to rotate the rear wheel. There have been too many cases of bikes getting away from riders when attempting this "shortcut." Allow time for the cleaner to soak in before using a stiff brush to scrub the big stuff off the chain and the sprockets. Follow this step up by wiping the chain with a clean rag. If it's been a while since you last cleaned the chain, you may need to "lather, rinse, and repeat." Also, if it has been a while since you cleaned and inspected the chain, the countershaft sprocket cover should be removed in order to clean the front sprocket, check for wear, and make sure the sprocket retention device is secure. In any case, the sprocket cover will need to be removed for the initial chain adjustment measure-



ment procedure so it's a good idea to do it at this point. Subsequent adjustments can be made without removing the countershaft cover.

Once the chain and sprockets are clean, inspect them for wear or damage. Look closely at the sprocket teeth. Are they hooked or worn to a sharp point? Are any broken? Next, look closely at the chain links. Are they binding or kinked? Are any of the O-rings damaged or missing?

Check the chain for signs of wear. While rolling the rear wheel, inspect the chain in order to determine if there are any places where it gets tighter and then looser. This is generally caused by uneven wear in the pins and bushings, but can also be due to other, more serious issues such as mismatched sprockets, out-of-round sprockets, worn sprocket carrier bearings or dampers, or even a worn axle spacer. Note that chains do not "stretch" — the pins and bushings wear, allowing the chain to elongate. Sprockets that are not machined correctly so that the center hole or mounting bolt pattern is not concentric with the sprocket tooth circle could also cause the tight/loose sections. In the case of a high mileage bike, it could also be the result of a worn sprocket carrier bearing, worn rubber dampers between the carrier and the wheel hub, or even a worn axle spacer between the carrier and hub. If the sprocket carrier and dampers are in good condition, fit together snugly, and you find that there are still tight and slack places in the chain when you are installing a new chain and sprockets, it is usually the result of poorly machined, non-concentric sprockets. Continue to roll the rear wheel and check to see if there are signs of wear on the sides of the sprocket teeth. A wear pattern found on the sprocket is usually the result of the rear wheel being misaligned.



If you have a shop manual, follow the factory procedure to measure the distance between a certain number of pins

to determine if the chain is still within the recommended wear tolerance. You can also go by an old rule of thumb and pull the chain straight back from the rearmost point on the rear sprocket, trying to lift the chain off the sprocket. If more than half of the sprocket's tooth becomes visible, it's time for a new chain. If you determine that the chain is worn, we strongly recommend replacing the sprockets at the same time, since running a new chain on worn sprockets will only damage your expensive new chain.

Wheel Alignment

Maintaining proper rear wheel alignment is usually pretty easy if your bike has eccentric adjusters at the rear axle, but even these should be checked to verify that they are correct. If your bike has sliding adjusters that fit into slots with stamped markings on the swingarm, you should definitely do a bit of investigation to determine if the stamped markings are accurate. There are a number of ways to determine if the rear wheel is aligned without relying on the stamped marks on the swingarm. One method of checking rear wheel alignment is to sight down the top run of the chain while rolling the rear wheel.



A good shop light or bright flashlight helps here. If the chain is not running straight, the rear wheel is misaligned. A better method is to measure the distance from the center of swingarm pivot to the center of the rear axle. The distance should be the same on both sides of the bike. If there are pipes or pegs or bags in the way of getting a straight-line tape measurement, measuring tools are available with offsets to allow measurement from the center of the axle to the center of the swingarm pivot. Moving the axle

to align the wheel requires the same procedure and tools as adjusting the chain.



After the wheel is aligned, check the stamped marks and make a note of whether they are accurate or not. Taking a photo for future reference might be worthwhile. If they are offset, you may want to leave the ones on the chain side in place and change the ones on the opposite side. When tightening the rear axle, place the axle wrench so that you are pulling forward, against the chain adjusters, so that the rear wheel is not pulled out of alignment before the axle is snug. Once the axle nut is snug, use a torque wrench to finish tightening it to spec and then recheck the wheel alignment. If the axle nut uses a cotter pin for retention, always install a new one.

Chain Adjustment

Most manufacturers recommend that a chain be inspected every 500-700 miles. For some long-distance riders, that equates to twice a day during long rides. However, a properly lubricated, high quality O — or X-ring chain running on high quality steel sprockets and used only on the street should not need to be adjusted that frequently.

Now that the chain is cleaned and aligned properly, it is time to start the adjustment process. The first step is to determine how much play is in the chain. This is measured as the vertical deflection at the midpoint of the lower run of the chain, with the bike in gear (but the engine off) and the rear wheel rotated to the rear to remove any slack from the top run of the chain. »



This photo above shows some slack that many riders would consider appropriate, thinking that there is no adjustment needed. On most all bikes, the amount of play in the chain varies as the swingarm travels through the arc of the available suspension travel. If the countershaft were designed to be concentric with the swingarm pivot (Diagram 1), the chain tension would remain constant as the swingarm moved through its arc. However, there have only been a few bikes ever designed and built with this feature.

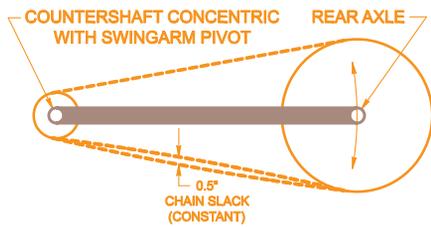


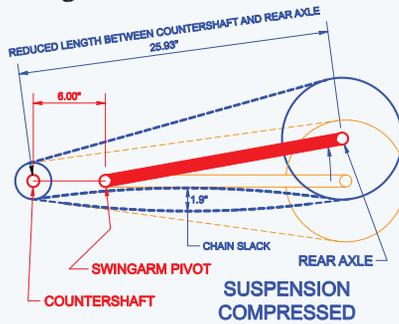
Diagram 1: For the rare bikes designed to have the countershaft and swingarm pivot concentric, there is no geometrical variation in chain slack during the suspension movement.

The vast majority of chain-driven bikes have the countershaft located some distance in front of the swingarm pivot. The further the countershaft is from the swingarm pivot, the more fluctuation there is in the chain slack as the suspension moves through the arc. Bikes with longer travel suspension have an even greater range of fluctuation in the amount of chain slack as the swingarm moves through its arc. That is why most modern long-travel dirt bikes have the countershaft located as close as possible to the swingarm pivot. This helps to minimize the differences in chain slack as the suspension moves through eleven or more inches of travel.

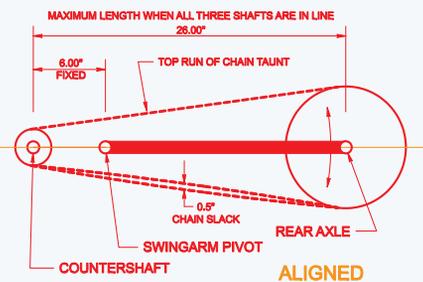
The question then becomes, where in the swingarm arc does the chain have the least amount of slack? The tightest point occurs when the center of the countershaft, the center of the swingarm pivot, and the center of the rear axle are all in a straight line. At any place in the arc above or below this alignment, the chain will have more slack (Diagram 2).

For most bikes, when unladed and parked on the centerstand, the chain will get tighter as the suspension compresses and it is possible for the chain to get so tight that it prevents the suspension from compressing fully.

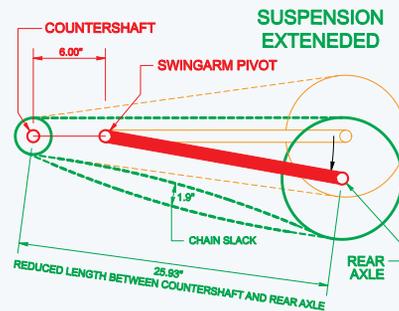
Diagram 2:



The maximum amount of chain slack will vary depending on: [1] The spacing between the countershaft and the swingarm; [2] The amount of total suspension travel; [3] The length of the swingarm. (The dimensions shown here as an example only).



The minimum chain slack is set at 0.5 inches when the countershaft, swingarm pivot, and rear axle are all in a straight line.

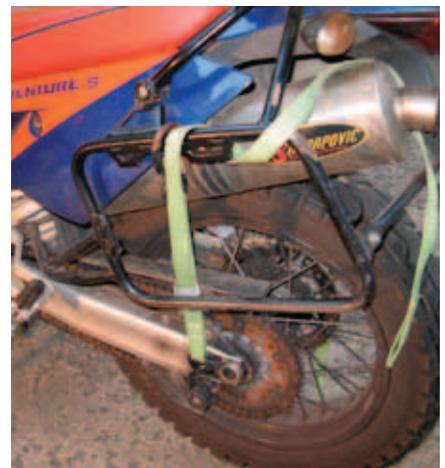


After setting the slack at 0.5 inches with the three shafts aligned, allow the suspension to fully extend and record the chain slack measurement. This will be the measurement that you use for future chain adjustments.



The photo above shows how far the suspension has to compress in order for the three shafts to be aligned. Note that there are a few short travel bikes that may have the rear axle above a straight line through the countershaft and swingarm pivot, even at full extension of the rear suspension. For these bikes, the tightest point is at full extension; compressing the suspension would only create more slack. If this condition exists, it will show up during your measurement process.

Since the key to proper chain adjustment is to get the countershaft, swingarm pivot, and rear axle all in a straight line, the rear suspension needs to be compressed. The best way to do this is to remove the shock absorber(s). The next best method is to compress the rear suspension using tie down straps or ratchet straps. We recommend reducing the shock preload to the minimum setting to facilitate compressing the suspension.



Make sure that the points on the swingarm and subframe or luggage frame where you attach the straps are strong enough to handle the load. If you have a long strap and loop it over the seat to connect both sides of the swingarm, it's a good idea to put something between the seat and the strap to spread the load and protect the seat from the strap tension.



Use a straightedge to verify that the countershaft, swingarm pivot, and rear axle are in a straight line. Note that in photo above, the chain is tight before reaching the alignment point (which means that the slack shown in the earlier photo was not enough). If the chain is too tight and prevents the suspension from compressing enough to line things up, you will need to loosen the axle nut, back off on the adjusters, and slide the axle forward. When the three points are aligned, the chain should have a half-inch of free play at the midpoint of the lower run while the top run of the chain has no slack. Measure the half-inch of free play by pushing the chain down at the midpoint, then pushing the chain up at the midpoint. The distance from the center of the chain at the low point to the center of the chain at the high point is the slack. You can measure from a point on the top of the chain link or from the center of a pin, or from the bottom of the chain link, as long as the point you select remains the same for lower and upper measurement (diagram 3).

Roll the wheel around and make sure that you are setting the slack at the tightest point of the chain. When the half-inch of free play is set, recheck the rear wheel alignment and tighten the rear axle nut to spec by pulling the axle wrench forward against the chain adjuster bolts. Recheck the chain measurement and roll the wheel to verify that there are no

places in the chain that have less than a half inch of free play. Carefully release the straps or reattach the shock mounts.

This may seem like far too much trouble to go through to get the chain adjusted correctly every time — and you would be right. The good thing is that you don't have to go through the compressing and lining up the three points the next time! Now that the slack at the tightest point in the suspension travel has been set to a half inch, all you have to do is put the bike on the center stand. With the rear suspension fully extended, measure the slack in the chain at the midpoint again.



With the bike on the centerstand and the suspension fully extended, you have an easily repeatable point of reference every time you park the bike. Record the amount of slack at the midpoint of the chain. On short travel bikes, it may only be an inch or less, but on longer travel bikes it may be two inches or more. Whatever this measurement is, it will be the correct amount of slack for your bike at full extension so that at the point of maximum chain tension in the suspension arc, the chain will have a half inch of slack.



Many riders may see the amount of slack that this procedure leaves in the chain and think it is too loose. However, if you adjust your chain with this procedure and find that you or your mechanic have been running your chain too tight, you may also find that suddenly the rear suspension is working smoother and absorbing large bumps much better. You may also find that the chain wears less and needs fewer adjustments once you know for sure how much slack is correct. Now it's time to properly lubricate the chain, but opening that can of worms will have to wait until another article. —

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Diagram 3: If using the measurement from your owner's or shop manual.

