

Customer:

Bike:

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Teknik Motorsport is a manufacturer and importer of motorcycle suspension products. We also have a workshop dedicated to developing and testing new products. Teknik is a family owned Australian company that is enthusiastic about motorcycling and is staffed by people who are passionate motorcyclists, and our products are manufactured in Australia wherever possible.

Teknik has been operating since 2001. We have been involved with Enduro legend Geoff Ballard, and the Ballards Yamaha Offroad team from 2001 and Lyndon Heffernan's Academy Of Off-Road Riding since 2003. We have also built the suspension for the GHR Honda Off Road Team, in Enduro, off road and the Australian Safari, culminating with an outright win in the 2004 Safari.

In 2006 we ran two Kawasaki KX250F's in our own MX Nationals Pro Lite MX team in conjunction with ADB magazine. A solid success, and team rider Mike Phillips has since gone on to much higher success.

For 2007/2008 we went road racing, attending every round of the ARRC, supporting a number of privateer riders in the Supersport class, and we performed major setup and development work for Craig McMartin on the 1098 and 1198 Ducati in Pro Twins. How'd he go? Two more CHAMPIONSHIPS! Lap records at every track, and nearly 2 seconds off his PB around his home track of Eastern Creek. Thats a win for Teknik and a win for you as all our development work from the track goes into your suspension.

All our parts and kits have been extensively tested in the field by both our own race team and riders we support.

Opening hours: 8:30am - 5:00pm AEST Monday - Friday 8:30am - 12:00pm AEST Saturday Sunday - Closed



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INTRODUCTION

Today's motorcycles are very advanced. Gone are the days of the owner having to finish the manufacturing. However, they are not perfect, they never can be. The nice folks who build your bike don't know you. They don't know if you weigh 60 kilos or 120 kilos. They don't know whether you carry a bunch of gear, or a pillion. They don't know where you ride or how you ride it.

Getting your suspension dialled in for your riding style is one of your first priorities when you take your new bike out on the track. However, it is an on-going process, and what worked today might not suit the next track conditions you encounter next week. Therefore, you have to take on the role of test rider yourself and learn to identify problem areas. Never stop testing and thinking about what your bike is doing. Read your owners manual too, it's full of good stuff.

This booklet is full of practical information that can help people with both revalved or standard suspension, and has been complied from Ohlins archival material, conversations with their road race engineers, input from Suspension Tech NZ and our own ongoing experience working with top road race riders at circuits throughout Australia.

The figures we have come up with have generally worked very well but individual riders may get better results with alternative personalized settings. Recent experiences with very high torque, high horsepower 180 BHP plus superbikes have proven just how difficult the job of balancing horsepower, grip and machine attitude can be. Our experience and personal education is ongoing and we hope these notes will assist in your set up, speed and safety. We will continue to offer our on track service at selected meetings and continue to develop our settings to the benefit of our clients.

When using this manual, it is intended that you start at the clickers section and work your way through. It is of little use making suspension and geometry adjustments when you have no idea of the basics: where your clickers are, ride height, springs rate, shock length. Remove the set-up sheet at the back of this manual and photocopy it. Keep the notes as a record for each track, and to give you direction when reviewing settings. If you don't keep records, you will chase your tail all weekend.

To get started, I've included a quote from Ross Maeda of Enzoracing in California. Ross has a way of making complex systems seem simple...

"To understand how to start adjusting your suspension, you have to understand the basic components. Both the forks and shock have two key elements: the spring and dampening.

> The spring is load or position-sensitive, which basically means it's job is to hold the rider's weight. The dampening -- which is what the clickers control -- is a speed-sensitive element.

The spring is really just a dumb piece of metal that's bending. It's like a trampoline, if you stand on a trampoline, it holds you up; but if you jump on it, it goes down a lot deeper and throws up equally as high. If you just had a spring on a motorcycle -- and no dampening -- it would be like a car going down the freeway without shocks; it would bounce up and down for miles.

Adding dampening to the suspension is like putting that trampoline in water. It will still support your weight, but you don't get the springy, bouncing effect."

CLICKERS

Note: All clicker settings are referred to from the fully hard (clockwise) position.

Often we call a client on Monday after a race to see how they went. Occasionally we're met with the response "it was too soft" or "it was to stiff". Our next question is always "What clicker position did you start out at and where did you end up?

Did your adjustments help?" Sometimes the answer is:

"I DIDN'T TOUCH THEM, I LEFT THEM RIGHT WHERE YOU PUT THEM."

Anyone who knows a suspension tuner will realise how much this drives them nuts. Find your suspension's adjusters (commonly called clickers), and adjust them yourself. One adjustment at a time so you know what it is doing. Keep a note of where you started form, so if you get lost you can go back.

Adjusters are like a tap, closing off the tap to restrict the flow of oil and produce a firmer dampening character. <u>When we turn</u> <u>the adjuster we are not adjusting the valving!</u> We are simply changing the quantity of oil that bleeds past the valving. If you have the wrong valving setting for your application, you will not get an optimum set-up by just turning clickers, however you can improve the motorcycle and make it "the best it can be". Likewise, even with a perfect shock specification, poor clicker settings will ruin the whole farm.

Turn the adjusters clockwise, counting the clicks or turns. Be gentle; don't keep turning the screw or knob once it stops. Turn the adjusters back out to the original position. Write the number of clicks or turns down on the set-up sheet.

If in doubt, 10C (compression) and 10R (rebound) is a good place to start for forks with over 20 clicks total adjustment. 1 ½ turns for those forks with no clicks. Units with less total clicks, use a midway position.

For Shocks, again check they are in the suggested positions, and if in doubt, 30 clicks out HSC,10 LSC, 14 R are good places to start for most Ohlins dampers.

BASIC GEOMETRY

This can be broken down into sections.

Fork travel / length, usually left standard.

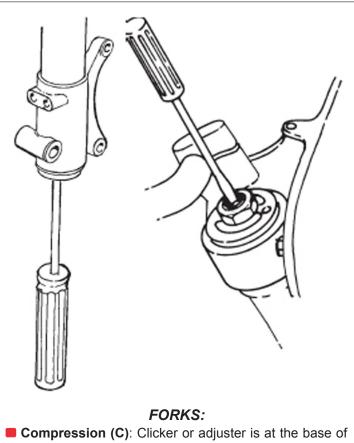
Fork height, the position of the fork in the triple clamps. This can be measured in lines above the top triple clamps. I personally prefer to measure length of fork between the bottom of the lower triple clamp and the end of the fork tube. This eliminates the question of do we measure from the front of back of the clamps and gets you used to making small

changes, as one line on the clamps will often be 3mm
Triple clamp offset and rake, again usually left standard.
Rear shock length, including any raising spacers (GSXR, R6 etc). A tremel bar is perfect for this. Measure the shock out of the bike with a spring on it to compress the internal top out spring

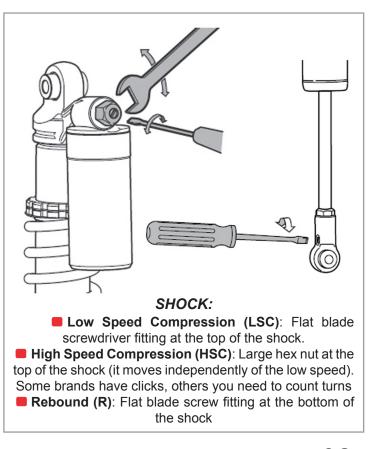
Linkage adjustments (Ducati ride height and different length pull rods on Japanese brands)

Swingarm length.

Tyre height if you use different profiles.



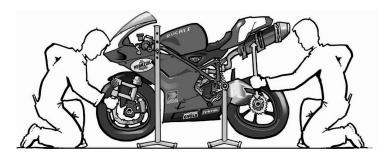
the fork, sometimes covered by a rubber plug. **Rebound (R)**: Is the top clicker for all forks

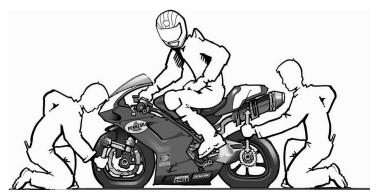


02

SAG

Before you start making adjustments it's best to know where you are starting from. First job is to check the suspension sag settings. This will allow you to check if you have the right springs and get used to making some adjustments. Often OEM springs will loose some free length over time, so if you feel the motorcycle is not handling how it did, recheck the sag.



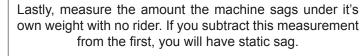


Determine the fully extended height of the suspension. This can only be checked with both front and rear wheels off the ground. If you have access to stands it makes life easier. Use a fixed point at the rear sub frame, not the rear ducktail as it can move around. Measure from the rear axle straight up, vertically. Wind all the clickers to full soft so dampening forces don't cloud the results. You need to be accurate as a few mm make a difference.

Next have the rider sit on the machine in his or her riding gear.

The first measurement minus this measurement will give us ride height (also known as rider sag).

As an example; if our first measurement was 500mm and this measurement is 460mm we therefore have 40mm of rider sag.



In our example, this measurement is 490mm, we subtracted from our original 500mm to get 10mm of static sag.

In our example, the machine we are measuring is a Superbike with a top out spring, and we require approximately 30mm rear rider sag, wind some more preload onto the rear spring to achieve this. However as we only have 10mm static sag, if we wind more preload on we will have no static sag, so we need to go to a stiffer spring.

If you have too much rider sag or too little, increase or decrease the amount of spring preload to get it closer.
 Then if static sag is correct, Rider sag less than minimum – spring is too firm (or if rider correct & static more than max)
 Static sag correct, rider sag more than max – spring is too soft (or if rider correct & static less than min)

See the following tables for a general guideline.

FORK SAGSupersport / Superbike with
Ohlins (no Top Out Springs)Supersport / Superbike
with Top Out SpringsRoad / Race 125 / 250Static Sag25 - 28 mm20 - 23 mm15 - 20 mmRider Sag+ 10 - 13 mm+ 10 - 13 mm+ 10 - 13 mm

Note:

1) Many front forks have internal top out springs which will influence the best ride height and settings.

2) Many OEM front forks require a higher initial ride height because mid valve tension is generally 'soft' allowing forks to 'blow' through their stroke too readily. Where mid valve tension is increased, Ohlins type settings can be used.

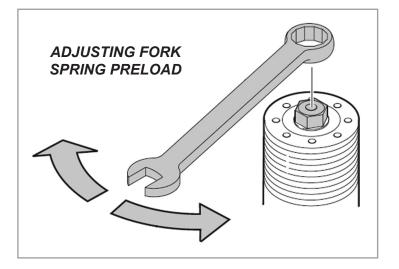


3) Excessive pre-load on overly soft front fork springs will cause harsh feel and poor mechanical grip.

4) On most forks setup for racing they will have zero preload on the fork springs with the preload adjuster backed all the way off and the top-out springs fully compressed. Most preload adjusters have a 1.0 mm pitch thread so 1 turn of the adjuster is 1mm of preload.

5) "Normal" preload range is 3 - 14mm. Lighter springs require more preload, heavier springs require less.

6) For a given rider there will usually be 2 or perhaps 3 spring rates that could be used, depending on the track. For example, if you ride a Supersport machine and use 0.90 kg/ mm springs at rough tracks like Broadford in Vic, but the high speeds and g-forces of Phillip Island may demand 1.00 kg/ mm, while you find at Eastern Creek that 0.95 kg/mm works



best. All 3 sets will come into the commonly accepted adjustment range or rider sag and static sag.

7) To minimize front fork stiction (commonly used term to describe the level of force needed to over come friction) it is very important that axle pinch clamps are only tightened after the forks have been compressed several times to 'neutralize' their position. Failure to do so can sometimes result in substantial stiction.

REAR STATIC SAG

- See notes on Top Out Springs

	Supersport / Superbike	Road / Race 250	Road / Race 125	
With Top Out Spring	10 - 15 mm	5 - 10 mm	-	
Without Top Out Spring	5 - 10 mm	0 - 5 mm	Just Top Out 0 mm	

Note: Road/Race 125's cannot afford to lose the momentum that sag would give in a straight line (loss of top speed). Fairing 'attitude' is everything.

REAR RIDER SAG

- Equates to normally 1/3rd of full stroke as a starting point

	Supersport / Superbike	Road / Race 250	Road / Race 125	
With Top Out Spring	27 - 32 mm	22 - 27 mm	-	
Without Top Out Spring	22 - 27 mm	17 - 22 mm	15 - 20 mm	

Note:

1) The above settings are guidelines only, and some riders may have better 'feel' and speed with alternative settings.

2) As with the forks there are usually 3 spring rates that can be used and still be "correct". We suggest that you measure your springs off the shock and then measure the installed length so you know the preload in mm. For example, if you are using a 90Nm shock spring but wish to fit a 95Nm spring, and you know that you are using 13mm of preload on the 90Nm spring then a reduction of 1mm in spring preload to 12mm will get you a similar starting point to maintain geometry but the 95Nm will "ramp up" more as you use more travel.

3) Many, but not all, Ohlins racing shocks feature and internal top out spring. The reason for this spring is to give a little more extension travel under braking as the weight of the machine is transferred forward. This allows the rider to go into the braking area a little deeper before the rear end starts to unload. These springs are usually available in 3 rates; soft, medium and hard. Selection is dependent on such factors as spring rate, machine weight and as a tuning tool for rider preference. Some of the top riders actually prefer to run a positive stop with no top-out spring as the more abrupt stop allows them to initiate a slide in, more commonly known as "backing it in". When measuring rear shock sag you must first determine if your shock is equipped with a top out spring. Check with your Ohlins representative whether your Ohlins shock is fitted with a top out spring.



The art of making a motorcycle work at a particular track is made easier when you consider it's largely the front to rear balance that is being adjusted, varying the weight carried by either the front or rear wheels.

If we increase the rear spring preload 1mm we are putting more weight on the front tyre. If we move the forks down in the triple clamps we are not only decreasing the rake, but increasing the trail and putting more weight on the rear! Everything is related.

For example by simply adding 1 tooth to the rear sprocket we can upset the whole motorcycle. In adding the tooth we may have to lengthen the chain, moving the rear wheel back. This increases the leverage on the rear shock, effectively reducing the spring rate. The longer wheelbase will typically make the machine more stable, but probably slower to turn. We may now have a tyre tearing issue that is not from the lower gearing.

Keep notes on the changes you make.

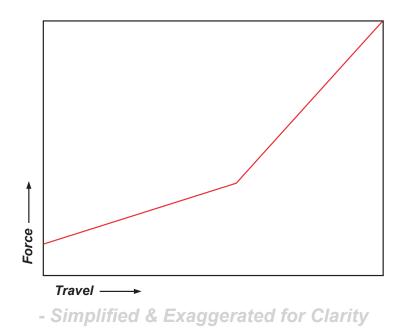
Issues such as running wide mid turn are related to the front to rear balance; however it is not easy to determine whether it's too much weight on the front or not enough! Only making a change and noting its positive or negative character will keep you moving forward.

STOCK SHOCK LINKAGE SYSTEMS

Don't let the salesman fool you into thinking that this year's "new model" has overcome all the faults of last year's. Linkages and stock rear shock settings are a classic example.

Standard springing is a necessary compromise because riders come in all shapes, sizes, expectations and weights. Add to that the possibility of an occasional pillion!

To counteract suspension bottoming through a high load situation the usual approach is to make the second half of the linkage very stiff, maintaining some form of crude ride height control.





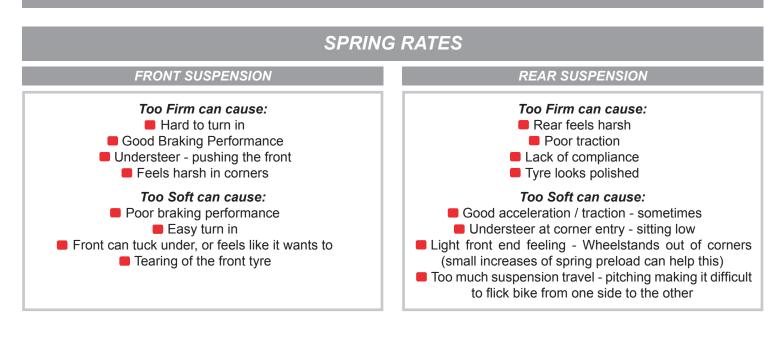
FORCE vs TRAVEL

The dramatic increase in the linkage force suits the occasional blast down the road with a pillion, but does create an interesting problem for road racing: You don't road race with a pillion!

If your chosen spring rate is too soft the suspension will blow through its stroke (especially on bumpier circuits, i.e. Oran, Broadford, Wakefield) and arrive at the "hard" part of the linkage ratio. The suspension will suddenly become very firm, causing overloading of the tyre. As the tyre will now be performing an unfair amount of the suspension work, its contact patch will distort the carcass inwards, causing shearing of the tyre surface. This can be mis-diagnosed in colder climates as cold shearing.

Production bikes are compromised by having to run the stock linkage, so the approach to the problem is to spring and valve the shock so it does most of it's work in the first 1/3 to 1/2 of the travel, keeping it away from the harsh part of the travel. Each model will react differently to changes.

If you are having a shearing problem, the answer is most commonly to increase the spring rate and/or preload and perhaps the compression valving spec. Don't blame the tyre before time!



COMPRESSION DAMPING

FRONT SUSPENSION

Too much Compression can cause:

- Good result during braking
 Feels harsh over bumps
 - Pattering mid corner

Too little Compression can cause:

Strong diving on the front

Unloads the rear too early causing loss of grip

Note:

Front end compression adjustment should harmonize with the front fork oil level.

REAR SUSPENSION

Too much Compression can cause:Rear wheel slides under acceleration

Harsh ride over bumps, poor 'hook-up'

Too little Compression can cause:

 Rear wheel starts to bump sideways under acceleration out of corners
 Bike will squat too much under power and cause front end to lose grip

REBOUND DAMPING

FRONT SUSPENSION

Too much Rebound can cause:

OversteerPoor front tyre grip

Front wheel feels like it is tucking under

Too little Rebound can cause:

Front end feels unstable like it is floating

REAR SUSPENSION

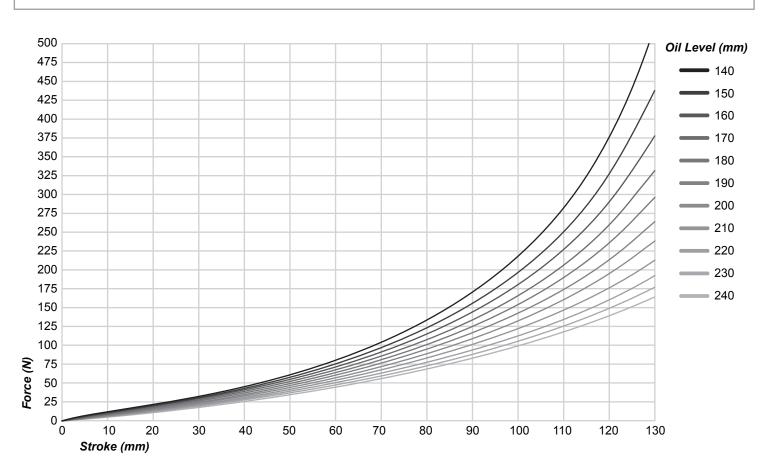
REAR SUSPENSION

Too much Rebound can cause:
Rear jumps on bumps instead of following the surface
Holds the rear down, causing understeer
Overheats shock, causing fade

Too little Rebound can cause:

 Rear tops out too fast under braking causing rear wheel to lose contact with the ground
 Bike feels unstable as if it is floating

06



OIL LEVEL RAISED: Forks are firmer towards the end of the stroke OIL LEVEL LOWERED: Forks are softer towards the end of the stroke

Note: 'Stop Go' circuits where brakes are used aggressively can require a higher fork oil level.

FRONT FORK AIR GAP

There are 2 forms of spring in every fork, the wire coil springs, and the air trapped in the fork above the oil. Both springs are sensitive to their position in the stroke, but not to speed (the dampening character is sensitive to the speed the fork compresses but not to position).

If you are using linear or straight wind springs, they will provide a linear progression in stiffness as the fork compresses. The air spring or air gap character is not linear; it has little influence in the first 1/2 of the stroke, but has a dramatic influence in the last 1/3. Too low and the fork will bottom too easily, too high and the fork will loose it's compliance in the last part of the stroke, particularly noticeable on transition from braking to corner entry.

BOTTOMING OUT DEVICES - HYDRAULIC & ELASTOMER

The reason for these is much the same as "abrupt" stock rear linkages, i.e. to afford some sort of crude ride height control with a wide variance in load.

In road racing this causes a problem when braking and turning into the corner, as the suspension stroke has been linear (predictable) and compliant up to the last 30 - 35mm of stroke, but when the hydraulic bottoming device starts working there is a massive (and unwanted) increase in dampening force, leading to a semi hydraulic lock situation. Much of the load is still on the front tyre and when you are banked over you need as much mechanical grip as possible. The sudden increase in compression dampening force means the interlock with the pavement is lost and the tyre is overloaded.

The solution is to either reduce the effectiveness of these systems, or remove them altogether. This will require the rider to be vigilant on controlling the bottoming resistance with a balance of air gap, spring rate and dampening.



Correct suspension set up has a major effect on tyre temperature and wear patterns, but so also does any myriad of other factors such as abrasiveness of track, ambient air temperature and track temperature, etc.

For example, on a Cold day, a less abrasive track, you may only achieve temps of say 40°C.

But on a Hot day, track temp is say 40°, the tyre temp may get to 80 – 100°C.

If rear tyre temp exceeds 85°C, raise tyre pressure 2 - 5psi.

Raise tyre pressure to reduce temp. Reduce tyre pressure to increase temp. Make sure to check tyre pressures when the tyres are on the warmers, but just as importantly, check pressures straight off the track too.

These comments are a guide only; tyre compounds and designs change constantly. For accurate info, talk to the tyre technicians at the race track.

	Production	600cc	1000cc
Front	65 - 70 ° C	70 - 75 ° C	70 - 75 ° C
Rear	70 - 80 ° C	70 - 85 ° C	75 - 85 ° C

TYRE GRIP RELATED TO COMPRESSION DAMPING

Tyre grip is created when the tyre is pressed onto the track surface enough to interlock with the grain of the asphalt.

Not enough compression dampening or overly soft springing allows the tyre to move free and ride up on top of the pavement grain, commonly referred to in open wheeler racing as dry aquaplaning. With very high horsepower this means wheel spin will initiate earlier.

If the compression dampening is overly firm, grip will also decrease because too much downward force from the suspension will overheat the tyre or compress it too much and distort the carcass with unduly high load variations.

Don't blame the tyre supplier for a problem that could be (and usually is) suspension set-up.

TYRE GRIP RELATED TO REBOUND DAMPING

Rebound is an event that occurs after the shock absorber has been compressed. Small track irregularities cause constant wheel movements (suspension movement) and rebound dampening controls this.

If the rebound dampening is too slow a loss of grip will occur that will be particularly noticeable on acceleration when exiting corners. The suspension remains pumped down (packing) and away from the compliant part of the stroke.

If the rebound dampening is too fast the wheel will spring away from the pavement at too great a rate causing the tyre to loose its interlock with the pavement. Fast rebound will have a particularly detrimental effect on braking, but also may allow the tyre to unload and spin on corner exit. The rider will often notice the rear feels "loose".

Therefore the "sweet spot" has to be found by trial and error.

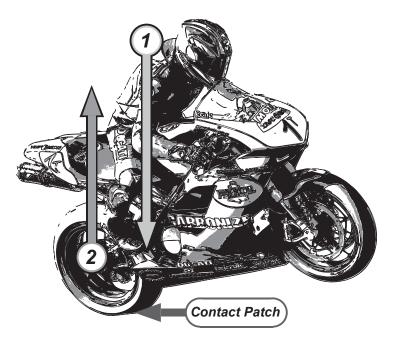
SUSPENSION STROKE

A road race bike should normally not use its full rear stroke. However on some circuits this is unavoidable, for example, Oran Park. If the suspension bottoms at a place where maximum grip is essential, the tyre cannot create it's best traction because it also has to perform as a spring. This causes tearing of the tread from the resulting loss of adhesion.

Correction is achieved by an increase in spring rate or compression damping, sometimes both. More surface and tyre grip / faster lap times generally requires firmer settings (i.e. Phillip Island). Less grip / wet tracks require softer settings and a less aggressive steering angle.

DRY AQUAPLANING

Within given limits normal thinking is that if you want more grip you go to softer springs and/or dampening rates. This can be very far from the truth.



To illustrate:

The rear suspension unit consisting of a spring and a damper tries to counterbalance the effect of chain torque.

The combination must be firm enough to keep the wheel "pushed" ONTO THE ROAD SURFACE but also be compliant enough to absorb surface irregularities. (1)

Under acceleration, torque imparted through the top run of the chain tries to pull the wheel/tyre off the road. The more torque applied the greater the problem. (2)



READ THIS BEFORE YOU REFIT YOUR FORK & SHOCK

FRONT SUSPENSION

Triple clamps: Wipe the clamps out with a solvent, they must be clean and oil free. Use a "scotchbrite" pad if you need to remove any hard deposits. Feel the steering head bearings while you are at it do they move freely?

Axle: Check the axle for any nicks or burrs. NEVER HIT YOUR AXLE WITH ANYTHING HARDER THAN BRASS OR PLASTIC. If your axle cannot centre in the axle foot, you will have a harsh feeling fork that you cannot remedy with clicker adjustment.

Install the forks and torque the triple clamps to manufacturer's specification. Over tightening will cause binding in the upper tubes.

Set the fork projection through the top clamps to the stock position. If you have a projection preference and have not changed fork settings, set it to your previous figure.

Lubricate the axle with thin oil or WD40, run it through the feet and wheel bearings to ensure it is smooth. Install the wheel and the axle, but leave the pinch bolts loose.

After all the other assembly work is done, drop the bike off the stand, hold the front brake and "pump" the forks several times, to centre the axle and the fork legs. Tighten the pinch bolts while the bike is sitting on the ground. THIS STEP IS CRITICAL.

Look through the tuning notes and go ride.

REAR SUSPENSION

Start tuning at standard ride height

Move the swing arm up and down to check for binding in the linkages.

Fit the shock, and torque the bolts to specifications.

Again, look at the tuning notes before riding.

On your first ride, start riding carefully. If you have had a major change to your suspension settings your bike will react differently on the track and you may crash as a result.



teknik TEKNIK SUSPENSION SETTINGS

IERNIK TERNIK SUSPENSION SETTINGS							
Date:		Event:		Rider:		Bike:	
	Session	1	2	3	4	5	6
•	Frack Temp						
Bike	Front Tyre PSI						
	Rear Tyre PSI						
	Gearing						
	Wheelbase						
	Fastest Time						
	Offset						
	Angle						
	Fork Type & #						
	Fork Height						
Front	Compression						
nt	Rebound						
	Spring Rate						
	Preload (mm)						
	Oil Level (mm)						
	Top Out Spring						
	Shock Type & #						
	Link						
	HYD SPEC Compression						
	(LS, HS)						
Rear	Rebound Spring Rate						
7	Preload (mm)						
	Top Out Spring						
	Shock Length						
	Swing Arm Length						
Note	es & Comments						

Don't know which parts will fit your bike?

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