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REF: Raw Data

DATA STORED HERE TEMPORARILY
WAITING TO BE INTEGRATED

Electrical Compatibility Information

submitted by Andy56 [1)]

Oil pressure switch

HD part number – Standard Automotive
- - - - - - - - - - - - - Products part number
26552-72 - - - - - - MC1801
26554-77 - - - - - - MC1802
26561-84 - - - - - - MC1803
26561-99 - - - - - - MC1804

Brush sets

HD part number – Standard Motor
- - - - - - - - - - - - - Products part number
30426-58 - - - - - - MC2309

Starter Relay TC models (2000-2011) V-ROD (2007-2011)
31522-00B - - - - - - Durite 0-728-13, Standard Motor Products MC-RLY5

Suggested wire sizes based on continuous load for standard multicore wire
14 gauge (2.0mm2) 15 Amps
16 gauge (1.3mm2) 7 Amps
18 gauge (0.82mm2) 5 Amps
20 gauge (0.5mm2) 3 Amps

For lighting 1 watt = 0.07 Amps so a single 21W bulb takes 21×0.07 = 1.47 Amps

Volt drop calculator for calculating wire size. (maximum acceptable volt drop nomaly 3-4%)
https://www.rapidtables.com/calc/wir...alculator.html

But remember the wire size has to be rated to the fuse it has to blow and not necessarily the continuous load.

- -

Suspension Info by ????

Comments: (by who??)

Calculating or measuring rake and trail is not necessary unless you are making significant changes from stock chassis parts. I'm not saying they are not important, just that stock bikes have limits built into them.

Chassis pitch due to front and rear ride height changes is just easier to understand and measure. Measuring and setting the frame rails level to the floor with the rider on the bike is just a safe starting point for Roadsters. The most important thing to understand is if you get into a stability problem, at least raise the triple clamps to reduce forward chassis pitch, assuming there are no other related problems.

2007.02.18 From my experience with Race Tech emulator kit and straight rate fork springs, Progressive 440's and Works Pro Racers and dealing with the technical people, I know none have actually done testing with a Rubbermount Sportster, at least not when I purchased (and returned) the products I mention. I know Progressive is taking off the shelf shocks, putting on springs to match rider weight, but not changing the dampening curve to match the spring rate. I know Works has no idea how to make their Pro Racers work for me, I weigh 230 lbs..

Have you read the wobble thread, or at least the last 10 pages? Part of the problem is the Roadster has to have a very specific set up with front and rear ride heights and swing arm and frame positions, and loose belt tension, fork brace and better tires to handle properly for guys my weight. The aftermarket shock companies are giving us rider sag specs, spring rates, dampening curves, and shock lengths and travel that do not account for the unique needs of Roadsters. I mention Roadster because that is what I have.

Most Sportster riders just accept lousy riding qualities as a fact of life. Most do not understand how to improve upon junk and flat wrong set up information provided by HD and aftermarket companies. By trial and error, and ignoring what the “pros” recommend, I have improved the ride and handling of my bike way beyond stock. Not done yet, but getting close.

In order for this information to be meaningful enough for the guy who is just starting out, much more information is needed. Rider weight, riding skill level, front and rear rider sag, frame and swing arm position, tires, fork oil etc. etc. Because the correct spring rates will not help if too many other things are out of adjustment.

2007.03.03 I measured out XL 50's XL 50. Everything is stock:

Frame rails level with floor. Swing arm is slightly above level. (Read the wobble thread page 53, post 526, and keep reading until you see the picture of the fat and happy rider.) 11 1/2 eye to eye shock length (fully extended) with 3/8“ rider sag. 2 1/2” rider sag in the forks.

I won't repeat everything I have done to my suspension, but at this point I think XL 50 has the perfect set up on his bike. To me it illustrates you must consider how spring rate, length, preload, etc. of both forks and shocks affects frame and swing arm position with the rider on the bike.

I also found that if the fork springs are too stiff for the rider, the back end feels too stiff, not the front end. I'm not entirely sure why, but something about “coupling.” Instead of absorbing bumps, the stiff front forks transmit the force to the shocks and preloads the springs. More preload on the shock springs makes them ride stiffer.

My assumption is that the stock suspension is for the 180 lb.. rider. A 130 lb.. rider will find the bike rides too stiff. Putting a lighter spring on the shocks will help reduce ride harshness for the 130 lb.. rider. But now a 200 lb.. rider will find the shocks too soft. It may be necessary to put a progressive or dual rate spring in the forks (and/or shocks) to be able to decrease the initial spring rate, yet increase the final spring rate, to find a good compromise for both riders.

Ideally, you would want to find the spring combination that allows the 130 lb.. rider to have a comfortable ride with no shock preload, and the 200 lb.. rider to be able crank in just enough shock preload to stiffen up the ride for him.

Increasing the oil level in the forks is one way to reduce braking dive for the heavier rider. The lighter rider probably won't be using full fork travel, and won't even notice.

Another way to build in some adjustment in the forks is to put a Schrader (air) valve in the fork caps. The lightweight rider may be good with no pressure, the heavy rider might want to add a few pounds of air pressure. I haven't done it, but it is an easy way to get some adjustability in the forks. I have had other bikes with air forks.

This is a very brief summary. Changing spring rates usually works best by changing the compression and rebound dampening curve also. As far as I know Roadsters and XL 50's share the same fork geometry. I don't know how much different the Customs and Lows with their raked front ends will be with these changes.

2007.09.18 Basically, preload is used to fine tune ride height (also called rider sag) to better match the weight of the rider to the movement of the spring. For example, if you are going to carry a passenger, tightening up the preload can keep the suspension from sagging too low and prevent bottoming out on the bigger bumps in the road. It is used to set the ride height (rider sag) of the suspension at 1/3 to 1/4 of the total suspension travel. It can be used to determine if the spring is too heavy or too light for the rider's weight.

Preload in forks is set by the spacer length. The preload for shocks is set by rotating the preload adjuster.

All shocks and forks have a fixed amount of total travel. The travel is measured as the distance from full extension (topped out) to full compression (bottomed out). When you sit on the bike, you generally want the forks or shocks to compress about 1/3 to 1/4 of the full travel. You need this sag to allow for the suspension to travel both up and down from that point.

The maximum travel of the shock body (or forks) may or may not be the same maximum travel the spring is capable of, and travel may also by limited by chassis design, i.e. tires rubbing. But we will ignore that point for now.

What happens when a heavy rider sits on a shock with a spring that is too light? The spring cannot support his weight and compresses too much. Instead of rider sag at 1/3 travel, he may compress the spring to 3/4 of the available travel. Let’s say he weighs 300 lbs., but he has a 100 lb./in spring with 4 inches of total travel. When he sits on the shock with no preload, he compresses the shocks 3 inches and has only 1 inch of travel left over to absorb road bumps. Every bump in the road 1 inch and over in height makes the shock bottom out, very uncomfortable. Once the spring is fully compressed, it then rebounds (fully extends) with close to equal force. This is what throws a rider off the seat. Nightster riders are finding out how bad 1 inch of travel is.

So he gets out the preload adjusting spanner wrench and starts cranking in more preload. By doing this, he is putting the spring under pressure. We can't measure the pressure, but we can measure the distance the spring is compressed. With no load on the spring it was originally 4 inches long. By adding preload, he has now compressed the spring to 3 1/2 inches. That 1/2 inch is the same as 50 lbs. of force on the spring. When he sits on the bike, it now compresses only 2 1/2 inches (rider sag)instead of the original 3. Still too much rider sag, he needs to get to only 1 inch rider sag, so he cranks in even more preload.

If he cranks in 1“ of preload (100 lbs. of force on the spring), he gets 2” rider sag. Still too much sag.

If he cranks in 2“ of preload (200 lbs. of force), he gets the 1” of rider sag he is looking for.

But look what happened to the spring. While sitting on the bike, it has only 2“ of travel left. (He wants to get the full 3” of travel beyond the 1“ rider sag.) But that is only half of his problem. Since the spring is now preloaded with 200 lbs. of force, it now takes 201 lbs. of force to even get the spring to move and it will now take 300 lbs. of force to get the spring to move the first full inch. Unfortunately, it will only take another 100 lbs. of force to get the shock to bottom out. This is one lousy ride, as soon as he get the suspension moving, it is already bottoming out.

What he needs is a 300 lb. spring with 4” travel. With zero preload, he will get his 1“ rider sag, and still have 3” travel left over to absorb road bumps.

Time out for Whittlebeast to edit and check my math and reasoning. If you guys are able to get through about another page of reading, you will be able to argue with any sales clerk about your suspension. Don't bother arguing with the engineers, they never let you win.

Now we will talk about progressive springs. A progressive spring is described with two spring rates, such as 75/120 lbs./inch. For our initial discussion, we will state the 75 lbs./in rate is the initial rate which controls the motion of the shock for the first 1 inch of travel. The 120 lb./in is the final rate which controls the motion of the shock for the last one inch of travel. The middle one inch of travel has a spring rate that progressively increases from 75 to 120 lbs./in.

The main advantage is that progressive springs provide a softer ride over 1“ bumps in the road, but quickly stiffens up to reduce bottoming over 3” bumps in the road. You get the best of both worlds, well not quite. The question becomes just exactly where is that transition point where the progressive spring crosses over from the soft / low initial rate to the hard / high final rate.

We will assume the 75/120 spring rate on a 13 “ shock is for the 180 lb. rider. But if we put our 300 lb. rider on these shocks, he will blow through the compression stroke even faster because of the lighter initial rate. If you watch the spring coils compress as the overweight rider sits on them, you will see the coils in the soft part of the spring bind up (also called stack) against each other. He never even feels the soft initial rate. If we put a 120 lb. rider, she will feel an even stiffer ride because both the initial and final rate are too stiff for her.

Adding too much preload to a progressive spring can do the same thing the heavy rider does. It is possible for the preload to coil bind (stack) the initial part of the spring before the rider even sits on the bike. This is why it is critical to get the proper initial rate of a progressive spring, and then use only the minimum preload needed to achieve the correct rider sag.

Now let's say Mr. Know Nothing About Suspension McKool wants that cool looking lowered look that a 11" shock provides. In just a few hundred miles he will realize that stock HD shock is really miserable. It is not uncommon for Harley suspension components to have the wrong spring rates and really bad damping curves. Harley tends to take the same shock body, shorten the shaft of the shock and then stick on whatever spring they have an excessive inventory of. A typical example is the 1" shock travel found on Nightsters. So he goes to the Progressive Suspension company website and finds the 11" 412-405B/C shock has 1.9" of travel, almost double the stock travel. But the spring is 90/130 lbs./in. A shorter shock must have a stiffer spring to compensate for the shorter travel. Problem here is that his initial rate has gone up from 75 to 90 lbs./in. That makes the ride even stiffer. This is the compromise riders with short travel suspensions must make.

When you buy a standard shock, changing preload is the only adjustment you can make. However, Works Performance sells what is called Dual Rate springs for forks and shocks. There are actually two separate springs, one stacked on top of the other. One spring has a soft rate, the other a hard rate. The initial spring rate is the combination of both springs compressing together. There is a metal tube inside the high rate spring which limits its travel. When the high rate spring is bottomed out against the metal tube, also called crossover spacer, the spring rate changes from the low initial rate where both spring were compressing, to the final rate which is now the softer spring compressing by itself. The big advantage with Works Dual Rate spring kit, is that you can change springs to give you the initial and final rate you want, as well as control the crossover point by changing the length of the crossover spacer. There is a formula to calculate the actual initial spring rate that results from both springs compressing together before reaching the crossover point. 1/total spring rate = 1/ spring rate of first spring + 1/spring rate of second spring.

Though multiple test rides and by changing the heavier spring and crossover point I ended up with an initial spring rate of 34 lb./in for first 2 ¾ inch fork travel and 60 lbs./in spring rate final 1 ¾ inch fork travel in my Roadster forks. This close to the 35/50 spring rate of the Progressive fork spring, but the 60 lb. final rate reduces bottoming and fork dive caused by my 240 lbs..

Compression and rebound damping will be the next topic. A spring by itself acts like a pogo stick, the harder you jump on it compressing the spring, the farther up in air it throws you because the spring rebounds (extends) with nearly equal force. A spring by itself has a relatively high amount of compression damping built in. It naturally resists being compressed. However, a spring has a relatively small amount of rebound dampening built in because it pushes back with nearly the same force that compressed it in the first place. If you had no damping, the spring would continue to oscillate back and forth forever, not a good thing.

Shocks and forks use oil to create compression and rebound damping needed to suppress spring oscillation. Compression damping reduces how far the spring compresses. Rebound damping reduces how far the spring rebounds (extends). Heavier springs need less compression damping, but more rebound dampening.

Cheap shocks have no adjustments for damping.

In order to get shocks that have external adjustments to fine tune compression and rebound damping, you start spending a lot more money. The Progressive 418's have one adjustment for the rebound damping. Ohlins, Works, Penske, WP make shocks that have external adjustments for compression and rebound damping. The best shocks have adjustments for high speed and low speed compression damping in addition to rebound dampening. The more expensive shocks also have a much greater range to adjust preload, and the damping can be changed internally to match different springs.

High speed and low speed compression damping are fine tuning adjustments which helps the rear tire follow different bumps in the road. For example, if you are riding down a concrete highway and can feel those expansion joints pounding your back, you shock has too much high speed damping. It is too stiff over those bumps and you feel each one up your back. Conversely, slow roller type bumps slowly pitch the bike up and down, sort of like laying on an inner tube in the ocean waves. Being able to reduce low speed compression damping will smooth out the ride.

Damping in the forks is controlled by holes in the damper rod that oil is pushed though as the forks move up and down. By drilling out the compression holes in the damper rod of my forks, I was able to decrease compression damping because more oil can flow through larger holes. By leaving the rebound holes alone, which are at the top of the damper rod, I was able to maintain a fairly high level of rebound damping in my forks. At the bottom are the large compression holes. Stock holes are about 1/16” dia. This is a totally different effect than increasing oil viscosity where both compression and rebound damping are increased at the same time. The small stock holes, especially when combined with HD SE heavy duty oil, cause forks to be way over damped. My forks can move up and down much faster than forks with the standard damping holes, and therefor track the bumps in the road much better keeping the tire in contact with the road.

Shocks have a rubber bumper in them to soften the blow when they bottom out. Good shocks can have such a good bumper, that you won't even feel the shock bottom out. In that case, you will have to use a plastic tie to see how much travel you are using. The rubber bumper in cheap shocks do nothing but prevent a hard metal to metal clunk.

2007.09.29 I aim for rear vertical oscillation frequency of chassis in cycles/min of 140 CPM (cell C52). I am getting…

a 100 lb rider needs 77.5#/in springs a 150 lb rider needs 89.3#/in springs a 200 lb rider needs 101#/in springs a 250 lb rider needs 113#/in springs a 300 lb rider needs 125#/in springs a 350 lb load needs 147#/in springs (assumes that this is a 200# driver with a 150# passenger)

Notice that for every 50# of load the springs need to change about 12 lbs/in

At this point my stock roadster shocks with stock Low springs is still the best combination I have found to date. I am 200 and I get a rider sag of about 1 1/4 of 3 1/4“ total on a 7/8 preload adjuster on full hard and 1/2” of extra preload shim. It takes a really bad bump at stupid speeds to bottom it. The ride is a little firm but plenty acceptable. My wife (140#) rides it with the 7/8 of preload off to give a nice low ride for her short legs. AW

2007.10.15 Today I talked to Progressive and after some prodding I managed to get the spring rates from the tech. To my surprise the long version of the 13.5“ shock has two versions of springs 75/120 and 90-130. The 75-120 is a step function spring rate that changes from the low rate to the high rate at what turns out to be right at a 200 lb rider. This leads to the conclusion that you should only purchase the 75/120 spring if you are in the 130# weight range. All people that weight in the 180# and above (like with passenger) should purchase the high HD springs. People in the 180 - 200# range that ride by themselves only, have to go with the 9” fixed rate spring 90# spring and build spacers to get to the correct rider sag or just tolerate the real bad ride on some surfaces. The HD spring is a true progressively wound spring. AW

Whittlebeast - On Shocks

(supplied by bgavin)

URLs

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https://en.wikipedia.org/wiki/Shock_absorber
http://xlforum.net/forums/showthread.php?t=47542
http://xlforum.net/forums/showthread.php?t=919213 (ricor rear shocks)

Definitions

Preload	Amount of spring compression, measured in pounds per inch of compression
Sag	Amount of suspension travel consumed by mounted rider in full gear. Set to 33% of full travel.
Travel	Total linear length of shock movement, eye-to-eye
Eye	Upper and Lower shock mounts
Full Extended	On center lift or cresting a hill at high speed
Full Compress	
Coil Over	Motorcycle shocks when the spring coils are mounted around the shock absorber.
Coil Bind	Maximum spring compression where all coils touch.
Twin Tube	Inner(pressure)/Outer(reserve) tube where hydraulic fluid is forced between the two tubes.

2007.02.27
So far I have found that the stock 1200 low springs are about 99 lbs/in The springs are 1.7“ ID with 13.25 free coils and .279” wire dia. Installed on the bike they are about 6.85“ with the shock eye to eye at 11.53” Just over 11.25“ with most of me on the bike. Spring free length 9.33” Installed the spring length is 6.85“. All this gives 2.48” preload 2.48“ x 99#/in = 245 lbs pre-load at full extention per side. Fully compressed and touching the bump staletto, the shock center to center is 9.75” or 1.78“ total available shock travel. The rebound damping on the stock shock appears to be way tighter than the 1200s shocks

even on full hard. All this data is very bad from a handling standpoint. Normaly you only want enough rebound damping to control the spring from overshooting the static ride height on a rebound.

stock 1200s springs are 51 lbs/in and the free length is 10.25” The springs are 1.93“ ID with 12.5 free coils and .270” wire dia. Installed on the bike they are about 7.75 and about 6.5 with most of my 200 lb butt on the bike. This leads to the stock shocks has about 383 lbs total on the rear or about 191 lbs on each shock. Extended the shocks are 13.25 eye to eye. Total shock travel is 2.37“ or 13.25 - 2.37 = 10.87 fully compressed to the bump steletto. About 12” with me on the bike. The unladen height of the seat with these shocks is 28.5“ or about .5” higher than the Harley claimed height.

After riding the bike … My first impression is that the stock 1200 Low way too much preload for any smaller rider and I am suspect for all riders. The stock shocks have way too much rebound damping in an attemp to soften up the slam against the shock as the springs recover from a large dip. The solution appears to be regaining some of the travel by installing shocks with longer travel. Sence I started this endever I ran across a Progressive shock number 412-4210c that is 13“ eye to eye, has 3.8” of total travel at the shock giving about 4.5“ of available wheel travel. The spring rate is a 75/120 that should be about correct for a single 180-200 rider. I have no idea what the preload on this shock or what the valving is like to give much more input. In time I may pop for a pair just to try.

The new Caddies will be here in a few days and I will install the spare sportster sport springs on them. I want to get back to the original Low ride height with a 160# rider with more available shock extension travle and with springs in the 50#/in range. I also hope to try the stock 85# springs in the Caddies as the preload will be only about 1.33” or about 113 lbs preload. The ID of the springs is not real interchangable and may become an issue.

If you measure from the bottom of the drive belt adjusting thread to the front point of the rear tail light I get stock 1200 Low is about 11.25“ With the new rear 1200s shocks I get 13.37” or just over 2“ higher with no rider.

(added 2/28/07) I laid out the rear suspension in CAD and the motion ratio is about .847 so the total rear suspension travel on the stock Low shocks is 1.78/.847 = 2.1” vertical chassis travel. The 1200s setup is 2.37/.847= 2.8“ vertical chassis travel. Normally a chassis is set up to have zero spring preload at full droop and just touch the bump stops on the largest you would ever expect to hit and and use 1/3 of the available at rest with the “normal load”. The stock Harley is a far cry from this goal.

(added 3/1/07) I put plastic wire ties on the shock shafts front and rear. Then went for a ride. What I found is that with me at 200 lbs, the 1200s shocks are using the entire available travel. I never felt the rear end hit hard so I am most likely close now, I am suspect that having a spring in the 85# range and with a free length of about 9” requiring less preload would be even better. In the front the standard setup appears to be close. I also noticed that about 33% of the riders weight goes on the front tire and about 66% goes on the rear tire.

AW
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2007.03.17
Generally dive in a motorcycle is not a problem. Running out of suspension at either end of the shock travel is.

Shock travel should almost never be controled by the shock. Travel should always be controled by the spring.

Shock damping is just there to provide as little damping as required to keep the chassis movement from over shooting and bouncing. Shocks are not there to control total travel.

Shocks have two types of resistance in compression “low speed damping” and “high speed damping”.

High speed damping controls when the tire hits things like a speed bump. Low speed damping is things like a big dip in the highway. Extension damping only controls bounce or overshoot as the tires recovers fron a bump.

Think of extension damping as the thing that only controls the spring. Compression damping controles the ride. Most of the time if you take the spring off the shock and pull in and out with your hands the resistance of the shock should be about the same going in and out. If you end up with way more of one that the other you must be trying to cover one problem with some other problem. Harley on the Low bikes is trying to cover up for too little extension travel with too much extension damping. Ride fast in fast bumps and the chassis will jack down or lower as you go thru the bumps.

If when trying to follow the above rules you end up with too tight of springs for comfort then you do not have enough suspension travel. Add shock travel and start over.

There is no such thing as upgrading springs. What you can change is spring rates and preload. The trick is knowing what direction to go. It is impossible for the shock guys to help you if their first question is not “what problem are we trying to solve. If you dont know what the problem is, you can't answer his first question. I was horified the first time I rode my 2007 1200 Low and have since spent about $600 getting parts and pieces off e-bay to have parts to test with. I now have setups for both me and my wife, one up and two up. And the bike only has 150 miles in it. I am close now and could do this on e-bay now for about $200 with combinations of Harley parts. I have not found the front suspension that much of a problem. The rear was a mess from the factory.

For a great schooling in suspension design, watch the motorcross pros on TV and then reread the above rules several times during the program. Every lap will make this more clear. I helped the Bigfoot monster truck team design and sort out their 10000 lb race truck and I have done chassis design for 700# 2 Gee winged autocross cars. This is all the same.

Google “Motion ratio” “shock tuning” “motorcycle shock tuning” for plenty more info.

Harleys try to break every one of these rules. Follow the rules and all is good.

Hope this helps

AW
* * * * * * * *

2007.03.19
Here are the shock dimensions that I got with the 1200 Low springs on the 1200 R shocks

shock length fully extended 13.25”
…you are in this range any time you crest a hill at high speed the trick is to keep the tire on the road at

all cost

shock length with bike straight up no rider weight 12.1“
…you are in this range every time the road goes down, it happens just as often as the road goes up

shock length with a 200# rider 11.4”
…you are in this range right after a raised or rising bump, This is all spring rate trying to save hardware.

shock length fully compressed 10“
…mechanical limit of the shock travel

shock length with the bike on the kickstand 12.5”
…this is a bling thing. not significant for handling

As you can see the bike with driver is very close to a Low but I have the full 3.25“ (about 3.8” at the chassis) of suspension travel available for softening out the bumps. The bike behaves far better crossing both small rapid bumps and large long humps. The thing Harley had screwed up was the lack of suspension droop with the factory Low shocks. A function of way too little shock travel and way too much spring preload. Looking at the Progressive shock charts I would think may of thair available combinations have similar issues.

Hope this helps people sort out thair suspensions to get the ride and look they are looking for. You do not have to have a bad ride to get a good look. I can now jumb back a forth from my Honda ST1300 to the Harley and they now feel very similar in the spring, damping and ride. Bumps are just not a problem. When I got the bike I literaly could not see the road from my head bouncing to the road bumps. The feel of the shock bottoming out on the Low and Custom bikes is realy the shock topping out on bumps. I can't beleve that this ever got past the Harley test riders.

AW
* * * * * * * *

2007.03.20
Here is a simple series of steps to get to your goal.

Pick a shock that has the most possible available stroke that when in the most compressed position will provide enough clearance for wires, fenders and other expensive things that the tire or belt may contact OR set this up so that you are 1 1/2“ below the ride height that you are looking for. Measure this totaly compressed length at the lower of these two points in the suspension travel. We will be aiming to only get the shock to this point at the bigest bump you ever intend to hit. Hopefully you can find a shock with around 3” of availible stroke.

Next you need to find a spring that with the shock at full droop can be installed on the shock by hand. This guarentees that at full droop the spring has no more energy that needs to be controled. With a sportster and with a rider in the 140 lb range the spring will end up at about 75# per inch. At 250# I would expect the spring rate to end up in the 140#/inch range. The spring rate needs to now support the bike and you so that there is still about 1 1/2“ available shock travel to deal with bumps. Air shocks may be an option but I have never had a set to play with. They still need to meet these rules.

AW

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2007.04.20
I rode about an hour or so with my wife on the back of the bike about 340# for both of us combined. I only noticed hitting the bump stops once. That was with the Low springs on R shocks. They were set on full preload plus about 1/2 inch. I built 1/2 inch rubber preload spacers the sit up in the top chrome caps.

AW
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2007.09.18
Basically, preload is used to fine tune ride height (also called rider sag) to better match the weight of the rider to the movement of the spring. For example, if you are going to carry a passenger, tightening up the preload can keep the suspension from sagging too low and prevent bottoming out on the bigger bumps in the road. It is used to set the ride height (rider sag) of the supension at 1/3 to 1/4 of the total suspension travel. It can be used to determine if the spring is too heavy or too light for the rider's weight.

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If he cranks in 1” of preload (100 lbs of force on the spring), he gets 2“ rider sag. Still too much sag.

If he cranks in 2” of preload (200 lbs of force), he gets the 1“ of rider sag he is looking for.

But look what happened to the spring. While sitting on the bike, it has only 2” of travel left. (He wants to get the full 3“ of travel beyond the 1” rider sag.) But that is only half of his problem. Since the spring is now preloaded with 200 lbs of force, it now takes 201 lbs of force to even get the spring to move and it will now take 300 lbs of force to get the spring to move the first full inch. Unfortunately, it will only take another 100 lbs of force to get the shock to bottom out. This is one lousy ride, as soon as he get the suspnsion moving, it is already bottoming out.

What he needs is a 300 lb spring with 4“ travel. With zero preload, he will get his 1” rider sag, and still have 3“ travel left over to absorb road bumps.

Time out for Whittlebeast to edit and check my math and reasoning. If you guys are able to get through about another page of reading, you will be able to argue with any sales clerk about your suspension. Don't bother argueing with the engineers, they never let you win.

Now we will talk about progressive springs. A progressive spring is described with two spring rates, such as 75/120 lbs/inch. For our initial discussion, we will state the 75 lbs/in rate is the initial rate which controls the motion of the shock for the first 1 inch of travel. The 120 lb/in is the final rate which controls the motion of the shock for the last one inch of travel. The middle one inch of travel has a spring rate that progressively increases from 75 to 120 lbs/in.

The main advantage is that progressive springs provide a softer ride over 1” bumps in the road, but quickly stiffens up to reduce bottoming over 3“ bumps in the road. You get the best of both worlds, well not quite. The question becomes just exactly where is that transition point where the progressive spring crosses over from the soft / low initial rate to the hard / high final rate.

We will assume the 75/120 spring rate on a 13 ” shock is for the 180 lb rider. But if we put our 300 lb rider on these shocks, he will blow through the compression stroke even faster because of the lighter initial rate. If you watch the spring coils compress as the over weight rider sits on them, you will see the coils in the soft part of the spring bind up (also called stack) against each other. He never even feels the soft initial rate. If we put a 120 lb rider, she will feel an even stiffer ride because both the initial and final rate are too stiff for her.

Adding too much preload to a progressive spring can do the same thing the heavy rider does. It is possible for the preload to coil bind (stack) the initial part of the spring before the rider even sits on the bike. This is why it is critical to get the proper initial rate of a progressive spring, and then use only the minimum preload needed to achieve the correct rider sag.

Now lets say Mr. Know Nothing About Suspension McKool wants that cool looking lowered look that a 11“ shock provides. In just a few hundred miles he will realize that stock HD shock is really miserable. It is not uncommon for Harley supension components to have the wrong spring rates and really bad damping curves. Harley tends to take the same shock body, shorten the shaft of the shock and then stick on whatever spring they have an excessive inventory of. A typical example is the 1” shock travel found on Nightsters. So he goes to the Progessive Suspension company website and finds the 11“ 412-405B/C shock has 1.9” of travel, almost double the stock travel. But the spring is 90/130 lbs/in. A shorter shock must have a stiffer spring to compensate for the shorter travel. Problem here is that his initial rate has gone up from 75 to 90 lbs/in. That makes the ride even stiffer. This is the compromise riders with short travel suspensions must make.

When you buy a standard shock, changing preload is the only adjustment you can make. However, Works

Performance sells what is called Dual Rate springs for forks and shocks. There are actually two separate springs, one stacked on top of the other. One spring has a soft rate, the other a hard rate. The initial spring rate is the combination of both springs compressing together. There is a metal tube inside the high rate spring which limits its travel. When the high rate spring is bottomed out against the metal tube, also called crossover spacer, the spring rate changes from the low initial rate where both spring were compressing, to the final rate which is now the softer spring compressing by itself. The big advantage with Works Dual Rate sping kit, is that you can change springs to give you the initial and final rate you want, as well as control the crossover point by changing the length of the crossover spacer. There is a formula to calculate the actual initial spring rate that results from both springs compressing together before reaching the crossover point. 1/total spring rate = 1/ spring rate of first spring + 1/spring rate of second spring.

Though multiple test rides and by changing the heavier spring and crossover point I ended up with a initial spring rate of 34 lb/in for first 2 ¾ inch fork travel and 60 lbs/in spring rate final 1 ¾ inch fork travel in my Roadster forks. This close to the 35/50 spring rate of the Progressive fork spring, but the 60 lb final rate reduces bottoming and fork dive caused by my 240 lbs.

Compression and rebound damping wil be the next topic. A spring by itself acts like a pogo stick, the harder you jump on it compressing the spring, the farther up in air it throws you because the spring rebounds (extends) with nearly equal force. A spring by itself has a relatively high amount of compression damping built in. It naturally resists being compressed. However, a spring has a relatively small amount of rebound dampening built in because it pushes back with nearly the same force that compressed it in the first place. If you had no damping, the spring would continue to oscilate back and forth forever, not a good thing.

Shocks and forks use oil to create compression and rebound damping needed to supress spring oscilation. Compression damping reduces how far the spring compresses. Rebound damping reduces how far the spring rebounds (extends). Heavier springs need less compression damping, but more rebound dampening.

Cheap shocks have no adjustments for damping.

In order to get shocks that have external adjustments to fine tune compression and rebound damping, you start spending a lot more money. The Progressive 418's have one adjustment for the rebound damping. Ohlins, Works, Penske, WP make shocks that have external adjustments for compression and rebound damping. The best shocks have adjustments for high speed and low speed compression damping in addition to rebound dampening. The more expensive shocks also have a much greater range to adjust preload, and the damping can be changed internally to match different springs.

High speed and low speed compression damping are fine tuning adjustments which helps the rear tire follow different bumps in the road. For example, if you are riding down a concrete highway and can feel those expansion joints pounding your back, you shock has too much high speed damping. It is too stiff over those bumps and you feel each one up your back. Conversely, slow roller type bumps slowly pitch the bike up and down, sort of like laying on an inner tube in the ocean waves. Being able to reduce low speed compression damping will smooth out the ride.

Damping in the forks is controlled by holes in the damper rod that oil is pushed though as the forks move up and down. By drilling out the compression holes in the damper rod of my forks, I was able to decrease compression damping because more oil can flow through larger holes. By leaving the rebound holes alone, which are at the top of the damper rod, I was able to maintain a fairly high level of rebound damping in my forks. Here is a picture of the damper rod sold by Progressive Suspension:

Quote: http://www.jpcycles.com/productgroup...ore=All&page=1 At the bottom are the large compression holes. Stock holes are about 1/16“ dia. This is a totally different effect than increasing oil viscosity where both compression and rebound damping are increased at the same time. The small stock holes, especially when combined with HD SE heavy duty oil, cause forks to be way over damped. My forks can move up and down much faster than forks with the standard damping holes, and therefor track the bumps in the road much better keeping the tire in contact with the road.

Shocks have a rubber bumper in them to soften the blow when they bottom out. Good shocks can have such a good bumper, that you won't even feel the shock bottom out. In that case, you will have to use a plastic tie to see how much travel you are using. The rubber bumper in cheap shocks do nothing but prevent a hard metal to metal clunk.

Many thanks to Whittlebeast for helping me write all this.

XLXR
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2007.09.20
The definition of motion ratio is (vertical wheel movement)/(change in shock length)

1) jack up the bike
2) remove the shocks
3) let the tire drop to the ground and measure what the shock lenth would be if it was there. say 13.5”
4) raise the tire exactly some amount of distance say 4“
5) now measure the new shock length say 10”

the motion ratio = 4“ / (13.5” - 10“) = 4” / 3.5“ = 1.14

AW
* * * * * * * *

2007.09.29
I have made a few huge changes to my motorcycle suspension calculator. The first thing I did was add the chassis rideheight when you are cornering at .75 gees. What I found is the added load supported by the springs was enough to callapse the springs in a corner. .75 gees is about the max cornering limit of a of a typical street car. .75 gees is when the bike lean angle is 38 degrees from vertical. Note that 1 gee is 45 degrees lean angle (about what a sport bike can do)

The other big change is you can enter your weight and then follow the directions in the purple box and it will find the spring rate required for your bike.

Please note that this all assumes that you have at least 3” of shock travel and can get to a rider sag of right at 1“. This is the least shock travel that I feel is enough to get a quality ride and still keep the chassis off the stops in corners and on the fairly large bumps. The Sportster Roadster (the best suspension that Harley offers on a Sporty) has about 1” less rear suspension travel than what the high tech sport cruisers use. The Nightster only has 1.25“ of rear suspension travel stock and rides like it.

Feel free to play with it and ask any questions you want. You can change any numbers that are yellow. White cells are calced on the fly. Orange cells are critical output.

I aim for rear vertical osolation frequency of chassis in cycles/min of 140 CPM (cell C52). I am getting…

a 100 lb rider needs 77.5#/in springs
a 150 lb rider needs 89.3#/in springs
a 200 lb rider needs 101#/in springs
a 250 lb rider needs 113#/in springs
a 300 lb rider needs 125#/in springs
a 350 lb load needs 147#/in springs (assumes that this is a 200# driver with a 150# passenger)

Notice that for every 50# of load the springs need to change about 12 lbs/in

AW
* * * * * * * *

2010.11.02
Adding spacers does not change the stiffness as that is a function of the weight supported by the spring and the stiffness of the spring. If neither of those things change then there is no change in stiffness.

Changing the spacer or moving the preload adjuster only changes the ride height and how hard you hit the stops when you do hit them running out of travel at the top or bottom of the shock.

AW
* * * * * * * *

Sportsterdoc - On Electrical

(supplied by Sportsterdoc)

Over the past 4 years, I find myself posting much of the same info regarding electrical issues or basic troubleshooting. To save time, I have saved a few documents, from which to cut and paste. As the documents increased, I thought it easier to put most in just one document…which I am sharing, below.

State of Charge (AGM battery)	
12.8+	100%
12.6	75%
12.3	50%
12.0	25%
11.8	Zero

Voltage Readings
1. KEY OFF battery voltage, at the battery: Normal is 12.8.
If just taken off a charger, voltage may be 13 point something. The battery needs to sit for a while (or turn on the key for ~3 seconds, then turn off) before a reading is useful. In the case of a bad cell, the

other cells overcharge and give an almost normal reading, until load is applied.
• If lower, then battery is discharged and needs charging or
• Battery has a bad cell

2. KEY ON battery voltage (headlight on): Normal is not under about 12.5 initially, but will decline the longer the headlight is on, without the motor running. Under no load, 12.5 volts indicates severe discharge, but under headlight load, it is just voltage drop.
• If lower, then battery is discharged and needs charging or
• Battery has a bad cell or
• Battery cable(s) have high resistance

3. KEY ON battery voltage while cranking: Normal is not under 10.5 volts
• If lower, then battery is discharged and needs charging or
• Battery has a bad cell or
• Battery cable(s) have high resistance or
• Starter is drawing too much current
• Solenoid contacts have high resistance

4. If the bike is running, battery voltage at about 2,500 RPMs should be 13.8 to 14.8
• If not, then check stator resistance and regulator ground
• If the stator is not shorted to ground and resistance is within spec, the regulator or regulator ground is suspect

5. When there is a problem with “no power” check the 30 amp circuit breaker or maxi fuse between the battery and the keyed switch and all the 15 amp fuses after the key switch (or circuit breakers on many Ironheads). If circuit breakers / fuses are OK, then measure voltage coming into the key switch and continue downstream until the voltage stops.

Coil Testing
Dual fire coil testing, typical for Ironheads and Rigid EVO, (except for Sportster Sport 1998-2003) and the last three years of the carburetor / first three years of the Rubsters (2005-2006) Coil has two primary screw terminals (+ & -) with twin coil towers. Beginning in 1999, the coil (31655-99) primary is connectorized (this coil is utilized through 2006).

Primary resistance is measured from + to - terminals, at 2.5 to 3.1 ohms (31655-99). Secondary (high voltage) winding resistance is tested from coil tower to coil tower, specifications vary, typically in the range of 10,000 ohms to 12,500 ohms. Check the FSM for primary and secondary coil resistance for your year.

Single fire coil testing, typical for for Sportster Sport (1998-2003) Coil (31646-99) has three connectorized primary terminals (- + -), referenced A (front) B (12 VDC) C (rear) and twin coil towers. This coil is two coils in one, with primary terminal B common.

Primary resistance is from + to -, both B to A and B to C at 0.4 to 0.6 ohms. For the 1200S (dual plug heads), measure secondary resistance between both front coil towers and then between both rear coil towers (each should measure 11.7K to 12.7K ohms).

Single fire coil testing for EFI Rubsters, 2007 and up (with input from Cosmo Kramer): Coil (31656-07) has 4 primary terminals, referenced, left to right, as A (+), B (+), C (rear) & D (front).

A or B to D should measure 0.3 to 0.7 ohm and A or B to C should measure 0.3 to 0.7 ohm. Secondary resistance: 1,500 to 2,400 ohms, tower to tower

Note: If resistance is lower than specified, that winding has partially shorted, bypassing part of the coil. If resistance is higher, then corrosion or failing internal connections may be adding to the resistance.

Sportster CKP Testing
Sportster crank position sensors are 2 wire units, which may be described as variable reluctance sensors or magnetic pulse generators, etc. They do not have as clean a signal as hall effect, but generally more durable (simple coil). As with the hall effect, they are typically rated -40 C to 150 C (300F).

For 2004-2006 Sportsters, the voltmeter red lead is connected to ICM position 8 and the black lead to ICM position 9.

For 2007-2013 Sportsters, the voltmeter read lead is connected to ECM position 30 and the black lead to ECM position 12.

Note: This is a sine wave and requires the AC scale
While cranking: ~ 0.3 VAC
At idle: ~ 1 VAC
Static: N/A

When your bike is not starting, this basic test will validate a functional CKP or indicate a failed CKP. A failed unit will not provide a signal. However, this is not sufficient to test for a failing unit with inconsistent output.

Spark plug secondary cable testing
Most electronic ignition module manufacturers recommend 3,000 ohms per foot, although some “high performance” cables are less.

Bank Angle Sensor (BAS) Bypass, prior to ICM, ECM models
The BAS (under the “ignition” triangle cover) has three wires and receives power from the gray wire (from the ignition fuse) which also powers the “engine stop/run switch”. If removing the sensor, that 12 VDC wire will need to be capped. Connecting the light green/gray wire (from the module) to ground, via the black wire, will provide run mode.

Ignition Module Bypass
The ignition module closes the coil primary circuit to ground. Based upon a timed signal from the cam sensor, the module opens the primary circuit, causing the secondary (high voltage) winding to discharge through the plugs to ground.

To verify that wiring and other components (coil, plug wires, plugs) are OK, when a failed/failing ignition module (pre 04) is suspected, try this: Pull the coil wire (at the coil) to the module (not the 12VDC to the coil primary). If connectorized, pull the connector, then jumper 12 VDC to the + side of the coil.

Note: The coil has no actual polarity. + & - are irrelevant, but + denotes incoming voltage and – denotes side to be grounded through the module. In other words, do not ground the incoming voltage without the load/resistance of the coil

Ground the ignition module side of the coil (-), then remove ground, expecting one spark (plug out of head, in secondary wire, plug prong grounded). If done correctly and no spark, then the problem is NOT the module.

Stator and regulator testing

Measure stator resistance to ground (∞) and stator resistance (0.1 to 0.5 ohm, depending upon system), pin to pin.
22 amp system ~ 0.2 to 0.4 ohms
32 amp system ~ 0.1 to 0.2 ohms

If you have a diode setting on your multimeter, you can use this test sequence adapted from JPCycles.

Generally, I just figure that if wiring (double check regulator ground)and stator check OK, blame the regulator.

Regulator Test: Each of the following tests isolates the regulator only, so if any of these tests fail, the regulator is at fault.

Identifying Wires:
Battery Charge Lead– Wire going from regulator to battery positive.
AC output leads– Wires coming from the Stator to regulator.
Ground– Wire from Regulator to ground or regulator may be grounded via the physical bolting to chassis.

Regulator Ground Test: Insure the regulator body is grounded or grounding wire is fastened tight to a good ground (you should verify this by checking continuity from regulator body to chassis ground).

Fwd/Reverse Bias Test/Diode Test: This check is testing the Diode function to ensure it is regulating the AC current for the stator into DC Current.

Switch multi meter to Diode Scale.
Place your Multi meter positive lead on each AC output wire.
Place your multi meter negative lead on the battery Charge wire.
The meter should read voltage typically around .5 volts.
Next, switch your multi meter leads putting the negative lead on the AC output wires and the Positive lead on the Battery Charge Wire.
The reading should be Infinite.
With your meter on the same setting, place your multi meter positive lead on the regulator ground wire or to the regulator directly, and then place your meter negative lead on the AC output leads. The meter should read voltage typically around .5 volts.
Next, switch your multi meter leads putting the negative lead on the regulator ground and the Positive lead on the AC output wires.
The reading should be Infinite.

BASIC TROUBLE-SHOOTING SEQUENCE

When the key and stop/run switches are on, but starter does not operate/no electrics, check voltages and insure that there is voltage past the keyed switch to all the fuses.

If the battery is good, the keyed switch has no voltage drop, the fuses are good, then battery cables are a common problem. Check (inspect/tug) BOTH ends of BOTH battery cables, especially the frame/motor end of the negative cable.

When a bike won’t start and yet the motor will turn over (starter will crank), my typical approach is –

1. Does it kick over “normal”? The first 10 of my 13 bikes had kick starts and it was easy to feel the compression. Without that feature, pull the plugs and put a finger over the plug hole while cranking. If you’ve had the bike a while, the amount of pressure should feel normal. If you have a compression tester, all the better. If rings are not excessively worn, no hole burned in piston and valves operated normal, then move on to the next step.

2. Were plugs wet, when pulled, after trying to start? If not, check for fuel flow (does accelerator pump squirt?…if not (and pump diaphragm is intact), then check if -
a. petcock screen not clogged?
b. fuel tank cap venting?
b. petcock flowing (vacuum connected on the vacuum operated)?
c. fuel in bowl (open drain screw [N/A on 1200S] is quick way to check)?
d. if a-c are OK, then remove carb bowl and check float valve not restricted with debris
e. float level correct?
f. If unsure, does starter fluid get it going? If so, then it is a fuel/fuel mixture issue. If you have fuel, then move on to the next step.

3. With plugs out, plugs in high voltage boots, plug prongs grounded (typically to cylinder/head cooling fins), kick the motor or operate the starter. Check for strong bright blue spark. If none, or weak, then check -
a. voltage to coil primary (should be same as battery voltage)
b. measure coil resistance
c. check high voltage plug wires (both ends)
d. check spark plug condition
e. check coil primary connection to points/ignition module/ICM (04-06)/ECM (07-13).
f. If EVERYTHING checks good, but still no spark, then it may be the points/condenser or nose cone ignition module/cam sensor (thru 03)/or the crank position sensor (CKP) 07-up.

Electrical maintenance
Check BOTH ends of BOTH battery cables: Inspect, tug

For 2007-2009, especially:
Remove chassis/harness ground (top of trans, clean external and internal threads, apply copper based (conductive) anti-seize and reinstall. Or at least measure resistance from top of chassis ground wire lug to battery negative post. Should be 0.1 ohm or less.
Pull maxi fuse, remove all fuses, clean front and back of fuse block. Reinsert fuses, reinsert maxi fuse.
Replace system relay if more than ~ 2 years old, less if parked or ridden in rain.

Screw Loose Dan - Rubbermount Jiffy Stands

Jiffy stand (aka kickstand) measurements for rubber mount Sportsters.

Since most folks wanting to compare jiffy stands are concerned with lean angle when resting, I measure them from the pivot point to the point they touch the ground, I deem this the “Useful Length”. The rough measurements can be made either on or off the bike. Either will get you in the neighborhood. The toe kick part of the jiffy stand can add significantly to the overall length.

For example here is a jiffy stand on/off the bike being measured (not sure what this stand is):

In either case, you can see that the stand is ~10.5”.

Here are some measurements I've taken:

PN	Useful Length (in)
50124-09BHP	~9.6
50238-07BHP	~6.3
49722-07BHP	~10
50185-04	~8.5

Pictures of these measurements can be seen in this post.

Trickle Charger

Destination: Ref-Electrical

Trickle charger pigtail location on 98 model [2]	Trickle charger below & to the rear of the battery box on 94 on model [3]


Ironhead Frames - Various XLF Members

Destination - IH Body Parts

1972 and earlier……….

piniongear http://xlforum.net/forums/showthread.php?t=1476377
Where the solo seat would go is a cast member that the tubes of the frame connect to. I went out to the shop to look at my 1971 frame in the same location as you showed in your picture. Mine is cast as 47650-67. So my 1971 carries this piece as a 1967 design, same as yours, but mine has a slightly different part nimber in that it is 47650 rather than 47658 as yours is. This difference I cannot explain. Frames 1970 through 1972 are the exact same. In my 1959-1969 service manual the frames for those years are given the exact same dimensions as the 1970-72. The 1973 is quite different in design and dimensions are different too.

Monte03 http://xlforum.net/forums/showthread.php?t=1476377
Neck numbers are not representative. On pre 70 Sportsters, the year the frame was stamped for use was under the seat right casting, these frames may have sat in a factory rack a year prior.. this is the lug that would be used for the Large Gas Tank.. did you look??

ironheadjunkie http://xlforum.net/forums/showthread.php?t=1476377
If you have a seat boss (circled in red)should be a letter and number Letter = Month & Number = Year. The Suffix numbers XXXX-52 is the year the casting was made. Also what type of upper motor mount do you have, Cast or Pressed Steel? Your frame looks to be a post 72 from the area circled in red, there should be some numbers on the neck circled in green!!! The last picture I posted would be along the line of how the frame would look if it was a pre 72.

16ouncePBR http://xlforum.net/forums/showthread.php?t=1476377&page=2
My take is that it is a 67-69 XLH frame due to the lack of neck VINS and the -67 casting numbers. 4 CH frames would not have the dogged legs to accommodate the big electric start batt, etc. 4 Also know as the start of the long frame Sportsters.

1973-1978…………

piniongear http://xlforum.net/forums/showthread.php?t=1476377
In 1973 the frame was changed and the steel casting was eliminated and replaced with steel straps which covered the two frame tubes having the open holes. (these two holes held the supports for the original solo seat.) See the flat metal 'shelf' on the right side of the casting piece? This should have 2 holes drilled in it. The 'shelf' was used to mount the start/light switch on some models. In 1971 many switches were located there, but my 1971 has the switch mounted above the horn on the left side. This is how it came from the factory and has the different wiring harness to back that up. H-D mixed and matched with this feature it seems.

1979-1985……….

Chevelle http://xlforum.net/forums/showthread.php?t=1514522
Like I stated, I have installed earlier engines in newer frames, but not vice versa. This does not necessarily apply to his post, just mentioning to possibly inform anyone who's interested. If using a 82-84 frame the front plates are larger like the early style, but the 82-84 plates are shaped differently and only work for 82-84. The same goes for a 82-84 rear motor mount. The early engine will not fit into a 82-84 w/o the 82-up rear mount. I assume the same for 77-up engines, they will only fit into 82-up frame w/ 82-up rear mount. I do not know if a 77-up engine will fit into an earlier frame. I don't know if a 82-up rear mount in this situation would be needed or not. I don't know if it will physically fit (the sump) between the frame rails. I do know a EVO enginewill fit into a 82 frame. This was only after my buddy attempted to do it. He was told over and over on different Internet sites that it was impossible.

Threads:
“Ironhead Animal Mother Reigns!” by snow http://xlforum.net/forums/showthread.php?t=1615459

Who - Subject

Go To Technical Menu

1)
Post#179 - http://xlforum.net/forums/showthread.php?t=2039687

2)
photo by Hippysmack

3)
photo by IXL2Relax of the XLFORUM http://xlforum.net/forums/showthread.php?p=5672190#post5672190