Basic coilover setup instructions:

Let's begin with some terminology. Keep in mind this stuff is a bit of a brain twister and you can fully expect to wear this document out reading and re-reading it. Researching other setup instructions will often give you the same info in another form which will help you learn too. This takes a little work.

Target ride height: height you want the truck to sit at when it's loaded and ready to wheel. AKA "static ride height".

Full Droop: axle position when the axle is hanging all the way out or dropped all the way down. With a 14" travel shock, there will be 14" of shock shaft showing. In the real world there may be a little less than full shock shaft showing at full droop because the limit straps can and usually should hold the axle up from full droop on the shock.

Full bump: Axle position when the suspension is fully compressed. At this point the shocks will be collapsed all the way and the bumpstops should be as compressed as they can get. Also known as "full stuff". Again, in the real world you should have a little shock shaft showing when the bumpstop is fully compressed just to make sure you're not bottoming on the shock.

Coil adjuster nut: The big nut that runs up and down the threaded shock body and presses on top of the coil stack.

Combined spring rate: The effective spring rate of the two coil springs when they're stacked on top of one another on a coilover shock. With identical spring rates top and bottom the combined rate will be ½ the rate of one spring. 250 over 250 will give a 125#/in spring rate. If the springs are different rates top and bottom use this equation to find combined rate:
1/top rate + 1/bottom rate = 1/combined rate (easy with a calculator with a "1/x" button)
Or use:
Combined = (x*y) / (x+y)
Common examples for a GM truck:

250/250 = 125	250/300 = 136
250/350 = 146	300/350 = 162
350/350 = 175	

Slider stop nuts: The thin nuts that stop the coil divider/slider from traveling up the shock body. The slider hitting the stop nuts will "lock out" the upper spring and make the suspension see only the lower springs' rate. See the slider stop nut setting section below for more details.

Dual rate springs: This term is used improperly a lot. Two springs stacked on top of one another will work at a single combined spring rate till one of them is made to stop traveling. It doesn't matter if the two springs are the same rate or two different rates, they will combine to one single rate. You can use the equations above to see this effect. The only proper use of the term "dual rate" is when you are using the slider stop nuts to stop the upper spring from moving and thus transition from the combined rate of 2 springs in the stack to the single rate of the bottom spring in the stack. There are more details in the stop nut settings section below.

Ride Load: the weight on the spring stack with the truck just sitting on the springs. Aka "static load"

Zero Preload position: Install both coil springs on the shock body. Leave the limit straps detached. With the shock at full droop dial the main coil adjuster nut till it just touches the top of the coil stack. This is your zero preload position. Record the measurement from the top of the adjuster to the top of the threaded body. From this point you will add preload to the spring stack to raise your ride height.

Now let's actually start working.

Setting Ride Height: There are 2 ways to pick a ride height for your coilover system on your truck; one is minimum height, the other is a set "lift" height.
To set it up with minimum height you'll start with the axle fully linked and, with the springs removed from the shocks, push the axle up to where it runs into something solid. Chances are you will end up with the top of the diff hitting a crossmember or the frame, maybe the steering hits the frame, maybe it's even the front driveshaft hitting the exhaust system or tire clearance to a set component. Then you decide if it's worth it to change your contact point. Sometimes changing the panhard bar length helps clearance, maybe you re-work whatever component is hitting, etc. At some point you're going to come to a part you don't want to change and that will set your full bump position for the suspension. That is your totally bottomed point and bumpstops should be set to make sure that everything absolutely stops before any damage occurs. Your ride height is when the axle is 7" (or roughly mid shock travel) down from this point. To set the upper coilover mounts, put the axle up to the bumpstops (full bump position) and collapse the shock fully with the lower coil cup installed. The top of the shock will be at the elevation it needs to be mounted. Allowances may need to be made in the shock mounting and bumpstop settings for things like tip wear on a hydraulic bumpstop. Lighter vehicles can bottom out on the shocks but this tends to bend mounting bolts so a proper bumpstop is preferable.

To set the truck at a specific "lift" height, set your frame and axle the distance apart you desire and this is your ride height setting. On a straight axle GM the stock measurement from the bottom of the frame to the top of the axle tube is approximately 8.5". So if you want a 6" lift, set that gap at around 14.5". Cycle the axle up from there by approximately 7" and make sure the axle is not going to hit anything besides the bumpstops when it bottoms out. At this full bottom out position collapse the shock fully against the coil cup and the top of the shock will be at the elevation above the frame where it should be mounted.

You can also set the upper mounting point for the shock by extending the shock 7" and putting the axle and frame at the separation you desire at ride height. Then the top of the shock will be at the correct mounting elevation. An easy way to hold the shock at this point is to cut a piece of wood, steel or just about anything to the length of shock shaft you want showing and tape it to the shaft. Then set the body down on your spacer and the shock will stay at the point you set.

In general, at ride height you're going to want to be roughly centered in the shock's travel. For a 14" travel shock you should set your ride height to where there is about 7" of shock shaft showing. I'm using words like "about" and "roughly" on purpose here, the coil retainer cup will use up about 3/8" of travel and you don't have to be super precise with this ride height at this point. If you're within ½" you're close enough for basic setup. If you have a specific ride height to hit you'll want to measure it all precisely.

Spring rate selection:

Start your initial ride height set up by installing your springs on the shock and droop the suspension fully. With the axle hanging on the shocks, dial your coil spring adjuster nut down to where it just does put some tension on the coil spring pack. This is your zero preload point. Record the distance from the top of the adjuster nut to the top end of the threads on your shock.

Now put the truck on the ground and measure how much shock shaft is showing. Subtract that from total shock travel and that's how much your spring stack compressed from full droop to ride load.

ZERO PRELOAD THREAD DISTANCE:
ZERO PRELOAD COMPRESSION TO RIDE LOAD:

At this point your truck should be sitting lower than ride height by some amount. The specific amount is more of a tuning detail but you should be sitting ½" to 2" lower than your target height. This will allow

you to add preload (dial the adjuster nut tighter) to bring the truck up to your target height. If the truck is sitting too high with zero preload, you cannot lower the truck since dialing the adjuster nut up will allow the coil stack to come loose at full droop. In actual use this could lead to the coil stack falling apart and jamming up in the mounts. You don't want to do this so don't run less than zero preload.

If your truck is sitting taller than your target ride height at zero preload, you need softer springs. You can use the technique below to find your new rate or this could be a good time to give us a call and we can recommend a new rate.
To find your proper starting spring rate you divide the weight on the spring stack (static load) by the desired compression travel to get to target ride height.
Compression travel to ride height on a known spring pack can tell you exactly how much weight is sitting on the coil stack. Multiply your compression to ride height by your combined spring rate and the answer is the weight on the stack.
For example: 6" compression with a 175# combined rate (350/350 springs) is 6" x 175#/in = 1050#.
You really want the truck to sit lower so that it compresses 8" under the static load so you need lighter springs. 1050/8 = 131.25#/in. This is close to a 125# rate that you would get from a 250/250 coil stack.

Coilover springs don't settle at all so there's no need to drive the truck before doing ride height measurements. Coilover springs are extrememly durable compared to the leaf springs many people are used to. They won't change rate and should not settle or change free length over time so what you have when you first install them is what you will have years down the road. When changing springs you will need to wiggle the truck around to overcome the sticking friction of the shock and we do this by rocking the truck side to side by hand and letting it settle (or sometimes forcing it to settle with our hands) back to center.

One wild card in this spring selection equation is the shock's gas pressure. Gas pressure will take load from the spring stack which can make a difference in spring selection on lighter vehicles. On a heavy truck it's not too big a concern but should still be considered. Typical load taken from gas pressure is 80-120#. Exact load carried by the gas pressure can be calculated by finding the area of the shock shaft (pi *radius^2) and multiplying by the gas pressure at ride height. Area of a 7/8" shaft is .601 square inches and at 150psi this will carry 90 lb of load. This load will need to be subtracted from the total load on the shock for spring calculations. This gas pressure load is obviously greater when running a dual shock system like a coilover and bypass shock. For more details see the section on gas pressure settings below. Just make sure your shocks are gassed when doing ride height/spring rate calculations.

Coil slider stop nut adjustment: The slider stop nuts are the two thin nuts on the body of the shock that stay inside the coil spring. The purpose is to stop the coil separator from sliding up the body of the shock which will make the coil stack transition from both springs compressing to just the lower spring compressing. This makes the overall rate change over from the combined spring rate to the single rate of the lower spring. This is why coilover spring packs are sometimes referred to as "dual rate". The dual rate term has nothing to do with the fact that you could have 2 different rate springs on the coil, it's because you can block the upper spring out of the equation making the lower spring the only one active.

For initial setup, keep the coil slider stop nuts within 2-3" of the main adjustment nut. This will keep them from engaging essentially making them act as if they are not there. Once spring rates and ride heights are set, you can play with the stop nuts to add a little bottom out resistance, a little body roll control and/or adjust the articulation balance from front to rear. For high speed use the sliders typically engage to bump the spring rate close to full bump to give the axle some extra push away from the chassis to get the wheels on the ground faster. Typically you would want the slider to engage in the last couple inches of the suspension's travel and the easiest way to set this is to just articulate the suspension till you are showing approximately 1.5" (for example) of shock shaft and measure where the coil slider is riding on the shock. Then droop the suspension and adjust the slider stop nuts to this position and twist it up again to test your setting. This engagement point can be calculated but this is the simplest way to set it without a bunch of

brain twisting.

Gas Pressure: Your shock reservoir has a dividing piston in it to separate the gas charge from the oil. The high pressure gas keeps the oil from cavitating (boiling and foaming under negative pressure) so that the damping remains consistent. The shocks must be charged before the vehicle is driven. A minimum is a 150psi charge installed when the vehicle is sitting at ride height. Charging the shock when the suspension is fully drooped is more consistent and will give a higher gas pressure. Higher pressures are important for more aggressive use with a coilover to push the oil through the valve stack on a hard compression hit. We run roughly 200psi at full droop in our Ultra 4 car and many vehicles run more for that type of use.
It's not a bad idea to put a charge of roughly 10 psi in the shock when you're cycling the suspension just to make sure that the piston moves properly with the oil level as the shaft moves in and out.
Nitrogen is the gas of choice for the gas charge in your shocks. Honestly, we've used CO2 for years with no bad effects in recreational vehicles since it's much more common than nitrogen shock gassing systems. Often a motorcycle shop will have a nitrogen charging system and could charge your shocks for a minimum fee. In a pinch shop air (DRY!) is better than no charge at all. Just purge the shock when you can and replace the air with a dry gas.
You can use a standard regulator gauge and tire filling type hose to set the pressure with good results. Set the regulator to your desired pressure then fill the reservoir just like you would a tire and you will hear the gas stop flowing after several seconds. Pull the chuck off quickly to keep leakage to a minimum and you're done.
A more accurate method is to use a dedicated shock charging tool like the one built by King. This will have an accurate high pressure gauge and a zero loss fill fitting for the most accurate gas charge.
DO NOT try to install your shocks at any suspension position other than full droop when there is a gas charge installed. There is enough force there that it's difficult to install them and will smash your fingers pretty good if they get away from you. Install them at full droop or with no gas.

Bumpstop setup:

The bumpstops primary job is to prevent damage on full bottom out. They can get hit HARD in aggressive use so the mounts need to be built appropriately. The stops must be set to be the only thing stopping the suspension. You don't want to bottom on steering components, your oil pan, etc. We've tried these things and they are a bad idea! This is where the precision of a hydraulic bumpstop is great. You can set the bumpstop to stop the axle within ¼" or so of important parts and trust that they will do it. If you're using a polyurethane bump, remember that they really don't have a precise bottom out point so you may want to leave some extra room.

Bumpstop mounting location can make a big difference in how they protect things. If the bumps are mounted narrow on the chassis they will put more load on the axle and won't protect as well in one wheel bump situations. We feel that mounting the bumpstops directly in front of or behind the coilover is the best system but that's often difficult to package. In general keep them as wide as you can.

Limit strap setup:

The limit straps' job is to prevent the shock from hitting full droop with the full force of the falling suspension. The shocks are not necessarily fragile but in droop they're essentially held together with a snapring and it's possible to damage the ring or the grooves with a hard pull. Limit straps have some stretch so on initial setup you'll want them to hold the axle short of full droop on the shock by about an inch. The straps will stretch more when wet. One in-use tuning tip that we've used is that you can twist the straps to shorten them. Keep an eye on the limit straps' location when they axle is at full stuff. Sometimes it's possible for the strap to get between the bumpstop and strike pad and the straps don't really like that. A good way to control their location through the suspension's travel is with some small bungee cords to pull them to the correct locations when they are slack.

Summary (most important details):

Mount your shocks to run at approximately mid travel at ride height. Make sure nothing collides at full bump besides the bumpstops.

You want a minimum of ½” of preload on your spring stack front and rear. Most setups use up to 2” of preload. If you have more than your desired preload amount build a stiffer spring stack. Less preload than your desired amount requires a softer spring stack.

Gas your shocks to a minimum of 150psi at ride height and never run them without gas pressure.

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Rear Coilover Conversion Instructions, ‘67-‘87 (‘91) GM Trucks

****There is extensive welding work required to install this kit. The welding involved will be critical to the safe operation of the vehicle. If you are not comfortable with your welding skills on a project of this type, find a qualified welder.****

1. If the truck is still leaf sprung, now is a good time to run a plumb bob down to the axle and mark the current axle location on the frame, this will help align the rear axle as well as give a reference for where you’ll want the axle to sit front/back.

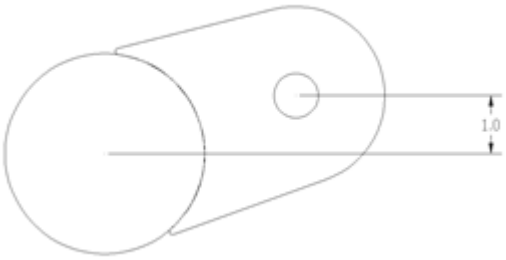
2. Remove all of the leaf spring perches and shock mounts from the axle so you’re starting with clean axle tubes.

3. Place the truss onto the axle and install the pinion support brace. You can place a handful of heavy tack welds on the truss to hold it in place, it basically locates itself.

4. Place the axle on jack stands under the truck at roughly the height it will be at with your wheels/tires on it. Center the axle front/back approximately where you want it to be (there will be adjustment at the end). Put a third jack stand under the pinion so that it points approximately where it needs to end up to suit your driveshaft configuration.

5. Place the lower link brackets on the axle tube as far out as possible, while keeping in mind that you’ll have to weld all sides of the bracket so make sure to keep room for that. The lower links are wider at the axle and closer together at the frame, make sure that the brackets are on the

correct side of the axle. Once the bracket is positioned as far outboard as possible, rotate it so that the mounting hole is 1” above axle centerline and place a handful of heavy tack welds on it to hold it in place. Repeat for the other side of the axle.



6. Set the frame on jack stands at approximately the ride height you want to end up with. Again, make sure the axle is under the truck on jack stands at roughly the height it will be it with wheels/tires on it and set front/back where you want it to be.

7. The axle side bracket placement is pretty well set as mentioned above, the frame side is more variable.

For a 4” or lower lift height, most people will set the frame side mount 41” forward (center of mounting hole to center of mounting hole) from the axle side mounts. Hard core rock crawling guys may want to mount it further back to make the links harder to hit and bend, guys that are more go-fast/desert oriented and/or don’t care about the clearance may want to move the bracket further forward to increase link length and help geometry at the extreme ends of travel. Most will end up at 41” center to center on the mounting holes but moving ~6” either direction for your specific needs is perfectly acceptable.

At around 6” of lift height, it isn’t recommended to move the frame side bracket any less than 41” center to center on the mounting holes. Moving the bracket forward on the frame will help geometry/drivability on a truck that sees high speed cornering.

Anything 8” of lift and up, plan on moving the frame side bracket as far forward as you can, usually right to the back of the transfer case on a shorter wheelbase vehicle.

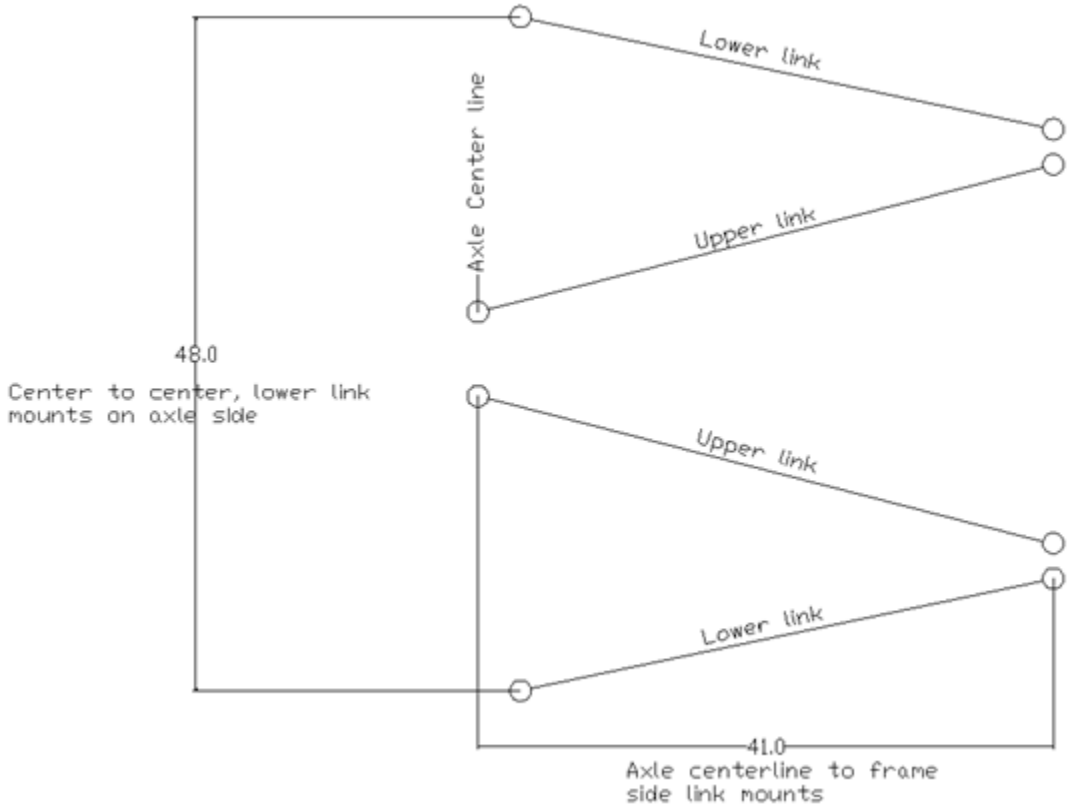
The frame side mount is always made at the best compromise. The further forward it is, the longer the links and the more gentle the geometry change of the suspension. However, the longer links are easier to hit on trail obstacles and easier to bend. Take the guidelines above into consideration and feel free to give ORD a call for advice.

Frame side bracket vertical placement.

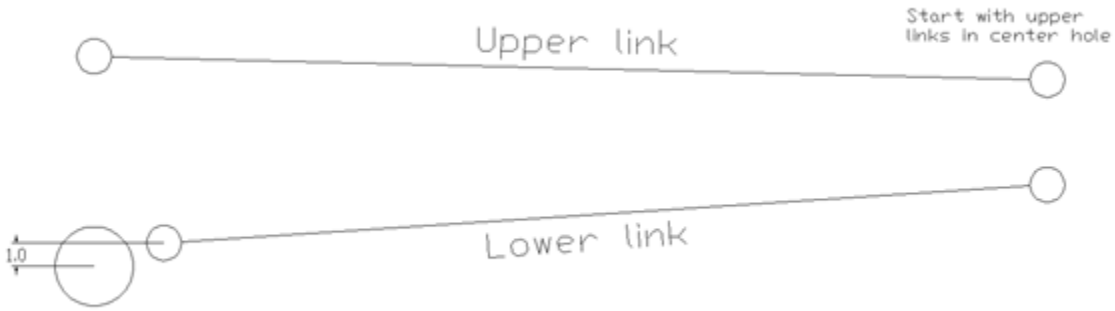
Our rear coilover bracket is designed to be mounted at the height of the lowest point on the frame which works out well for K5s, suburbans. T rucks have a frame that steps up behind the cab and leaves the location for the link brackets higher than the belly height. We have found the cleanest way to change the mounting elevation for the link bracket is to fabricate a frame extension to essentially make the bottom of the frame flat from the belly section to the link bracket mounting location. Sectioning a length of rectangular tubing has worked well for this as well as fabricating the extension from plate and/or strap. Here is an example of a sectioned tube extension:

The big benefit of dropping the bracket is that it sets the anti squat characteristics of the suspension to a much more neutral zone. A good side benefit is that this will give you more room to run the exhaust over the bracket and link arm.

This diagram should give you an idea of how the links will lay out when looking from above. The two dimensions shown below are the only two you need to worry about, the rest are set by our brackets.



This is a side view and here again, most everything is set by our brackets. The main point here is to make sure the bolt hole for the lower link mount on the axle side is 1” above axle centerline with your pinion angle within a couple degrees of its final rotation.



8. Choose a mounting point for the frame side brackets and place a handful of heavy tack welds on the frame side brackets. Don't mess with any of the gussets at this point, those will go in during final assembly.

9. Measure center to center between the mounting points, measure your inserts and joints (don't forget about the jam nuts!) and cut link tubing to length.

10. Put the insert and Johnny Joint into one end of the tubing and cope the other end for the flex joint. Tack weld the insert and flex joint housing to the link tubing. Install links on to brackets, there is a small spacer included for the Johnny Joint end.

11. At this point you can evaluate if you're happy where you chose to put the links and where you chose to put the axle. The links probably won't have any clearance issues but you can watch out for those at this point.

12. Make sure the truck is set at ***final*** ride height i.e. set the body/frame at the lift height you want to end up with, tires don't matter at this point, just distance from axle to frame. Once that is set, you can set the shock hoop height. The springs that we provide should settle halfway through the shock's travel, so we'll set up the shock hoops with the shocks midway through their travel (typically 8" of shock shaft showing).

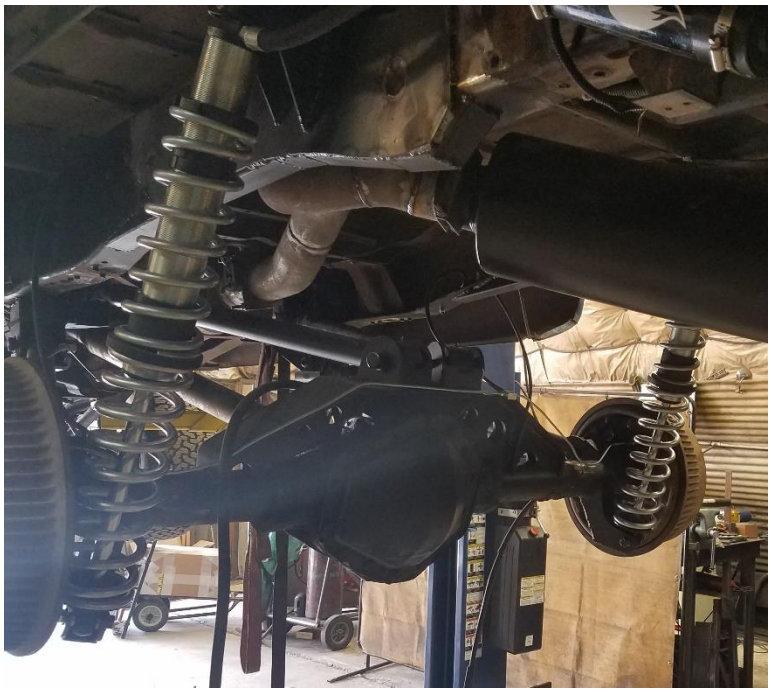
    If you're using 16" travel King 2.5" remote reservoir shocks (the shocks we send with most kits), you'll want the shock eye to eye mounting distance to be 34". If you're using your own shocks, you'll want them at the center of their travel. When setting the shock hoop height make sure to account for the length of the shock tabs that weld to the hoop. One trick for mocking up the shock mounting parts is to cut a piece of material (wood, steel, whatever) to length at half the shocks travel (7" for a 14" travel shock) and

tape it to the shock shaft (with the springs removed) so that the shock will easily sit at halfway through its travel.

13. It is possible to set ride height above or below mid-travel in the shock, but always make sure that rear has at least an inch more bump travel than the front. The vehicle can become unstable if the shocks bottom out and aren’t setup that way.

14. A: Now you’ll have to attach the shock hoops to your frame. At most lift heights, there is a good chance you’ll have to bring the shock through the floor of the truck. Individual fitment will vary and this is the main part that takes some fabrication. Make sure that the shock mounts are the correct distance apart (from the last couple steps). Rear shock placement is relatively forgiving. Mounting directly to the top of the axle tube is common and tipping the top of the shock forward 15 or so degrees is fine and will increase suspension travel a little. Another common mounting system is to mount the shock off the back of the axle tube and run through the floor behind a back seat.

    B: If you’re using our underbed upper mount, the upper bracket placement is relatively open but in general you’ll want the shock as vertical as possible and with the upper eye as close to the bed as possible. From there, the lower eye of the shock will mount off the backside of the axle tube and toward the outer end of the axle. It’s common to mount the shock eye lower than the axle tube and often by several inches.



15. With the springs removed from the shocks, mount them to the frame and axle. Everything should be ONLY tack welded at this point.

16. Now you need to cycle the suspension. There are six main positions you’ll need to check, those are:

Both tires at full compression
Both tires at full droop
Driver’s side at full compression, passenger’s side at full droop
Passenger’s side at full compression, driver’s side at full droop
Driver’s side at full compression, passenger’s side at ride height
Passenger’s side at full compression, driver’s side at ride height

Don’t forget to check tire clearance because the linked up suspension will follow a different path than the leaves did.

17. An engine hoist is a good tool to use to cycle the suspension. A simple floor jack and wood blocks works fine too. As the suspension cycles check everything you can. You ***cannot*** cycle the suspension enough, finding clearance issues now will save a lot of time later. Make sure to install one of the tires you’re going to use on the compression side of the axle as you cycle the suspension, this will help you determine fender clearance issues and you’ll be able to see if there are tire to spring clearance issues.

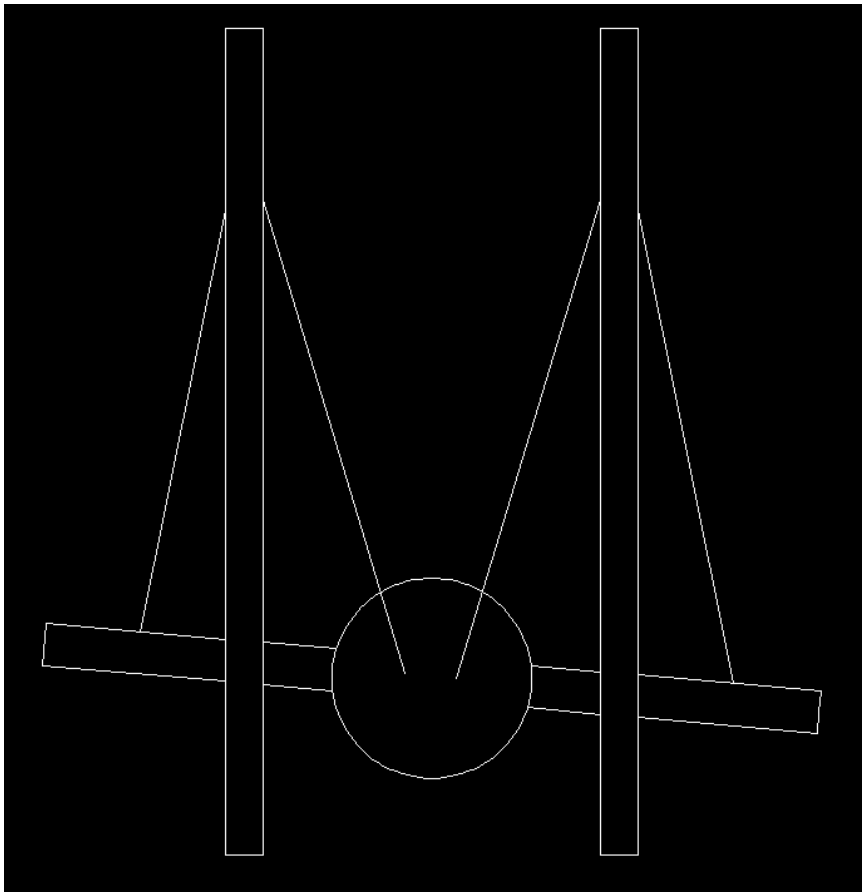
18. A note on clearances: with a link and coil system the axle path is very well defined compared to other suspension systems like leaf springs that are much less precise. It IS POSSIBLE for you to check EVERY location the axle could ever achieve relative to the frame and body. Don’t build your tolerances so tight that a change/adjustment will cause interference and allow some room for bushing deflection, bump stop deflection, etc.

19. When you know clearances are all good, you can final weld all the parts. Be reasonable with the welds on the threaded bungs for the links, you don’t want to distort the threads. They need to be secure, not overdone. In any custom suspension there will be plenty of places where extra bracing and gussets will be necessary. You can consider the components in our kit as the bare bones with plenty of places appropriate to add in for your needs.

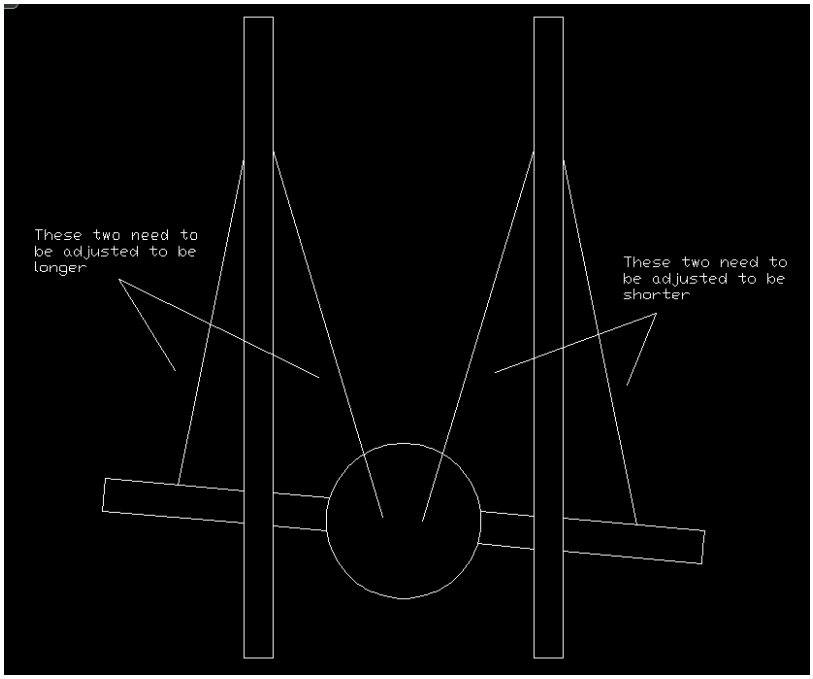
Rear Coilover Adjustments

To adjust your rear 4 link to make the axle square with the chassis, follow these guidelines.

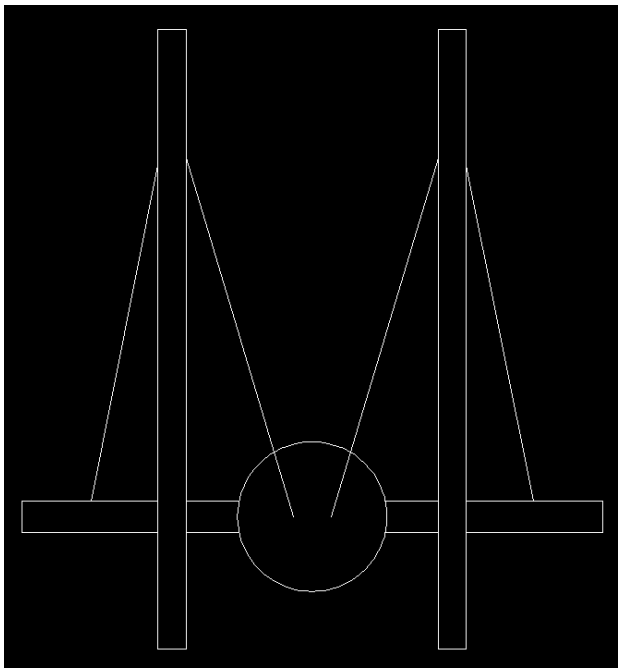
In this situation, the axle isn’t parallel with the chassis:



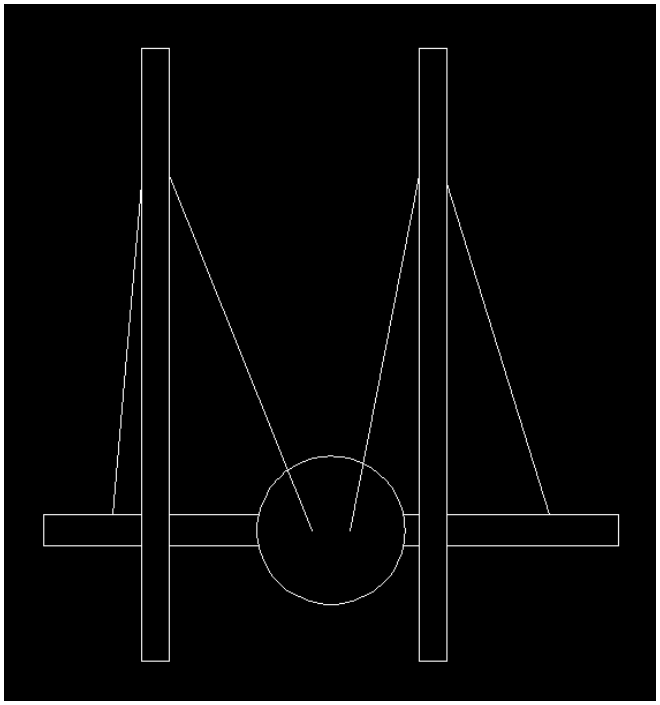
To fix this, you’ll have to make two of the links longer and two shorter by threading the links in/out:



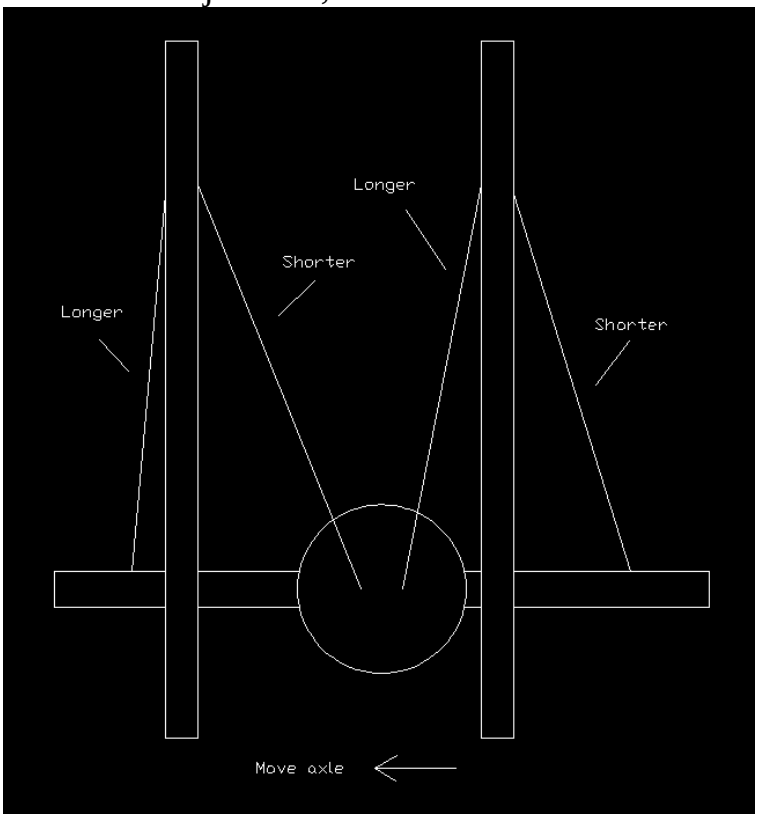
By adjusting the link length as shown above, you can make the axle square with the chassis:



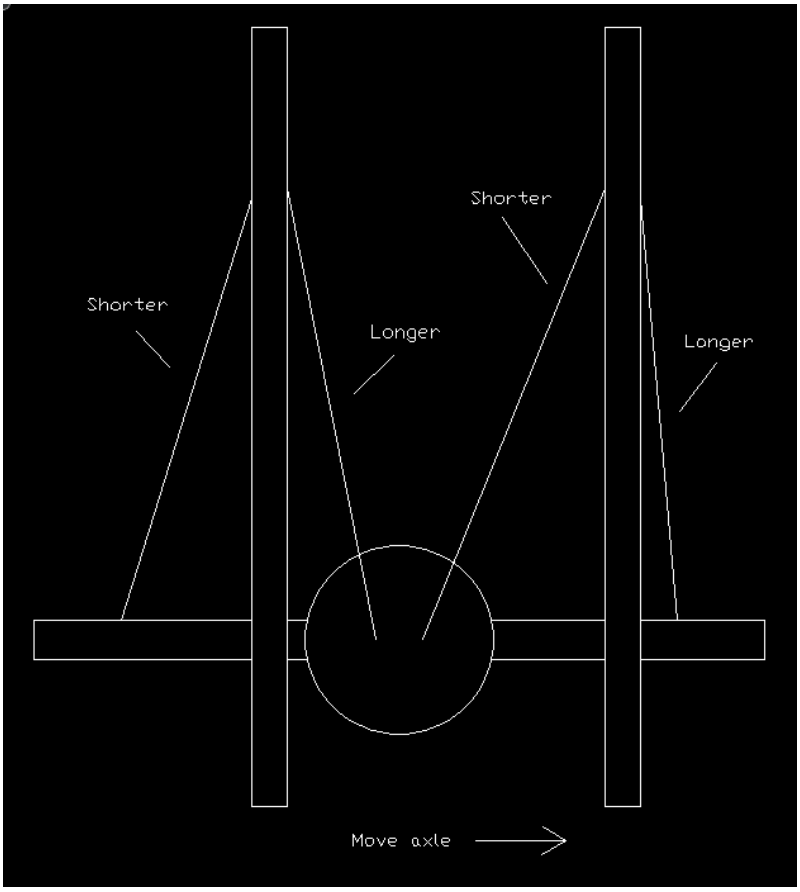
In this scenario the axle is offset to one side:



To adjust this, see the notes below:



To move the axle the opposite direction, see below:



To change wheelbase, adjust both **lower** links by the same amount.

Pinion angle is the last adjustment you’ll make, to change that you’ll adjust both **upper** links by the same amount.