

### What Is Hydraulic-Assist?

Instead of reading a long wordy novel you can view a video that quickly and easily explains everything at the following link <a href="https://www.youtube.com/watch?v=amM0eLL1EvU">https://www.youtube.com/watch?v=amM0eLL1EvU</a>

### **General Information**

- I have successfully used the stock power steering pumps and reservoirs from many different makes and models without any issues. There are a lot of opinions and recommendations on this topic on the Internet but I have done it both ways and I don't see a reason to change from stock.
  - Stock systems are great in that they are closed pressurized loops which in turn reduces cavitation in most styles of power steering pumps that lack the ability to pull fluid into the pump housing.
- You can expect a healthy stock power steering pump will output a maximum of ≈1300 PSIG to the system if you feel like calculating max turning forces on the knuckles.
- The on demand orbital valve that exists in stock style steering boxes allows ≈300 PSIG on the system at all times unless resistance in turning requires more pressure.
  - This is independent of RPM but note that max pressure will not occur at idle.
- Since the internal value is on demand it means that when the input/output shafts are not turning the fluid will only circulate through the system and through a fluid cooler which is highly recommended to increase the life of the parts in the system.

### Suggested Equipment

- Use appropriate PPE for each task.
- Typical Socket Set
- Blue Loctite
- Hydraulic Jack
- Jack Stands
- Torque Wrench

- Grinder & flapper disk
- Welder
- Impact Wrench
- Drip Pan
- Pliers/Channel Locks
- Flare Nut Wrenches
- Magnetic Dish

- Small Pry Bar
- 2-3 lb. Hammer
- 34 mm Socket
- Pitman Arm Puller (not the fork type)

#### **Recommended Parts**

- Transmission Cooler that will be added between the return line of the steering gear box and the power steering pump. Lots of options for this item, the main purpose is to remove the most amount of BTUs possible with the least amount of restriction to the system.
  - o <u>https://amzn.to/39kNy5x</u>
- You will need high pressure lines for the ram that will be mounted to the axle and they will need to be compatible with a 3/8 JIC(m) if you have your steering gear modified through bleepinjeep.
  - o <u>https://amzn.to/2vQVrlz</u>
    - I like the field attachable fittings/hoses myself as they are easily repaired on the trail if needed. Gates – G27170-0606 <u>https://amzn.to/3bqP3Re</u>
    - Use only Gates hose meant for field attachable fittings. The fitting listed here requires 3/8" ID.
- Of all the steering rams that I have used in the past I like the PSC version the best as it has a small footprint on the front axle and it is rebuildable. I have done this modification many times and the 1.5" bore size with an 8" stroke seems to work very well with little lag in steering response and ample power while on obstacles on the trail. You can get it with the hose kit or without using the links below.





- With Hose kit <u>https://www.pscmotorsports.com/8-travel-1-5-cylinder-assist-axle-kit.html</u>
- Only the ram and brackets <u>https://www.pscmotorsports.com/psc-sc2200k.html</u>
- Rebuild kit for 1.5" ram <u>https://www.pscmotorsports.com/psc-rbk-sc-1.5.html</u>
- Use the suggested power steering fluid recommended by the power steering pump manufacturer you are using with the system. PSC and I both recommend Swepco715: <u>https://amzn.to/2WW9At5</u>

#### **Steering Box Removal**

- Remove the bolt from the collar on the input shaft so that the shaft between the steering wheel and the gear box can be separated. You won't be able to slide it off until the last step.
- Remove the pitman arm NUT using an impact wrench.
- Remove the pitman arm from the output shaft. If you are having trouble removing the pitman arm you can hit the pitman arm with a 2-3 lb. hammer at the location shown below while the pitman arm removal tools' jacking bolt is tight. Go back and forth between hammering and retorquing until the pitman arm has been removed as seen below.





- Remove the bolts that secure the steering box to the frame.
- Slide the collar off the input shaft as you slowly lower the box. Sometimes a pry bar is needed on this step.





#### **Steering Box Modification**

There are really only a few options here;

- Option1: You can modify the steering box yourself by following the step by step directions that we have put together by going to the following link (<u>https://www.youtube.com/watch?v=d7BESAD\_EIY</u>).
- Option 2: You can send the box to us and we will do all the hard work for you while you fabricate the hydraulic ram
  installation by clicking on this link <u>https://bleepinjeep.com/product/hydro-assist-modified-steering-box/</u>.



• Option 3: You can send it to an expensive machine shop that doesn't do this very often.

#### **Ram Installation**

- The first step is locating a mounting point on the axle and on the tie rod/knuckle. Since there are many different suspension configurations and different complications that evolve from driver/passenger side differentials this will have to be mocked up with your specific setup. Below is what worked on a 1998 Jeep TJ.
- Some basic guidelines include DO NOT MOUNT the ram where;
  - The ram will make contact with any steering components through all motions of travel (i.e. far enough away from the axle but not too close to the tie rod.)
  - The ram will hit obstacles on the trail.
  - o The hydraulic lines will hit the frame or radiator fan.
  - The ram travel will bottom out before the steering box hits its limit (both left and right of course).
    - There are varying opinions to whether blocks should be put in the ram or not to limit travel.



- If you rely on the steering box factory limits the pressure will relieve in the system before stressing the knuckle.
- If you try and limit the steering solely with the knuckle limit bolts you will wear out your ball joints at an accelerated rate and possibly break the forged knuckle as excessive force can be applied in certain situations.
- The drag link will hit the ram when the suspension is fully compressed. The easiest way to do this is by removing the front coil springs.
- The drag link will hit or pinch the hydraulic hoses during travel.
- I chose this spot on my axle truss. Be sure to clean the steel with a flapper disk so that proper welding techniques can be followed.



• Next mock up a mount based on measurements to properly space the hydraulic ram away from the axle.







• During the mock up of the ram and mount to the axle it is suggested to use a jack stand or blocks so that you can triple check all measurements before welding starts (You should push the knuckles far left and far right to simulate max steering).





• The PSC kit comes with a 5/8" rod end and in my case, I needed a 3/4" rod end. A combination of drilling, cutting and tapping an adapter can be easily made.









Always do a final check to make sure fitment will be perfect prior to tack welding the bracket to the axle.





• Once tack welded remove the hydraulic ram, complete the welds, primer and paint.







• Reassemble the suspension components.



#### **Steering Box Installation**

- Since the input shaft collar is keyed having a second set of hands to hold the box while you guide the box onto the collar is very helpful.
- Next insert one of the frame bolts and turn a few times (it is just to hold the box temporarily).
- Apply Blue Loctite on the remaining frame bolt threads and install into the steering box.
- Remove temporary bolt and apply Blue Loctite to the threads of that bolt.
- Torque all bolts to manufacturers specification.
- Make sure the steering wheel is straight and (do not turn the steering wheel during this whole time while you have the steering disconnected).
- Make sure the gearbox is in the middle of its travel. (If you need to check, you can rotate fully one direction, then the other direction, then rotate back to the middle).
- Install pitman arm and torque to manufacturers specification.
- Install remaining steering components and torque to manufacturers specification.



• Now for the hydraulic lines. Most boxes are configured to output pressure during turning as indicated below.



NOTE: If your box is an oddity don't worry nothing will break it just wont turn. Switch the two hydraulic lines and you'll be all set.

- I am not showing a drawing to the axle since the ram can be mounted one of four ways. Just think about the high pressure and how it will move the piston in the hydraulic cylinder.
- Be sure not to over torque the hydraulic fittings. They do not need to be as tight as an NPT to seal and work properly. Normally snug plus a half turn is plenty tight.
- Fill the power steering reservoir with fluid.
- **Before you start the engine!** With the front axle off of the ground manually turn the steering wheel lock to lock until no air bubbles air appearing in the reservoir and the fluid levels stops dropping. It could take 3 Left/Right cycles or 10 just don't get in a rush.
  - Failure to do this step will likely result in power steering pump damage!!
- Start the engine on Jack stands and turn wheels left to right a couple times and keep topping off fluid... repeat
- Remove jack stands and go for a test drive.