

944 *Power to Manual Steering Rack Swap*

944s are notorious for leaky power steering systems. At least 8 out of 10 of these cars that I have been underneath usually have had power steering fluid covering the lower front of the engine bay and the various suspension bushings. The sway bar bushings on the passenger side usually die a horrible death due to the effects of said leaks. Leaks may come from the pump, reservoir, lines, or even the power rack itself.

Unfortunately, my power steering rack was completely trouble free, with nary a drop of fluid leaving the system. What's the problem then, you say? Frankly, I have always felt that the 944 power steering is over-assisted. I also feel that it does not offer proper "road feel", and feedback to what is going on. To further compound my personal issues, weight reduction procedures on my car in recent years have made the power steering seem like even more overkill. My decision to switch to manual steering was finally concentered by driving some early 911 cars and experiencing the marvelous steering feedback that they have.

Not all 944 cars came with power steering from the factory. The 1982 (European models) and 1983 cars came standard with manual steering racks. Power racks were added in the 1984 model year. Some sources state that this occurred due to Porsche's attempt to alleviate owner complaints of wheel vibrations experienced at the 60-70mph mark. The addition of the power rack insulated the driver from a lot of road feel, and thus most of the vibration issue. The vibration complaints lessened somewhat after this component change. It is now common knowledge that the vibration issue can come from one or a combination of many things: tires, tie rods, wheel bearings, ball joints, etc.

Besides early production cars, certain race-specific 944's came with manual steering. In particular, cars made for the Rothmans 944 race series (8V non-turbo N/A's) in 1986 had manual racks. 944 turbo cars made for the various Turbo Cup race series' in Canada, France, and Germany from 1986 through 1989 had manual racks as well.

OK, enough with the history lesson and onto the meat of this article. To convert the 944 to proper manual steering takes somewhat more than simply disconnecting the pump and fluid lines. This method works, but the ratio on the un-assisted power rack is wrong and extremely "heavy". To do it properly, you will need the following:

- 1 manual steering rack, part# 944.347.011.00
- 2 manual rack inner tie rod ends, part# 944.347.033.01
- 2 manual rack outer tie rod ends, part# 944.347.333.01
- Drivers side and passenger side rack boots, part#'s 171.419.831.c and 171.419.832.c respectively
- 1 manual steering rack intermediate shaft, part# 944.347.027.01

I sourced most of my parts second-hand from various 1983 model year 944's. This

article concerns doing the rack swap on a 1985.5 944 ("early offset"). The procedure is basically the same for all 1982 thru 1986 model year 944's, including the turbo models (the only notable difference on these models is the brake booster heat shield which gets in the way during intermediate shaft removal and replacement). Post 86 cars that have "late offset" share the same basic procedure, with one exception being in the parts list mentioned above. Post-86 cars have longer outer tie rod ends. For these you would need to source part# 944.347.033.03 from your local dealer, or custom aftermarket units from a vendor such as Andial. At this time, I would also like to comment that used intermediate shafts usually have a slight bit of play in the u-joints. If in doubt, purchase this part new (available from www.944online.com and www.paragon-products.com).

Following is a list of tools that are needed for this job:

- Jack Stands or Ramps
- Floor Jack
- Light
- Wheel Blocks
- 19mm - Wheel Wrench
- 19mm Wrench
- 17mm Wrench
- 10mm Wrench
- 12mm Wrench
- 13mm Wrench and Socket
- 30mm Wrench
- 6mm Allen Wrench
- 10" Adjustable Wrench
- 3 Quart Low Profile Basin
- Small Gear Puller (pickle fork)
- 8" long - 3/8" Drive Extension
- Flat Blade Screwdriver
- Cold Chisel
- 3" Vise with Soft Jaws
- 12" long - 3/8" Drive Extension

Preparation and draining of the system.

1. Park your vehicle on flat ground.
2. Apply the parking brake, open the driver's side window, block the rear wheels and disconnect the negative lead of the battery.
3. Use your 19mm wheel wrench and loosen the front wheel lug nuts just enough to allow easy removal after the tires are off the floor.
4. Jack each side of the car sequentially at the designated jacking points and place jack stands under the frame rails in the vicinity of the jacking points.
5. Remove the front wheels and set aside.
6. If so equipped (ala the 951 or S2), remove the black nose underspoiler ("batwing") or aftermarket splitter.
7. Remove the 7 undercover panel (belly pan) bolts using a 3/8 drive ratchet and 10mm

socket, and remove the undercover.

8. With the car secure, place the catch basin under the power steering pump. Using a 19mm wrench, remove the pressure line from the pump, and allow the power steering fluid to drain into the basin.

9. Turning the steering wheel lock to lock several times will help void the steering gear of fluid. Allow to drain completely.

At this time, I would like to mention that I found that removing the air box assembly (on a non-turbo 8v 944) made things a little more accessible while doing the work on this project. This does not have to be done, and will vary according to your model year and application.

Front Sway Bar Removal

Tools Needed: 13mm socket, 13mm wrench, 17mm wrench, 8 inch long 3/8" drive extension, flat blade screwdriver.

1. On the passenger side, use a 13mm socket and a 13mm wrench to remove the 2 clamp bolts holding the sway bar to the frame anchor.

2. On the drivers side, use the 13mm socket on the extension to remove the 2 bolts attaching the sway bar frame anchor to the frame. Removal of the frame anchor provides working clearance for Step 3.

3. Use the 17mm wrench to remove the nut attaching the sway bar to the control arm on each side, and remove the sway bar. With a screw driver, loosen the clamps on the alternator cool air intake tube and remove it also (if your car has the A/C delete option, this may not be necessary). You should now have a clear path to the steering gear shaft and lower universal joint on the intermediate shaft.

Disconnect Tie Rod Ends

Tools Needed: 19mm wrench, gear puller or hammer

1. On each side, use the 19mm wrench to loosen and remove the locking nut on the tie-rod end ball joint.

2. Use a small gear puller to disconnect the tie-rod end from the steering knuckle. If a gear puller is not available, a moderate tap on the top of the tie rod end bolt with a hammer sometimes works quite well to loosen and remove.

Disconnect the Steering Intermediate Shaft

Tools Needed: 13mm wrench, 13mm socket, 12 inch long 3/8 drive extension, short pry bar.

1. Turn the steering wheel until the universal clamp bolt head is in line with your access from under the car.

2. Reach in behind the steering column to put a 13mm wrench on the nut and use the 13mm socket and extension to remove the clamp bolt. The clamp bolt must be completely removed before the universal can be removed from the steering gear. Some light pressure from a small pry bar (or large screwdriver) should be sufficient to loosen the clamp from the shaft. The universal and clamp will not come all the way off until the steering gear unit is lowered.

3. Repeat step#2 above for the upper clamp. You may need an assistant to help you by holding a wrench on one side of the bolt while you undo the nut with the socket. It will

be confined and cramped underneath the brake booster, especially on a Turbo car.

Rack Removal

Tools Needed:

13mm wrench
6mm Allen wrench
Phillips head screwdriver
10mm wrench.

1. Use the 6 mm Allen wrench to remove the return line from the steering gear housing of the rack. Note that you should attempt to clear any gunk out of the 6mm Allen bolt head, and then lightly tap the Allen wrench into the bolt head with a mallet before attempting to unscrew. Even then, it will probably strip out. You may want to have your channel locks ready, if it is stripped you can grab the outside of the bolt with them and twist it off.
2. Remove the pressure line support clamp from the rack housing and the ground wire that is attached at that location.
3. Remove the ground wire (for the horn) that is attached to the rack and to the cross member. This will be attached to the rack with a Phillips screw or 10mm bolt, depending on year/make of rack.
4. Then, with the 13mm wrench, remove the 4 rack mounting bolts.

Slide the rack out of its mounting journals and simultaneously slip off the steering universal joint as you lower the rack assembly.

Steering Pump Removal

Tools Needed:

19mm wrench,
(2) 13mm wrenches

1. Loosen and remove the 19mm return line banjo bolt (you already loosened the other 19mm bolt when you drained the system). There will be a little bit of fluid left in the system still, allow to drain. It is critical that you remove this banjo bolt now, because if you wait until after you have removed the pump from the bracket, you won't be able to sufficiently hold the pump tight enough to undo the bolt.
2. Loosen and remove the tensioner from the pump with the 13mm wrench.

3. Loosen and remove the 13mm bolt and nut on the pivot bracket. At this time you can swing the pump down and relieve tension on the belt.
4. Remove the belt from the pulleys.

Remove the bolts that you loosened in #3 above. There are two bushings that the pump swivels in that must be removed in order to get the pump out. I tapped them out lightly with a small mallet and a flathead screwdriver. Once they are out, the pump can be removed and placed aside.

Power Steering Reservoir, Cooler, and Hose removal

Tools Needed:

(2) 10mm wrenches
(2) 13mm wrenches
Flathead screwdriver

1. Use a flathead screwdriver to loosen and remove the large hose clamp that holds the power steering reservoir to the bracket.
2. Lift the reservoir up and out of the compartment to gain access to the two hose clamps below it. Loosen and remove the hose clamps with the flat head screwdriver, pull the hoses off to completely free the reservoir.
3. The line that runs from the reservoir to the cooler is attached by multiple brackets, all held on by 10mm nuts and bolts. Undo and remove brackets. Loosen and remove the hose clamp that holds the hose to the cooler. Pull the hose out and set aside.
4. Undo the hose clamp that attaches the return hose to the other end of the cooler.
5. Loosen and remove the bracket near the fender well that holds the cooler to the car. This is attached by 2 13mm bolts and nuts. Remove the cooler.
6. Loosen and remove the 2 10mm bolts that hold the return hose bracket to the underside of the frame rail. Remove the return hose.

Loosen and remove the 2 10mm bolts and nuts that hold the last remaining hose to the crossmember. Remove the hose.

At this time, I am going to assume that you have the manual rack assembly assembled in one piece. (Clarks Garage has an excellent tutorial on installing tie rod inner and outer ends for this purpose.) Measure the distance from tie-rod end to tie-rod end on your power rack that you just removed. You want to replicate this measurement as close as possible on your manual rack by adjusting the rod ends. An alignment will still be necessary (well, unless you are VERY GOOD), but this will be good enough to get

you to the shop for the final alignment once the project is finished.

I would also like to comment that before you start to install the manual rack, take advantage of the fact that your engine bay is somewhat empty and do some cleaning and some poking about to check for any leaks, issues, etc. Even though my power steering unit had no leaks, there was an impressive collection of gunk in its vicinity. Additionally, if your motor mounts are in disrepair, at this point in the procedure they are very accessible.

Manual Rack Installation

Tools Needed:

Same as power rack removal plus optional 10x1x35mm bolt and a grinder. An additional pair of hands (friend, girlfriend, etc) is also advised for this.

1. Have your helper hold the steering wheel steady while you install the steering intermediate shaft on the upper spline near the firewall (under the brake booster). Be certain to slide the clamp end on so that the pinch point hole for the bolt aligns with the cut out on the spline. Insert the bolt and nut, finger tighten only at this time.
2. Center the rack. This is done by removing the threaded plastic plug from the view port on the underside of the steering gear housing and turning the steering shaft until the dimple in the rack gear is in alignment with the view port.
3. Once in alignment, thread a 10x1x35+/-mm bolt into the view port to lock the rack in the centered position. The bolt should have a smooth tapered end to engage the dimple. Use a grinder or hand file to accomplish this. At this time, I recommend to cut a second bolt of the same thread to 15+/-mm to use after install as a plug for the hole. The plastic plug that you removed in step #1 above is probably disintegrated or in poor shape, the bolt is a much better solution.
4. Place the rack assembly into position on the passenger side of the car and finger tighten one of the passenger side mounting bolts. Allow the driver's side to hang down slightly.
5. Next, you will want to have your helper/assistant hold the steering wheel straight. Now, on my car, I noticed that the steering wheel was 180 degrees out so that it needed to be held straight and upside down for this step. I think that this is a function of the way the manual intermediate shaft joint/couplers are pressed onto the shaft----one of them is 180 degrees different than one of the power intermediate shaft joint/couplers. I do not know if this is true for every manual intermediate shaft. You will figure out if you need to have the wheel upside down or right side up when you get to the next step. If it is not aligned properly, turn the wheel 180 degrees and adjust the wheel later by removing and inverting if

necessary.

6. At this point, the open side of the universal clamp should be in generally good alignment with the flat side of the steering gear shaft.
7. Align the split in the clamp exactly in the center of the shaft flat. If you don't, the clamp bolt cannot be installed.
8. With the steering column universal joint clamp positioned over the steering gear shaft, push the rack assembly up into position. The universal clamp will now slide down the steering gear shaft where it belongs. If it does not go on easily, a little grease on the splines may help. Also, a flathead screw driver may be used to pry the clamp open a little while attempting to slide the assembly together.
9. Install and hand tighten the clamp bolt. Install and hand tighten the remaining two mounting bolts.
10. Getting the mounting bolts aligned and finger tightened is a bit of a chore but absolutely necessary to avoid cross threading the aluminum cross member.
11. Re-connect the ground wire to the rack from the cross member.
12. Tighten the rack mounting bolts to about 30 ft-lbs.
13. Tighten the top and bottom intermediate shaft bolts/nuts to 50 ft-lbs.
14. Remove your custom centering bolt, then replace and tighten the view port plastic plug (or, if the plug is disintegrated, use the second bolt that I recommended making in #3 above). Before you remove the centering bolt-----if your steering wheel is off center, now is the time to remove and replace in the proper position while the rack is centered with the bolt.
15. Connect the tie rods to the steering knuckles tightening the locking nuts to about 30 ft-lbs. You will need to apply sufficient pressure to the tie rod end ball joint shaft to prevent it from turning in the knuckle.
16. Install the alternator fresh air tube (if so equipped) and the driver's side sway bar mounting bracket.
17. Next, install the sway bar. This must be done by connecting the ends first. The sway bar to control arm mounting bolts should be tightened to 18 ft-lbs.

Then using a jack, raise the sway bar until the mounting clamps are in alignment with mounting brackets. Be sure both sides go into the proper position simultaneously. Install the clamp bolts and tightened to 17 ft-lbs.

Finishing the job

1. Install the underbody belly pan.
2. Install the batwing (if so equipped).
3. Install the wheels and lower the car off the jacks.
4. Torque the lug nuts to the appropriate torque.
5. Reconnect the battery.
6. Take car to the alignment shop.