

How to lighten the steering on your Porsche 928

by Mike Miller

I have a 1982 Euro 928s manual which I love but I do not love how heavy the steering is particularly with modern grippier tyres run at 34 psi and the reduced upper body strength that comes with age! I don't use Porsche pressures as I don't do 120/130 mph cruising. I value my license!

So I obtained a scrap 928 steering rack to strip, examine and practice modifying. I then was able to modify my 928s rack without removing it and have lightened the steering by approximately 40%. It is now so much nicer to drive and feels so much more agile. **Here is how.**

Caution!

- I believe the part you will be modifying, the little torsion quill shaft in the Rotary Valve Assembly (RVA) is custom fitted so if a mistake is made machining this you will need a replacement rack.
- The legality of this modification in relation to vehicle rules in your country although it is perfectly safe and will reduce the maximum stress in the quill shaft, it is **YOUR OWN** responsibility.
- The micro splines on the end of the steering column and on the rack input shaft are very soft and very easily damaged so treat them with great respect.
- Take great care not to scratch the seals.
- Be paranoid about cleanliness.



The input shaft from the scrap rack!

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A Recap on how the power steering works

The positive displacement power steering pump provides a constant pressure from correct idle upwards. When fluid flow to the rack is not required the pressure relief valve in the pump just recirculates the fluid. This is the primary reason the fluid heats up. As long as the pump's set pressure is enough to provide the assistance demanded by the Rotary Valve Assembly, which by design is increasing, the pump pressure will not lighten the steering.

The input shaft to the rack has a small amount of rotational movement allowed before it locks hard against the pinion shaft. This small amount of relative movement is what opens the control valves in the Rotary Valve Assembly allowing pump pressure on one side of the main rack piston and fluid return on the other. The input shaft and the pinion shaft are also connected by a small quill shaft. When you steer this quill shaft provides torsional resistance to the relative angular movement and therefore to the amount of valve opening.

It is the torsional stiffness of this quill shaft that determines how much power assistance the driver gets for a given steering effort.

The torsional stiffness of a solid shaft is proportional to the fourth power of its diameter. The highest stress when twisting occurs on the outer surface of the shaft so by reducing the diameter of the shaft to lighten the steering we will be reducing the maximum stress the shaft experiences and increasing its fatigue life.



Small angular movement between input shaft (top) and pinion shaft (bottom)

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Quill shaft removed.

It is this property of the Rotary Valve Assembly that results in less assistance at speed, purely because the steering resistance is less at speed so the quill shaft twists less and the valves open less.

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The Procedure



Rack pressure pad cover plate.

Undo evenly the two M8 bolts securing the pressure pad cover plate. There will be a spring and shims. Place carefully aside for replacement on reassembly.



Rack centring inspection hole

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Remove the bolt (it maybe plastic) from the rack centring inspection hole.

Remove the clamp bolts from both ends of the steering column universal joint. I made 2 small wedges which I tapped into the splits to make removal easier. Tap the UJ up as high as you can onto the steering column and off the rack input shaft. This way you should be able to remove the UJ and tie the steering column out of the way.

Now centre the rack checking the indent in the rack is visible in the middle of the inspection hole. Undo the 3 M6 bolts 2 or 3 turns only at this stage.

Put the UJ partially onto the input shaft and clamp lightly. Place a good drip tray under the rack (all the fluid in the system is going to drain out) .

Note: the angular position of the input shaft before you start to withdraw it and also when it has withdrawn from the pinion so you can reassemble it in the same position.

Now you can start to lever out the Rotary Valve Assembly using the M6 cover retaining bolts as a fulcrum and levering on the UJ. Replace the M6 bolts with longer ones to continue the extraction of the Rotary Valve Assembly until the fluid pours out.

I left it like this overnight. Once the Rotary Valve Assembly is loose remove the UJ and then carefully withdraw the complete Rotary Valve Assembly. The last piece to come out will be a thrust washer/plate which may stay in place held by surface tension of the fluid in the recess in the housing shown by the arrow in the picture. Carefully remove it.



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Recess in housing for thrust washer/plate

With the Rotary Valve Assembly on the bench carefully note and photograph the order of the parts. Remove the cover plate after cleaning the input shaft being careful with the seal.



The collar/bearing holder on the right in this picture can be carefully levered off the shaft followed by bearings and shims etc. Note and photograph order of assembly.

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Remove bolt securing valve covers and springs and place aside so they can be reassembled as matching pairs with the valve bodies still in the RVA.

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Ignore the pin, not part of the valves.



Position of pins securing the quill shaft.

The photo above shows where you will find the pins securing the quill shaft. They are staked over and I used a very small cutter in a Dremmel to cut away the staking at one end of each pin so the pins could be removed. A press is best.

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Press with punch in, shaft resting on aluminium packers in V block

This picture shows me pushing the pin back in during reassembly but I pressed it out the same way.

When both pins are removed wrap some insulation tape round the Rotary Valve Assembly where the valves are so they don't fall out when you pull the input shaft out of the pinion assembly. You may have to hold the input shaft in soft jaws in the vice while you tap the pinion assembly away. ***Note: Be very careful not to damage the hydraulic seals.***

Once you have the quill shaft out measure its diameter. Mine was 5.34mm. I machined it down to 4.8mm. You may want to preserve a slightly heavier feel by going to 5 or 4.9 mm. Remember its the fourth power of the diameter ratio to calculate the stiffness ratio.

The quill shaft is spring tempered steel so it was difficult for me to get a smooth finish even with a new tipped tool so I removed the last 0.1 mm with fine files and increasingly fine emery and wet and dry until I had replicated its original fineness of finish and smoothness of curves.

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Reassembly is quite straight forward

Once you have the Rotary Valve Assembly assembled ready to go back in first carefully wipe the recess in the rack casing for the thrust washer and the thrust washer and secure it in place with some plain mineral grease.

Now rotate the input shaft to the same orientation it came free with and carefully replace it in the housing using the UJ to wriggle it by hand to get it in. It should go in quite easily by hand up to the point where the cover O ring will require gentle tightening of the bolts to pull it down. ***Note: If more force is require, don't do it!***

Investigate. Make sure the thrust washer is still properly centred in its recess.

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Once you have the Rotary Valve Assembly in and checked the UJ lines up with the steering wheel central and the rack central you can secure everything to the WSM torques, replace the pressure pad shims, spring and cover plate and the cantering inspection hole.

Refill the steering fluid reservoir, let it stand for 5 minutes then start the engine for 30 seconds and turn off. Top up reservoir, restart engine and exercise steering from lock to lock weight off wheels. Check for leaks and top up reservoir.

Job Done!

Mike Miller