

Power Steering Torsion Bar Modification

Background:

From time to time, people carry out the procedure of modifying the rack and pinion or steering box torsion bar inside the rotary valve to change the amount of steering assistance available to the driver. There are two common reasons for doing this:

1. to provide more power assistance for people who have a physical disability that affects their ability to turn the steering wheel; and
2. to decrease the amount of power steering assistance in 1950s and 1960's American vehicles to give the driver more steering 'feel'.

For this reason, it is necessary to firstly confirm that such modifications do in fact require LVV certification, and secondly to provide some clarification on what is required to be assessed during the LVV certification process.

About power assist steering systems:

Most power steering assemblies are hydraulic/mechanical units. An internal rotary valve directs power steering fluid flow, and controls pressure to reduce the amount of steering effort required to turn the wheels.

Rotary Valve:

A power steering system should assist the driver only when he is exerting force on the steering wheel (such as during a turn). When the driver is not exerting force (such as when driving in a straight line), the system shouldn't provide any assistance. The device that senses the amount of force being applied on the steering wheel is called a rotary valve.

Torsion bar:

The key to the rotary valve is a torsion bar. The torsion bar is a thin steel rod that twists when torque is applied to it. The top of the bar is connected to the steering column (and therefore the steering wheel), and the bottom of the bar is connected to the pinion or worm gear (which turns the wheels), so the amount of torque present in the torsion bar is equal to the amount of torque the driver is applying to turn the wheels. The more torque the driver applies to turn the wheels, the more the torsion bar twists.

As the torsion bar twists, it rotates the inside of the spool valve relative to the outside. Because the inner part of the spool valve is also connected to the steering shaft (and therefore to the steering wheel), the amount of rotation between the inner and outer parts of the spool valve depends on how much torque the driver applies to the steering wheel.

When the steering wheel is not being turned, both hydraulic lines provide the same amount of pressure to the steering gear. However, if the spool valve is turned one way or the other, ports open up to provide high-pressure fluid to the appropriate line.

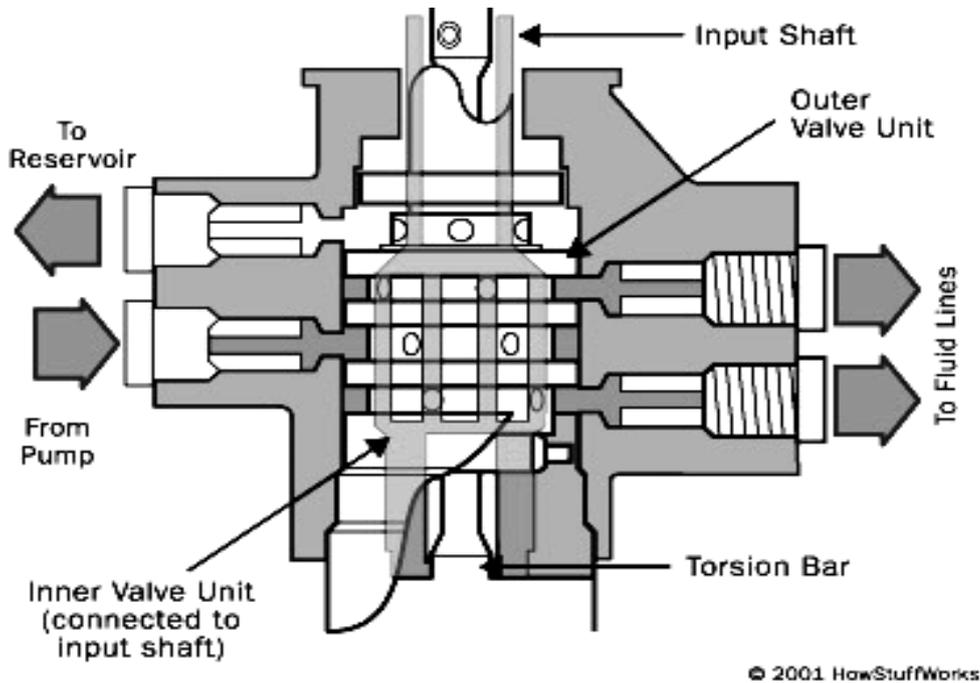


Illustration courtesy of HowStuffWorks.com.

The Modification:

Increasing power assistance:

Increasing power assistance is a procedure in which a minute amount of material from the diameter of the torsion bar is removed to allow it to twist more with driver input. Only a person who is vastly experienced and knowledgeable in the field of power steering systems should perform this modification. Most manufacturers or companies in the power steering industry have specifications on exactly how much can be safely removed from the torsion bar before it requires replacement. This should be established before commencement of any machining to ensure that the torsion bar is not modified to such an extent which could cause the torsion bar to become dangerously weakened.

Note that if the torsion bar breaks in service, the power assistance will be lost but manual steering control will still be maintained.

A similar but less effective way of increasing the power assistance in a steering system can be achieved by installing a pressure flow regulator into the hose between the steering gear and the steering pump. Whilst there are no known safety issues with this modification, the low speed steering effort will be much greater than through the torsion bar modification method. This alternative is legal, but is not the recommended way of achieving increased power assistance.

The pressure flow regulator system also requires LVV certification.

Decreasing power assistance:

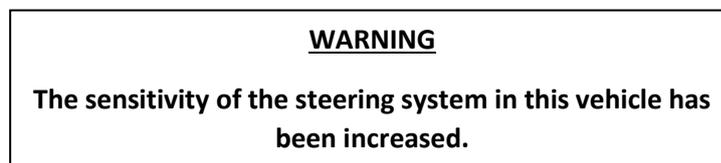
Decreasing power assistance is achieved by installing a larger-diameter torsion bar into the rotary valve assembly, which will provide a greater amount of resistance against the torque being applied by the driver.

The LVV Certification Procedure:

When increasing power assistance for a person with a disability:

When assessing a low volume vehicle that has had an increase in power assistance carried out, the LVV Certifier must:

- see documentation that establishes who the person or company is that has carried out the modification; and
- be satisfied that the person or company who has carried out the modification has the necessary experience and knowledge to safely undertake such work; and
- be satisfied after a thorough road-test that the vehicle can be safely operated by anyone who might drive the vehicle; and
- be satisfied that the steering system provides sufficient power assistance to enable the primary (disabled) user of the vehicle to safely steer the vehicle; and
- arrange for a warning label to be manufactured and affixed in a prominent location within the vehicle, clearly visible to anyone who drives the vehicle, that warns the driver that the sensitivity of the steering system has been increased. The label should appear similar to the sample shown below:



When decreasing power assistance:

When assessing a low volume vehicle that has had a decrease in power assistance carried out, the LVV Certifier must:

- see documentation that establishes who the person or company is that has carried out the modification; and

- be satisfied that the person or company who has carried out the modification has the necessary experience and knowledge to safely undertake such work; and
- be satisfied after a thorough road-test that the vehicle can be safely operated by anyone who might drive the vehicle.

Documentation required:

The LVV Certifier is required to supply the following documents with this certification:

- F000-MN Certification Plate Order Form
- F001-MN LVV Statement of Compliance Certificate
- F002-MN LVV Data Form
- F003-MN LVV Safety Item Form
- F004-MN LVV rectification Form
- F005-MN LVV Plate Attachment Delegation Form if required
- A one page hand written document detailing the modification and inspection processes, along with some commentary on how the certifier concluded that the modification was performed safely, and confirming that the requirements specified in this Information Sheet have been met.

If you have a client that wants someone to undertake this sort of work on their behalf, LVVTA recommends Phil Game of PG Hydraulics in Auckland. PG Hydraulics is an industry leader in all steering system issues, and does a lot of modification work for both performance and disability applications. LVVTA has used Phil Game as a source of specialised steering expertise for many years and we have great confidence in his knowledge and skill. Phil can be contacted on (09) 2745871 or 0800-STEERING. PG Hydraulics' address is 10 Andromeda Crescent, East Tamaki, Auckland.

If you have any queries, or require any further clarification relating to this Information Sheet, please feel free to contact the technical team at the LVVTA office on (04) 238-4343.