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POWER TO MANUAL STEERING CONVERSION for Hydraulically-assisted Steering Racks and Steering Boxes

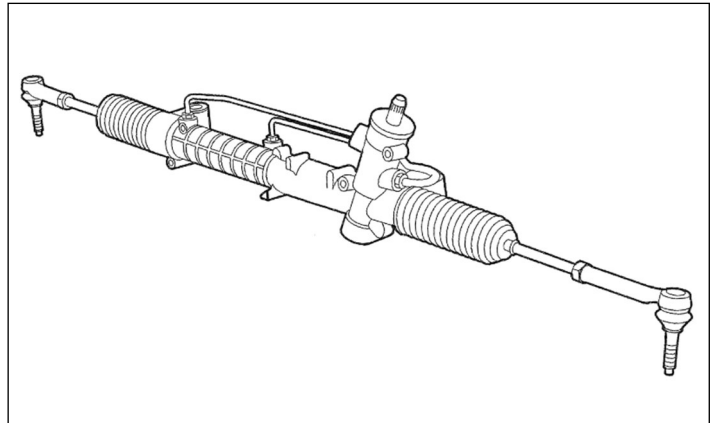
► Introduction

This Information Sheet provides a safe and compliant method of converting a power assisted steering rack (rack and pinion) or steering box, to manual (non-power assisted) steering.

► Background

There are circumstances where it is preferable for a vehicle to be fitted with manual steering rather its factory-fitted hydraulically-assisted power steering. Some examples of these circumstances are:

- more 'feel', and less sensitivity, is required;
- component selection has removed the need for power assistance;
- limited engine bay space is available;
- the complexity of hydraulic pumps and high-pressure hoses make power steering impractical.



► Important Notes Before You Start

1. Non-power steering set-ups usually require greater steering input from the driver, through the steering wheel. That means input loads through the rotating components (steering column, couplings, universal joints, intermediate shafts, splines etc) will be greater. When a steering system is converted from power to manual, all rotating components must be assessed by an LVV Certifier, and compared to non-powered steering components and systems to ensure that a reduction in strength in the system has not occurred, or that a 'weak link' has not been introduced.
2. An LVV Certifier must ensure that any major steering component changes will be compatible with all existing parts (steering ratios can vary between power and non-power units) and meet the relevant technical requirements in the New Zealand Car Construction Manual (NZCCM) Chapter 7 (Steering Systems), and Chapter 19 (Vehicle Operation), section 19.9. Where any geometry changes occur due to component repositioning, a bump-steer swing-check is required to verify the bump-steer is within tolerance.
3. Steering rack and steering box internals can be complex, and only professional steering specialists engaged in the repair, reconditioning, or manufacturing of automotive steering components should attempt the modifications referred to in this Information Sheet. Where required, evidence of work completed, or verified, by such a specialist must be provided to the LVV Certifier.
4. Note that no safety-critical part of a steering rack or steering box may be welded, unless the welded section is the vehicle manufacturer's unmodified original equipment. This includes the torsion bar and all internal shafts.
5. Many modern production vehicles use electric power assisted steering (EPAS), which incorporates a column-mounted electric motor to provide power assistance to a manual steering rack. Rack and pinion assemblies

from these vehicles are often very robust due to the high level of power assistance they receive, with larger, stronger input shafts, and rack and pinions. For example, a modern Toyota or Nissan EPAS-equipped rack and pinion has larger and stronger internal components than a VT-VZ Holden Commodore rack, and is of similar width. Rack and pinion assemblies from EPAS-equipped donor vehicles should be considered as an option, as these components are readily available in both used, new, and rebuilt states, and may be more economical and durable than the modified assemblies covered in this Information Sheet.

► Torsion Bar

Requirements:

The torsion bar must be removed, and the upper section of the pinion assembly (the radial valve spool) replaced with a newly machined 4140 (minimum) one-piece steel part, and pinned in place for positive fail-safe engagement.

Some assemblies may require a new upper bearing and housing or upgraded flange attachments to prevent the pinion from driving out of, or over-stressing, the housing and/or its fasteners. This must be assessed by a steering specialist, with the final specification dependant on the intended application and design of the parts.

Note that welding of the torsion bar or replacing the torsion bar with a solid piece is prohibited.

Explanation of Requirements:

A torsion bar provides a 'signal' from the steering wheel to the hydraulic system to achieve the desired amount of pressure (assistance) to the steering box or rack and pinion. When a power assisted steering box or rack is converted to non-powered steering, the torsion bar is no longer required and must be removed to eliminate any free play that can cause wheel shake, or reverse feedback from the wheels back up to the steering wheel. While it is more likely to occur in rear-wheel drive vehicles, it can also occur with certain combinations of wheel size, offset, or wheel alignment specifications. Removal of the torsion bar also improves steering feel and feedback, and any wear or free-play issues which can occur over time are minimised.

► Internal Parts

Requirements:

The power assisted steering rack or box must be stripped of all internal power steering seals and any parts not required for operation in its non-powered configuration.

Explanation of Requirements:

This is to eliminate any possible resistance or restriction within the assembly.

► Lubrication

Requirements:

All components within the rack and pinion or box should be lubricated in the same way a non-powered steering rack or steering box is lubricated.

Steering racks should have correct grease applied to all contact points on shafts, bushings, bearings, and rack and pinion.

Steering boxes should use a heavy-grade steering gear oil.

Explanation of Requirements:

Correct lubrication will ensure the components operate smoothly and efficiently and will not wear prematurely.

▶ Boots and Sealing

Requirements:

External seals and boots must be compatible with the lubricants used in the new configuration, and must be fit for purpose. Any disused hydraulic fluid ports must be fitted with durable and compatible plugs (pipes must not be interconnected using a 'looped' piece of rubber hose).

Explanation of Requirement:

Correctly installed seals, plugs, and boots will prevent the ingress of water, dirt, and other foreign materials that can cause corrosion, degradation of lubricants, and premature wear.

▶ Specialist Verification

Requirements:

All the above work must be carried out by, or inspected and signed off by, a steering specialist as detailed in item #3 of the Important Notes Before You Start section. Evidence in the form of a detailed invoice including a written statement that confirms the above has been completed to an acceptable standard, must be supplied to the LVV Certifier.

Explanation of Requirement:

This is due to the complexity of power steering assemblies, and to eliminate the need for an LVV Certifier to strip and inspect the steering assembly in every case.

▶ Further Assistance

For advice on alternative methods of converting OEM power steering to non-powered steering, please contact your LVV Certifier, or the LVVTA technical staff at tech@lvvta.org.nz



FOR FURTHER INFORMATION PLEASE CONTACT YOUR LVV CERTIFIER, OR LVVTA.