

● Power steering boxes

Ford and Holden (Kirby Bishop Variable Ratio)

1. Prior to commencing the remove and refit procedure soak the upper part of the sector shaft (above the pitman arm) with penetrating oil. This will allow time for the oil to work its way down the splines while you are carrying out the other removal procedures and will allow the pitman arm to be removed without applying too much force.
2. When removing the pitman arm retaining nut and pitman arm, put a piece of timber in place (between the pitman arm and the chassis) to prevent excessive force being applied to the worm shaft.
3. When removing the steering box from its location in the vehicle take care not to dislocate the inner steering column as this will prevent the new box being easily located and may cause the coupling to be distorted. Prior to fitting the new steering box check that the coupling is in good condition, if in doubt, fit a new coupling. When refitting the coupling do not allow twisting torque to be applied to the worm shaft as this may damage the worm shaft and cause the steering to be biased.
4. Prior to tightening the steering box mounting bolts start the pressure hose barrel nut as it is often difficult to start once the mounting bolts have been tightened. Make sure that the barrel nut is torqued to the manufacturer's specifications using an appropriate tube nut spanner.
5. Always replace the short piece of return hose at the steering box end. It is difficult to seal the joint (no matter how tight you do the clamp) if the old hose is retained. A new piece of hose is supplied with all APS exchange units.
6. When the steering box has been refitted check that the steering wheel spoke is level when the road wheels are in the straight ahead position, if not, centralize the steering wheel by adjusting the length of the tie rods. This is normally done when resetting the toe-in.

Important: Do not remove the steering wheel to centralize the spoke. The steering wheel and the inner steering shaft must be kept aligned (to their marks) at all times. If the marks are not aligned the steering box will be off centre when the road wheels are in the straight ahead position and the box may have excessive lash.

● Power steering racks

Commodore VB-VK

1. Prior to installing the rack and pinion assembly check the following:
 - (a) Upper strut bearings and mounting plates (for wear or binding)
 - (b) Bottom ball joints (for wear or binding)
 - (c) Outer tie-rod ends (for wear or binding)
 - (d) Intermediate shaft (for wear or seized universal joints)
 - (e) Steering column (for worn or collapsed bearings)
2. **Installation**
 - (a) Fit tie-rod end lock nuts. (Count the number of turns when removing from old unit.)
 - (b) Fit tie-rod ends. (If any doubt exists about the condition of the old tie-rod ends replace with new. Be sure they are the correct type – Power and Manual **are** different.)
 - (c) Place rack in position on cross member mounting brackets and push top of pinion housing towards front of car while tightening mounting bolts. This will ensure that the angle on the intermediate shaft is not too great.

NOTE: In some instances where access is difficult it may be useful to support the rack on a piece of timber clamped to the cross member which will allow the hose connections to be made and tightened prior to placing the rack in position on its mounting brackets. When connecting the hoses to the rack make sure that there is no dirt on the flares of the hose ends as this may prevent you obtaining a good seal and any dirt entering the system is likely to cause the pump valve to stick.

 - (d) Connect the intermediate shaft making sure that it is correctly aligned. On early models care should be taken to ensure that the top flexible joint does not foul against the firewall which will cause the steering to bind at every 180 degrees of the wheel.
 - (e) Connect tie-rod ends to the steering arms making sure that split pins are re-inserted on the castellated nuts.
 - (f) Fill the reservoir with fluid and bleed according to the manufacturer's instructions, it is better not to rev the engine during the start-up and bleeding operation.
 - (g) Reset the toe-in to manufacturer's specifications and recheck the system for oil leaks.

Commodore VL-VS & Falcon/Fairlane EA-EF – Variable ratio power steering racks

1. Prior to installing the rack and pinion assembly check the following:
 - (a) Upper strut bearings and mounting places (for wear or binding)
 - (b) Bottom ball joints (for wear or binding)
 - (c) Outer tie-rod ends (for wear or binding)
 - (d) Intermediate shaft (for wear or seized universal joints)
 - (e) Steering column (for worn or collapsed bearings)

NOTE: All APS racks are tested for performance under load, and for returnability. Any binding in the above areas will increase the steering effort above specifications.

2. Installation

- (a) Fit tie-rod end lock nuts. (Count the number of turns when removing from old unit.)
- (b) Fit tie-rod ends. (If in any doubt about the condition of the old tie-rod ends replace with new.)
- (c) Centralize rack assembly and steering wheel spoke before placing rack in position on cross member and connecting intermediate shaft.
- (d) Connect hoses to rack—**DO NOT** overtighten barrel nuts and **ALWAYS** replace O Rings. New O Rings are supplied with all APS Exchange Units.

NOTE: While hoses are disconnected from the rack, care should be taken to prevent any dirt from entering the system as this will cause the pump flow valve to stick which in turn will lead to lack of assist at idle.

- (e) Connect tie-rod ends to the steering arms making sure that the split pins are re-inserted in the castellated nuts.
- (f) Fill the reservoir with fluid and bleed according to manufacturer's instructions. To avoid aerating the fluid **DO NOT** rev the engine during the start up and bleeding procedure. If the fluid does become aerated, switch the engine off and leave the vehicle stand for an hour or so which will allow the aeration to dissipate.
- (g) Rest the toe-in to manufacturer's specifications and recheck the system for oil leaks.

WARNING: Do not turn the steering wheel without the motor running as in some instances it may dislodge the inner rack shaft seal and cause the fluid to leak into the boots.

Power Steering racks with spool type valves – i.e. Ford Laser 4WD

As the pinion on this type of rack is designed to move up and down during operation it is critical that the column and intermediate shaft are adjusted to

provide clearance for this. If clearance is not provided the rack is likely to bias to one side. Check the workshop manual for the correct method of setting the clearance.

Power Steering Racks with aluminium (die cast) pinion housings

i.e. Magna TM-TP, Nissan Skyline, Saab, Toyota, Volvo

When connecting the hose barrel nuts to the above racks care must be taken not to cross thread OR overtighten the barrel nuts as this will damage the housing which in most instances cannot be repaired. It could also mean the loss of your core deposit as in most instances the housing is not available as a separate component and where it is the cost is substantial.

Most of the above racks use rubber O Rings as a seal on the hose connections so it is not necessary to overtighten the barrel nut to obtain a good seal.

As a general rule it is always best to start barrel nuts with your fingers.

● Air Bags

CAUTION: If the vehicle is fitted with an SRS (Air Bag), a steering wheel clamp must be fitted to the steering wheel in the straight ahead position (and the ignition key removed as an added measure to engage the steering lock), locking the steering column. **If this procedure is not carried out and the steering wheel is spun while the steering rack is removed, the clock spring on the upper end of the steering column will be destroyed, causing non-deployment of the AIR BAG! (Refer to vehicle service manual.)**

● Power steering hoses

Replace power steering hoses before problems occur.

Unless the vehicle is a late model and has low mileage, all hoses should be replaced. Not only is a deteriorated hose unsafe, but it may retain residue which could contaminate the new pump or gear and cause premature failure. Not all worn hoses can be detected from an outward inspection, as they deteriorate from the inside out.

Power steering pressure hoses transfer the hydraulic fluid from the pump to the gear and have to withstand pressures up to 2000 psi.

Steel braided hoses can create groaning noises, and vibrations at lock. OE manufacturers use nylon braided rubber hose because the rubber absorbs the pulses in the fluid that cause vibration. Most OE hoses also have an internally fitted vibration damper to prevent groaning.

Hoses fitted to vehicles up to the early 80s used brass

or aluminium olives in the connecting fittings to seal the joint and prevent fluid leakage. Most late model vehicles now use O Rings in place of the olives and it is most important that the O Rings be replaced whenever the connecting fittings are disturbed. When fitting new O Rings don't forget to smear them with hydraulic fluid to ensure they are not damaged during installation of the hose and DO NOT overtighten the connecting fitting as this will damage the new O Ring and cause a leak at the joint.

● Power steering pumps

Power steering pumps generate the hydraulic pressure needed to operate the steering box or rack and are designed to provide maximum assistance at engine idle.

The saginaw pump is now the most common pump used on Ford and GM passenger vehicles and there are two basic types of these pumps:

Integral Reservoir

The integral reservoir type is encased in a metal canister which is sealed between the pump body and canister with an O Ring. Care must be taken not to lever against the canister when tightening the drive belt as this is likely to damage the canister and create a fluid leak between the canister and the pump body.

External Reservoir

There are two types of these pumps, a standard size and a mini series (such as used on the early VL 6 cylinder and Camira). The standard size was first used by General Motors on the VK 6 cylinder – PSP339, this is a standard size external reservoir pump with the reservoir mounted on the inner skirt of the mudguard and the suction line connected to the pump body with a banjo type fitting.

This fitting was prone to leaking which allows the pump to suck air and aerate the fluid. When the fluid becomes aerated the pump is noisy in operation and the rack can also become jerky in operation. It is essential that the copper washers (located on either side of the banjo fitting) be replaced whenever the fitting is removed, in addition to this it may be necessary to replace the hose as it is often difficult to reseal the joints when the old hose is reused.

It is always wise to replace the supply hose on all external reservoir pumps when the pump is being replaced as it is difficult to reseal hoses that have become brittle with age.

VN (V6) Pump – PSP343. When refitting this pump be sure to replace the canister O Ring with the new O Ring supplied with the pump. Because of the high underbonnet temperatures on this vehicle the O Ring tends to become brittle very quickly which allows the pump to suck air causing the fluid to aerate. This

makes the pump noisy in operation and may cause the steering to become jerky.

Nissan Pintara / Skyline Power Steering Pump

– **PSP418.** This pump is an external reservoir pump. It has a strainer inside the reservoir on top of the return pipe which can become blocked causing excessive back pressure in the system. Whenever the pump is replaced the strainer should be removed and cleaned. There is a small retaining clip on top of the strainer which needs to be removed before the strainer can be removed.

Mitsubishi Magna TM-TP Power Steering Pump

– **PSP487.** This pump is also an external reservoir pump and is prone to sucking air around the supply hose fittings. Before replacing a pump which is noisy check that this hose is not damaged and the connections on each end of the hose are properly sealed.

OIL CONTAMINATION

Contaminated fluid **will** cause premature failure of exchange units. Always flush the system thoroughly and fit a return line filter wherever possible. **APS Part No. PSA700** fits most popular makes.

If you have a power steering problem you need help with, ring the experts and let us solve the problem for you:

**APS Toll Free Support Line –
1800 335 634**

So why the pump?

Worn pumps can cause damage to hydraulic power steering systems, such as:

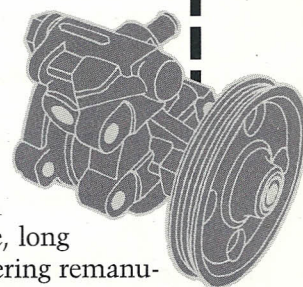
- Damage to seals
- Scored shafts
- Scored power bores
- Sticky valves (resulting in partial loss of power assist)

We want drivers to have safe, reliable, long life usage from Australian Power Steering remanufactured products. That is why we recommend a pump replacement when a new rack or box is fitted.

That way you are sure that there are no residual contaminants (fine metal particles) in the hydraulic system, and the APS 3 year/100,000 kms warranty is fully secured.

Do a full replacement the first time!

If in doubt, prior to fitting, call 1800 335 634 for technical assistance from the experts.



Steering system noises:

Rattle

- Pressure hose touching other parts of the car. (Adjust or secure.)
- Loose pump pulley nut (Replace nut, tighten to specs.)
- Pump vanes not installed properly or sticking in rotor slots. (Install correctly, remove all burrs, varnish or dirt.) (Replace pump.)
- Loose pump or gear mountings. (Tighten bolts to specs.)
- Steering linkage looseness. (Replace if necessary.)
- Improper high point adjustment of steering gear. (Adjust to specs.)

Chuckle or thumping noise

- Loose steering column or column connections. (Adjust or replace.)

- Free play in worm and piston assembly. (Centralise steering gear or replace as necessary.)
- Steering gear operating off centre. (Centralise steering gear.)
- Worn steering gear. (Replace as necessary.)

Gear squawk sound

- Cut dampener "O" ring on spool valve. (Replace steering gear.)

Groan

- Low fluid level. (Fill as required.)
- Air in fluid. (Check all hose connections and internal pump seals for leakage.)

Hissing

- There is some hissing noise in all power steering systems. This sound is most noticeable during slow speed parking, and

when the steering wheel reaches the end of its travel. There is no relationship between this noise and the performance of the power steering system. (Do not replace the steering gear unless the hiss sound is extremely obnoxious. A replacement steering gear will have a slight hiss sound.)

Growl

- Restriction in steering gear or hose. (Remove restriction.)
- Scored pump pressure plates, thrust plate or rotor. (Replace pump.)

Belt squeal or chirp

- Loose or glazed belt. (Adjust or replace.)

Pump swish sound

- Pump flow control valve defective. (Replace pump.)

Steering system conditions:

Poor return of steering wheel

- Steering column friction. (Align column.)
- Steering linkage or ball joints binding. (Replace.)
- Steering gear adjustments too tight. (Adjust to specs.)
- Excessive internal leakage in steering gear. (Replace steering gear.)
- Steering gear to column not aligned. (Align column.)
- Tyres underinflated. (Inflate to specified pressure.)
- Steering column coupling binding. (Adjust or replace.)
- Improper front wheel alignment. (Align to specs.)

Steering wheel jerks when turning

- Low fluid level. (Fill as required.)
- Loose belt at pump. (Tighten.)
- Sticky pump flow control valve. (Inspect for burrs and dirt, or replace pump.)
- Engine idle too slow, air in system. (Check all hose connections and internal pump housings and seals for leaks.)
- Low pump pressure. (Pressure check, replace pump.)
- Steering linkage hitting obstruction. (Correct clearance.)

Occasional increase in effort when turning steering wheel fast

- Pump drive belt loose or glazed. (Adjust or replace.)
- High internal leakage in gear. (Check for high pump pressure, replace pump.)
- Low fluid level. (Fill as required.)

Excessive steering wheel return or loose steering

- Worn or damaged steering linkage or wheel bearings. (Replace as necessary.)
- Loose steering gear mounting. (Tighten bolts to specs.)
- Improper high point adjustment of steering gear. (Check and adjust to specs.)
- Steering column coupling loose. (Tighten to specs.)
- Loose sector shaft adjustment on gear. (Adjust to specs.)
- Loose thrust bearing preload adjustment. (Adjust to specs.)
- Air mixed with fluid. (Check all hose connections and internal pump housings and seals for leaks.)

Hard steering

- Low pump output. (Pressure check.) Or restriction in system. (Remove restriction.)
- Loose pump belt. (Tighten.)
- Low fluid level in reservoir. (Check for leaks, fill as required.)
- Sticking or plugged spool valve or flow control valve. (Clean or replace.)
- Tyres underinflated. (Inflate to specified pressure.)
- Steering linkage binding from lack of lubrication. (Lubricate.)
- Steering column binding. (Replace worn parts and align.)
- Steering gear adjusted too tight. (Adjust to specs.)

Car pulls to one side or the other

- Front end out of alignment. (Align front end to specs.)
- Steering gear control valve worn. (Replace steering gear.)
- Steering linkage or wheel bearings worn. (Replace as necessary.)



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