

STEERING

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STEERING

Minor Maintenance

Steering Gear Lubrication

The rack and pinion steering gears are lubricated by a semi-liquid grease.

The correct amount of grease can only be applied during a steering gear rebuild and therefore check and top-up is not a maintenance service operation.

Specified Lubricant:

EP Semi Fluid Lithium Base O Grease

Specified Amount: 50 Grams

Fluid Contamination

If the power steering fluid has been contaminated, the power steering lines should be flushed and the steering pump, reservoir, rack and pinion gear must be removed, dismantled, cleaned, assembled, and installed as described in this chapter.

Power Steering Pump Fluid Level

Run the engine until the fluid is at normal operating temperature, (74-80 degrees Celsius). Turn the steering wheel from lock to lock several times then turn off the engine.

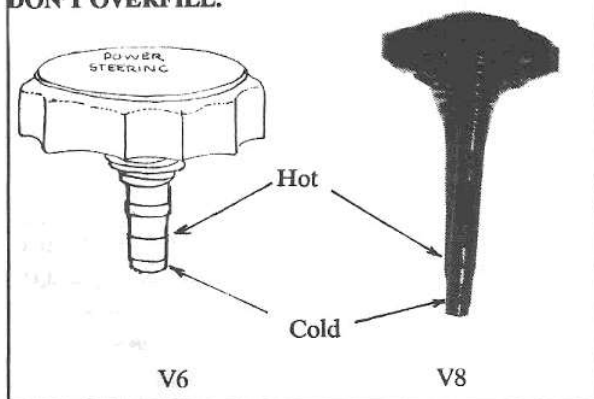
Check the fluid level in the pump reservoir by the dip stick. If required top-up the fluid to the 'HOT' mark on the dip stick with the specified fluid. DON'T OVERFILL.

Specified Fluid:

Dexron 11 Automatic Transmission Fluid

Specified Fluid Capacity: 650 ml

Check the fluid level in the pump and in the pump reservoir by the dip stick. If required top-up the fluid to the 'HOT' mark on the dip stick with the specified fluid. DON'T OVERFILL.



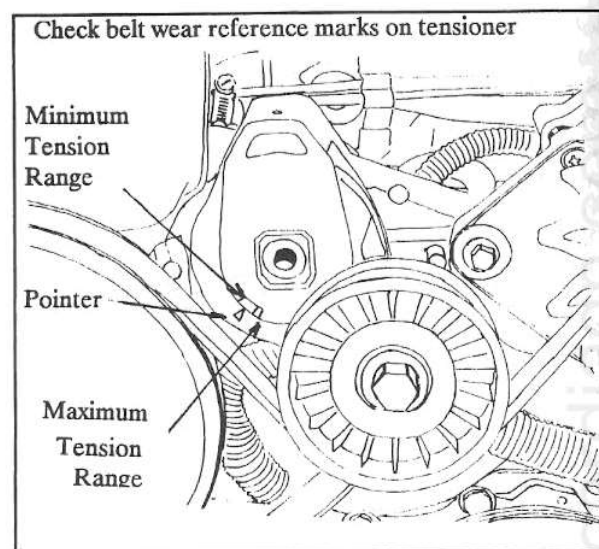
ADJUSTMENTS

V6 - REPLACE DRIVE BELT and ADJUST BELT TENSION

1. Loosen the locknut on the automatic adjusting idler pulley mounting stud and turning the stud, relieve the tension on the drive belt.

2. Remove the belt if belt is to be removed.

3. Install new drive belt (if applicable) on crankshaft, alternator, power steering, air conditioner and water pump pulleys.



4. Adjust belt, turn the automatic adjuster idler pulley mounting stud to adjust tension.

5. Check belt wear reference marks on tensioner. Install a new automatic tensioner if tension is not within specification.

V8 DRIVE BELTS

Inspection

* Some belt squeal when the engine is started or stopped is normal and has no effect on durability of drive belt.

Visual Inspection

* Condition of the belt is best judged by twisting the belt so as to see the "V" surfaces.

Stages of Belt Wear:

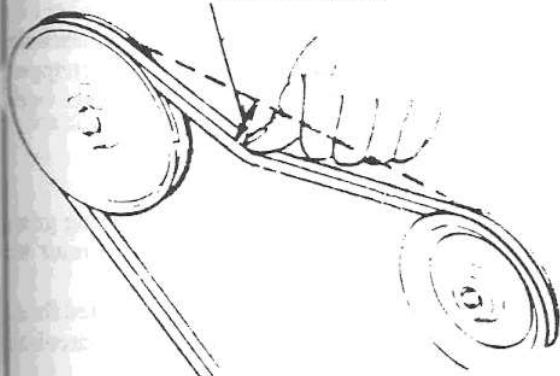
1. NEW BELT: Cracks or chunks.

POWER STEERING PUMP

NEW BELT DEFLECTION (mm) 8-9

USED BELT DEFLECTION (mm) 10-11

Belt Deflection



2. MODERATELY USED BELT: Few cracks; some wear on surfaces. Replacement not required.

3. SEVERELY USED BELT: Several cracks per inch. Should be replaced before chunking occurs.

4. FAILED BELT: Separation of belt material from backing (chunking). Replace belt immediately.

ALTERNATOR WATER PUMP.

NEW BELT DEFLECTION (mm) 7-8

USED BELT DEFLECTION (mm) 9-10

POWER STEERING PUMP

NEW BELT DEFLECTION (mm) 8-9

USED BELT DEFLECTION (mm) 10-11

AIRCONDITIONING

NEW BELT DEFLECTION (mm) 8-9

USED BELT DEFLECTION (mm) 10-11

To adjust the tension, loosen alternator mounting bolts and adjusting arm pivot bolt. Then turn adjusting nut on alternator upper mounting bolt to achieve correct tension. Tighten mounting bolts and adjust arm pivot bolt.

Replacement

Release tension of the belts by loosening the alternator, air conditioner, power steering pump adjustment bolts. Remove drive belts from drive pulleys. Replace belts, making care the belts are fitted correctly. Tension belts by adjusting and tightening alternator, air conditioner etc.

Ignition Lock / Steering Column**Remove**

1. Remove the upper and lower shrouds from the steering column as described in this chapter.

2. Remove the shear bolt attaching the steering lock clamp with a hammer and centre punch. Remove lock from column.

Install

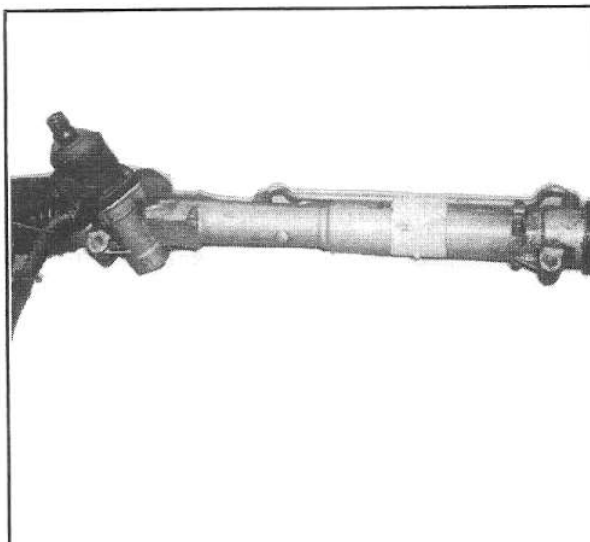
1. Place the steering ignition lock assembly onto the steering column.

2. Engage a new shear head clamp bolt and tighten until the head shears off.

3. Assemble the shrouds to the column as described in this section.

RACK and PINION

All rack and pinion adjustments must be performed with the rack and pinion removed from the vehicle.

**Pinion Bearings**

There is no adjustment possible on the pinion bearings. If considered that there is extreme free play in the pinion bearings, then the bearings should be replaced.

Centralising the Rack

When vehicle is travelling straight ahead it is vital that the rack bar is positioned centrally within its ratio pattern.

The rack bar is in the straight ahead position when the distance between the housing lock stop face and the inner face of the tie rod ball joint is equal for both locks. This distance can be set by rotating the pinion to the halfway position of its total lock to lock rotation.

When the rack is in the straight ahead position, the input shaft must be in the position as shown on next page. Input shaft square back must be 16° from the centre line of the steering rack.

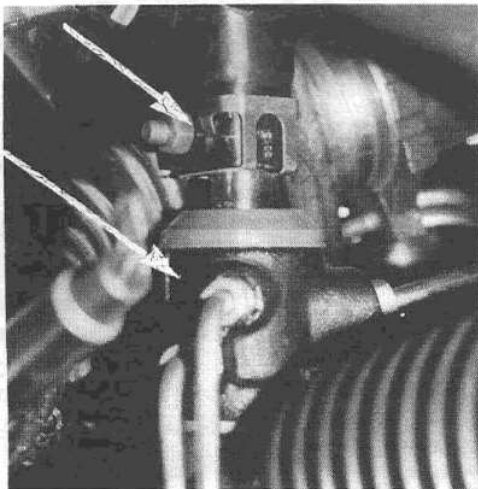
If the position is at any other angle, then the pinion is displaced by one or more teeth and must be corrected before the gear is installed in the vehicle.

Rack Pad

1. Using Holden special tool AU211 release locknut and back off 2 turns in order to release the compression on seal.

2. With the steering gear in the straight ahead position, and using Holden special tool AU301, tighten the rack

Bottom of clip to align with paint mark.



Shaft square back 16° from centre line

Input shaft square back 16° from the centre line of the steering rack

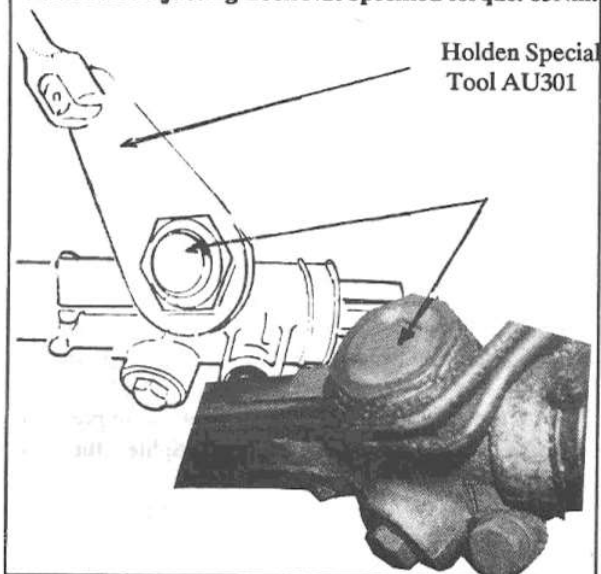
pad adjusting screw to a torque of 12 Nm. Turn rack pad adjusting screw back (unscrew) 25 degrees.

3. Holding the adjusting screw in the above position tighten the locknut to specification.

Rack Pad Adjusting Lock Nut specified torque: 65Nm.

Holding the adjusting screw in the above position tighten the locknut to specification.

Rack Pad Adjusting Lock Nut specified torque: 65Nm.



4. Check that the rack moves freely over the complete lock to lock travel.

Check that the pinion torque does not exceed 2.0 Nm over the total travel.

Note: If the gear should bind or appear tight over any part of the total rack travel, check the rack pad clearance as above and if not the cause, the gear should be stripped and the rack and pinion examined for wear, replace worn parts.

Bleeding the System

After any repairs are carried out on the steering gear, pump or lines the following start up operation must be used.

1. Fill reservoir to the 'cold' level with the specified fluid.
2. Start engine and run for 2 or 3 seconds to circulate the fluid, top up reservoir.
3. Repeat step 2 until the fluid level remains constant.
4. Idle engine and turn steering wheel quickly to lightly contact each stop three times, stop engine and top up reservoir.

Power Steering Pump Hoses and Tubes

Remove

1. Disconnect the tubes from the steering gear valve housing and drain the fluid into a container.
2. Disconnect the fluid return hose and the pressure tube from the pump.
3. Remove the tubes and hoses from the vehicle.

Install

V6 Power Steering Fluid Reservoir



V8 Power Steering Fluid Reservoir

1. Install the tubes to the steering gear valve housing.
2. Install the fluid return hose and the pressure tube to the pump.
3. Fill the reservoir with the specified power steering fluid.

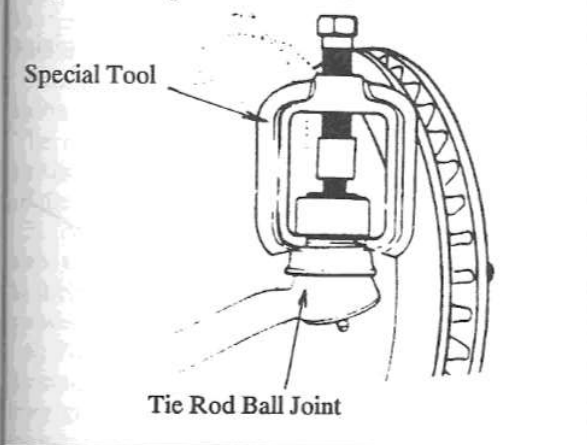
STEERING

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Tie Rod Ball Joint**Remove**

1. Raise vehicle, loosen tie rod end locknut 1/4 of a turn.

Loosen tie rod end stud nut and free the stud taper in the spindle using Tool No. 9A-10.



2. Loosen tie rod end stud nut and free the stud taper in the spindle using Tool No. 9A-10.

3. Remove nut and disconnect the tie rod end from the spindle, hold tie rod and unscrew tie rod end.

Install

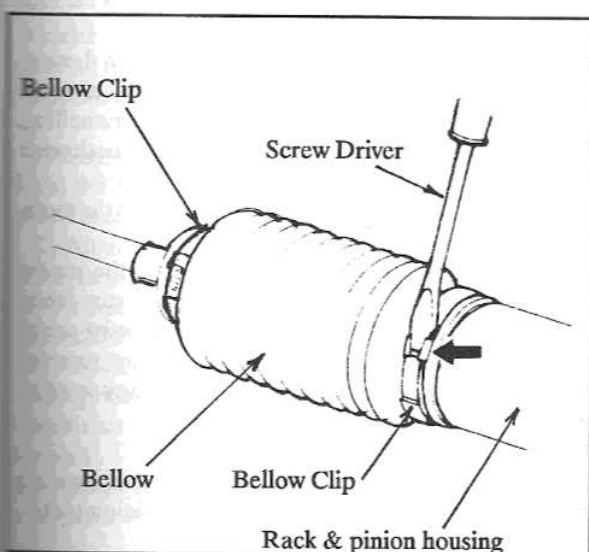
1. Hold tie rod and screw the end onto the rod until it locks tightly.

2. Locate tie rod end stud in the spindle, install and tighten the nut. Pin the nut.

3. Lower the vehicle and check the toe-in, tighten tie rod end lock nut.

Bellows**Remove**

1. Raise the vehicle and remove the tie-rod end as previously described.



2. Remove tie rod end locknut, and remove the clips from the bellows then remove the bellows from the gear.

Install

1. Install the bellows on the gear, install the bellows clips but don't tighten the small clip.

2. Install the locknut and tie rod end, don't tighten the locknut.

3. Lower the vehicle and check the toe-, tighten the small bellows clip and the tie-rod end locknut.

MAJOR REPAIRS & REBUILD**Rack & Pinion Steering Gear**

* All repairs must be performed with the steering gear removed from the vehicle.

Right or Left hand of the steering gears refers to that end as viewed from the drivers position in the vehicle.

CAUTION: It is most important that the steering gear parts are kept free from dirt and foreign particles, hence, the exterior of the steering gear assembly must be cleaned completely before the gear is dismantled or assembled on a clean work bench.

During service, the steering gear should preferably be held in a suitable fixture. Do not grip the general housing in a vice as this could cause deformation and cracking of the thin aluminium section resulting in binding or failure of the gear.

Steering Gear**Remove**

1. Place a drain pan under the steering.
2. Disconnect the pump to steering gear hydraulic lines at the gear using a six point tube nut wrench.

3. Loosen the clamp bolt at the upper end of the coupling shaft. Remove the bolt from the clamp at the lower end of the coupling shaft. Slide the coupling shaft upwards until it is clear of the steering gear input shaft.

4. Raise the vehicle supporting it under the body side rails, loosen the tie rod end stud nuts and free the tie rod end stud tapers in the wheel spindles. Remove the nuts and detach the tie rod ends from the spindles.

5. Remove the two bolts attaching the steering gear assembly to the sub-frame and remove the gear from the vehicle.

Dismantle

1. Remove the tie rod ends and bellows as previously described. Turn the gear to full left lock.

2. Hold the exposed tooth end of the rack in the vice equipped with protective jaws.

3. Release the tab washer from the flat on the tie rod ball housing. Unscrew the housing and rod assembly from the rack.

4. Remove the gear from the vice and rotate the pinion enough to expose the left hand tab washer. Remount the assembly in the vice gripping the exposed teeth of the rack.

5. Remove the left hand tie rod assembly as in Step 4. Remove the gear housing assembly from the vice and remount it by gripping the left hand mounting boss.

6. Disconnect the fluid transfer pipes from the valve housing and the gear housing.

7. Remove the dust seal from the housing.

8. Using an allen key to remove the two valve housing attaching screws and pull the valve housing from the input shaft.

9. Remove and dispose of the 'O' ring seal front the spigot on the rack housing.

10. Drive the valve seal and bearing from the valve housing.

11. Release the rack pad adjuster locknut with Holden Tool No. AU301, turn the gear to the full right hand lock.

12. Remove the lower pinion bearing retaining screw from the housing.

13. Remove the lower pinion bearing retaining nut from the pinion.

14. Remove the rack pad adjuster screw, spring and rack pad assembly using Holden Tool No. AU211.

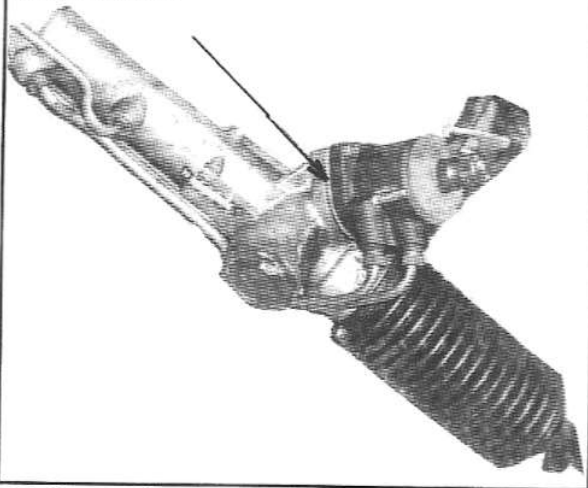
15. Wind the pinion assembly from the rack housing.

16. Remove and dispose of the 4 Teflon sealing rings from the valve sleeve.

This is best achieved by cutting them diagonally with a sharp knife taking care not to scratch the grooves or subsequent leakage will result.

*The Pinion Assembly Must Not Be Further Dismantled.

Remove the pinion seal and bearings from the housing. Discard the seal



17. Remove the pinion seal and bearings from the housing. Discard the seal.

18. Unscrew the rack bearing retaining screw from the left hand end of the housing.

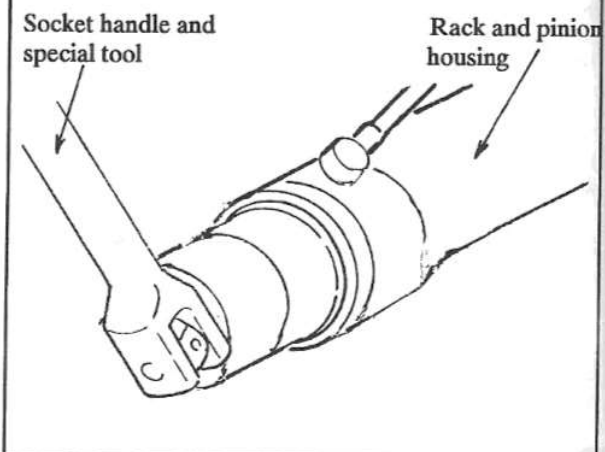
19. Remove the rack from the left hand end of the housing.

* The inner rack seal and back up ring together with the rack bearing will be removed on the rack, therefore some

resistance will be encountered when the rack contacts these items.

Remove the rack bearing from the rack bar.

Rotate the piston in a anti-clockwise direction to release the lock wire.



20. Rotate the piston in a anti-clockwise direction to release the lock wire.

21. Remove the piston from the rack bar.

22. Remove the circlip from the rack bar.

23. Remove the inner rack seal and retaining ring from the rack bar.

24. Remove the Teflon ring and rubber ring from the piston outside diameter.

25. Remove the 'O' ring from the inside diameter of the piston.

26. Remove the 'O' ring from the outside diameter of the rack bearing.

27. Remove the rack seal from the end of the rack bearing taking care not to damage the bearing or seal diameters.

Clean and Inspect.

1. Wash all parts in a cleaning solvent and blow off with air.

2. Examine the rubber bellows thoroughly for damage and deterioration, replace if required, dispose of all seals.

3. Inspect pinion bearings for signs of brinnelling, damage and wear, examine pinion for signs of tooth wear or damage.

4. Examine rack for signs of wear or damage to the teeth, rack pad faces and bush journal.

5. Inspect housing for wear or damage in the pinion bearing bores, seal bores, power bore and lock stop faces.

6. Inspect the rack pad for damage or excessive wear, examine the valve housing and bearing for any wear or damage. Then examine the valve sleeve for any wear or damage.

Assembly

1. Install the upper pinion bearing into the rack housing using a bearing insertion tool. Examine the pinion seal.

2. Install the lower pinion bearing into the rack housing using retaining screw to push it into place. Leave the retaining screw in position until the pinion is installed.

3. Assemble the 'O' ring and the Teflon ring into the groove in the outer diameter of the piston.

4. Position the piston assembly into the tapered sleeve, for 5 minutes to shrink the Teflon ring back to its operating dimension.

* Both the inner and outer rack seals have a tapered nylon ring installed in a recess in a rear face of the seal. The rings must be installed with the taper towards the spring loaded seal lip. Make sure that the tapered ends of the rings are correctly seated.

5. Assemble the seal back up ring and inner rack seal onto the rack bar. Make sure the spring loaded sealing lip is facing the left hand end of the rack. Take care when passing the seal over the piston circlip grooves.

6. Place the piston on the rack bar tapered face first. Locate the short leg of the lock wire in the hole in the lock ring groove of the rack with the long leg of the wire pointing to the right. Slide the piston over the lock wire so that the wire is located in the slot in the piston face.

7. Rotate the piston in a clockwise direction to wind the wire into the locking groove on the inner diameter of the piston. When fully home approx 2mm of wire should protrude into the piston slot to aid in possible future removal of the piston.

8. Install the 4 Teflon seal rings into the grooves of the valve sleeve. It will be necessary to expand the rings, so that they can be easily fitted into the sleeve grooves. The rings may be more easily worked if they are warmed in hot water.

9. When the rings are fitted into the grooves place the assembly into a cylinder type clamp for 5 minutes to shrink the rings to their operating dimension.

10. Liberally smear the rack teeth and journal with specified grease.

Specified Lubricant:

EP Semi Fluid Lithium Base O Grease

Smear the rack seals and bearing with specified power steering fluid.

Specified Fluid:

Dexron 11 Automatic Transmission Fluid

11. Install the rack bar into the housing, rack teeth first, from the left hand end. Take care not to damage the piston seal on the internal threads in the housing.

12. Align the teeth with the pinion bore to facilitate the fitting of the pinion. Do not press the inner rack seal into its bore at this time. Install the rubber sealing on the outside diameter of the rack bearing.

13. Assemble the outer rack seal into the end of the rack bearing with the sealing lip toward the bearing bore. Check that the nylon ring is in its place in the rear face of the seal.

14. Install the rack bearing assembly onto the rack bar and press it into the housing, install the rack bearing

retaining screw with Holden tool No AU305. Tighten to specification.

Rack Bearing Lock Nut specified torque: 60Nm.

15. Press the rack bar towards the right hand end of the housing until the resistance of the inner rack seal is felt, continue pressing until the seal is lightly bottomed out. The end of the rack bar should now be 0.9-3.4 mm below the outer face of the rack bearing locknut. Insert 50 grams of specified grease into the pinion bore.

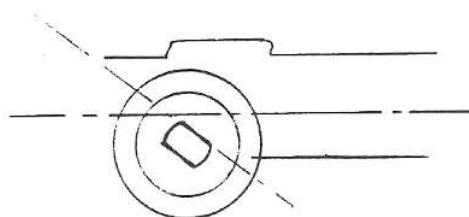
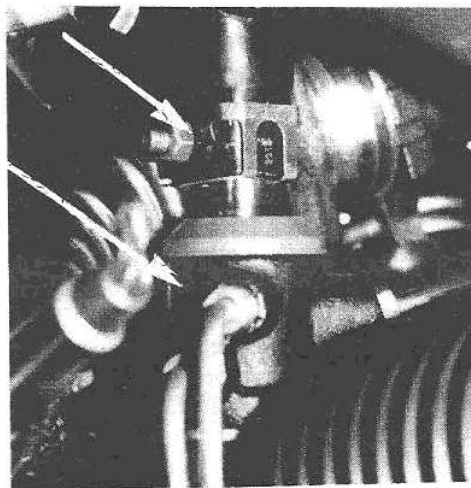
Specified Lubricant:

EP Semi Fluid Lithium Base O Grease

16. Centralise the rack (the distance from the housing lock stop face to the end of the rack bar is the same on both sides).

17. Maintaining the rack in its central position insert the pinion.

Bottom of clip to align with paint mark.



Shaft square back 16° from centre line

Input shaft square back 16° from the centre line of the steering rack

: Input shaft square back 16° from the centre line of the steering rack.

* The pinion will rotate 90 degrees anti-clockwise as it meshes with the rack teeth.

18. Install the rack pad and insert, washer and spring in the housing.

19. Apply loctite to the adjuster screw thread.

Install the assembly in the housing. The adjuster screw locknut has the word 'Inside' stamped on one face, this face must be towards the housing. Loosely install the locknut.

20. Remove the lower pinion bearing retaining screw and install the bearing retaining nut on the pinion. Turn the gear to the full left lock then tighten the retaining nut on the pinion. Turn the gear to the full left lock then tighten the retaining nut to 55 Nm. Pack the bearing with grease. This is a deformed thread locknut and should not be re-used.

21. Coat the thread of the retaining screw with loctite or equivalent and install and tighten to specification.

Retaining Screw specified torque: 60Nm

22. Install a new 'O' ring onto the spigot of the rack housing.

23. Install the valve seal in the valve housing.

24. Install the valve bearing, wide flange toward the seal.

25. Slide the valve housing over the valve sleeve and locate it on the spigot of the rack housing. Be careful not to damage the Teflon sleeve seals during this process.

26. Install the valve housing retaining screws and tighten to specification.

Valve Housing Retaining Screws specified torque: 6Nm

27. Fit new 'O' rings to the oil transfer pipes and connect the pipes to the valve housing and rack housing. Tighten the tube nuts to specification.

Fluid Transfer Tube nuts specified torque: 15Nm

Adjust the rack pad as described under adjustments.

28. Install the tie rods, and rotate the gear to the full left lock and hold the tooth end of the rack bar in a vice equipped with protective jaws. Place a tab washer on the end of the rack bar with the tabs located in the slot on the bar and screw in the tie rod. Tighten the tie rod ball joints to specification.

Tie Rod Ball Joints specified torque: 90-100Nm

29. Remove the gear from the vice and rotate the pinion enough to expose the left hand end of the rack bar. Mount the assembly in the vice gripping the exposed teeth of the rack.

30. Repeat number 28, then install the bellows and tie rod ends as previously described.

Install

1. Position the steering gear assembly on the sub-frame, install and tighten the attaching bolts.

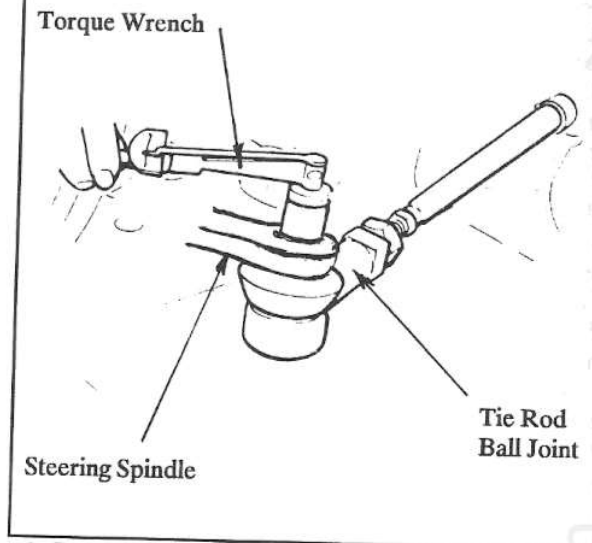
2. Connect the tie rod ends to the wheel spindles, install, tighten and pin the nuts to specification.

Tie Rod Ball Joint Ends specified torque: 58-71Nm

Centralize the steering gear and lower the vehicle.

3. Align the splines on the coupling shaft joint with the splines on the steering gear valve and slide the shaft onto the valve. Install and tighten the lower clamp bolt, tighten the upper clamp bolt.

Tie Rod Ball Joint Ends specified torque: 58-71Nm



4. Connect the hydraulic lines to the steering gear and tighten the unions with a six point tube nut wrench.

5. Top up the pump reservoir with the specified fluid and bleed the system.

Specified Fluid:

Dexron 11 Automatic Transmission Fluid

Rack & Pinion Steering Gear Mounting Bushes

Remove

Using a press, press the bushes from the rack housing.

Install

Press the new bushes into the rack housing after smearing the bushes with a soapy water solution.

V6 Power Steering Pump.

Power Steering Pump Hoses and Tubes

1. Remove fluid from power steering pump reservoir.

2. Detach hoses from pump.

3. Disconnect hose at rack and pinion steering gear housing.

Install

1. Replace hose to rack and pinion steering gear housing, do not tighten the connector.

2. Lower vehicle, replace teflon seal on pump pressure hose union, and install hose to the power steering pump.

Power Steering Clamp Nut specified torque: 40-55Nm

3. Raise vehicle, tighten hose connection.

Power Steering Clamp Nut specified torque: 40-55Nm

* Refill power steering pump with specified fluid.

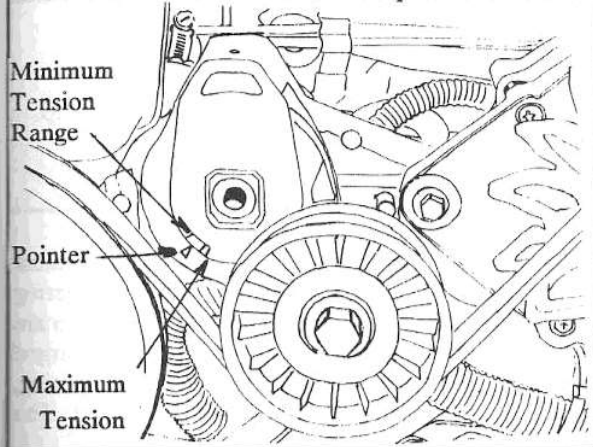
Specified Fluid:

Dexron 11 Automatic Transmission Fluid

Power Steering Pump & Reservoir**Remove**

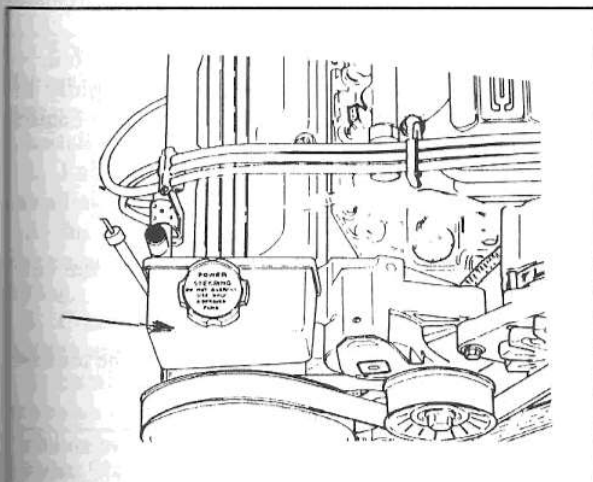
1. Using an 18mm spanner, engaged in the drive belt tensioner to relieve tension and remove the serpentine drive belt.

Relieve belt tension and remove serpentine drive belt.



2. Remove the power steering pump pulley.

3. Remove fluid from pump reservoir using a syringe or siphon hose.



4. Loosen the pump pressure line connector and disconnect pressure line. Detach return line.

CAUTION: Take care to prevent power steering pump fluid loss by plugging connections.

5. Remove pump from retaining bracket.

Dismantle

1. Remove pump pulley if not removed.

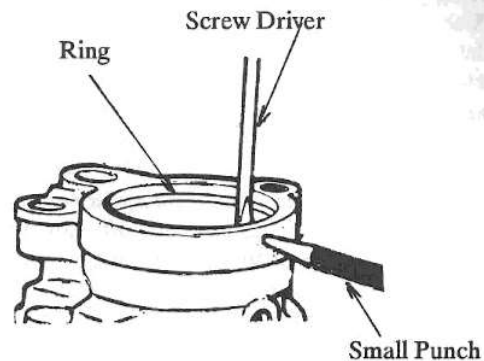
2. Remove outlet fitting, flow control valve, and flow control spring from pump.

3. Remove pump reservoir as outlined.

4. Place pump assembly in a bench vice.

5. Remove end plate retaining ring, compress ring by pushing a punch in through the hole in the pump housing,

Compress ring by pushing a punch in through the hole in the pump housing.



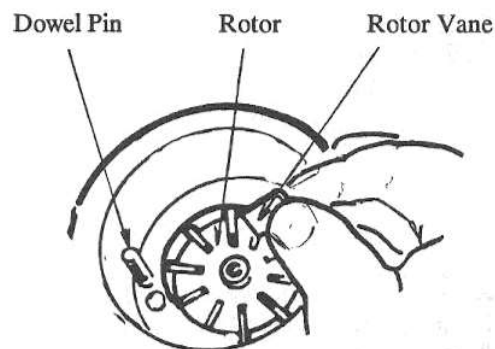
remove ring with a screwdriver, take care as the end plate is spring loaded.

6. Remove end plate, spring and "O" ring from pump housing.

7. Remove pump from vice and remove flow control valve and spring.

8. Tap pump shaft if necessary to remove shaft, pump ring, rotor assembly and thrust plate. Dismantle this assembly.

Remove rotor vane, rotor and retaining ring and "O" ring.



9. Remove rotor vane, rotor and retaining ring and "O" ring.

10. Remove dowel pins and remove shaft seal with a screw driver.

Clean and Inspect.**Steering Pump**

The following precautions must be observed when servicing the power steering pump:

1. Use a clean work bench and tools, thoroughly clean exterior of the unit with solvent. Drain as much fluid from the pump as possible.

2. If only reservoir is to be removed, clean as outlined. Do not use cleaning solvents on the seal.

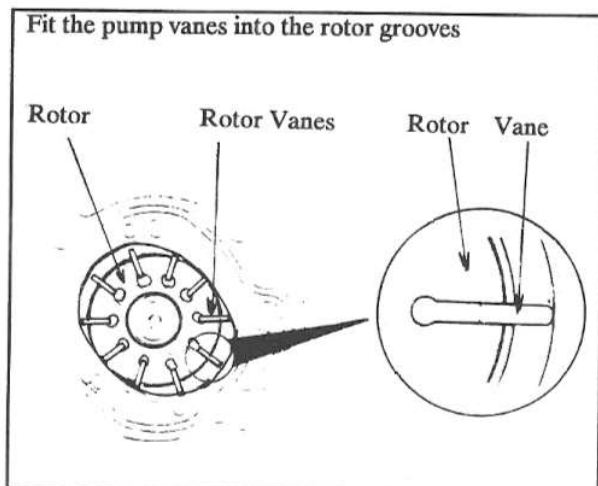
Steering Pump-Reservoir

Take following precautions when servicing the power steering pump reservoir:

* Use a clean work bench and tools, plug the inlet and outlet openings of the pump with plugs or masking tape, thoroughly clean the exterior of the pump with solvent.

Assemble

1. Install new shaft seal make sure the seal is seated properly, replace dowl pins.
2. Install new pressure plate "O" ring into pump body.
3. (a) Install thrust plate on the shaft with the ported section facing the spline end of the shaft.
- (b) Replace the rotor on the shaft, countersunk end facing thrust plate.
- (c) Install new shaft retaining ring, tap the ring into position with the help of a socket.
- (d) Install this assembly into the pump body, fit the dowel pins into the thrust plate.
4. Install pump ring (use two small holes) onto dowel pins, have the arrow facing up.
5. Fit the pump vanes into the rotor grooves.



6. Replace the pressure plate, narrow slots fit onto dowel pins, fit the spring onto the plate.
7. Install new end plate "O" ring, end plate and retaining ring.
8. Fit the flow control spring and plunger into pump body.

9. Replace the outlet fitting with a new "O" ring and tighten the fitting to specification.

Outlet Fitting specified torque: 60-100Nm

Install

1. Position pump in mounting bracket, and install return line and torque hose clamp.

Power Steering Pump Bolts specified torque: 40-55Nm

2. Install pump reservoir screws and torque to specification.

Power Steering Pump Reservoir Bolts specified torque: 1.0-2.5Nm

3. Install pressure hose connector, install pump pulley.

Pump Fluid Line specified torque: 40-55Nm

4. Install the pump pulley and tighten to specification.

Power Steering Pump Pulley Bolts specified torque: 10-20Nm

5. Install the serpentine drive belt.

* Make sure belt is correctly engaged on pulley ribs.

6. Fill power steering pump reservoir with specified fluid.

Specified Fluid:

Dexron 11 Automatic Transmission Fluid

7. Crank engine over without starting to prime pump.

V8 Power Steering Pump.

The power steering pump is a constant displacement vane type providing hydraulic pressure for the steering system. The housing and internal parts of the pump are inside the reservoir so the pump parts operate submerged in oil. The reservoir is sealed against the pump housing, leaving the housing face and the shaft hub exposed. The reservoir has a filler neck with a cap.

Start-Up Procedure

(After Pump, Steering Box or Line Repair)

1. Fill reservoir to the cold level with specified fluid.
2. Let engine run for one or two seconds to circulate fluid. Top up reservoir
3. Repeat number 2 until reservoir level remains full.
4. Idle engine and turn steering wheel rapidly to momentarily contact each lockstop 3 times, stop engine and top up reservoir.

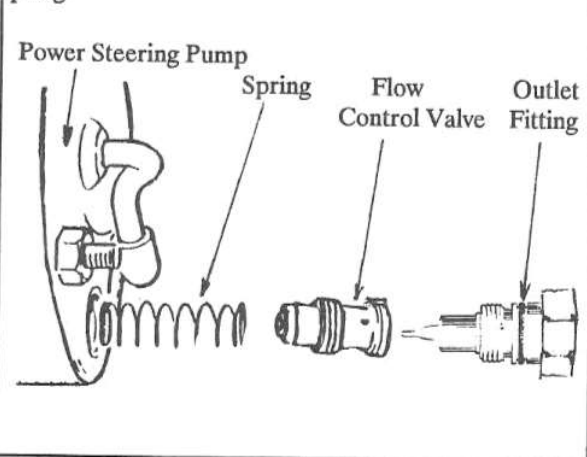
Pump Drive Belt**Remove**

Loosen the idler pulley locknut and release the belt tension. Remove the belt.

Install

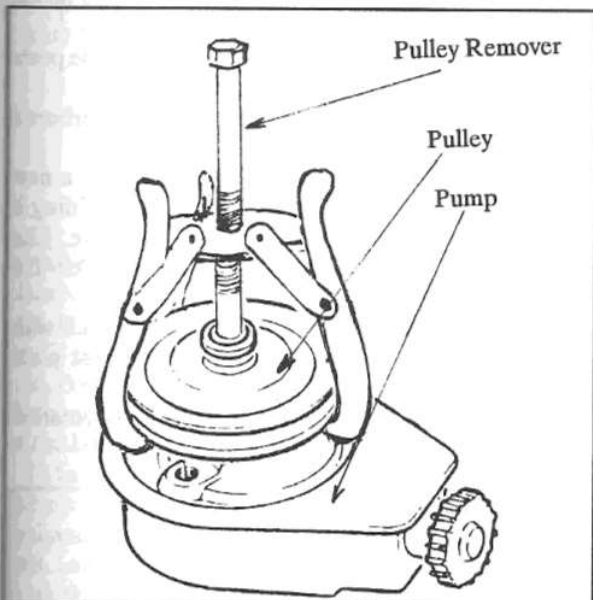
Position the belt over the pulleys and adjust the tension as previously described.

Remove the outlet fitting, the flow control valve and the spring



Outlet Fitting Flow Control Valve and Spring**Remove**

1. Disconnect the fluid return hose at the reservoir and drain the fluid into a container.
2. Disconnect the pressure hose from the outlet fitting using a ring spanner to prevent damage to the tube nut.



3. Remove the outlet fitting, the flow control valve and the spring. Dispose of all seals. It may be necessary to use a magnet to withdraw the flow control valve.

Install

1. Lubricate seals with power steering fluid prior to installation.
2. Install the spring and the flow control valve. The screened end is towards the spring. Install the outlet fitting.
3. Connect the pressure hose to the outlet fitting and tighten using a ring spanner.
4. Install the fluid return hose to the reservoir. Fill the reservoir with the specified power steering fluid.

Power Steering Pump Pulley**Remove**

1. With the pump removed from the vehicle, drain as much fluid as possible through the filler tube.
2. Install pulley remover tool on the pulley hub, and place the tool and pump in a vice.
3. Hold the pump and rotate the tool nut counterclockwise to remove the pulley. Do not apply in and out pressure on the pump shaft. Pressure will damage the internal thrust areas and the snap ring and groove, remove the tool.

Rotor Shaft Seal**Remove**

1. Remove the pump pulley from the rotor shaft, place the pump assembly in a holding fixture, with the pulley end of the shaft uppermost.
2. Clean any rust or dirt from the pulley end of the rotor shaft.
3. To prevent scoring of the rotor shaft, wrap 10mm shim stock (free of burrs) around the shaft and push the shim stock into the ID of the seal until it contacts the bushing.
4. Using a sheet metal punch, or similar tool, carefully pierce the metal portion of the seal body face, and pry the old seal out.

*** Do not damage the bushing, housing or the rotor shaft.**

Install

1. Remove the shim stock from the rotor shaft, and place the new rotor shaft seal on the seal protector with the metal backing facing the pulley end of the shaft.
2. Place the seal protector tool and the rotor shaft seal on the rotor shaft.
3. Using seal installation Tool and a plastic or rubber mallet, tap on the end of the tool until the seal is seated in the housing.
4. Remove the tools and install the pulley on the rotor shaft.

Power Steering Pump

1. Use a clean work bench and tools.
2. Clean the exterior of the unit with solvent. Drain as much fluid as possible
3. Do not use solvent on seals.

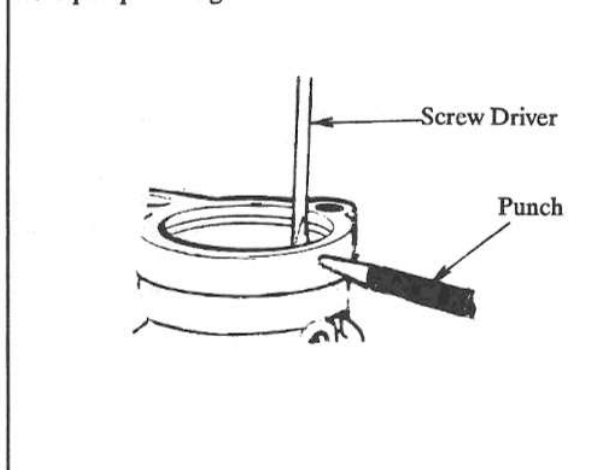
Remove

1. Disconnect the pressure and return lines from the pump and plug them to prevent loss of fluid or entrance of dirt into the system. Remove the drive belt.
2. Remove the two bolts securing the front mounting bracket to the cylinder head. Remove the nut attaching the pump to the rear bracket and remove the pump, remove the front mounting bracket from the pump.

Dismantle

1. Remove any corrosion from the shaft to prevent damage to the shaft bushing when the shaft is being removed.
2. Clamp the hub or pump in a vice so the extending portion of the shaft points down. Do not clamp the pump too tightly or bearing damage may result.
3. Remove the pressure union, O-ring assembly, and the mounting bolt from the back of the reservoir. Dispose of all seals and O-rings.
4. Rock the reservoir slightly back and forth to unseat the O-ring seal. Remove the reservoir. Remove and dispose of the O-ring.
5. Remove the bolt and pressure union seals from the counterbored spaces in the pump housing. Discard the seals. Remove the magnet.
6. Rotate the end plate retaining ring so that one end of the ring is over the hole in the housing. Insert a small punch in the 3mm diameter hole in the housing side

Compress ring by pushing a punch in through the hole in the pump housing.



opposite the flow control valve hole. Compress the retaining ring with the punch and remove the ring by twisting a screwdriver under the ring.

7. Remove the end plate. The end plate is spring loaded and will generally sit above the housing level for easy removal. If the plate sticks, rock back and forth lightly to free it.

8. Remove the pressure plate spring, remove the end plate O-ring seal.

9. Remove the pump from the vice and turn it over allowing the flow control valve, its spring, and the dowel pins to fall out. Do not disassemble the flow control valve. Service it as a unit.

10. Tap very lightly on the end of the shaft until the pressure plate, cam ring, vanes, rotor and shaft fall free.

11. Remove the retaining ring by clamping the shaft in a soft-jawed vice and prying the ring off the shaft. Do not damage the shaft with the vice jaws. Dispose of the retaining spring.

12. Remove the rotor and thrust plate from the shaft, remove the pressure plate seal from the housing bore and dispose of. Hold the housing in a vice and remove the shaft seal using a suitable puller. Removal will destroy the seal.

Clean and Inspect

Steering Pump

The following precautions must be observed when servicing the power steering pump:

Use a clean work bench and tools, thoroughly clean exterior of the unit with solvent. Drain as much fluid from the pump as possible.

Steering Pump-Reservoir

Take following precautions when servicing the power steering pump reservoir:

* Use a clean work bench and tools, plug the inlet and outlet openings of the pump with plugs or masking tape, thoroughly clean the exterior of the pump with solvent

Assemble

1. Clean all metal parts with solvent, lubricate all parts with Power Steering Fluid M2C163A prior to assembly.

2. Clamp the end hub of the housing in a vice with the pump chamber uppermost. Do not clamp too tightly or the bearing may be damaged.

3. Install a new pressure plate O-ring seal in the third groove from the rear of the housing. Install both dowel pins.

4. Install the thrust plate on the drive shaft with the ports toward the splined end of the shaft.

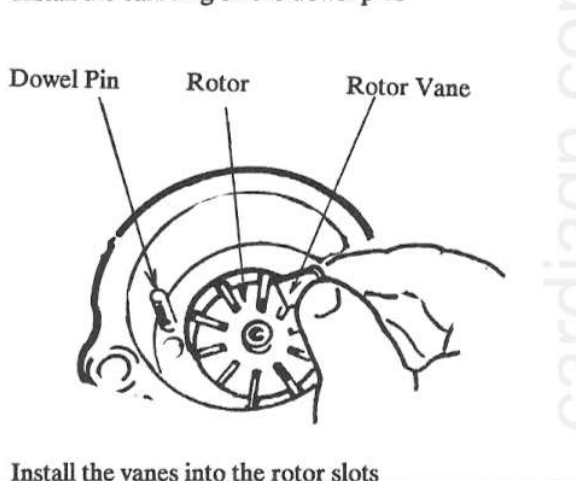
5. Install the rotor on the shaft with the counterbored end toward the thrust plate.

6. Clamp the shaft in a soft-jawed vice. Install a new retaining ring on a splined end of the shaft by sliding it down over the shaft until it seats in the ring groove. Use the round wire ring from the retaining ring service kit. Do not damage the shaft.

7. Insert the shaft in the housing. Lubricate shaft with power steering fluid, and make certain the thrust plate slides properly on the dowel pins.

8. Install the cam ring on the dowel pins with the rotation arrow toward the rear of the housing.

Install the cam ring on the dowel pins



Install the vanes into the rotor slots

9. Install the vanes into the rotor slots. Be sure the vanes slide freely.

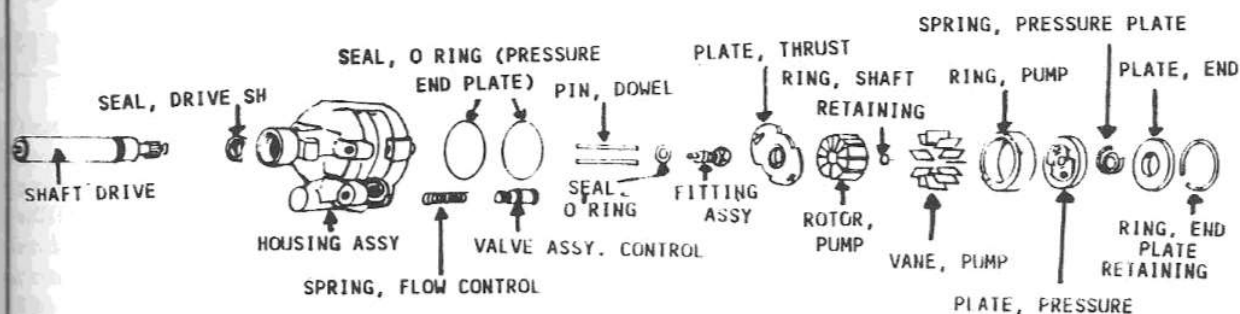
10. Lubricate the pressure plate to prevent damage to the pressure plate O-ring seal.

11. Install the pressure plate on the dowel pins with the circular spring depression toward the rear of the housing. The narrow slots in the plate should engage the dowel pins. To seat pressure plate press it about 1.2mm over the O-ring.

12. Lubricate a new end plate o-ring and install it in the second groove from the rear of the housing.

13. Install the pressure plate spring in the groove in the pressure plate.

14. Lubricate the end plate to prevent damage to the o-ring, and press it into the housing with a press or a 'G' clamp. Press the end plate only far enough to allow



installation of the retaining ring. Release the press or 'G' clamp.

15. Install the end plate retaining ring. Release the press or 'G' clamp.

16. Position the control valve spring in its hole and insert the control valve with the screened end towards the front of the housing.

17. Install new mounting bolt and pressure union seals in the countersunk holes. Lubricate a new reservoir O-ring seal and install it on the housing.

18. Lubricate the inside edge of the reservoir and install it on the housing. Align the holes in the reservoir and housing. Replacement reservoirs do not have an identification number. If a new reservoir is installed imprint the model number of the defective reservoir on the new part for future identification.

19. Insert the mounting bolt and tighten to specification.

Reservoir Bolt specified torque: 35-80Nm

20. Lubricate a new O-ring and install it on the pressure union in the groove next to the head hex. Insert the pressure union in the flow control valve hole in the back of the reservoir and tighten to specification.

21. Install a new seal.

22. Install the pulley.

Install

1. Install the front mounting bracket on the pump. Position the pump on the rear mounting bracket and install the nut and bolts tighten to specification.

Power Steering Pump Bolt specified torque: 20-28Nm

2. Install and adjust the drive belt.

3. Install the pressure hose to the pump fitting.

Tighten the tube nut with a tube nut wrench rather than with an open end wrench.

Press Hose Fitting specified torque: 40-55Nm

3. Install the return hose to the pump, fill the pump with the specified fluid and carry out the start up procedure.

Specified Fluid:

Dexron 11 Automatic Transmission Fluid

STEERING COLUMN

Steering Column

The steering column, which includes a combination ignition steering-ignition lock is of the collapsible type to lessen the possibility of injury to the driver of the vehicle, should the vehicle be involved in an accident.

The steering column may collapse up to approx. 150mm upon a hard impact.

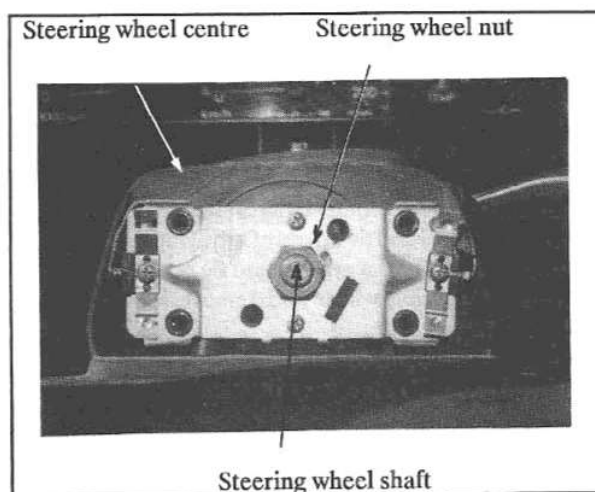
Steering Wheel

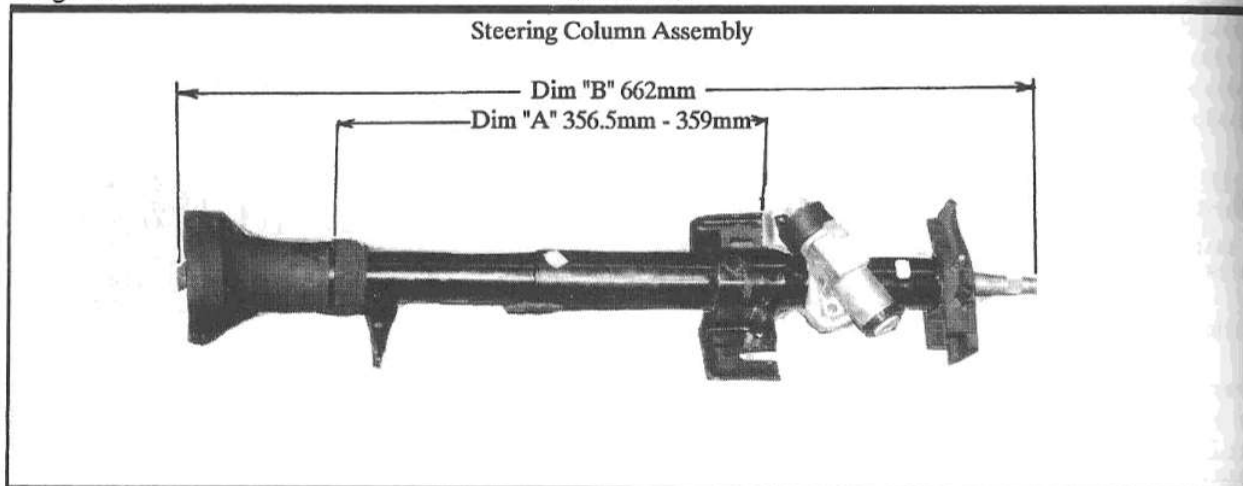
Remove

1. Remove the horn pad which is a push on / pull off fit, sometimes it may not pull off easily. Insert a small rod at the back of the horn pad and lightly tap the rear of the lugs, this will help to loosen the horn pad. Lift the pad from the steering wheel.

2. Mark the exact location of the steering wheel in relation to the steering shaft and column.

3. Remove the steering wheel nut and remove the wheel by grasping the rim of the wheel and pulling it from the shaft. Do not strike the shaft with a hammer as this will damage the bearing, you may need to use a steering wheel puller.



**Install**

1. Make sure that the horn connectors are in position and lubricate with specified grease.

Horn Contacts specified grease: HN 1346

2. Position the steering wheel on the shaft aligning the mark on the hub of the wheel with the mark on the end of the shaft. Install a new locknut and tighten to specification.

Steering Wheel Nut specified torque: 20-22Nm

3. Align the lugs on the horn bar and steering, push the horn bar into place.

Steering Column Upper and Lower Cover**Remove**

1. Remove the four screws securing the lower cover to the column and detach the cover.

2. Remove the three mounting bracket nuts to the column, lower the column. Remove the top cover.

Install

1. Replace the top cover. Lift the column into position, and replace the three mounting bracket nuts to the column, tighten to specification.

Steering Column nuts specified torque: 12-16Nm

2. Replace the lower cover and four screws securing the lower cover to the column.

Steering Column**Remove**

1. Pull back steering shaft clamp boot and remove steering shaft clamp bolt, upper universal joint to coupling shaft.

2. Remove lower right dash panel by turning attaching lock screws. Detach column wiring at the multi-pin plugs, unscrew fuse panel and tie up out of way. Unplug stop light connectors from pedal assembly and tie out of way.

3. Remove steering wheel and remove lower column cover screws and cover.

4. Remove 3 nuts securing the steering column.

5. Remove the nuts securing the column support bracket to the pedal support bracket. Pull back on column to:

- remove column from pedal assembly.

- remove the top column cover.

- remove steering shaft coupling from rack and pinion steering gear input shaft.

6. Remove column from vehicle.

CHECKING CONDITION of STEERING COLUMN

To ascertain if the steering column has been damaged due to an accident the steering column must be measured at two locations, these are shown at the top of the next page. If the measurements are not as specified replace the steering column. Check for steering shaft collapse by measuring dimension as illustrated on next page.

Install**CAUTION:**

1. Install steering column assembly to vehicle and slide into position so that:

- refit column to pedal assembly.

- replace the top column cover.

- install steering shaft coupling to rack and pinion steering gear input shaft.

2. Replace the nuts securing the column support bracket to the pedal support bracket, tighten to specification.

Steering Column to Pedal Assembly Nut specified torque: 12-16Nm

3. Replace 3 nuts securing the steering column tighten to specification.

Steering Column Securing Nuts spec torque: 12-16Nm

4. Replace steering wheel and lower column cover and screws. Tighten steering wheel nut to specification.

Steering Wheel Nut specified torque: 20-22Nm

5. (a) Plug stop light connectors to pedal assembly.

(b) Untie fuse panel and screw into position.

(c) Reconnect column wiring at the multi-pin plugs.

(d) Replace lower right dash panel and fix into position by turning attaching lock screws.

6. Pull back steering shaft clamp boot and replace steering shaft clamp bolt & upper universal joint to coupling shaft.

Steering Shaft Upper Coupling bolt specified torque: 23-30Nm

POWER STEERING FLUID PRESSURE TESTS

Test 1 provides a means of determining whether the power steering system hydraulic parts are faulty. If test 1 results in readings indicate faulty hydraulic operation, test 2 will identify the faulty part. Before performing hydraulic circuit test, carefully check drive belt tension, condition of driving pulley and fluid level.

The engine should be at normal operating temperature. Front tyres at correct pressure. The engine must be operating at idle RPM.

Connect a pressure gauge and valve (valve position between pump and pressure gauge) assembly in the high pressure hydraulic line between the pump and steering gear. Remove the high pressure line at the steering pump, install the valve then pressure gauge, reinstall the hose to the pressure gauge.

* Refill the power steering system with fluid to the correct level.

Test 1 - Hydraulic Circuit Open

1. Engine idling over, valve open so fluid can run through pressure gauge, turn the steering wheel so the steering is fully turned.

2. Pressure should be at or marginally above 9250 kPa, if not check for faulty components.

Test 2 - Hydraulic Circuit Closed

1. Engine idling over, valve open so fluid can run through pressure gauge, turn the valve so it is closed for a second or two, just long enough to read pressure then open valve again.

- * Low pressure that is less than 9250 kPa.
 - Check for faulty pump.
 - Flow control valve stuck or inoperative.
- * High pressure that is over 9300 kPa
 - Check for hoses that are blocked or kinked causing

Problem Diagnosis.

Problem: Hard Steering

Possible Causes & Remedies:

- * Tyres incorrectly inflated. Remedy-Inflate tyres to correct pressure.
- * Insufficient lubricant. Remedy-Lubricate suspension and steering linkage.
- * Excessive caster. Remedy-Check front wheel alignment.
- * Steering system joints worn. Remedy-Replace steering system joints.
- * Lower arm ball joints worn. Remedy-Replace lower arm ball joints.
- * Steering column binding. Remedy-Inspect steering column.

* Steering gear out of adjustment or broken. Remedy-Adjust or repair steering gear.

* Power steering belt loose. Remedy-Adjust belt.

* Fluid level in reservoir low. Remedy-Check reservoir.

* Power Steering unit faulty. Check power steering unit.

Power Steering Unit Checks

- * Check fluid level on cap dip stick.
- * Loose drive belt.
- * Drive belt slipping.
- * High internal leakage.
- * Insufficient pump pressure.
- * Sticky flow control valve.
- * Steering column to rack & pinion connection may not be correctly aligned.

If none of the above problems are found, carry out a pressure test as described in this Chapter, for other possible causes such as.

- * Control valve problems.
- * Pump pressure not as specified.
- * Steering pump bypass of fluid.

Problem: Poor return

Possible Causes & Remedies:

- * Tyres incorrectly inflated. Remedy-Inflate tyres to correct pressure.
- * Insufficient lubricant. Remedy-Lubricate suspension and steering linkage.
- * Wheel alignment incorrect. Remedy-Check front wheel alignment.
- * Steering column binding. Remedy-Inspect steering column.
- * Steering gear out of adjustment or broken. Remedy-Adjust or repair steering gear.

Problem: Excessive Play

Possible Causes & Remedies:

- * Front wheel bearing worn. Remedy-Replace front wheel bearing.
- * Main shaft yoke or intermediate shaft yoke worn. Remedy-Replace main shaft or intermediate shaft.
- * Lower arm ball joints worn. Remedy-Replace lower arm ball joints.
- * Steering system joints worn. Remedy-Replace steering system joints.
- * Steering gear out of adjustment or broken. Remedy-Adjust or repair steering gear.

Problem: Abnormal Noise I

Possible Causes & Remedies:

- * Steering linkage loose. Remedy-Tighten steering linkage.
- * Steering system joints worn. Remedy-Replace steering system joints.
- * Steering gear out of adjustment or broken. Remedy-Adjust or repair steering gear.

Problem: Drive Belt Squeal

Possible Causes & Remedies:

- * Loose drive belt
- * Drive belt slipping
- * Drive belt badly worn
- * Drive belt has a glazed surface

Problem: Noise from Power Steering Pump

Possible Causes & Remedies:

- * Excessive back-pressure in hoses or steering gear caused by restriction.
- * Scored pressure plate, thrust plate or rotor.
- * Extreme wear of pump ring and vanes.
- * Vanes not installed correctly.

Problem: Miscoloured Power Steering Fluid

Possible Causes & Remedies:

- * Power steering fluid has air mixed with it. Check pump for problem and repair.

Problem: Steering pump pressure not as specified.

Possible Causes & Remedies:

- * Pump has not been correctly assembled.
- * Internal components of pump are extremely worn.
- * Control valve problems.
- * Pump pressure not as specified.
- * Steering pump internal bypass of fluid.

Leaking Pump Remedies

- * Check oil level - if leakage persists with the level correct and cap tight, replace the cap because of poor cap ventilation.
- * Replace drive shaft seal. Make certain that drive shaft is clean and free of pitting in seal area.
- * Replace reservoir O-ring seal.
- * Torque hose fitting nut to 40 - 54 Nm. If leakage persists, replace O-ring seal.
- * Torque outlet fitting to 75 Nm. If leakage persists, replace O-ring seal.
- * Torque hose fitting nut to 48 Nm. If leakage persists, replace connector and reface the tube flare. If nut threads are damaged, replace nut.
- * Replace O-ring seal.

Specifications**STEERING GEAR**

Steering Gear Type:

Power Steering Rack & pinion with integral power cylinder & rotary valve mechanism - variable ratio.

No. of Steering Wheel Turns Lock to Lock:

Power Steering 2.68

Nominal Rack Travel Total:

Power Steering 144 mm

POWER STEERING PUMP Make: Saginaw

Type: V6 "N" Series vane type

V8 "P" Series vane type

Pressure at idle:

V6 9300 - 10,000 kPa

V8 9300 - 10,000 kPa

Drive: Pulley

Lubrication (Power Steering):

Hydraulic Dexron II Automatic Transmission Fluid

Fluid Capacity: Approx 650 mls.**Drive Belt Tension:**

V6 Belt Self Adjusting

V8 - New Belt 57 kg

- Used Belt* 34 kg

* Belt is considered "used" after 10 minutes running

Toe-in Specification (all models):

Toe-in (total) 0°30' - 0°30' (3.0 - 3.0 mm)

Toe-in (per wheel) 0°15' - 0°15' (1.5 - 1.5 mm)

Turning Circle (Kerb**Weight):** Kerb to Kerb Wall to Wall

Power Steering 10.7 m 11.4 m

Specified Grease for Rack & Pinion Steering Gear Unit:

EP Semi Fluid Lithium Base O Grease

Specified Locking Compound:

Power Steering Loctite 242 or equivalent.

Torque Specifications Nm**Steering Column**

Upper column nut 23-30 Nm

Lower clamp bolt 18-22 Nm

Rack & Pinion Steering Gear

Steering gear attaching bolts 44-56 Nm

Steering fluid lines 40-54 Nm

Flexible coupling nuts 18-22 Nm

Rack Adjusting Screw Lock Nut 55-65 Nm

Rack Adjusting Screw 10-12 + 25°-30°

Power Steering Pump**1/6**

Pump to Mounting Bracket 40-54 Nm

Pulley Retaining Bolt 10-20 Nm

Fluid Outlet Fitting 50-102 Nm

Fluid Outlet Tube Fitting 40-54 Nm

Reservoir Screw 1.0-2.5 Nm

1/8

Pump to Mounting Bracket 20-28 Nm

Fluid Outlet Fitting 50-102 Nm

Fluid Outlet Tube Fitting 40-54 Nm

Reservoir Screw 35-80 Nm