POWER STEERING

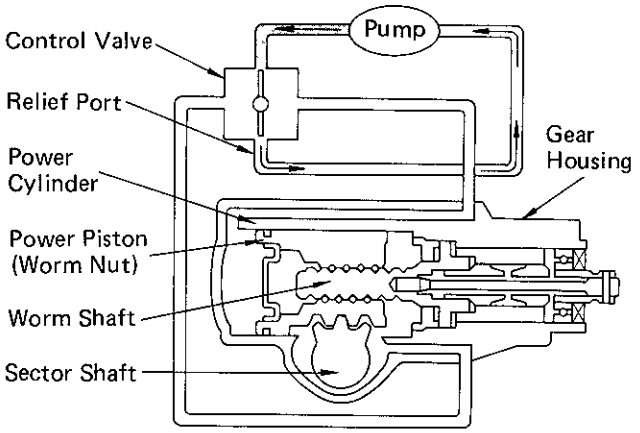
Description

PRINCIPLES OF POWER STEERING

Power steering is one type of a hydraulic device for utilizing engine power as a steering effort. Consequently, the engine is used to drive a pump to develop fluid pressure, and this pressure acts on a piston within the power cylinder so that the pinion assists the rack effort. The amount of this assistance depends on the extent of pressure acting on the piston. Therefore, if more steering force is required, the pressure must be raised. The variation in the fluid pressure is accomplished by a control valve which is linked to the steering main shaft.

• NEUTRAL (STRAIGHT-AHEAD) POSITION

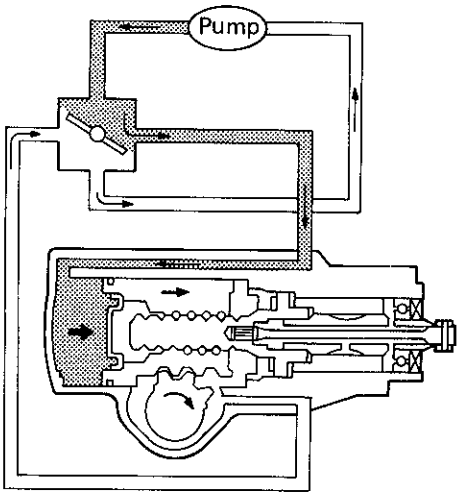
Fluid from the pump is sent to the control valve. If the control valve is in the neutral position, all the fluid will flow pass through the control valve into the relief port and back to the pump. At this time, hardly any pressure is created and because the pressure on the cylinder piston is equal on both sides, the piston will not move in either direction.



SR2452

• WHEN TURNING

When the steering main shaft is turned in either direction, the control valve also moves, closing one of the fluid passages. The other passage then opens wider, causing a change in fluid flow volume and, at the same time, pressure is created. Consequently, a pressure difference occurs between both sides of the piston and the piston moves in the direction of the lower pressure so that the fluid in that cylinder is forced back to the pump through the control valve.



SR2453

SERVICE HINT

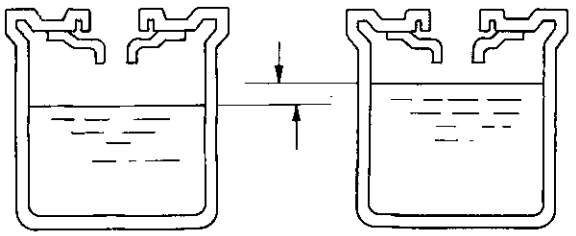
Troubles with the power steering system are usually concerned with hard steering due to the fact that there is no assist. In such case, before attempting to make repairs, it is necessary to determine whether the trouble lies with the pump or with the gear housing. To do this, an on-vehicle inspection can be made by using a pressure gauge.

ON-VEHICLE INSPECTION

Power steering is a hydraulic device and any problems are normally due to insufficient fluid pressure acting on the piston. This could be caused by either the pump not producting the specified fluid pressure or the control valve in the gear housing not functioning properly so that the proper amount of fluid pressure can be obtained.

If the fault lies with the pump, the same symptoms will generally occur whether the steering wheel is turned fully to the right or left. On the other hand, if the fault lies with the control velve, there will generally be a difference between the amount of assist when the steering wheel is turned to the left and right, causing harder steering. However, if the piston seal of the power cylinder is worn, there will be a loss of fluid pressure whether the steering wheel is turned to the right or left and symptoms will be the same for both.

Before performing an on-vehicle inspection, a check must first be made to confirm that the power steering system is completely free of any air. If there is any air in the system, the volume of this air will change when the fluid pressure is raised, causing a fluctuation in the fluid pressure so that the power steering will not function properly. To determine if there is any air in the system, check to see if there is a change of fluid level in the reservoir tank when the steering wheel is turned fully to the right or left.



When Turning — SR2392 — Neutral — SR2393

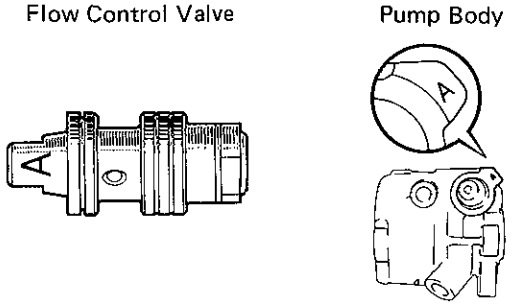
Also, air in the system will sometimes result in an abnormal noise occurring from the pump or gear housing when the steering wheel is fully turned in either direction. This on-vehicle inspection must always be performed to insure that the power steering system is working properly after overhauling or repairing the pump or gear housing.

VANE PUMP

The main component parts of the vane pump, such as the cam ring, rotor, vanes and flow control valve are highly precision parts and must be handled carefully. Also, because this pump produces a very high fluid pressure, O-rings are used for sealing each part. When reassembling the pump, always use new O-rings.

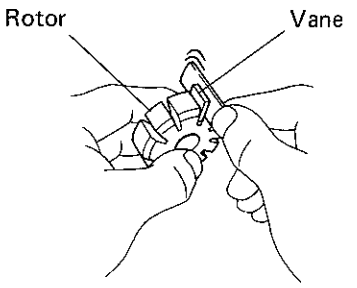
In the flow control valve, there is a relief valve which controls the maximum pressure of the pump. The amount of this maximum pressure is very important; if it is too low, there will be insufficient power steering assist and if too high, it will have an adverse effect on the pressure hoses, oil seals, etc. If the maximum pressure is either too high or too low due to a faulty relief valve, do not disassemble or adjust the relief valve, but replace the flow control valve as an assembly.

The clearance between the flow control valve and pump body installation hole is very important. When replacing the flow control valve, be sure to do so with one having the same mark in order to insure the proper clearance.

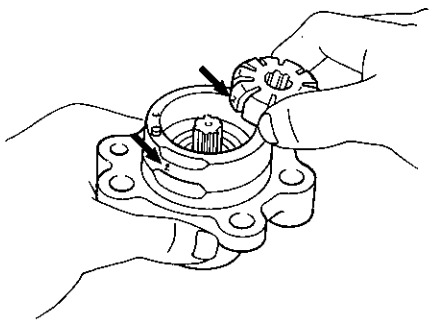


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The function parts of the pump which produce fluid pressure are the cam ring, rotor and vanes, and these should be checked to wear. If the clearance between each is not within standard when reassembling, any worn parts should be replaced. In this case, the replaced cam ring and rotor should be of the same length (have the same mark), and the vanes should be replaced with those having a length corresponding to that mark, otherwise the proper thrust clearance cannot be obtained. If there is too much thrust clearance, there will be insufficient fluid pressure at low speeds. If there is too little thrust clearance, it may result seizure of the vanes.



SR2397

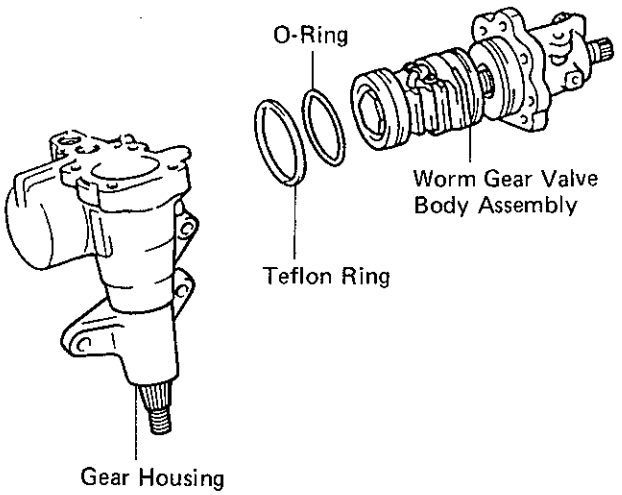


SR2398

GEAR HOUSING

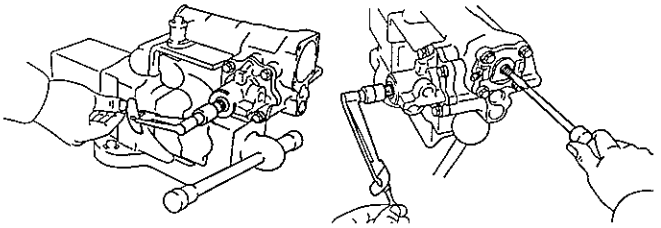
Because of the high pressure, even the slightest scratch will cause fluid leakage, resulting in an inoperative power steering system.

Teflon rings are used for the cross shaft, piston and control valve. These teflon rings are highly durable against wear, but if it is necessary to replace them, be careful not to stretch the new ones. After installing a teflon ring into its groove, snug it down into the groove before assembly of the cylinder or housing to prevent possible damage.



SR3616

As with the recirculating ball type steering, preload is very important. If the preload is not correct, it could result in such trouble as steering wheel play or lack of durability so always make sure that it is correct.



Check the worm gear preload — SR2455

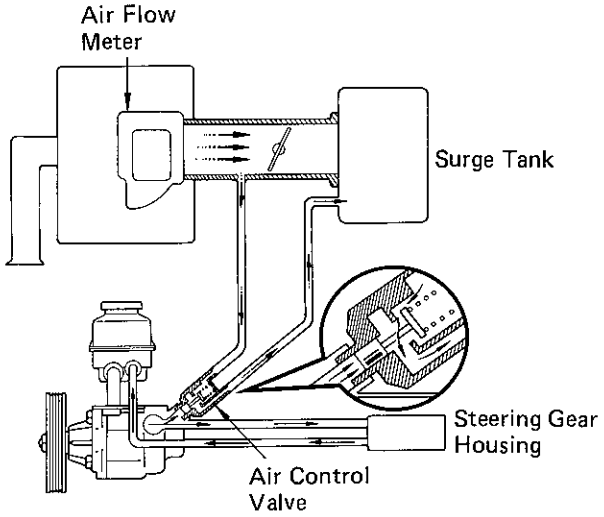
Adjust total preload — SR2456

IDLE-UP DEVICE

The pump produces the maximum fluid pressure when the steering wheel is turned fully to the right or left and, at this time, there is a maximum load on the pump which causes a decrease in engine idle rpm. To solve this problem, some vehicles are equipped with an idle-up device which acts to raise the engine idle rpm whenever there is a heavy load on the pump.

EFI ENGINES

On EFI engines, when the piston of the air control valve is pushed by fluid pressure, the air valve opens and the volume of air by-passing the throttle valve is increased to regulate engine rpm.



SR3154

The idle-up device functions to raise engine idle rpm when pump fluid pressure acts on the air control valve, installed to the pump body, to control the flow of air.