

1.1 GENERAL DESCRIPTION - POWER STEERING

POWER STEERING RACK AND PINION

The power steering gear features a variable ratio rack and pinion that is made possible by the unique design of the rack teeth. This means that the effective pitch radius of the pinion is less in the straight ahead position than on turns. Refer to Figure 9A-2.

This results in less turns being required from lock to lock. For example, 3.5 turns would be required if the 'on centre' ratio was used from lock to lock, whereas only 2.7 turns are required with this rack design.

The helical toothed pinion is supported in the steering gear housing by a needle roller bearing at the lower end and a deep groove radial ball race at the upper.

The rack operates within the housing and is supported at one end by a rack bearing and at the other end by the pinion and a spring loaded pad, which maintains slack free adjustment of the rack with the pinion. Refer Figures 9A-1 and 9A-2.

The tie rods are connected to each end of the rack by pre-assembled ball joints and to the steering arms by tie rod end ball joints.

Principles of Operation

With the engine running and the steering wheel in the neutral position (straight ahead), fluid flows continuously from the power steering pump to the steering gear and back to the pump, via the fluid reservoir. In this steering mode, very little pressure is required to maintain the high fluid flow rate that occurs at this time. As a result, little engine power is required to operate the system.

When turning the steering wheel to either side, fluid flow from the pump is directed by a rotary control valve fitted to the steering gear, to whichever side of the rack piston is appropriate, as indicated by the steering wheel position. The fluid pressure then increases as necessary, to provide the required steering assistance.

This rotary control valve assembly, is located between the input shaft and the pinion, in the steering gear.

Referring to Figure 9A-1, the rotary valve assembly consists of an inner member which forms part of the input shaft and a surrounding sleeve member. The whole valve rotates in the steering gear housing as the steering wheel is turned, but it is the slight relative movement between the inner valve and outer sleeve members that controls and directs the power steering fluid flow.

Fluid is fed to the valve and from there, to the left and right sides of the rack piston via circumferential grooves in the outer sleeve, that are sealed by P.T.F.E. seals. The outer sleeve is coupled by a pin to the rack pinion, while the input shaft is coupled to the rack pinion by a flexible torsion bar that provides a mechanical but flexible link between the two members.

In the straight ahead position, the valve remains centred. As steering effort requirements increase, the torsion bar flexes, causing slight relative rotation between the input shaft and sleeve, directing fluid and providing power assistance as needed.

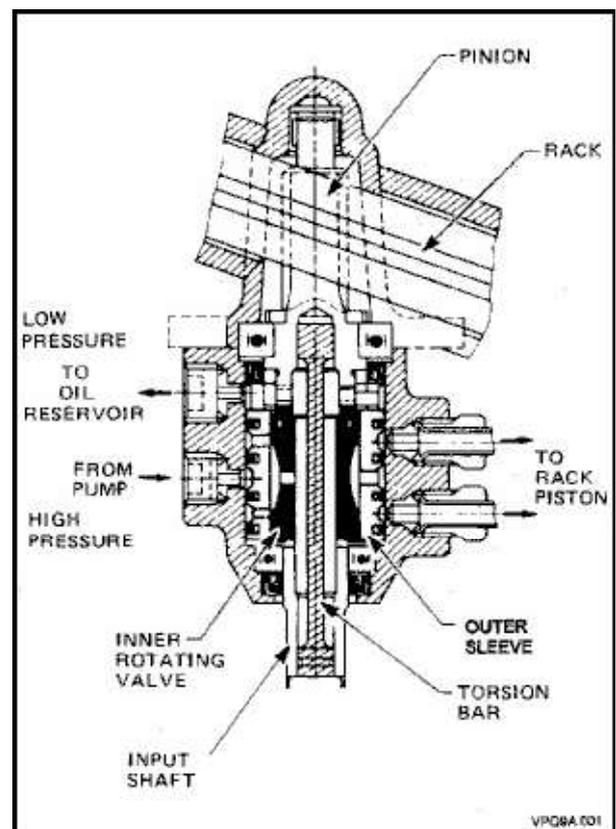


Figure 9A-1

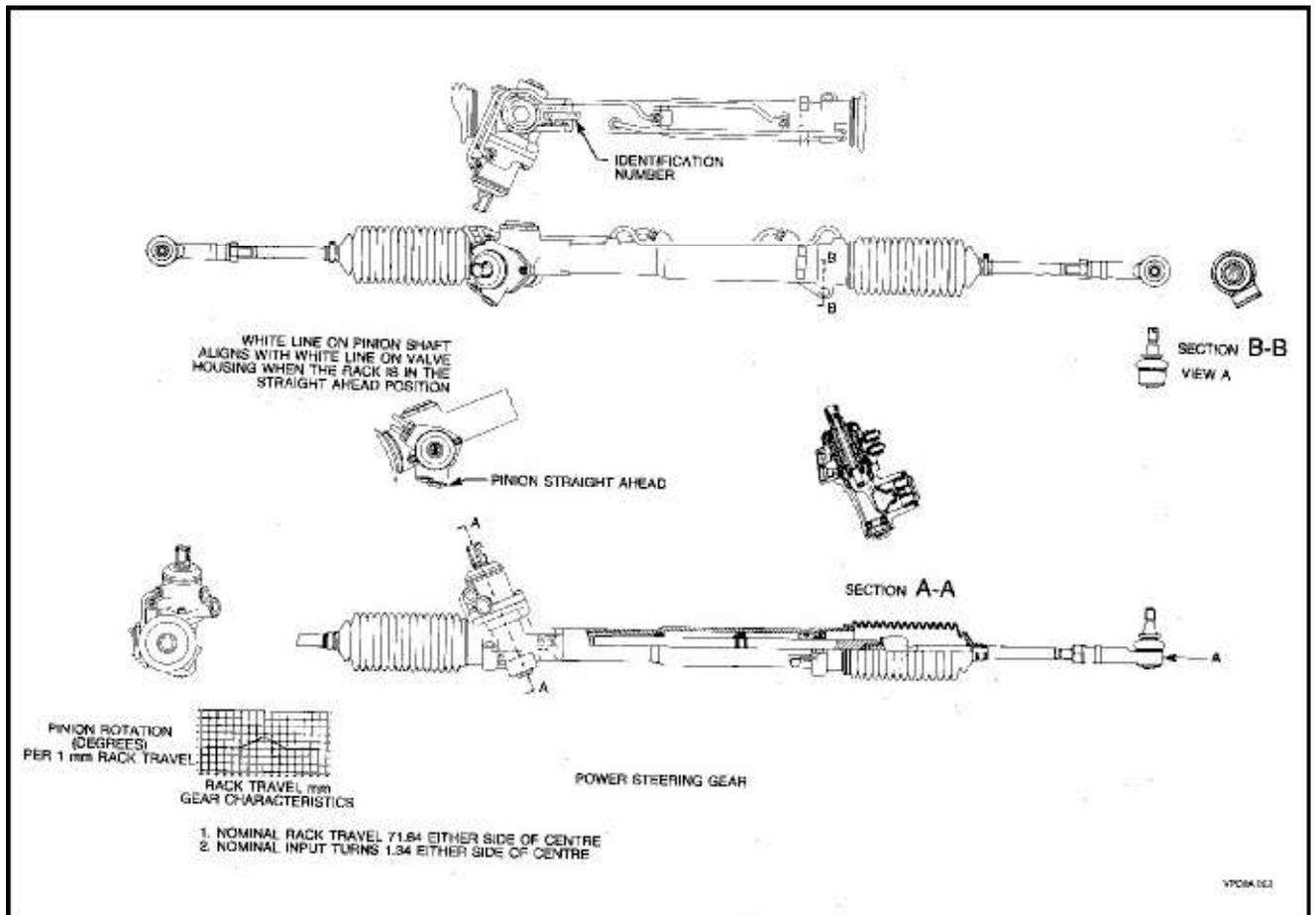


Figure 9A-2

Neutral Position (Straight Ahead)

From the stylised cross-sectioned view of the rotary valve shown in Figure 9A-3, it can be seen that in this attitude, fluid flow is directed into the cavities of the inner valve assembly and out through a number of drilled holes in the outer sleeve (Shown as [A]). In this steering position, the inner valve allows fluid to pass equally to both sides of the rack piston (shown as 'Static' because no fluid actually flows to and from the steering gear). The bypassed fluid returns to the fluid reservoir through holes drilled in the longitudinal grooves of the inner valve (shown as [B]). With an equal pressure applied to both sides of the rack piston, no power assistance is provided.