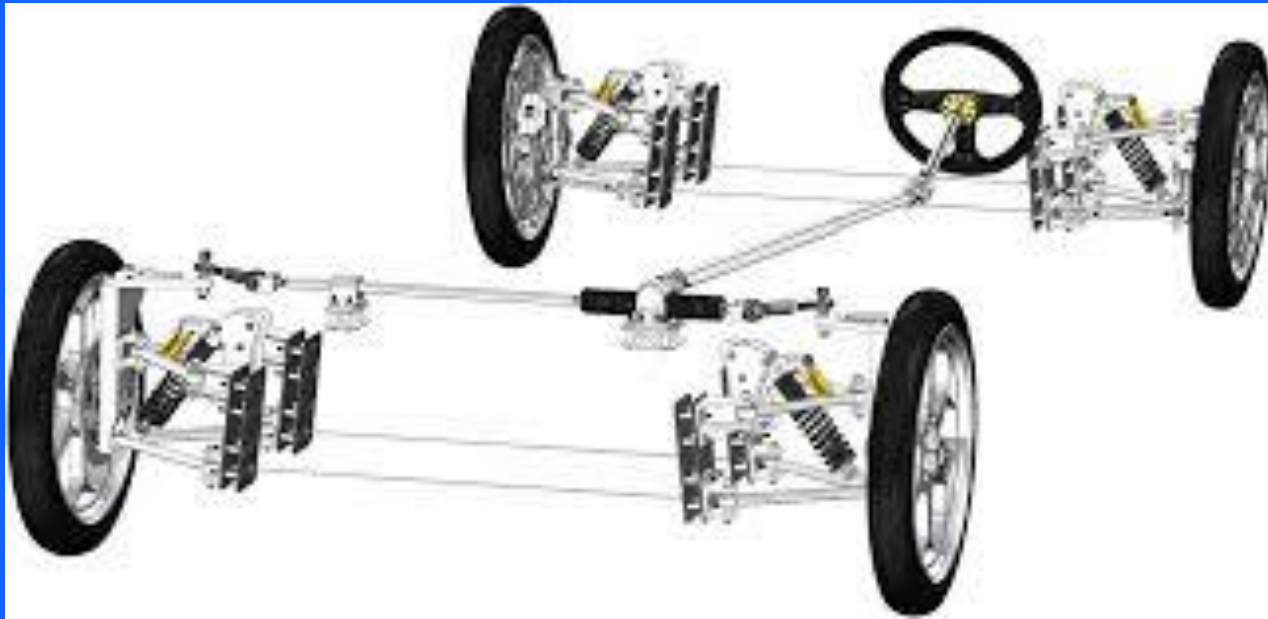


Steering Systems



Functions of a Steering System

- **Maintain direction on the road**
- **Steer vehicle from left to right**
- **Allow upward travel of suspension system**
 - **Adjust wheel alignment**
 - **Ensure proper tire wear**



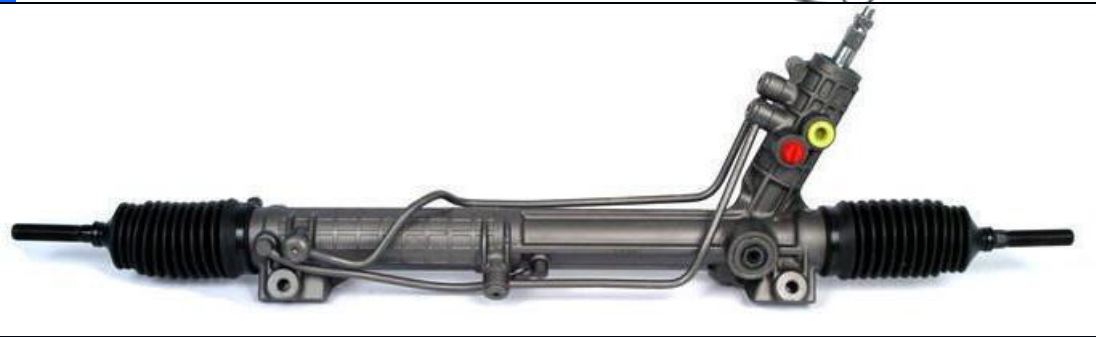
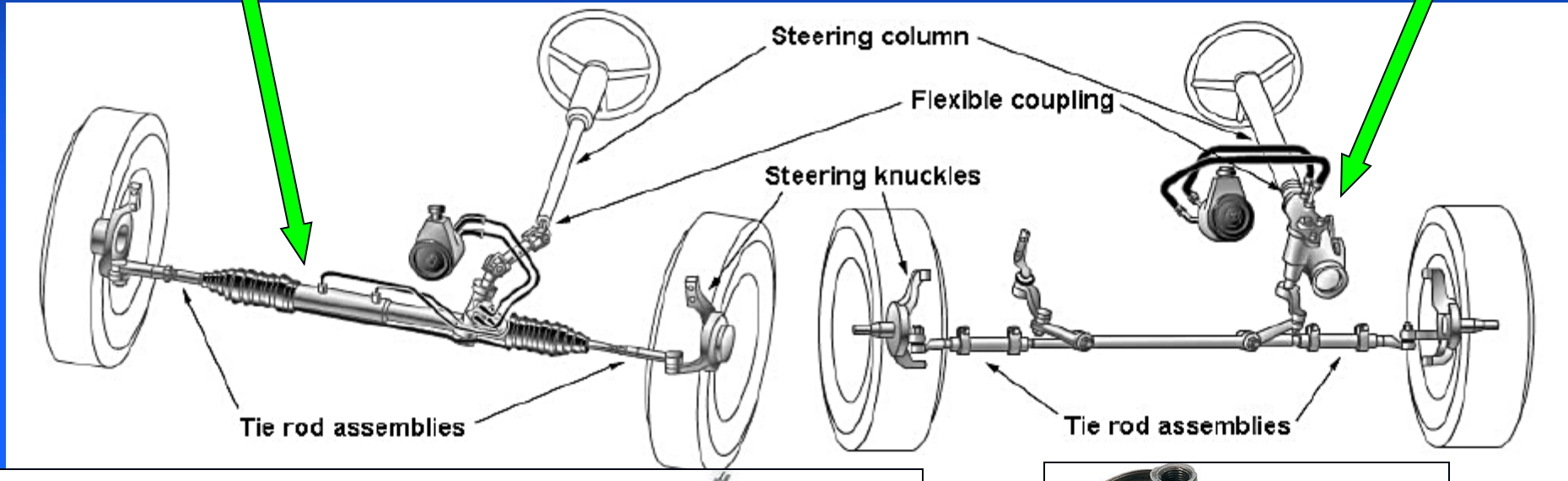


Steering Gears

- 2 types of steering gears...

➤ rack & pinion

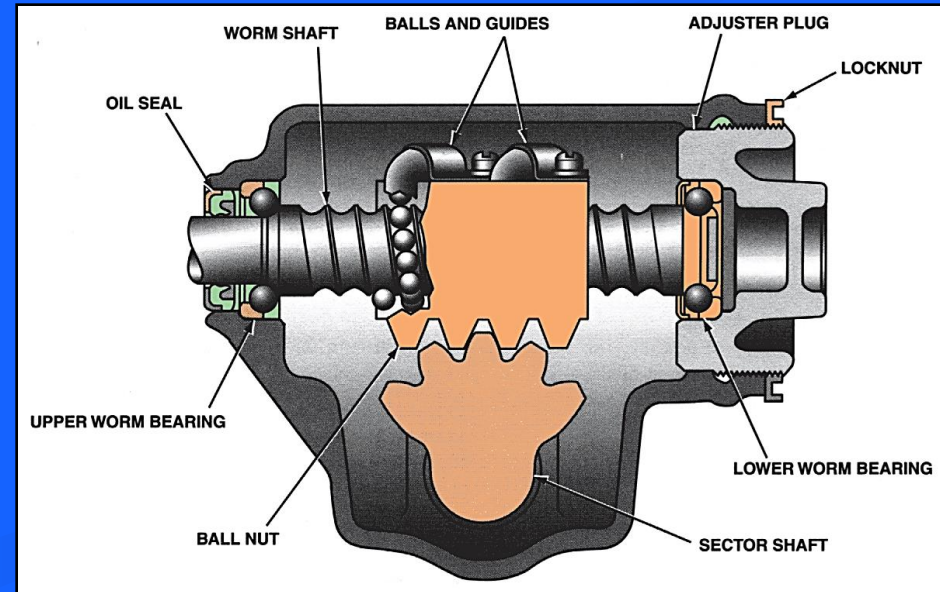
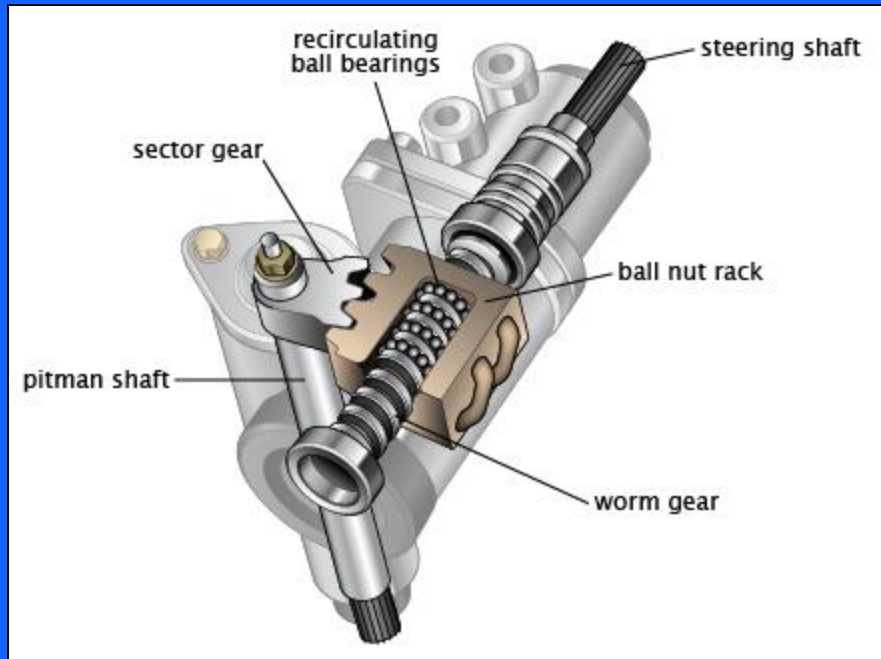
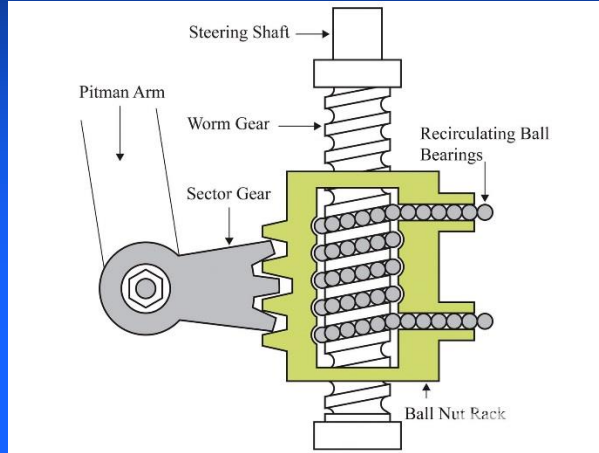
➤ steering box





Recirculating-Ball Steering Box

- offers good mechanical advantage
- bulky/heavy





Steering Box Linkage

- parallelogram linkage
 - transmits steering box movement to the wheels
- less precise steering "feel"
 - advantages
 - disadvantages

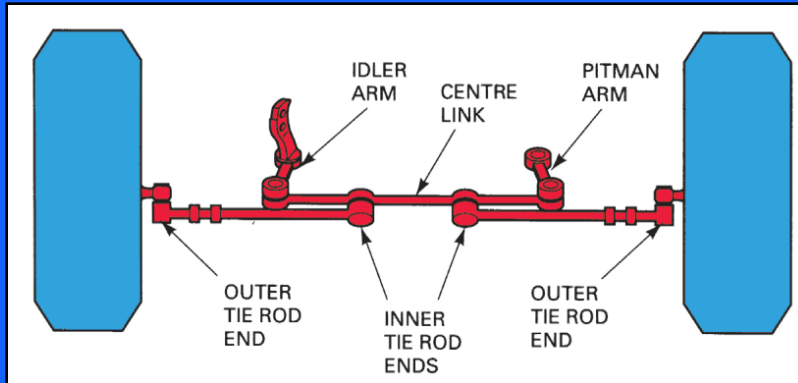
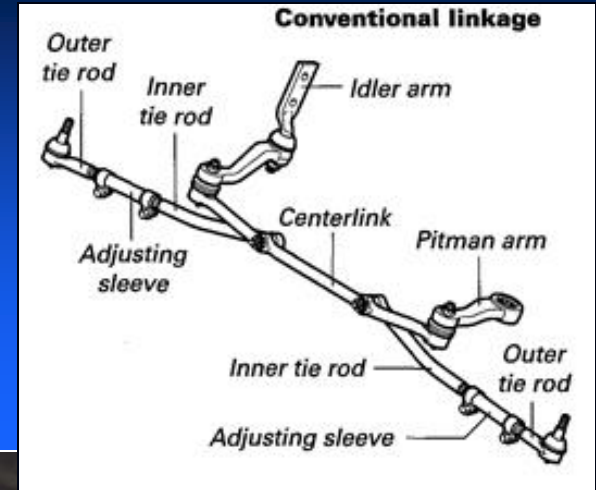
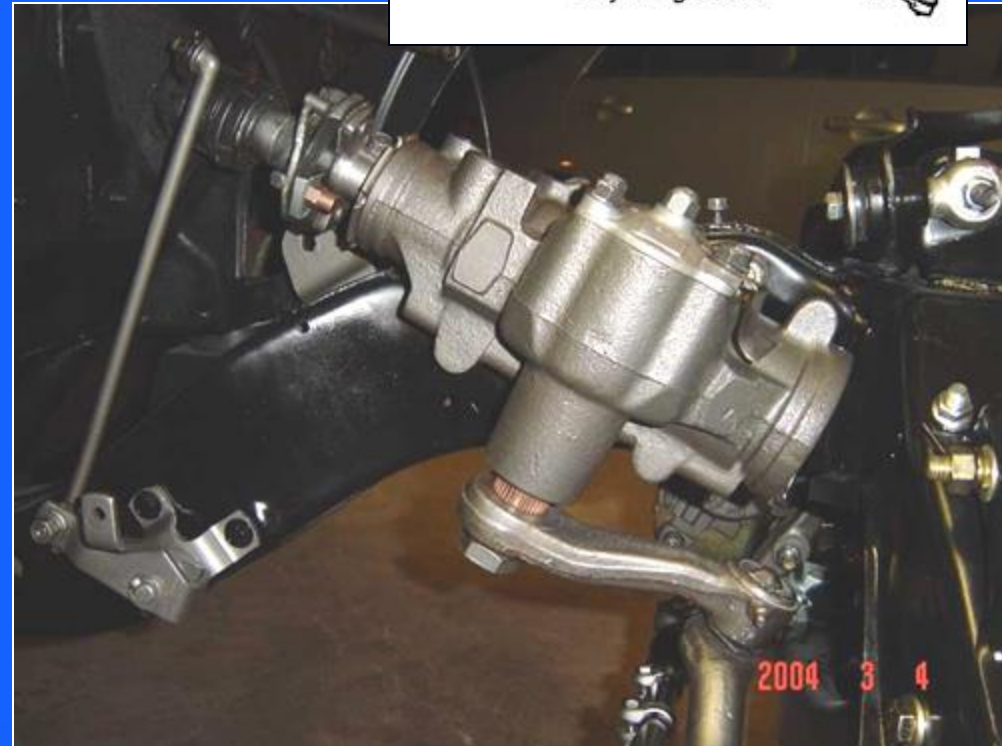


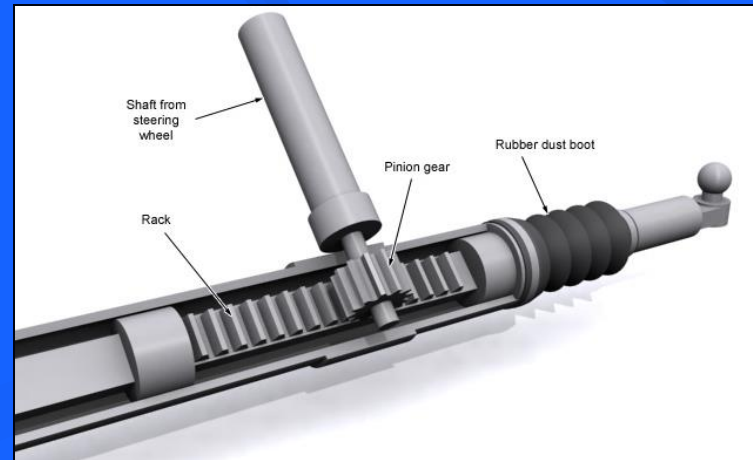
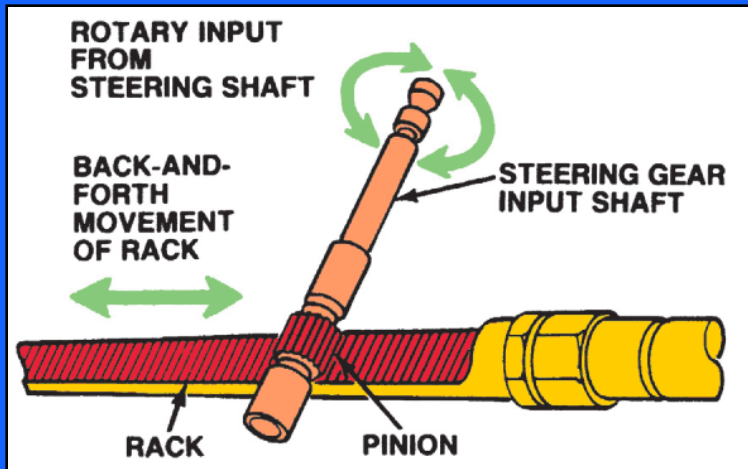
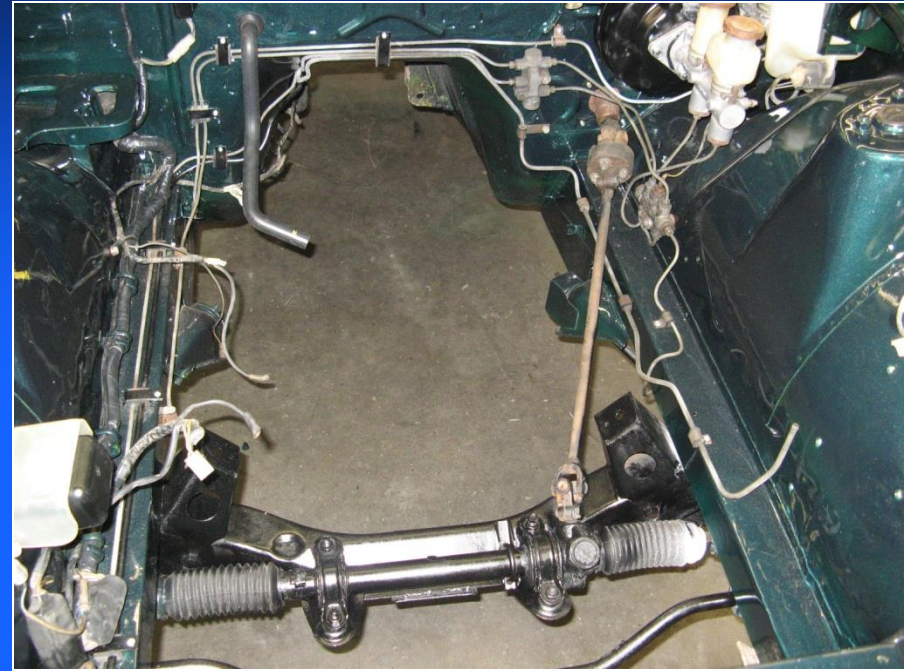
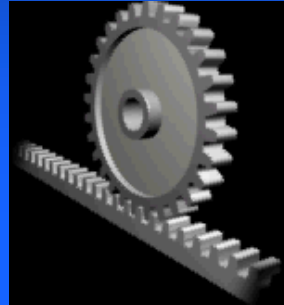
Figure 41-6 Steering movement is transferred from the pitman arm that is splined to the sector shaft (pitman shaft) through the centre link and tie rods to the steering knuckle at each front wheel. The idler arm supports the passenger side of the centre link and keeps the steering linkage level with the road. (Courtesy of Dana Corporation)





Rack & Pinion

- less mechanical advantage (compared to steering box)
- lighter – fewer parts
- compact
- more direct steering feedback or “feel”
- advantages
- disadvantages





Rack & Pinion

- tie rod ends transmit motion from the rack to the steering knuckle
- they also allow for up & down movement over bumps & pot holes & turns

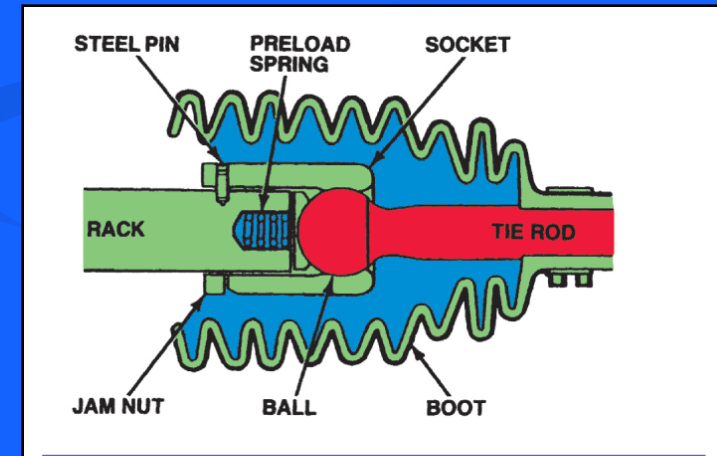
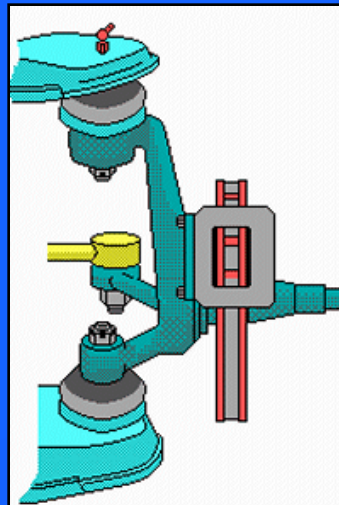
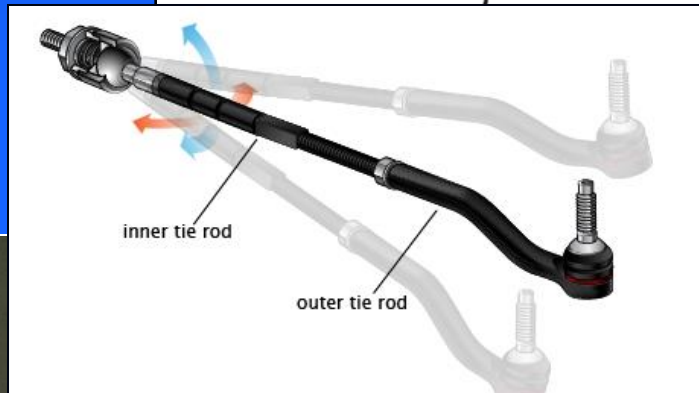
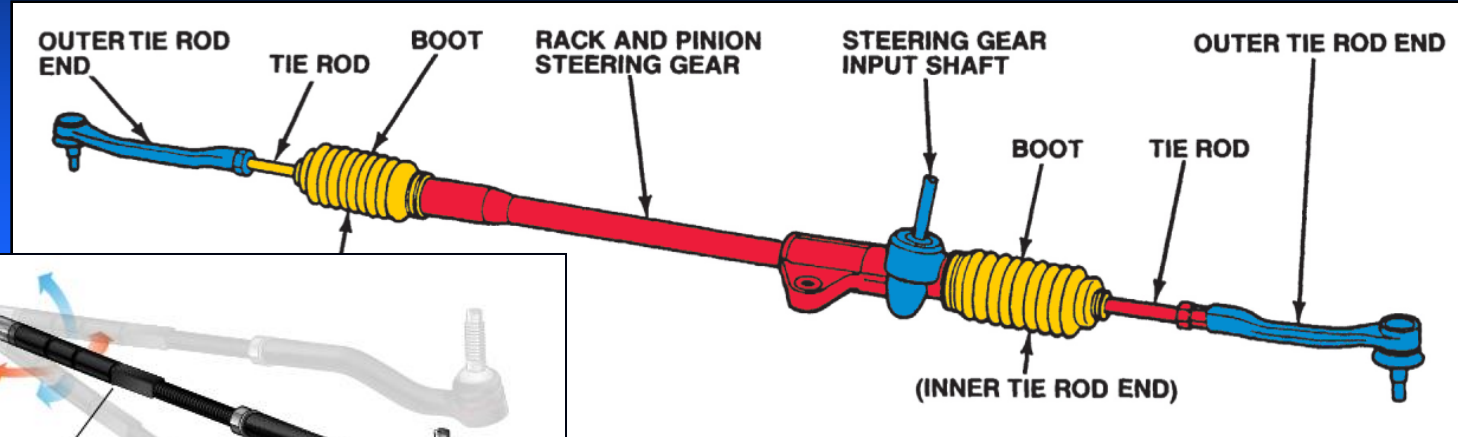
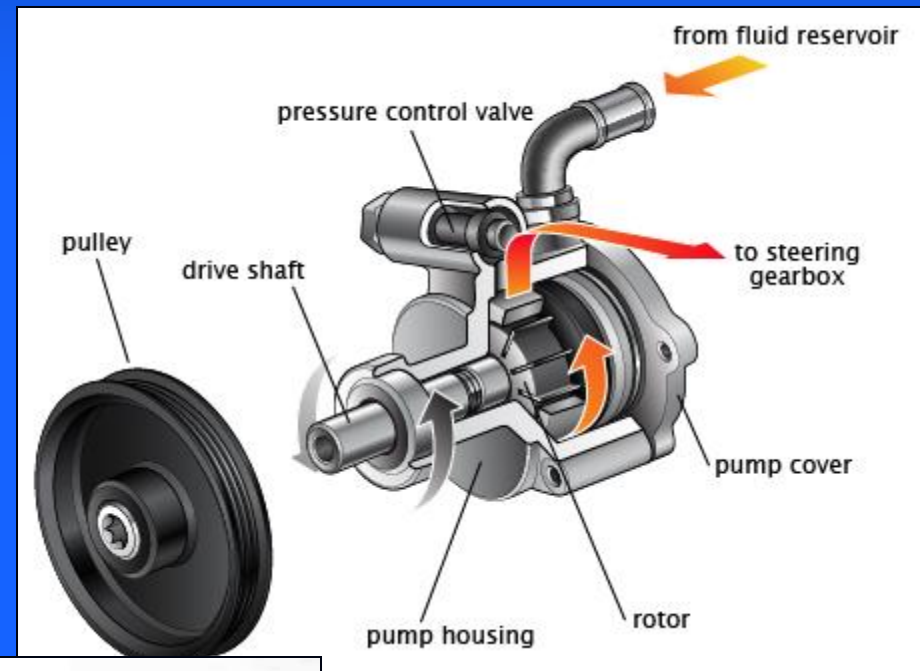
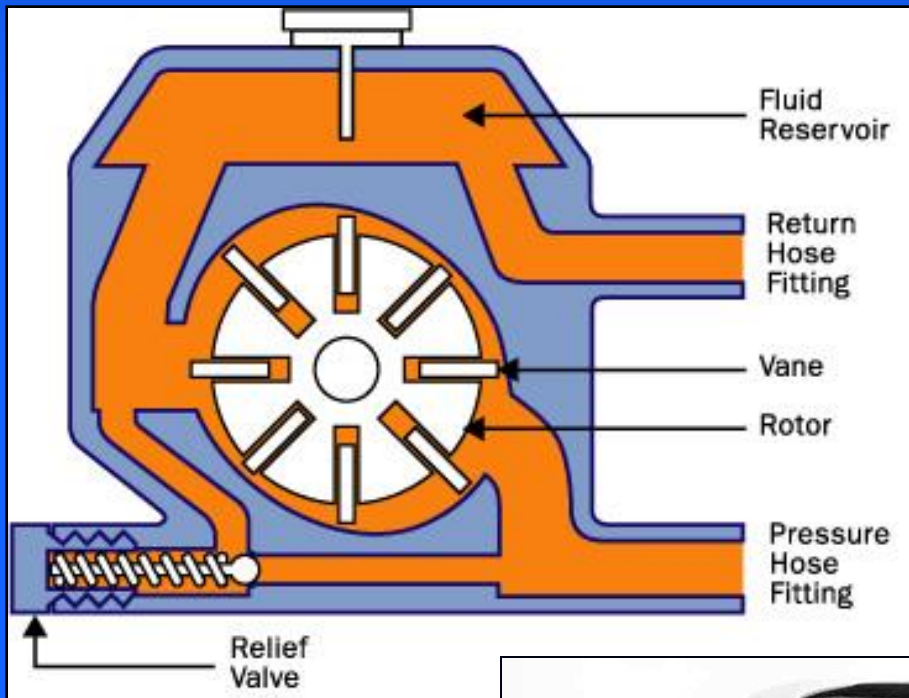


Figure 41-34 On rack and pinion steering, the end of the inner tie rod forms the ball and a separate socket fits over the ball and anchors the tie rod to the rack. This is called a ball-socket assembly.

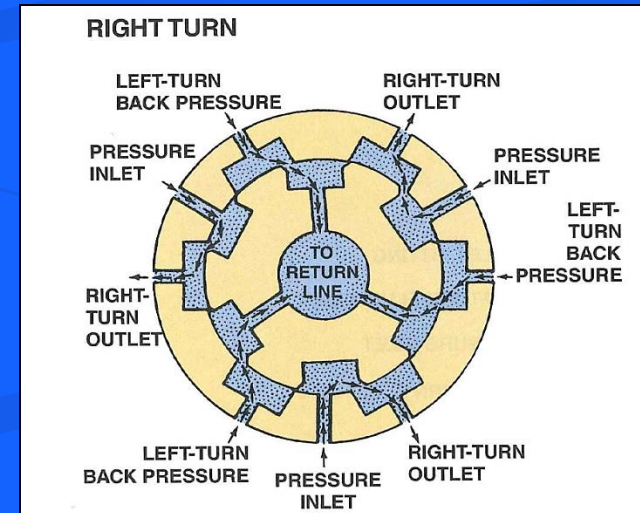
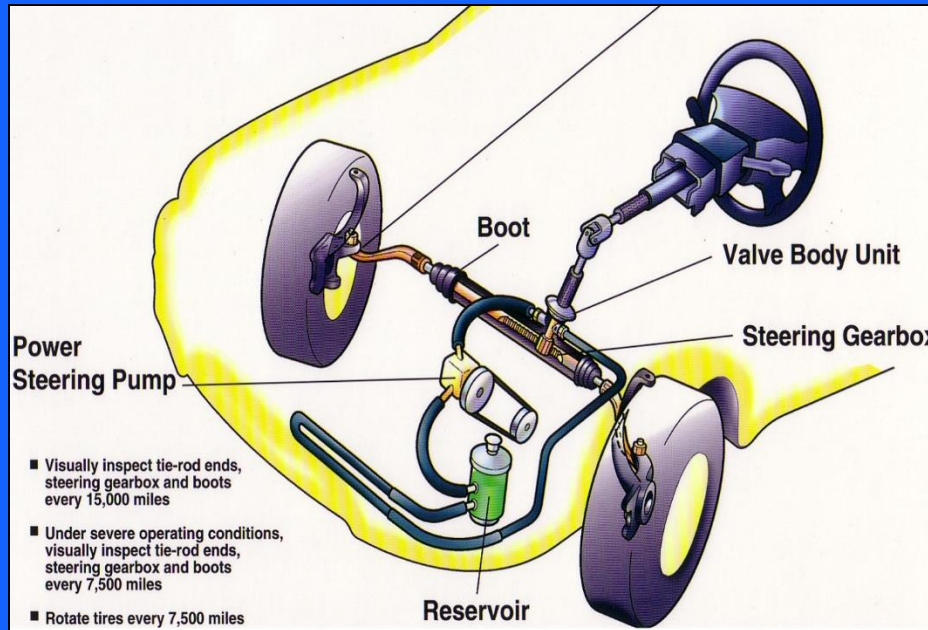
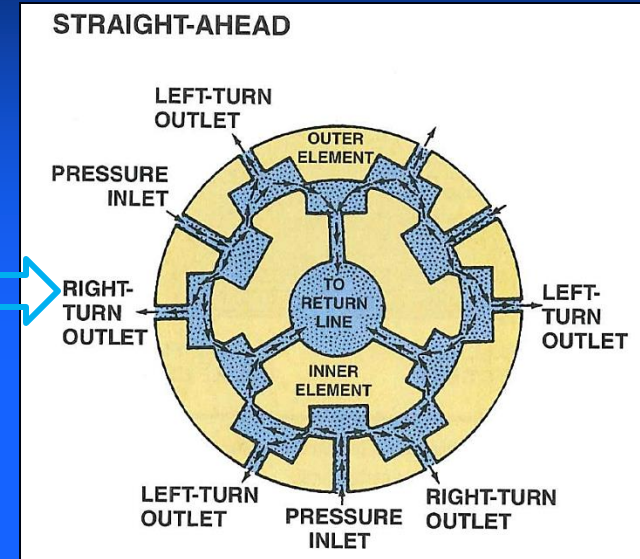
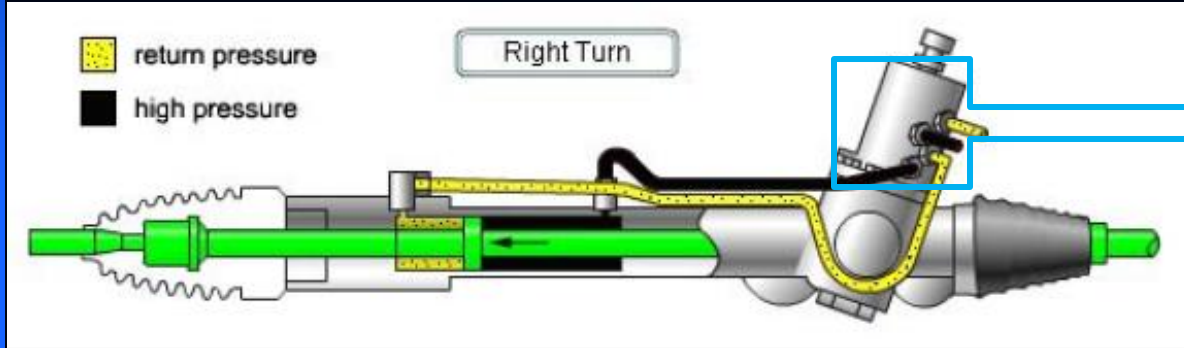
Power Steering

- power assist steering helps the driver turn the steering gear with reduced effort
- on most cars, a belt driven hydraulic pump is used
- this pump generates hydraulic oil pressure which is used to help move the steering gear



Power Steering – Rack & Pinion

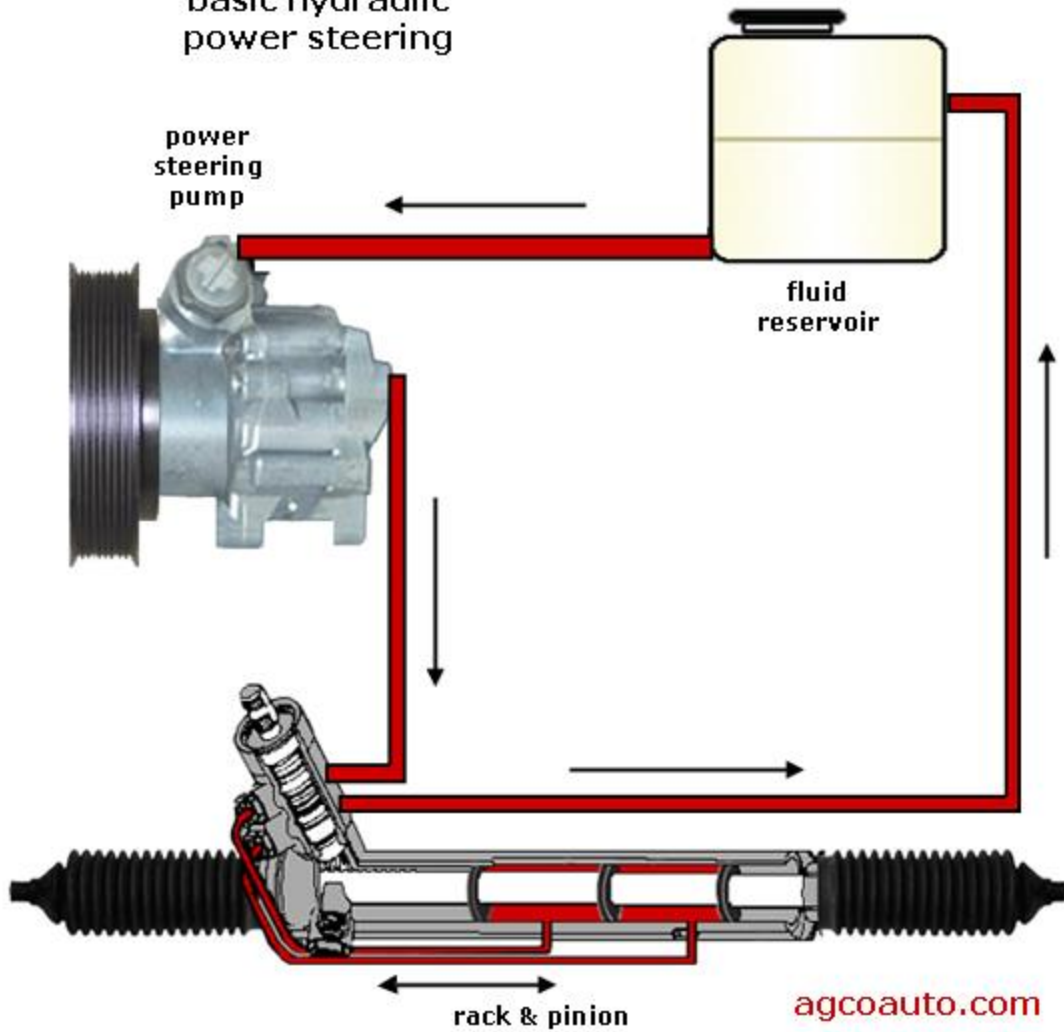
- hydraulic pressure is supplied by the engine driven oil pump
- rotary spool valve directs hydraulic pressure to the rack piston based on driver input



basic hydraulic
power steering

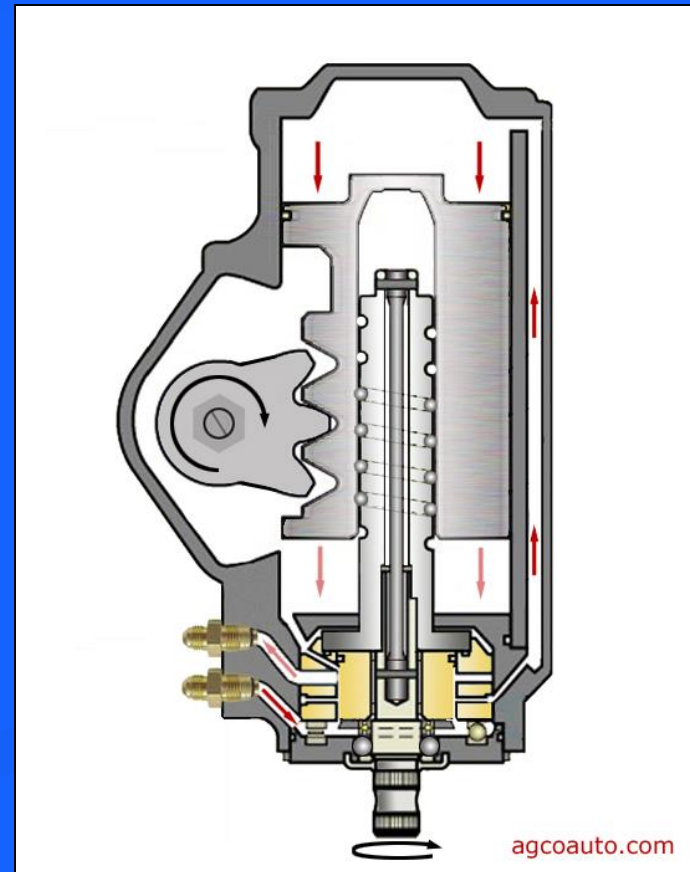
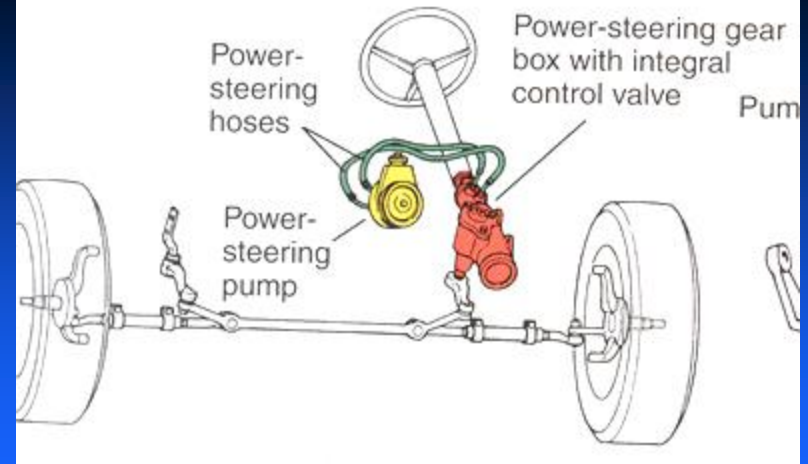
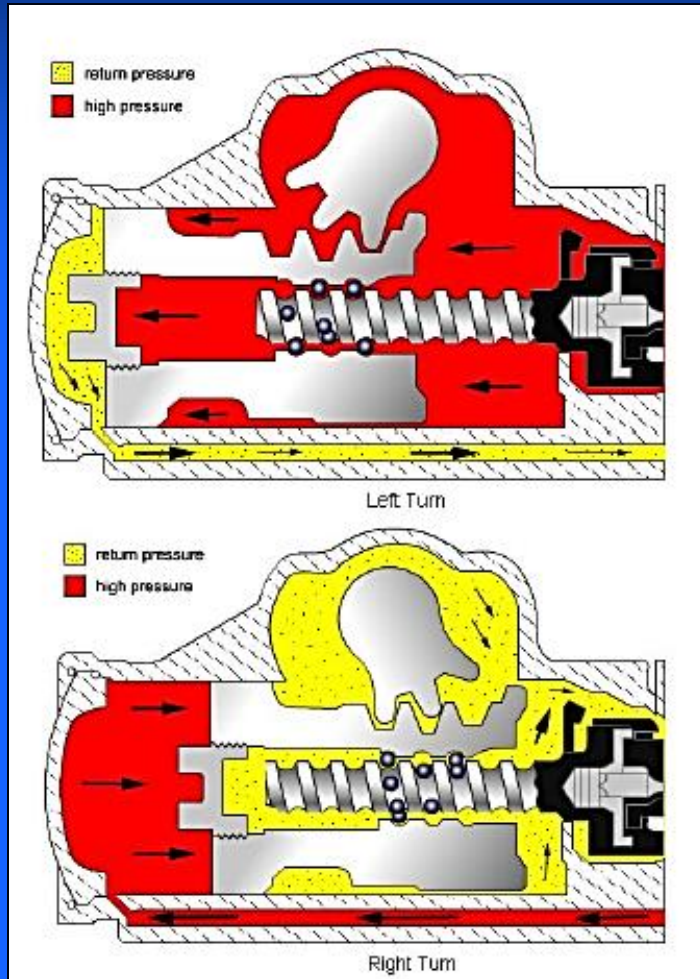
power
steering
pump

fluid
reservoir

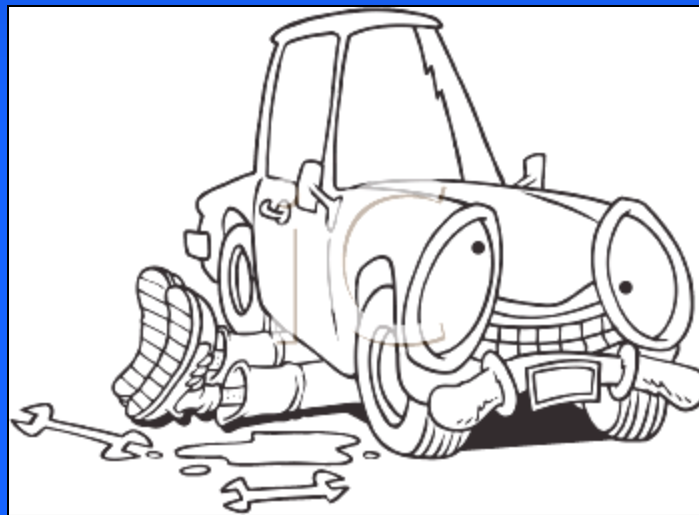


Power Steering Box

- worm nut doubles as the hydraulic piston

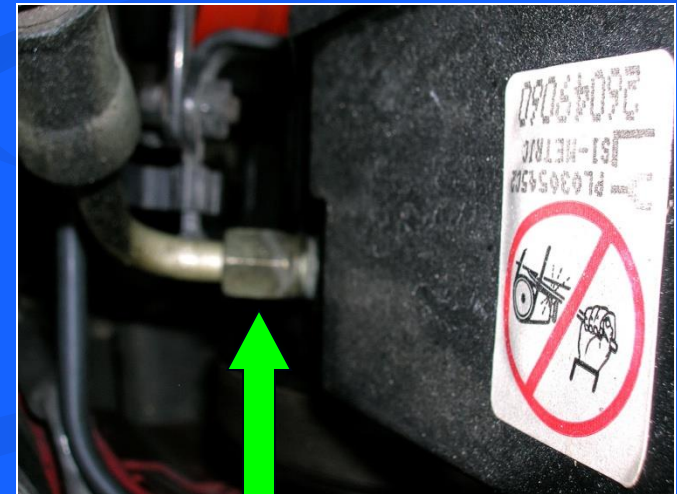
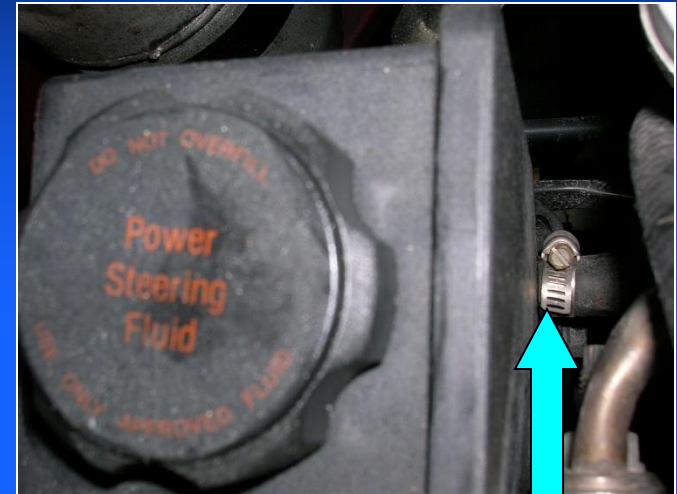
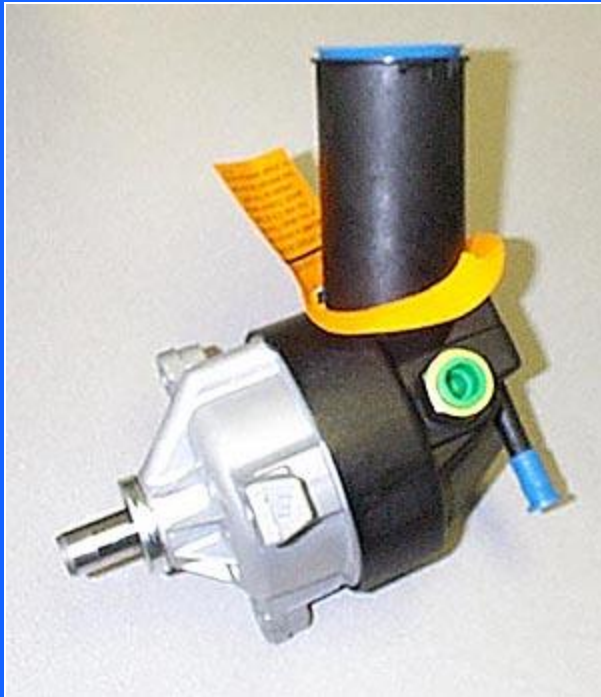


Steering System Service



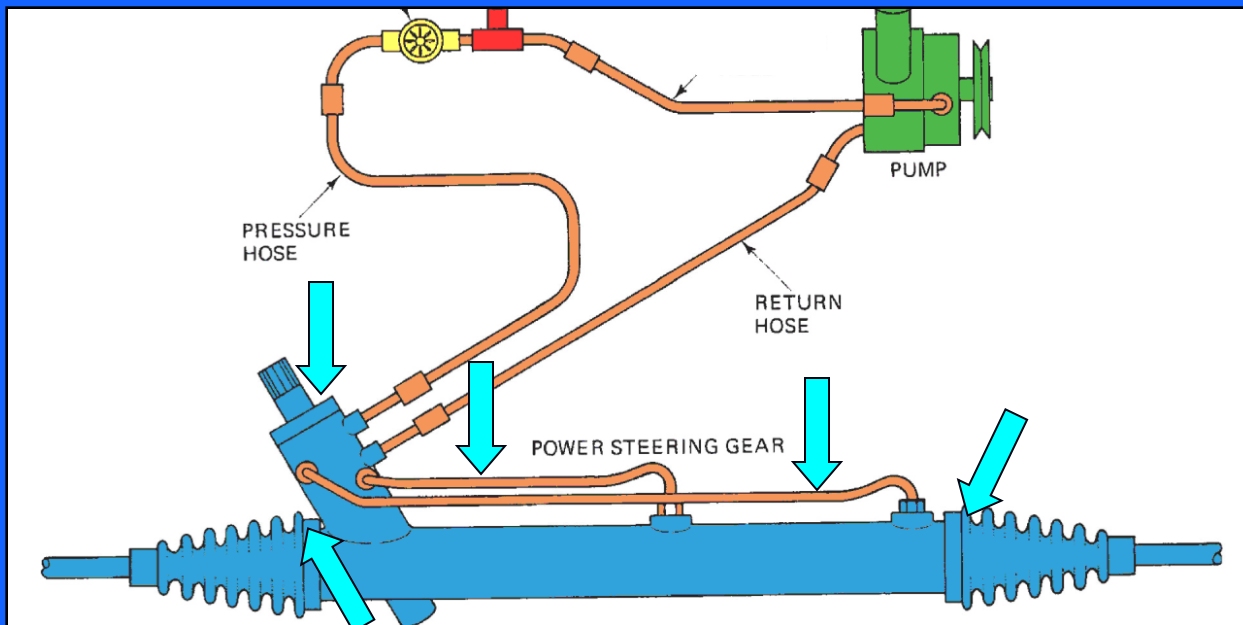
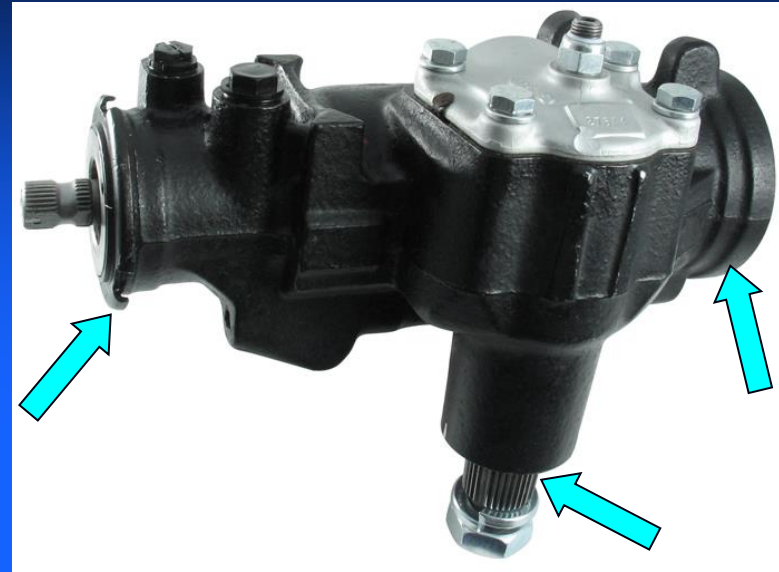
Power Steering Fluid Leaks

- check the 2 lines that connect pump to steering gear
 - hose clamp = return (low pressure line)
 - threaded hose end = high pressure line
- power steering pump
 - can be disassembled & resealed
 - or install a rebuilt pump \$50 to \$100



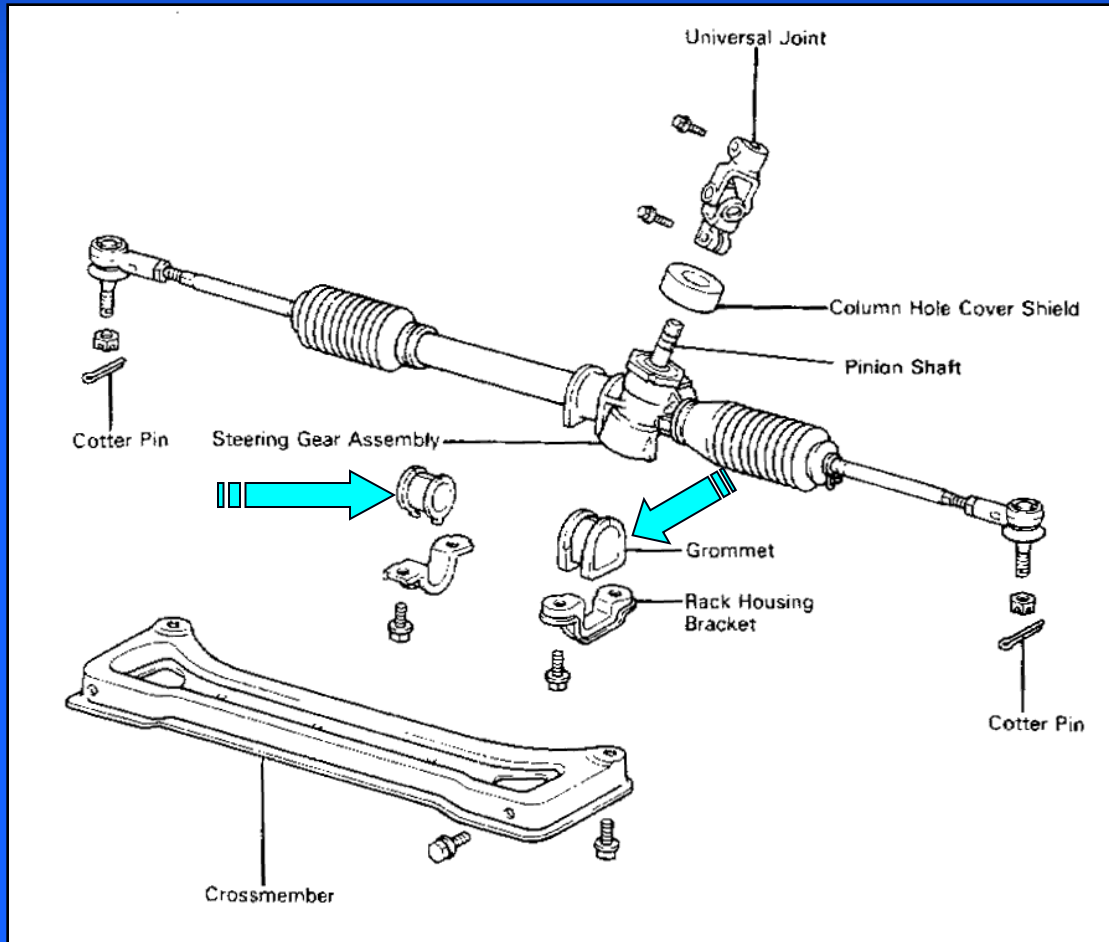
Power Steering Fluid Leaks

- steering box can leak...
 - pitman shaft seal
 - cover seal
 - adjuster plug seal
- steering rack can leak...
 - fluid lines
 - pinion seal
 - piston seals



Rack Bushings

- rack bushings isolate the passenger compartment from harshness & vibration
 - check these 2 bushings for deterioration

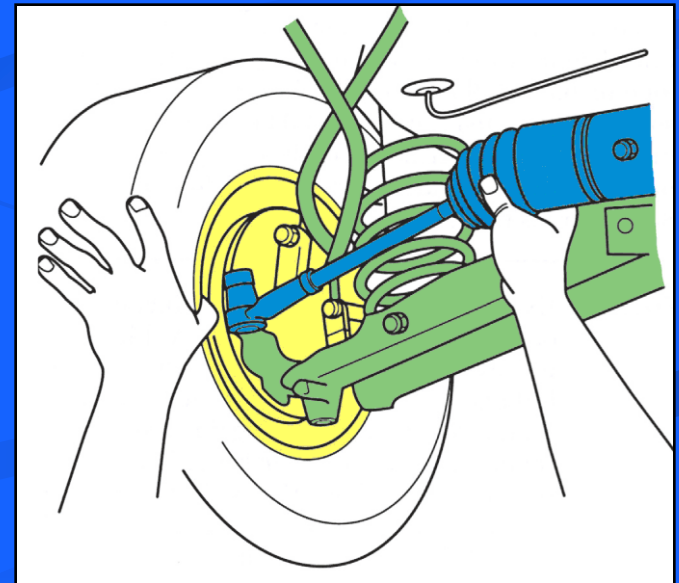
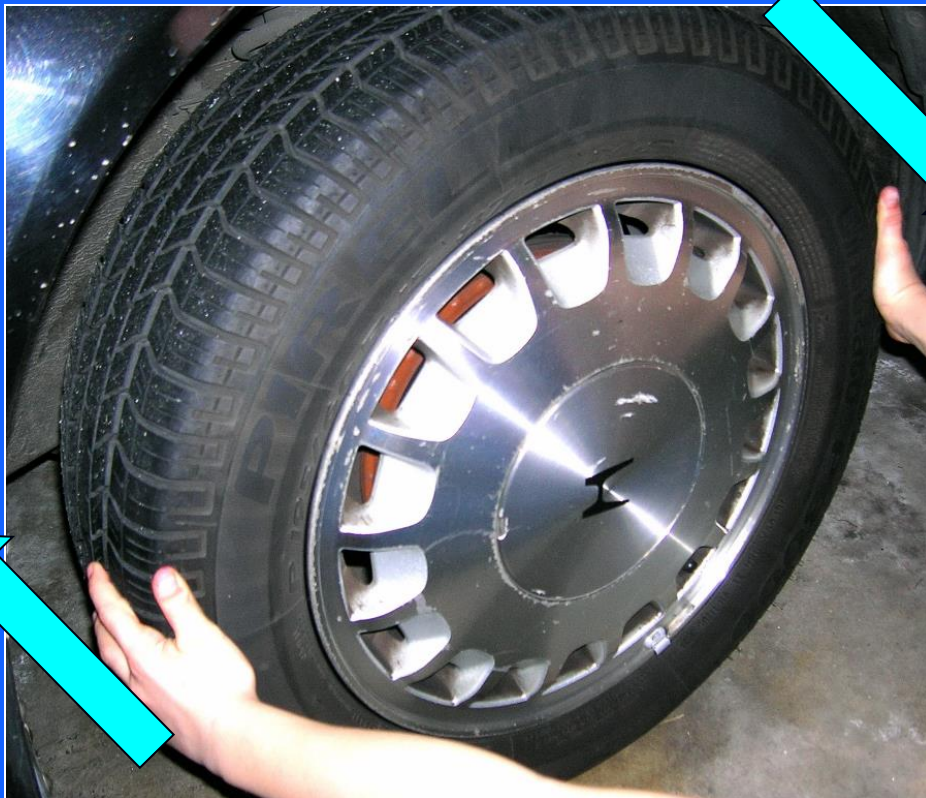
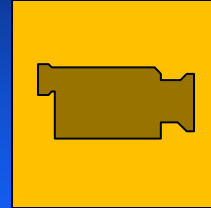




Checking Steering Linkage Wear

- rack & pinion

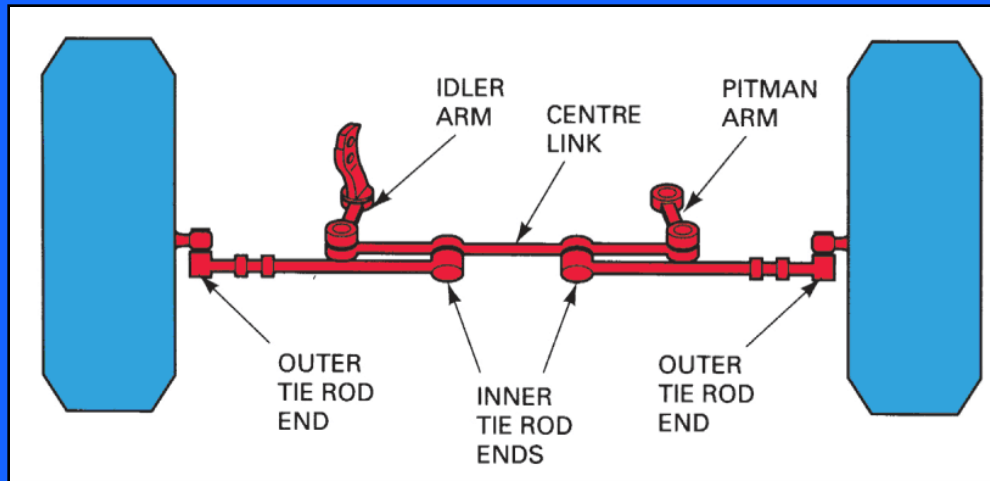
- check inner & outer tie rod ends
- grab the front & back side of the tire
- rock it back & forth
- watch for slop in the tie rod ends





Checking Steering Linkage Wear

- parallelogram steering linkage
 - move front tires in & out
- check for looseness in...
 - pitman arm
 - idler arm
 - center link
 - inner & outer tie rod ends



Steering Column

- column u-joints connect steering column to steering gear
- u-joints should be checked for looseness
- they can also bind which leads to stiff steering

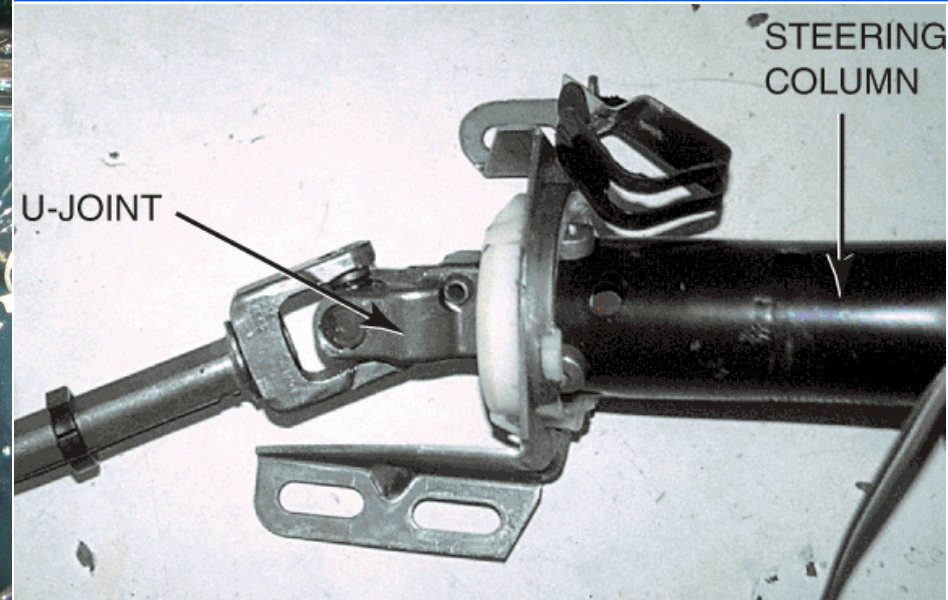
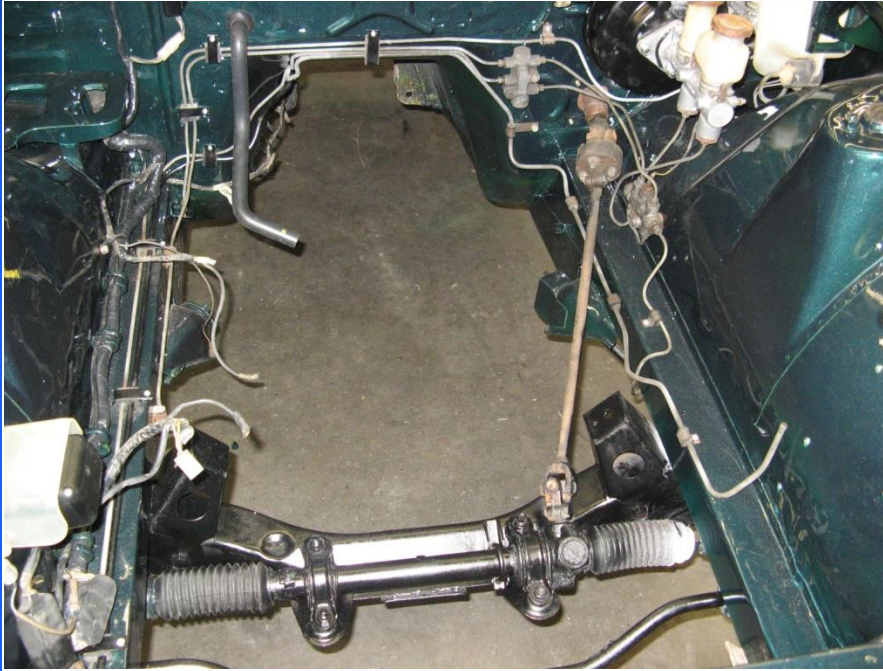
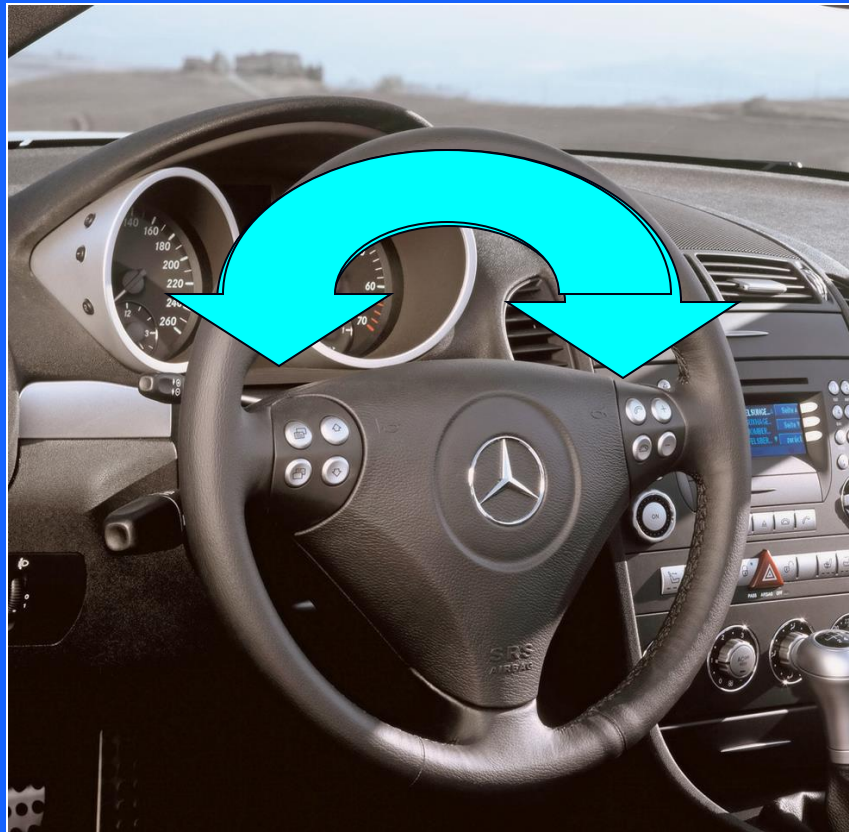


Figure 41-3 The left end of the steering column slips over the input shaft of the steering gear. The U-joint allows the steering column to align with the steering gear.



Checking Steering Linkage Wear

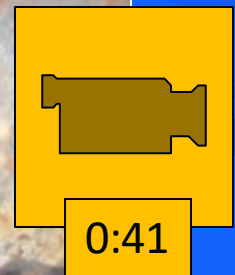
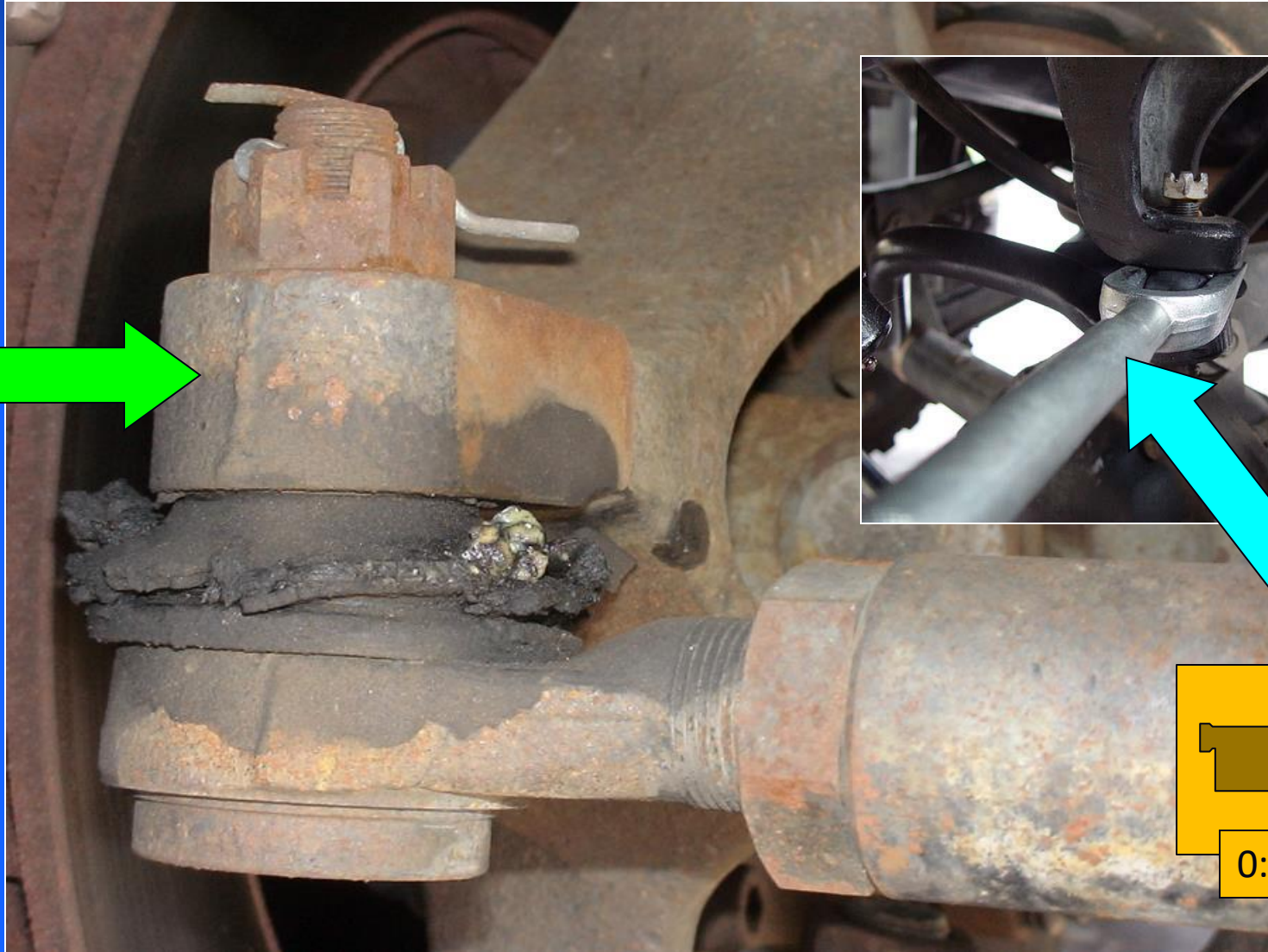
- alternately, you can check the linkage this way...
- leave the vehicle on the ground (or drive-on hoist)
- have an assistant move steering wheel back & forth thru the free play
- look at the linkage for slop, wear & movement





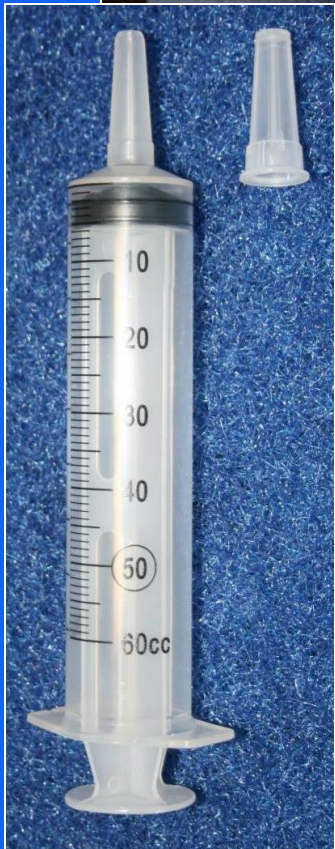
Disconnecting Tie Rod Ends

- leave the nut on, but loosened – this will protect the threads from the hammer
- tap the **knuckle** with a ball peen hammer
- a “**pickle fork**” can be used if the tie rod end is being replaced



0:41

Power Steering Fluid Changes?

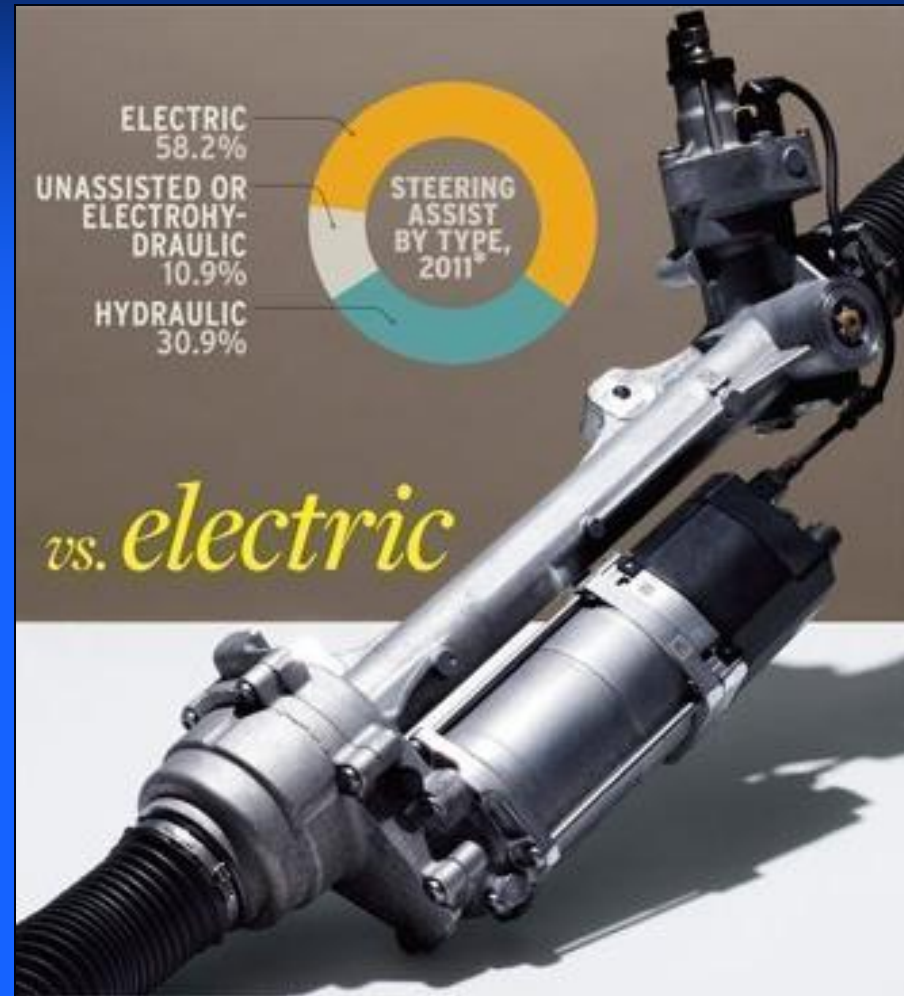


Recent Advances

- **Electronic Power Steering**



Electronic Steering



Electronic Power Steering

