

STEERING

CONTENTS

	page		page
POWER STEERING GEAR	9	STEERING COLUMN	20
POWER STEERING PUMP	4	STEERING LINKAGE	24
POWER STEERING	1		

POWER STEERING

INDEX

	page		page
GENERAL INFORMATION		DIAGNOSIS AND TESTING	
POWER STEERING SYSTEM	1	POWER STEERING SYSTEM DIAGNOSIS CHARTS	2

GENERAL INFORMATION

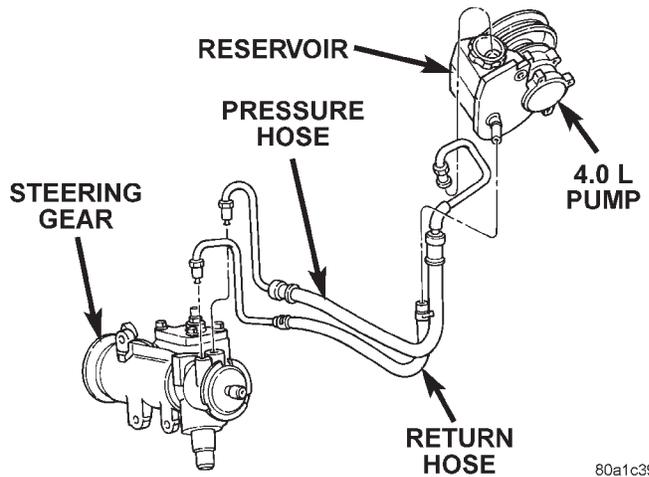
POWER STEERING SYSTEM

The power steering pump (Fig. 1) is a constant flow rate and displacement vane type pump. The pump reservoir is attached to the pump body. The pump is connected to the steering by the pressure and return hoses.

The steering gear (Fig. 1) used is a recirculating ball type gear. The gear acts as a rolling thread between the worm shaft and rack piston. The worm shaft is supported by a thrust bearing at the lower end and a bearing assembly at the upper end. When the worm shaft is turned the rack piston moves. The rack piston teeth mesh with the pitman shaft. Turning the worm shaft turns the pitman shaft, which moves the steering linkage.

The power steering system consists of:

- Hydraulic pump
- Recirculating ball steering gear
- Steering column
- Steering linkage



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Fig. 1 Power Steering Gear & Pump

DIAGNOSIS AND TESTING

POWER STEERING SYSTEM DIAGNOSIS CHARTS

STEERING NOISE

There is some noise in all power steering systems. One of the most common is a hissing sound evident at a standstill parking. Or when the steering wheel is at the end of it's travel. Hiss is a high frequency noise similar to that of a water tap being closed slowly. The noise is present in all valves that have a high velocity fluid passing through an orifice. There is no relationship between this noise and steering performance.

CONDITION	POSSIBLE CAUSES	CORRECTION
OBJECTIONAL HISS OR 'WHISTLE	1. Steering intermediate shaft to dash panel seal. 2. Noisy valve in power steering gear.	1. Check and repair seal at dash panel. 2. Replace steering gear.
RATTLE OR CLUNK	1. Gear mounting bolts loose. 2. Loose or damaged suspension components. 3. Loose or damaged steering linkage. 4. Internal gear noise. 5. Pressure hose in contact with other components.	1. Tighten bolts to specification. 2. Inspect and repair suspension. 3. Inspect and repair steering linkage. 4. Replace gear. 5. Reposition hose.
CHIRP OR SQUEAL	1. Loose belt.	1. Adjust or replace.
WHINE OR GROWL	1. Low fluid level. 2. Pressure hose in contact with other components. 3. Internal pump noise.	1. Fill to proper level. 2. Reposition hose. 3. Replace pump.
SUCKING AIR SOUND	1. Loose return line clamp. 2. O-ring missing or damaged on hose fitting. 3. Low fluid level. 4. Air leak between pump and reservoir.	1. Replace clamp. 2. Replace o-ring. 3. Fill to proper level. 4. Repair as necessary.
SCRUBBING OR KNOCKING	1. Wrong tire size. 2. Wrong gear.	1. Verify tire size. 2. Verify gear.

BINDING AND STICKING

CONDITION	POSSIBLE CAUSE	CORRECTION
DIFFICULT TO TURN WHEEL STICKS OR BINDS	1. Low fluid level. 2. Tire pressure. 3. Steering component. 4. Loose belt. 5. Low pump pressure. 6. Column shaft coupler binding. 7. Steering gear worn or out of adjustment.	1. Fill to proper level. 2. Adjust tire pressure. 3. Inspect and lube. 4. Adjust or replace. 5. Pressure test and replace if necessary. 6. Replace coupler. 7. Repair or replace gear.

DIAGNOSIS AND TESTING (Continued)

INSUFFICIENT ASST. OR POOR RETURN TO CENTER

CONDITION	POSSIBLE CAUSE	CORRECTION
HARD TURNING OR MOMENTARY INCREASE IN TURNING EFFORT	<ol style="list-style-type: none"> 1. Tire pressure. 2. Low fluid level. 3. Loose belt. 4. Lack of lubrication. 5. Low pump pressure. 6. Internal gear leak. 	<ol style="list-style-type: none"> 1. Adjust tire pressure. 2. Fill to proper level. 3. Adjust or replace. 4. Inspect and lubricate steering and suspension compnents. 5. Pressure test and repair as necessary. 6. Pressure and flow test, and repair as necessary.
STEERING WHEEL DOES NOT WANT TO RETURN TO CENTER POSITION	<ol style="list-style-type: none"> 1. Tire pressure. 2. Wheel alignment. 3. Lack of lubrication. 4. High friction in steering gear. 	<ol style="list-style-type: none"> 1. Adjust tire pressure. 2. Align front end. 3. Inspect and lubricate steering and suspension compnents. 4. Test and adjust as necessary.

LOOSE STEERING AND VEHICLE LEAD

CONDITION	POSSIBLE CAUSE	CORRECTION
EXCESSIVE PLAY IN STEERING WHEEL	<ol style="list-style-type: none"> 1. Worn or loose suspension or steering components. 2. Worn or loose wheel bearings. 3. Steering gear mounting. 4. Gear out of adjustment. 5. Worn or loose steering coupler. 	<ol style="list-style-type: none"> 1. Repair as necessary. 2. Repair as necessary. 3. Tighten gear mounting bolts to specification. 4. Adjust gear to specification. 5. Repair as necessary.
VEHICLE PULLS OR LEADS TO ONE SIDE	<ol style="list-style-type: none"> 1. Tire Pressure. 2. Radial tire lead. 3. Brakes dragging. 4. Wheel alignment. 5. Weak or broken spring. 6. Loose or worn steering or suspension components. 	<ol style="list-style-type: none"> 1. Adjust tire pressure. 2. Rotate tires. 3. Repair as necessary. 4. Align vehicle. 5. Replace spring. 6. Repair as necessary.

POWER STEERING PUMP

INDEX

	page		page
DESCRIPTION AND OPERATION		POWER STEERING PUMP- 4.0L	6
POWER STEERING PUMP	4	DISASSEMBLY AND ASSEMBLY	
DIAGNOSIS AND TESTING		PUMP PULLEY	7
PUMP FLOW RATE AND PRESSURE	4	PUMP RESERVOIR	7
PUMP LEAKAGE DIAGNOSIS	5	SPECIFICATIONS	
SERVICE PROCEDURES		TORQUE CHART	8
POWER STEERING PUMP - INITIAL		SPECIAL TOOLS	
OPERATION	5	POWER STEERING PUMP	8
REMOVAL AND INSTALLATION			
POWER STEERING PUMP - 5.2L/5.9L	6		

DESCRIPTION AND OPERATION

POWER STEERING PUMP

Hydraulic pressure for the power steering system is provided by a belt driven power steering pump (Fig. 1). The pump shaft has a pressed-on drive pulley that is belt driven by the crankshaft pulley. The power steering pump is a constant flow rate and displacement, vane-type pump. The pump internal parts operate submerged in fluid. The flow control orifice is part of the high pressure line fitting. The pressure relief valve inside the flow control valve limits the pump pressure. The reservoir is attached to the pump body with spring clips. The power steering pump is connected to the steering gear by the pressure and return hoses.

NOTE: Power steering pumps have different pressure rates and are not interchangeable with other pumps.

DIAGNOSIS AND TESTING

PUMP FLOW RATE AND PRESSURE

The following procedure is used to test the operation of the power steering system on the vehicle. This test will provide the gallons per minute (GPM) or flow rate of the power steering pump along with the maximum relief pressure. Perform test any time a power steering system problem is present. This test will determine if the power steering pump or power steering gear is not functioning properly. The following pressure and flow test is performed using Power Steering Analyzer Tool kit 6815 (Fig. 2) and Adapter Kit 6893.

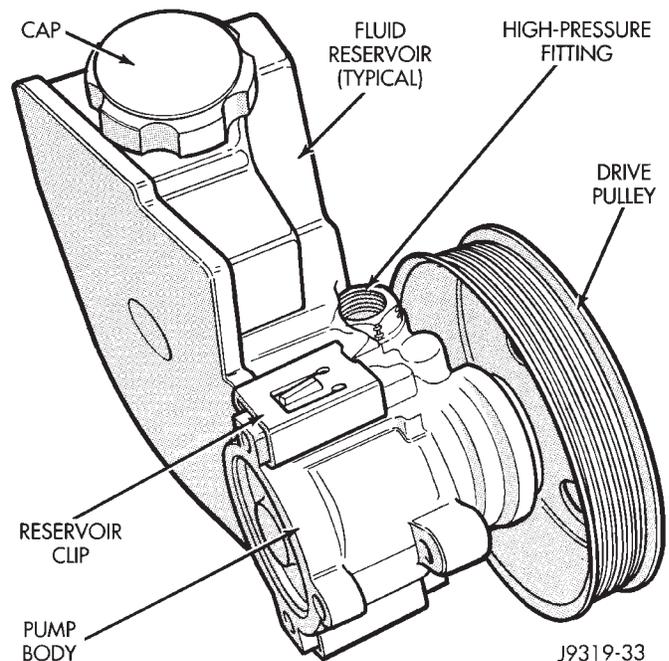
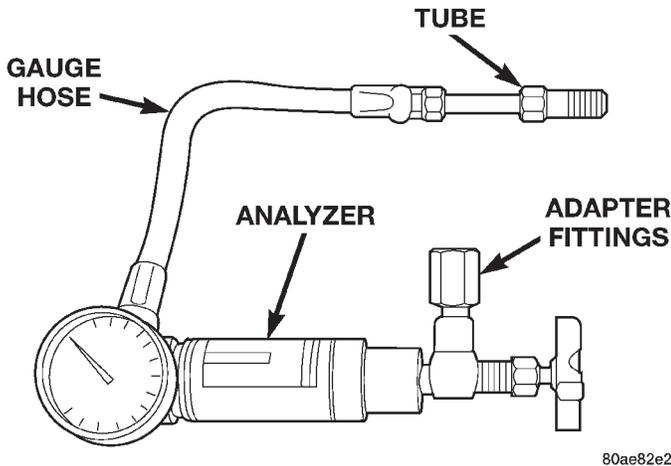


Fig. 1 Pump With Integral Reservoir

FLOW AND PRESSURE TEST

- (1) Check the power steering belt to ensure it is in good condition and adjusted properly.
- (2) Connect pressure gauge hose from the Power Steering Analyzer to Tube 6865.
- (3) Connect Adapter 6826 to Power Steering Analyzer test valve end.
- (4) Disconnect the high pressure hose from the power steering pump.
- (5) Connect Tube 6865 to the pump hose fitting.
- (6) Connect the power steering hose from the steering gear to Adapter 6826.
- (7) Open the test valve completely.

DIAGNOSIS AND TESTING (Continued)



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Fig. 2 Power Steering Analyzer

(8) Start engine and let idle long enough to circulate power steering fluid through flow/pressure test gauge.

(9) Shut off the engine and check the fluid level, add fluid as necessary. Start engine again and let idle.

(10) Gauge should read below 862 kPa (125 psi), if above, inspect the hoses for restrictions and repair as necessary. The initial pressure reading should be in the range of 345-552 kPa (50-80 psi).

(11) Increase the engine speed to 1500 RPM and read the flow meter. The reading should be 2.4 - 2.8 GPM, if the reading is below this specification the pump should be replaced.

CAUTION: This next step involves testing maximum pump pressure output and flow control valve operation. Do not leave valve closed for more than three seconds as the pump could be damaged.

(12) Close valve fully three times for three seconds and record highest pressure indicated each time. **All three readings must be above pump relief pressure specifications and within 345 kPa (50 psi) of each other.**

- Pressures above specifications but not within 345 kPa (50 psi) of each other, replace pump.
- Pressures within 345 kPa (50 psi) of each other but below specifications, replace pump.

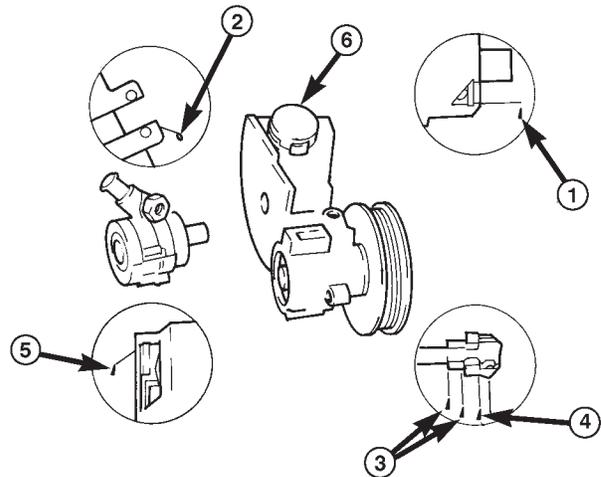
(13) Open the test valve and turn the steering wheel to the extreme left and right positions against the stops. Record the highest pressure reading at each position. Compare readings to the pump specifications chart. If pressures readings are not within 50 psi. of each other, the gear is leaking internally and must be repaired.

CAUTION: Do not force the pump to operate against the stops for more than 2 to 4 seconds at a time because, pump damage will result.

PUMP SPECIFICATIONS

ENGINE	RELIEF PRESSURE ± 50	FLOW RATE (GPM)
4.0L	9653 kPa (1400 psi)	1500 RPM 2.4 - 2.8 GPM
5.2L	9653 kPa (1400 psi)	
5.9L	9653 kPa (1400 psi)	

PUMP LEAKAGE DIAGNOSIS



1. BUSHING (BEARING) WORN, SEAL WORN. REPLACE PUMP.
2. REPLACE RESERVOIR O-RING SEAL.
3. TORQUE HOSE FITTING NUT TO SPECIFICATIONS. IF LEAKAGE PERSISTS, REPLACE O-RING SEAL.
4. TORQUE FITTING TO SPECIFICATIONS. IF LEAKAGE PERSISTS, REPLACE O-RING SEAL.
5. REPLACE PUMP.
6. CHECK OIL LEVEL: IF LEAKAGE PERSISTS WITH THE LEVEL CORRECT AND CAP TIGHT, REPLACE THE CAP.

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SERVICE PROCEDURES

POWER STEERING PUMP – INITIAL OPERATION

WARNING: THE FLUID LEVEL SHOULD BE CHECKED WITH ENGINE OFF TO PREVENT INJURY FROM MOVING COMPONENTS.

CAUTION: Use MOPAR Power Steering Fluid or equivalent. Do not use automatic transmission fluid and do not overfill.

Wipe filler cap clean, then check the fluid level. The dipstick should indicate **COLD** when the fluid is at normal temperature.

- (1) Fill the pump fluid reservoir to the proper level and let the fluid settle for at least two minutes.

SERVICE PROCEDURES (Continued)

(2) Start the engine and let run for a few seconds then turn engine off.

(3) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(4) Raise the front wheels off the ground.

(5) Slowly turn the steering wheel right and left, lightly contacting the wheel stops at least 20 times.

(6) Check the fluid level add if necessary.

(7) Lower the vehicle, start the engine and turn the steering wheel slowly from lock to lock.

(8) Stop the engine and check the fluid level and refill as required.

(9) If the fluid is extremely foamy or milky looking, allow the vehicle to stand a few minutes and repeat the procedure.

CAUTION: Do not run a vehicle with foamy fluid for an extended period. This may cause pump damage.

REMOVAL AND INSTALLATION

POWER STEERING PUMP- 4.0L

REMOVAL

(1) Remove serpentine drive belt, refer to Group 7 Cooling.

(2) Vehicles equipped with Speed Proportional Steering, disconnect actuator harness.

(3) Remove pressure and return hoses from pump and drain pump.

(4) Remove 3 pump mounting bolts through pulley access holes.

(5) Loosen the 3 pump bracket bolts (Fig. 3).

(6) Tilt pump downward and remove from engine.

(7) Remove pulley from pump.

INSTALLATION

(1) Install pulley on pump.

(2) Install pump on engine.

(3) Tighten pump bracket bolts to 47 N·m (35 ft. lbs.).

(4) Install 3 pump mounting bolts and tighten to 27 N·m (20 ft. lbs.).

(5) Install the pressure and return hoses to pump.

(6) Vehicles equipped with Speed Pro Steering, connect actuator harness.

(7) Install drive belt, refer to Group 7 Cooling.

(8) Add power steering fluid. Refer to Power Steering Pump Initial Operation in this section.

POWER STEERING PUMP - 5.2L/5.9L

REMOVAL

(1) Remove the serpentine drive belt. Refer to Group 7 Cooling.

(2) Remove the pressure and return hoses from pump and drain pump.

(3) Vehicles equipped with Speed Proportional Steering, disconnect actuator harness.

(4) Remove pump mounting bolts and remove the pump (Fig. 4).

(5) Remove pulley from pump.

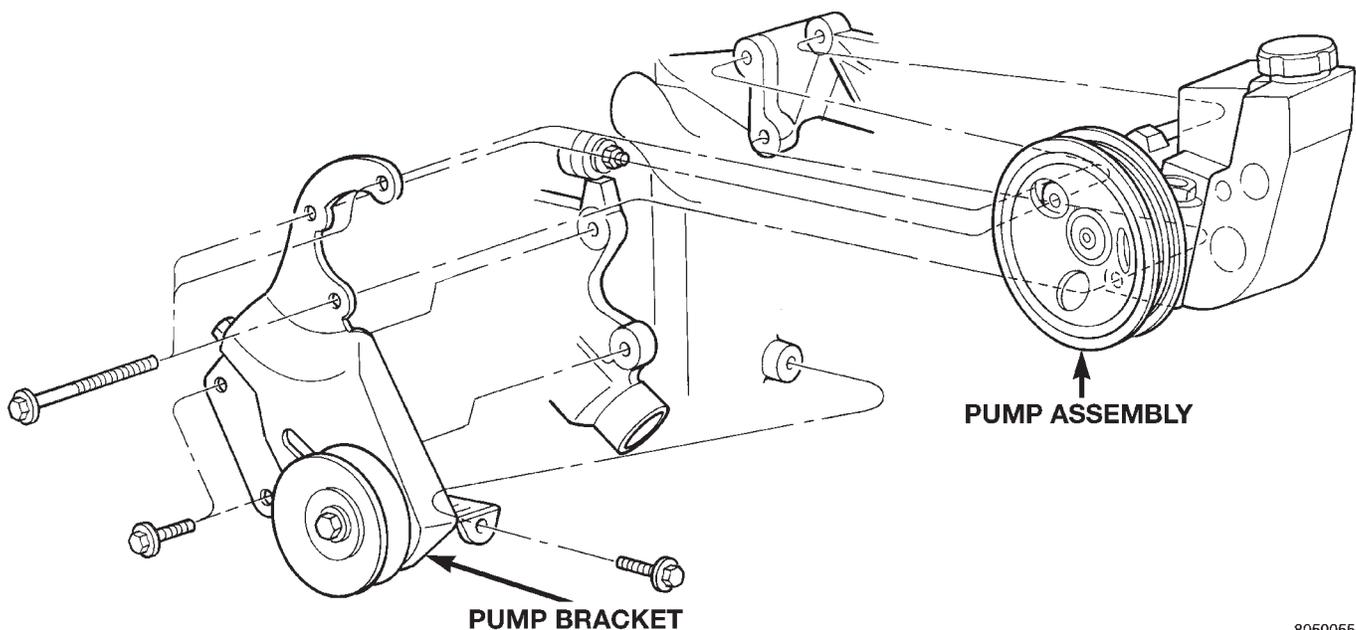


Fig. 3 Pump Mounting - 4.0L

REMOVAL AND INSTALLATION (Continued)

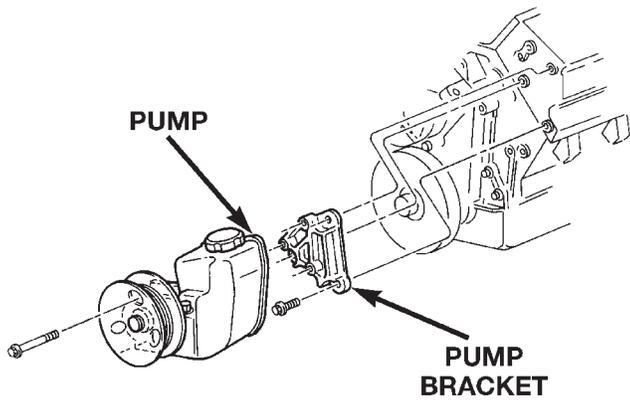


Fig. 4 Pump Mounting – 5.2L/59L

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INSTALLATION

- (1) Install pulley on pump.
- (2) Mount pump on bracket and install bolts. Tighten bolts to 27 N·m (20 ft. lbs.).
- (3) Install the pressure and return hoses to pump.
- (4) Vehicles equipped with Speed Pro Steering, connect actuator harness.
- (5) Install drive belt, refer to Group 7 Cooling.
- (6) Add power steering fluid. Refer to Power Steering Pump Initial Operation in this section.

DISASSEMBLY AND ASSEMBLY

PUMP PULLEY

DISASSEMBLY

- (1) Remove pump assembly.
- (2) Remove pulley from pump with Puller C-4333 (Fig. 5).

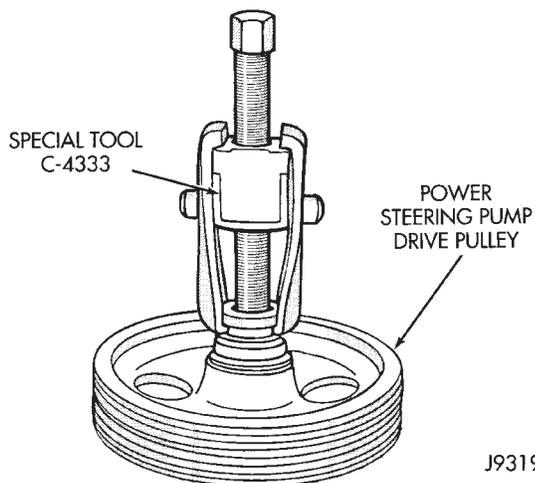


Fig. 5 Pulley Removal

ASSEMBLY

- (1) Replace pulley if bent, cracked, or loose.

- (2) Install pulley on pump with Installer C-4063-B (Fig. 6) flush with the end of the shaft. Ensure the tool and pulley remain aligned with the pump shaft.

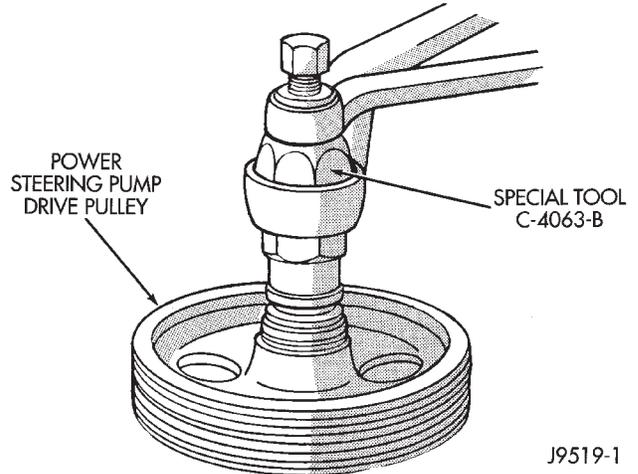


Fig. 6 Pulley Installation

- (3) Install pump assembly.
- (4) With Serpentine Belt, run engine until warm (5 min.) and note any belt chirp. If chirp exists, move pulley outward approximately 0.5 mm (0.020 in.). If noise increases, press on 1.0 mm (0.040 in.). **Be careful that pulley does not contact mounting bolts.**

PUMP RESERVOIR

DISASSEMBLY

- (1) Remove power steering pump.
- (2) Clean exterior of pump.
- (3) Clamp the pump body in a soft jaw vice.
- (4) Pry up tab and slide the retaining clips off (Fig. 7).

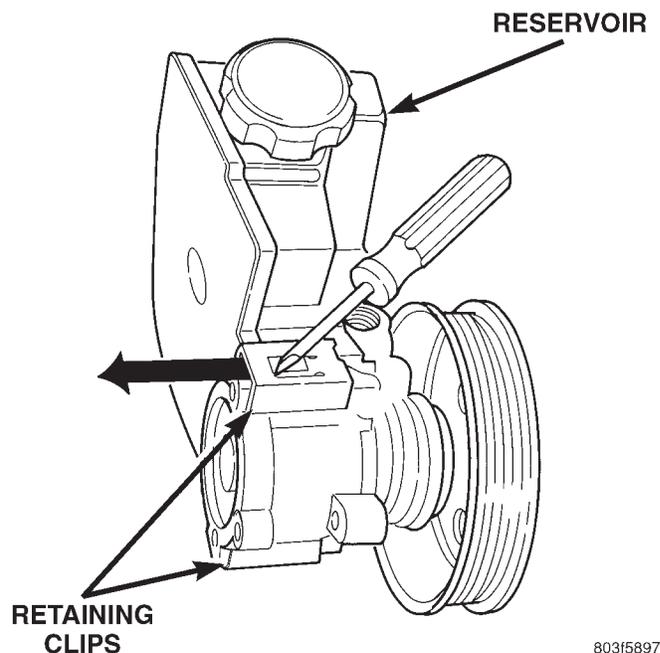


Fig. 7 Pump Reservoir Clips

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DISASSEMBLY AND ASSEMBLY (Continued)

(5) Remove fluid reservoir from pump body.
Remove and discard O-ring seal.

ASSEMBLY

- (1) Lubricate new O-ring Seal with Mopar Power Steering Fluid or equivalent.
- (2) Install O-ring seal in housing.
- (3) Install reservoir onto housing.
- (4) Slide and tap in reservoir retainer clips until tab locks to housing.
- (5) Install power steering pump.
- (6) Add power steering fluid, refer to Pump Initial Operation.

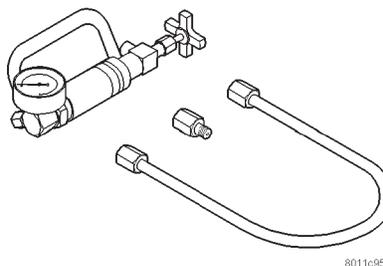
SPECIFICATIONS

TORQUE CHART

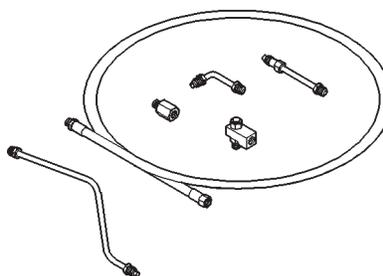
DESCRIPTION	TORQUE
Power Steering Pump	
Bracket Bolts.....	41 N·m (30 ft. lbs.)
Pump Bolts.....	27 N·m (20 ft. lbs.)
Flow Control Valve.....	75 N·m (55 ft. lbs.)
Pressure Line.....	28 N·m (21 ft. lbs.)

SPECIAL TOOLS

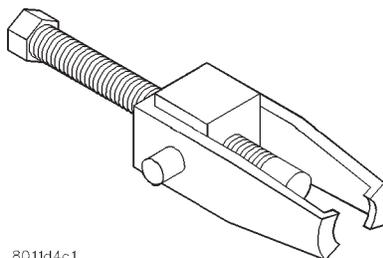
POWER STEERING PUMP



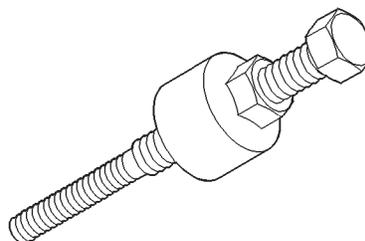
Analyzer Set, Power Steering Flow/Pressure 6815



Adapters, Power Steering Flow/Pressure Tester 6893



Puller C-4333



Installer, Power Steering Pulley C-4063-B

POWER STEERING GEAR

INDEX

	page		page
DESCRIPTION AND OPERATION		RACK PISTON AND WORM SHAFT	15
POWER STEERING GEAR	9	SPOOL VALVE	13
DIAGNOSIS AND TESTING		ADJUSTMENTS	
POWER STEERING GEAR LEAKAGE		STEERING GEAR	17
DIAGNOSIS	10	SPECIFICATIONS	
REMOVAL AND INSTALLATION		POWER STEERING GEAR	19
STEERING GEAR	10	TORQUE CHART	19
DISASSEMBLY AND ASSEMBLY		SPECIAL TOOLS	
HOUSING END PLUG	11	POWER STEERING GEAR	19
PITMAN SHAFT/SEALS/BEARING	11		

DESCRIPTION AND OPERATION

POWER STEERING GEAR

The power steering gear is a recirculating ball type gear (Fig. 1). The gear acts as a rolling thread between the worm shaft and rack piston. The worm shaft is supported by a thrust bearing at the lower end and a bearing assembly at the upper end. When the worm shaft is turned the rack piston moves. The

rack piston teeth mesh with the pitman shaft. Turning the worm shaft turns the pitman shaft, which turns the steering linkage.

CAUTION: Components attached with a nut and cotter pin must be torqued to specification. Then if the slot in the nut does not line up with the cotter pin hole, tighten nut until it is aligned. Never loosen the nut to align the cotter pin hole.

- 1 — RING, RETAINING
- 2 — PLUG
- 3 — SEAL, O-RING
- 4 — RING, TEFLON
- 5 — COVER, SIDE
- 6 — NUT, ADJUSTER LOCK
- 7 — GASKET
- 8 — SHAFT, PITMAN
- 9 — SHAFT, WORM
- 10 — RACE
- 11 — BEARING, THRUST
- 12 — VALVE, CHECK
- 13 — HOUSING
- 14 — SCREW
- 15 — CLAMP
- 16 — GUIDE, BALL
- 17 — BALLS
- 18 — PISTON, RACK
- 19 — PLUG
- 20 — BEARING, NEEDLE
- 21 — WASHER, BACKUP
- 22 — RING, RETAINING
- 23 — SHAFT, STUB
- 24 — SPOOL, VALVE
- 25 — BODY, VALVE
- 26 — NUT, COUPLING SHIELD RET. AND LOCK
- 27 — THRUST SUPPORT ASSEMBLY
- 28 — SEAL, PITMAN SHAFT
- 29 — SEAL, DUST
- 30 — NUT, ADJUSTER

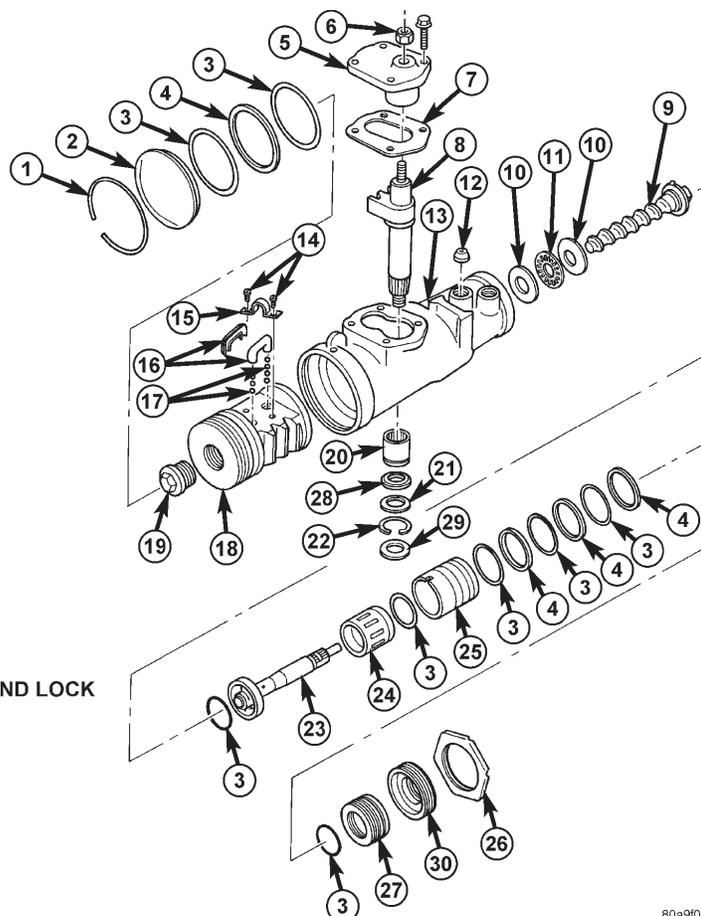
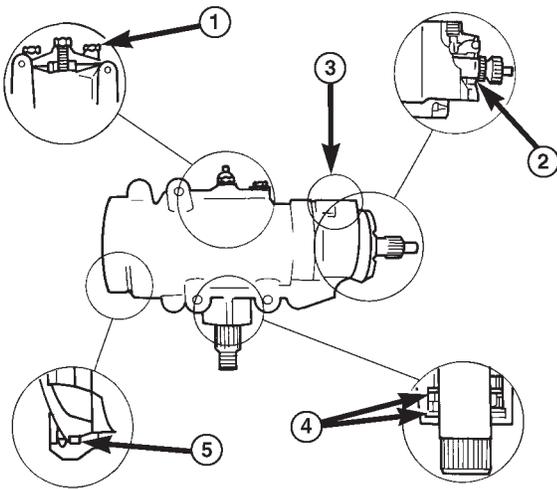


Fig. 1 Recirculating Ball Type Gear

DIAGNOSIS AND TESTING

POWER STEERING GEAR LEAKAGE DIAGNOSIS



1. SIDE COVER LEAK - TORQUE SIDE COVER BOLTS TO SPECIFICATION. REPLACE THE SIDE COVER SEAL IF THE LEAKAGE PERSISTS.
2. ADJUSTER PLUG SEAL - REPLACE THE ADJUSTER PLUG SEALS.
3. PRESSURE LINE FITTING - TORQUE THE HOSE FITTING NUT TO SPECIFICATIONS. IF LEAKAGE PERSISTS, REPLACE THE SEAL.
4. PITMAN SHAFT SEALS - REPLACE THE SEALS.
5. TOP COVER SEAL - REPLACE THE SEAL.

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REMOVAL AND INSTALLATION

STEERING GEAR

REMOVAL

- (1) Place the front wheels in the straight ahead position with the steering wheel centered.
- (2) Remove and cap the pressure and return hoses from the steering gear.
- (3) Remove the column coupler shaft from the gear (Fig. 2).
- (4) Remove pitman arm from gear with Puller C-4150A (Fig. 3).
- (5) Remove the steering gear retaining bolts and nuts. Remove the steering gear from the vehicle (Fig. 4).

INSTALLATION

- (1) Position the steering gear on the frame rail and install the bolts. Tighten the bolts to 88 N-m (65 ft. lbs.) torque.
- (2) Install the column coupler shaft.
- (3) Install the pitman arm and tighten nut to 251 N-m (185 ft. lbs.).
- (4) Connect pressure and return hoses to steering gear and tighten to 28 N-m (21 ft. lbs.).

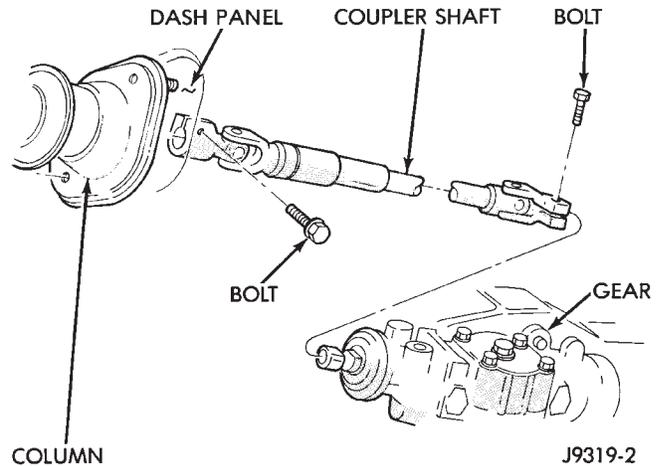


Fig. 2 Coupling Shaft

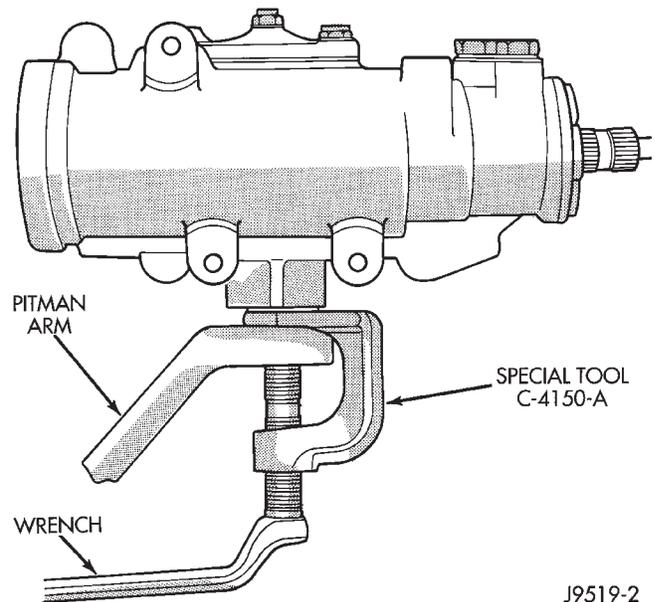


Fig. 3 Pitman Arm Removal

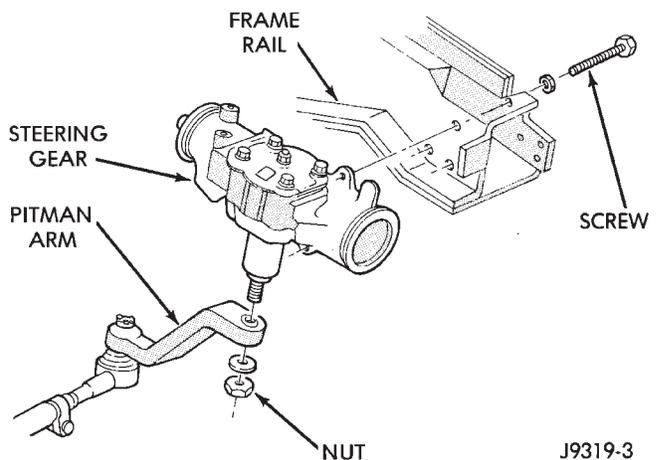


Fig. 4 Steering Gear Mounting

DISASSEMBLY AND ASSEMBLY

HOUSING END PLUG

DISASSEMBLY

(1) Unseat and remove retaining ring from groove with a punch through the hole in the end of the housing (Fig. 5).

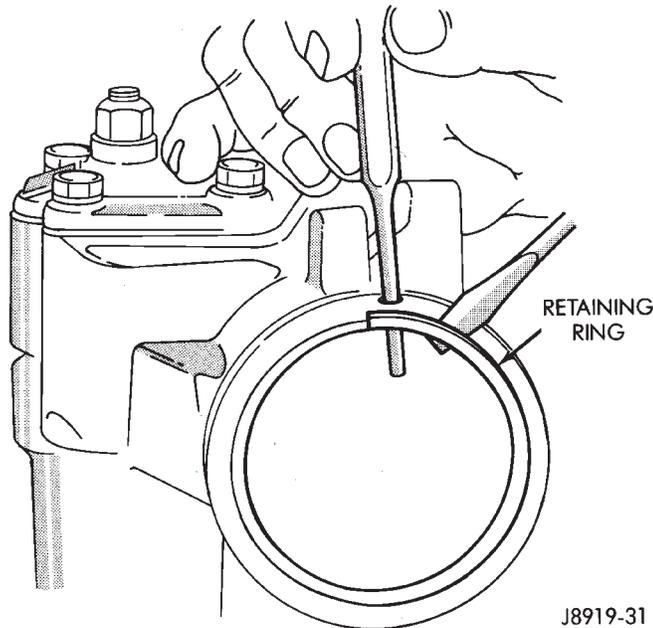


Fig. 5 End Plug Retaining Ring

(2) Slowly rotate stub shaft with 12 point socket COUNTER-CLOCKWISE to force the end plug out from housing.

CAUTION: Do not turn stub shaft any further than necessary. The rack piston balls will drop out of the rack piston circuit if the stub shaft is turned too far.

(3) Remove O-ring from the housing (Fig. 6).

ASSEMBLY

(1) Lubricate O-ring with power steering fluid and install into the housing.

(2) Install end plug by tapping the plug lightly with a plastic mallet into the housing.

(3) Install retaining ring so one end of the ring covers the housing access hole (Fig. 7).

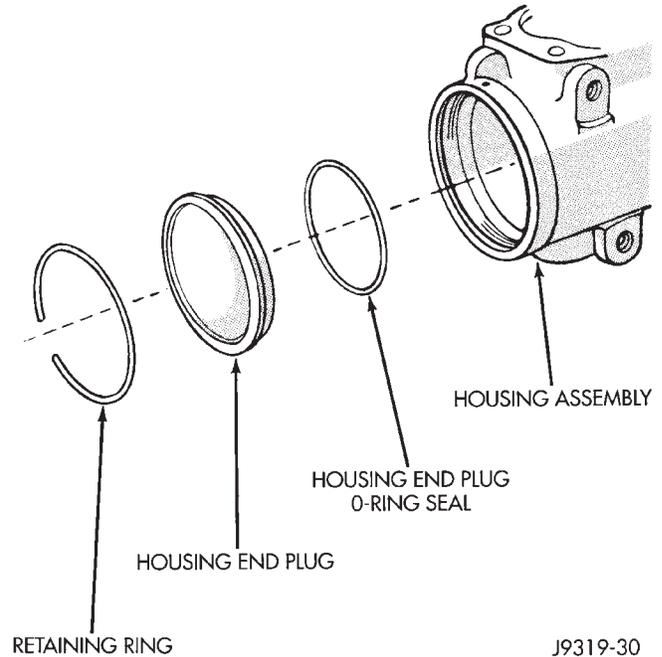


Fig. 6 End Plug Components

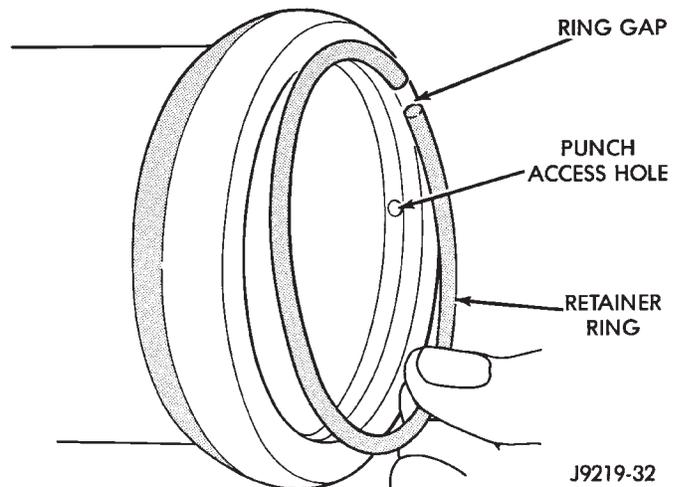


Fig. 7 Installing The Retaining Ring

PITMAN SHAFT/SEALS/BEARING

DISASSEMBLY

(1) Clean exposed end of pitman shaft and housing with a wire brush.

DISASSEMBLY AND ASSEMBLY (Continued)

- (2) Remove preload adjuster nut (Fig. 8).
- (3) Rotate the stub shaft with a 12 point socket from stop to stop and count the number of turns.
- (4) Center the stub shaft by rotating it from the stop 1/2 of the total amount of turns.
- (5) Remove side cover bolts and remove side cover, gasket and pitman shaft as an assembly (Fig. 8).

NOTE: The pitman shaft will not clear the housing if it is not centered.

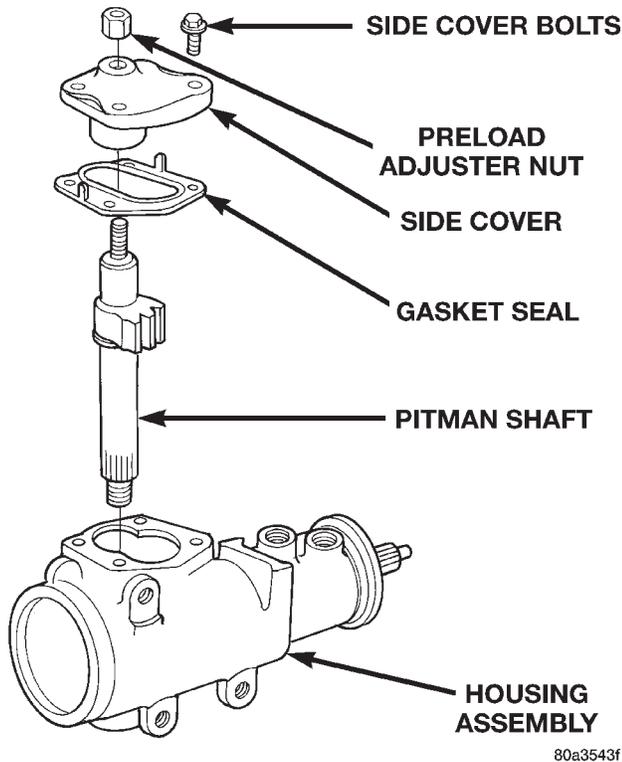


Fig. 8 Side Cover and Pitman Shaft

- (6) Remove pitman shaft from the side cover.
- (7) Remove dust seal from the housing with a seal pick (Fig. 9).

CAUTION: Use care not to score the housing bore when prying out seals and washer.

- (8) Remove retaining ring with snap ring pliers.
- (9) Remove washer from the housing.
- (10) Remove oil seal from the housing with a seal pick.
- (11) Remove pitman shaft bearing from housing with a bearing driver and handle (Fig. 10).

ASSEMBLY

- (1) Install pitman shaft bearing into housing with a bearing driver and handle.
- (2) Coat the oil seals and washer with grease.
- (3) Install the oil seal with a driver and handle.
- (4) Install backup washer.

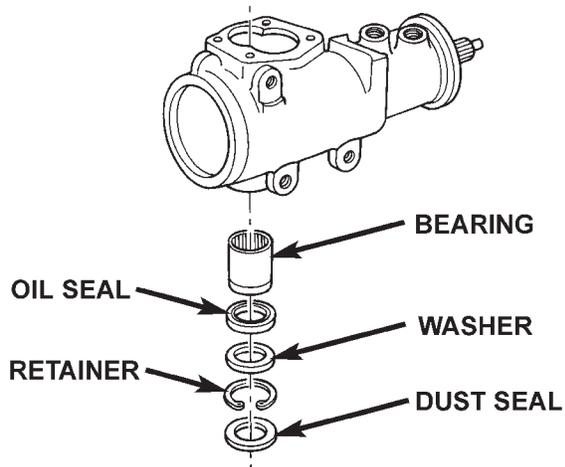


Fig. 9 Pitman Shaft Seals & Bearing

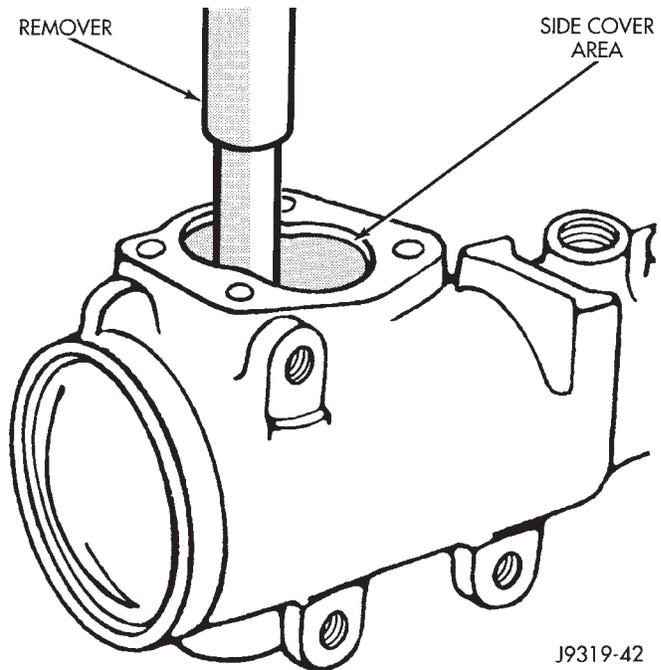


Fig. 10 Needle Bearing Removal

- (5) Install the retainer ring with snap ring pliers.
- (6) Install dust seal with a driver and handle.
- (7) Install pitman shaft to side cover by screwing shaft in until it fully seats to side cover.
- (8) Install preload adjuster nut. **Do not tighten nut until after Over-Center Rotation Torque adjustment has been made.**
- (9) Install gasket to side cover and bend tabs around edges of side cover (Fig. 8).
- (10) Install pitman shaft assembly and side cover to housing.
- (11) Install side cover bolts and tighten to 60 N·m (44 ft. lbs.).
- (12) Adjust Over-Center Rotation Torque.

DISASSEMBLY AND ASSEMBLY (Continued)

SPOOL VALVE

DISASSEMBLY

- (1) Remove lock nut (Fig. 11).
- (2) Remove adjuster nut with Spanner Wrench C-4381.
- (3) Remove thrust support assembly out of the housing (Fig. 12).
- (4) Pull stub shaft and valve assembly from the housing (Fig. 13).

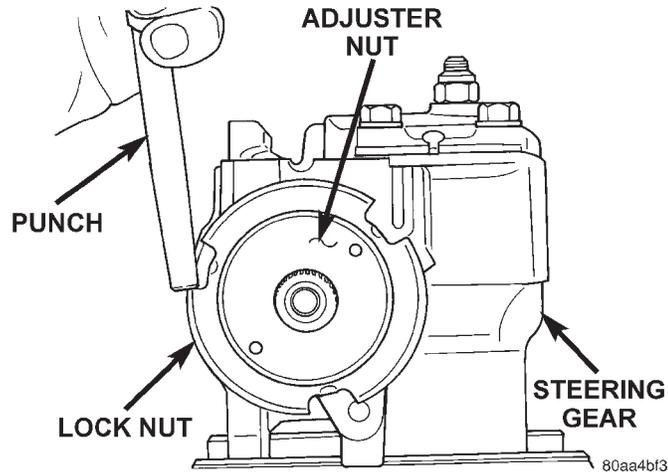


Fig. 11 Lock Nut and Adjuster Nut

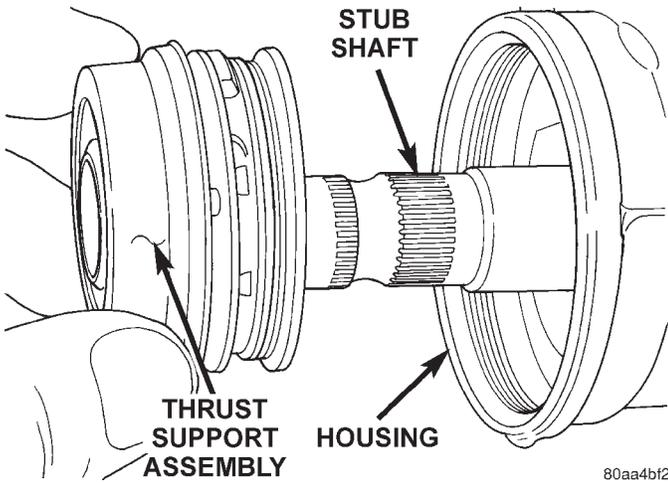


Fig. 12 Thrust Support Assembly

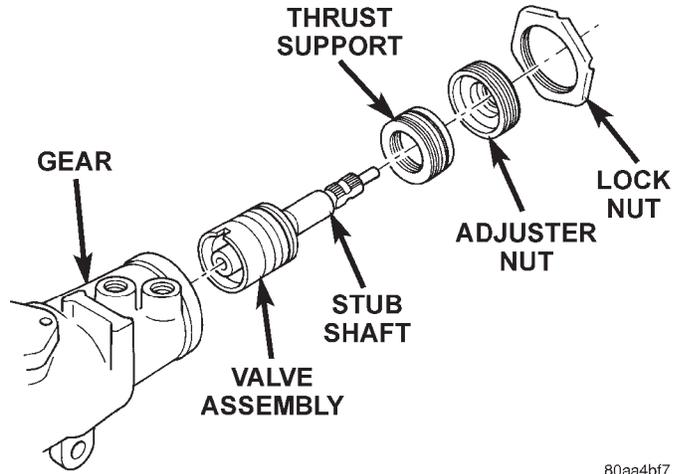


Fig. 13 Valve Assembly With Stub Shaft

- (5) Remove stub shaft from valve assembly by lightly tapping shaft on a block of wood to loosen shaft. Then disengage stub shaft pin from hole in spool valve and separate the valve assembly from stub shaft (Fig. 14).

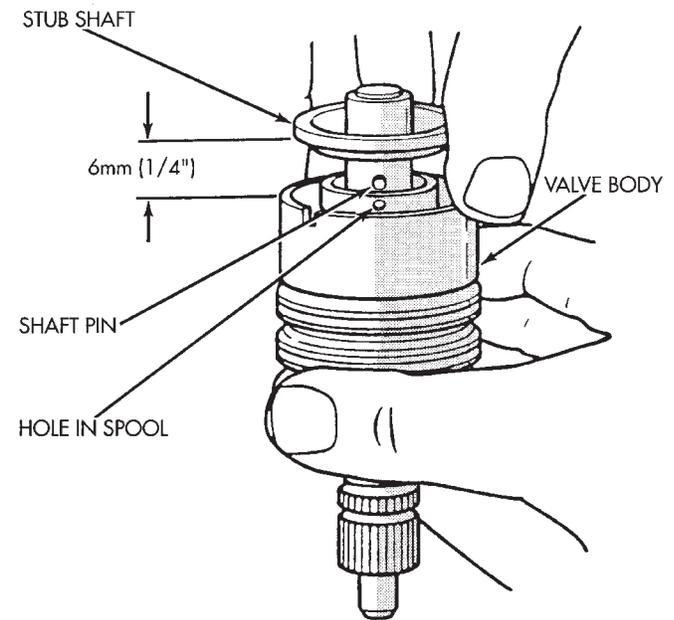


Fig. 14 Stub Shaft

DISASSEMBLY AND ASSEMBLY (Continued)

(6) Remove spool valve from valve body by pulling and rotating the spool valve from the valve body (Fig. 15).

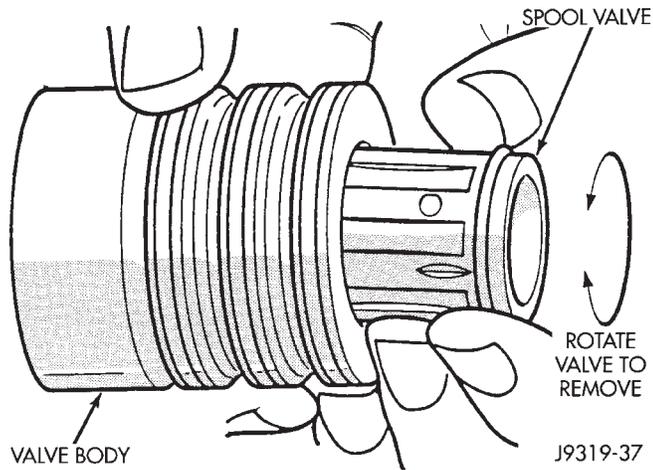


Fig. 15 Spool Valve

(7) Remove spool valve O-ring and valve body teflon rings and O-rings underneath the teflon rings (Fig. 16).

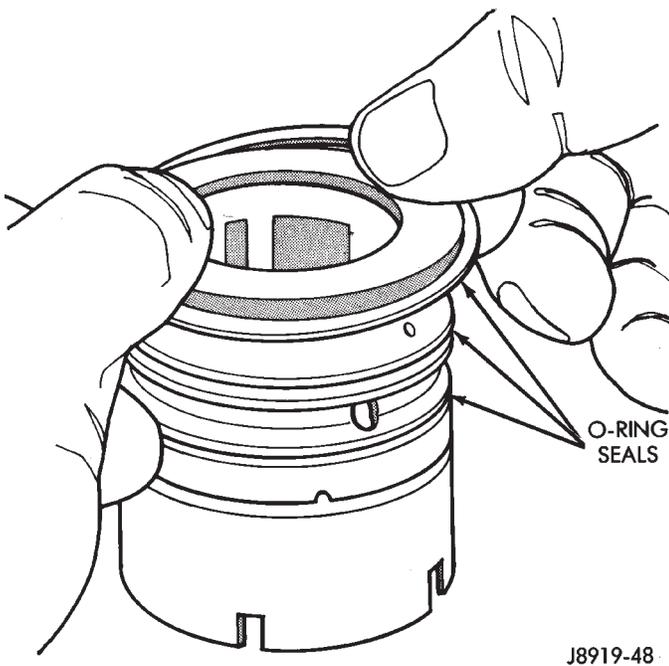


Fig. 16 Valve Seals

(8) Remove the O-ring between the worm shaft and the stub shaft.

ASSEMBLY

NOTE: Clean and dry all components, then lubricate with power steering fluid.

(1) Install spool valve spool O-ring.

(2) Install spool valve in valve body by pushing and rotating. Hole in spool valve for stub shaft pin must be accessible from opposite end of valve body.

(3) Install stub shaft in valve spool and engage locating pin on stub shaft into spool valve hole (Fig. 17).

NOTE: Notch in stub shaft cap must fully engage valve body pin and seat against valve body shoulder.

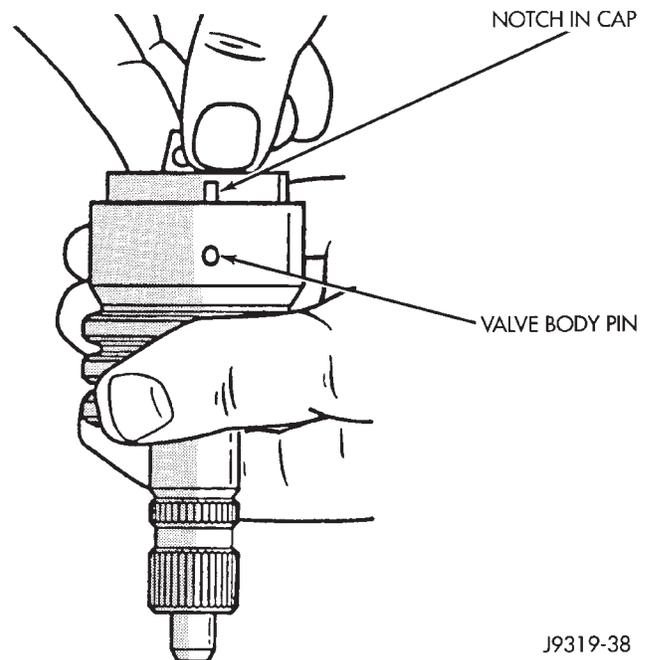


Fig. 17 Stub Shaft Installation

(4) Install O-rings and teflon rings over the O-rings on valve body.

(5) Install O-ring into the back of the stub shaft cap (Fig. 18).

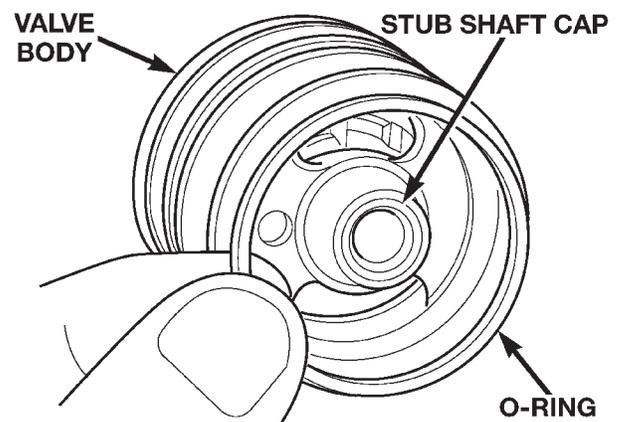


Fig. 18 Stub Shaft Cap O-Ring

DISASSEMBLY AND ASSEMBLY (Continued)

- (6) Install stub shaft and valve assembly in the housing. Line up worm shaft to slots in the valve assembly.
- (7) Install thrust support assembly.

NOTE: The thrust support is serviced as an assembly. If any component of the thrust support is damaged the assembly must be replaced.

- (8) Install adjuster nut and lock nut.
- (9) Adjust Thrust Bearing Preload and Over-Center Rotating Torque.

RACK PISTON AND WORM SHAFT

DISASSEMBLY

- (1) Remove housing end plug.
- (2) Remove rack piston plug (Fig. 19).
- (3) Remove side cover and pitman shaft.

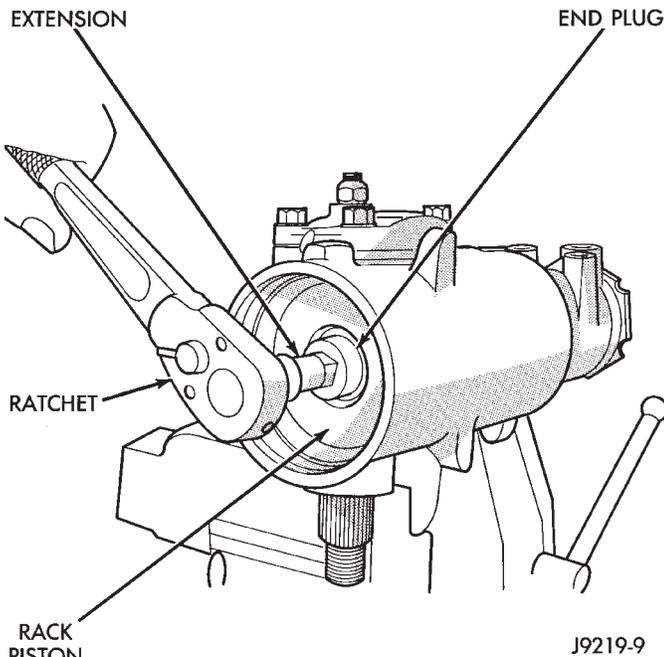


Fig. 19 Rack Piston End Plug

- (4) Turn stub shaft **COUNTERCLOCKWISE** until the rack piston begins to come out of the housing.
- (5) Insert Arbor C-4175 into bore of rack piston (Fig. 20) and hold tool tightly against worm shaft.
- (6) Turn the stub shaft with a 12 point socket **COUNTERCLOCKWISE**, this will force the rack piston onto the tool and hold the rack piston balls in place.
- (7) Remove the rack piston and tool together from housing.
- (8) Remove tool from rack piston.
- (9) Remove rack piston balls.
- (10) Remove clamp bolts, clamp and ball guide (Fig. 21).
- (11) Remove teflon ring and O-ring from the rack piston (Fig. 22).

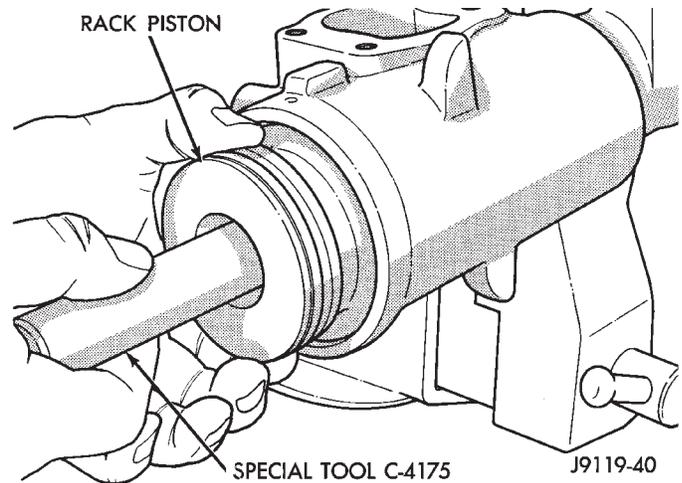


Fig. 20 Rack Piston with Arbor

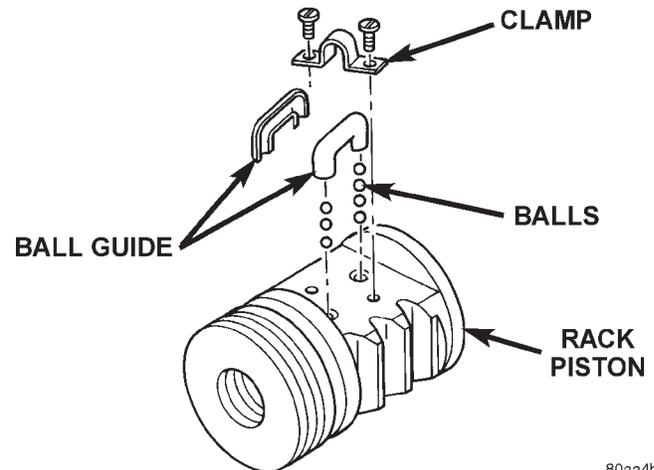


Fig. 21 Rack Piston

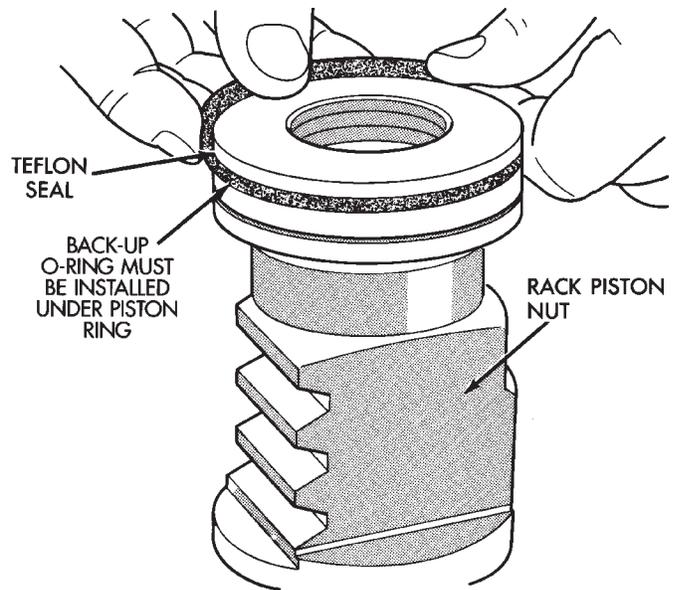


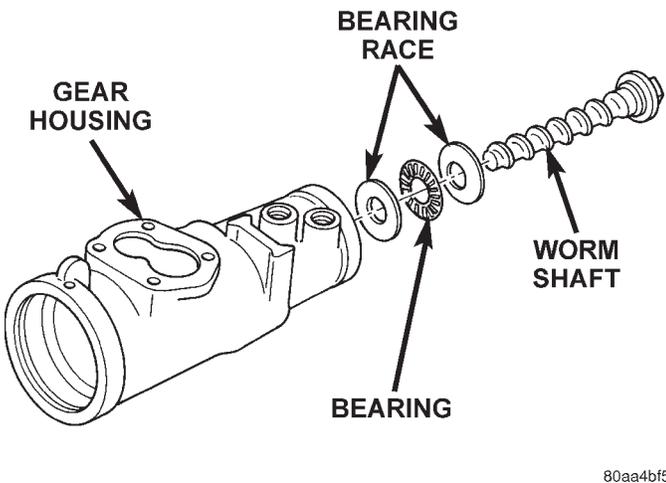
Fig. 22 Rack Piston Teflon Ring and O-Ring

DISASSEMBLY AND ASSEMBLY (Continued)

(12) Remove the adjuster lock nut and adjuster nut from the stub shaft.

(13) Pull the stub shaft with the spool valve and thrust support assembly out of the housing.

(14) Remove the worm shaft from the housing (Fig. 23).



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Fig. 23 Worm Shaft

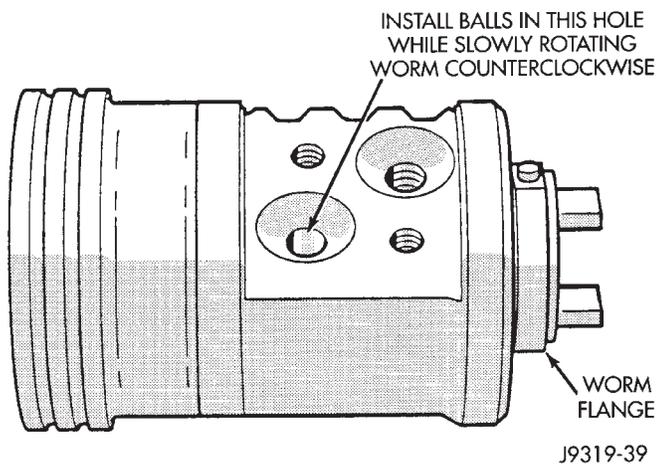
ASSEMBLY

NOTE: Clean and dry all components and lubricate with power steering fluid.

(1) Check for scores, nicks or burrs on the rack piston finished surface. Slight wear is normal on the worm gear surfaces.

(2) Install O-ring and teflon ring on the rack piston.

(3) Install worm shaft in the rack piston and align worm shaft spiral groove with rack piston ball guide hole (Fig. 24).



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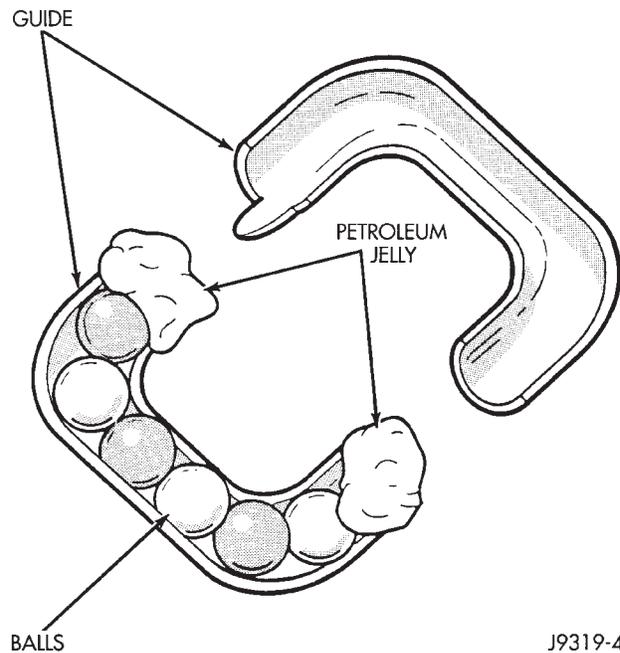
Fig. 24 Installing Balls in Rack Piston

CAUTION: The rack piston balls must be installed alternately into the rack piston and ball guide. This

maintains worm shaft preload. There are 12 black balls and 12 silver (Chrome) balls. The black balls are smaller than the silver balls.

(4) Lubricate and install rack piston balls through return guide hole while turning worm shaft COUNTERCLOCKWISE (Fig. 24).

(5) Install remaining balls in guide using grease to hold the balls in place (Fig. 25).



J9319-40

Fig. 25 Balls in the Return Guide

(6) Install the guide onto rack piston and install clamp and clamp bolts. Tighten bolts to 58 N·m (43 ft. lbs.).

(7) Insert Arbor C-4175 into bore of rack piston and hold tool tightly against worm shaft.

(8) Turn the worm shaft COUNTERCLOCKWISE while pushing on the arbor. This will force the rack piston onto the arbor and hold the rack piston balls in place.

(9) Install the races and thrust bearing on the worm shaft and install shaft in the housing (Fig. 23).

(10) Install the stub shaft with spool valve, thrust support assembly and adjuster nut in the housing.

(11) Install the rack piston and arbor tool into the housing.

(12) Hold arbor tightly against worm shaft and turn stub shaft CLOCKWISE until rack piston is seated on worm shaft.

(13) Install pitman shaft and side cover in the housing.

(14) Install rack piston plug and tighten to 150 N·m (111 ft. lbs.).

(15) Install housing end plug.

DISASSEMBLY AND ASSEMBLY (Continued)

(16) Adjust worm shaft thrust bearing preload and over-center rotating torque.

ADJUSTMENTS

STEERING GEAR

CAUTION: Steering gear must be adjusted in the proper order. If adjustments are not performed in order, gear damage and improper steering response may result.

NOTE: Adjusting the steering gear in the vehicle is not recommended. Remove gear from the vehicle and drain the fluid. Then mount gear in a vise to perform adjustments.

WORM THRUST BEARING PRELOAD

(1) Mount the gear carefully into a vise.

CAUTION: Do not overtighten the vise on the gear case. This may affect the adjustment

(2) Remove adjuster plug locknut (Fig. 26).

(3) Rotate the stub shaft back and forth with a 12 point socket to drain the remaining fluid.

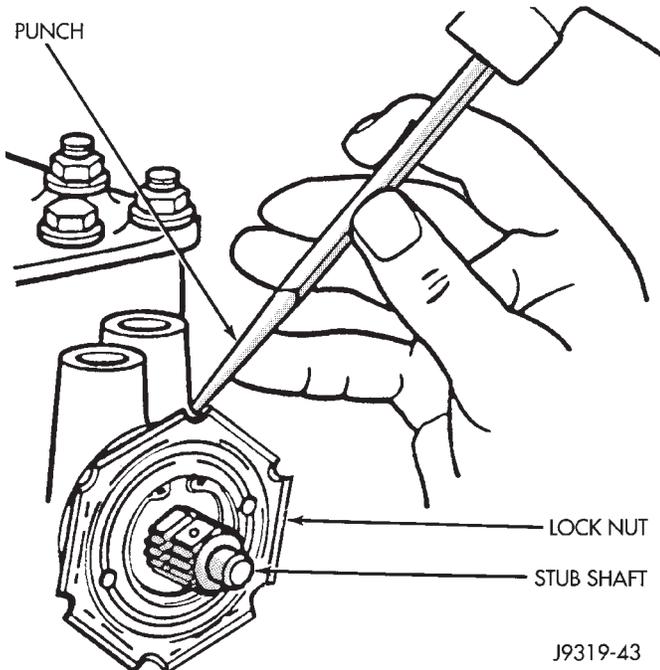


Fig. 26 Loosening the Adjuster Plug

(4) Turn the adjuster in with Spanner Wrench C-4381. Tighten the plug and thrust bearing in the housing until firmly bottomed in the housing about 34 N·m (25 ft. lbs.).

(5) Place an index mark on the housing even with one of the holes in adjuster plug (Fig. 27).

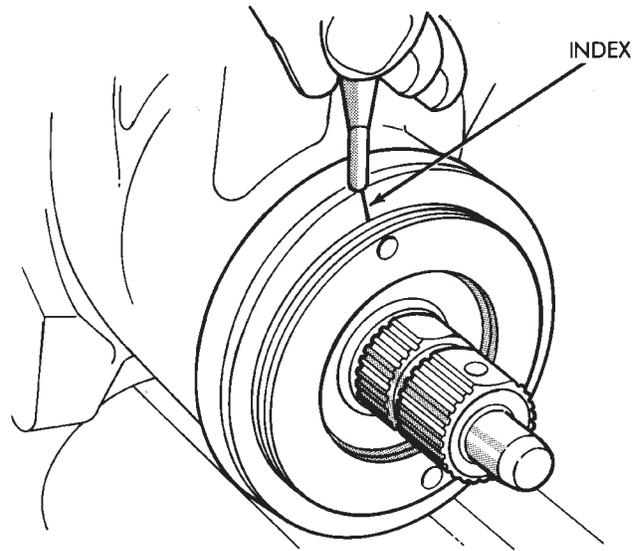


Fig. 27 Alignment Marking On Housing

(6) Measure back (counterclockwise) 10 mm (0.40 in) and mark housing (Fig. 28).

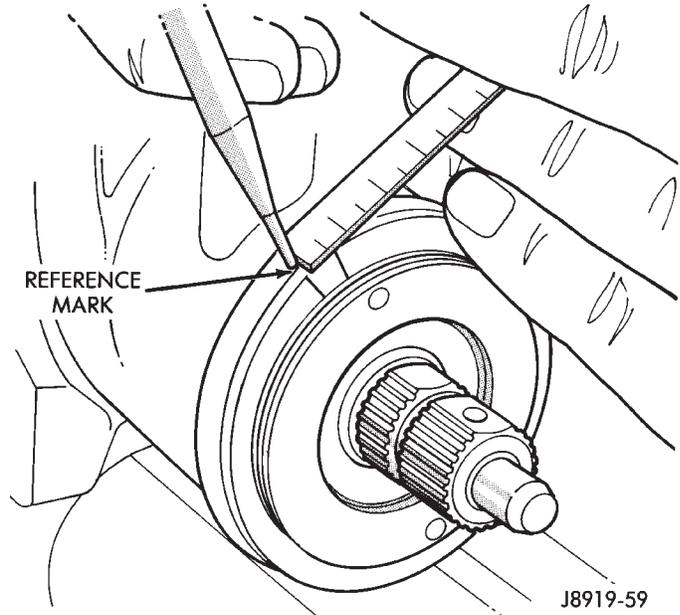
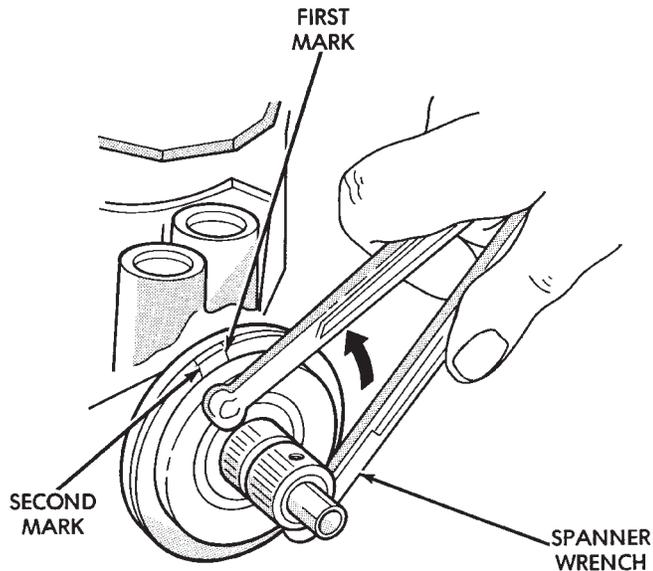


Fig. 28 Second Marking On Housing

ADJUSTMENTS (Continued)

(7) Rotate adjustment cap back (counterclockwise) with spanner wrench until hole is aligned with the second mark (Fig. 29).



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Fig. 29 Aligning To The Second Mark

(8) Install and tighten locknut to 108 N-m (80 ft. lbs.). Be sure adjustment cap does not turn while tightening the locknut.

OVER-CENTER

NOTE: Before performing this procedure, the worm bearing preload adjustment must be performed.

(1) Rotate the stub shaft with a 12 point socket from stop to stop and count the number of turns.

(2) Starting at either stop, turn the stub shaft back 1/2 the total number of turns. This is the center of the gear travel (Fig. 30).

(3) Place the torque wrench in the vertical position on the stub shaft. Rotate the wrench 45 degrees each side of the center and record the highest rotational torque in this range (Fig. 31). This is the Over-Center Rotating Torque.

NOTE: The stub shaft must rotate smoothly without sticking or binding.

(4) Rotate the stud shaft between 90° and 180° to the left of center and record the left off-center preload. Repeat this to the right of center and record the right off-center preload. The average of these two recorded readings is the Preload Rotating Torque.

(5) The Over-Center Rotating Torque should be 0.45-0.9 N-m (4-8 in. lbs.) **higher** than the Preload Rotating Torque.

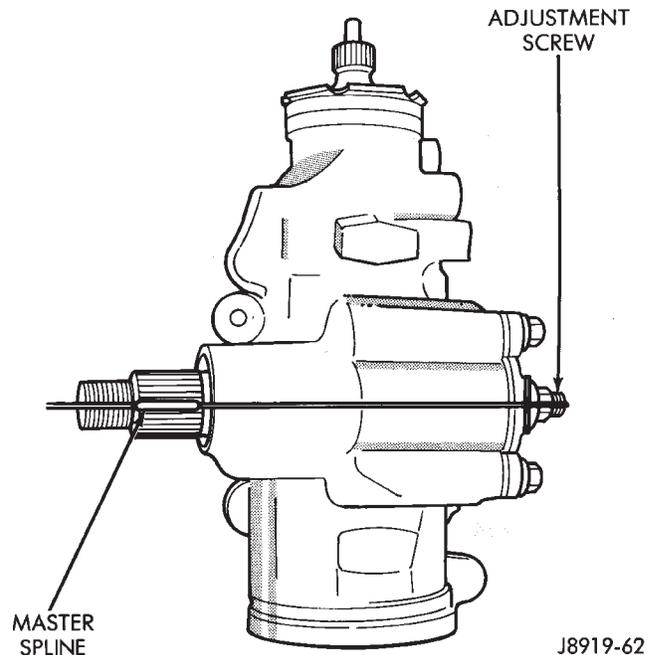


Fig. 30 Steering Gear Centered

(6) If an adjustment to the Over-Center Rotating Torque is necessary, first loosen the adjuster lock nut. Then turn the pitman shaft adjuster screw back (COUNTERCLOCKWISE) until fully extended, then turn back in (CLOCKWISE) one full turn.

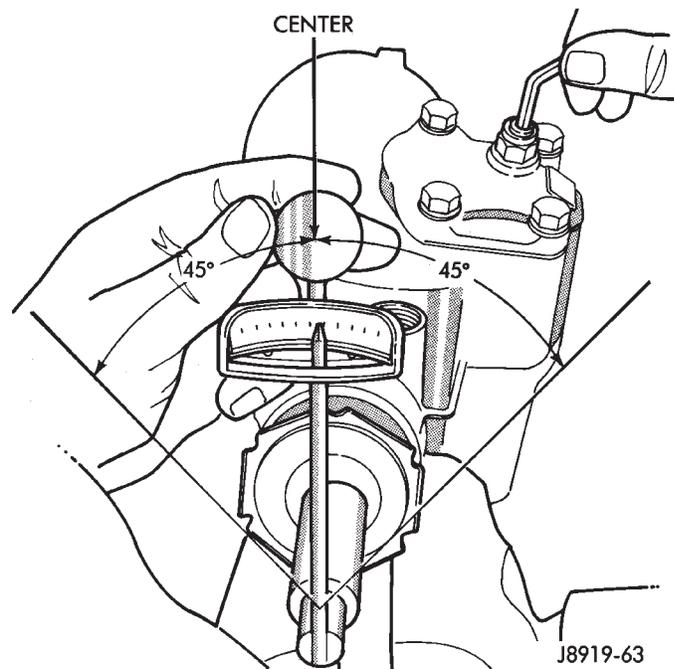


Fig. 31 Checking Over-center Rotation Torque

(7) Remeasure Over-Center Rotating Torque. If necessary turn the adjuster screw and repeat measurement until correct Over-Center Rotating Torque is reached.

ADJUSTMENTS (Continued)

NOTE: To increase the Over-Center Rotating Torque turn the screw **CLOCKWISE**.

(8) Prevent the adjuster screw from turning while tightening adjuster lock nut. Tighten the adjuster lock nut to 49 N·m (36 ft. lbs.).

SPECIFICATIONS

POWER STEERING GEAR

Steering Gear

Type Recirculating Ball
 Gear Ratio 12.7:1

Worm Shaft Bearing

Preload 0.45-1.13 N·m (4-10 in. lbs.)

Pitman Shaft Overcenter Drag

New Gear (under 400 miles) 0.45-0.90 N·m
 (4-8 in. lbs.) + Worm Shaft Preload
 Used Gear (over 400 miles) 0.5-0.6 N·m
 (4-5 in. lbs.) + Worm Shaft Preload

TORQUE CHART

DESCRIPTION

TORQUE

Power Steering Gear

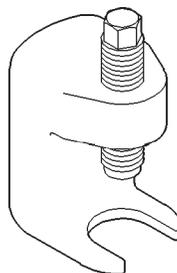
Adjustment Cap Locknut 108 N·m (80 ft. lbs.)
 Adjustment Screw Locknut 49 N·m (36 ft. lbs.)
 Gear to Frame Bolts 88 N·m (65 ft. lbs.)
 Pitman Shaft Nut 251 N·m (185 ft. lbs.)
 Rack Piston Plug 150 N·m (111 ft. lbs.)
 Side Cover Bolts 60 N·m (44 ft. lbs.)
 Pressure Line 28 N·m (21 ft. lbs.)
 Return Line 28 N·m (21 ft. lbs.)
 Return Guide Clamp Bolt 58 N·m (43 ft. lbs.)

SPECIAL TOOLS

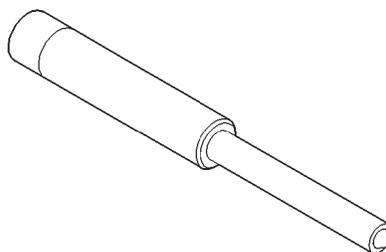
POWER STEERING GEAR



Remover/Installer, Steering Plug C-4381



Remover, Pitman Arm C-4150A



Remover/Installer Steering Rack Piston C-4175

STEERING COLUMN

INDEX

	page		page
GENERAL INFORMATION		REMOVAL AND INSTALLATION	
STEERING COLUMN	20	STEERING COLUMN	22
DIAGNOSIS AND TESTING		SPECIFICATIONS	
IGNITION SWITCH	21	TORQUE CHART	23

GENERAL INFORMATION

STEERING COLUMN

The tilt column (Fig. 1) has been designed to be serviced as an assembly, less the wiring, switches, shrouds, steering wheel, etc. Most steering column components can be serviced without removing the steering column from the vehicle.

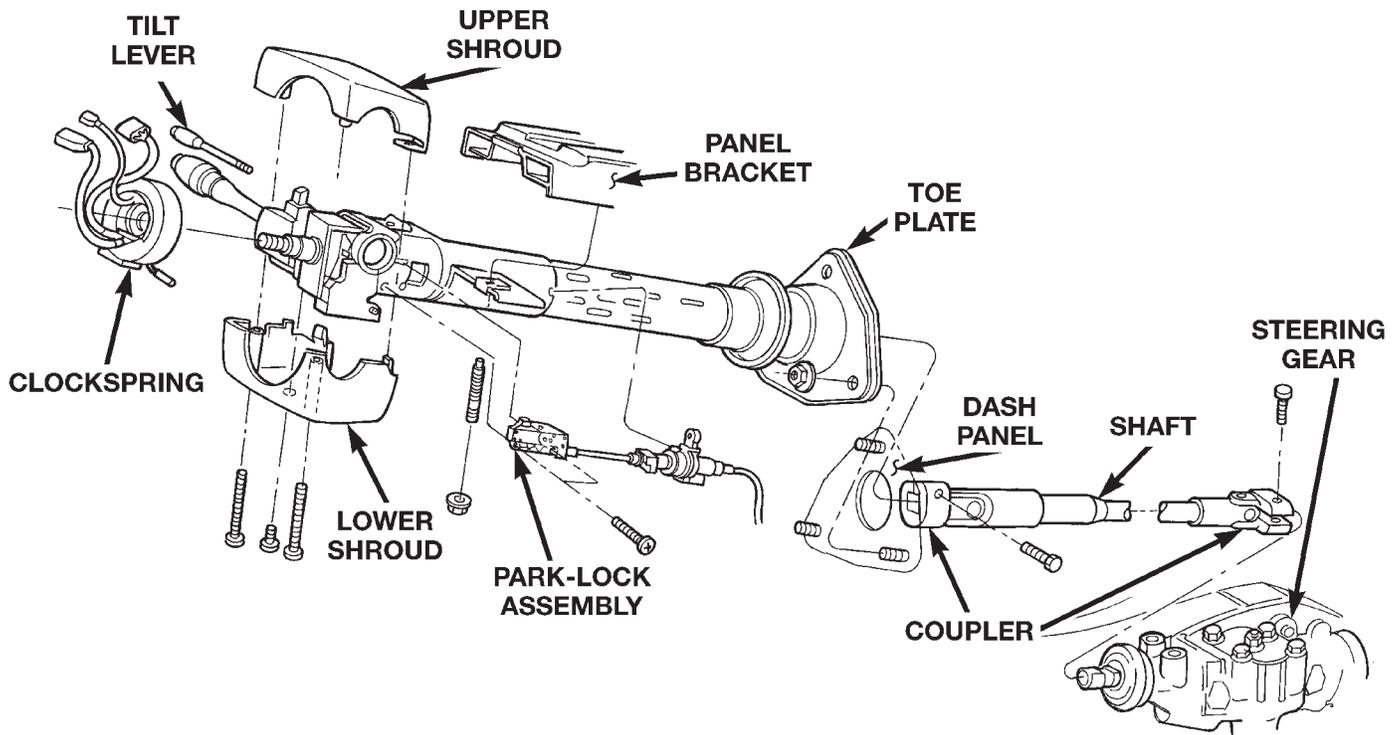
SERVICE PRECAUTIONS

Safety goggles should be worn at all times when working on steering columns.

To service the steering wheel, switches or airbag, refer to Group 8M and follow all WARNINGS and CAUTIONS.

WARNING: THE AIRBAG SYSTEM IS A SENSITIVE, COMPLEX ELECTRO-MECHANICAL UNIT. BEFORE

ATTEMPTING TO DIAGNOSE, REMOVE OR INSTALL THE AIRBAG SYSTEM COMPONENTS YOU MUST FIRST DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE. THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE. FAILURE TO DO SO COULD RESULT IN ACCIDENTAL DEPLOYMENT OF THE AIRBAG AND POSSIBLE PERSONAL INJURY. THE FASTENERS, SCREWS, AND BOLTS, ORIGINALLY USED FOR THE AIRBAG COMPONENTS, HAVE SPECIAL COATINGS AND ARE SPECIFICALLY DESIGNED FOR THE AIRBAG SYSTEM. THEY MUST NEVER BE REPLACED WITH ANY SUBSTITUTES. ANYTIME A NEW FASTENER IS NEEDED, REPLACE WITH THE CORRECT FASTENERS PROVIDED IN THE SERVICE PACKAGE OR FASTENERS LISTED IN THE PARTS BOOKS.



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Fig. 1 Steering Column

GENERAL INFORMATION (Continued)

CAUTION: Do not attempt to remove the pivot pins to disassemble the tilting mechanism. Do not remove ignition locking link, shaft lock plate or plate retainer. This will damage the column (Fig. 2) and (Fig. 3).

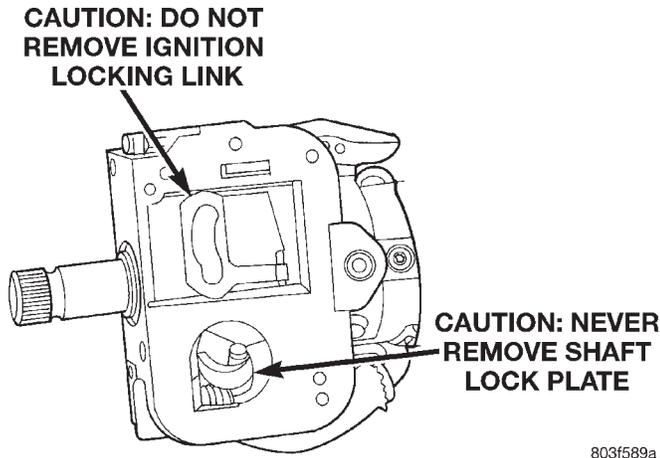


Fig. 2 Observe Cautions

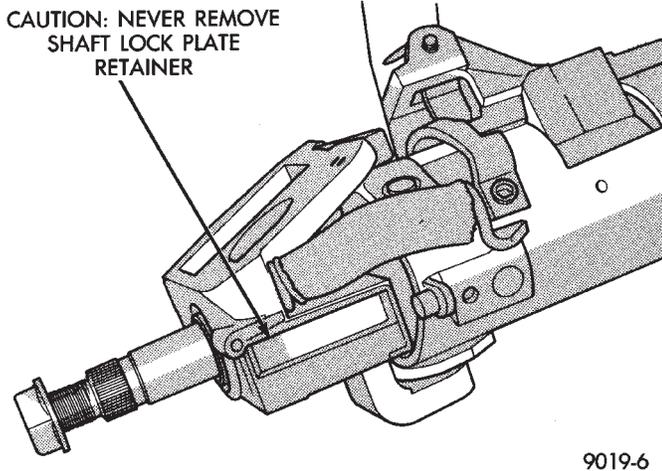


Fig. 3 Observe Cautions

DIAGNOSIS AND TESTING

IGNITION SWITCH

TEST AND REPAIR

If the ignition switch effort is excessive, remove the ignition switch from the steering column. Refer to Group 8D Ignition System. Using a key cylinder, check the turning effort of the switch. If the ignition switch binds look for the following conditions.

(1) Look for rough areas or flash in the casting and if found remove with a file (Fig. 4).

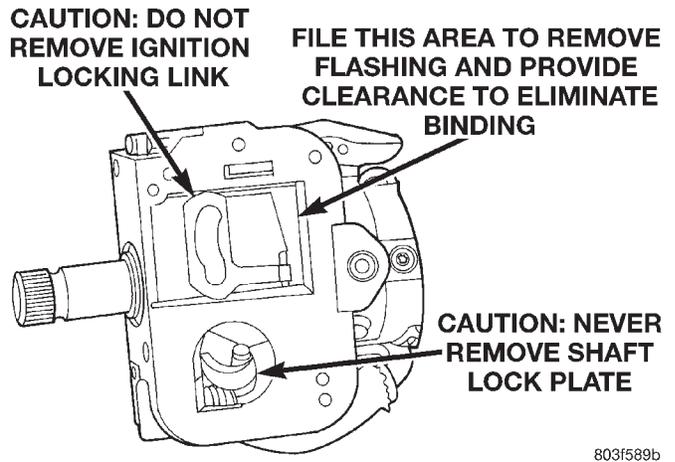


Fig. 4 Steering Column Flash Removal And Non-Serviceable Components

(2) With the ignition switch removed, slide the slider in its slot in the sleeve and verify a loose fit over the length of the slot. If the slider binds in the slot at any point lightly file the slider or slot until clearance is achieved.

(3) If no binding is found, lightly file the ramp on the ignition switch, (The ramp fits into the casting) until binding no longer occurs.

REMOVAL AND INSTALLATION

STEERING COLUMN

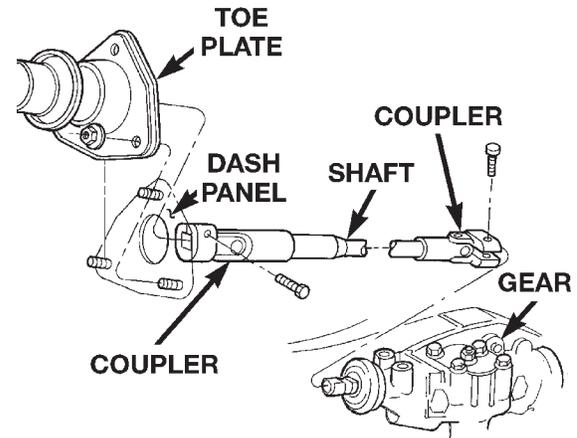
WARNING: BEFORE SERVICING THE STEERING COLUMN THE AIRBAG SYSTEM MUST BE DISARMED. FAILURE TO DO SO MAY RESULT IN ACCIDENTAL DEPLOYMENT OF THE AIRBAG AND POSSIBLE PERSONAL INJURY. REFER TO GROUP 8M RESTRAINT SYSTEMS FOR SERVICE PROCEDURES.

REMOVAL

- (1) Position front wheels straight ahead.
- (2) Disconnect the negative (ground) cable from the battery.
- (3) Remove the airbag, refer to Group 8M Restraint Systems for service procedures.
- (4) Remove the steering wheel with an appropriate puller.

CAUTION: Ensure the puller bolts are fully engaged into the steering wheel and not into the clock-spring, before attempting to remove the wheel. Failure to do so may damage the steering wheel.

- (5) Remove column coupler upper pinch bolt (Fig. 5).
- (6) Remove the knee blocker, refer to Group 8E Instrument Panel Systems.
- (7) Remove tilt lever from column.



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Fig. 5 Column Coupler Shaft

- (8) Remove the upper and lower lock housing shrouds.
- (9) Loosen the column mounting nut/washer assemblies to allow the column to drop.
- (10) Remove the Interlock cable from the steering column. Refer to Group 21 Transmission and Transfer Case.
- (11) Remove multi-function switch connector screw and remove connector.
- (12) Remove the wiring harness from the remaining switches and the steering column (Fig. 6).
- (13) Remove the ignition switch.
- (14) Remove the clock spring, and switches refer to Group 8 Electrical for service procedures.
- (15) Remove the toe plate to dash panel nuts.

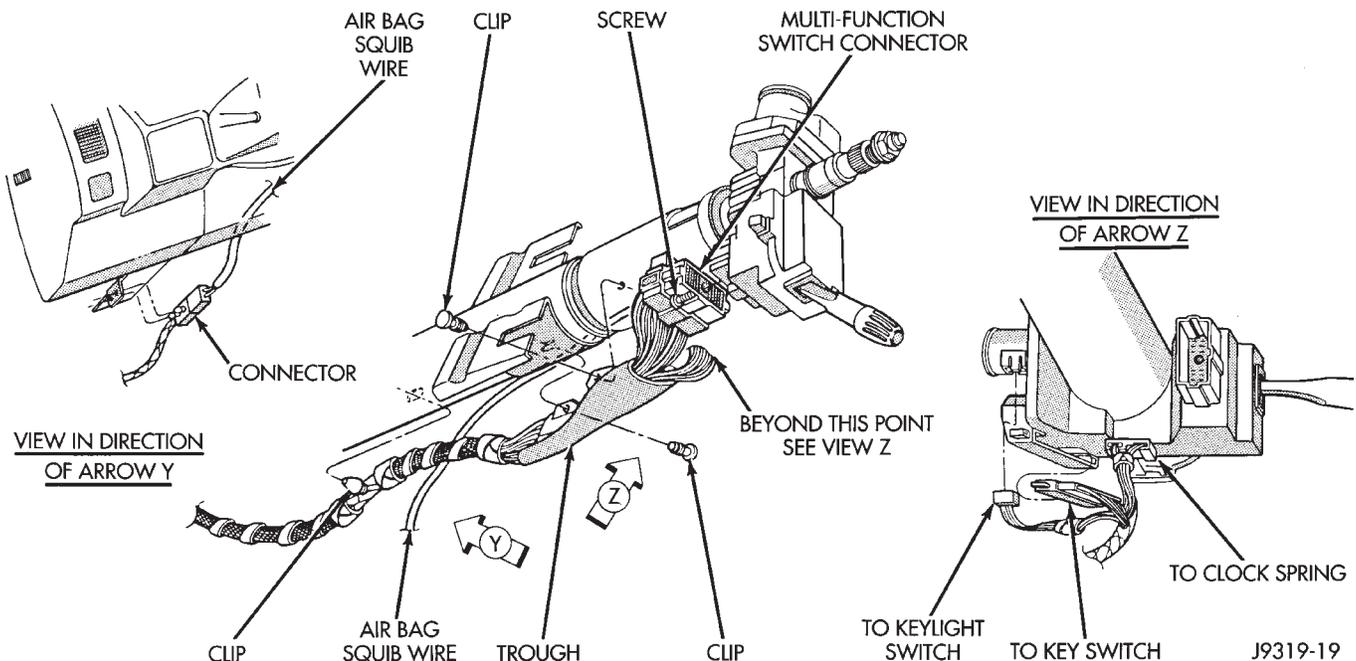


Fig. 6 Steering Column Wiring Harness

REMOVAL AND INSTALLATION (Continued)

(16) Remove the mounting nut/washer assemblies and remove the column.

INSTALLATION

(1) With the front wheels in the straight ahead position. Align and install the column to coupler. **Do not apply force at the top of the steering column shaft.**

(2) Remove the column shaft shipping lock pin (installed in service column).

(3) Ensure the ground clip is on spacer slot.

(4) Install the Interlock cable from the steering column. Refer to Group 21 Transmission and Transfer Case.

(5) Install wiring harness connections to steering column. **Ensure the wiring is not pinched and all connections are correctly locked in place.**

(6) Install the clock spring, and switches refer to Group 8 Electrical for service procedures.

(7) Install the harness connector to the switches.

(8) Install the ignition switch.

(9) Install shaft coupler pinch bolt loose, load column up to panel bracket.

(10) Be sure both spacers are fully seated in the column support bracket. Tighten the column mounting nut/washer assemblies to 12 N·m (105 in. lbs.).

(11) Tighten the toe plate attaching nuts to 12 N·m (105 in. lbs.).

(12) Tighten the coupler pinch bolt to 49 N·m (36 ft. lbs.).

(13) Install the heater cross over tube under the column.

(14) Install the upper and lower shrouds and tilt lever.

(15) Install the knee blocker, refer to Group 8E Instrument Panel Systems

(16) Install the steering wheel and airbag, refer to Group 8M Passive Restraint Systems for procedures.

(17) Connect the battery ground (negative) cable.

SPECIFICATIONS

TORQUE CHART

DESCRIPTION	TORQUE
Steering Column	
Steering Wheel Nut . . . . .	.61 N·m (45 ft. lbs.)
Column Bracket Nuts . . . . .	.12 N·m (105 in. lbs.)
Shaft Coupler Bolts . . . . .	.49 N·m (36 ft. lbs.)
Toe Plate Bolts . . . . .	.12 N·m (105 in. lbs.)

STEERING LINKAGE

INDEX

	page		page
GENERAL INFORMATION		STEERING DAMPENER	26
STEERING LINKAGE	24	TIE ROD	25
SERVICE PROCEDURES		SPECIFICATIONS	
STEERING LINKAGE	24	TORQUE CHART	26
REMOVAL AND INSTALLATION		SPECIAL TOOLS	
DRAG LINK	25	STEERING LINKAGE	26
PITMAN ARM	25		

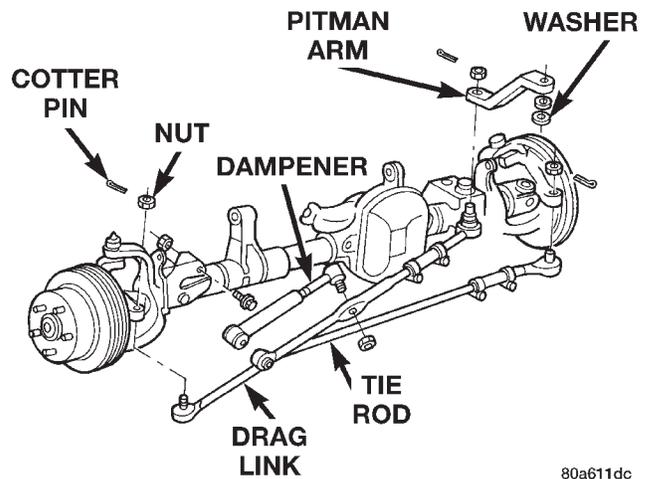
GENERAL INFORMATION

STEERING LINKAGE

The steering linkage consists of a pitman arm, drag link, tie rod, and steering dampener (Fig. 1) and (Fig. 2). Adjustment sleeves are used on the tie rod and drag link for toe and steering wheel alignment.

CAUTION: Components attached with a nut and cotter pin must be torqued to specification. Then if the slot in the nut does not line up with the cotter pin hole, tighten nut until it is aligned. Never loosen the nut to align the cotter pin hole.

NOTE: Periodic lubrication of the steering system components is required. Refer to Group 0, Lubrication And Maintenance for the recommended maintenance schedule.



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Fig. 2 Steering Linkage-8 Cylinder Engine

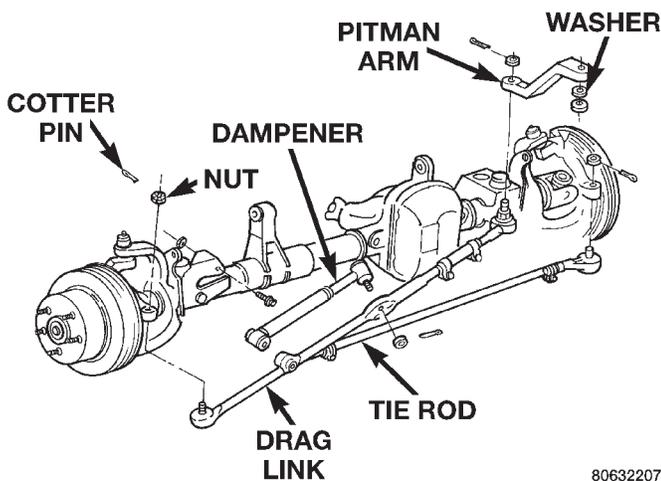
SERVICE PROCEDURES

STEERING LINKAGE

The tie rod end and ball stud seals should be inspected during all oil changes. If a seal is damaged, it should be replaced. Before installing a new seal, inspect ball stud at the throat opening. Check for lubricant loss, contamination, ball stud wear or corrosion. If these conditions exist, replace the tie rod. A replacement seal can be installed if lubricant is in good condition. Otherwise, a complete replacement ball stud end should be installed.

CAUTION: If any steering components are replaced or serviced an alignment must be performed, to ensure the vehicle meets all alignment specifications.

CAUTION: Components attached with a nut and cotter pin must be torqued to specification. Then if the slot in the nut does not line up with the cotter pin hole, tighten nut until it is aligned. Never loosen the nut to align the cotter pin hole.



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Fig. 1 Steering Linkage-6 Cylinder Engine

REMOVAL AND INSTALLATION

TIE ROD

REMOVAL

(1) Remove the cotter pins and nuts at the steering knuckle and drag link (Fig. 1) and (Fig. 2).

(2) Loosen the ball studs with a puller tool to remove the tie rod.

(3) If necessary, loosen the end clamp bolts and remove the tie rod ends from the tube.

INSTALLATION

(1) If necessary, install the tie rod ends in the tube. Position the tie rod clamp (Fig. 3) and tighten to:

- Drag Link: 49 N·m (36 ft. lbs.)
- Tie Rod-6 Cyl. Engine: 27 N·m (20 ft. lbs.)
- Tie Rod-8 Cyl. Engine: 49 N·m (36 ft. lbs.)

(2) Install the tie rod on the drag link and steering knuckle. Install the retaining nuts.

(3) Tighten the ball stud nut on the steering knuckle to 47 N·m (35 ft. lbs.). Tighten the ball stud nut to drag link to 75 N·m (55 ft. lbs.) torque. Install new cotter pins and bend end 60°.

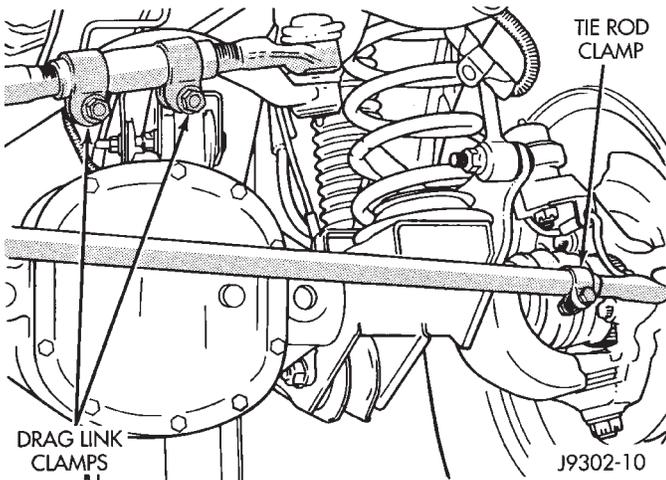


Fig. 3 Tie Rod/Drag Link Clamp Bolt

PITMAN ARM

REMOVAL

(1) Remove the cotter pin and nut from the drag link at the pitman arm.

(2) Remove the drag link ball stud from the pitman arm with a puller.

(3) Remove the nut and washer from the steering gear shaft. Mark the pitman shaft and pitman arm for installation reference. Remove the pitman arm from steering gear with Puller C-4150A (Fig. 4).

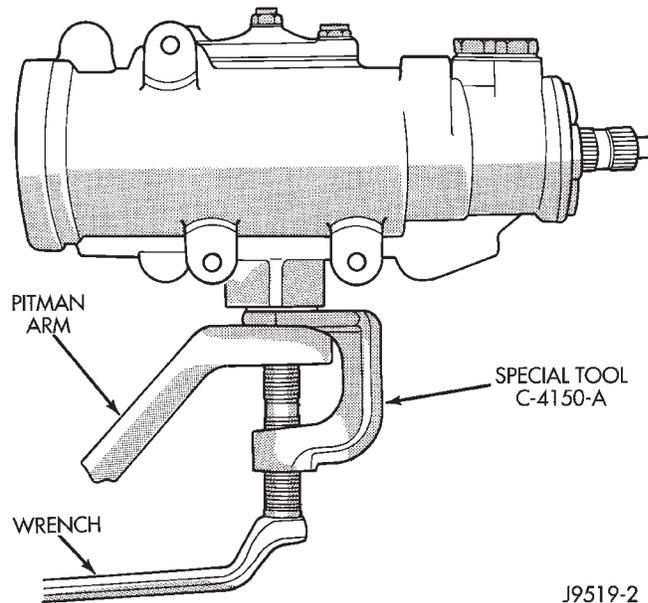


Fig. 4 Pitman Arm Removal

INSTALLATION

(1) Align and install the pitman arm on steering gear shaft.

(2) Install the washer and nut on the shaft and tighten the nut to 251 N·m (185 ft. lbs.).

(3) Install drag link ball stud to pitman arm. Install nut and tighten to 81 N·m (60 ft. lbs.). Install a new cotter pin.

DRAG LINK

REMOVAL

(1) Remove the cotter pins and nuts at the steering knuckle and drag link (Fig. 1).

(2) Remove the steering dampener ball stud from the drag link with a puller.

(3) Remove the drag link from the steering knuckle with a puller tool. Remove the same for tie rod and pitman arm.

(4) If necessary, loosen the end clamp bolts and remove the tie rod end from the link.

INSTALLATION

(1) Install the drag link adjustment sleeve and tie rod end. Position clamp bolts (Fig. 3).

(2) Position the drag link at the steering linkage. Install the drag link to the steering knuckle nut. Do the same for the tie rod and pitman arm.

(3) Tighten the nut at the steering knuckle to 47 N·m (35 ft. lbs.). Tighten the pitman nut to 81 N·m (60 ft. lbs.) and tie rod ball stud nut to 47 N·m (35 ft. lbs.). Install new cotter pins and bend end 60°.

REMOVAL AND INSTALLATION (Continued)

(4) Install the steering dampener onto the drag link and tighten the nut to 74 N·m (55 ft. lbs.). Install a new cotter pin and bend end 60°.

STEERING DAMPENER

REMOVAL

- (1) Place the front wheels in a straight ahead position.
- (2) Remove the steering dampener retaining nut and bolt from the axle bracket (Fig. 1).
- (3) Remove the cotter pin and nut from the ball stud at the drag link.
- (4) Remove the steering dampener ball stud from the drag link using C-3894-A puller.

INSTALLATION

- (1) Install the steering dampener to the axle bracket and drag link.
- (2) Install the steering dampener bolt in the axle bracket and tighten nut to 74 N·m (55 ft. lbs.).
- (3) Install the ball stud nut at the drag link and tighten nut to 74 N·m (55 ft. lbs.). Install a new cotter pin.

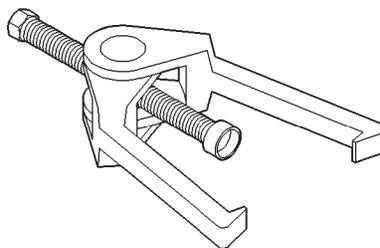
SPECIFICATIONS

TORQUE CHART

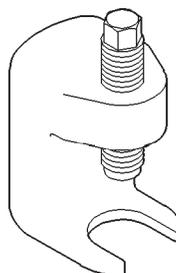
DESCRIPTION	TORQUE
Pitman Arm	
Shaft Nut . . . . .	.251 N·m (185 ft. lbs.)
Drag Link	
Pitman Arm Nut . . . . .	.81 N·m (60 ft. lbs.)
Knuckle Nut . . . . .	.47 N·m (35 ft. lbs.)
Clamp Bolts. . . . .	.49 N·m (36 ft. lbs.)
Tie Rod Ends	
4.0L Clamp Bolts. . . . .	.27 N·m (20 ft. lbs.)
5.2L Clamp Bolts. . . . .	.49 N·m (36 ft. lbs.)
Tie Rod	
Knuckle Nut . . . . .	.47 N·m (35 ft. lbs.)
Drag Link Nut . . . . .	.75 N·m (55 ft. lbs.)
Steering Damper	
Frame Bolt . . . . .	.74 N·m (55 ft. lbs.)
Drag Link Nut. . . . .	.74 N·m (55 ft. lbs.)

SPECIAL TOOLS

STEERING LINKAGE



Puller C-3894-A



Remover Pitman C-4150A