JAGUAR & TRIUMPH POWER-ASSISTED RACK & PINION

Jaguar
XJ6
Triumph
TR8

DESCRIPTION

Vehicles are equipped with a power assisted rack and pinion type steering system. The system consists of two main components: the rack and pinion steering gear and the power assist pump. The two components are connected by flexible fluid lines. The power assist pump and fluid reservoir are combined.

LUBRICANT

Type – ATF Dexron II

Intervals – Check power steering fluid every 3,000 miles.

TESTING

Control Valve & Pinion (Jaguar Only) – 1) Connect a 100 psi (7 kg/cm²) pressure gauge into pump return line, start engine and allow to idle. Pressure reading should be approximately 40 psi (2.8 kg/cm²). Turn steering gear left and right a small amount.

CAUTION – *Excessive turning of steering gear will cause gauge damage.*

2) Pressure should increase equal amounts as wheel is turned in either direction. A slight fall in pressure occurring before rise in pressure indicates a defective control valve. Stop and restart engine and check that steering does not kick to one side.

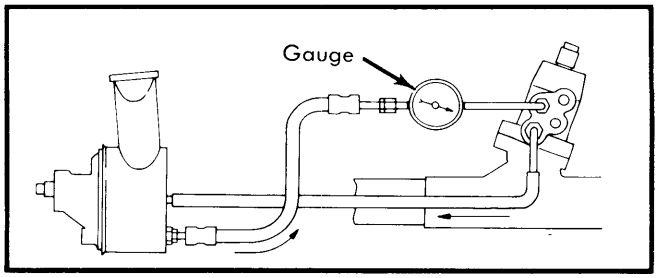

Fig. 1 Pressure Gauge Connection

Hydraulic System – 1) Connect a 1500 psi (100 kg/cm²) pressure gauge into the pump pressure line, start engine and allow to idle.

2) Turn steering to full lock and exert pressure on steering gear. On Jaguar, pressure should be 1100-1200 psi (77.5-84.4 kg/cm²) at idle. On Triumph, pressure should be a minimum of 450 psi (32 kg/cm²) at idle and 950-1000 psi (67-70 kg/cm²) at 1000 RPM.

NOTE – *On Jaguar models, if pressure is below 1100 psi (77.5 kg/cm²) at idle, but rises with engine speed increase, problem is either a defective pump control valve or internal leakage in rack and pinion.*

3) On Triumph, release steering wheel and allow to come off full lock position. Pressure reading should be a maximum of 55 psi (4 kg/cm²) at idle.

4) If system pressure readings were not to specifications, connect a shut-off valve (JD. 10-2) between pump and pressure gauge. This will isolate steering pump from steering gear and determine if problem is in gear or pump.

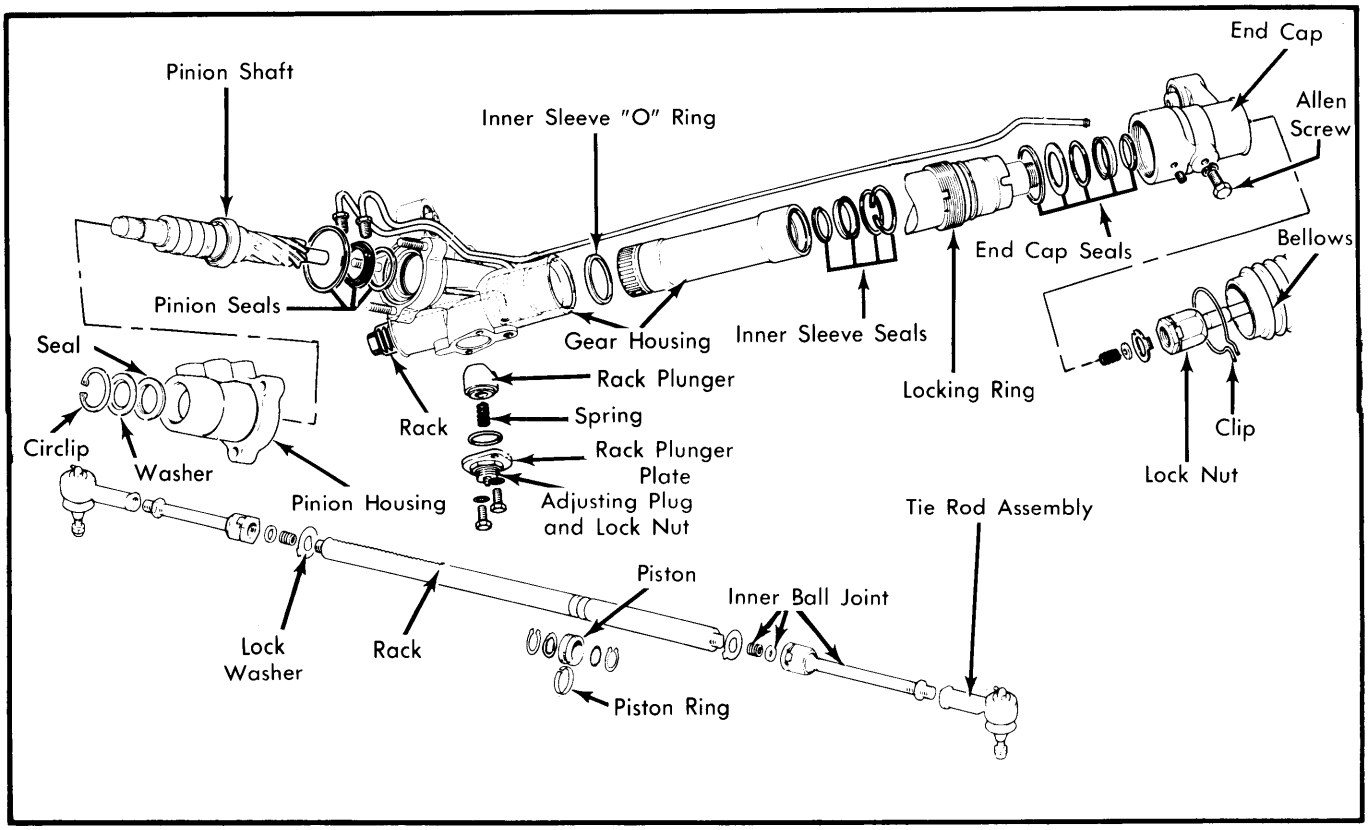

Fig. 2 Exploded View of Jaguar and Triumph Power Assisted Rack and Pinion Steering Gear

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5) With shut-off valve open, start engine and allow steering fluid to reach normal operating temperature. Close shut-off valve and repeat pressure tests.

NOTE – *Do not keep shut-off valve closed for more than 5 seconds at a time, otherwise fluid will overheat and damage to system could occur.*

6) If test pressures are now to specifications, fault is in steering gear. If test pressures are still not to specifications, fault is in pump. *Refer to OVERHAUL in this article.*

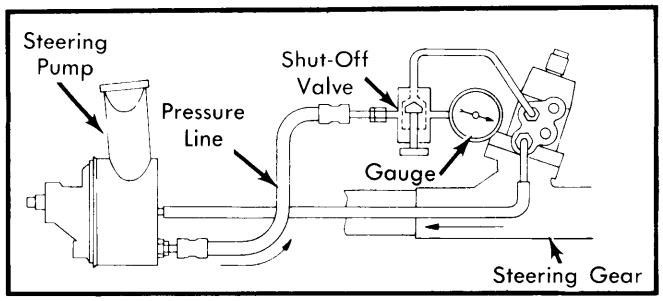

Fig. 3 Pressure Gauge and Shut-Off Valve Connections

SYSTEM BLEEDING

Turn wheels to full left lock, add fluid to "COLD" level mark on dipstick. Start engine and idle. Turn steering wheel lock to lock to expell air. Check fluid level. Straighten wheels and run engine for several minutes. Turn off engine, check fluid level. Fluid should be up to "HOT" mark on dipstick.

REMOVAL & INSTALLATION

STEERING GEAR

NOTE – *Amount and location of all washers and spacers must be noted for correct installation.*

Removal – 1) On Jaguar models, remove lower steering column. Drain fluid from pump, disconnect pressure and return lines then cap openings. Disconnect ball joints from steering knuckles. Remove rack-to-suspension bolt. Remove heat shield bracket and spacers. Remove remaining bolts from rack mounting, save washers, then remove steering gear from vehicle.

2) On Triumph models, remove fresh air duct from engine compartment. Install an engine support bracket and support engine. Remove cold air intake hoses from temperature valves. Remove bolts attaching engine mounts to sub frame. Raise vehicle so front wheels are off ground.

3) Disconnect ball joints from steering knuckles and steering shaft from gear. Remove clamp from power steering lines, then disconnect pressure and return lines from steering gear. Drain fluid and cap openings. Remove nuts and bolts attaching steering gear to sub frame.

4) Position a jack under sub frame then remove bolts attaching sub frame-to-frame and lower sub frame until rear mounting bolts just clear sub frame. Turn steering to full right lock. Move steering gear to right until left tie rod clears, then remove steering gear from vehicle.

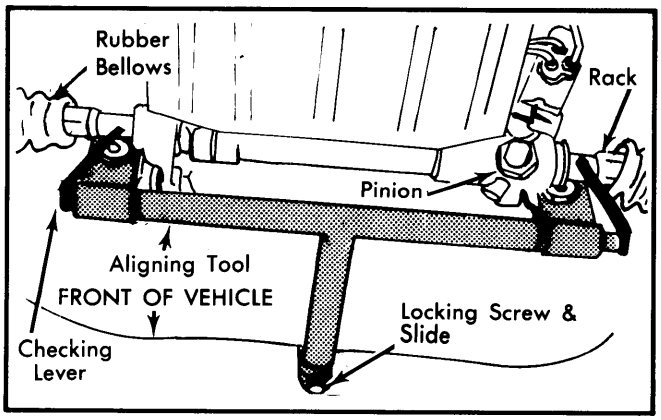

Fig. 4 Installing Rack and Pinion Gear

Installation – 1) On Triumph models, to install steering gear assembly, reverse removal procedures. On Jaguar models, position rack against mounting brackets and center lugs on bracket. Insert shims between lug and bracket to insure a gap of .05" (1.3 mm) on both sides of rack lug and mounting bracket. Insert mounting bolts but do not tighten.

2) Repeat centering procedure on upper and lower mountings on pinion side of rack. Make sure heat shield mounting bracket is located on upper mounting bolt. Remove clip securing rubber bellows to rack housing and fold bellows back to expose inner ball joints.

3) Install attachment brackets, of alignment tool JD. 36A, over large hex head bolts on lower control arms. It may be necessary to bend shields slightly to locate tool correctly. See *Fig. 4*.

4) Release locking screw and slide collar along tool to front of suspension unit until slot engages front weld flange of crossbeam. Lock slide in this position. Rotate alignment tool until legs rest on tie rods. To adjust slack, loosen lock nut of single bolt mounting and raise or lower same side of rack assembly.

5) Remove tool, fully tighten rack mounting lock nuts. Reposition bellows and secure clips. On all models, reinstall tie rods and power steering hoses. Refill and bleed system, then check wheel alignment.

POWER STEERING PUMP

Removal – 1) On Triumph models, remove left air intake hose from temperature control valve. Remove pressure and return lines from pump, then drain fluid and cap openings. Loosen pivot and adjusting nuts, push pump toward engine and take belt off pulley. Remove pump adjusting and pivot bolts, then remove pump.

2) On Jaguar models, remove air cleaner. Partially drain radiator and remove upper radiator hose. Drain fluid from steering pump, then disconnect and cap fluid lines. Loosen nut securing adjusting rod to timing cover.

3) Remove bolt securing adjuster rod to pump, swing adjuster clear of pump. Remove lower pump pivot nut. Move pump toward engine and remove belt. Remove lower pivot bolt and remove pump from vehicle.

Installation – To install power steering pump, reverse removal procedures. After replacement, adjust belt tension and bleed system.

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CONTROL VALVE AND PINION

NOTE – *No adjustment or repair is possible except the replacement of the pinion seal.*

Removal – Remove steering gear assembly. Clean rack and pinion housing. Note position of pinion housing ports-to-valve cylinder pipes for reassembly reference. Loosen rack plunger lock nut and adjusting screw to remove spring tension. Remove pinion housing bolts and remove pinion housing with pinion shaft.

Installation – To install control valve and pinion, reverse removal procedure. Make sure pinion housing ports are aligned with cylinder pipes. On Jaguar models, make sure recess on pinion shaft are in correct position with pinion housing.

OVERHAUL

RACK ASSEMBLY

Disassembly – **1)** Clean rack and pinion housing, drain assembly of fluid. Remove clips attaching bellows to tie rods and fold bellows back, exposing tie rod inner ball joint. Straighten lock tab of tie rod inner ball joint.

2) Remove tie rods from rack by loosening lock nut on inner ball joint. Note position of pinion housing-to-valve cylinder pipes, then remove pipes. Remove air transfer pipe. On Jaguar models, remove Allen screw from end cap. On all models, remove locking ring from end housing and remove end housing.

3) Remove rack plunger lock nut, adjusting nut, spring and plunger. Remove pinion housing cover, then remove pinion housing from rack housing. Remove pinion from pinion housing. Remove snap ring, washer and seal from pinion housing. Remove rack from rack housing.

4) Remove porting adapter and slide porting ring along cylinder until feed hole is exposed. Using a scribe (or similar tool) pry seal until seal can be removed from cylinder with a hooked wire. Remove all seals, "O" rings and sleeves from rack housing.

NOTE – *Do not remove seals from pinion piston.*

Inspection – Clean all parts in solvent and blow dry or air dry. Do not wipe dry as lint could contaminate parts and cause malfunction when assembled. Check all parts for excessive wear, scratches, nicks or scoring. Replace parts as necessary. Check rack teeth and pinion teeth for chips, burrs and other damage. Always replace all "O" rings and seals upon reassembly. Check rubber bellows for cracks, splits or holes, replace as necessary.

Reassembly – **1)** Lubricate all "O" rings, seals and sleeves before installation. Also lubricate all moving parts before installation. Install seal and "O" ring to end housing.

2) Install new center feed porting adapter to porting ring. Position ring to allow conical seating on adapter to engage with seating on cylinder, then tighten. Install rack seal over rack teeth up against piston. Install anti-extrusion ring to recess in back of rack seal.

3) Lubricate inside of rack housing and grease rack. Insert rack into rack housing with firm steady pressure until seal seats against abutment face. Make sure piston ring collapses and enters rack housing without damage.

4) Install new seal, washer and snap ring to pinion housing. Install new pinion valve seal to pinion shaft (located against pinion bearing). Lubricate pinion shaft, piston seals and bearing. Carefully install pinion shaft to pinion housing, tapping gear end of shaft lightly to make sure it is seated.

5) Grease pinion teeth and small journal of pinion then install pinion and housing (use new gasket) to rack housing. Make sure rack teeth and pinion teeth mate correctly. Make sure pinion housing ports are correctly aligned so cylinder-to-valve pipes can be installed.

6) Install seals to end housing. Install end housing-to-rack housing and screw locking ring into end housing just enough to hold mounting feet in parallel alignment. With end housing and mounting feet in alignment, tighten locking ring.

7) Install rack plunger, spring, adjusting plug and lock nut. Tighten adjusting plug, while moving rack through full stroke, until rack is hard to move then back off adjusting nut just enough to obtain a smooth rack movement (approximately $\frac{1}{8}$ turn). Tighten lock nut while holding adjusting plug from turning.

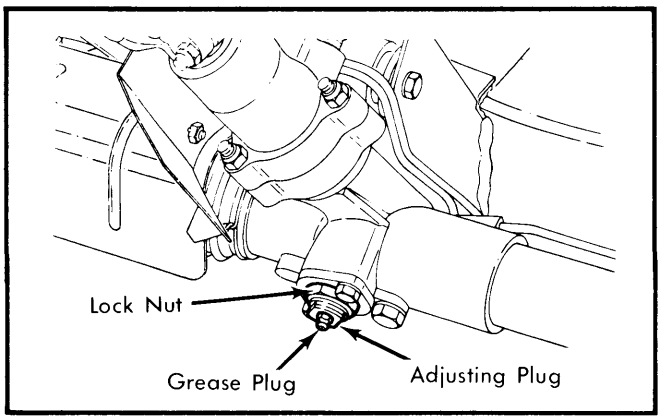

Fig. 5 Rack End Play Adjustment

8) Install air transfer pipe and cylinder-to-valve pipes. Place bellows onto tie rods, small opening towards outer ball joint. Install tie rod inner ball joint to rack. Make sure lock washer tab is aligned with slot in rack end. Pull rack out until rack teeth can be held in soft jawed vise, then tighten tie rod inner ball joint lock nut. Repeat procedure for other tie rod. Bend lockwasher tab into rack slots with punch.

9) Place 1 to 2 oz. of grease to each bellows then attach bellows to rack housing and tie rod with wire clips. Remove plug in rack plunger adjusting plug and install grease nipple. Using a hand grease gun, fill with approximately 5 strokes of grease gun. Remove grease nipple and replace plug.

POWER STEERING PUMP

Disassembly – **1)** Remove rear mounting plate and pulley from pump. Remove front mounting plate from pump and clean pump body. Remove pressure outlet union and mounting plate studs from rear of pump. Tip pump and remove flow control valve and spring.

2) Place pump in padded vise and tap pump casing from body. Remove "O" rings from pump body and magnet from flange. With suitable pin punch, push retaining ring free from groove and lever from body. Remove spring retaining plate and spring. Remove "O" ring from recess in pump body.

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3) Remove Woodruff key from shaft. Tap roller spindle toward body and remove pump assembly from body. Remove "O" ring from recess in pump body. Remove dowel pins.

4) Remove rotor housing top plate and rotor housing. Remove rotor vanes and circlip securing rotor to drive shaft. Remove drive shaft oil seal from pump body.

Cleaning and Inspection – Clean all parts with lint-free cloth. Replace all "O" rings and seals. Check all parts for scratches, nicks, burrs or excessive wear. Replace rotor ring and vanes if excessive wear or chatter marks are present. Check flow control valve for free movement in bore. Lubricate all parts with power steering fluid before reassembly. Check interference fit between pump shaft and pulley. Replace parts if interference fit is less than .001" (.025 mm) or more than .0026" (.066 mm).

Reassembly – **1)** Lubricate drive shaft seal and fit into pump shaft housing. Fit "O" ring to lower recess in pump body. Place dowel pins in locating holes. With cutaway face uppermost, fit bottom plate to drive shaft.

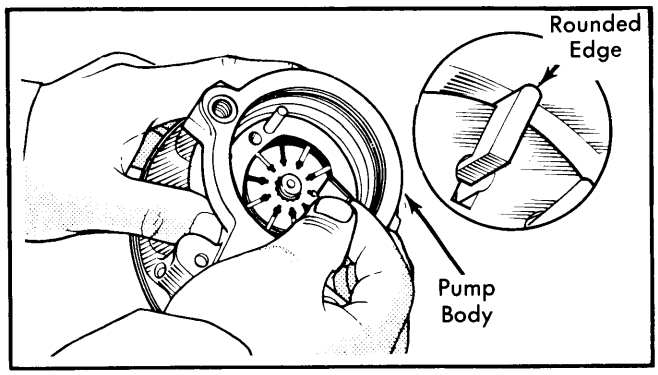

Fig. 6 Placing Vanes in Rotor Plate

2) Fit rotor over splines of drive shaft (countersunk face towards thrust plate) and secure with snap ring. Insert vanes in rotor with curved edge out. Fit drive shaft and rotor to pump body, ensuring that dowel pins locate through smallest holes of bottom plate. With arrow towards rear of housing, place pump ring chamber over rotor and dowel pins.

3) With spring recess up, fit chamber top plate over dowel pins. Push complete pump assembly home. Fit "O" ring into upper recess of pump body. Fit spring to recess in top plate. Place retaining plate over spring and push into body. Fit "O" rings to port recess, and large "O" ring to outside pump body and magnet to flange.

4) Place pump casing over body. Locate mounting studs into outer casing and into pump body. Place outer casing over pump body. Tighten mounting studs. Install spring and flow control valve. Fit pressure outlet union. Place Woodruff key in drive shaft spindle. Replace pulley and mounting plates. Refill system with fluid and bleed system.

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (mkg)
Center Feed Porting Adapter Ring	22-25 (3.0-3.5)
Pump High Pressure Fitting	25-40 (3.5-5.5)
Rack Housing End Plate Lock Ring	80-90 (11.1-12.4)
Rack Housing Mounting Bolts	
Jaguar	49-55 (6.8-7.6)
Triumph	30 (4.1)
Tie Rod Inner Ball Joint Lock Nut	
Jaguar	45-55 (6.2-7.6)
Triumph	66-81 (9.1-11.2)

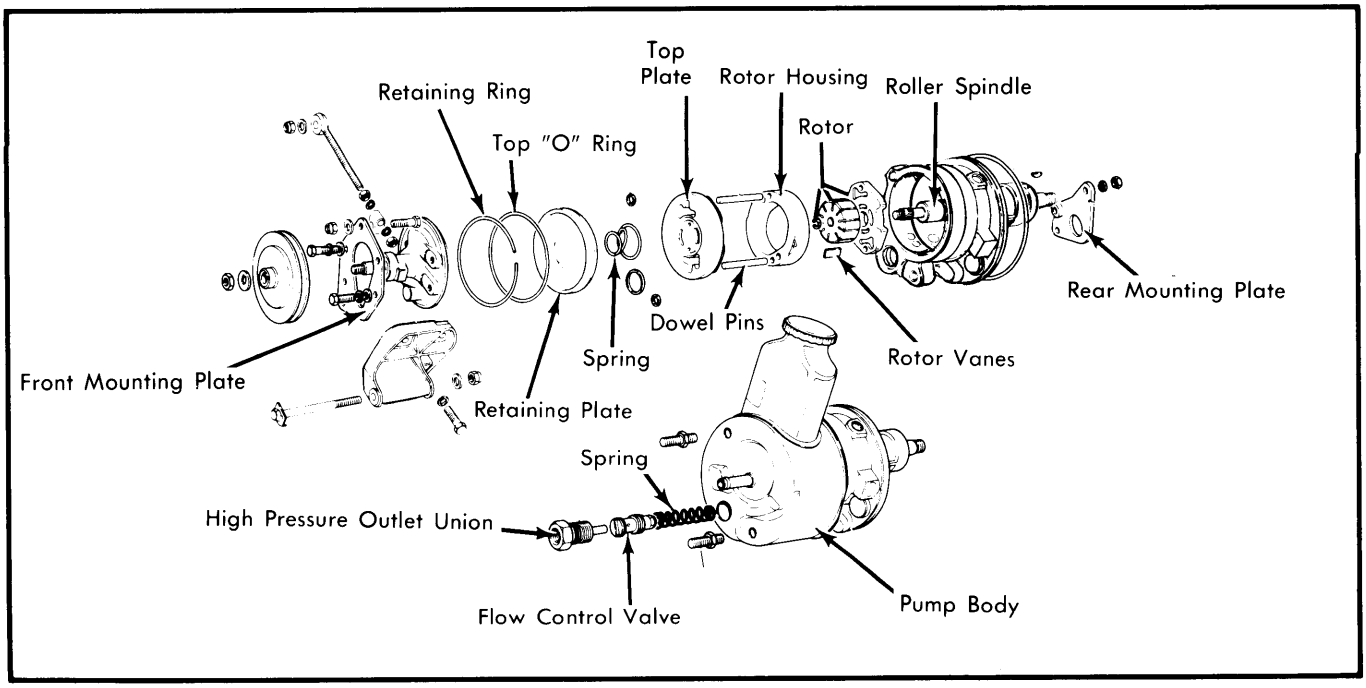

Fig. 7 Exploded View of Jaguar and Triumph Power Steering Pump