TOYOTA POWER-ASSISTED RECIRCULATING BALL

Celica
Corolla
Corona
Cressida
Land Cruiser
Pickup
Supra

DESCRIPTION

POWER STEERING PUMP

The power steering pump is a vane type composed of an engine driven eccentric rotor, a fixed ring (having six slotted grooves), and a flow control valve (to regulate maximum oil pressure and amount of oil flow). Slippers are fitted in each slotted groove and are pressed against rotor outside surface by pressure produced in adjoining slots and by spring tension. As rotor rotation increases or decreases, then space between the rotor and fixed ring changes accordingly, in order to control oil flow.

POWER STEERING GEAR

Power steering gear consists of a mechanism which converts steering wheel torque to cross shaft torque by means of worm and power piston nut, and of a mechanism which detects hydraulic pressure developed by vane pump and controls this pressure in proportion to the steering effort.

LUBRICATION

HYDRAULIC SYSTEM LUBRICANT

Capacity
Pickup 4-WD — 1.8 pts.
All Other Models — 1.7 pts.

Type — ATF Dexron

ADJUSTMENT

BELT TENSION ADJUSTMENT

With 22 lbs. (10 kg) pressure applied, belt deflection between idler pulley and pump pulley should be .28-.35" (7-9 mm) on Corona and .43-.55" (11-14 mm) on Land Cruiser. On all other models, use belt tension gauge and adjust belt tension to 100-150 lbs. (45-68 kg) for new belt or to 60-100 lbs. (27-45 kg) for used belt.

SYSTEM BLEEDING

1) Jack up front of vehicle and support with safety stands. Fill fluid to proper level in vane pump reservoir (turn wheels fully in both directions and recheck fluid level).

2) Start engine and let idle. Turn steering from lock to lock 2 or 3 times. Lower vehicle. Run engine at 1000 RPM or less. Turn wheel from lock to lock 2 or 3 times. Center steering wheel. If fluid level does not rise and no foaming of fluid is evident, bleeding is complete. If level rises, or foaming is evident, repeat procedure until air is released.

FLUID REPLACEMENT

Raise and support front of vehicle. Disconnect return hose and drain fluid into container. Turn steering wheel from lock to lock while draining. Connect return hose, add fresh fluid and bleed system.

HYDRAULIC PRESSURE TESTING

1) Disconnect pressure lines from steering gear case and vane pump. Attach pressure gauge with gauge side connected to vane pump. Attach valve side of gauge to pressure line. Bleed air from system and check fluid level.

2) With engine at idle, check fluid pressure reading with pressure gauge valve closed. Correct pressure should be 882 psi (62 kg/cm^2) for 4WD Pickup, 1024 psi (72 kg/cm^2) for all other models.

NOTE — *Do not keep pressure gauge valve closed for more than 10 seconds. Fluid testing temperature should be 176°F (80°C).*

3) Check pressure with steering wheel at lock position and pressure valve open. Pressure should be 882 psi (62 kg/cm^2) for 4WD Pickup, 1024 psi (72 kg/cm^2) for all other models. Measure pressure with engine at idle and again at 3000 RPM. Pressure difference should be less than 71 psi (5 kg/cm^2). If more, check flow control valve.

4) With vehicle on flat surface, turn steering wheel to center position. With engine idling, measure steering turning force at steering wheel outer rim over a full rotation on both sides of center point. Turning force should not exceed 7.7 lbs. (3.5 kg) on Pickup, 13.2 lbs. (6.0 kg) on Land Cruiser or 8.8 lbs. (4.0 kg) on all other models.

REMOVAL & INSTALLATION

POWER STEERING PUMP

Removal — Loosen pulley mounting nut before removing drive belt. Disconnect and plug pressure line at pump housing. Disconnect and plug return line at pump housing on Celica, Supra, Corona and Pickup or at reservoir on Corolla, Cressida and Land Cruiser. Remove pump mounting bolts, then remove pump.

NOTE — *Keep disconnected hoses elevated to prevent fluid from draining out.*

Installation — To install, reverse removal procedure and note: Adjust drive belt tension and bleed system.

POWER STEERING GEAR

Removal — Disconnect and plug pressure and return lines at gear housing. Mark steering gear shaft to flexible coupling or universal joint, then disconnect flexible coupling or universal joint. Mark pitman arm to sector shaft, then disconnect pitman arm. Disconnect steering gear housing from heat shield on Land Cruiser. Remove steering gear mounting bolts, then remove steering gear.

Installation — To install, reverse removal procedure and note: Align all marks during installation. Bleed system and perform pressure test.

TOYOTA POWER-ASSISTED RECIRCULATING BALL (Cont.)

OVERHAUL

POWER STEERING PUMP

Disassembly – **1)** Mount power steering pump in vise. Remove union from rear housing. Remove reservoir from pump (if equipped). Index mark front and rear housings for reassembly reference. Remove front housing bolts.

2) Tap off front housing with plastic hammer. Be careful that vane plates, rotor and cam plate do not fall out. Remove ring cam, rotor and vane plates. Clamp front housing in a vise. Using chisel, pry off oil seal. Remove snap ring.

3) With plastic hammer, lightly tap the rotor shaft out of front housing and tap bottom of rear housing. Remove rear plate and spring. Temporarily install a bolt to plug. Push bolt and remove snap ring. Pull out bolt and remove plug. Remove spring and control valve by hand.

Inspection – **1)** Check all parts for wear or damage and replace as necessary. Check oil clearance between bushing and rotor shaft. Maximum clearance is .0028" (.07 mm). Check that bearings operate smoothly. If necessary, press out old bearing and press in new bearing. Measure difference between cam ring and rotor. Maximum difference should be .0024" (.06 mm).

2) Vane plate dimensions should be .589 x .307 x .067" (14.97 x 7.80 x 1.70 mm). Maximum clearance between vane plate and rotor groove is .0024" (.06 mm). Check flow control valve for leakage with compressed air. Control valve spring should be 1.85-1.97" (47-50 mm) long.

Reassembly – **1)** Lubricate flow control valve and spring with automatic transmission fluid (ATF). Install control valve, spring, plug and snap ring to pump. Lubricate rotor shaft with ATF. Install to front housing by tapping with plastic hammer.

2) Install snap ring to front housing. Apply multipurpose grease to oil seal lip. Using a driver and hammer, install oil seal. Lubricate and install "O" ring to front housing. Align fluid passages of ring cam and front housing and install ring cam.

3) Lubricate rotor with ATF. Install rotor with cut spline facing toward front housing. Make sure letters on ring cam and rotor match. Lubricate vane plates with ATF. Install vane plates with round end facing outward. Lubricate and install 2 "O" rings to rear plate.

4) Place rear plate on the ring cam with pin holes aligned with pins. Place spring on the rear plate. Align marks on front and rear housings and install. Half tighten front and rear housing mounting bolts. Clamp rear housing in vise. Tighten housing bolts evenly 3 or 4 times.

5) Lubricate and install "O" ring to union. Insert and tighten union. Check to ensure rotor shaft operates smoothly. Install pulley nut and check rotating torque. Torque should be less than 239 INCH lbs. (27 N·m).

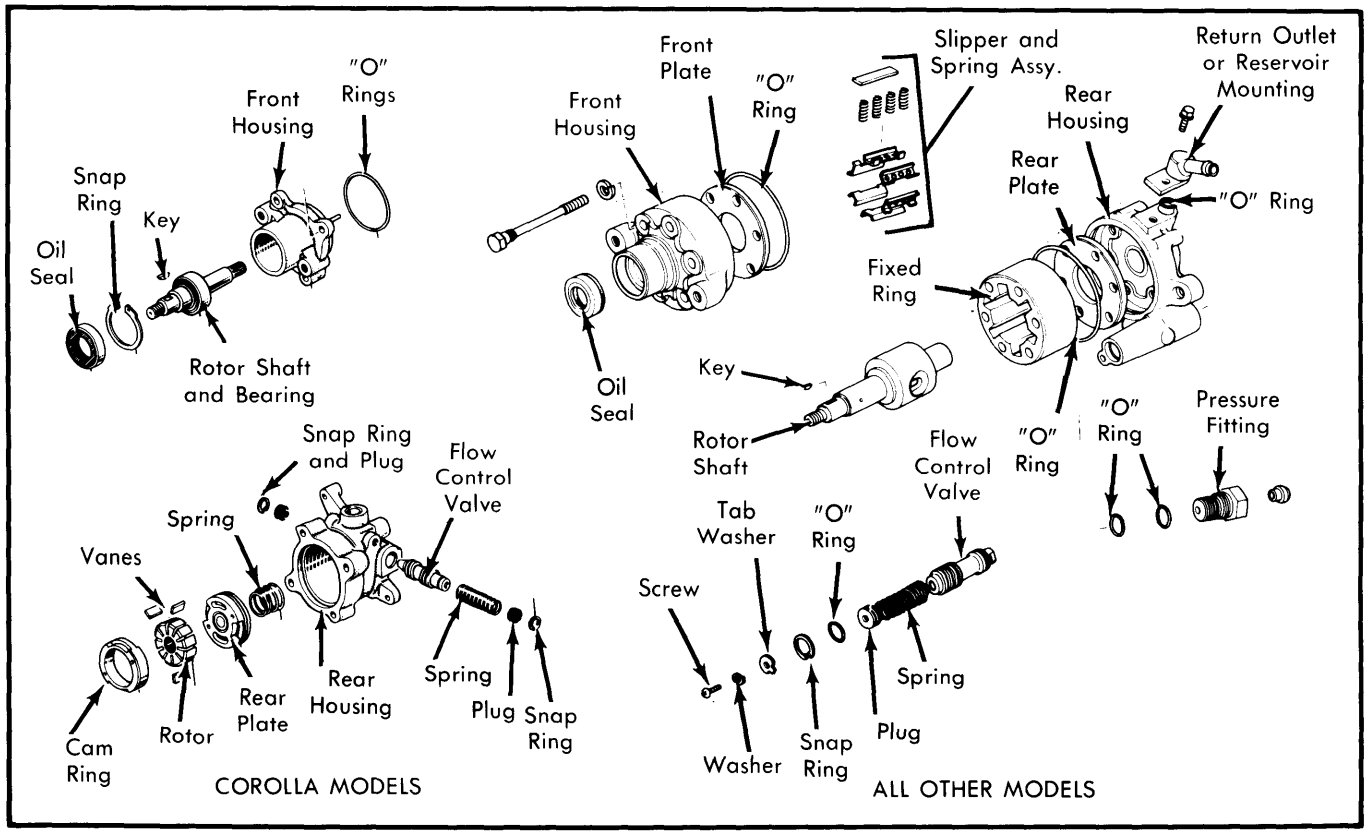

Fig. 1 Exploded View of Toyota Power Steering Pump Assemblies

TOYOTA POWER-ASSISTED RECIRCULATING BALL (Cont.)

POWER STEERING GEAR

Disassembly – 1) Attach gear housing to holding tool and mount in a vise. Remove sector shaft adjusting screw lock nut and sector shaft cover bolts. Turn sector shaft adjusting screw clockwise until cover is removed. Remove sector shaft by tapping bottom end with mallet.

2) Remove valve housing-to-gear housing bolts. Hold power piston nut with hand and turn worm shaft clockwise (counterclockwise on Celica). Remove valve assembly and power piston from gear housing.

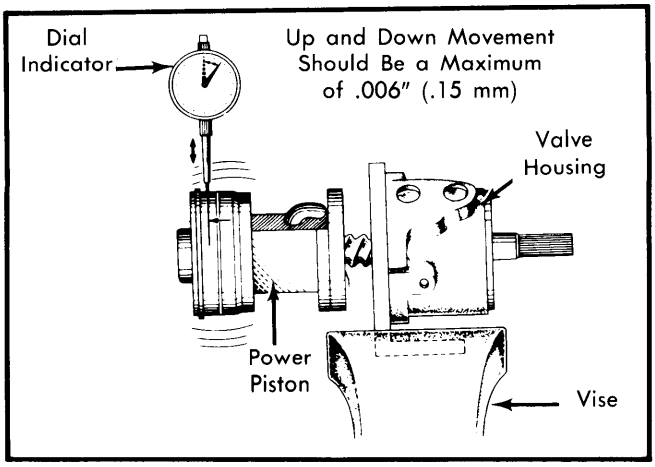

Fig. 2 Using Gauge to Check Ball Clearance

CAUTION – *Ensure that power piston nut does not come off worm shaft. Do not disassemble valve body or remove power piston from worm shaft.*

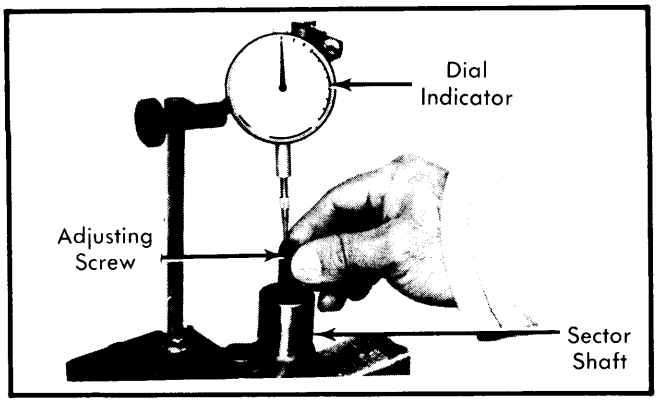

Fig. 3 Using Dial Indicator to Check Sector Shaft Thrust Clearance

3) Install valve assembly in vise. Using a dial indicator measure ball clearance. If clearance exceeds .006" (.15 mm) replace valve assembly.

4) Install sector shaft in a vise. Using dial indicator, check sector shaft adjusting screw for thrust clearance of .001-.002" (.03-.05 mm). To adjust thrust clearance, remove stake on adjusting nut. Turn adjusting nut to obtain correct thrust clearance, then stake out.

5) Temporarily install valve assembly in gear housing and install mounting bolts. Using lock nut tool, remove lock nut and adjusting bolt from gear assembly. Remove and replace as needed, oil seal, "O" ring, and bearing assembly. Install lock nut and tighten. Remove valve assembly from gear housing.

Cleaning & Inspection – 1) Clean and dry all parts in solvent. Coat all sliding parts, "O" rings and teflon rings with power steering fluid upon reassembly.

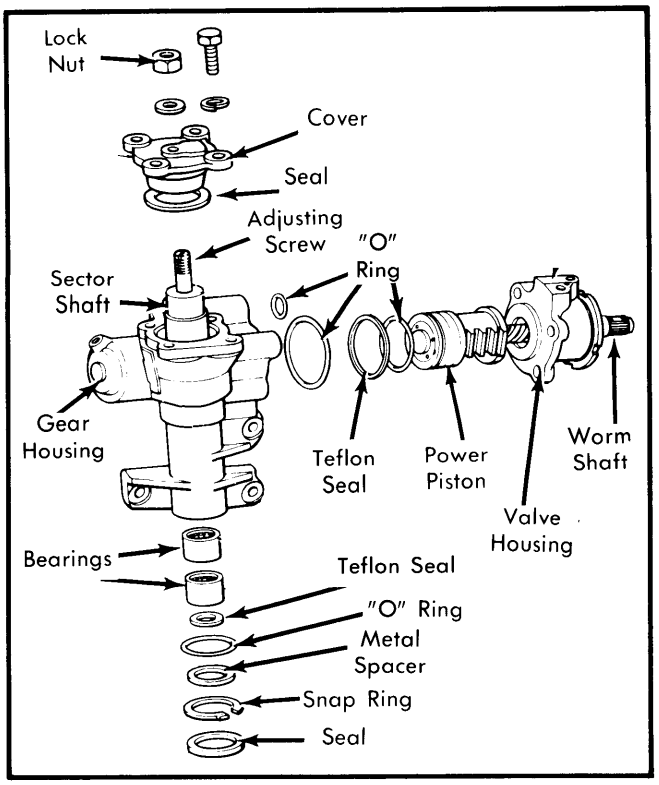

Fig. 4 Exploded View of Toyota Power Steering Gear Assembly

2) Inspect sector shaft for peeling or pitting at ball rolling surface. Check power piston nut mesh with sector shaft. Look for damaged tooth surfaces or ball rolling surfaces.

3) Gear housing bearings must be replaced if bearing rollers are pitted or peeled. Also replace housing bearings if it was noticed that sector shaft bearing surfaces had been scored or pitted.

4) Remove teflon ring and "O" ring from gear housing. Using needle bearing removing tool, remove needle bearings.

Reassembly – 1) Install needle bearings with longer edge of outer race facing outwards. Make sure that top end aligns with housing end surface. Install lower bearing so it is positioned .93" (23.6 mm) away from housing inner end surface on Land Cruiser, or .76" (19.4 mm) on all other models.

2) Install "O" ring and Teflon ring to power piston. Install large and small "O" rings to gear housing, then install power piston assembly to gear housing. Tighten bolts.

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3) To adjust worm shaft preload, loosen lock nut and install adjusting wrench to adjusting plug. Install torque wrench to wormshaft and tighten adjusting plug to obtain specified preload. See table. Hold adjusting plug and tighten lock nut.

4) Wrap a piece of tape around spline area of sector shaft. Align sector shaft gear teeth with power piston teeth (centered) and insert sector shaft into gear housing. Do not turn sector shaft during installation, as damage to "O" ring could result.

5) Install sector shaft cover, with seal, to sector shaft adjusting screw. Turn screw counterclockwise until cover will fit completely down on gear housing. Install bolts and tighten. To adjust total preload of steering gear, place steering gear in center postion and attach torque wrench to worm shaft.

Worm Bearing Preload

Application	INCH lbs. (N·m)
Celica & Supra	2.6-3.5 (.3-.4)
All Other Models	3.5-5.6 (.4-.6)

6) Turn sector shaft adjusting screw until correct total preload is obtained. Total steering gear preload should be worm bearing preload plus 4.3-5.2 INCH lbs. (.5-.6 N·m) for Celica and Supra, 2.6-3.5 INCH lbs. (.3-.4 N·m) for Corona, and 1.7-2.6 INCH lbs. (.2-.3 N·m) for all other models. Install sector shaft adjusting lock nut and tighten.

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (N·m)
Pump Housing Bolts	
Corolla	30-40 (41-54)
All Other Models	24-30 (33-41)
Sector Shaft Adjusting Screw Lock Nut	
Celica & Supra	94-123 (128-168)
All Other Models	33-39 (45-53)
Sector Shaft Cover Bolts	30-40 (41-54)
Sector Shaft-to-Pitman Arm Nut	
Land Cruiser	120-141 (163-192)
2WD Pickup	80-90 (109-122)
4WD Pickup	116-137 (158-186)
All Other Models	80-101 (109-137)
Worm Gear Adjusting Plug Lock Nut	
Celica & Supra	14-22 (19-30)
All Other Models	33-39 (45-53)