

## TOYOTA POWER-ASSISTED RECIRCULATING BALL

Celica  
Corolla  
Corona  
Cressida

Supra  
Land Cruiser  
4-WD Pickup

### 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.

## GENERAL SERVICE

### HYDRAULIC SYSTEM LUBRICANT

#### Capacity

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

Type — ATF Dexron

### BELT TENSION ADJUSTMENT

With 22 lbs. (10 kg) pressure applied, belt deflection between idler pulley and pump pulley (crank pulley and pump pulley on Cressida) should be as follows: Corona, .28-.35" (7-9 mm); Cressida, .71-.85" (18-21.5 mm); Land Cruiser, .43-.55 (11-14 mm). On all other models, use a 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<sup>2</sup>) on Pickup and 1024 psi (72 kg/cm<sup>2</sup>) on 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) Open pressure valve. With steering wheel at full lock position, check system pressure. Correct pressure is 882 psi (62 kg/cm<sup>2</sup>) on Pickup and 1024 psi (72 kg/cm<sup>2</sup>) on 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<sup>2</sup>) on all models. If pressure difference is 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) Attach pump to suitable holding tool and mount in vise. On Corolla, Cressida and Land Cruiser models, remove bolts attaching reservoir to housing and remove reservoir. Be careful not to lose sealing "O" ring located in pump housing. Remove pulley if not already removed.

2) Mark front and rear housings for reassembly reference. Remove front housing bolts and tap front housing off. On Corolla models, remove rotor, cam ring and rotor shaft with front cover. On all other models, make sure rotor shaft remains with rear housing.

3) On Corolla models, tap plate and spring out of rear housing. Remove snap ring, seal, spring and flow control valve from rear housing. From other side of rear housing, remove other snap ring and seal of flow control valve. On front housing, remove cam ring, rotor and vanes. Remove snap ring and then tap rotor shaft out of front housing.

4) On all other models, pull rotor shaft from rear housing while holding slipper assemblies in (to prevent slippers from flying out). Tap rear housing off of fixed ring. Remove flow control valve screw, tab washer and snap ring. Reinsert screw into plug and pull plug, spring and flow control valve out.

**Inspection** - 1) On Corolla models, check rotor shaft bearing and replace if necessary. Check rotor shaft and housing bushing diameters. Clearance should be .0004-.0028" (.01-.07

mm). On all other models, place rotor shaft in vise with front housing installed. Mount dial indicator so plunger is against housing; then move housing side-to-side and measure bushing clearance. Turn rotor shaft around and install rear housing to measure bushing clearance. Both clearances should be .0004-.001" (.01-.03 mm).

2) On all models except Corolla, measure overall length of rotor (between end faces) and overall length of fixed ring. If overall length of rotor is more than fixed ring, replace with new rotor shaft sub-assembly.

3) On Corolla models, check rotor, cam ring and rear plate for wear or scratches. Measure vanes for minimum value of following specifications: Length, .589" (14.97 mm); height, .307" (7.8 mm); width, .067" (1.7 mm). Check clearance between rotor and vane. Should be maximum of .0026" (.06 mm). If any measurement is not to specifications, replace components as necessary.

4) On all other models, inspect slipper for wear: Measure length and thickness. If thickness is less than .055" (1.4 mm) or if length is less than 1.572" (39.92 mm), replace entire set. Check free length of slipper spring. If length is less than .51" (13 mm), replace springs.

5) On all models, use special tool (SST 09630-30030) to test flow control valve for leaks. With valve installed inside of tool, apply 58-73 psi (4.1-5.1 kg/cm<sup>2</sup>). Place a small amount of oil in top of tool and watch for air bubbles. If air bubbles appear, replace flow control valve. Measure flow control valve spring for free length of 1.9-2.0" (47-50 mm). Replace if necessary.

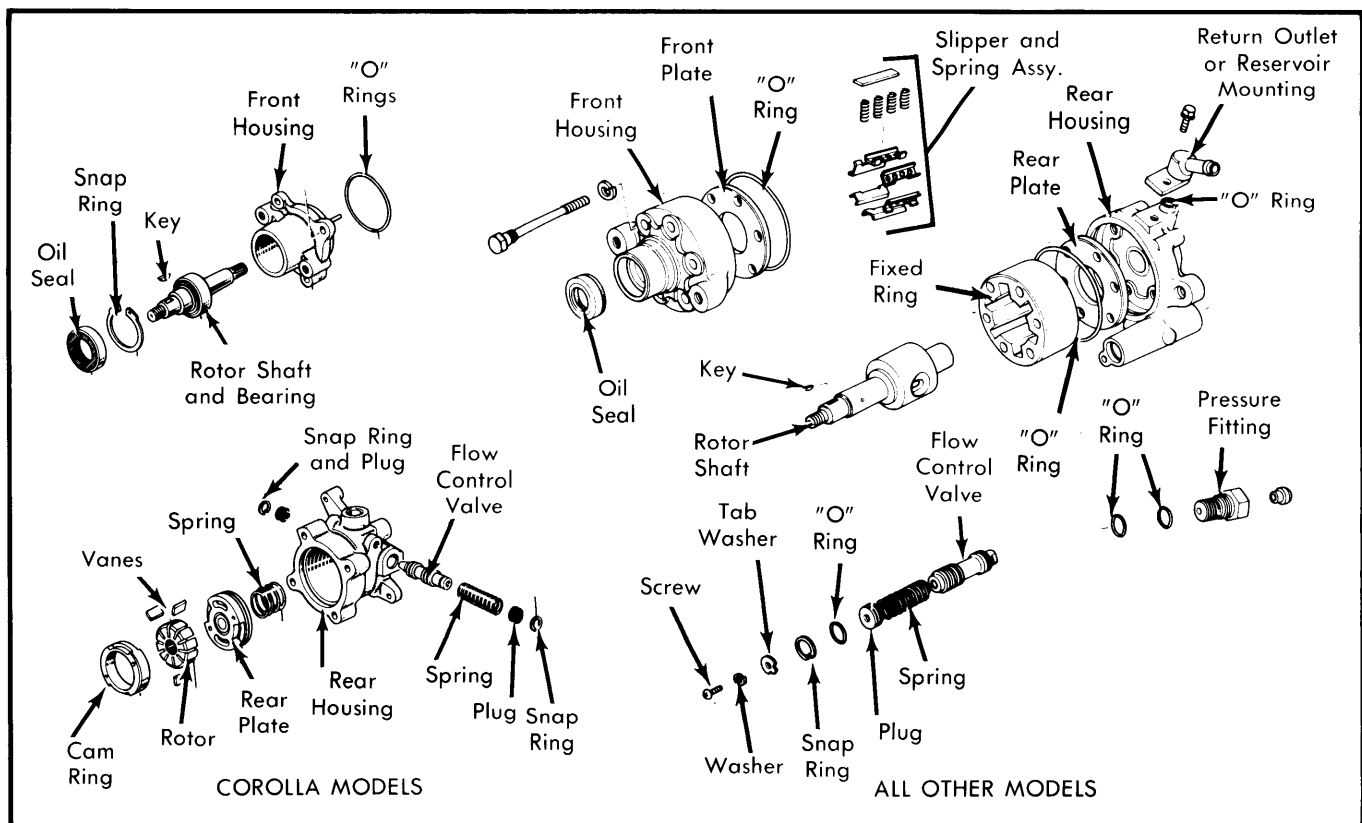


Fig. 1 Exploded View of Toyota Power Steering Pump Assembly

## TOYOTA POWER-ASSISTED RECIRCULATING BALL (Cont.)

**Reassembly – 1)** Coat all moving parts with power steering fluid. Install flow control valve assembly in reverse order of disassembly. If flow control valve was replaced, make sure mark on flow control valve matches mark on pump housing.

**2)** On Corolla models, install rotor shaft and snap ring to front housing. Install cam ring and rotor (with chamfered side of hub facing front housing). Install rotor vanes with rounded edge facing out. Install rear plate and spring to cam ring, then install rear housing to front housing.

**3)** Install 2 housing bolts to hold housings in place; then install reservoir to rear housing. Install rest of housing bolts and tighten.

**4)** On all other models, install rear plate (with large beveled side facing rear housing) to rear housing. Install fixed ring to rear housing, using 2 bolts as guides. Install rotor shaft to rear housing. Make sure code marks on rotor shaft, fixed ring and slipper assemblies match. Install slipper assemblies to fixed ring and rotor shaft.

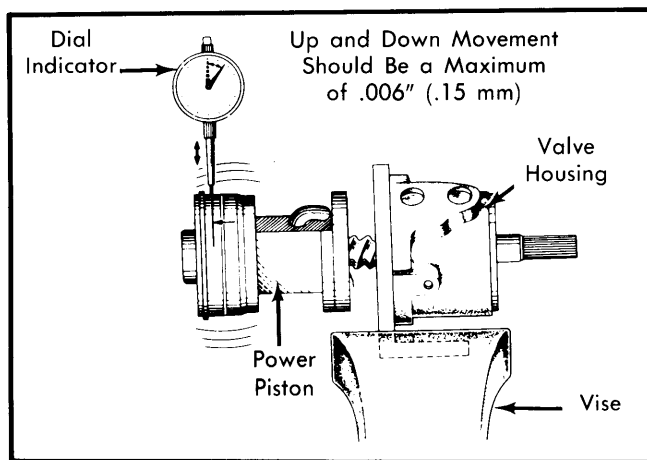
**5)** Install front plate (with large beveled side facing front housing). Install front housing to rear housing. On models with separate reservoir, install return fitting. On models with integral mounted reservoir, install reservoir to pump. Install housing bolts and tighten.

**6)** On all models, temporarily install pulley. Using a spring gauge, measure turning force of pump. Corolla turning force should be less than 1.1 lbs. (.5 kg). All other models should be less than 6.2 lbs. (2.8 kg).

## POWER STEERING GEAR

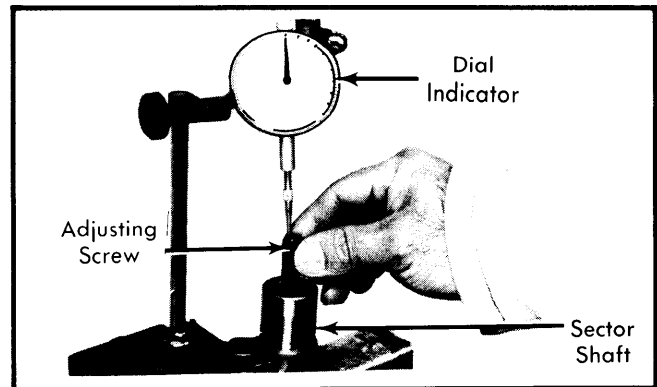
**Disassembly – 1)** Attach gear housing to holding tool and mount in a vise. Remove sector shaft adjusting screw lock nut and sector shaft cover bolts. Turn sector shaft adjusting screw clockwise until cover is removed. Remove sector shaft by tapping bottom end with mallet.

**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.



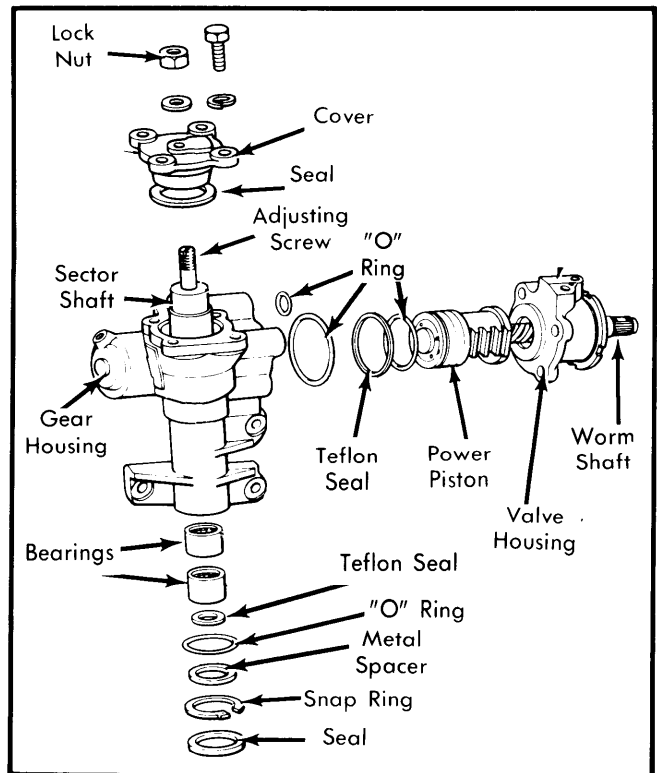
**Fig. 3 Using Dial Indicator to Check Sector Shaft Thrust Clearance**

**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**

## TOYOTA POWER-ASSISTED RECIRCULATING BALL (Cont.)

**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 and make sure bearing top end aligns with housing end surface. Install lower bearing so that it is positioned .93" (23.6 mm) on Land Cruiser and Pickup models, or .76" (19.4 mm) on all other models, away from housing inner end surface.

**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.

**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 until preload is 3.5-5.6 INCH lbs. (4.0-6.5 cmkg) on all models. 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 position and attach torque wrench to worm shaft.

**6)** Turn sector shaft adjusting screw until correct total preload is obtained. Total steering gear preload should be 6.1-9.1 INCH lbs. (7.0-10.5 cmkg) for Corona and Cressida models or 5.2-8.2 INCH lbs. (6.0-9.5 cmkg) for all other models. Install sector shaft adjusting lock nut and tighten.

### TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (mkg)
Pump Housing Bolts	
Corolla .....	30-40 (4.1-5.5)
All Other Models .....	24-30 (3.3-4.1)
Sector Shaft Adjusting Screw Lock Nut ....	30-40 (4.1-5.5)
Sector Shaft Cover Bolts .....	30-40 (4.1-5.5)
Sector Shaft-to-Pitman Arm Nut	
Pickup, Land Cruiser .....	116-137 (16.0-19.0)
All Other Models .....	80-101 (11.0-14.0)
Worm Gear Adjusting Plug Lock Nut .....	33-40 (4.5-5.5)