

STEERING SYSTEM - POWER RACK & PINION

1993 Toyota Celica

1993 STEERING
Toyota - Power Rack & Pinion
Celica

DESCRIPTION & OPERATION

System consists of a rack and pinion assembly, hydraulic pump, and hoses. On some vehicles, an air control valve increases idle speed when power steering pump is under load.

LUBRICATION

FLUID TYPE

Use Dexron-II fluid.

FLUID LEVEL CHECK

When fluid is at normal operating temperature, fluid level should be between HOT marks on fluid reservoir or dipstick. When fluid is cold, fluid level should be between COLD marks on fluid reservoir or dipstick. Add Dexron-II fluid if necessary.

HYDRAULIC SYSTEM BLEEDING

1) With engine off, check fluid level in power steering pump reservoir. See FLUID LEVEL CHECK. Raise and support vehicle. Turn wheels fully in both directions. Recheck fluid level. Start and run engine at 1000 RPM or less. Rotate steering from lock to lock 2 or 3 times. Lower vehicle.

2) Rotate 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 fluid level rises more than 0.20" (5.0 mm) or foaming is evident, repeat procedure until air is released.

ADJUSTMENTS

POWER STEERING PUMP BELT

Using belt tension gauge, measure belt tension. See BELT TENSION SPECIFICATIONS table.

BELT TENSION SPECIFICATIONS TABLE

Application	Lbs. (kg)
New	100-150 (45-68)
Used (1)	60-100 (27-45)

(1) - Belt is used if it has been in operation longer than 5 minutes.

TESTING

AIR CONTROL VALVE

Start engine. Turn A/C off. Rotate steering wheel right and left. Engine RPM should not decrease more than 50 RPM. Pinch air hose shut. Rotate steering wheel right and left. Engine RPM should decrease about 200 RPM. If system fails any of these tests, check vacuum hoses and air control valve.

HYDRAULIC SYSTEM PRESSURE TEST

Pressure Test

1) Disconnect pressure line at line joint. Connect pressure gauge according to manufacturer's instructions. Bleed air from system. Check fluid level. With engine at idle, close valve for 2-3 seconds. Note fluid pressure. See HYDRAULIC PRESSURE table.

HYDRAULIC PRESSURE TABLE

Application	psi (kg/cm ²)
1.6L	970 (70)
2.0L	1140 (80)
2.2L	1070 (75)

NOTE: DO NOT keep pressure gauge valve closed longer than 10 seconds. Fluid testing temperature should be 176°F (80°C) or warmer.

2) Open valve fully. Note pressure with engine at idle and at 3000 RPM. Pressure difference should be less than 71 psi (5 kg/cm²). If difference is greater than specified, check flow control valve. If flow control valve is okay, repair or replace pump.

3) With steering wheel at lock position and pressure valve open, again measure pressure. See HYDRAULIC PRESSURE table. If pressure is less than specified, steering gear has an internal leak. Repair or replace steering gear.

STEERING WHEEL TURNING FORCE

1) Attach spring scale to steering wheel, as close to rim as possible. Steering effort should not exceed value specified in table. See STEERING EFFORT SPECIFICATIONS table. Repair or replace power steering unit if turning force exceeds specification.

STEERING EFFORT SPECIFICATIONS TABLE

Application	Lbs. (Kg)
Celica	8.8 (4)

REMOVAL & INSTALLATION

POWER STEERING PUMP

Removal (1.6L)

1) Raise and support front of vehicle. Remove right front wheel. Remove right fender apron. Remove air control valve vacuum hose. Remove drive belt.

2) Remove pressure and return lines. Plug and elevate lines

to prevent fluid loss. Remove pulley nut. Remove pump bolts and pump.

Removal (2.0L & 2.2L)

Raise and support front of vehicle. Remove engine undercover and lower crossmember. Remove and plug pressure and return lines. Remove drive belt. On 4WD models, separate right tie rod end from steering knuckle. Remove drive pulley. On all models, remove pump mounting bolts. Remove pump.

Installation (All Models)

To install, reverse removal procedure. Fill and bleed system. See HYDRAULIC SYSTEM BLEEDING under LUBRICATION. On FWD models, check front end alignment (if necessary). Proceed to appropriate WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in the WHEEL ALIGNMENT section.

POWER RACK & PINION

CAUTION: On models with air bag, position front wheels straight ahead, then secure steering wheel to prevent it from rotating, before disconnecting steering column "U" joint.

Removal

1) On Celica, remove air cleaner and duct. On all models, raise and support front of vehicle. Remove front wheels. Separate tie rod ends from steering arms. Remove steering column hole cover for access to steering coupler bolts.

2) Mark and disconnect steering coupler "U" joint. Remove and plug pressure and return lines. Remove air control vacuum valve hose (if equipped). On Celica All-Trac, remove exhaust pipe. On Celica, remove rear engine mount bracket. On Celica, remove crossmember.

3) On Celica All-Trac, mark and remove drive shaft. Remove stabilizer bar (if necessary). Remove steering gear mounting brackets. Remove steering gear. Use care not to tear rack boots when removing from chassis.

Installation

To install, reverse removal procedure. Check front end alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in the WHEEL ALIGNMENT section.

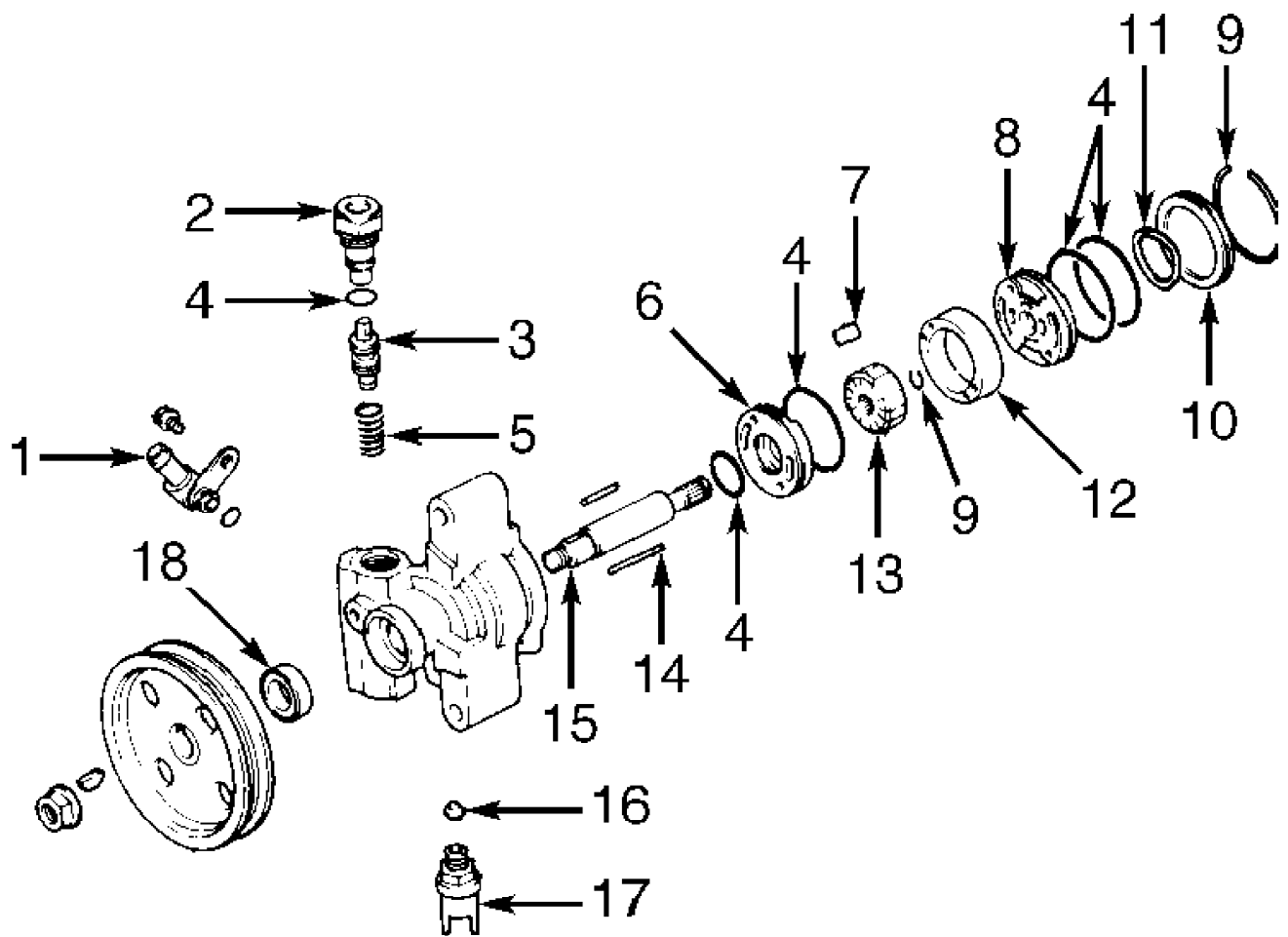
OVERHAUL

POWER STEERING PUMP

Disassembly

1) Remove drive pulley. Place power steering pump in vise. Remove reservoir and bracket. Remove air control valve (if equipped). See Fig. 1 or 2. Remove pressure feed tube, pressure port, flow control valve, and spring. Remove rear housing bolts or snap ring.

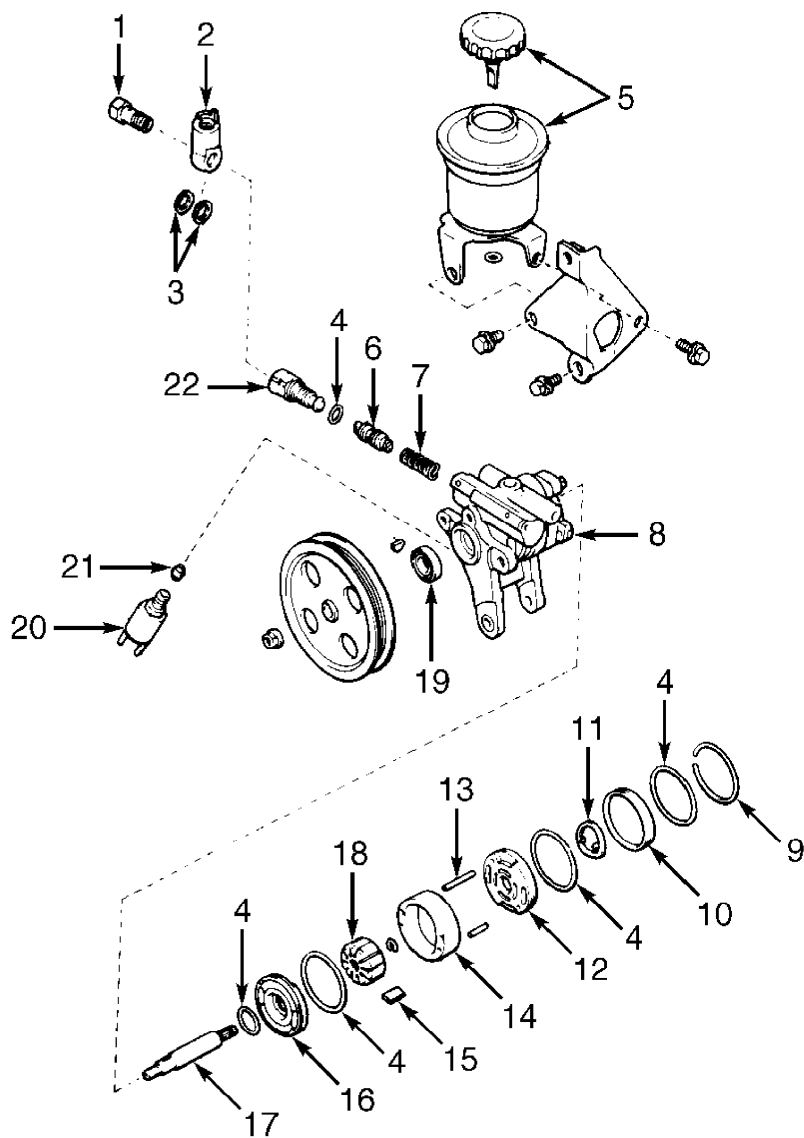
2) Using plastic mallet, tap end of shaft to remove rear housing and wave washer. Remove pump shaft, cam ring, and vane plates. Remove rotor and side plate. Drive out straight pins.



- | | |
|------------------------|-----------------------|
| 1. Suction Port Union | 10. Rear Housing |
| 2. Pressure Port Union | 11. Wave Washer |
| 3. Flow Control Valve | 12. Cam Ring |
| 4. "O" Ring | 13. Rotor |
| 5. Spring | 14. Straight Pin |
| 6. Front Side Plate | 15. Pump Shaft |
| 7. Vane | 16. Union Seat |
| 8. Rear Side Plate | 17. Air Control Valve |
| 9. Snap Ring | 18. Oil Seal |

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Fig. 1: Exploded View Of Power Steering Pump (2.0 & 2.2)
 Courtesy of Toyota Motor Sales, U.S.A., Inc.



- | | |
|-----------------------|-------------------------|
| 1. Union Bolt | 12. Rear Side Plate |
| 2. Pressure Feed Tube | 13. Straight Pin |
| 3. Gasket | 14. Cam Ring |
| 4. "O" Ring | 15. Vane |
| 5. Reservoir Tank | 16. Front Side Plate |
| 6. Flow Control Valve | 17. Shaft |
| 7. Spring | 18. Rotor |
| 8. Front Housing | 19. Oil Seal |
| 9. Snap Ring | 20. Air Control Valve |
| 10. Rear Housing | 21. Union Seat |
| 11. Wave Washer | 22. Pressure Port Union |

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Fig. 2: Exploded View Of Power Steering Pump (Celica 1.6)
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

Inspection

1) Except on models with shaft bearing, measure oil clearance

between pump housing bushing and rotor shaft. See Fig. 3. If clearance exceeds 0.0028" (0.07 mm), replace pump. On all models, discard all "O" rings and oil seals, and replace with new ones.

2) Inspect vane plates for wear or damage. See VANE PLATE SPECIFICATIONS table. Maximum clearance between vane plate and rotor groove is 0.0012" (0.03 mm). If clearance exceeds specification, replace rotor and vane plate as an assembly.

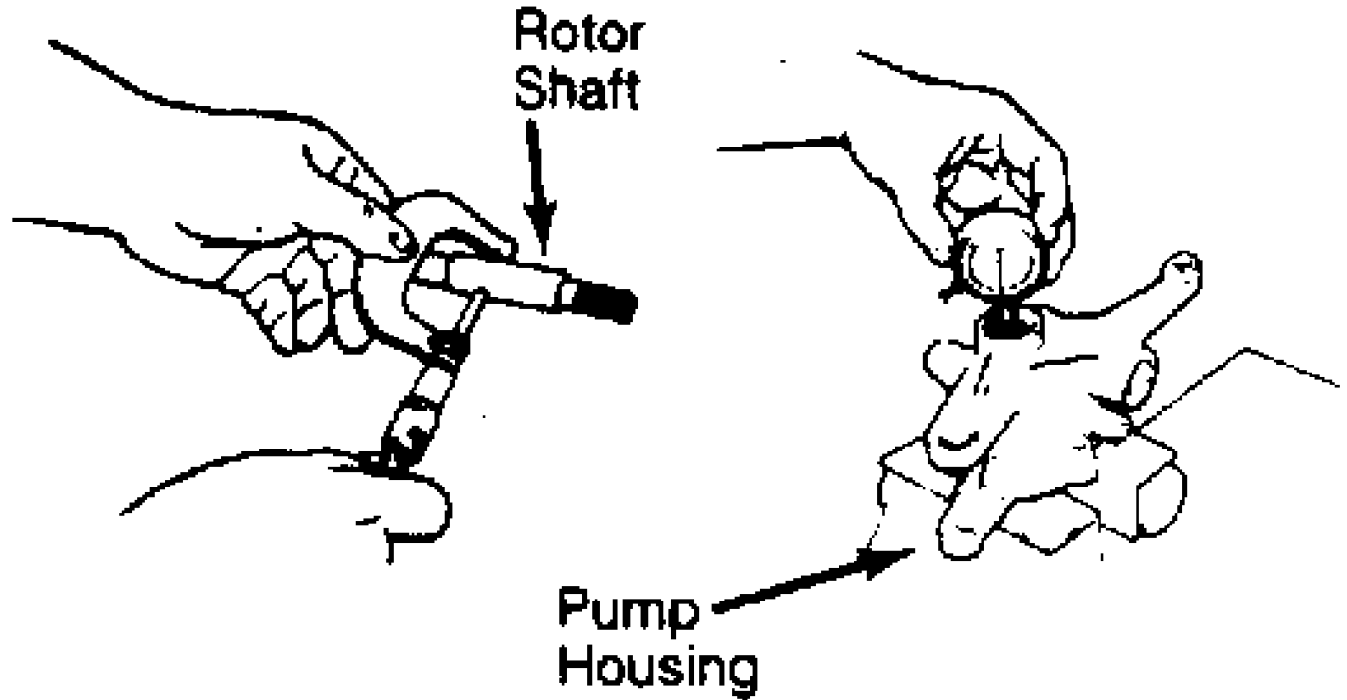


Fig. 3: Measuring Pump Shaft Clearance
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

VANE PLATE SPECIFICATIONS TABLE

Application	In. (mm)
Minimum Height	0.315 (8.00)
Minimum Thickness	0.0697 (1.770)
Minimum Length	0.5894 (14.970)

3) Using 57-71 psi (4.0-5.0 kg/cm²) compressed air, check flow control valve for leakage. See Fig. 4. Spring length should be 1.42-1.49" (36-38 mm). Replace spring if length is not as specified.

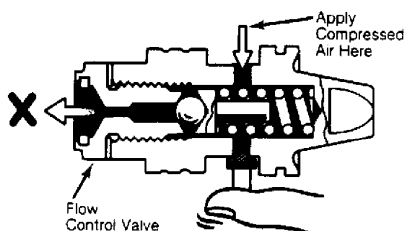


Fig. 4: Checking Flow Control Valve
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

Reassembly

1) Coat all sliding surfaces with ATF. Assemble front plate and rotor assembly onto pump shaft. See Fig. 5. Coat shaft seal with grease. Install longer pin into housing. Align pin and hole in front plate.

2) Using a plastic mallet, tap pump shaft into housing. Install cam ring with scribe mark toward rear of pump. Install vane plates with rounded end facing rear of pump. Install rear side plate and "O" ring. Install wave washer, "O" ring, and rear housing.

3) Measure pump shaft rotating preload. Preload should not exceed 2.7 INCH lbs. (0.3 N.m). If preload exceeds specification, disassemble pump and inspect components. To complete reassembly, reverse disassembly procedure.

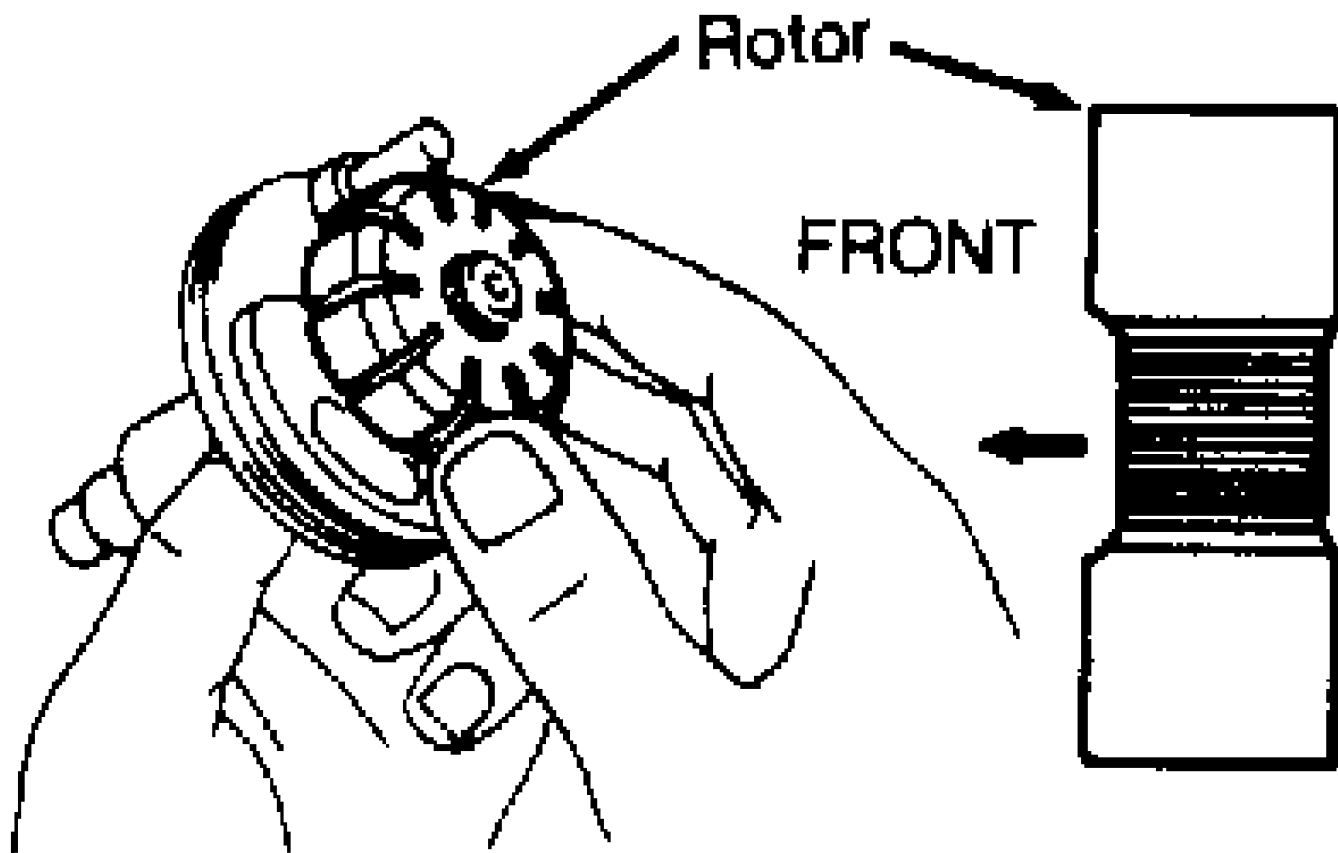


Fig. 5: Installing Power Steering Pump Rotor
Courtesy of Toyota Motor Sales, U.S.A., Inc.

STEERING GEAR

NOTE: Lubricate all internal parts of steering gear with power steering fluid before reassembly.

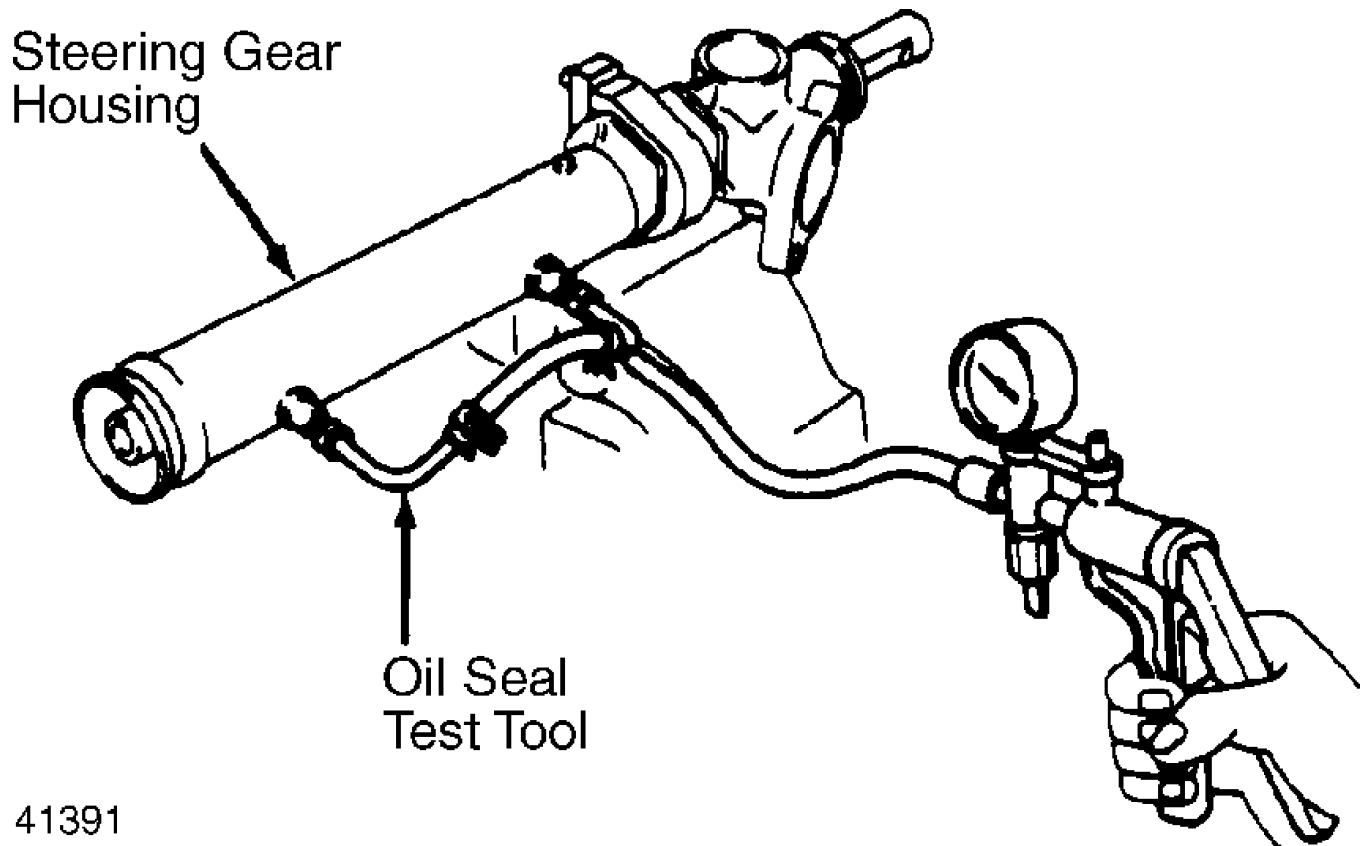


Fig. 6: Testing Rack Seal
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

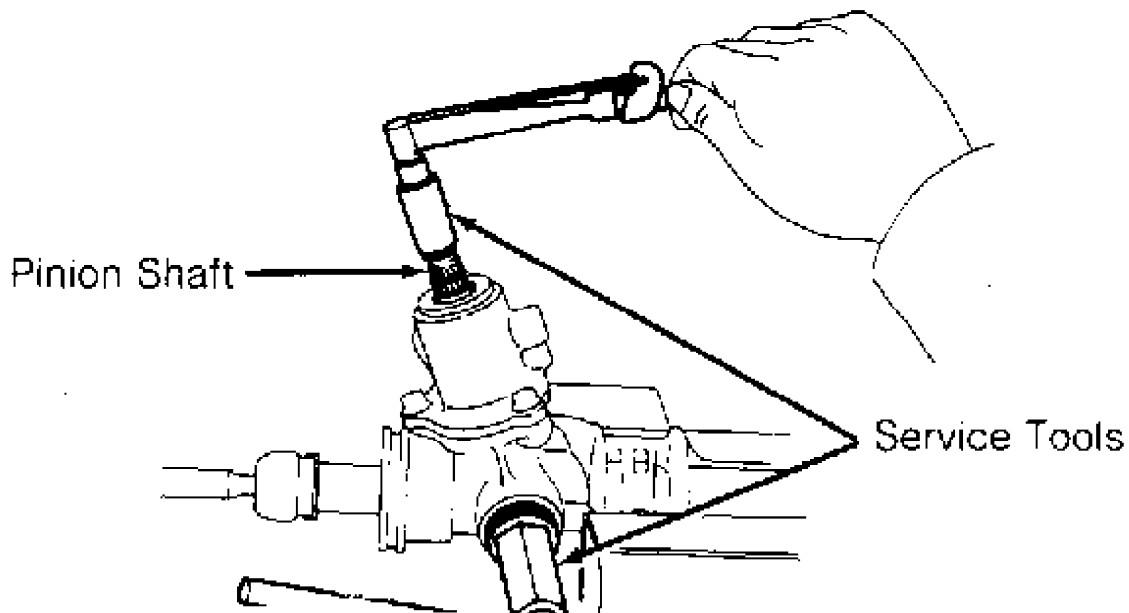


Fig. 7: Setting Rack & Pinion Total Preload
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

Disassembly

- 1) Using Rack Housing Stand (09612-00012), mount steering

gear in vise. Remove left and right turn tubes. Mark and remove tie rod ends. Remove boots. See Fig. 8.

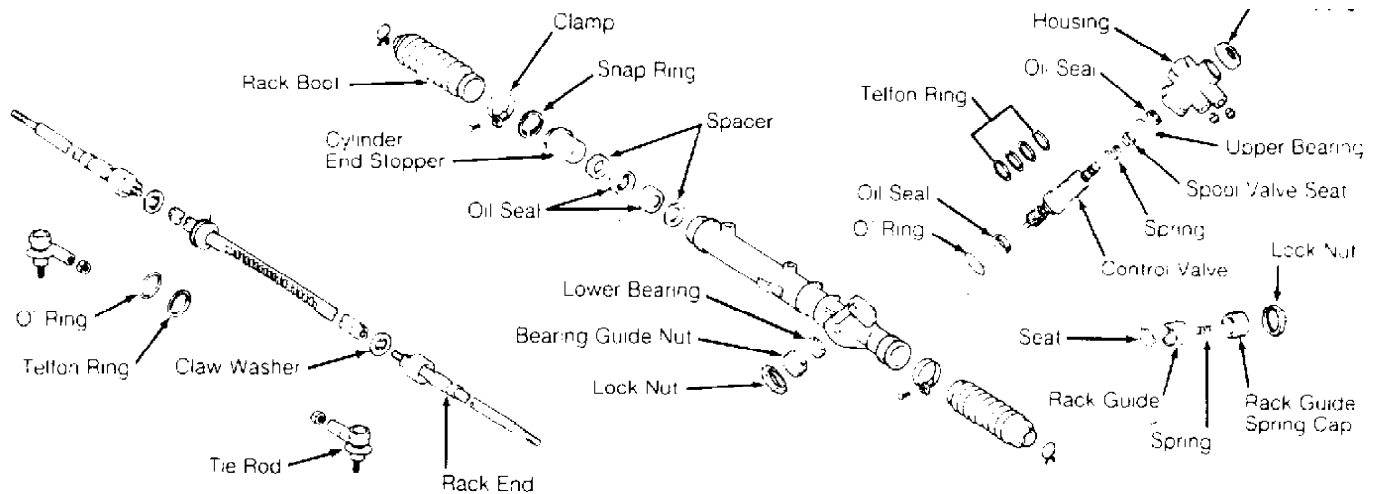


Fig. 8: Exploded View Of Power Rack & Pinion Steer Gear Components
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

2) Unstake claw washers. Mark left and right rack ends for reassembly reference. Using Wrench (09628-10020), remove rack ends and claw washers. Remove rack guide spring cap lock nut. Remove spring cap. Remove rack guide spring, guide, and seat.

3) Remove bearing guide lock nut and guide nut. Remove dust cover. Mark control valve housing and rack for reassembly reference. Remove control valve housing. Remove control valve and bearing.

4) Remove snap ring from end of housing. Using Bearing Replacer (09612-10061), press cylinder end stopper out until end stopper touches press plate. Pull out rack with cylinder end stopper, spacer, and oil seal. Drive out rack housing oil seal and spacer.

Inspection & Repair

1) Check all parts for damage and deterioration. Place rack on "V" blocks. Measure runout at center of rack. Maximum runout is 0.012" (0.30 mm). Inspect back surface of rack for wear or damage. Inspect all bearings and seals for damage. Replace as necessary. Replace all "O" rings. Replace rack housing if defective.

2) Using a small screwdriver, remove Teflon ring from rack. Lubricate NEW ring with power steering fluid. Carefully expand ring with Expander (09631-24020). Install ring onto rack, and firmly snug down with finger pressure.

3) Remove Teflon rings from control valve in similar manner. Lubricate Teflon rings with power steering fluid. Slide rings over Installer (09620-24040). Install rings onto control valve. Snug down rings with fingers. Slide chamfered end of Seal Ring Setter (09620-224050) over assembly to seat seal rings.

Reassembly & Adjustments

1) Install rack housing oil seal and spacer. Install Rack Cover (09631-32010) onto rack. Install rack into cylinder. Remove rack cover. Wind vinyl tape around steering rack end. Install oil seal into cylinder. Install spacer. Drive in cylinder end stopper with Bearing Replacer (09612-22011). Install snap ring.

3) Install Oil Seal Tester (09631-12070). Apply 15.8 in. Hg vacuum for 30 seconds. If vacuum drops, recheck seals, "O" rings, and Teflon rings in rack housing. See Fig. 6.

4) Coat control valve Teflon rings with power steering fluid. Insert valve into steering housing. Install "O" ring, spring, and

spring seat. Align reference marks on control valve housing. Install control valve lower bearing.

5) Apply Loctite 242 sealant to 2 or 3 threads of bearing guide nut. Install and tighten bearing guide nut to 11 ft. lbs. (15 N.m). Loosen guide nut until rotating torque is 3.5-5.3 INCH lbs. (0.4-0.6 N.m). See Fig. 7.

6) Apply Loctite 242 sealant to 2 or 3 threads of bearing guide lock nut. Install and tighten lock nut to 41 ft. lbs. (56 N.m). Measure preload, and readjust if necessary.

7) Install rack guide, guide spring, and seat. Apply Loctite 242 sealant to threads of rack guide spring cap. Install and tighten cap to 18 ft. lbs. (25 N.m). Back off spring cap 12 degrees. Rotate control valve shaft left and right twice.

8) Loosen spring cap until preload is eliminated. Tighten spring cap until preload is 8.0-10.6 INCH lbs. (0.9-1.2 N.m). Apply liquid sealer to threads of lock nut, and install lock nut. Tighten lock nut to 41 ft. lbs. (56 N.m). Measure preload, and readjust if necessary. To complete reassembly, reverse disassembly procedure.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Air Control Valve	27 (36)
Control Valve Bearing Guide Lock Nut	41 (56)
Control Valve Housing Bolts	23 (31)
Control Valve Lower Bearing Self-Locking Nut	
FWD	18 (25)
All-Trac	11 (15)
Pressure Port	51 (69)
Pulley Bolt Or Nut	32 (43)
Pump Bracket Bolt	29-33 (39-45)
Rack Guide Spring Cap Lock Nut	51 (69)
Rear Housing Bolt	34 (46)
Stabilizer Bar Bracket Bolt	14 (19)
Steering Gear-To-Chassis	43 (58)
Steering Rack Tie Rod	61 (83)
Tie Rod Lock Nut	41 (56)
Tie Rod-To-Steering Arm Nut	36 (49)
Turn Tubes	14 (19)
"U" Joint Pinch Bolt	24 (32)
Wheel Lug Nuts	76 (103)
	INCH Lbs. (N.m)
Return Port Bolt	106 (12)