

# STEERING SYSTEM - POWER RACK & PINION

1996 Toyota Supra

1995-96 STEERING  
Toyota - Power Rack & Pinion  
Supra

## 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 dip-stick. 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

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Application	Lbs. (kg)
Supra .....	(1)

(1) - Belt tension is controlled by an automatic tensioner. No adjustment is required.

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## TESTING

## AIR CONTROL VALVE

Start engine. Turn A/C off. Rotate steering wheel right and left. Engine RPM should not decrease greater 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 hydraulic system. Check power steering fluid level. With engine at idle, close pressure gauge valve for 2-3 seconds. Note fluid pressure. See HYDRAULIC PRESSURE table.

### HYDRAULIC PRESSURE TABLE

Application	psi (kg/cm <sup>2</sup> )
Supra .....	1138 (80)

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

3) With steering wheel at full 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

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)
Supra .....	9.0 (4.1)

## REMOVAL & INSTALLATION

### POWER STEERING PUMP

#### Removal

1) Remove battery and battery tray. Raise and support front of vehicle. On turbo models, loosen air hose clips as necessary to remove intake air hose.

2) On all models, disconnect and plug hoses at pump. Disconnect hoses from air control valve on pump. Remove engine

undercover. Remove pressure line. On turbo models, remove pulley nut, belt, and pulley. On all models, remove pump.

#### Installation

To install, reverse removal procedure. Fill and bleed system. See HYDRAULIC SYSTEM BLEEDING under LUBRICATION. Check front end alignment (if necessary). See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in 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) Raise and support front of vehicle. Remove front wheels. Separate tie rod ends from steering arms. Remove engine undercover (if equipped). Using driver-side seat belt, secure steering wheel in straight-ahead position. Mark and disconnect steering coupler "U" joint.

2) On all models, remove steering damper. Remove any line clamp bolts which may interfere with gear removal. Remove steering gear mounting brackets and 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 WHEEL ALIGNMENT section.

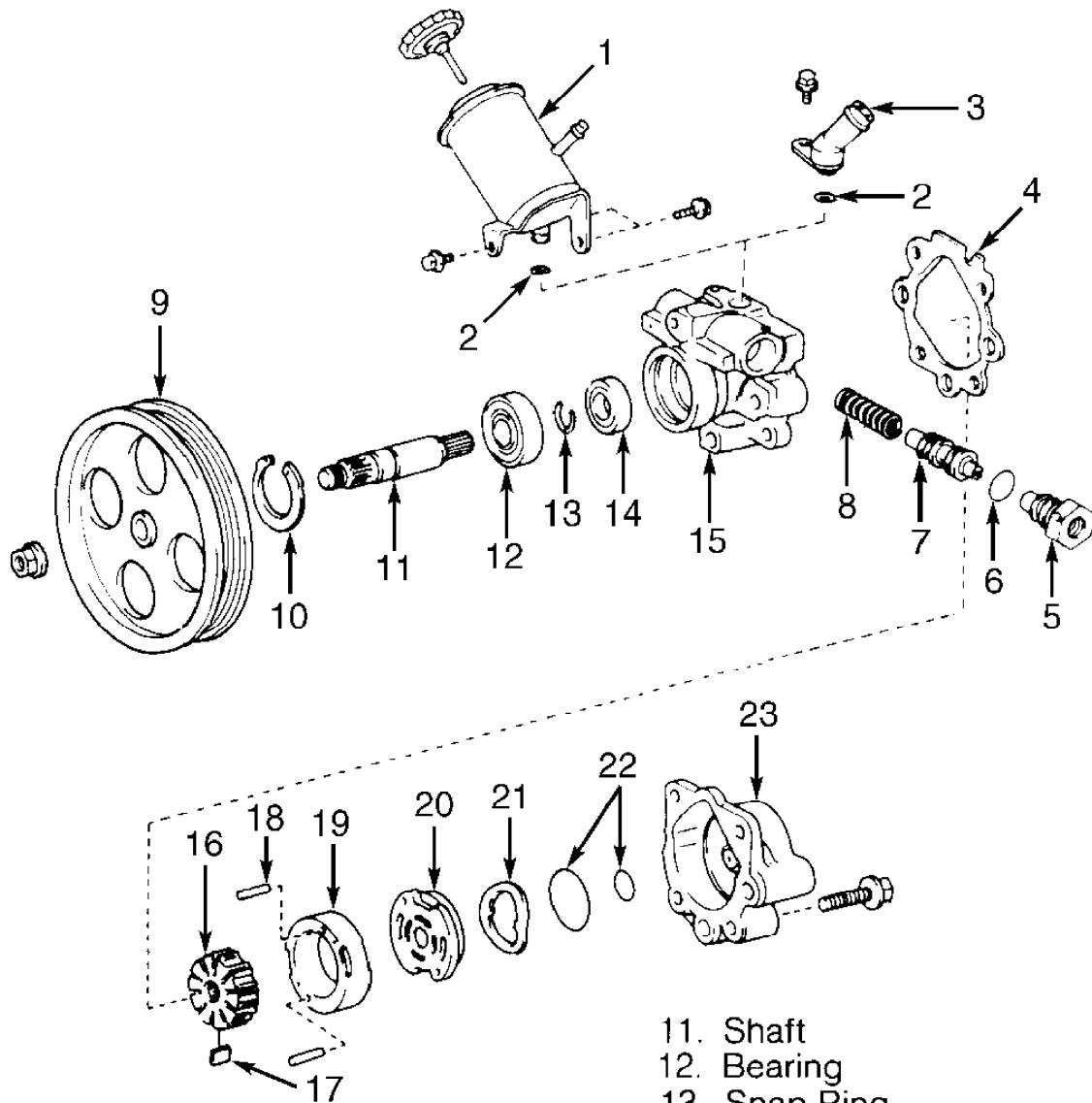
## OVERHAUL

### POWER STEERING PUMP

#### Disassembly

1) Remove pulley, if not already removed. Remove reservoir if necessary. Remove suction and pressure ports. Remove flow control valve and spring. See Fig. 1.

2) Mark front and rear housings for reassembly reference. Remove rear housing. Remove cam ring, rotor, and vane plates. Remove snap ring, shaft, and bearing. Tap out oil seal. Wrap vinyl tape around shaft serrations. Press bearing from shaft. Using plastic mallet, tap out rear side plate and wave washer.



- |                       |                     |
|-----------------------|---------------------|
| 1. Reservoir          | 11. Shaft           |
| 2. "O" Ring           | 12. Bearing         |
| 3. Suction Port       | 13. Snap Ring       |
| 4. Gasket             | 14. Oil Seal        |
| 5. Pressure Port      | 15. Front Housing   |
| 6. "O" Ring           | 16. Rotor           |
| 7. Flow Control Valve | 17. Vane Plate      |
| 8. Spring             | 18. Straight Pin    |
| 9. Pulley             | 19. Cam Ring        |
| 10. Snap Ring         | 20. Rear Side Plate |
|                       | 21. Wave Washer     |
|                       | 22. "O" Ring        |
|                       | 23. Rear Housing    |

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Fig. 1: Exploded View Of Power Steering Pump  
 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. 2. 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.

3) Using 57-71 psi (4.0-5.0 kg/cm<sup>2</sup>) compressed air, check flow control valve for leakage. See Fig. 3. Spring length should be a minimum of 1.30" (33 mm). Replace spring if length is not as specified.

VANE PLATE SPECIFICATIONS TABLE

Application	In. (mm)
Minimum Height .....	0.339 (8.60)
Minimum Thickness .....	0.055 (1.40)
Minimum Length .....	0.590 (14.99)

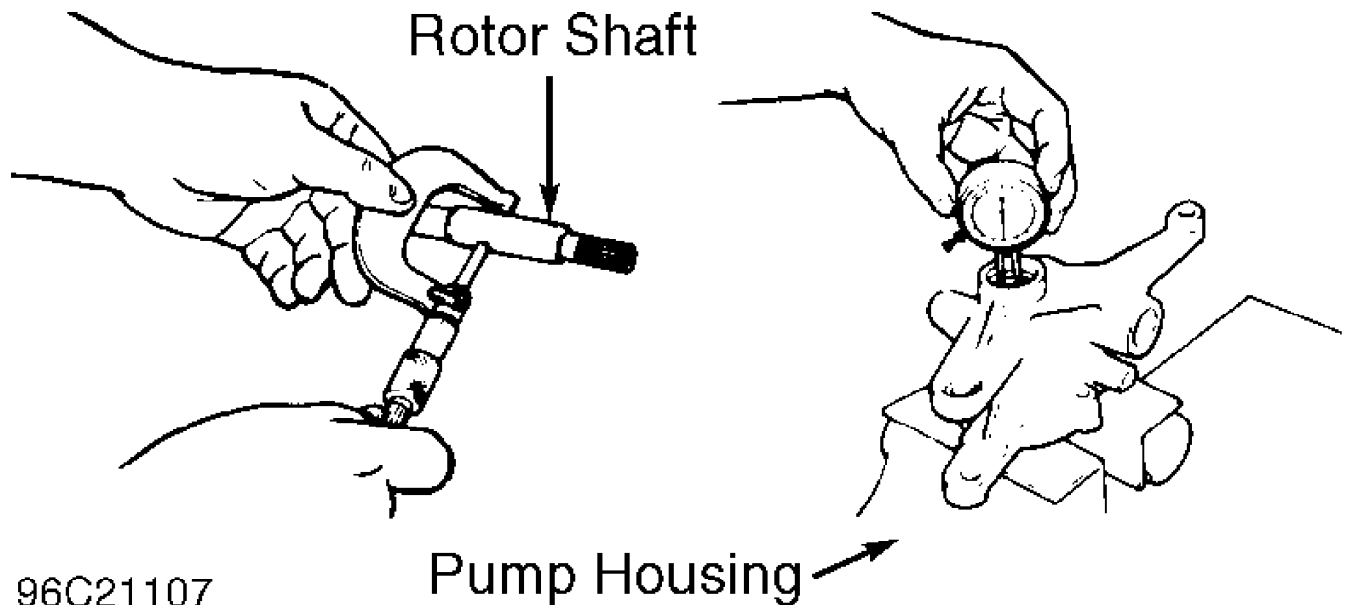


Fig. 2: Measuring Pump Shaft Clearance  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

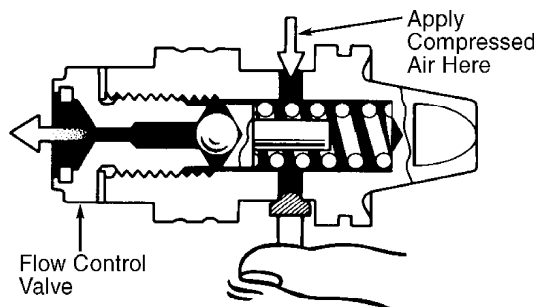


Fig. 3: Checking Flow Control Valve  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

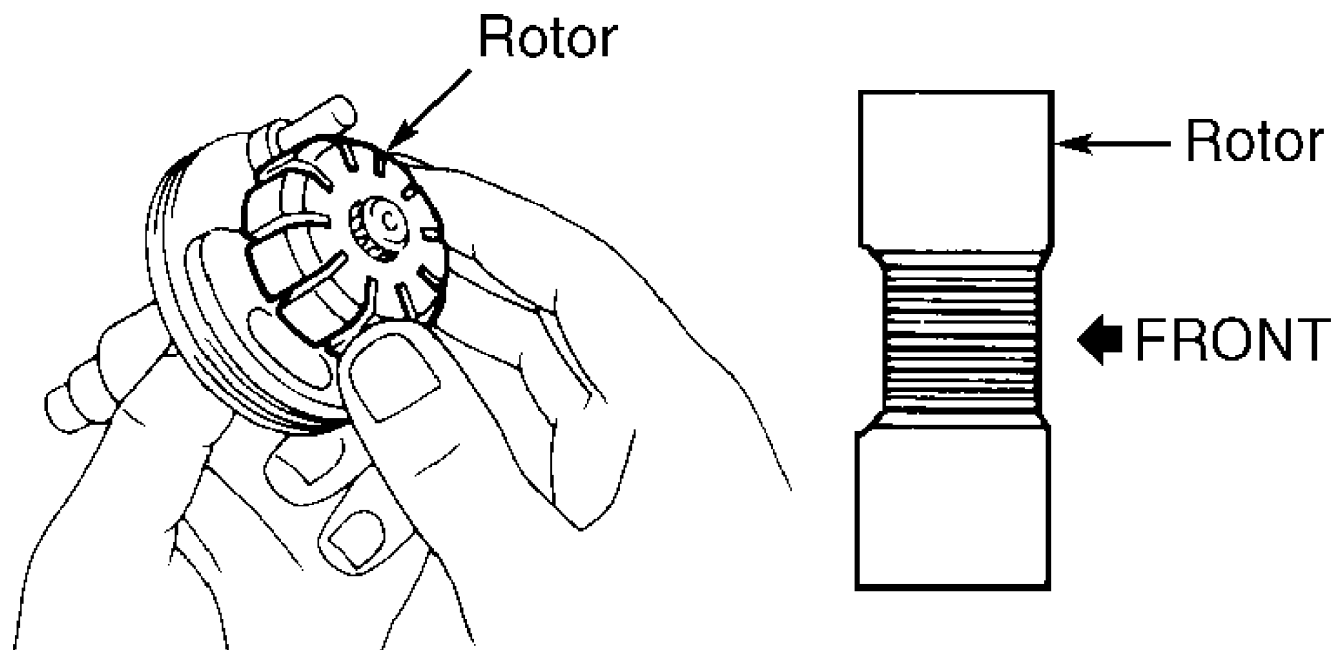
Reassembly

- 1) Coat all sliding surfaces with ATF. Assemble front plate

and rotor assembly onto pump shaft. See Fig. 4. 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 1.8 INCH lbs. (0.2 N.m). If preload exceeds specification, disassemble pump and inspect components. To complete reassembly, reverse disassembly procedure.



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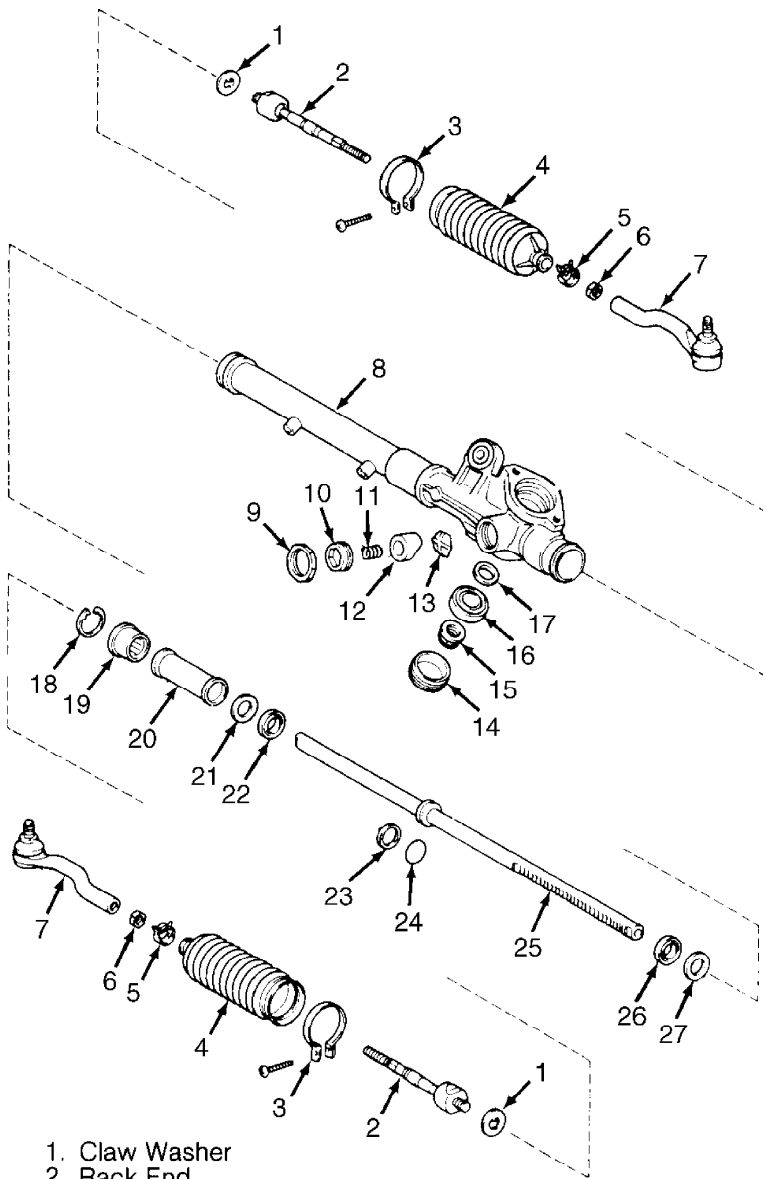
Fig. 4: Installing Power Steering Pump Rotor  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

## STEERING GEAR

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

### Disassembly (Supra)

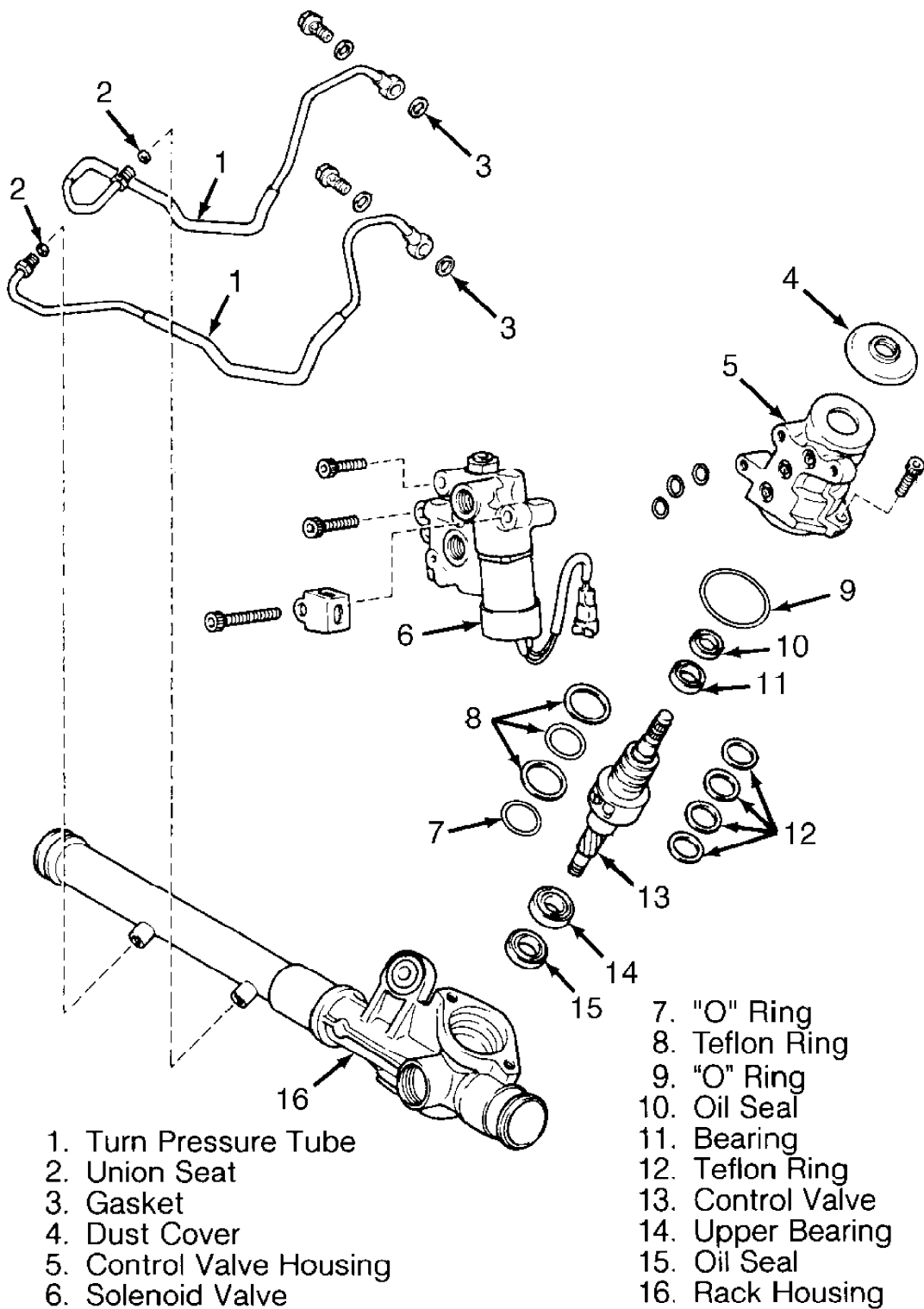
1) Using Rack Housing Stand (09612-00012), mount steering gear in vise. Remove left and right turn tubes. Mark and remove tie rod ends. Remove boots. See Figs. 5 and 6.



- |                        |                          |
|------------------------|--------------------------|
| 1. Claw Washer         | 16. Lower Bearing        |
| 2. Rack End            | 17. Spacer               |
| 3. Clamp               | 18. Snap Ring            |
| 4. Rack Boot           | 19. Cylinder End Stopper |
| 5. Clip                | 20. Spacer               |
| 6. Lock Nut            | 21. Spacer               |
| 7. Tie Rod End         | 22. Oil Seal             |
| 8. Rack Housing        | 23. Teflon Ring          |
| 9. Spring Cap Lock Nut | 24. "O" Ring             |
| 10. Spring Cap         | 25. Steering Rack        |
| 11. Guide Spring       | 26. Oil Seal             |
| 12. Rack Guide         | 27. Spacer               |
| 13. Guide Seat         |                          |
| 14. Rack Housing Cap   |                          |
| 15. Self-Locking Nut   |                          |

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Fig. 5: Exploded View Of Power Rack & Pinion Steering Gear (1 Of 2)  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.



- 1. Turn Pressure Tube
- 2. Union Seat
- 3. Gasket
- 4. Dust Cover
- 5. Control Valve Housing
- 6. Solenoid Valve

- 7. "O" Ring
- 8. Teflon Ring
- 9. "O" Ring
- 10. Oil Seal
- 11. Bearing
- 12. Teflon Ring
- 13. Control Valve
- 14. Upper Bearing
- 15. Oil Seal
- 16. Rack Housing

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Fig. 6: Exploded View Of Power Rack & Pinion Steering Gear (2 Of 2)  
 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. Remove rack housing cap.

3) Remove nut, lower bearing, and spacer. Cover shaft splines with vinyl tape. Remove control valve housing bolts. Using brass drift, tap out control valve housing. Using plastic mallet, tap out control valve.

4) Remove snap ring. Using plastic mallet, tap end of housing to remove end stopper and spacers. Press rack from housing. Remove oil seal and spacer. If necessary, remove upper bearing and oil seal.

#### Inspection & Repair

1) Place rack on "V" blocks. Measure runout at center of rack. Maximum runout is .006" (.15 mm). Inspect back surface of rack for wear or damage.

2) Using a small screwdriver, remove Teflon rings. Coat new Teflon rings with power steering fluid. Stretch new rings by hand, just enough to install. Snug rings down by hand. Slide Ring Compressor (09631-20081) or (09631-32020) over rings to compress them before assembling steering gear. Install new oil seals and "O" rings.

#### Reassembly & Adjustments

1) Install spacer and oil seal. Slide Rack Cover (09631-32010) onto rack, and coat with power steering fluid. Insert rack into cylinder. Remove rack cover. Wind vinyl tape around steering rack end. Lubricate with power steering fluid.

2) Insert oil seal into cylinder. Install spacers. Drive in end stopper with Replacer (09620-30010). Install snap ring.

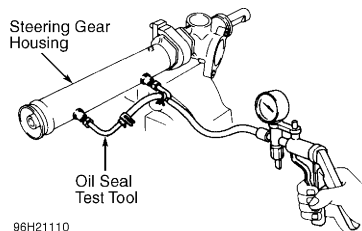
3) Install Oil Seal Tester (09631-22030). Apply 15.8 in. Hg for 30 seconds. If vacuum drops, recheck seals, "O" rings, and Teflon rings in rack housing. See Fig. 7.

4) Coat control valve Teflon rings with power steering fluid. Wrap vinyl tape around serrations on control valve shaft. Install control valve into steering housing. Install spacer and lower bearing. Hold shaft in position, and install NEW self-locking nut.

5) Apply Loctite 242 sealant to 2 or 3 threads of rack housing cap. Install rack housing cap. Apply Loctite 242 sealant to 2 or 3 threads of rack guide spring cap. Install rack guide seat, rack guide, rack guide spring, and rack guide spring cap. Tighten rack guide cap to 18 ft. lbs. (25 N.m).

6) Loosen spring cap 12 degrees. Rotate control valve shaft left and right 2 times. Loosen spring cap until preload is eliminated. Tighten spring cap until turning preload is 8.8-16.8 INCH lbs. (1.0-1.9 N.m). See Fig. 8. Apply liquid sealer to threads of lock nut, and install lock nut. Tighten lock nut to specification. Measure preload, and readjust if necessary.

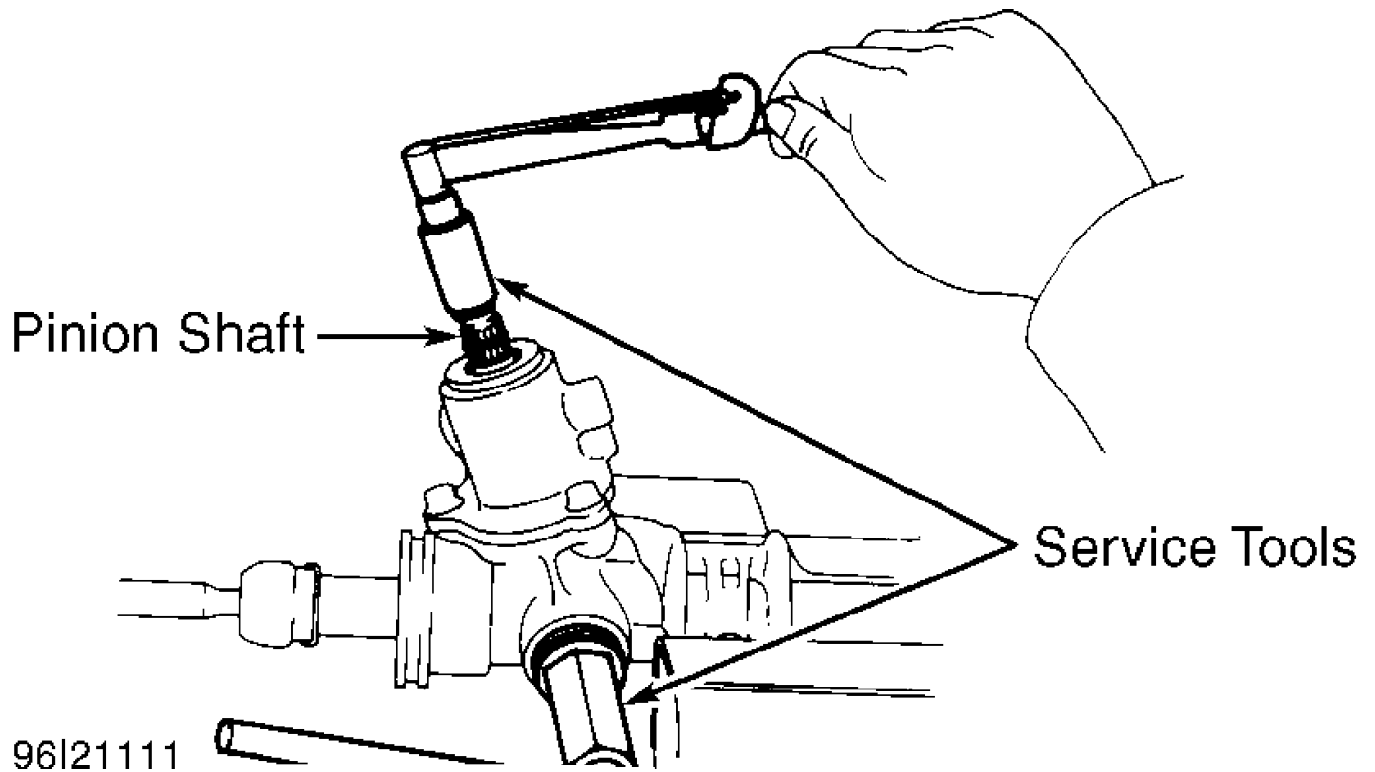
7) Apply Loctite 242 sealant to 2 or 3 threads of rack guide spring cap nut. Install and tighten nut to 41 ft. lbs. (56 N.m). Measure preload, and readjust if necessary. Install dust cover. To complete assembly, reverse disassembly procedure.



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Fig. 7: Testing Rack Seal

Courtesy of Toyota Motor Sales, U.S.A., Inc.



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 Fig. 8: Setting Rack & Pinion Total Preload  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

### TORQUE SPECIFICATIONS

#### TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Control Valve Bolts	13 (18)
Control Valve Self-Locking Nut	29 (39)
Pressure & Return Lines	
Steering Gear	36 (49)
Steering Pump	61 (83)
Pump Housing Bolts	13 (18)
Rack End	66 (90)
Rack Guide Spring Cap Nut	41 (56)
Rack Housing Cap	51 (69)
Tie Rod End Castle Nuts	36 (49)
Tie Rod End Lock Nut	41 (56)
Turn Pressure Tube	
Bolt	25 (34)
Nut	18 (24)
"U" Joint Clamp Bolt	26 (35)