

1999 Toyota RAV4
1999-2000 STEERING Power Rack & Pinion - Trucks

1999-2000 STEERING

Power Rack & Pinion - Trucks

DESCRIPTION & OPERATION

System consists of a rack and pinion assembly, hydraulic power steering pump, hoses and control valves. On some models an air control valve is used to increase idle speed when power steering pump is under load.

LUBRICATION

FLUID TYPE

Use Dexron-II or Dexron-III ATF fluid.

FLUID LEVEL CHECK

When fluid is at normal operating temperature, fluid level should be between HOT marks on fluid reservoir. When fluid is cold, fluid level should be between COLD marks on fluid reservoir. Add as 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. Lower vehicle. Start engine and run at idle.
2. Turn wheels fully to lock in one direction. Hold for a few seconds. Turn wheels fully to opposite lock. Hold for a few seconds. Repeat process several times.
3. Check fluid. If there is no evidence of excess bubbles or foaming, bleeding is complete. If not, repeat process until no bubbling is evident. Adjust fluid level as necessary.

ADJUSTMENTS

POWER STEERING PUMP BELT

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

BELT TENSION SPECIFICATIONS

Application ⁽¹⁾	Lbs. (kg)
RAV4	
New	95-145 (43-66)
Used ⁽²⁾	60-100 (27-45)
Sienna	
New	150-185 (68-84)
Used ⁽²⁾	95-135 (43-61)

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Tacoma, Tundra & 4Runner	
New	135-180 (61-82)
Used ⁽²⁾	85-120 (39-54)
(1) Land Cruiser uses automatic belt tensioner.	
(2) Belt is used if it has been in operation for longer than 5 minutes.	

SYSTEMS TESTS

AIR CONTROL VALVE

Land Cruiser, RAV4, Tacoma & 4Runner

Start and fully warm up engine. Ensure A/C is off. With engine at idle, turn steering wheel to full LOCK position until test is complete. Ensure engine RPM decreases when air control valve vacuum hose is pinched shut. When hose is released, engine RPM should increase to normal. If system fails this test, check vacuum hose, connections, and air control valve.

HYDRAULIC SYSTEM PRESSURE TEST

Pressure Test

1. Connect pressure to power steering pump high pressure line. 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. DO NOT keep valve closed for more than 10 seconds. Note fluid minimum pressure. See **HYDRAULIC PRESSURE** table.
2. Open pressure gauge valve fully. Note pressure with engine at 1000 RPM and at 3000 RPM. DO NOT turn steering wheel. Pressure difference should be less than 71 psi (5 kg/cm2). If difference is greater than specified, check flow control valve. If valve is okay, repair or replace power steering pump.
3. When 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.

HYDRAULIC PRESSURE

Application	Minimum Pressure - Psi (kg/cm ²)
RAV4	1067 (75)
Sienna	1138 (80)
Land Cruiser, Tacoma, Tundra & 4Runner	1209 (85)

STEERING WHEEL TURNING FORCE

1. Center steering wheel. Check that free play of steering wheel does not exceed 1.58" (40 mm) on Land Cruiser, or 1.18" (30 mm) on all other models. Remove steering wheel pad.
2. Attach INCH-lb torque wrench to steering wheel nut. Start and idle engine. Using torque wrench, turn

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and measure turning force. See **STEERING EFFORT SPECIFICATIONS** table. Repair or replace power steering pump if force exceeds specifications.

STEERING EFFORT SPECIFICATIONS

Application	INCH Lbs. (N.m)
RAV4 & Sienna	52 (5.9)
Land Cruiser, Tacoma, Tundra & 4Runner	43 (4.9)

REMOVAL & INSTALLATION

POWER STEERING PUMP

Removal (Land Cruiser)

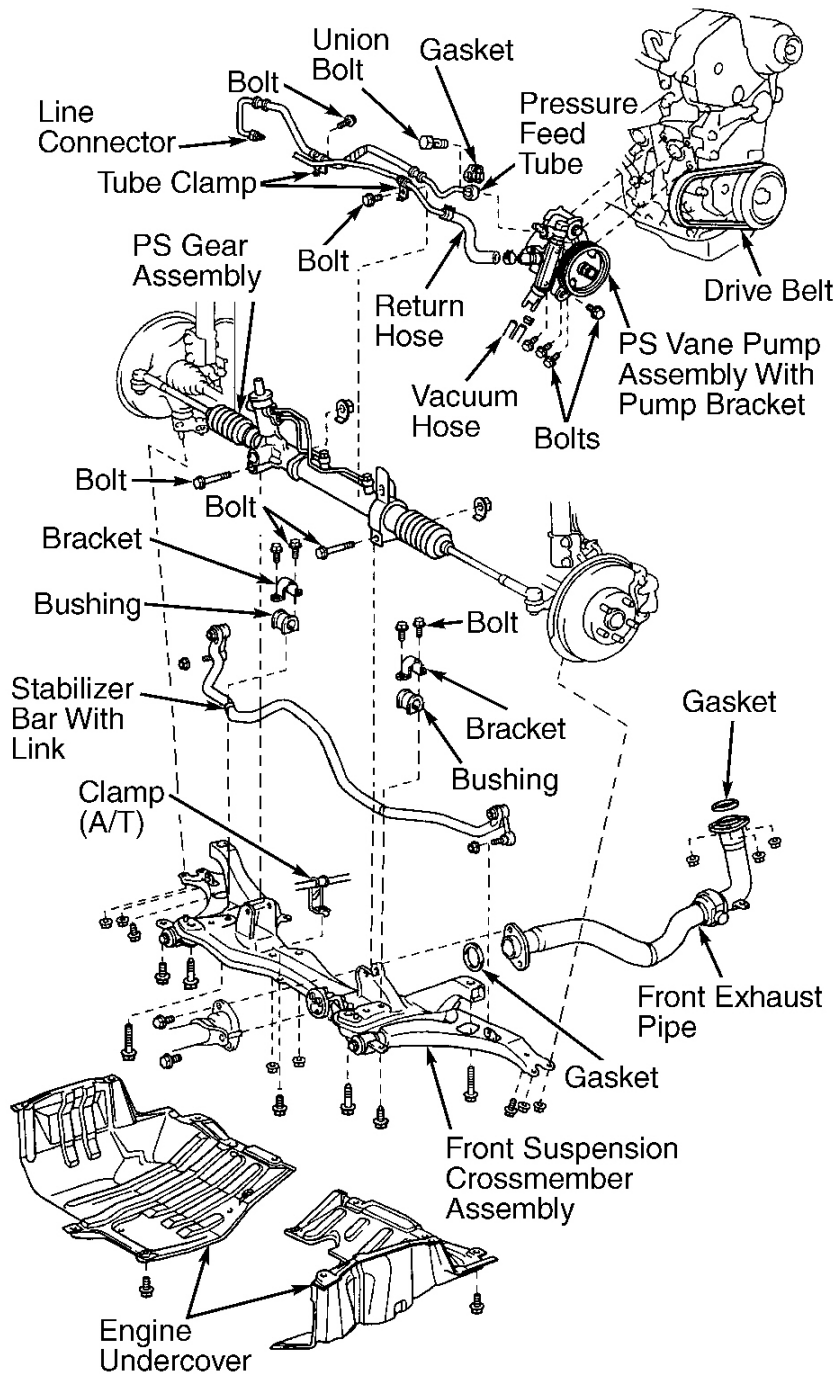
1. Raise and support front of vehicle. Remove right and left engine under covers. Disconnect MAF connector. Remove hose from air cleaner. Remove clamp, bolts and remove air cleaner assembly. Loosen drive belt tensioner and remove drive belt.
2. Disconnect and plug return hose. Use drain pan to catch power steering fluid when connections are released. Remove 3 bolts, and remove power steering pump.

Removal (RAV4)

1. Raise and support front of vehicle. Remove right and left engine under covers. Remove front exhaust pipe. See **Fig. 1**.
2. Remove stabilizer bar with link. Disconnect right and left lower control arms. See **FRONT - AVALON, CAMRY, CAMRY SOLARA, CELICA, COROLLA, ECHO, RAV4 & SIENNA** appropriate FRONT SUSPENSION article in SUSPENSION.
3. Remove 2 power steering gear assembly set bolts and nuts. Remove front suspension crossmember assembly. See **Fig. 1**.
4. Disconnect 2 tube clamps and 2 vacuum hoses. Disconnect and plug return line. Use drain pan to catch power steering fluid when connections are released.
5. Loosen top and bottom pump bolts and remove drive belt. Disconnect pressure feed tube. Remove 3 power steering pump bracket bolts. Remove pump assembly with bracket.
6. Remove union bolt and gasket. Remove pressure feed line.

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Fig. 1: Identifying Components For Removal Of Power Steering Pump & Gear (RAV4)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Removal (Sienna)

1. Raise and support front of vehicle. Remove clip, and disconnect fluid return hose. Use drain pan to catch power steering fluid when connections are released. Remove clamps and holders from pressure feed pipe. Remove pressure feed pipe from power steering gear.
2. Loosen top and bottom pump bolts, and remove drive belt. Disconnect oil pressure switch connector. Loosen bolt hidden behind power steering pump drive pulley until power steering pump can be removed (bolt cannot be fully removed). See **Fig. 2**.
3. Remove oil pressure switch from union bolt. Remove union bolt and gasket. Remove pressure feed line.

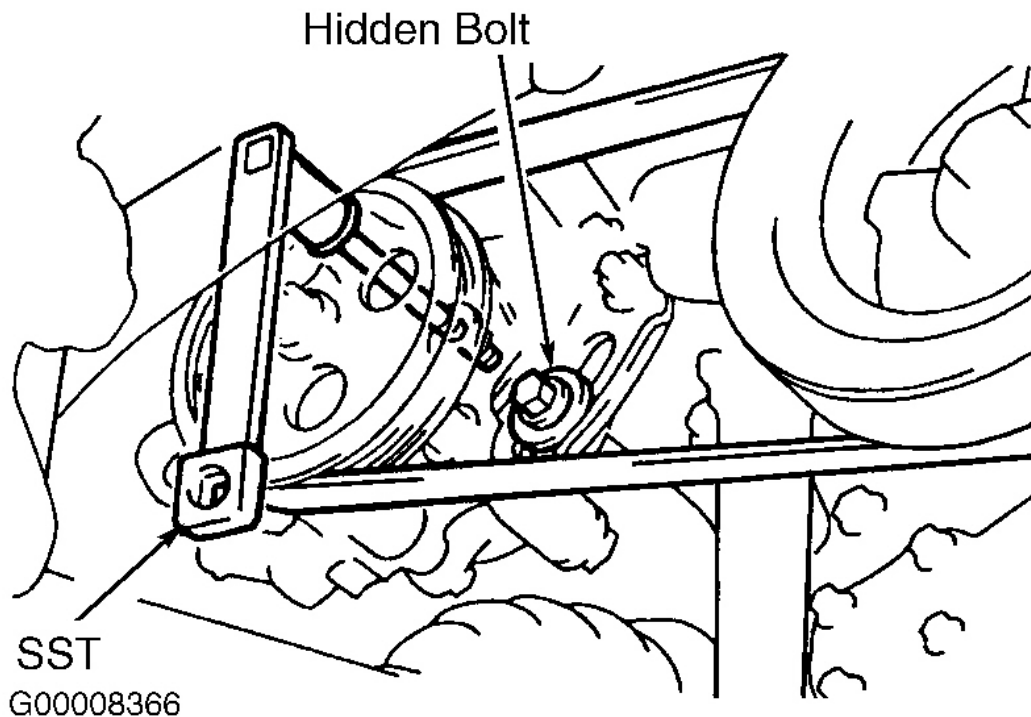


Fig. 2: Locating & Loosening Hidden Bolt Located Behind Power Steering Pump Drive Pulley (Sienna)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Removal (Tacoma & 4Runner 4-Cylinder)

1. Loosen power steering idle pulley bolt, then loosen belt adjusting bolt. Remove drive belt. Use 24-mm spanner to hold pressure port union. Remove union bolt and gaskets. Remove pressure feed line from pump.
2. Disconnect and plug return hose. Use drain pan to catch power steering fluid when connections are released.
3. Remove pump bolts. Remove power steering pump.

Removal (Tacoma & 4Runner V6)

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1. Remove air cleaner assembly. Disconnect and plug return hose. Use drain pan to catch power steering fluid when connections are released.
2. Disconnect oil pressure switch connector. Remove oil pressure switch from pressure feed line. Remove union bolt and gaskets. Disconnect pressure feed line from pump.
3. Loosen power steering pump adjusting bolts. Remove drive belt. Remove power steering pump mounting bolts. Remove power steering pump.

Removal (Tundra)

1. Disconnect MAF connector. Remove hose from air cleaner. Remove clamp, bolts and remove air cleaner assembly. On V8 engines, loosen drive belt tensioner and remove drive belt. On all models, disconnect and plug return hose. Use drain pan to catch power steering fluid when connections are released.
2. On V6 models, disconnect oil pressure switch connector and remove oil pressure switch. On V8, remove vacuum hoses. On all models, disconnect pressure feed line from pump. On V6 models, remove drive belt. On all models, loosen power steering pump adjusting bolts. Remove power steering pump mounting bolts. Remove power steering pump.

Installation (All Models)

To install, reverse removal procedure. Fill and bleed system. See **HYDRAULIC SYSTEM BLEEDING** under LUBRICATION.

POWER RACK & PINION

Removal (Land Cruiser)

1. Place front wheels in straight-ahead position. Remove steering wheel and pad. Remove right and left engine under covers. Disconnect both tie rod ends. See **FRONT - LAND CRUISER** article in SUSPENSION.
2. Drain engine oil. Remove oil filter assembly. Disconnect lower steering column shaft from steering gear. Disconnect pressure and return lines from steering gear. Remove line clamps. Place matchmarks on tie rod end and rack end. Remove both tie rods.
3. Remove power rack and pinion assembly mounting bolts and nuts. Remove rack and pinion assembly.

Installation

1. To install, reverse removal procedure, except install power feed and return line clamps to rack and pinion assembly first.
2. After installation, place front wheels in straight-ahead position. Center steering wheel spiral cable, then install steering wheel and pad. Check front wheel alignment.

Removal (RAV4)

1. Place front wheels in straight-ahead position. Remove steering wheel and pad.
2. Remove right and left engine under covers. Disconnect both tie rod ends. See **FRONT - AVALON, CAMRY, CAMRY SOLARA, CELICA, COROLLA, ECHO, RAV4 & SIENNA** article in

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SUSPENSION. Remove front exhaust pipe. Remove stabilizer bar with link.

3. Disconnect lower steering column shaft from steering gear. Disconnect pressure and return lines from steering gear. Remove line clamps.
4. Disconnect right and left lower control arms. See **FRONT - AVALON, CAMRY, CAMRY SOLARA, CELICA, COROLLA, ECHO, RAV4 & SIENNA** article in SUSPENSION.
5. Remove power rack and pinion assembly mounting bolts and nuts. Securely suspend rack and pinion assembly.
6. Remove front suspension crossmember. See **Fig. 1** . Remove power rack and pinion assembly.

Installation

1. To install, reverse removal procedure, except install power feed and return line clamps to rack and pinion assembly first.
2. After installation, place front wheels in straight-ahead position. Center steering wheel spiral cable, then install steering wheel and pad. Check front wheel alignment.

Removal (Sienna)

1. Place front wheels in straight-ahead position. Remove steering wheel and pad. Disconnect both tie rod ends. See **FRONT - AVALON, CAMRY, CAMRY SOLARA, CELICA, COROLLA, ECHO, RAV4 & SIENNA** article in SUSPENSION.
2. Disconnect lower steering column shaft from steering gear. Remove nut holding tube clamp on rack housing. Disconnect pressure and return lines from steering gear.
3. Disconnect, but DO NOT remove, stabilizer bar. See **FRONT - AVALON, CAMRY, CAMRY SOLARA, CELICA, COROLLA, ECHO, RAV4 & SIENNA** article in SUSPENSION.
4. Remove power rack and pinion assembly mounting bolts and nuts. Lift stabilizer bar to remove bolts. Remove power rack and pinion assembly.

Installation

To install, reverse removal procedure, installing assembly from left side of vehicle. After installation, place front wheels in straight-ahead position. Center steering wheel spiral cable, then install steering wheel and pad. Check front wheel alignment.

Removal (Tacoma)

1. Place front wheels in straight-ahead position. Remove steering wheel and pad. On 4WD models, remove engine under cover. Disconnect both tie rod ends.
2. Disconnect lower steering column shaft from steering gear. Disconnect pressure and return lines from steering gear.
3. Remove power rack and pinion assembly mounting bolts and nuts. Remove power rack and pinion assembly.

Installation

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To install, reverse removal procedure. After installation, place front wheels in straight-ahead position. Center steering wheel spiral cable, then install steering wheel and pad. Check front wheel alignment.

Removal (Tundra)

1. Place front wheels in straight-ahead position. Remove steering wheel and pad. Disconnect both tie rod ends. Disconnect lower steering column shaft from steering gear. Remove clamp plate bolt and remove clamp plate.
2. Disconnect pressure and return lines from steering gear. Remove power rack and pinion assembly mounting bolts and nuts. Remove power rack and pinion assembly.

Installation

To install, reverse removal procedure. After installation, place front wheels in straight-ahead position. Center steering wheel spiral cable, then install steering wheel and pad. Check front wheel alignment.

Removal (4Runner)

1. Place front wheels in straight-ahead position. Remove steering wheel and pad. Remove engine under cover.
2. Remove stabilizer bar. Disconnect both tie rod ends. Disconnect lower steering column shaft from steering gear. Disconnect pressure and return lines from steering gear.
3. Remove power rack and pinion assembly mounting bolts and nuts. Remove power rack and pinion assembly.

Installation

To install, reverse removal procedure. After installation, place front wheels in straight-ahead position. Center steering wheel spiral cable, then install steering wheel and pad. Check front wheel alignment.

OVERHAUL

POWER STEERING PUMP

Disassembly (RAV4)

1. Mount pump assembly in soft-jaw vise. Ensure pump rotates smoothly. Using a torque wrench, check pump rotating torque. Rotating torque should be 2.4 INCH lbs. (.3 N.m) or less. Remove front bracket and pump bracket.
2. While holding pulley, remove pulley nut. Remove pulley and Woodruff key from pump shaft. Remove air control valve. See **Fig. 3**. Remove pressure feed No. 2 tube.
3. Remove union bolt and "O" ring from suction (return) port. Remove "O" ring from pressure port. Remove flow control valve and spring. See **Fig. 3**.
4. Remove flow control valve seat snap ring. Install a 6 x 1 x 50 mm bolt about 2-3 threads into seat. Pull spring seat from housing. Remove "O" ring.

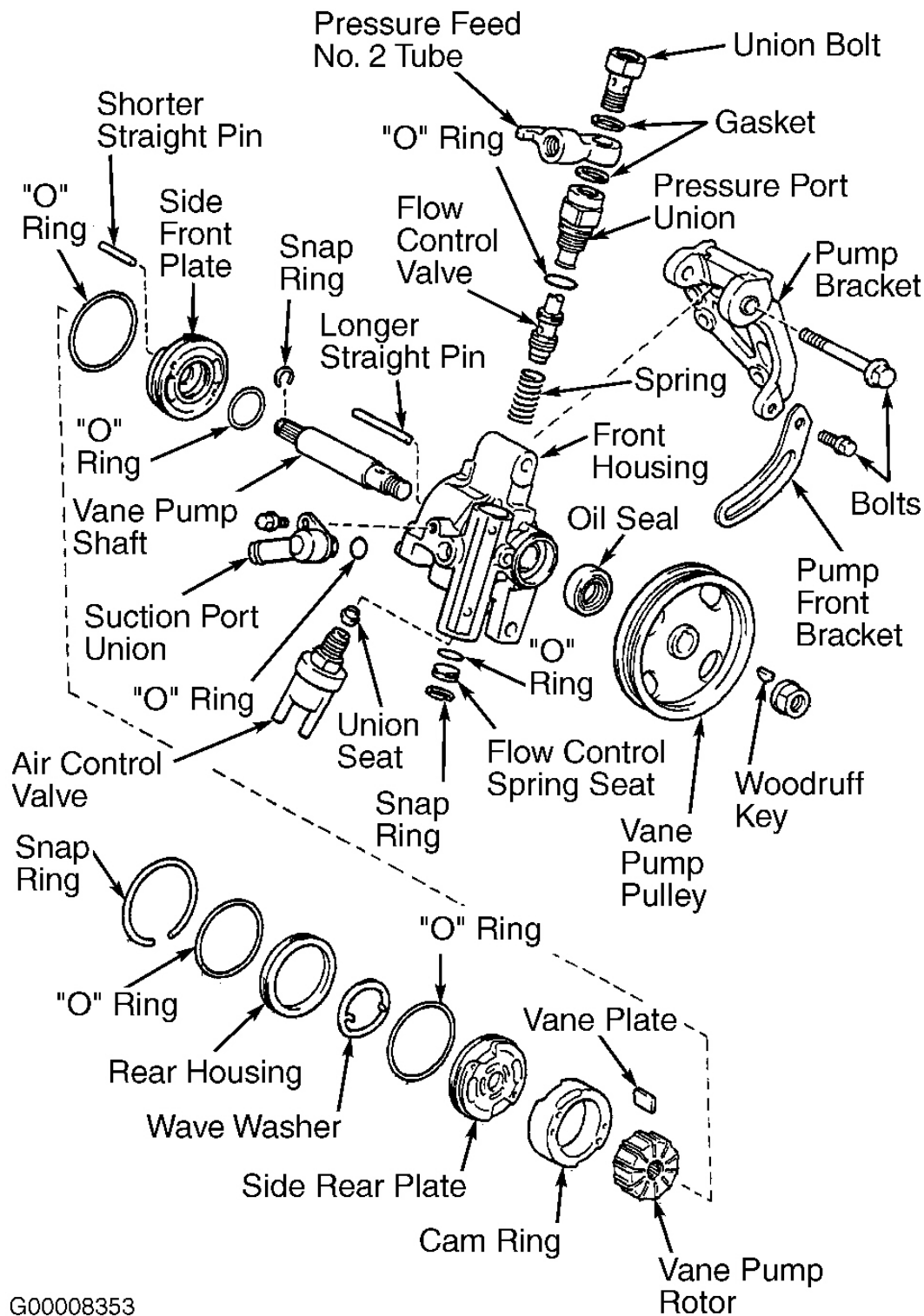
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5. Remove rear housing snap ring. Wrap tape on serrated part of pump shaft. Using soft-face hammer, tap out rear housing, washer and side rear plate. Remove "O" rings.
6. Remove cam ring and 10 vane plates. See **Fig. 3** . Remove pump shaft with rotor and side front plate.
7. Remove snap ring from pump shaft. Remove 2 "O" rings from plate. Remove rotor and side front plate from pump shaft. Remove short straight pin from side front plate and long straight pin from front housing.

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Fig. 3: Exploded View Of Power Steering Pump (RAV4)

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Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Inspection

1. Using micrometer, measure diameter of pump shaft. Using calipers, measure diameter of pump housing shaft bushing. Determine amount of clearance. Clearance should be .0012-.0020" (.030-.050 mm). Clearance should not exceed .0028" (.071 mm). If clearance exceeds maximum specification, replace front housing and pump shaft.
2. Using micrometer, measure height, thickness and length of 10 vane plates. See **VANE PLATE SPECIFICATIONS** table. Use feeler gauge to measure clearance between rotor groove and plate. Maximum clearance is .0012" (.030 mm). If clearance exceeds maximum, replace plate and/or rotor with one having same mark stamp of "1", "2", "3", "4" or no marking.
3. Coat flow control valve with power steering fluid and check that it falls smoothly into valve hole on its own weight.
4. Check flow control valve for leakage by closing one hose and applying 57-71 psi (4-5 kg/cm²) air pressure to opposite hole. Air should NOT come out hole on end of valve. If valve does not respond as indicated, replace valve with one having same letter mark as on front housing and/or on valve.
5. Using calipers, measure free length of flow control valve spring. Minimum free length is 1.42" (36.0 mm). If not within specification, replace spring.
6. If necessary, replace oil seal. Coat NEW seal lip with power steering fluid and carefully press NEW oil seal into position. Ensure seal is in same direction as removed.

VANE PLATE SPECIFICATIONS

Application	In. (mm)
RAV4	
Height	.319 (8.1)
Length	.59008 (14.988)
Thickness	.0707 (1.796)
Land Cruiser, Sienna, Tacoma, Tundra & 4Runner	
Height	.339 (8.6)
Length	.5902 (14.991)
Thickness	.0550 (1.397)

Reassembly

1. Coat all internal components with power steering fluid. Install long straight pin into front housing and short straight pin into side front plate.
2. Install 2 NEW "O" rings to side front plate. Coat "O" rings with power steering fluid. Install front plate to pump shaft. Install rotor to pump shaft with mark facing outward. Install NEW snap ring to pump shaft.
3. Align hole of plate and longer straight pin, and tap shaft into place with soft-face hammer. Use care not to damage oil seal and "O" rings. Align holes of cam ring and 2 straight pins, and install cam ring with mark facing outward. Install 10 vane plates, with round end facing outward.
4. Coat a NEW "O" ring with power steering fluid. Install "O" ring to side rear plate. Align holes on plate and 2 straight pins, and install plate. Install wave washer so protrusions fit into slots in side rear plate.

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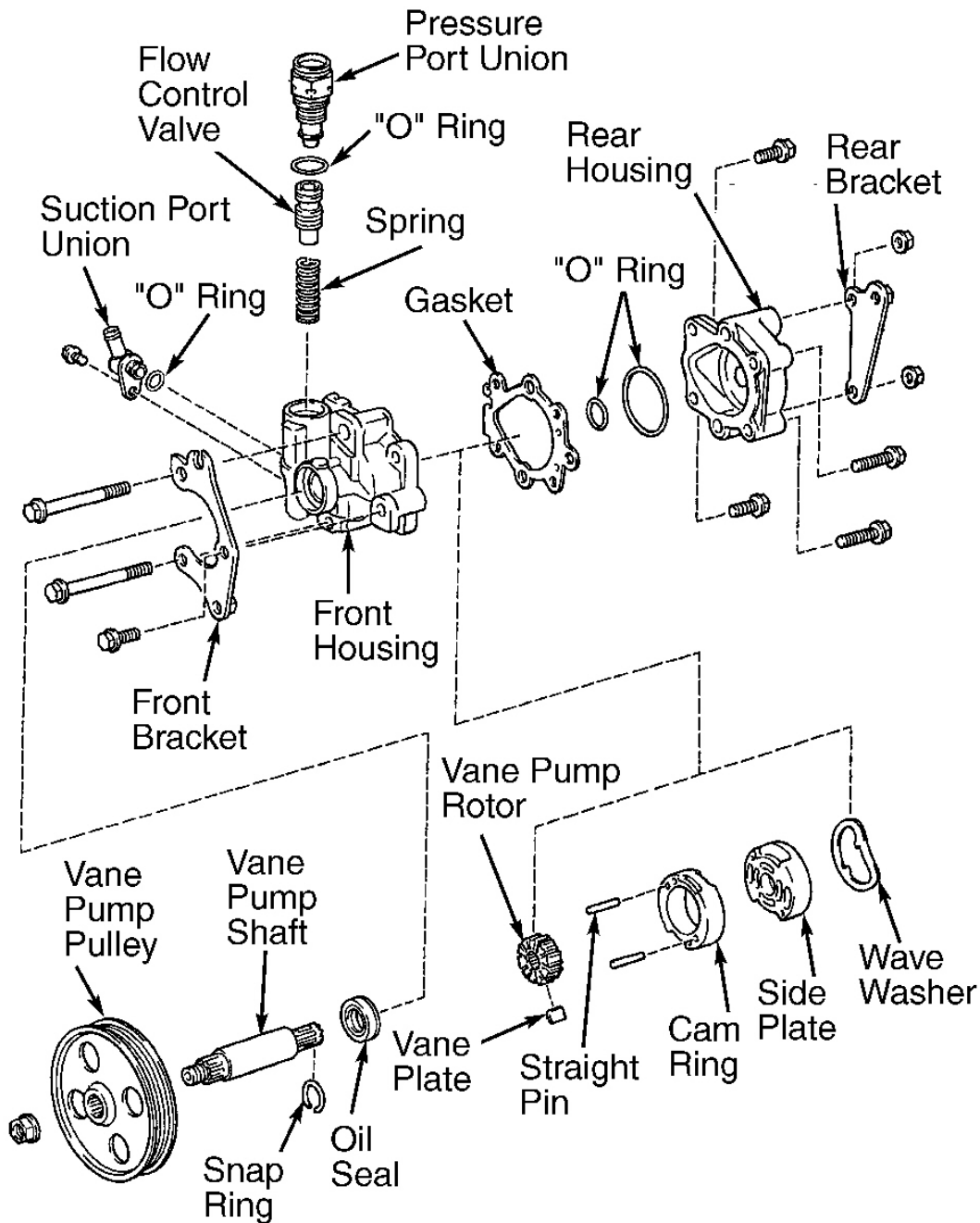
5. Coat a NEW "O" ring with power steering fluid. Install "O" ring into pump rear housing. Using soft-face hammer, tap rear housing to front housing. Install NEW snap ring.
6. Coat a NEW "O" ring with power steering fluid. Install "O" ring to flow control spring seat. Using same bolt for removal, thread into spring seat a small amount. Install spring seat to front housing. Remove bolt. Install NEW snap ring.
7. Install flow control spring and valve. Ensure valve is facing correct direction. Coat a NEW "O" ring with power steering fluid. Install "O" ring to pressure port union. Tighten union to specification. See **TORQUE SPECIFICATIONS** .
8. Coat a NEW "O" ring with power steering fluid. Install "O" ring to suction (return) port union. Install union with bolt, and tighten to specification. See **TORQUE SPECIFICATIONS** . Install pressure feed No. 2 tube.
9. Tighten pressure feed line union bolt, with NEW gasket on each side of line. Tighten to specification. See **TORQUE SPECIFICATIONS** . Pressure feed line installation angle is 2.5 degrees from straight-up position.
10. Install NEW union seat for air control valve. Install and tighten valve to specification. See **TORQUE SPECIFICATIONS** .
11. Install Woodruff key to pump shaft. Position and hold pulley while installing and tightening pulley nut. See **TORQUE SPECIFICATIONS** .
12. Install pump brackets. Measure pump rotating torque. Using a torque wrench, check pump rotating torque. Rotating torque should be 2.4 INCH lbs. (.3 N.m) or less.

Disassembly (Sienna)

1. Mount pump assembly in soft-jaw vise. Ensure pump rotates smoothly. Using a torque wrench, check pump rotating torque. Rotating torque should be 2.4 INCH lbs. (.3 N.m) or less.
2. While holding pulley, remove pulley nut. Remove pulley from pump shaft. Remove front and rear mounting brackets.
3. Remove union bolt and "O" ring from suction (return) port. Remove "O" ring from pressure port. Remove flow control valve and spring. See **Fig. 4** .
4. Remove rear housing bolts and 2 "O" rings. Remove wave washer, side plate and gasket.
5. Remove cam ring and 10 vane plates. See **Fig. 4** . Remove snap ring and remove pump rotor. Remove pump shaft. Remove 2 straight pins from front housing.

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Fig. 4: Exploded View Of Power Steering Pump (Sienna)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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1. Using micrometer, measure diameter of pump shaft. Using calipers, measure diameter of pump housing shaft bushing. Determine amount of clearance. Clearance should be .0012-.0020" (.030-.050 mm). Clearance should not exceed .0028" (.071 mm). If clearance exceeds maximum specification, replace front housing and pump shaft.
2. Using micrometer, measure height, thickness and length of 10 vane plates. See **VANE PLATE SPECIFICATIONS** table. Use feeler gauge to measure clearance between rotor groove and plate. Maximum clearance is .0014" (.035 mm). If clearance exceeds maximum, replace plate and/or rotor with one having same mark stamp of "1", "2", "3", "4" or no marking.
3. Coat flow control valve with power steering fluid and check that it falls smoothly into valve hole on its own weight.
4. Check flow control valve for leakage by closing one hole and applying 57-71 psi (4-5 kg/cm²) air pressure to opposite hole. Air should NOT come out hole on end of valve. If valve does not respond as indicated, replace valve with one having same letter mark as on front housing and/or on valve.
5. Using calipers, measure free length of flow control valve spring. Minimum free length is 1.272" (32.3 mm). If not within specification, replace spring.
6. If necessary, remove oil seal from housing. Coat NEW seal lip with power steering fluid and carefully press NEW oil seal into position. Ensure seal is in same direction as removed.

Reassembly

1. Coat all internal components with power steering fluid. Install pump shaft. Install 2 NEW straight pins into front housing.
2. Align holes of cam ring and 2 straight pins, and install cam ring with mark facing outward. Install pump rotor with mark facing outward. Install NEW snap ring on pump shaft. Install 10 vane plates, with round end facing outward.
3. Install a NEW gasket on housing. Install side plate. Install wave washer so protrusions fit into slots in side plate.
4. Coat 2 NEW "O" rings with power steering fluid. Install "O" rings into pump rear housing. Install rear housing and tighten bolts to specification. See **TORQUE SPECIFICATIONS**.
5. Install flow control spring and valve. Ensure valve is facing correct direction. Coat a NEW "O" ring with power steering fluid. Install "O" ring to pressure port union. Tighten union to specification. See **TORQUE SPECIFICATIONS**.
6. Coat a NEW "O" ring with power steering fluid. Install "O" ring to suction (return) port union. Tighten union bolt to specification. See **TORQUE SPECIFICATIONS**.
7. Install pump brackets. Position and hold pump pulley and install nut. Tighten nut to specification. See **TORQUE SPECIFICATIONS**. Measure pump rotating torque. Using a torque wrench, check pump rotating torque. Rotating torque should be 2.4 INCH lbs. (.3 N.m) or less.

Disassembly (Tacoma & 4Runner 4-Cylinder)

1. Mount pump assembly in soft-jaw vise. Ensure pump rotates smoothly. Using a torque wrench, check pump rotating torque. Rotating torque should be 2.4 INCH lbs. (.3 N.m) or less.
2. While holding pulley, remove pulley nut. Remove pulley from pump shaft. Remove fluid reservoir. Remove and discard "O" ring.

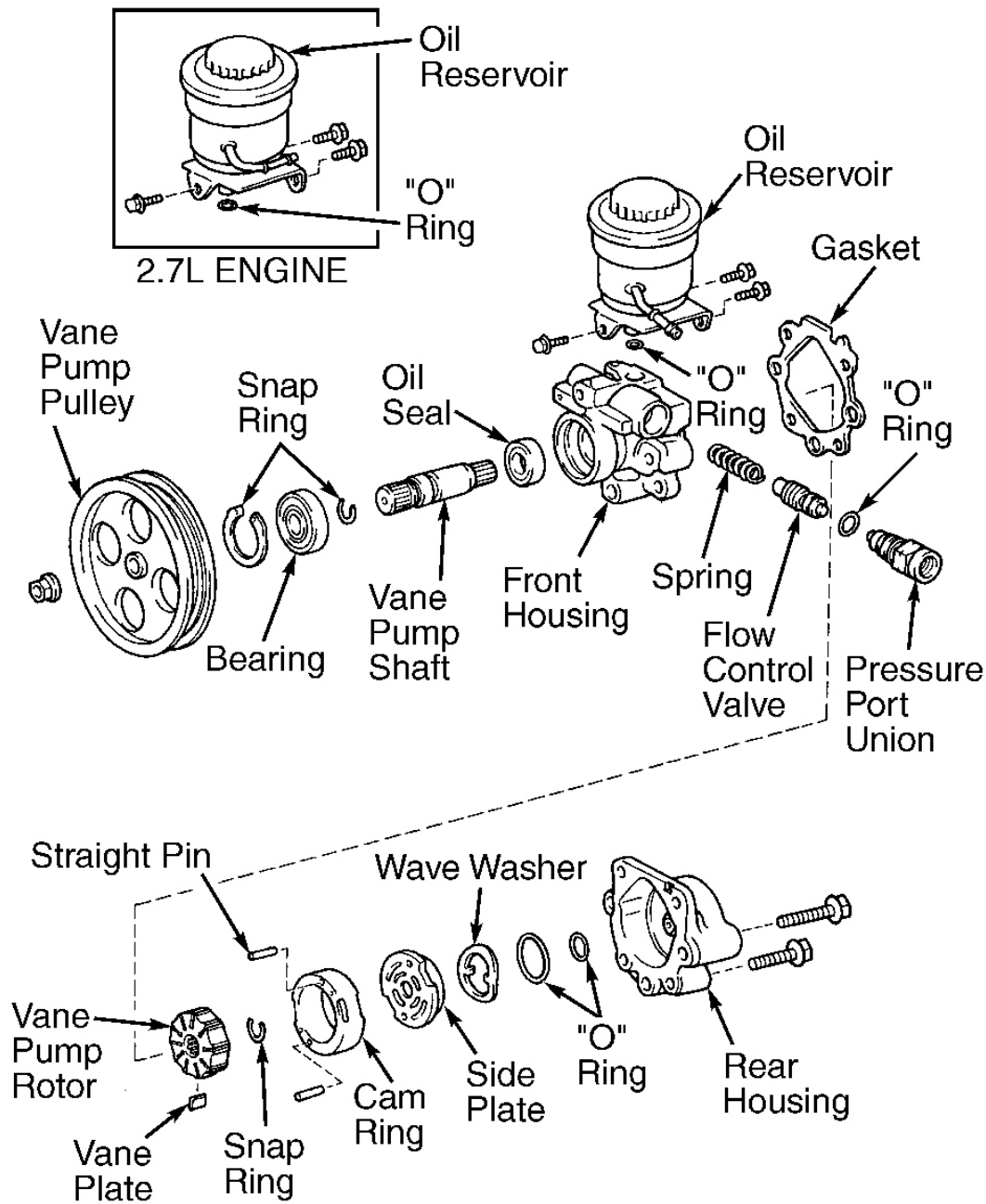
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3. Remove union bolt and "O" ring from pressure port. Remove flow control valve and spring. See **Fig. 5** . Remove pump bracket.
4. Remove rear housing bolts and 2 "O" rings. Remove wave washer, side plate and gasket.
5. Remove cam ring and 10 vane plates. See **Fig. 5** . Remove snap ring and pump rotor. Remove pump shaft. Remove 2 straight pins from front housing.

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Fig. 5: Exploded View Of Power Steering Pump (Tacoma & 4Runner 4-Cylinder)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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1. Using micrometer, measure diameter of pump shaft. Using calipers, measure diameter of pump housing shaft bushing. Determine amount of clearance. Clearance should be .0012-.0020" (.030-.050 mm). Clearance should not exceed .0028" (.071 mm). If clearance exceeds maximum specification, replace front housing and pump shaft.
2. Using micrometer, measure height, thickness and length of 10 vane plates. See **VANE PLATE SPECIFICATIONS** table. Use feeler gauge to measure clearance between rotor groove and plate. Maximum clearance is .0014" (.035 mm). If clearance exceeds maximum, replace plate and/or rotor with one having same mark stamp of "1", "2", "3", "4" or no marking.
3. Coat flow control valve with power steering fluid, and check that it falls smoothly into valve hole on its own weight.
4. Check flow control valve for leakage by closing one hose and applying 57-71 psi (4-5 kg/cm²) air pressure to opposite hole. Air should NOT come out hole on end of valve. If valve does not respond as indicated, replace valve with one having same letter mark as on front housing and/or on valve.
5. Using calipers, measure free length of flow control valve spring. Minimum free length is 1.307" (33.2 mm). If not within specification, replace spring.
6. If necessary, replace oil seal in front housing. Coat NEW seal lip with power steering fluid and carefully press NEW oil seal into position. Ensure seal is in same direction as removed.
7. If necessary, replace pump shaft bearing. Press old bearing off of shaft. Remove snap ring. Install NEW snap ring. Coat NEW bearing with power steering fluid. Press bearing onto shaft.

Reassembly

1. Coat all internal components with power steering fluid. Cover serrated part of shaft with vinyl tape. Press pump shaft with bearing into housing. Install NEW snap ring in front housing. Install 2 NEW straight pins into front housing.
2. Align holes of cam ring and 2 straight pins, and install cam ring with mark facing outward. Install pump rotor with mark facing outward. Install NEW snap ring on pump shaft. Install 10 vane plates, with round end facing outward.
3. Install a NEW gasket on front housing. Install side plate, aligning holes with straight pins. Install wave washer so protrusions fit into slots in side plate.
4. Coat 2 NEW "O" rings with power steering fluid. Install "O" rings into pump rear housing. Install rear housing and tighten bolts to specification. See **TORQUE SPECIFICATIONS** .
5. Install flow control spring and valve. Ensure valve is facing correct direction. Coat a NEW "O" ring with power steering fluid. Install "O" ring to pressure port union. Tighten union to specification. See **TORQUE SPECIFICATIONS** .
6. Install fluid reservoir with NEW "O" ring. Tighten bolts to specification. See **TORQUE SPECIFICATIONS** .
7. Position and hold pump pulley, and install nut. Tighten nut to specification. See **TORQUE SPECIFICATIONS** . Measure pump rotating torque. Using a torque wrench, check pump rotating torque. Rotating torque should be 2.4 INCH lbs. (.3 N.m) or less.

Disassembly (Land Cruiser, Tacoma & 4Runner V6 & Tundra V6 & V8)

1. Mount pump assembly in soft-jaw vise. Ensure pump rotates smoothly. Using a torque wrench, check

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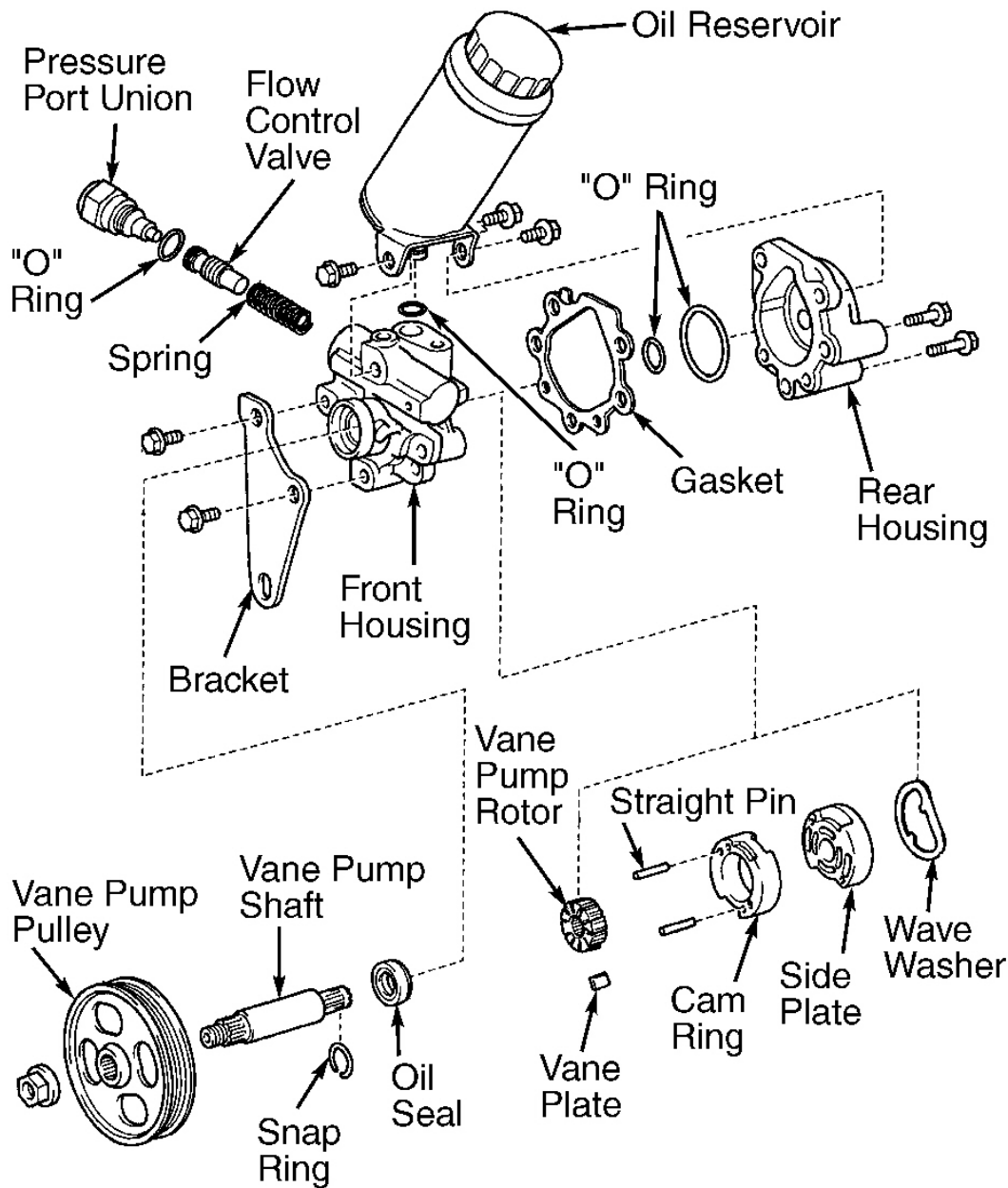
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pump rotating torque. Rotating torque should be 2.4 INCH lbs. (.3 N.m) or less.

2. While holding pulley, remove pulley nut. Remove fluid reservoir. Remove and discard "O" ring.
3. Remove union bolt and "O" ring from pressure port. Remove flow control valve and spring. See **Fig. 6** . Remove pump bracket.
4. Remove rear housing bolts and 2 "O" rings. Remove wave washer, side plate and gasket.
5. Remove cam ring and 10 vane plates. See **Fig. 6** . Remove snap ring and pump rotor. Remove pump shaft. Remove 2 straight pins from front housing.

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Fig. 6: Exploded View Of Power Steering Pump (Tacoma & 4Runner V6 Shown; Land Cruiser & Tundra Are Similar)

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Inspection

1. Using micrometer, measure diameter of pump shaft. Using calipers, measure diameter of pump housing

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shaft bushing. Determine amount of clearance. Clearance should be .0012-.0020" (.030-.050 mm). Clearance should not exceed .0028" (.071 mm). If clearance exceeds maximum, replace front housing and pump shaft.

2. Using micrometer, measure height, thickness and length of 10 vane plates. See **VANE PLATE SPECIFICATIONS** table. Use feeler gauge to measure clearance between rotor groove and plate. Maximum clearance is .0014" (.035 mm). If clearance exceeds maximum, replace plate and/or rotor with one having same mark stamp of "1", "2", "3", "4" or no marking.
3. Coat flow control valve with power steering fluid and check that it falls smoothly into valve hole on its own weight.
4. Check flow control valve for leakage by closing one hole and applying 57-71 psi (4-5 kg/cm²) air pressure to opposite hole. Air should NOT come out hole on end of valve. If valve does not respond as indicated, replace valve with one having same letter mark as on front housing and/or on valve.
5. Using calipers, measure free length of flow control valve spring. Minimum free length is 1.307" (33.2 mm). If not within specification, replace spring.
6. If necessary, remove oil seal from housing. Coat NEW seal lip with power steering fluid and carefully press NEW oil seal into position. Ensure seal is in same direction as removed.

Reassembly

1. Coat all internal components with power steering fluid. Install 2 NEW straight pins into front housing. Install pump shaft.
2. Align holes of cam ring and 2 straight pins. Install cam ring, with mark facing outward. Install pump rotor with mark facing outward. Install NEW snap ring on pump shaft. Install 10 vane plates, with round end facing outward.
3. Install a NEW gasket on front housing. Install side plate, aligning holes with straight pins. Install wave washer so protrusions fit into slots in side plate.
4. Coat 2 NEW "O" rings with power steering fluid. Install "O" rings into pump rear housing. Install rear housing and tighten bolts to specification. See **TORQUE SPECIFICATIONS** .
5. Install flow control spring and valve. Ensure valve is facing correct direction. Coat a NEW "O" ring with power steering fluid. Install "O" ring to pressure port union. Tighten union to specification. See **TORQUE SPECIFICATIONS** .
6. Install pump bracket. Install fluid reservoir. Tighten bolts to specification. See **TORQUE SPECIFICATIONS** .
7. Position and hold pump pulley and install nut. Tighten nut to specification. See **TORQUE SPECIFICATIONS** . Measure pump rotating torque. Using a torque wrench, check pump rotating torque. Rotating torque should be 2.4 INCH lbs. (.3 N.m) or less.

POWER RACK & PINION

Disassembly (RAV4)

NOTE: When removing oil seals, be sure to note direction seals are facing for reinstallation in same direction.

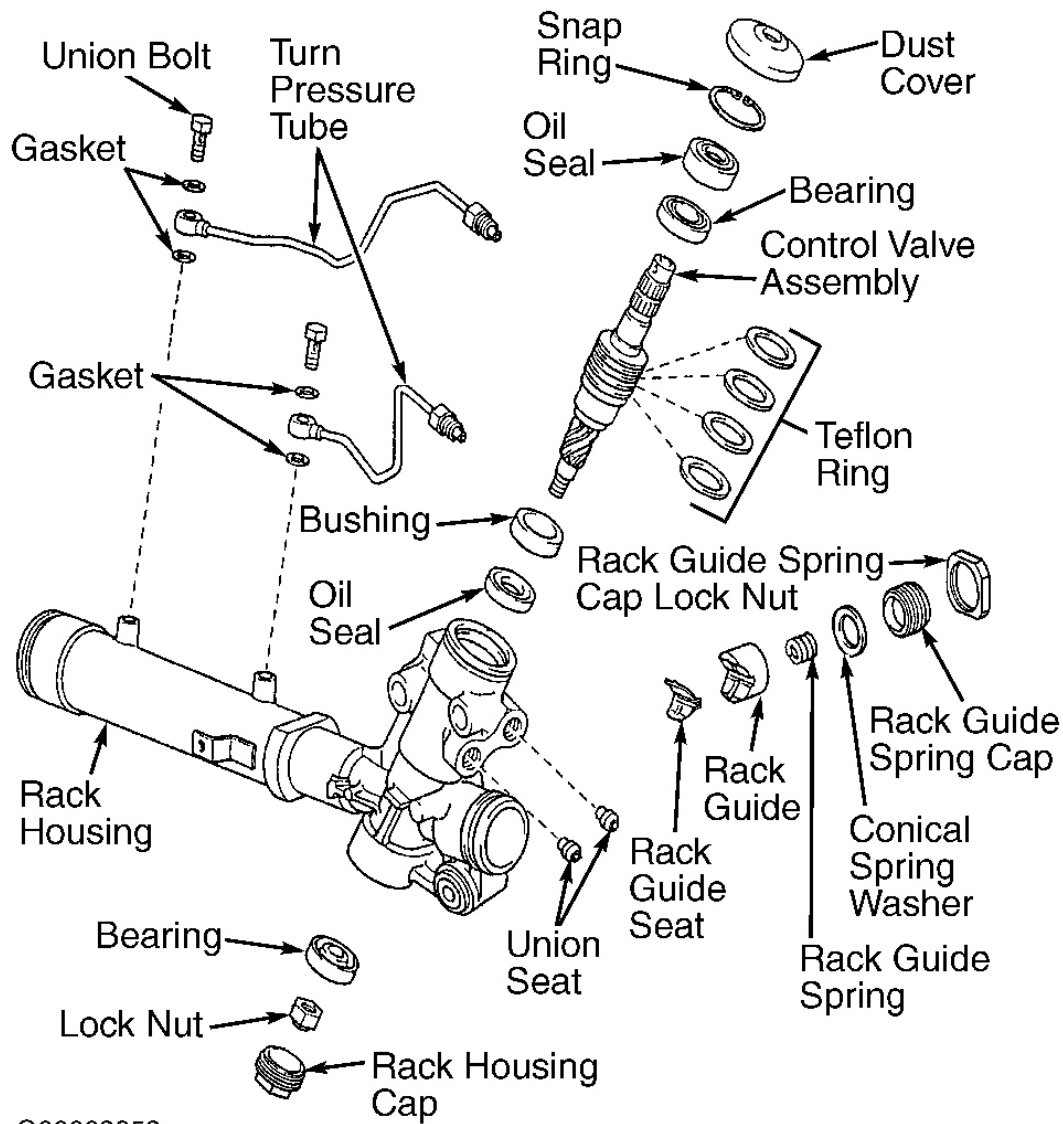
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1. Secure rack and pinion housing in soft-jaw vise (DO NOT over-tighten vise). Remove 2 turn pressure tube union bolts, gaskets and tubes. See **Fig. 7**.
2. Place reference marks on tie rod end and rack end. Loosen lock nut. Remove screw and loosen clamp. Mark and remove left and right side rack boots.
3. Unstake claw washer on both rack ends. See **Fig. 8**. Holding steering rack, use appropriate removal tool to remove rack ends. Mark left and right sides for proper reinstallation.
4. Place reference marks on mounting bracket and rack housing. Remove retaining bolt. Remove bracket and grommet.
5. Remove rack guide spring cap lock nut. See **Fig. 7**. Remove rack guide spring cap, spring, rack guide and seat. Remove seat from guide.
6. Remove rack housing cap from lower side of housing. Remove dust cover from upper side of housing. See **Fig. 7**.
7. Remove snap ring from inside rack housing, above control valve assembly. Using puller, remove control valve with oil seal and bearing. Remove oil seal and bearing from control valve.
8. Remove bearing from lower side of rack housing. Mount rack vertically in vise. Remove snap ring from end of rack housing. Press rack end stopper from rack housing. Remove oil seal from rack. See **Fig. 8**. Press oil seal from rack housing.

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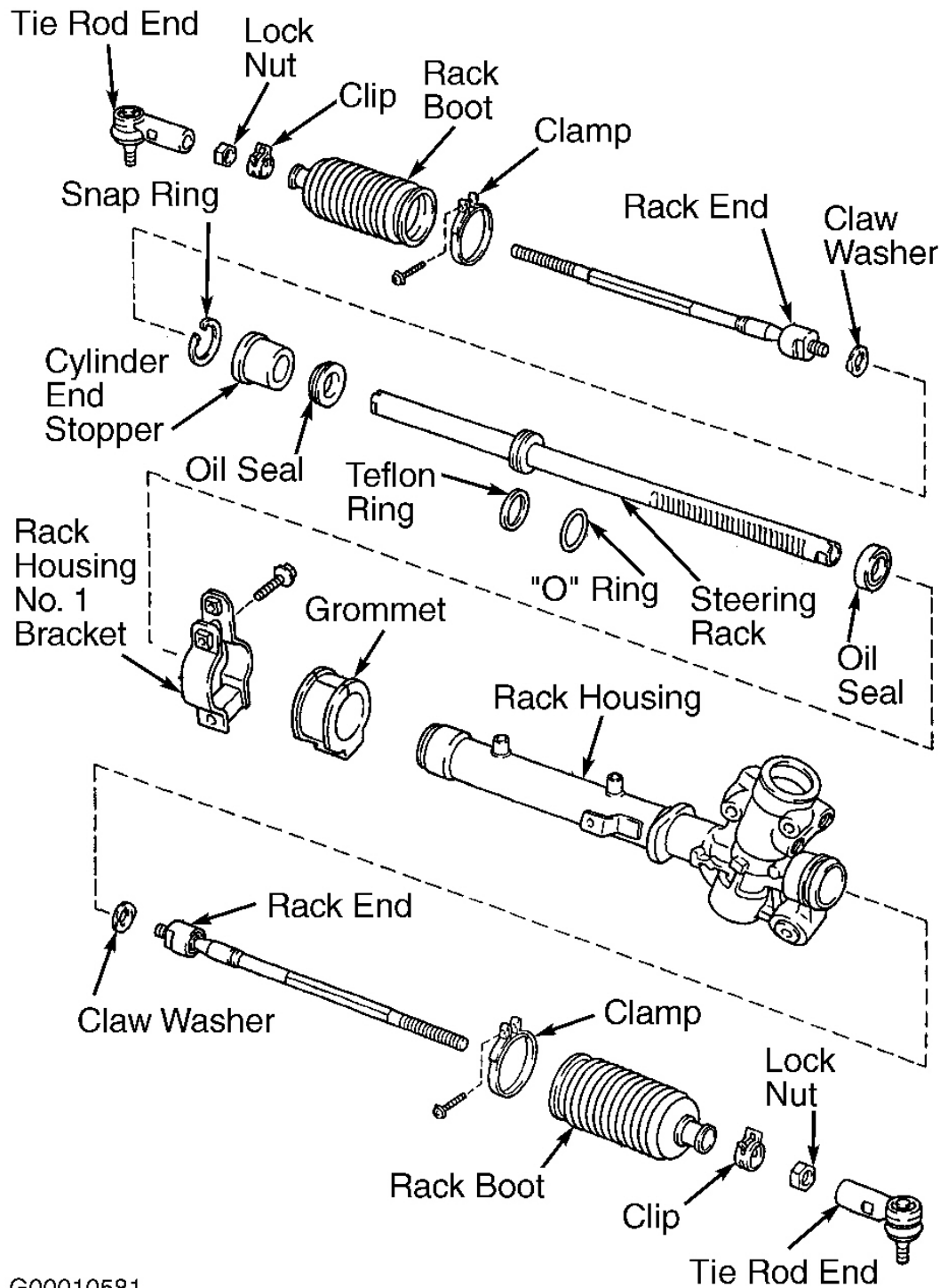


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Fig. 7: Exploded View Of Power Rack & Pinion Steering Gear Assembly (RAV4 - 1 Of 2)
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Fig. 8: Exploded View Of Power Rack & Pinion Steering Gear Assembly (RAV4 - 2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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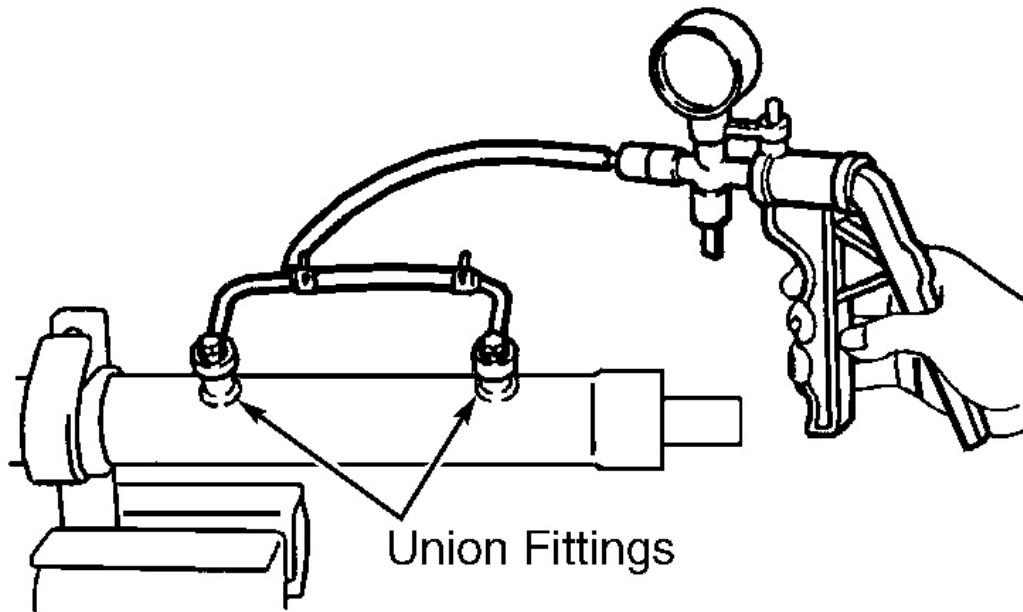
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Inspection

1. With rack mounted horizontally on "V" blocks, use dial indicator to measure rack runout. Runout should not exceed .012" (.3 mm). Check rack and teeth for wear and damage. Replace rack if necessary.
2. Using cylinder gauge, measure inside diameter of rack housing bushing. Maximum diameter should not exceed 1.11" (28.2 mm). Using micrometer, measure outside diameter of control valve. Minimum diameter should not exceed 1.09" (27.69 mm). Replace components if necessary.
3. If necessary, use puller to extract bushing from rack housing. Using screwdriver, carefully tap oil seal upward out of rack housing. Coat NEW seal lip with power steering fluid. Using seal installer, carefully tap NEW seal into place from upper side of rack housing. Make sure oil seal is facing same direction as removed.
4. Coat NEW bushing with molybdenum disulfide lithium-base grease. Using press, install bushing against oil seal in rack housing.
5. If necessary, use screwdriver to remove Teflon ring and "O" ring from steering rack. Coat NEW "O" ring with power steering fluid. Install "O" ring. Carefully expand NEW Teflon ring by hand, only enough to accommodate installation. Coat Teflon ring with power steering fluid. Press ring into rack groove. Use ring installer to fully seat ring.
6. If necessary, use screwdriver to remove 4 Teflon rings from control valve assembly. Coat NEW rings with power steering fluid. Slightly expand rings by hand, and install in each groove. Use installer tool to slide over rings and fully seat them.
7. If necessary, use screw extractor to remove 2 union seats from rack housing. See **Fig. 7** . Use drift and hammer to tap in 2 NEW union seats.
8. Check cylinder end stopper bushing for wear or damage. If necessary, replace cylinder end stopper (bushing is not replaceable separately). Coat inside of bushing with molybdenum disulfide lithium-base grease.

Reassembly

1. With rack housing mounted vertically in soft-jaw vise, coat NEW seal with power steering fluid, and press into rack housing from end opposite control valve housing portion. See **Fig. 8** . Ensure oil seal faces in proper direction.
2. Mount rack housing horizontally in vise. Clean rack teeth of any burrs. Place protective end piece on steering rack teeth end. Coat protective sleeve with power steering fluid. Install steering rack into rack housing. Remove protective sleeve.
3. Coat NEW oil seal lip with power steering fluid. Wrap tape on end of steering rack (opposite of control valve housing end). Push oil seal evenly into rack housing. See **Fig. 8** .
4. Install end stopper into rack housing. Install NEW snap ring.
5. Install special connectors onto union fittings of rack housing, and attach hand vacuum pump. Apply 15.75" Hg for about 30 seconds. Ensure there is no vacuum leak. If leak exists, check installation of oil seals at each end of housing. See **Fig. 9** .

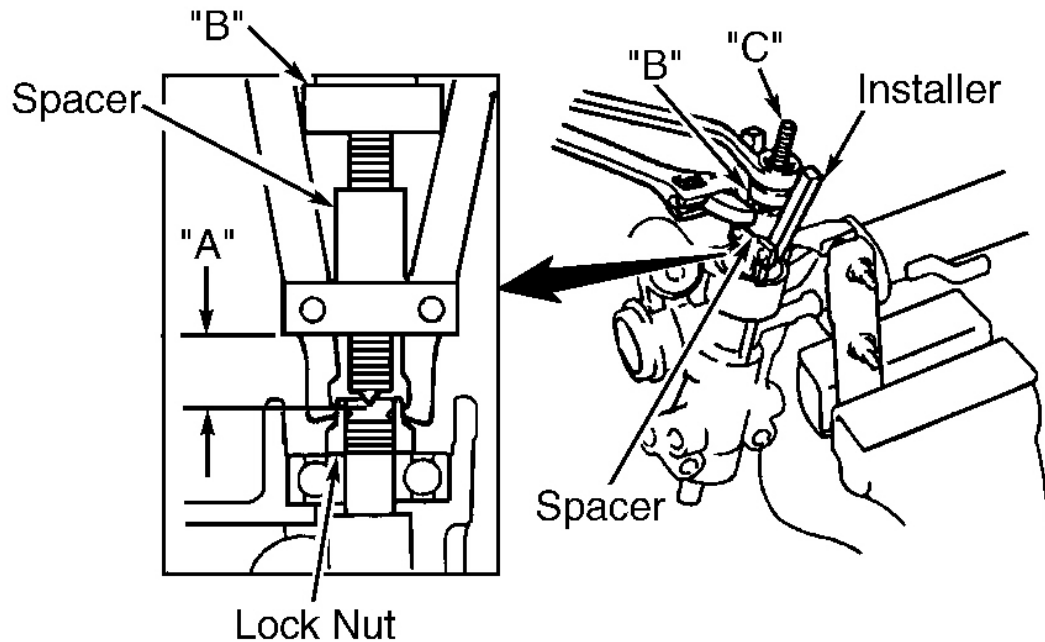


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Fig. 9: Performing Air Tightness Check

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6. Coat Teflon rings with power steering fluid. Install control valve assembly into rack housing. Press NEW bearing into place on top of control valve. Press NEW oil seal into place after coating lip with power steering fluid. Install NEW snap ring. See **Fig. 7** . Install dust cover.
7. Press NEW bearing into lower side of rack housing. Install lock nut onto lower end of control valve assembly. Tighten to specification. See **TORQUE SPECIFICATIONS** . Using installer tool, box wrench and crescent wrench, turn "C" to set dimension "A" to .65-.67" (16.5-17.0 mm). Stake nut by turning part "B" until it touches spacer of installer tool. See **Fig. 10** .



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Fig. 10: Installing & Setting Control Valve Lock Nut (RAV4)

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8. Apply thread lock sealant to 2-3 threads of rack housing cap. Install and tighten cap to specification. See **TORQUE SPECIFICATIONS** .
9. Install rack guide seat to guide. Install guide, spring, washer and cap. Temporarily tighten cap.
10. Temporarily install both rack ends. Using 21-mm wrench, tighten rack guide spring cap to 18 ft. lbs. (24 N.m). Loosen cap by 12 degrees. Using torque wrench on top end of control valve stem, turn stem right and left 1-2 times. Using 21-mm wrench, loosen rack guide spring cap until rack guide spring is not functioning. Tighten control valve stem and rack guide spring cap until preload is within 6.9-11.3 INCH lbs. (0.8-1.3 N.m), measured with torque wrench on control valve stem. See **Fig. 11** .

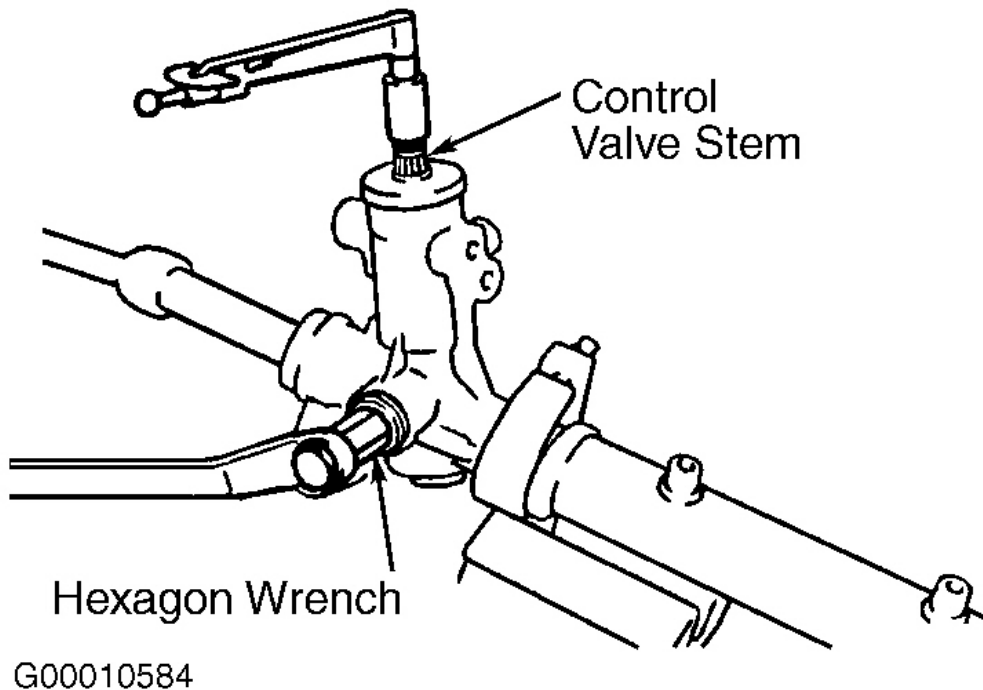


Fig. 11: Setting Assembly Preload (RAV4)

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11. Apply thread lock sealant to rack guide spring cap lock nut. Using 21-mm wrench to hold spring cap from rotating, use torque wrench to tighten lock nut to specification. See **TORQUE SPECIFICATIONS** . Recheck preload.
12. Remove both rack ends. Install NEW claw washers on each end of rack. Align claws with grooves in rack. Install rack ends. Hold rack from turning and tighten rack ends to 44 ft. lbs. (60 N.m). Stake claw washers.
13. Install grommet in rack housing mounting bracket No. 1. Align reference marks, and install bracket. Tighten retaining bolt to specification. See **TORQUE SPECIFICATIONS** .
14. Ensure steering rack hole (next to rack end) is not clogged with grease. Clean as necessary. Install boots, clamps and clips. Tighten clamp bolts until there is .08" (2.0 mm) clearance between clamp ends.
15. Screw tie rod end lock nut onto tie rod until reference marks are aligned. Install left and right tie rod ends. After adjusting toe-in, tighten lock nuts to specification. See **TORQUE SPECIFICATIONS** .
16. Install 2 turn pressure tubes. Use NEW gaskets on union fittings. Tighten fittings to specification. See **TORQUE SPECIFICATIONS** .

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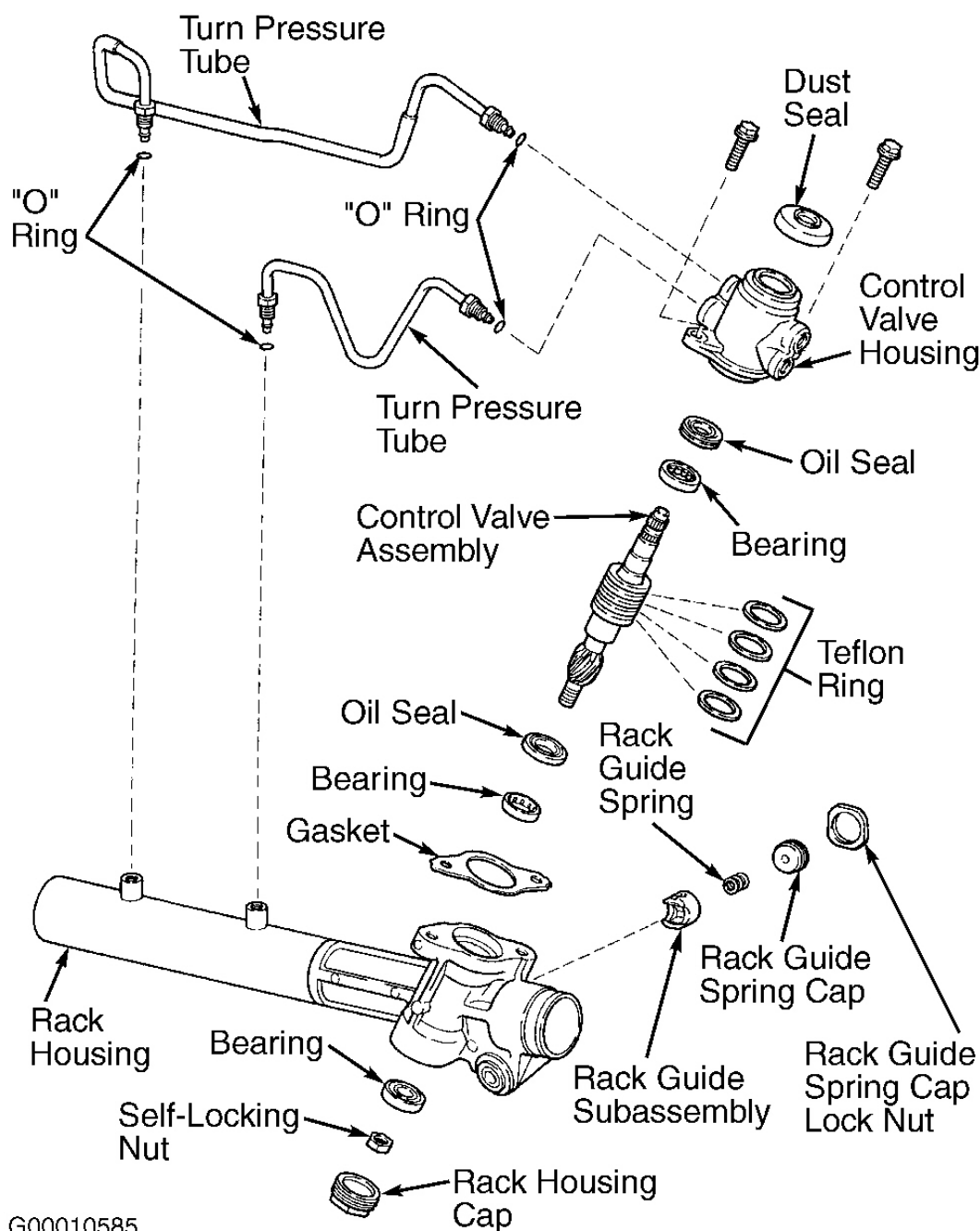
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NOTE: When removing oil seals, be sure to note direction seals are facing for reinstallation in same direction.

1. Secure rack and pinion housing in soft-jaw vise (DO NOT over-tighten vise). Remove 2 turn pressure tubes and "O" rings. See **Fig. 12** .
2. Place reference marks on tie rod end and rack end. Loosen lock nut. Remove screw and loosen clamp. Mark and remove left and right side rack boots.
3. Unstake claw washer on both rack ends. See **Fig. 13** . Holding steering rack, remove rack ends. Mark left and right sides for proper reinstallation. Remove washers.
4. Remove rack guide spring cap lock nut. See **Fig. 12** . Remove rack guide spring cap, spring and rack guide sub-assembly.
5. Remove rack housing cap from lower side of housing. Hold shaft from rotating, and remove self-locking nut from top end of control valve shaft. Remove dust cover from upper side of housing. See **Fig. 12** .
6. Place reference marks on valve housing and rack housing. Remove mounting bolts, valve housing and gasket. Tape serrated end of valve shaft. Invert housing on protected blocks and press control valve assembly, with oil seal, out of housing. Remove oil seal from control valve assembly.
7. Place reference marks on No. 2 mounting bracket and rack housing. Pry bracket clamp apart, and remove bracket and grommet.
8. Remove cylinder end stopper, turning clockwise, until wire end is visible in service hole. Turn cylinder end stopper counterclockwise and remove wire. See **Fig. 13** and **Fig. 14** .

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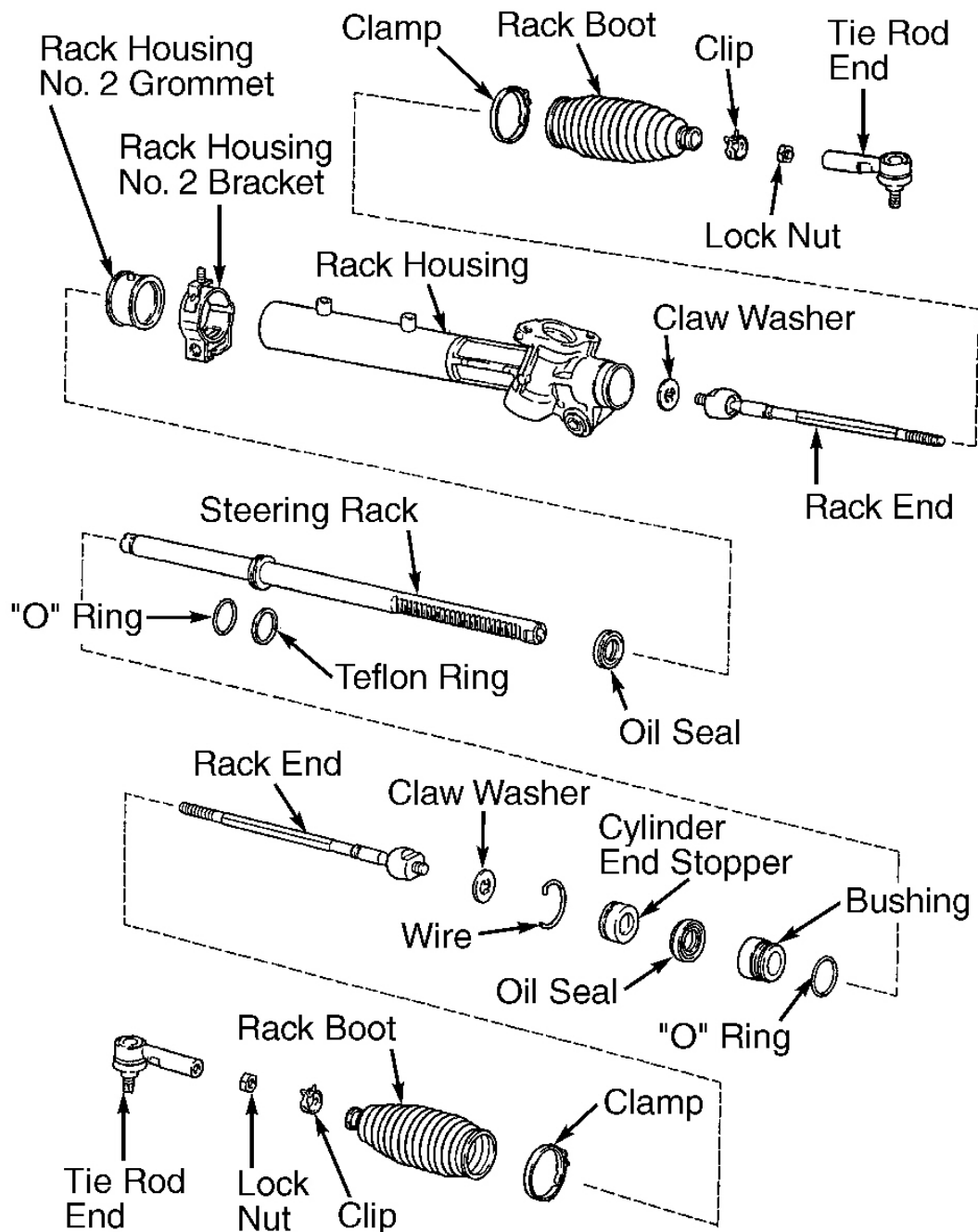


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Fig. 12: Exploded View Of Power Rack & Pinion Steering Gear Assembly (Sienna - 1 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

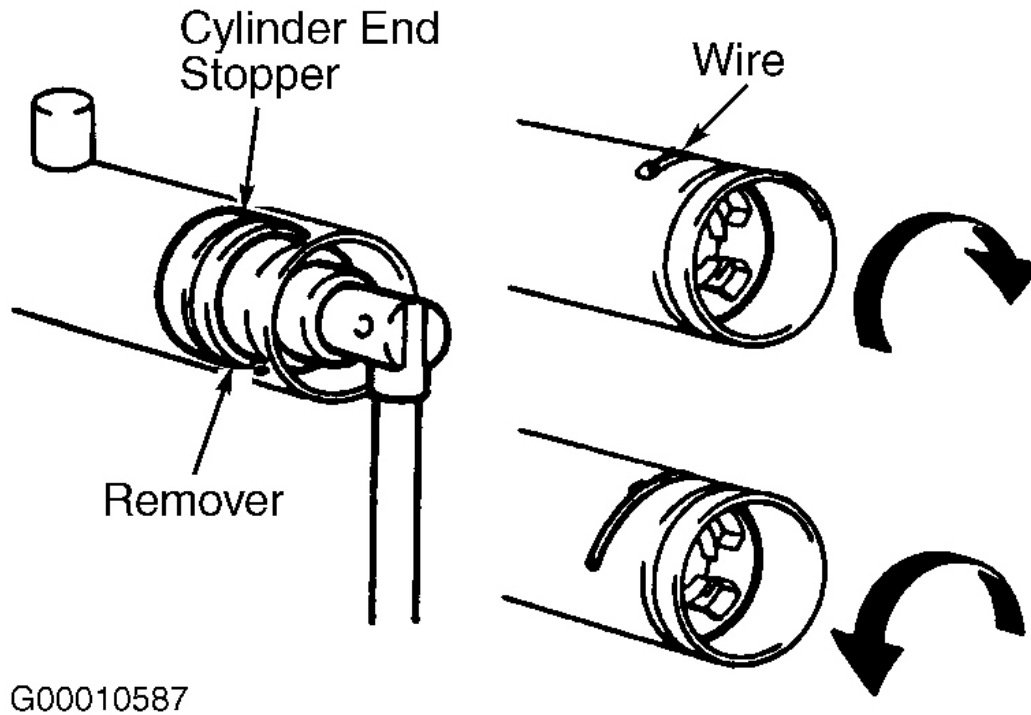
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Fig. 13: Exploded View Of Power Rack & Pinion Steering Gear Assembly (Sienna - 2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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Fig. 14: Removing Cylinder End Stopper (Sienna)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. Using brass bar and hammer, tap rack and bushing out of housing. Remove bushing from rack. Remove "O" ring from bushing. See **Fig. 13** . Press oil seal from rack housing.

Inspection

1. With rack mounted horizontally on "V" blocks, use dial indicator to measure rack runout. Runout should not exceed .012" (.30 mm). Check rack and teeth for wear and damage. Replace rack if necessary.
2. If necessary, press oil seal and bearing from control valve housing. Coat NEW seal lip with power steering fluid. Press seal into place. Ensure oil seal is facing same direction as removed.
3. Coat NEW bushing with molybdenum disulfide lithium-base grease. Using press, install bearing against oil seal in rack housing.
4. If necessary, use brass bar and hammer to tap lower bearing out of rack housing. See **Fig. 12** . Turn housing over, and use press to press upper bearing out of rack housing.
5. If necessary, use puller to remove oil seal from rack end bushing. See **Fig. 12** . Coat NEW oil seal lip with power steering fluid. Press seal into bushing.
6. If necessary, use screwdriver to remove Teflon ring and "O" ring from steering rack. Coat NEW "O" ring with power steering fluid. Install "O" ring. Carefully expand NEW Teflon ring by hand, only enough to

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accommodate installation. Coat Teflon ring with power steering fluid. Press ring firmly into rack groove.

7. If necessary, use screwdriver to remove 4 Teflon rings from control valve assembly. Coat NEW rings with power steering fluid. Slightly expand rings by hand and install in each groove. Use installer tool to slide over rings and fully seat them.

Reassembly

1. With rack housing mounted vertically in soft-jaw vise, coat NEW seal with power steering fluid, and press into rack housing from end opposite control valve housing portion. See **Fig. 13** . Ensure oil seal faces in proper direction.
2. Mount rack housing horizontally in vise. Clean rack teeth of any burrs. Place protective end piece on steering rack teeth end. Coat protective sleeve with power steering fluid. Install steering rack into rack housing. Remove protective sleeve.
3. Coat NEW "O" ring with power steering fluid. Install "O" ring on rack end bushing. Wrap tape on end of steering rack (opposite of control valve housing end). Install bushing into rack housing. See **Fig. 12** .
4. Align hole for wire of cylinder end stopper with slot of rack housing. Use installer tool and turn stopper clockwise 400-500 degrees. See **Fig. 13** .
5. Install special connectors onto union fittings of rack housing and attach hand vacuum pump. Apply 15.75" Hg for about 30 seconds. Ensure there is no vacuum leak. If there is, check installation of oil seals at each end of housing. See **Fig. 9** .
6. Install grommet into rack housing bracket. Align nub on grommet with hole in bracket. Place bracket in vise, and tighten clamp in place.
7. Wrap serrated end of control valve shaft with tape. Coat Teflon rings with power steering fluid. Install control valve assembly into rack housing. Press NEW oil seal into place after coating lip with power steering fluid.
8. Place NEW gasket on rack housing. Align reference marks and position valve housing to rack housing. Install and tighten bolts to specifications. See **TORQUE SPECIFICATIONS** .
9. Hold control valve shaft bottom end to prevent turning. Install NEW self-locking nut on top end of shaft. Tighten to specifications. See **TORQUE SPECIFICATIONS** . Install dust cover.
10. Apply thread lock sealant to 2-3 threads of rack housing cap. Install and tighten cap to specification. See **TORQUE SPECIFICATIONS** . Stake cap in 2 places.
11. Apply thread lock sealant to 2-3 threads of rack guide spring cap. Install rack guide sub-assembly, spring and cap. Temporarily tighten cap.
12. Temporarily install both rack ends. Tighten rack guide cap to 18 ft. lbs. (24 N.m). Using wrench on rack guide cap, loosen cap by 12 degrees. Using torque wrench on top end of control valve stem, turn stem right and left 1-2 times. Using wrench, loosen rack guide spring cap until rack guide spring is not functioning. Tighten rack guide spring cap until preload is within 6.9-12.2 INCH lbs. (0.8-1.4 N.m), measured with torque wrench on control valve stem.
13. Apply thread lock sealant to rack guide spring cap lock nut. Using wrench to hold spring cap from rotating, use torque wrench to tighten lock nut to specification. See **TORQUE SPECIFICATIONS** . Recheck preload.
14. Remove both rack ends. Install NEW claw washers on each end of rack. Align claws with grooves in rack. Install rack ends. Hold rack from turning, and tighten rack ends to 44 ft. lbs. (60 N.m). Stake claw washers.

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15. Ensure steering rack hole (next to rack end) is not clogged with grease. Clean as necessary. Install boots and clamps. Pinch clamps until there is .08" (2.0 mm), or less, clearance between clamp ends.
16. Screw tie rod end lock nut onto tie rod until reference marks are aligned. Install left and right tie rod ends. After adjusting toe-in, tighten lock nuts to specification. See **TORQUE SPECIFICATIONS** .
17. Install 2 NEW "O" rings, coated with power steering fluid, and 2 turn pressure tubes. Tighten fittings to specification. See **TORQUE SPECIFICATIONS** .

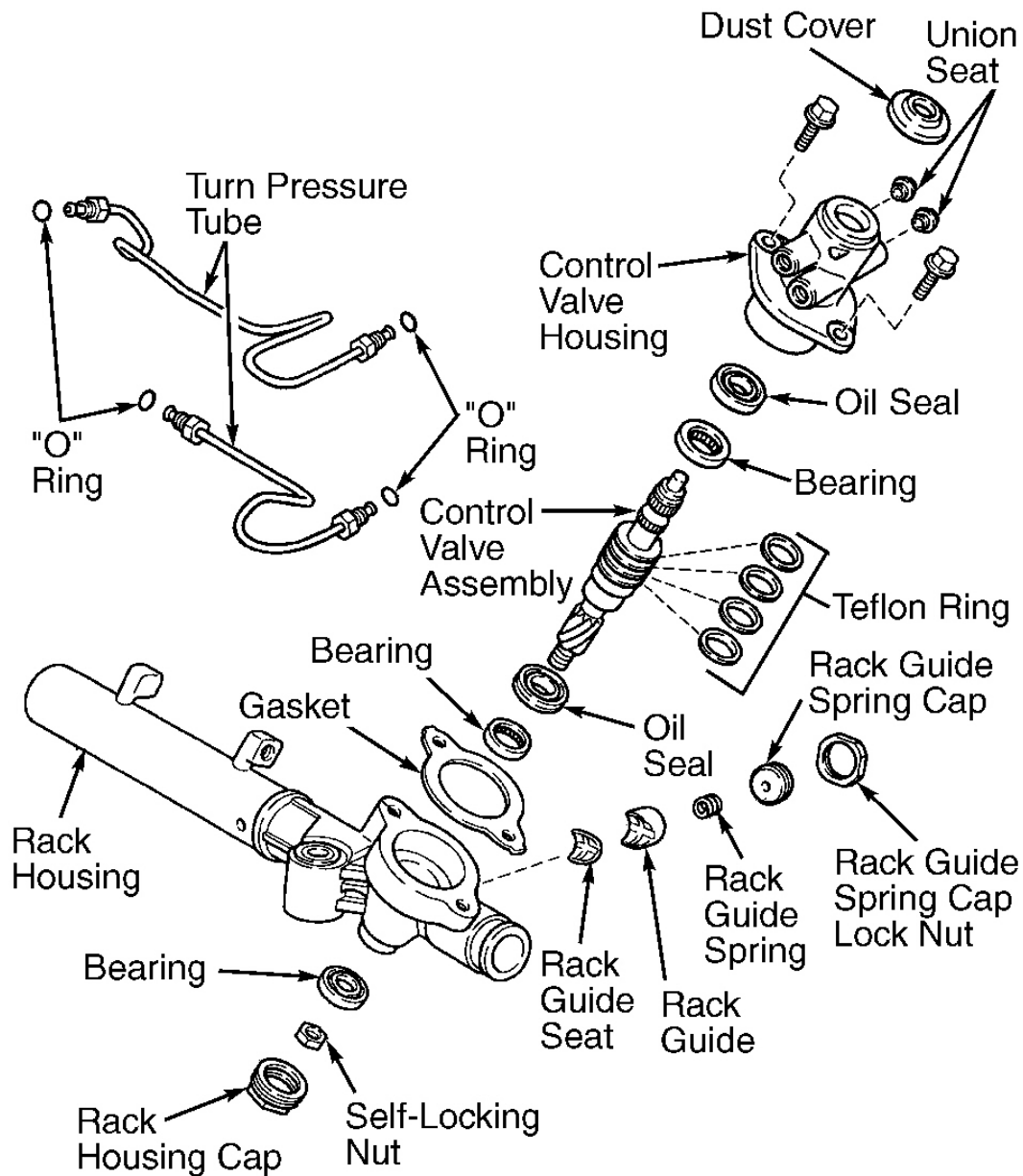
Disassembly (Tacoma 2WD)

NOTE: **When removing oil seals, be sure to note direction seals are facing for reinstallation in same direction.**

1. Secure rack and pinion housing in soft-jawed vise (DO NOT over-tighten vise). Remove 2 turn pressure tubes and 4 "O" rings. See **Fig. 15** .
2. Place reference marks on tie rod end and rack end, across lock nut. Remove lock nuts and tie rod ends. Loosen boot clamps. Mark and remove left and right side rack boots.
3. Unstake claw washer on both rack ends. See **Fig. 16** . Holding steering rack, use appropriate removal tool to remove rack ends. Mark left and right sides for proper reinstallation.
4. Place reference marks on mounting bracket and rack housing. Remove retaining bolt, bracket and grommet.
5. Remove rack guide spring cap lock nut. See **Fig. 15** . Remove rack guide spring cap, spring, rack guide and seat. Remove seat from guide.
6. Remove rack housing cap from lower side of housing. Remove self-locking nut from lower end of control valve shaft. Remove dust cover from upper side of housing. See **Fig. 15** .
7. Place reference marks on valve housing and rack housing. Remove mounting bolts and pull control valve assembly and housing from rack housing.
8. Tape serrated end of control valve shaft. Press control valve assembly and oil seal from housing. Remove oil seal from control valve.
9. Remove cylinder end stopper, turning clockwise, until wire end is visible in service hole. Turn cylinder end stopper counterclockwise and remove wire. See **Fig. 14** .
10. Using an extension bar and 19-mm socket wrench, press steering rack and bushing from housing. Remove bushing from rack. Remove "O" ring from bushing. Press oil seal from rack housing. See **Fig. 16** .

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Fig. 15: Exploded View Of Power Rack & Pinion Steering Gear Assembly (Tacoma 2WD - 1 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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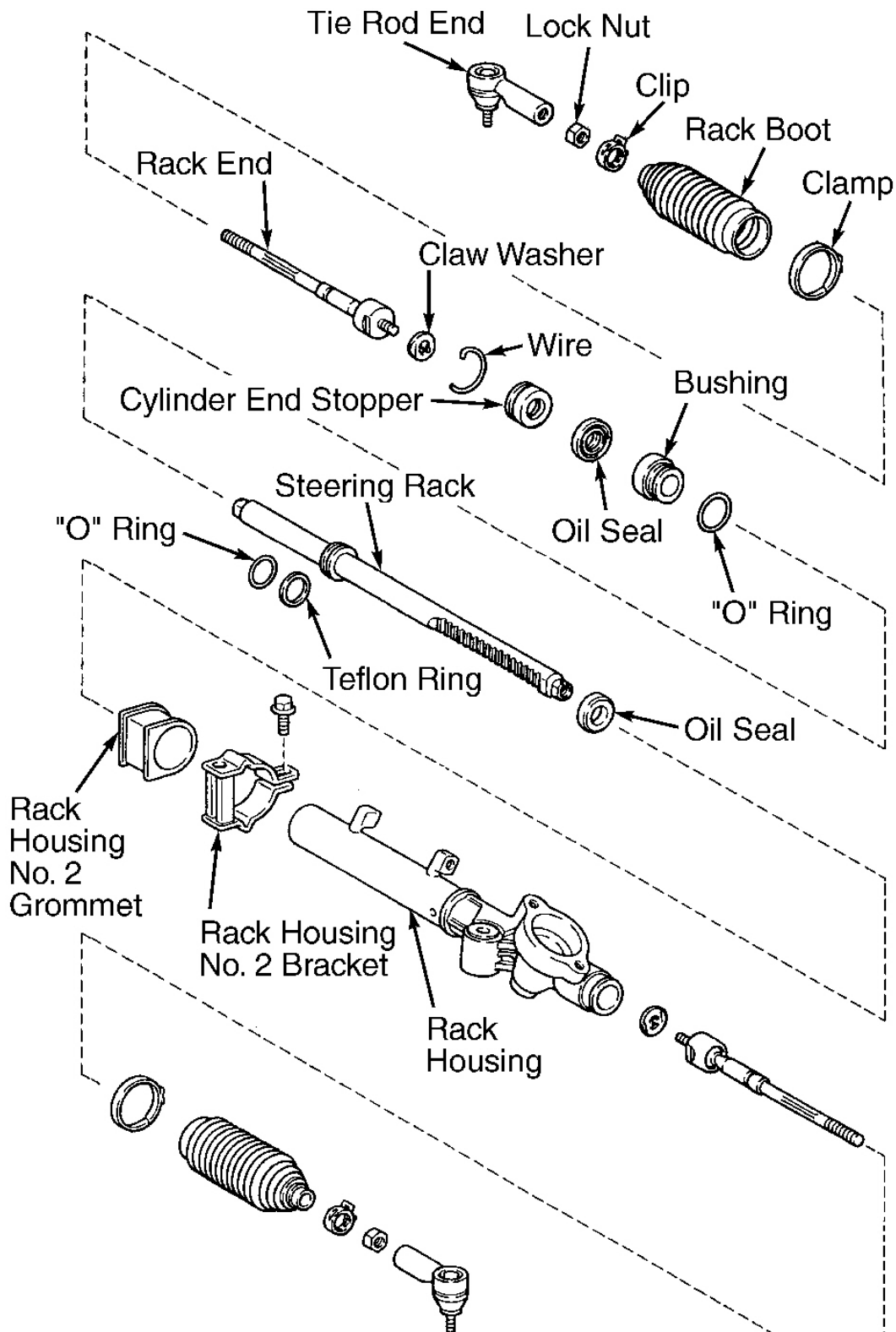


Fig. 16: Exploded View Of Power Rack & Pinion Steering Gear Assembly (Tacoma 2WD - 2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Inspection

1. With rack mounted horizontally on "V" blocks, use dial indicator to measure rack runout. Runout should not exceed .012" (.30 mm). Check rack and teeth for wear and damage. Replace rack if necessary.
2. If necessary, press oil seal and bearing from control valve housing. Coat NEW seal lip with power steering fluid. Press seal into place. Ensure oil seal is facing same direction as removed.
3. Coat NEW bushing with molybdenum disulfide lithium-base grease. Using press, install bushing against oil seal in rack housing.
4. If necessary, use brass bar and hammer to tap lower bearing out of rack housing. See **Fig. 15** . Turn housing over and press upper bearing out of rack housing.
5. Coat NEW lower bearing with molybdenum disulfide lithium-base grease. Using press, install NEW bearing into lower side of rack housing. Turn housing over, coat NEW upper bearing with molybdenum disulfide lithium-base grease. Using press, install bearing into upper side of rack housing.
6. If necessary, use puller to remove oil seal from rack end bushing. See **Fig. 16** . Coat NEW oil seal lip with power steering fluid. Press seal into bushing.
7. If necessary, use screwdriver to remove Teflon ring and "O" ring from steering rack. Coat NEW "O" ring with power steering fluid. Install "O" ring. Carefully expand NEW Teflon ring by hand, only enough to accommodate installation. Coat Teflon ring with power steering fluid. Press ring firmly into rack groove.
8. If necessary, use screwdriver to remove 4 Teflon rings from control valve assembly. Coat NEW rings with power steering fluid. Slightly expand rings by hand and install in each groove. Use installer tool to slide over rings and fully seat them.
9. If necessary, use screw extractor to remove union seats from side of control valve housing. Carefully tap NEW seats into place.

Reassembly

1. With rack housing mounted vertically in soft-jaw vise, coat NEW seal with power steering fluid, and press into rack housing from end opposite control valve housing portion. See **Fig. 16** . Ensure oil seal faces in proper direction.
2. Mount rack housing horizontally in vise. Clean rack teeth of any burrs. Place protective sleeve end piece on steering rack teeth end. Coat protective sleeve with power steering fluid. Install steering rack into rack housing. Remove protective sleeve.
3. Coat NEW "O" ring with power steering fluid, and install on rack bushing. Tape steering rack end and coat end with power steering fluid. Install rack bushing. Remove tape.
4. Align hole for wire of cylinder end stopper with slot of rack housing. Use installer tool and turn stopper clockwise 400-500 degrees. See **Fig. 14** .
5. Install special connectors onto union fittings of rack housing and attach hand vacuum pump. Apply 15.75" Hg for about 30 seconds. Ensure there is no vacuum leak. If there is, check installation of oil seals at each end of housing. See **Fig. 9** .
6. Coat Teflon rings of control valve assembly with power steering fluid. Wrap serrated end of control valve shaft with tape. Push control valve assembly into housing. Press NEW oil seal into place after coating lip

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with power steering fluid.

7. Place NEW gasket on rack housing. Position control valve housing. Install and tighten mounting bolt. See **TORQUE SPECIFICATIONS** . Hold control valve shaft from turning, and install NEW self-locking nut on lower end of shaft. Install dust cover.
8. Apply thread lock sealant to 2-3 threads of rack housing cap. Install and tighten cap to specification. See **TORQUE SPECIFICATIONS** . Stake cap in 2 places.
9. Install rack guide seat to guide. Apply thread lock sealant to 2-3 threads of rack guide spring cap. Install guide, spring, washer and cap. Temporarily tighten cap.
10. Temporarily install both rack ends. Using 21-mm wrench, tighten rack guide spring cap to 18 ft. lbs. (24 N.m). Loosen cap by 12 degrees. Using torque wrench on top end of control valve stem, turn stem right and left 1-2 times. Loosen rack guide spring cap until rack guide spring is not functioning. Tighten rack guide spring cap until preload is within 7.8-13.0 INCH lbs. (0.9-1.5 N.m), measured with torque wrench on control valve stem. See **Fig. 11** .
11. Apply thread lock sealant to rack guide spring cap lock nut. Hold spring cap from rotating, use torque wrench to tighten lock nut to specification. See **TORQUE SPECIFICATIONS** . Recheck preload.
12. Remove both rack ends. Install No. 2 rack housing bracket and grommet. Align reference marks. Install and tighten bolt. See **TORQUE SPECIFICATIONS** .
13. Install NEW claw washers on each end of rack. Align claws with grooves in rack. Install rack ends. Hold rack from turning, and tighten rack ends to 44 ft. lbs. (60 N.m). Stake claw washers.
14. Ensure steering rack hole (next to rack end) is not clogged with grease. Clean as necessary. Install boots, clamps and clips. Pinch clamp until there is .08" (2.0 mm) or less clearance between clamp ends.
15. Screw tie rod end lock nut onto tie rod until reference marks are aligned. Install left and right tie rod ends. After adjusting toe-in, tighten lock nuts to specification. See **TORQUE SPECIFICATIONS** .
16. Install 2 turn pressure tubes. Use NEW "O" rings coated with power steering fluid. Tighten fittings to specification. See **TORQUE SPECIFICATIONS** .

Disassembly (Land Cruiser, Tacoma 4WD, Tundra & 4Runner)

NOTE: When removing oil seals, be sure to note direction seals are facing for reinstallation in same direction.

1. Secure rack and pinion housing in soft-jaw vise (DO NOT over-tighten vise). Remove 2 turn pressure tubes. Remove union seats from fittings. See **Fig. 17** .
2. Place reference marks on tie rod ends and rack ends, across lock nuts. Remove lock nuts and tie rod ends. Remove boot clips and clamps. Mark and remove left and right side rack boots.
3. Unstake claw washer on both rack ends. See **Fig. 18** . Holding steering rack, use appropriate removal tool to remove rack ends. Mark left and right sides for proper reinstallation.
4. Remove rack guide spring cap lock nut. See **Fig. 17** . Remove rack guide spring cap, spring and rack guide. Remove dust cover.
5. Place reference marks on valve housing and rack housing. Remove mounting bolts, and pull control valve assembly and housing from rack housing. Remove "O" ring from rack housing.
6. Loosen bearing guide nut. See **Fig. 17** . Tape serrated end of control valve shaft. Tap control valve assembly and bearing guide nut from housing. Remove nut. Remove "O" ring from nut.

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7. Remove cylinder end stopper, turning counterclockwise. Remove "O" ring from stopper. See **Fig. 18**.
8. Position rack housing vertically, and press oil seal and spacer from housing. See **Fig. 18**.

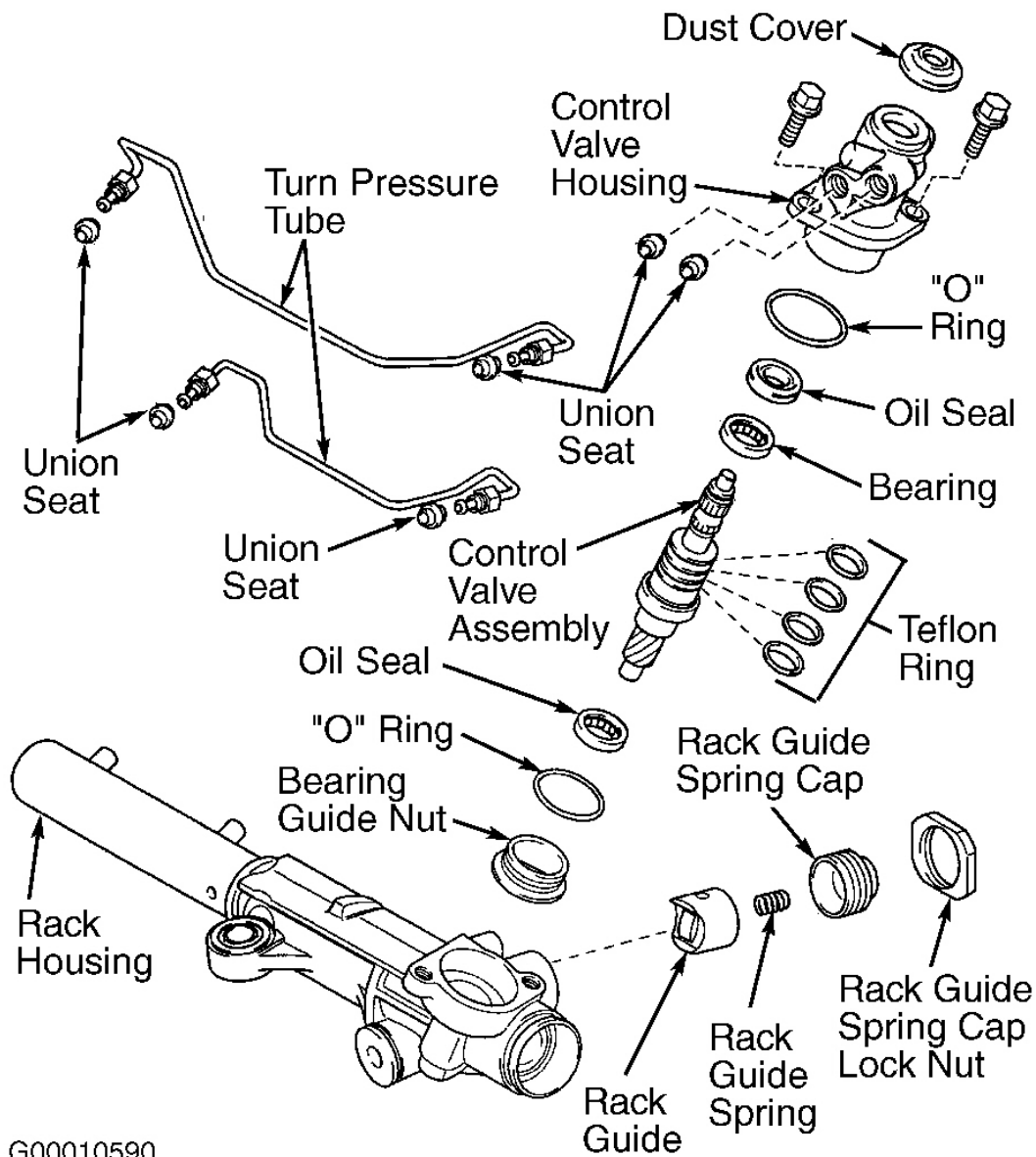


Fig. 17: Exploded View Of Power Rack & Pinion Steering Gear Assembly (Tacoma 4WD & 4Runner Shown; Land Cruiser & Tundra Are Similar - 1 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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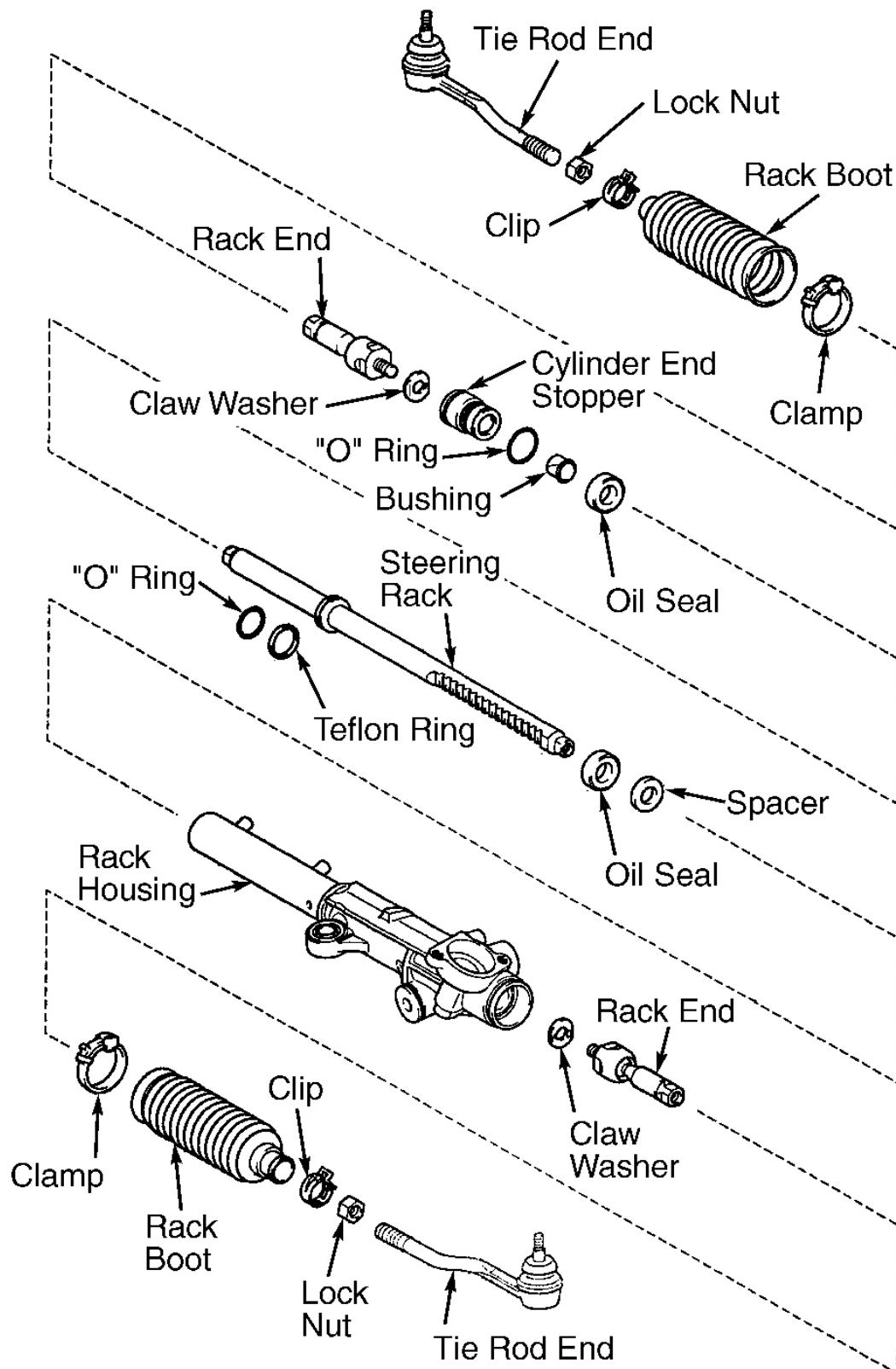


Fig. 18: Exploded View Of Power Rack & Pinion Steering Gear Assembly (Tacoma 4WD & 4Runner Shown; Land Cruiser & Tundra Are Similar - 2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Inspection

1. With rack mounted horizontally on "V" blocks, use dial indicator to measure rack runout. Runout should not exceed .012" (.30 mm). Check rack and teeth for wear and damage. Replace rack if necessary.
2. If necessary, press oil seal and bearing from control valve housing. Coat NEW seal lip with power steering fluid. Press seal into place. Ensure oil seal is facing same direction as removed.
3. Coat NEW bushing with molybdenum disulfide lithium-base grease. Using press, install bushing against oil seal in rack housing.
4. If necessary, press oil seal from bearing guide nut. Coat NEW oil seal with power steering fluid and press into bearing guide nut.
5. Check needle bearing of rack housing for pitting or wear. If faulty, replace rack housing. If okay, coat inside of bearing with molybdenum disulfide lithium-base grease.
6. Inspect condition of control valve bearing. If worn or damaged, replace control valve assembly. If okay, coat inside of bearing with molybdenum disulfide lithium-base grease.
7. Check inside of cylinder end stopper bushing. If faulty, replace bushing. If okay, coat inside of bearing with molybdenum disulfide lithium-base grease.
8. If necessary, use screwdriver to remove Teflon ring and "O" ring from steering rack. Coat NEW "O" ring with power steering fluid. Install "O" ring. Carefully expand NEW Teflon ring by hand, only enough to accommodate installation. Coat Teflon ring with power steering fluid. Press ring firmly into rack groove.
9. If necessary, use screwdriver to remove 4 Teflon rings from control valve assembly. Coat NEW rings with power steering fluid. Slightly expand rings by hand, and install in each groove. Use installer tool to slide over rings and fully seat them.
10. If necessary, use screw extractor to remove union seats from side of control valve housing. Carefully tap NEW seats into place.

Reassembly

1. With rack housing mounted vertically in soft-jaw vise, coat NEW seal lip with power steering fluid. Press seal and spacer into rack housing from end opposite control valve housing portion. See **Fig. 18** . Ensure oil seal faces in proper direction.
2. Mount rack housing horizontally in vise. Clean rack teeth of any burrs. Place protective sleeve end piece on steering rack teeth end. Coat protective sleeve with power steering fluid. Install steering rack into rack housing. Remove protective sleeve.
3. Coat NEW rack housing oil seal lip with power steering fluid. Install seal into rack housing.
4. Coat NEW cylinder end stopper "O" ring with power steering fluid. Install cylinder end stopper and tighten to specification. See **TORQUE SPECIFICATIONS** . Stake rack housing at end stopper.
5. Install special connectors onto union fittings of rack housing and attach hand vacuum pump. Apply 15.75" Hg for about 30 seconds. Ensure there is no vacuum leak. If there is a leak, check installation of oil seals at each end of housing. See **Fig. 9** .
6. Coat Teflon rings of control valve assembly with power steering fluid. Wrap serrated end of control valve

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shaft with tape. Push control valve assembly into housing. Coat NEW "O" ring with power steering fluid and install into bearing guide nut. Install and tighten nut. See **TORQUE SPECIFICATIONS** . Stake guide nut.

7. Coat NEW control valve "O" ring with power steering fluid. Install into control valve housing. Align reference marks for housings. Position control valve housing. Install and tighten mounting bolts. See **TORQUE SPECIFICATIONS** . Install dust cover.
8. Install rack guide, spring and rack guide spring cap. Apply thread lock sealant to cap threads. Temporarily install cap.
9. Temporarily install both rack ends. Using a 21-mm wrench, tighten rack guide spring cap to 18 ft. lbs. (24 N.m). Loosen cap by 12 degrees on Tundra, or 19 degrees on all other models. With torque wrench on top end of control valve stem, turn stem right and left 1-2 times. Loosen rack guide spring cap until rack guide spring is not functioning. Tighten rack guide spring cap until preload is within 11.5-16 INCH lbs. (1.3-1.8 N.m) on Land Cruiser, 10.4-13.9 INCH lbs. (1.2-1.6 N.m) on Tundra, or 4.1-14.9 INCH lbs. (0.5-1.7 N.m) on all other models, measured with torque wrench on control valve stem. See **Fig. 11** .
10. Apply thread lock sealant to rack guide spring cap lock nut. Hold spring cap from rotating, use torque wrench to tighten lock nut to specification. See **TORQUE SPECIFICATIONS** . Recheck preload.
11. Remove both rack ends. Install NEW claw washers on each end of rack. Align claws with grooves in rack. Install rack ends. Hold rack from turning and tighten rack ends to 56 ft. lbs. (76 N.m). Stake claw washers.
12. Ensure steering rack hole (next to rack end) is not clogged with grease. Clean as necessary. Install boots, clamps and clips. Pinch clamp until there is .08" (2.0 mm) or less clearance between clamp ends.
13. Screw tie rod end lock nut onto tie rod until reference marks are aligned. Install left and right tie rod ends. After adjusting toe-in, tighten lock nuts to specification. See **TORQUE SPECIFICATIONS** .
14. Install NEW union seats into housing fittings. Install 2 turn pressure tubes. Tighten fittings to specification. See **TORQUE SPECIFICATIONS** .

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS (LAND CRUISER)

Application	Ft. Lbs. (N.m)
Power Steering Pump	
Mounting Bolts/Nut	13 (17)
Power Steering Pulley Nut	32 (43)
Pressure Feed Tube Union Bolt	42 (56)
Pressure Port Union	61 (83)
Rear Housing Bolts	17 (23)
Rack & Pinion	
Assembly Mounting Bolts/Nuts	74 (100)
Bearing Guide Nut	19 (25)
Control Valve Housing-To-Rack Housing Bolts	13 (18)
Control Valve Housing-To-Pressure Feed Tube	36 (49)
Control Valve Stem-To-Intermediate Shaft Clamp Bolt	26 (35)
Cylinder End Stopper	49 (65)

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Rack End	56 (76)
Rack Guide Spring Cap Lock Nut	51 (69)
Tie Rod End Lock Nuts	41 (56)
Tie Rod End Nuts	53 (72)

TORQUE SPECIFICATIONS (RAV4)

Application	Ft. Lbs. (N.m)
Exhaust Pipe-To-Manifold Nuts	45 (61)
Front Suspension Crossmember	
Control Arm End Bolts/Nuts	94 (127)
Inner Lower Nuts	82 (112)
Inner Upper Bolts	152 (206)
Lower Suspension Arm Bracket	101 (137)
Power Steering Pump	
Air Control Valve	27 (37)
Bracket Bolts	32 (43)
Pressure Port Union	51 (69)
Pulley Nut	32 (43)
Return Port Union Bolt	(1)
Pressure Feed Tube Fitting	32 (43)
Pressure Feed Tube Mounting Bolt	(1)
Pressure Feed Tube Union Bolt	38 (52)
Rack & Pinion	
Assembly Mounting Bolts	83 (113)
Rack Guide Spring Cap Lock Nut	32 (43)
Rack Housing Cap	51 (69)
Rack Housing Lock Nut	(1)
Rack Housing No. 1 Bracket Bolt	45 (61)
Steering Rack End	61 (83)
Turn Pressure Tube Fittings	22 (30)
Turn Pressure Tube Union Nuts	22 (30)
Stabilizer Bar End Mounting Nuts	
4-Door Models	54 (73)
2-Door Models	33 (45)
Tie Rod End Lock Nuts	41 (56)
Tie Rod Ends	36 (49)
(1) Tighten to 115 INCH lbs. (13 N.m).	

TORQUE SPECIFICATIONS (SIENNA)

Application	Ft. Lbs. (N.m)
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Air Control Valve	27 (37)
Front Bracket Bolts	32 (43)
Mounting & Adjusting Bolts	32 (43)
Pressure Port Union	62 (84)
Pulley Nut	32 (43)
Rear Housing Bolts	12 (16)
Return/Suction Port Union Bolt	(1)
Pressure Feed Tube-To-Pump Fitting	18 (24)
Pressure Feed Tube Union Bolt	38 (52)

Rack & Pinion

Assembly Mounting Bolts	134 (182)
Control Valve Housing-To-Rack Housing Bolts	13 (18)
Control Valve Stem-To-Intermediate Shaft Clamp Bolt	26 (35)
Rack Housing Cap	43 (58)
Rack Housing Self-Locking Nut	18 (24)
Rack Housing No. 2 Bracket Nut	(2)
Stabilizer Bar End Mounting Nuts	14 (19)
Steering Rack End	61 (83)
Tie Rod End Lock Nuts	54 (73)
Tie Rod End Nuts	36 (49)

Tube Fittings

Control Valve Housing-To- Rack Fitting	(1)
Housing-To-Pump	18 (24)

INCH Lbs. (N.m)

Pressure Feed Tube-To-Body Mounting Bolt	69 (7.8)
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(1) Tighten to 115 INCH lbs. (13 N.m).

(2) Tighten to 89 INCH lbs. (10 N.m).

TORQUE SPECIFICATIONS (TACOMA 2WD)

Application	Ft. Lbs. (N.m)
Power Steering Pump	
Bracket Bolts (V6)	32 (43)
Mounting Bolts/Nut	
4-Cylinder	29 (39)
V6	32 (43)
Power Steering Idler Pulley Bolt	29 (39)
Pressure Feed Tube Union Bolt	34 (46)
Pressure Port Union	61 (83)

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Rear Housing Bolts	17 (23)
Reservoir Mounting Bolts	
Front	(1)
Rear	17 (23)
Pressure Feed Tube-To-Pump Union Bolt	34 (46)
Rack & Pinion	
Assembly Mounting Bolts/Nuts	148 (201)
Control Valve Housing-To-Rack Housing Bolts	13 (18)
Control Valve Housing-To-Rack Tube Fitting	(1)
Control Valve Stem-To-Intermediate Shaft Clamp Bolt	26 (35)
Rack End	61 (83)
Rack Guide Spring Cap Lock Nut	51 (69)
Rack Housing Cap	43 (58)
Rack Housing No. 2 Bracket Bolt	45 (61)
Rack Housing Self-Locking Nut	18 (24)
Tie Rod End Lock Nuts	40 (54)
Tie Rod End Nuts	53 (72)
(1) Tighten to 115 INCH lbs. (13 N.m).	

TORQUE SPECIFICATIONS (TACOMA 4WD, TUNDRA & 4RUNNER)

Application	Ft. Lbs. (N.m)
Power Steering Pump	
Bracket Bolts (V6)	32 (43)
Mounting Bolts/Nut	
4-Cylinder	29 (39)
V6	32 (43)
Power Steering Idler Pulley Bolt	29 (39)
Pressure Feed Tube Union Bolt	34 (46)
Pressure Port Union	61 (83)
Rear Housing Bolts	17 (23)
Reservoir Mounting Bolts	
Front	(1)
Rear	17 (23)
Pressure Feed Tube-To-Pump Union Bolt	34 (46)
Rack & Pinion	
Assembly Mounting Bolts/Nuts	123 (167)
Bearing Guide Nut	18 (24)
Control Valve Housing-To-Rack Housing Bolts	13 (18)
Control Valve Housing-To-Rack Tube Fitting	18 (24)
Control Valve Stem-To-Intermediate Shaft Clamp Bolt	26 (35)

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Cylinder End Stopper	58 (79)
Rack End	56 (76)
Rack Guide Spring Cap Lock Nut	51 (69)
Rack Housing Bracket Bolt/Nut	123 (167)
Tie Rod End Lock Nuts	41 (56)
Tie Rod End Nuts	67 (91)
(1) Tighten to 115 INCH lbs. (13 N.m).	