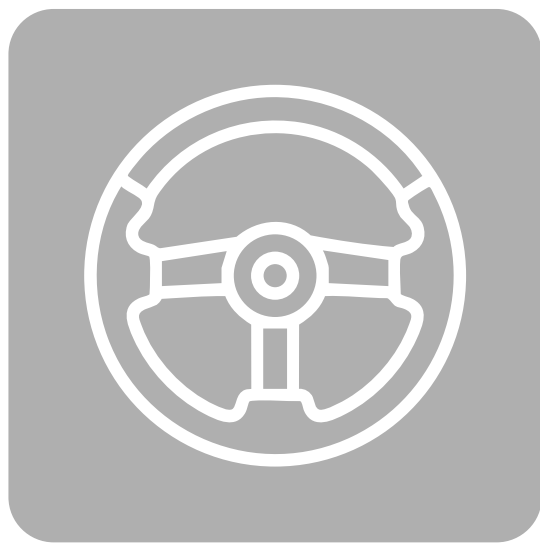


HARBORFRONT

STEERING SYSTEM



SECTION **ST**

CONTENTS

PRECAUTIONS AND PREPARATION2	POWER STEERING SYSTEM (Model: PB59K)20
Supplemental Restraint System (SRS) "AIR BAG"2	Description20
Steering System2	POWER STEERING GEAR (Model: PB59K)21
Special Service Tools3	Removal and Installing21
Commercial Service Tool.....4	Power Steering Gear Component21
ON-VEHICLE SERVICE5	Pre-disassembly Inspection and Adjustment.....22
Steering System5	Disassembly.....23
Checking and Adjusting Drive Belts (For power steering)5	Assembly24
Checking Fluid Level5	POWER STEERING SYSTEM (Model: PB48S)27
Checking Fluid Leakage6	Description27
Bleeding Hydraulic System.....6	POWER STEERING GEAR (Model: PB48S)28
Checking Steering Wheel Turning Force (For power steering)7	Removal and Installing28
Checking Steering Wheel Play7	Power Steering Gear Component28
Checking Neutral Position on Steering Wheel8	Pre-disassembly Inspection and Adjustment.....29
Checking Front Wheel Turning Angle.....8	Disassembly.....30
Checking Hydraulic System.....8	Assembly32
STEERING WHEEL AND STEERING COLUMN10	POWER STEERING OIL PUMP35
Steering Wheel10	Disassembly and Assembly35
Steering Column11	Pre-disassembly Inspection35
Disassembly and Assembly12	Inspection.....36
Inspection.....13	Disassembly.....36
MANUAL STEERING GEAR (Model: VB66K)14	Assembly37
Removal and Installation14	STEERING LINKAGE38
Disassembly.....15	Removal and Installation38
Assembly and Adjustment15	Disassembly.....39
Inspection.....18	Inspection.....40
	SERVICE DATA AND SPECIFICATIONS (SDS)41
	General Specifications41
	Inspection and Adjustment41

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Supplemental Restraint System (SRS) "AIR BAG"

The Supplemental Restraint System "Air Bag" used along with a seat belt, helps to reduce the risk or severity of injury to the driver in a frontal collision. The Supplemental Restraint System consists of an air bag module (located in the center of the steering wheel), a diagnosis sensor unit, warning lamp, wiring harness, a crash zone sensor (4WD models) and spiral cable. Information necessary to service the system safely is included in the **RS section** of this Service Manual.

WARNING:

- To avoid rendering the SRS inoperative, which could increase the risk of personal injury or death in the event of a collision which would result in air bag inflation, all maintenance must be performed by an authorized NISSAN dealer.
- Improper maintenance, including incorrect removal and installation of the SRS, can lead to personal injury caused by unintentional activation of the system.
- Do not use electrical test equipment on any circuit related to the SRS unless instructed to in this Service Manual. SRS wiring harnesses are covered with yellow insulation either just before the harness connectors or for the complete harness, for easy identification.

Steering System

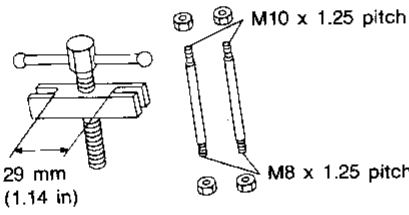
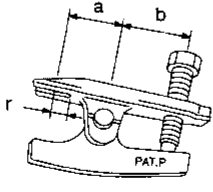
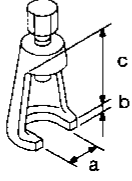
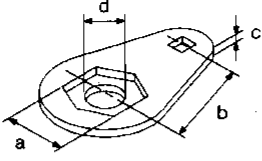
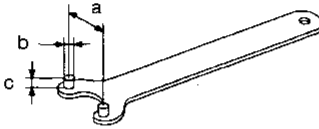
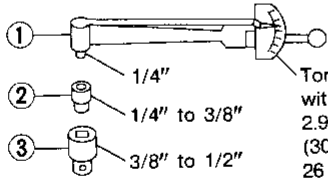
- Before disassembly, thoroughly clean the outside of the unit.
- Disassembly should be done in a clean work area. It is important to prevent the internal parts from becoming contaminated by dirt or other foreign matter.
- For easier and proper assembly, place disassembled parts in order on a parts rack.
- Use nylon cloths or paper towels to clean the parts; common shop rags can leave lint that might interfere with their operation.
- Before inspection or reassembly, carefully clean all parts with a general purpose, non-flammable solvent.
- Before assembly, apply a coat of recommended ATF* to hydraulic parts. Petroleum jelly may be applied to O-rings and seals. Do not use any grease.
- Replace all gaskets, seals and O-rings. Avoid damaging O-rings, seals and gaskets during installation. Perform functional tests whenever designated.

*: Automatic Transmission Fluid type DEXRON™ II E, DEXRON™ III, or equivalent.

PRECAUTIONS AND PREPARATION

Special Service Tools

The actual shapes of Kent-Moore tools may differ from those of special service tools illustrated here.

Tool number (Kent-Moore No.) Tool name	Description	Unit application		
		Manual steering	Power steering	
ST27180001 (J25726-A) Steering wheel puller	 <p>29 mm (1.14 in) M10 x 1.25 pitch M8 x 1.25 pitch NT544</p>	Removing steering wheel	X	X
HT72520000 (J25730-B) Ball joint remover	 <p>a: 33 mm (1.30 in) b: 50 mm (1.97 in) r: R11.5 mm (0.453 in) NT546</p>	Removing ball joint and swivel joint	X	X
ST29020001 (J24319-01) Steering gear arm puller	 <p>a: 34 mm (1.34 in) b: 6.5 mm (0.256 in) c: 61.5 mm (2.421 in) NT551</p>	Removing pitman arm	X	X
KV48101500 (J28802) Lock nut wrench	 <p>a: 73.1 mm (2.878 in) b: 100 mm (3.94 in) c: 12 mm (0.47 in) d: 60 mm (2.36 in) dia. NT534</p>	Removing and installing lock nut	X	—
KV48101400 (J28803) Adjusting plug wrench	 <p>a: 46.7 mm (1.839 in) b: 8.5 mm (0.335 in) dia. c: 7 mm (0.28 in) NT539</p>	Adjusting and tightening lock nut	X	—
ST3127S000 (See J25765-A) ① GG91030000 (J25765-A) Torque wrench ② HT62940000 (—) Socket adapter ③ HT62900000 (—) Socket adapter	 <p>1/4" 1/4" to 3/8" 3/8" to 1/2" NT541</p>	Measuring turning torque	X	X

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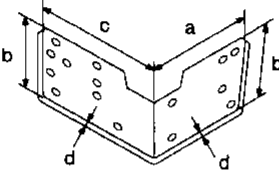
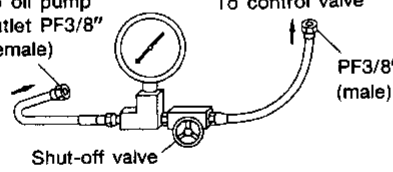
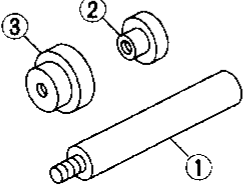
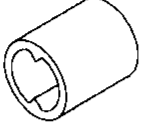
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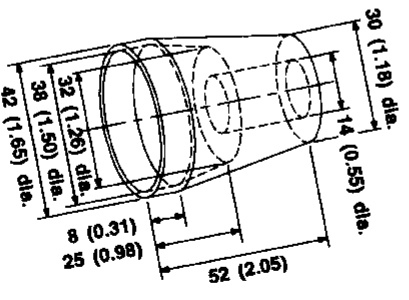
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PRECAUTIONS AND PREPARATION

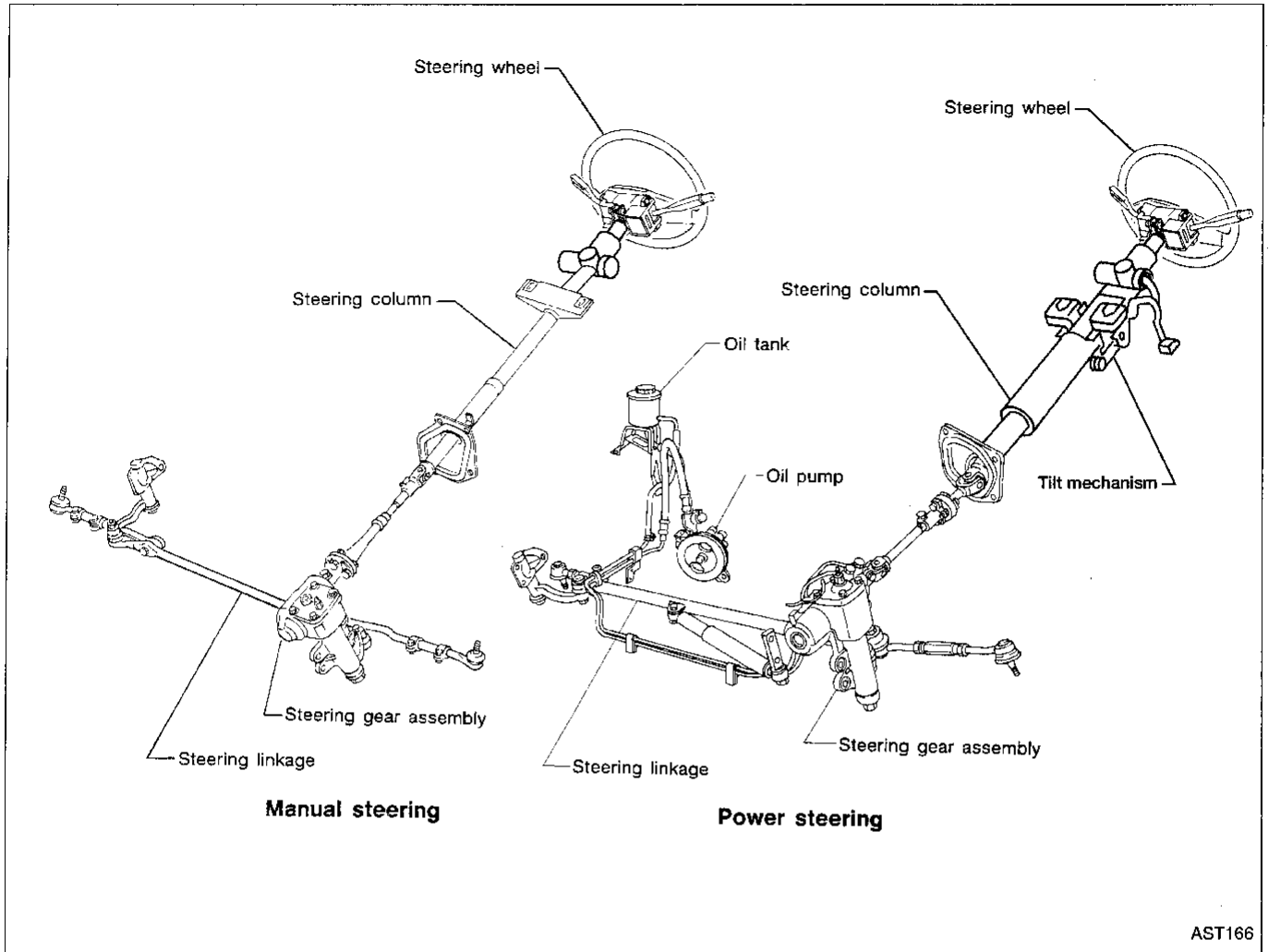
Special Service Tools (Cont'd)

Tool number (Kent-Moore No.) Tool name	Description	Unit application	
		Manual steering	Power steering
KV48100301 (—) Strut & steering gearbox attachment	 <p style="text-align: right;">Steering gear is installed.</p> <p style="text-align: right;">a: 162 mm (6.38 in) b: 110 mm (4.33 in) c: 190 mm (7.48 in) d: 9 mm (0.35 in)</p>	X	X
NT543			
ST27091000 (J26357 and J26357-10) Pressure gauge	 <p style="text-align: center;">Measuring oil pressure</p>	—	X
NT547			
KV481009S0 (—) Oil seal drift set ① KV48100910 (—) Drift ② KV48100920 (J26367) Adapter ③ KV48100930 (J26367) Adapter	 <p style="text-align: center;">Installing oil seal</p>	—	X
NT174			
KV48100700 (J26364) Torque adapter	 <p style="text-align: center;">Adjusting worm bearing pre-load</p>	X	X
NT169			

Commercial Service Tool

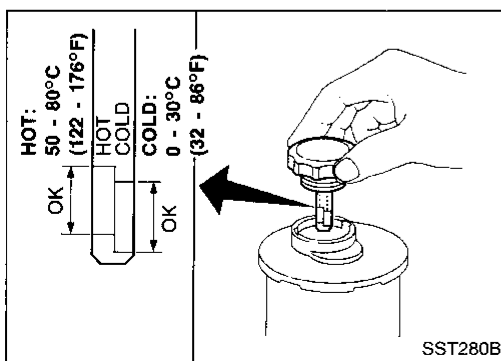
Tool name	Description	Unit application	
		Manual steering	Power steering
Boot band attachment	 <p style="text-align: center;">Installing boot band Unit: mm (in)</p>	X	X
NT175			

Steering System



Checking and Adjusting Drive Belts (For power steering)

Refer to MA section ("Checking Drive Belts", "ENGINE MAINTENANCE").



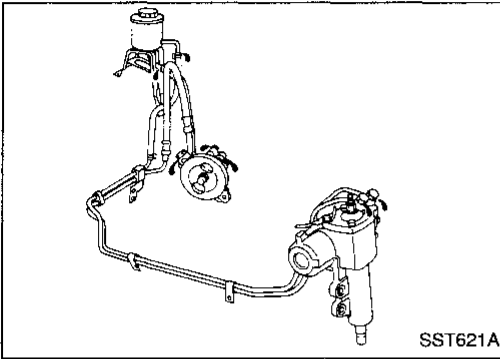
Checking Fluid Level

Check fluid level referring to the scale on the dipstick. Use "HOT" range for fluid temperatures of 50 to 80°C (122 to 176°F). Use "COLD" range for fluid temperatures of 0 to 30°C (32 to 86°F).

CAUTION:

- Do not overfill.
- Recommended fluid is Automatic Transmission Fluid type "DEXRON™ II E, DEXRON™ III", or equivalent.

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Checking Fluid Leakage

Check lines for proper attachment, leaks, cracks, damage, chafing or deterioration.

1. Run engine between idle speed and 1,000 rpm.
 - **Make sure temperature of fluid in reservoir tank rises to 60 to 80°C (140 to 176°F).**
2. Turn steering wheel right-to-left several times.
3. Hold steering wheel at each "lock" position for five seconds and carefully check for fluid leakage.

CAUTION:

Do not hold steering wheel at lock position for more than 15 seconds.

4. If fluid leakage from any line is noticed, loosen flare nut and then retighten.

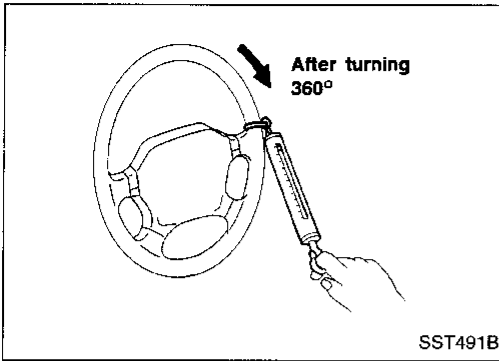
Do not overtighten connector as this can damage O-ring, washer and connector.

5. If fluid leakage from power steering pump is noticed, check power steering pump. Refer to ST-35.
6. If fluid leakage from power steering gear is noticed, check power steering gear. Refer to ST-20 (4WD models), or ST-27 (2WD models).

Bleeding Hydraulic System

1. Raise front end of vehicle until wheels are clear of the ground.
2. Add fluid to reservoir tank to specified level. Then quickly turn steering wheel fully to right and left and lightly touch steering stoppers.
Repeat steering wheel operation until fluid level no longer decreases.
3. Start engine.
Repeat step 2 above.
 - Incomplete air bleeding will cause the following to occur:
 - a. Air bubbles in reservoir tank
 - b. Clicking noise in power steering pump
 - c. Excessive buzzing in power steering pumpWhen this happens, bleed air again.

Fluid noise may occur in the valve or power steering pump. This is common when the vehicle is stationary or while turning the steering wheel slowly. This does not affect the performance or durability of the system.



Checking Steering Wheel Turning Force (For power steering)

1. Park vehicle on a level, dry surface and set parking brake.
2. Start engine and run at idle speed or 1,000 rpm.
3. Bring power steering fluid up to adequate operating temperature. [Make sure temperature of fluid is approximately 60 to 80°C (140 to 176°F).]

Tires need to be inflated to normal pressure.

4. Check steering wheel turning force when steering wheel has been turned 360° from neutral position.

Steering wheel turning force:

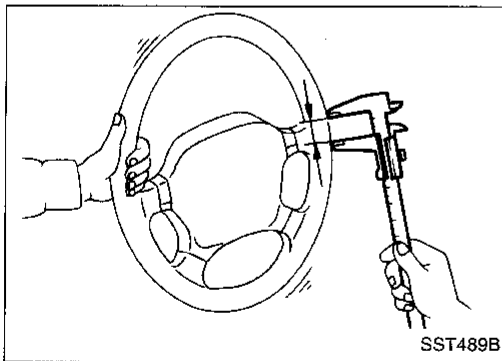
PB48S-type

24.5 - 29.4 N (2.5 - 3.0 kg, 5.5 - 6.6 lb)

PB59K-type

39 N (4 kg, 9 lb) or less

5. If steering wheel turning force is out of specification, check the following:
 - a. Hydraulic system. Refer to "Checking Hydraulic System", ST-8.
 - b. Steering Column. Refer to ST-11.
 - c. Front suspension and axle. Refer to FA section ("Front Axle and Front Suspension Parts", "ON-VEHICLE SERVICE").
 - d. Steering gear turning torque. Refer to "TURNING TORQUE MEASUREMENT", ST-22 (4WD models), or ST-29 (2WD models).



Checking Steering Wheel Play

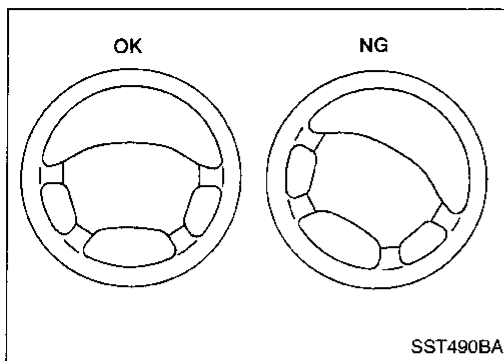
- Place wheels in a straight ahead position and check steering wheel play.

Steering wheel play:

35 mm (1.38 in) or less

- If it is not within specification, check the following for loose or worn components.
 - a. Steering column. Refer to ST-11.
 - b. Front suspension and axle. Refer to FA section ("Front Axle and Front Suspension Parts", "ON-VEHICLE SERVICE".)
 - c. Steering gear. [Refer to ST-14 (manual steering), ST-20 (power steering 4WD), or ST-27 (power steering 2WD).]

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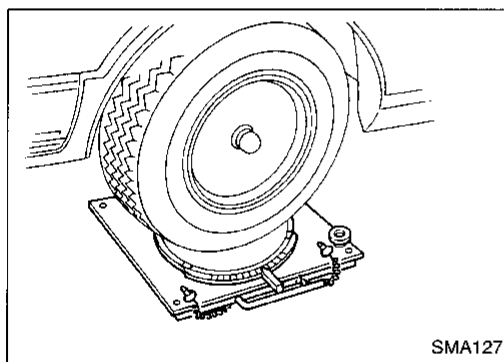


Checking Neutral Position on Steering Wheel

- Make sure that wheel alignment is correct.
Wheel alignment:
Refer to FA section ("Inspection and Adjustment", "SERVICE DATA AND SPECIFICATIONS").
- Verify that the steering gear is centered before removing the steering wheel.

Checking

1. Check that the steering wheel is in the neutral position when driving straight ahead.
2. If it is not in the neutral position, remove the steering wheel and reinstall it correctly.
3. If the neutral position is still not correct:
 - a. Loosen tie-rod lock nuts.
 - b. Move tie-rods, in opposite direction, the same amount on both left and right sides.
This will compensate for error in the neutral position.



Checking Front Wheel Turning Angle

1. Rotate steering wheel fully right, then left; measure turning angle.

Turning angle of full turns:

- Refer to FA section ("Inspection and Adjustment", "SERVICE DATA AND SPECIFICATIONS").
2. If it is not within specification, check stopper bolt adjustment. Refer to FA section ("FRONT WHEEL TURNING ANGLE", "Front Wheel Alignment".)

Checking Hydraulic System

Before starting, check belt tension, driving pulley and tire pressure.

1. Set Tool. Open shut-off valve. Then bleed air. Refer to "Bleeding Hydraulic System", ST-6.
 2. Run engine at idle speed or 1,000 rpm.
- **Make sure temperature of fluid in reservoir tank rises to 60 to 80°C (140 to 176°F).**

WARNING:

Warm up engine with shut-off valve fully opened. If engine is started with shut-off valve closed, fluid pressure in power steering pump increases to maximum. This will raise fluid temperature abnormally.

3. Check pressure with steering wheel fully turned to left and right positions while idling at 1,000 rpm.

CAUTION:

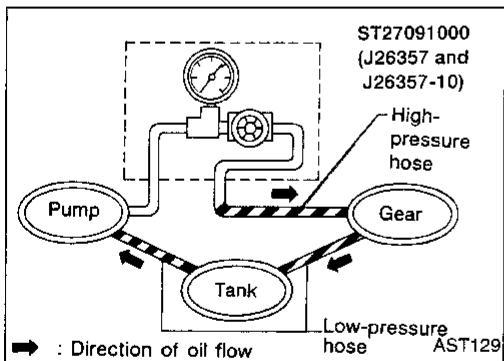
Do not hold the steering wheel at full lock position for more than 15 seconds.

Oil pump maximum pressure:

7,649 - 8,238 kPa

(78 - 84 kg/cm², 1,109 - 1,194 psi) at idling

4. If power steering pressure is below standard pressure, slowly close shut-off valve and check pressure.



ON-VEHICLE SERVICE

Checking Hydraulic System (Cont'd)

CAUTION:

Do not close shut-off valve for more than 15 seconds.

- When pressure reaches maximum pressure, gear is damaged. Check power steering gear. Refer to ST-20 (4WD models), or ST-27 (2WD models).
 - When pressure remains below standard pressure, pump is damaged. Check power steering pump. Refer to ST-35.
5. If power steering pressure is higher than standard pressure, power steering pump flow control valve is damaged. Check power steering pump. Refer to ST-35.
 6. After checking hydraulic system, remove Tool and add fluid as necessary. Then completely bleed air out of system. Refer to ST-6.

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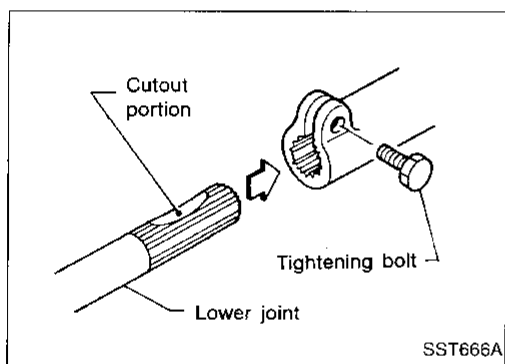
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Steering Column

REMOVAL

CAUTION:

- The rotation of the spiral cable (SRS "Air bag" component part) is limited. If the steering gear must be removed, set the front wheels in the straight-ahead direction. Do not rotate the steering column while the steering gear is removed.
 - Remove the steering wheel before removing the steering lower joint to avoid damaging the SRS spiral cable. Refer to ST-10.
1. Remove steering wheel, refer to ST-10.
 2. Remove driver lower finisher and reinforcement.
 3. Disconnect combination switch electrical connectors and air bag harness connector.
 4. Remove key interlock cable (A/T models).
 5. Pull back carpet and remove dash insulator.
 6. Remove bolt from lower joint.
 7. Remove two steering column bolts and remove steering column.



INSTALLATION

- When installing steering column, finger-tighten all lower bracket and clamp retaining bolts; then tighten them securely. Make sure that undue stress is not applied to steering column.
- When fitting steering lower joint, be sure tightening bolt faces cutout portion.
- Align spiral cable correctly when installing steering wheel. Refer to RS section ["Air Bag Module and Spiral Cable", "SUPPLEMENTAL RESTRAINT SYSTEM (SRS)"].

CAUTION:

After installation, turn steering wheel to make sure it moves smoothly. Ensure the number of turns from the straight forward position to left and right locks are the same. Be sure that the steering wheel is in a neutral position when driving straight ahead.

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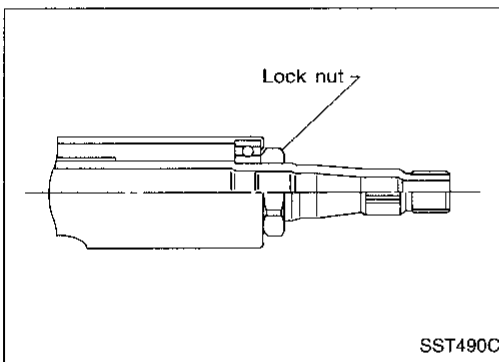
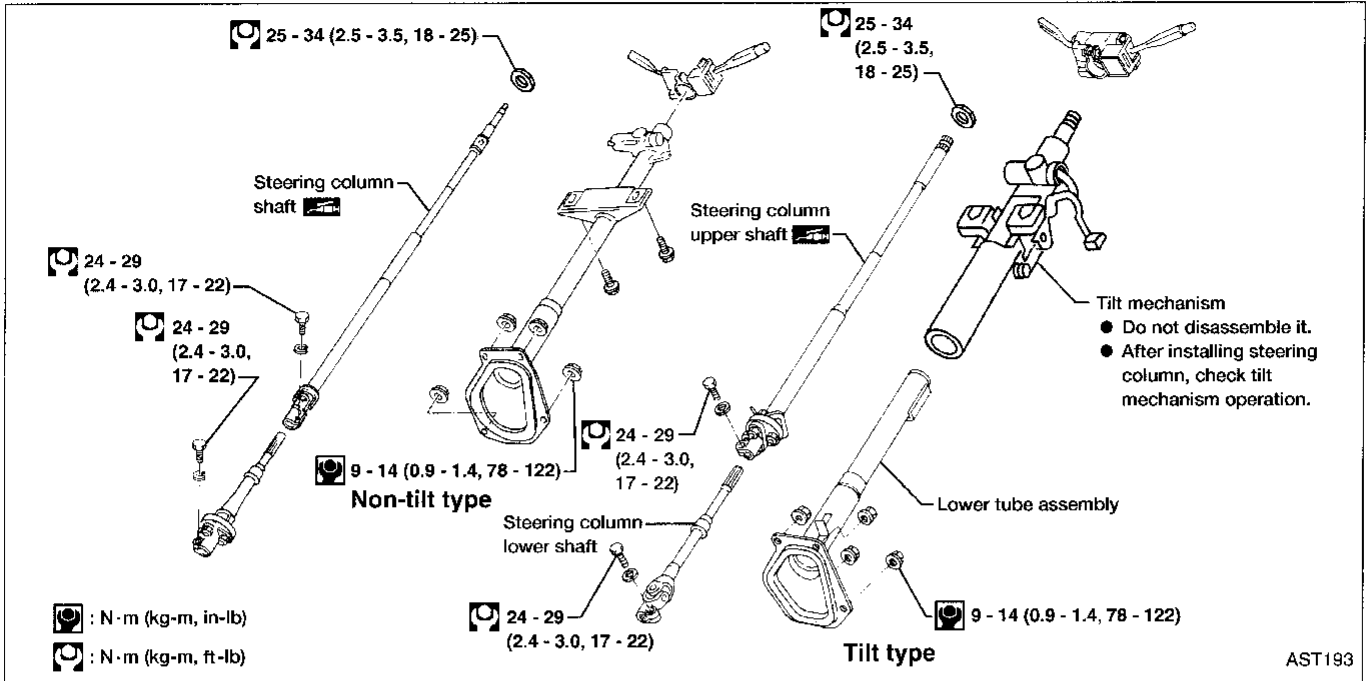
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STEERING WHEEL AND STEERING COLUMN

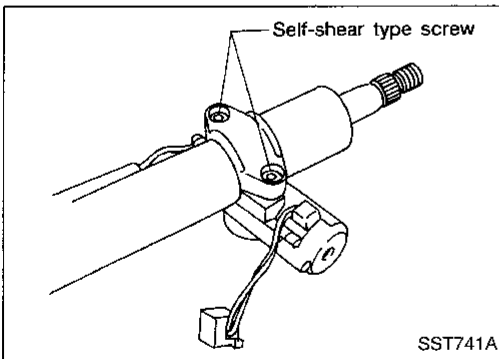
Disassembly and Assembly



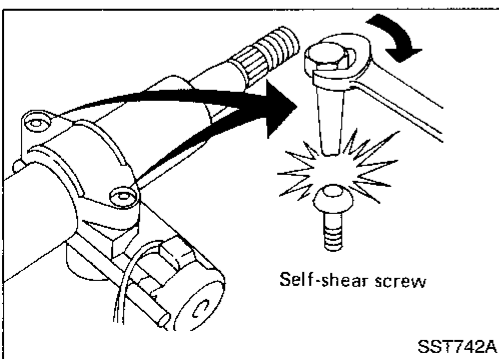
- When disassembling and assembling, unlock steering lock with key.
- Remove combination switch.
- Install lock nut on steering column shaft and tighten the nut to specified torque.

Lock nut:

: 25 - 34 N·m (2.5 - 3.5 kg-m, 18 - 25 ft-lb)



- Steering lock
 - Break self-shear type screws using a drill or other appropriate tool.



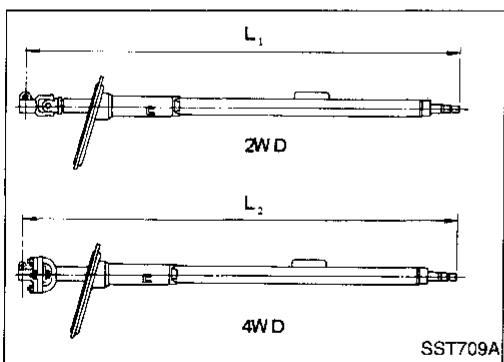
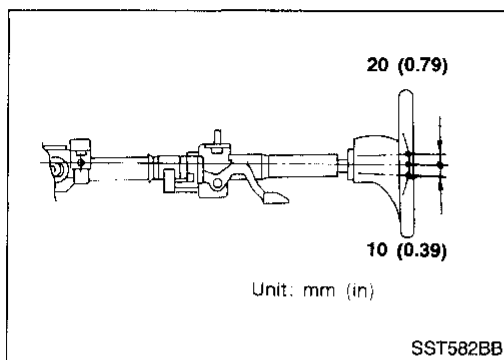
- Install self-shear type screws, then tighten until heads break off.

STEERING WHEEL AND STEERING COLUMN

Disassembly and Assembly (Cont'd)

Tilt mechanism

After installing steering column, check tilt mechanism operation.



Inspection

- When steering wheel does not turn smoothly, check the steering column as follows and replace damaged parts.
 - a. Check column bearings for damage or unevenness. Lubricate with recommended multi-purpose grease or replace steering column as an assembly, if necessary.
 - b. Check jacket tube for deformation or breakage. Replace if necessary.
- When the vehicle is involved in a light collision, check dimension "L". If it is not within specifications, replace steering column as an assembly.

Column length " L_1 & L_2 ":

$L_1 = 895.0 - 898.6$ mm
(35.24 - 35.38 in)

$L_2 = 863.1 - 866.7$ mm
(33.98 - 34.12 in)

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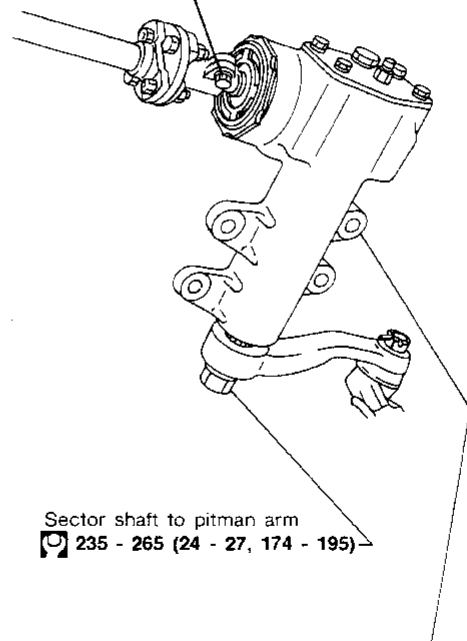
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Removal and Installation

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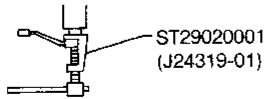
Worm shaft to rubber coupling
24 - 29 (2.4 - 3.0, 17 - 22)
 Align the groove in worm shaft with the bolt hole in rubber coupling flange yoke, and press coupling bolt through the undercut section of worm shaft.

: N·m (kg-m, ft-lb)



Sector shaft to pitman arm
235 - 265 (24 - 27, 174 - 195)

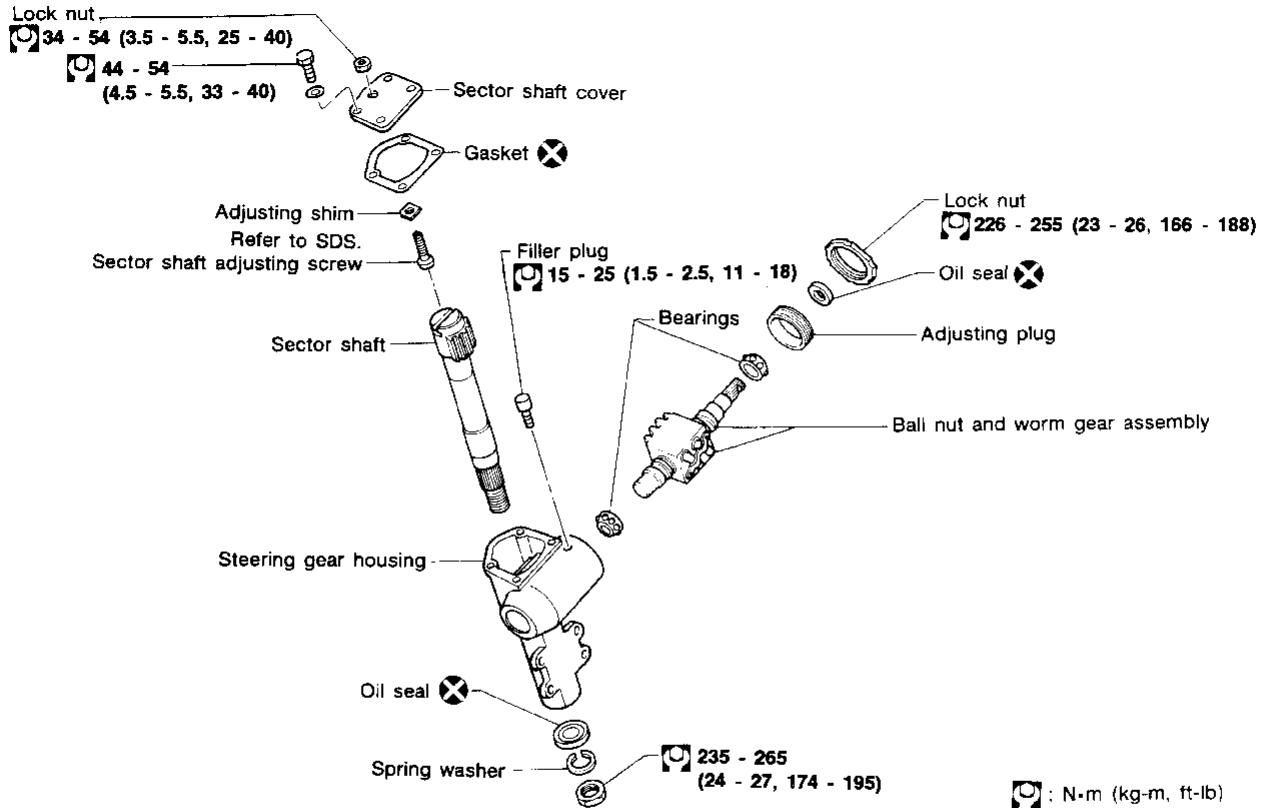
Gear housing to frame
84 - 96 (8.6 - 9.8, 62 - 71)



- Install pitman arm.
 Align four grooves of gear arm serrations with four projections of sector shaft serrations, and install and tighten lock washer and nut.

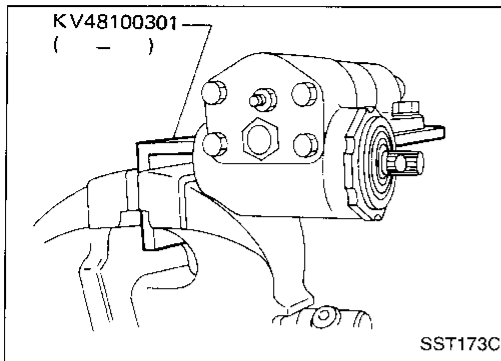
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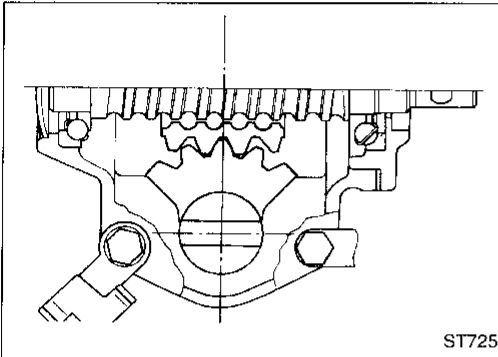
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MANUAL STEERING GEAR (Model: VB66K)



Disassembly

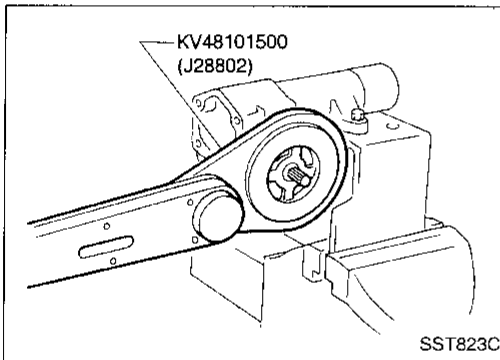
1. Place steering gear in a vise using Tool.



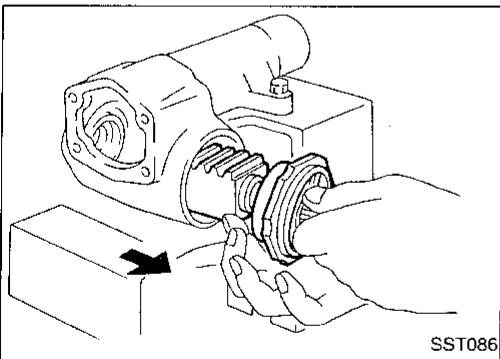
2. Set worm gear in a straight-ahead position.
3. Remove sector shaft together with sector shaft cover.

CAUTION:

- When pulling sector shaft out, be careful not to damage oil seal or associated parts.
- Do not remove sector shaft needle bearings from steering gear housing. If necessary, replace gear housing as an assembly.



4. Loosen adjusting plug lock nut using Tool.



5. Remove worm gear together with worm bearing.

CAUTION:

- Be careful not to rotate ball nut fully to either end of worm gear. Ends of ball guides will be damaged if nut is rotated until it stops at end of worm gear.
- Do not separate ball nut from worm gear assembly. If necessary, replace entire unit as an assembly.
- Do not remove sector shaft needle bearings from steering gear housing. If necessary, replace entire gear housing as an assembly.

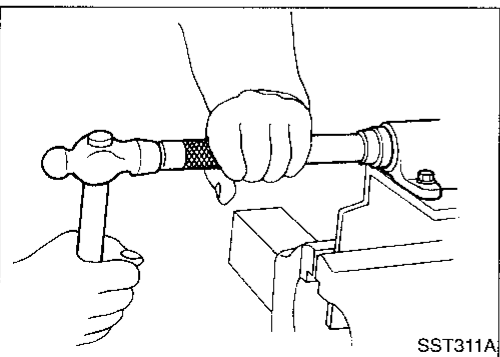
Assembly and Adjustment

Apply multi-purpose grease to sealing area of new oil seals for sector shaft and worm gear.

WORM GEAR BEARING PRELOAD

1. Drive oil seal into place.

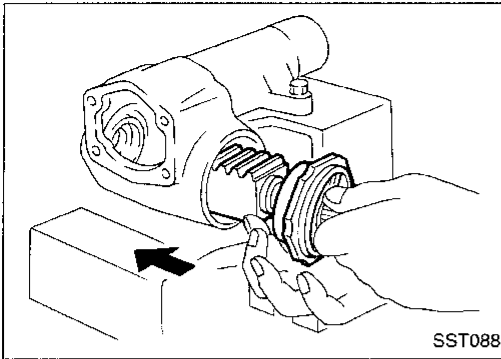
Before installing oil seal, coat oil seal contacting face with gear fluid.



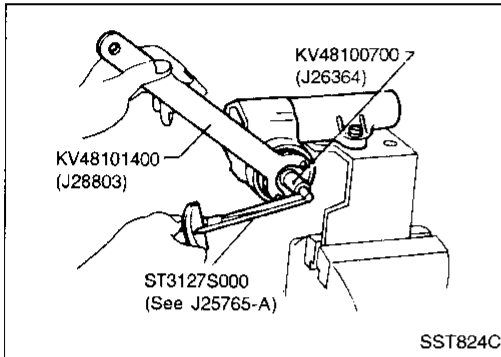
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MANUAL STEERING GEAR (Model: VB66K)

Assembly and Adjustment (Cont'd)



2. Place worm gear assembly together with worm gear bearing into gear housing.



3. Adjust worm gear bearing preload using Tools.

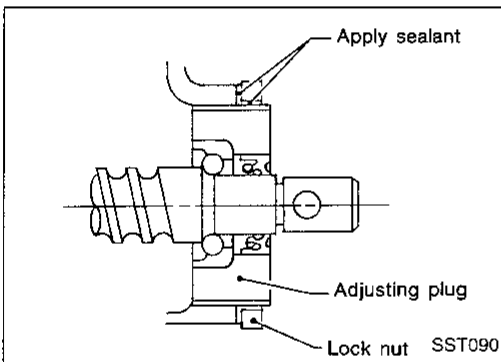
CAUTION:

- Always adjust worm gear bearing preload by turning adjusting plug in clockwise direction.
- Before measuring preload, rotate worm gear a few turns in both directions to seat worm gear bearing.

Worm gear bearing preload:

0.69 - 0.88 N·m

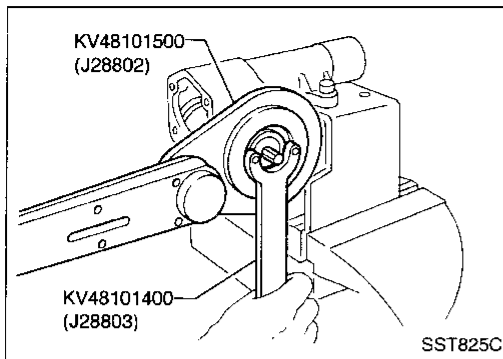
(7.0 - 9.0 kg-cm, 6.1 - 7.8 in-lb)



4. Apply suitable sealant to inner surface of lock nut.

MANUAL STEERING GEAR (Model: VB66K)

Assembly and Adjustment (Cont'd)



5. Tighten lock nut using Tools.

Lock nut:

: 226 - 255 N·m (23 - 26 kg·m, 166 - 188 ft·lb)

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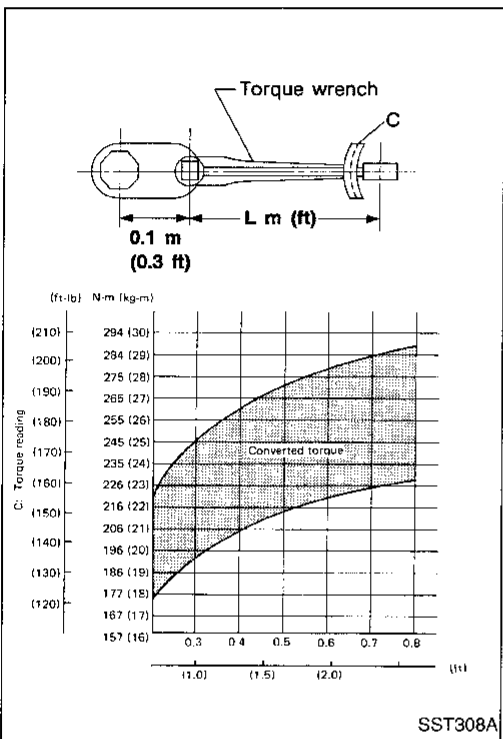
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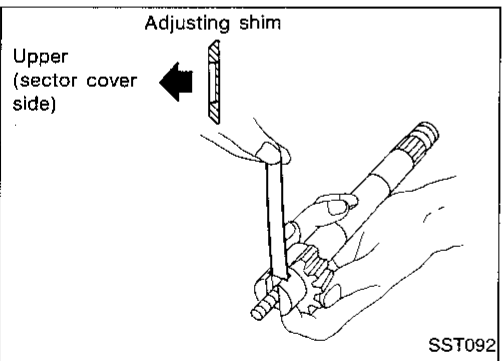
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• When tightening lock nut, use the chart shown at left to determine the proper reading of torque. (Length of torque wrench vs. setting or reading of torque)

6. After tightening lock nut, check worm gear bearing preload to make sure it is within specification.

SST308A



SECTOR SHAFT END PLAY

Select and install proper adjusting shim to achieve proper end play between sector shaft and adjusting screw.

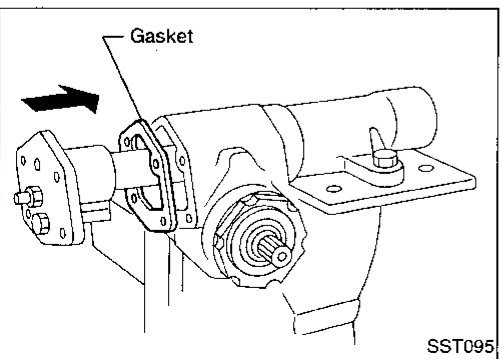
Sector shaft end play:

0.1 mm (0.004 in) or less

Sector shaft adjusting screw shims:

Refer to SDS, ST-42.

SST092



STEERING GEAR PRELOAD AND BACKLASH

1. Set worm gear in a straight-ahead position.

Carefully insert sector shaft in gear housing, being careful not to scratch oil seal.

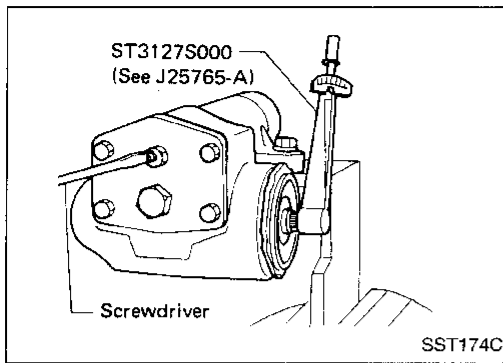
2. Turn adjusting screw until sector shaft just contacts ball nut. Temporarily tighten lock nut.

3. Lubricate contacting portion of sector shaft and ball nut with gear oil or bearing grease.

SST095

MANUAL STEERING GEAR (Model: VB66K)

Assembly and Adjustment (Cont'd)



4. Adjust steering gear turning torque in a straight-ahead position using Tool, then lock with lock nut.

CAUTION:

- Always adjust steering gear preload by turning adjusting screw in clockwise direction.
- Rotate worm gear a few turns in both directions to seat steering gear assembly.

- a. Measure turning torque at 360° position from straight-ahead position using Tools.

Turning torque at 360°:

0.69 - 0.88 N·m (7.0 - 9.0 kg·cm, 6.1 - 7.8 in·lb)

- b. Measure turning torque at straight-ahead position.

Straight-ahead position is a position where stub shaft is turned 2.14 turns (two full turns and 50°) from lock position.

Turning torque at straight-ahead position:

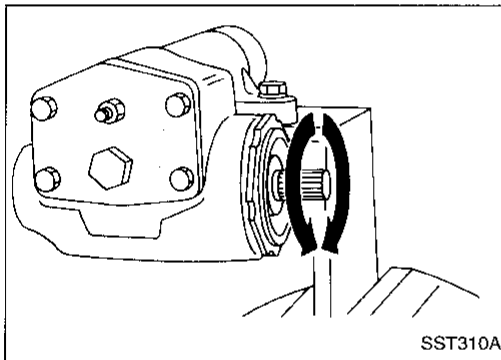
0.20 - 0.39 N·m (2.0 - 4.0 kg·cm, 1.7 - 3.5 in·lb)

higher than turning torque at 360°

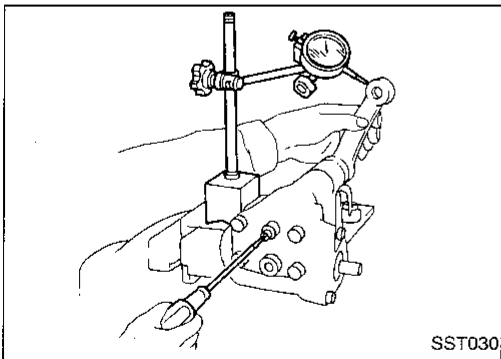
Maximum turning torque:

1.08 N·m (11.0 kg·cm, 9.5 in·lb)

If turning torque is not within specifications, adjust by turning sector shaft adjusting screw.



5. Turn worm gear several times by hand to properly break in worm bearing.
6. Check steering gear preload. Readjust as necessary.



7. Measure total preload.
8. Check backlash. Measure backlash at top end of pitman arm in straight-ahead position.

Backlash (in straight-ahead position):

0.1 mm (0.004 in) or less

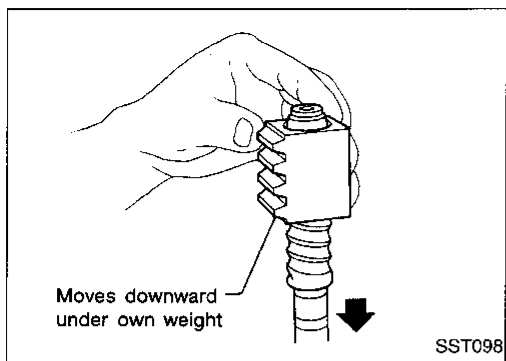
Inspection

Clean all the disassembled parts in solvent, then check condition.

SECTOR SHAFT

1. Check gear teeth surface for pitting, burrs, cracks or any other damage, and replace as necessary.
2. Check sector shaft serration for distortion and replace as necessary. Also check gear housing for deformation.

MANUAL STEERING GEAR (Model: VB66K)



Inspection (Cont'd)

STEERING WORM ASSEMBLY

1. Inspect ball nut gear teeth surface. Replace if pitting, burrs, wear or any other damage is found.
2. Ball nut must rotate smoothly on worm gear. If found to be too tight, assembly should be replaced. Check rotation of ball nut as follows:

CAUTION:

Be careful not to allow ball nut to rotate fully to either end of worm gear.

- a. Move ball nut to either end of worm gear. Gradually stand worm shaft and ball nut assembly on end until ball nut moves downward on worm gear under its own weight.
- b. If ball nut does not move freely over entire stroke, replace assembly.

Be careful not to damage ball nut guide tube while check is being made.

BEARING

1. Inspect worm gear bearing for wear, pitting or any other damage. Replace as necessary.

When replacing worm gear bearing, replace bearing and outer race as a set.

2. If sector shaft needle bearings are worn or damaged, replace gear housing as an assembly.

OIL SEALS

- Discard any oil seal which has been removed.
- Replace oil seal if sealing surface is deformed or cracked.
- Discard oil seal if spring is fatigued or dislocated.

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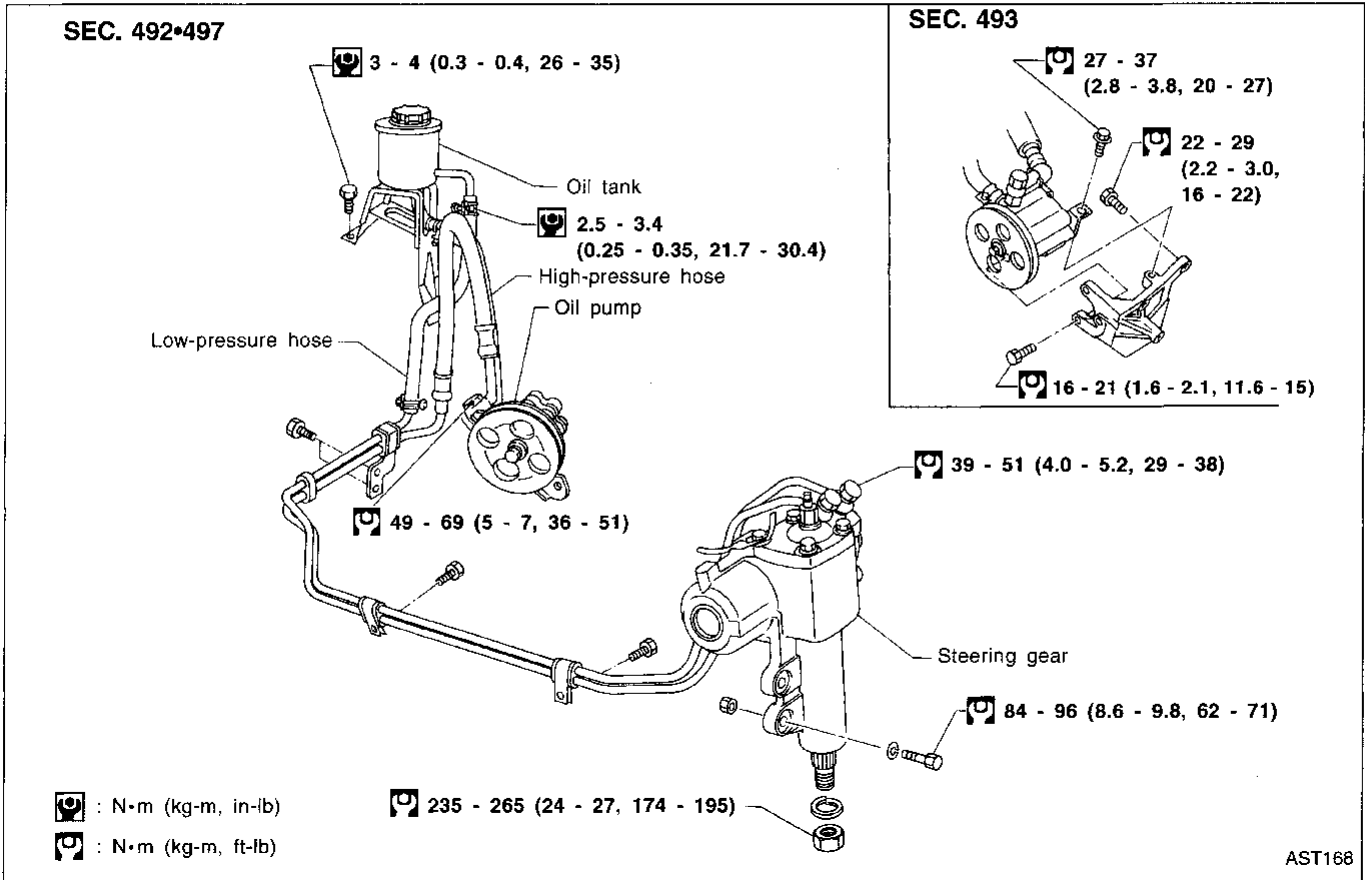
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POWER STEERING SYSTEM (Model: PB59K)

Description



CAUTION:

- Parts which can be disassembled are strictly limited. Never disassemble parts other than those specified.
- Disassemble in as clean a place as possible.
- Clean your hands before disassembly.
- Do not use rags; use nylon cloths or paper towels.
- Follow the procedures and cautions indicated in the Service Manual.

POWER STEERING GEAR (Model: PB59K)

Removal and Installing

Before removal, clean gear housing and oil pump exteriors using a steam cleaner. Then dry with compressed air.

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- Plug openings of gear housing, and securely locate hose connectors at a position higher than oil pump and cover with rag.
- Be extremely careful to prevent entry of foreign matter into hoses through connectors.
- When installing gear arm, align four grooves of gear arm serrations with four projections of sector shaft serrations, and install and tighten lock washer and nut.

39 - 51 (4.0 - 5.2, 29 - 38)

Lower joint to stub shaft
24 - 29 (2.4 - 3.0, 17 - 22)

84 - 96 (8.6 - 9.8, 62 - 71)

Sector shaft to pitman arm
235 - 265 (24 - 27, 174 - 195)

Pitman arm to tie-rod
54 - 98 (5.5 - 10.0, 40 - 72)

⊗ : N·m (kg-m, ft-lb)

SST123CB

Power Steering Gear Component

SEC. 492

56 - 64 (5.7 - 6.5, 41 - 47)

Lock nut
29 - 44 (3.0 - 4.5, 22 - 33)

Dust cover

56 - 64 (5.7 - 6.5, 41 - 47)

Sector shaft cover

O-ring

U-packing

Sector shaft adjusting shim

Sector shaft adjusting screw

Sector shaft

O-ring

Rear housing

Worm gear assembly (Do not disassemble.)

O-ring

Teflon ring

O-ring

Gear housing

U-packing

Oil seal

⊗ : N·m (kg-m, ft-lb)

AST169

Pre-disassembly Inspection and Adjustment

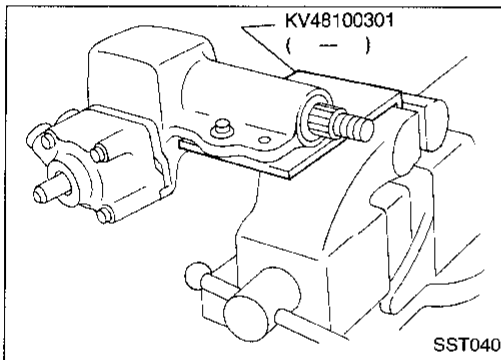
Before disassembling power steering gear component parts, make sure there is no oil leakage around sealing portion and check steering turning torque as follows:

Check sealing portion.

- Sector shaft cover O-ring
- Sector shaft U-packing
- Sector shaft oil seal
- Rear housing O-ring
- Gear housing O-ring

Discard any oil seal and O-ring which have been removed.

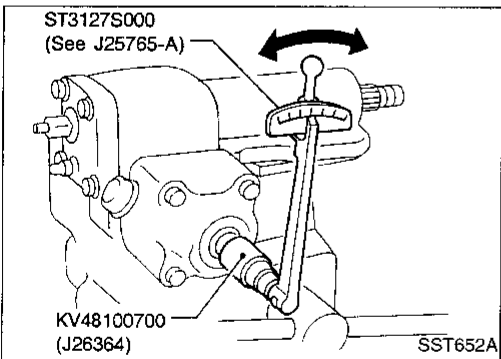
Replace oil seal and O-ring if sealing surface is deformed or cracked.



TURNING TORQUE MEASUREMENT

1. Measure turning torque at 360° position.

a. Install steering gear on Tool.

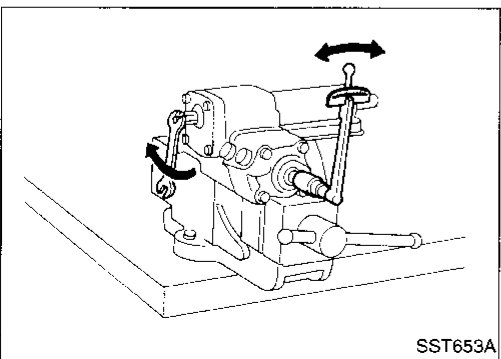


b. Turn stub shaft all the way to right and left several times.

c. Measure turning torque at 360° position from straight-ahead position with Tools.

Turning torque at 360°:

0.15 - 0.78 N·m (1.5 - 8.0 kg·cm, 1.3 - 6.9 in·lb)



d. Measure turning torque at straight-ahead position.

Straight-ahead position is a position where stub shaft is turned 2.14 turns (two full turns and 50°) from lock position.

Turning torque at straight-ahead position:

0.25 - 1.32 N·m (2.5 - 13.5 kg·cm, 2.2 - 11.7 in·lb)

higher than turning torque at 360°

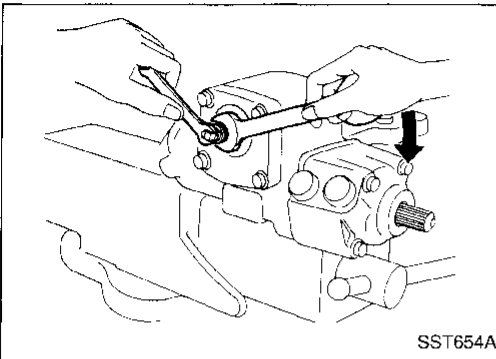
Maximum turning torque:

1.03 - 1.47 N·m (10.5 - 15 kg·cm, 9.1 - 13.0 in·lb)

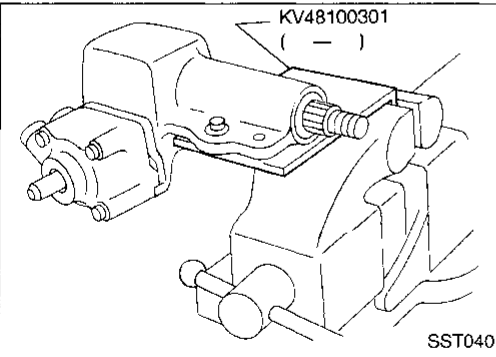
If turning torque is not within specifications, adjust by turning sector shaft adjusting screw.

POWER STEERING GEAR (Model: PB59K)

Pre-disassembly Inspection and Adjustment (Cont'd)



2. Tighten adjusting screw lock nut with tools.



Disassembly

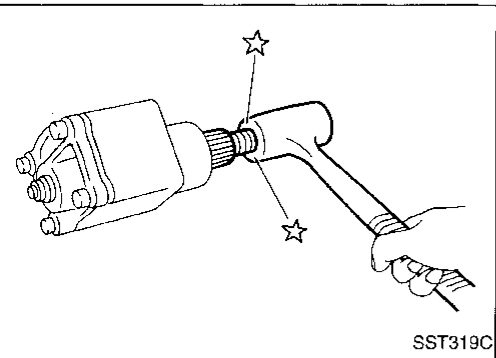
Before disassembly, measure turning torque.

If not within specifications, replace steering gear assembly.

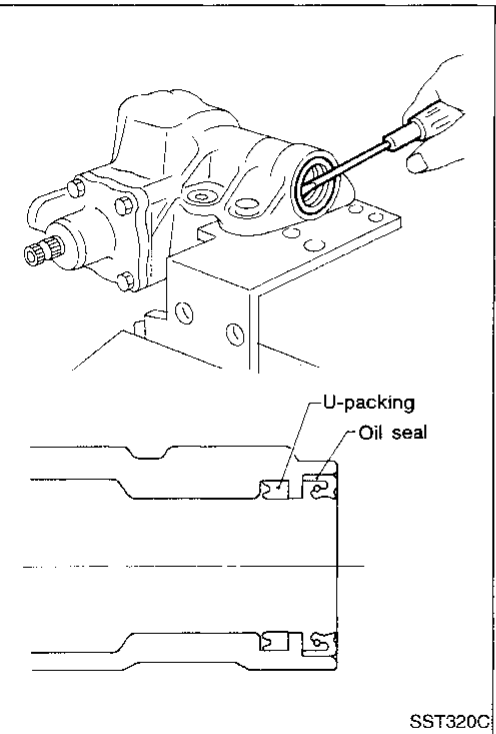
CAUTION:

Oil sealing parts, dust cover, copper washer and snap ring must not be used again after removal.

1. Place steering gear in a vise with Tool.
2. Set worm gear in a straight-ahead position.



3. Loosen (do not remove) sector shaft cover bolt.
4. Knock out end of sector shaft with a plastic hammer.
5. Remove sector shaft by hand.



6. Remove oil seal.
7. Remove U-packing.

CAUTION:

When removing oil seal and U-packing, be careful not to scratch gear housing.

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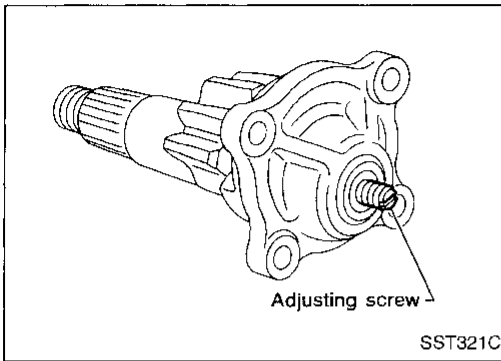
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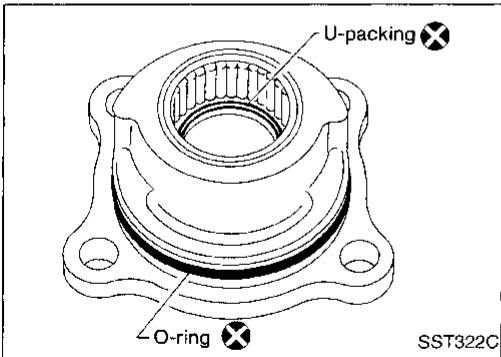
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POWER STEERING GEAR (Model: PB59K)

Disassembly (Cont'd)



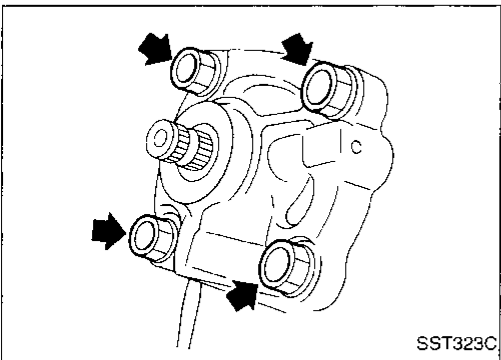
8. Remove lock nut, then loosen adjusting screw using a screwdriver. Separate sector cover and sector shaft.



9. Remove O-ring.
10. Remove U-packing.

CAUTION:

- When removing U-packing, be careful not to scratch sector cover, needle bearing, etc.
- Needle bearing cannot be disassembled. If it is damaged, remove sector cover assembly.



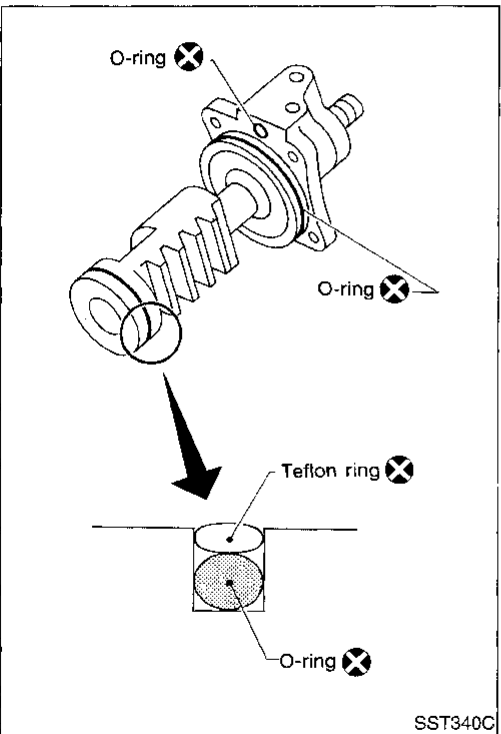
11. Remove dust seal.
12. Remove rear housing bolts.
13. Remove rear housing together with worm gear assembly.

CAUTION:

Worm gear assembly cannot be disassembled. When it is removed, be careful not to disengage worm gear from shaft or allow it to drop.

14. Remove teflon ring and O-ring of worm gear assembly.

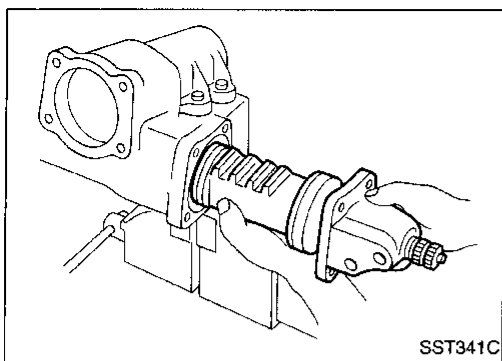
Assembly



1. Install new O-ring on worm gear assembly.
 - Apply a thin coat of ATF to new O-ring.
2. Install new teflon ring on worm gear assembly.
 - Make sure that teflon ring is seated in correct position.
3. Install new O-ring into rear housing.

POWER STEERING GEAR (Model: PB59K)

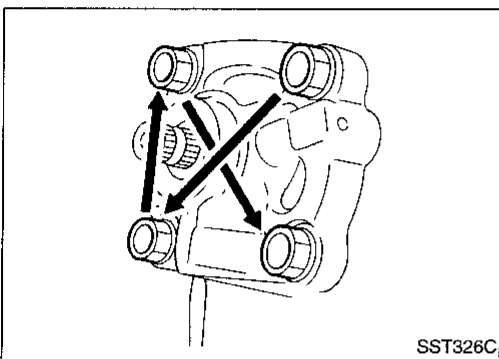
Assembly (Cont'd)



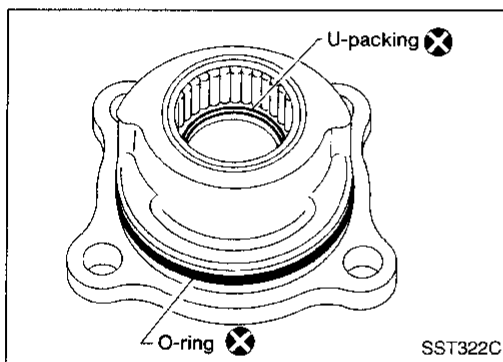
4. Install worm gear assembly with rear housing into the gear housing.

CAUTION:

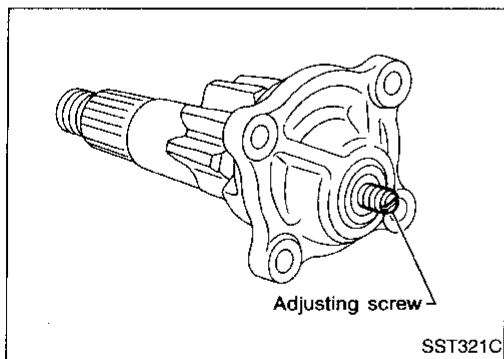
- Apply a thin coat of ATF inside gear housing and piston before insertion.
- Be careful not to damage teflon ring at piston end when inserting worm gear assembly into gear housing.



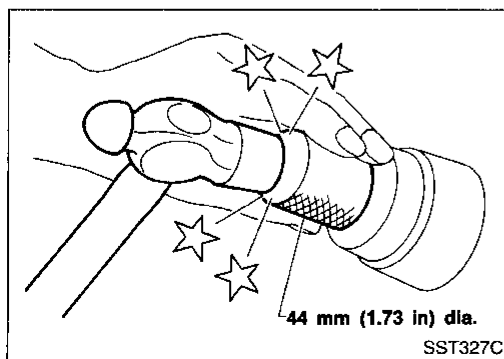
5. Gradually tighten rear housing bolts in a criss-cross fashion.



6. Install new O-ring into sector shaft cover.
- Before installing, apply a thin coat of ATF to O-ring.
7. Install new U-packing into sector shaft cover.
- Before installing, apply a thin coat of ATF to U-packing.
 - Direct grooved side of U-packing to needle bearing.



8. Install sector shaft into sector shaft cover.
- Set adjusting screw to its outermost position.
- Before installing sector shaft, apply multi-purpose grease to adjusting screw and adjusting screw shim.

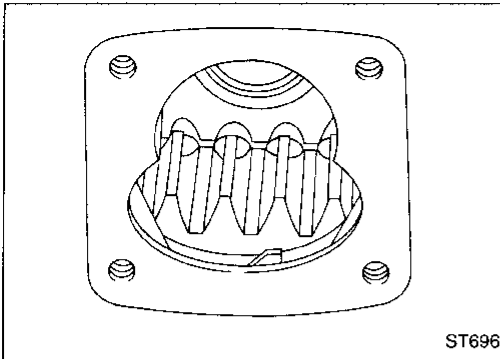


9. Install new oil seal into gear housing with suitable tool.
- Before installing oil seal, apply multi-purpose grease to oil seal lips.

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POWER STEERING GEAR (Model: PB59K)

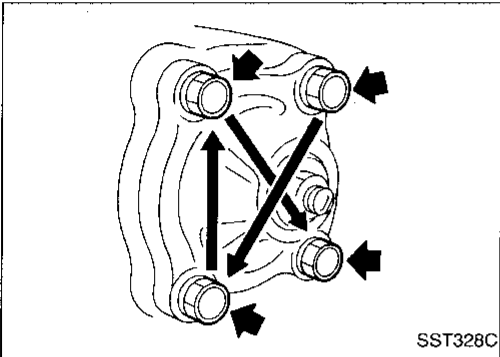
Assembly (Cont'd)



10. Set piston rack at straight-ahead position.

Turn piston rack about 10° to 15° toward yourself with your finger.

This enables smooth insertion of sector gear.



11. Gradually insert sector shaft into gear housing.

12. Tighten sector shaft cover bolts.

13. Set worm gear turning torque by turning sector shaft adjusting screw and locking with lock nut.

Refer to "TURNING TORQUE MEASUREMENT", "Pre-disassembly and Adjustment", ST-22.

- If set and adjusting turning torque is considerably different from the value before disassembly, replace the entire assembly.

14. Check sector shaft end play in neutral position.

End play:

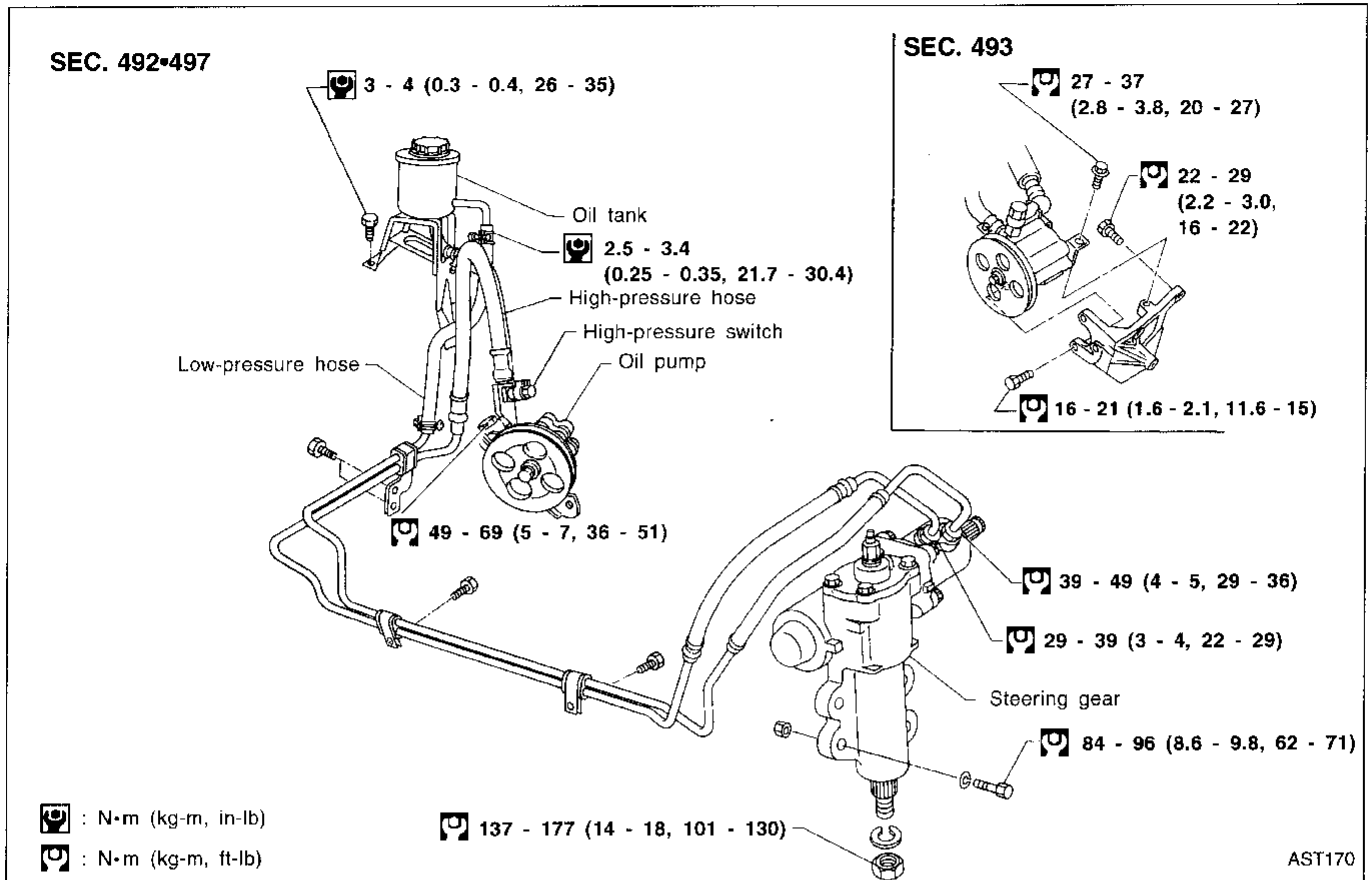
Less than 0.1 mm (0.004 in)

If not within specification, adjust it with adjusting screw.

15. Check worm gear preload. If not within specification, readjust it.

POWER STEERING SYSTEM (Model: PB48S)

Description



This power steering adopts spool valve control which was developed in a technical tie-up with the ZF Company.

Only the sealing parts can be replaced. The remaining parts must be replaced as an assembly.

CAUTION:

- Parts which can be disassembled are strictly limited. Never disassemble parts other than those specified.
- Disassemble in as clean a place as possible.
- Clean your hands before disassembly.
- Do not use rags; use nylon cloths or paper towels.
- Follow the procedures and cautions indicated in the Service Manual.

POWER STEERING GEAR (Model: PB48S)

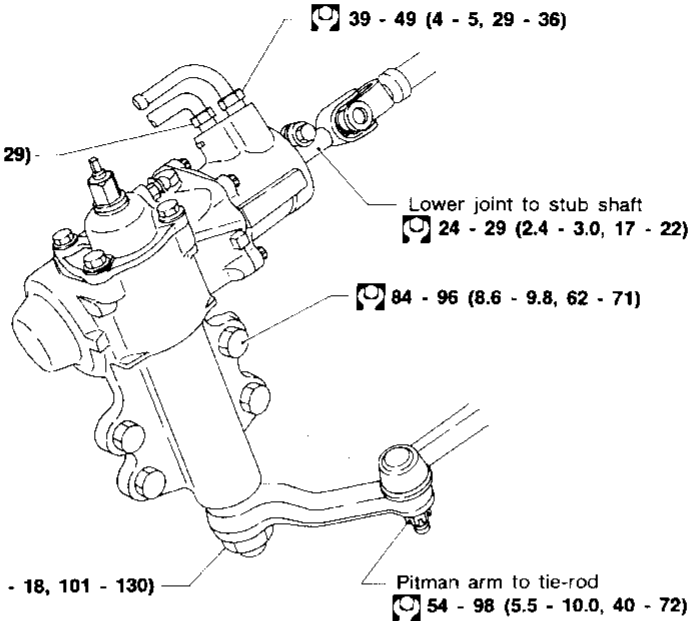
Removal and Installing

Before removal, clean gear housing and oil pump exteriors using a steam cleaner. Then dry with compressed air.

STEERING GEAR

SEC. 492

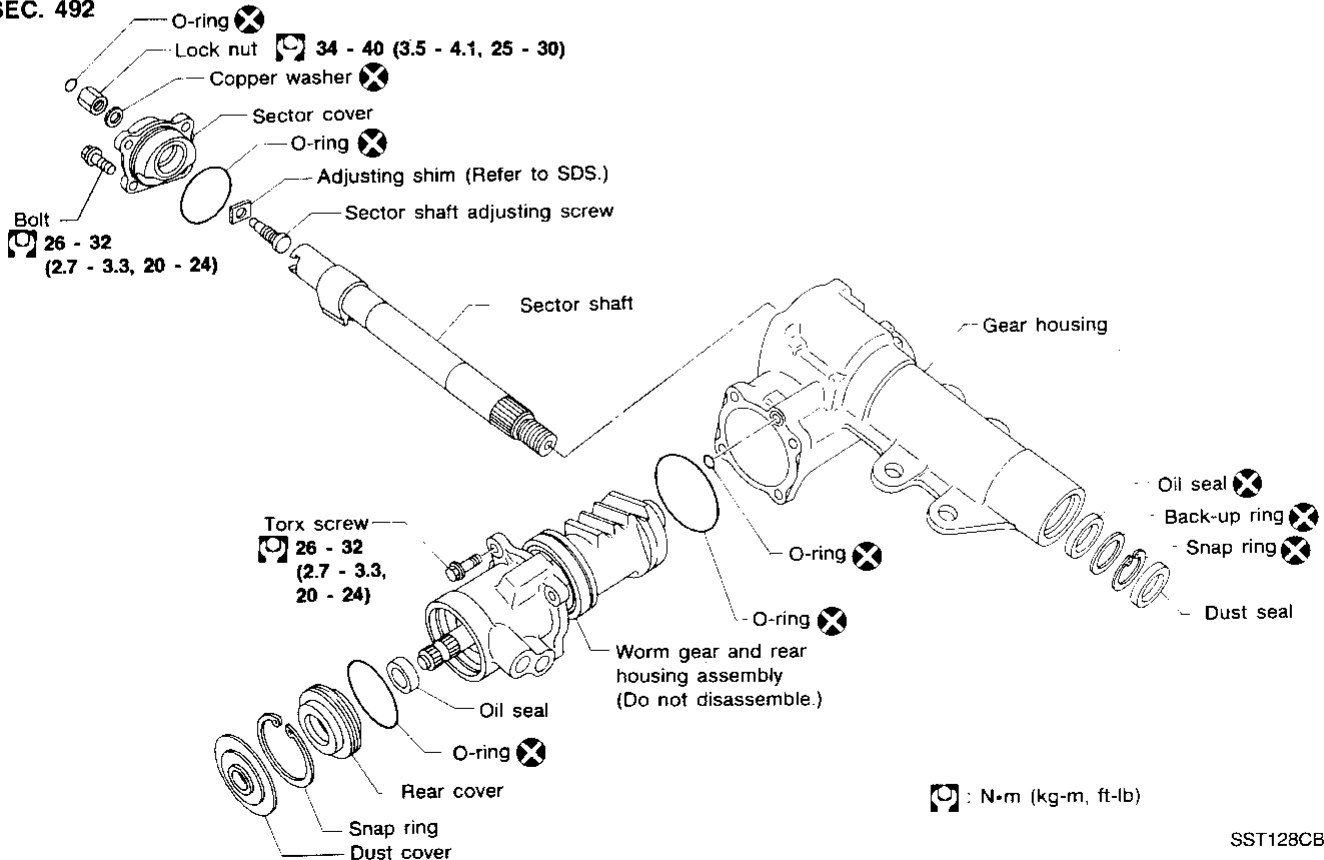
- Plug openings of gear housing, and securely locate hose connectors at a position higher than oil pump and cover with rag.
- Be extremely careful to prevent entry of foreign matter into hoses through connectors.
- When installing gear arm, align four grooves of gear arm serrations with four projections of sector shaft serrations, and install and tighten lock washer and nut.



SST127CB

Power Steering Gear Component

SEC. 492



SST128CB

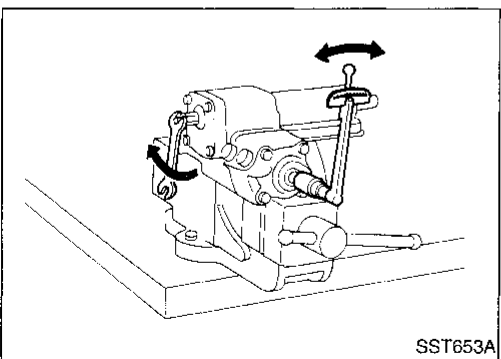
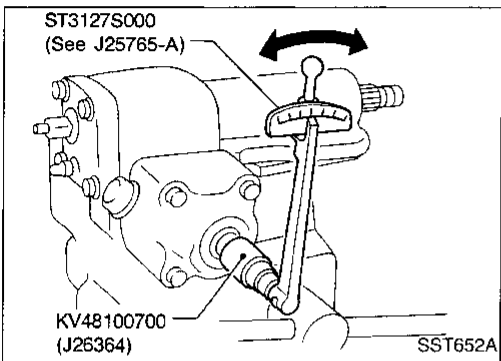
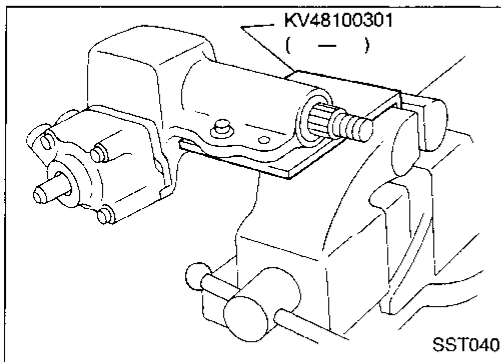
Pre-disassembly Inspection and Adjustment

Before disassembling power steering gear component parts, make sure there is no oil leakage around sealing portion and check steering turning torque as follows:

Check sealing portion.

- Adjusting screw nut O-ring
- Sector shaft cover O-ring
- Sector shaft oil seal
- Rear cover oil seal and O-ring
- Rear housing O-ring
- Gear housing O-ring

Discard any oil seal and O-ring which have been removed. Replace oil seal and O-ring if sealing surface is deformed or cracked.



TURNING TORQUE MEASUREMENT

1. Measure turning torque at 360° position.
 - a. Install steering gear on Tool.

- b. Turn stub shaft all the way to right and left several times.
- c. Measure turning torque at 360° position from straight-ahead position with Tools.

Turning torque at 360°:

0.7 - 1.2 N·m (7 - 12 kg·cm, 6.1 - 10.4 in·lb)

- d. Measure turning torque at straight-ahead position.

Straight-ahead position is a position where stub shaft is turned 2.14 turns (two full turns and 50°) from lock position.

Turning torque at straight-ahead position:

0.1 - 0.4 N·m (1 - 4 kg·cm, 0.9 - 3.5 in·lb)

higher than turning torque at 360°

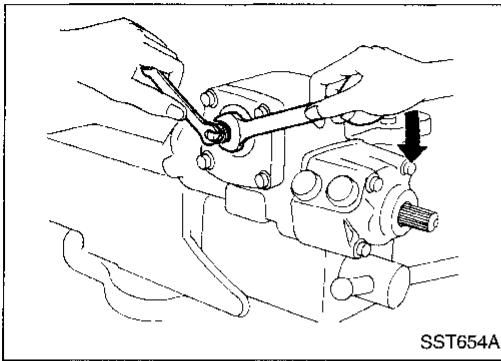
If turning torque is not within specifications, adjust by turning sector shaft adjusting screw.

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POWER STEERING GEAR (Model: PB48S)

Pre-disassembly Inspection and Adjustment (Cont'd)

2. Tighten adjusting screw lock nut with tools.



Disassembly

Before disassembly, measure turning torque.

If not within specifications, replace steering gear assembly.

CAUTION :

Oil sealing parts, dust cover, copper washer and snap ring must not be used again after removal.

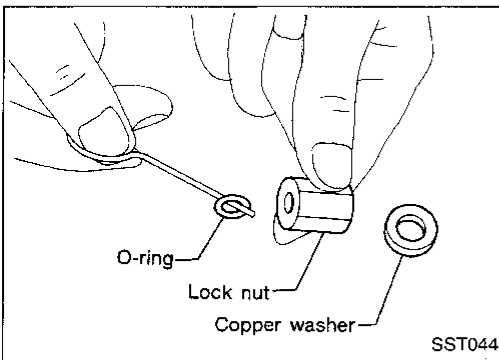
ADJUSTING SCREW LOCK NUT O-RING

Remove adjusting screw lock nut, and replace O-ring.

SECTOR SHAFT OIL SEAL

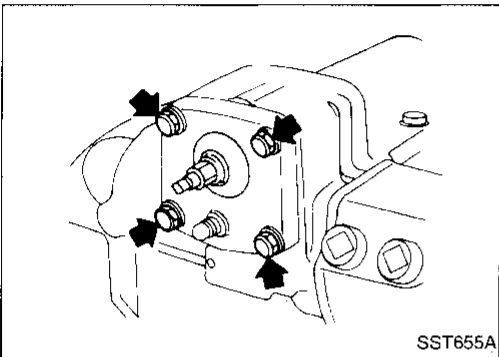
1. Set stub shaft in a straight-ahead position.

Straight-ahead position is a position where stub shaft is turned 2.14 turns (two full turns and 50°) from lock position.



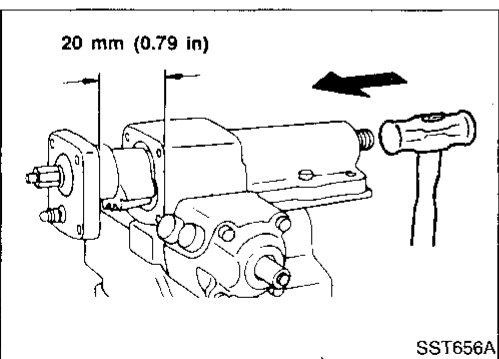
2. Disconnect sector shaft cover bolt.

Do not turn lock nut unless necessary; otherwise it will damage O-ring, resulting in an oil leak.



3. Draw out sector shaft.

Knock out end of sector shaft approximately 20 mm (0.79 in).



POWER STEERING GEAR (Model: PB48S)

Disassembly (Cont'd)

4. Connect a roll of plastic film to sector shaft.

Plastic film:

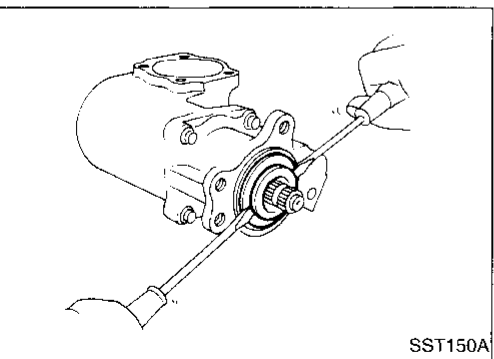
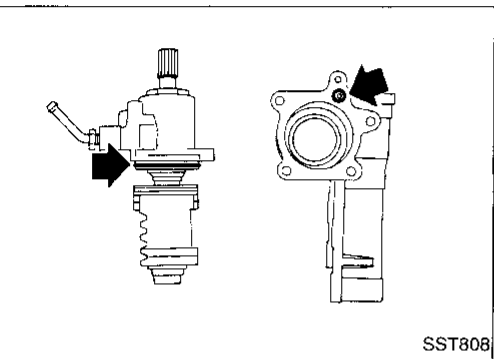
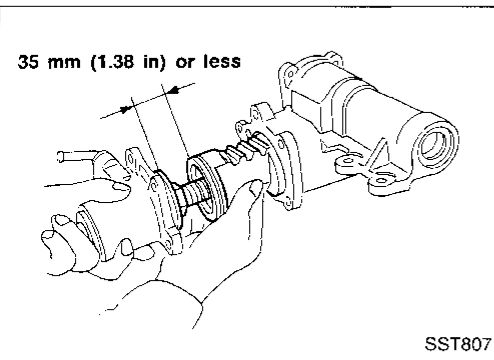
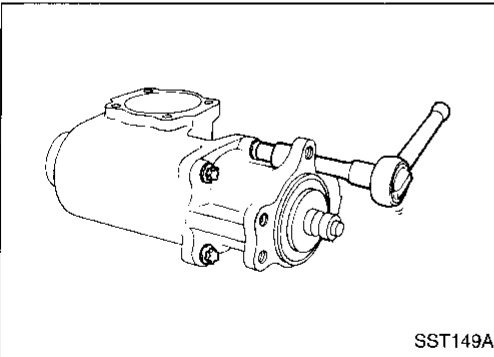
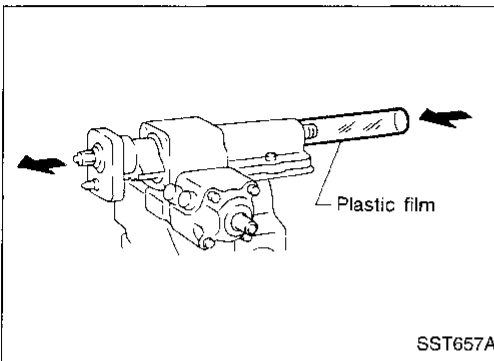
Thickness 0.1 mm (0.004 in)

Length x width

200 x 200 mm (7.87 x 7.87 in)

5. Pull out sector shaft by hand.

Attach plastic film to needle bearings located at two places inside gear housing while simultaneously pulling out sector shaft so that bearings will not drop into housing.



REAR HOUSING O-RING

1. Remove torx screw.

2. Remove rear housing together with worm gear assembly.

CAUTION:

- When worm gear assembly is removed, piston may turn and come off under its own weight. Hold piston to prevent it from turning.
- If piston-to-rear housing clearance exceeds 35 mm (1.38 in) recirculating ball will be out of groove of worm gear; do not reinstall piston but replace the entire assembly.
- Be careful not to damage teflon ring at piston end when removing.

3. Remove O-rings.

REAR COVER O-RING AND OIL SEAL

1. Remove snap ring, then rear cover.
2. Remove O-ring and oil seal.

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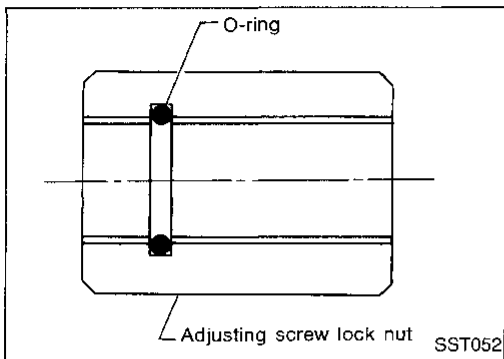
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POWER STEERING GEAR (Model: PB48S)

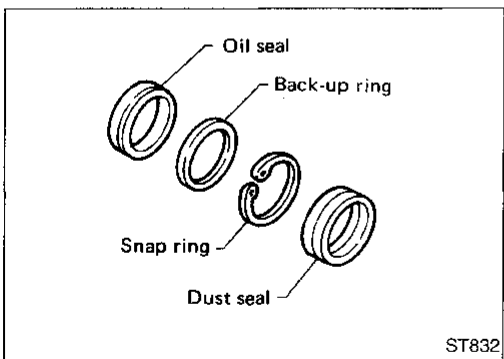


Assembly

ADJUSTING SCREW LOCK NUT O-RING

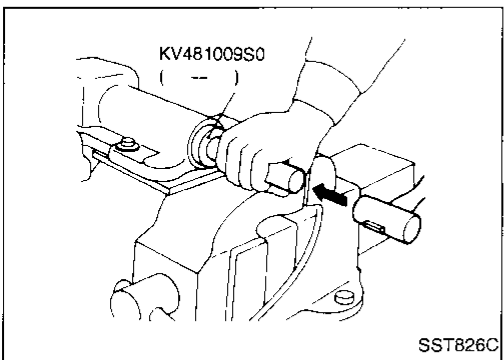
Insert new O-ring into adjusting screw lock nut.

- Before inserting, apply a thin coat of petroleum jelly to O-ring.
- Insert O-ring to make sure it fits into groove.

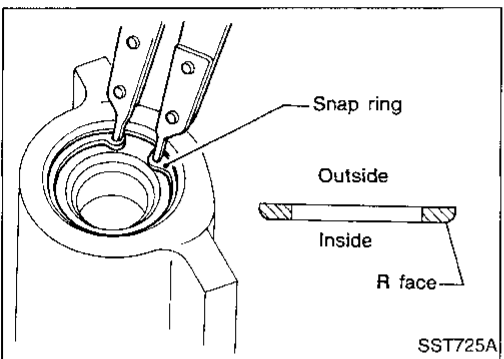


SECTOR SHAFT OIL SEAL

- When installing, be sure to use new oil seal, dust seal, back-up ring and snap ring.
- Before installing, apply a thin coat of petroleum jelly to new oil seal and dust seal.



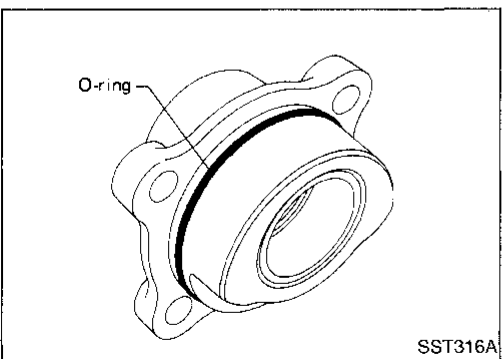
1. Press new oil seal and then install back-up ring with Tool.



2. Install a new snap ring into gear housing.

CAUTION:

- Turn snap ring to make sure it fits into groove.
- Always install snap ring with R face facing inward.



3. Press a new dust seal.
 4. Fit new O-ring into sector shaft cover.
- Before installing, apply a thin coat of petroleum jelly to O-ring.
 - Make sure that O-ring is installed properly and is not damaged by sector shaft.

POWER STEERING GEAR (Model: PB48S)

Assembly (Cont'd)

SECTOR SHAFT END PLAY

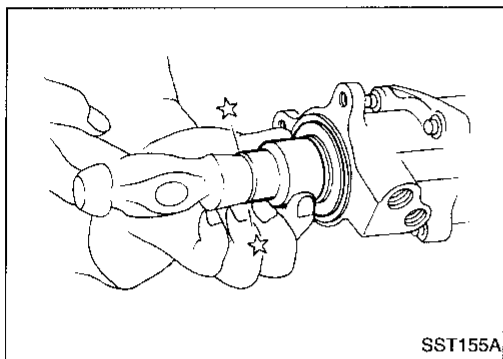
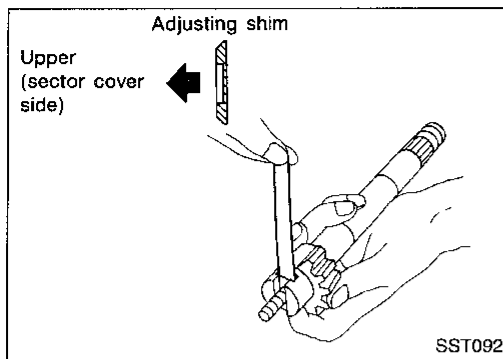
Select suitable adjusting shim and adjust end play between sector shaft and adjusting screw.

Sector shaft end play:

0.01 - 0.03 mm (0.0004 - 0.0012 in)

Sector shaft adjusting screw shims:

Refer to SDS, ST-42.

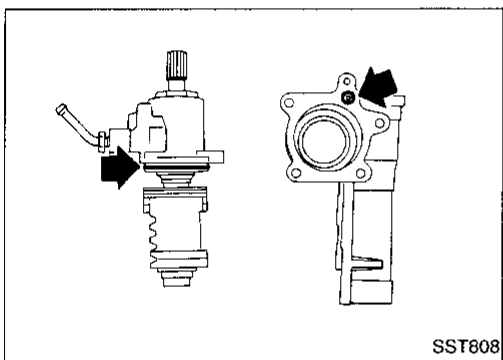


REAR COVER O-RING AND OIL SEAL

1. Install new O-ring and oil seal.
2. Install rear cover, then install snap ring.

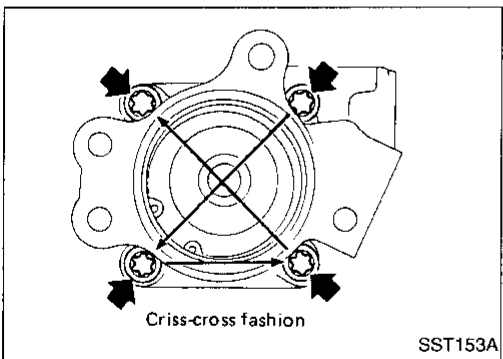
CAUTION:

- a. Turn snap ring to make sure it fits into grooves.
- b. Always install snap ring with its rounded edge facing rear cover.



REAR HOUSING O-RING

1. Install new O-rings.
 - a. Before installing, apply a thin coat of petroleum jelly to O-ring.
 - b. Make sure O-ring is installed correctly and is not damaged by worm gear.



2. Gradually insert worm gear and rear housing assembly into gear housing, being careful not to damage oil seal and O-rings.
3. Install torx screws.

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POWER STEERING GEAR (Model: PB48S)

Assembly (Cont'd)

SECTOR SHAFT

1. Set piston rack at straight-ahead position.

Turn piston rack about 10° to 15° toward yourself with your finger. This permits smooth insertion of sector gear.

2. Wrap vinyl tape around serration area of sector shaft.

Vinyl tape prevents oil seal lip from being damaged during insertion.

3. Gradually insert sector shaft into gear housing, being careful not to damage oil seal.

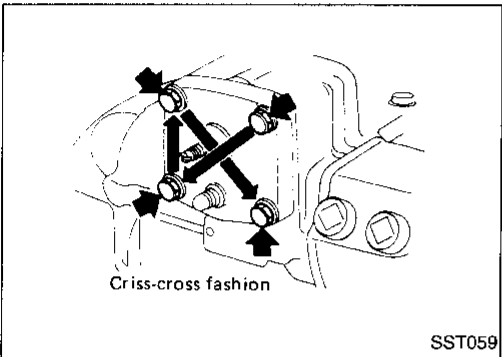
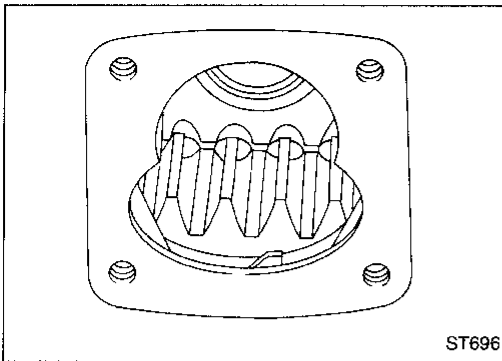
When inserting sector shaft into gear housing, remove plastic film. Be careful not to drop bearings into gear housing.

4. Tighten sector shaft cover bolts.

5. Check turning torque and steering gear preload.

Refer to "TURNING TORQUE MEASUREMENT", "Pre-disassembly Inspection and Adjustment", ST- 29.

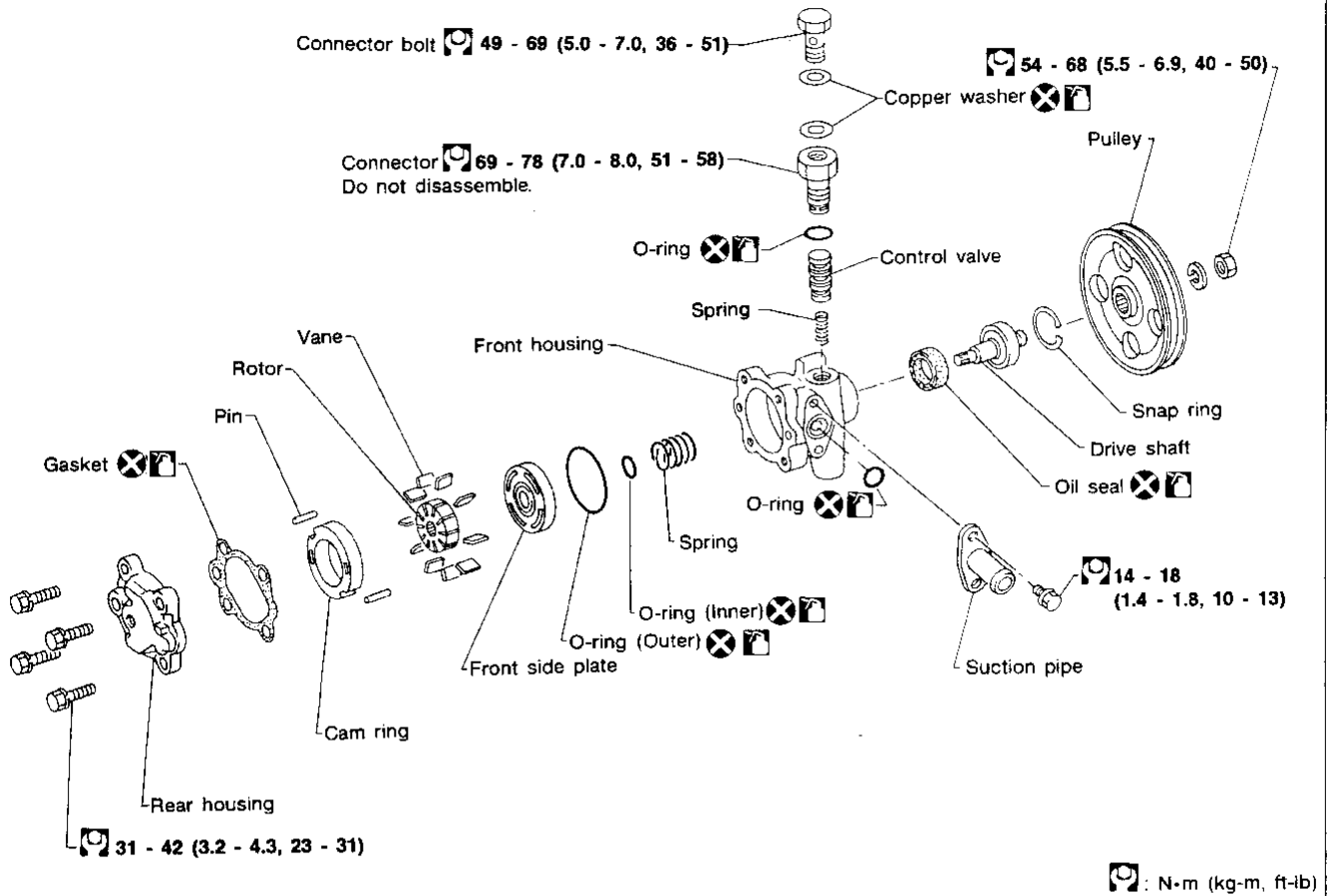
- If turning torque is considerably different from the value before disassembly, replace the entire assembly.



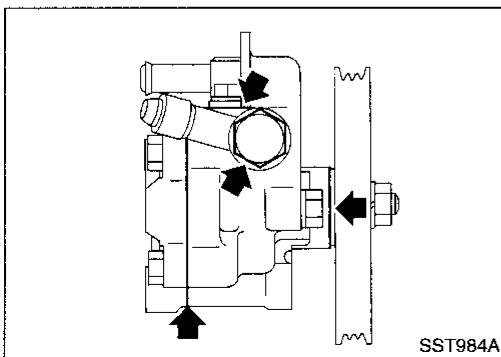
POWER STEERING OIL PUMP

Disassembly and Assembly

SEC. 490



AST167



Pre-disassembly Inspection

Disassemble the power steering oil pump only if the following items are found.

- Oil leak from any point shown in the figure.
- Deformed or damaged pulley.
- Poor performance.

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POWER STEERING OIL PUMP

Inspection

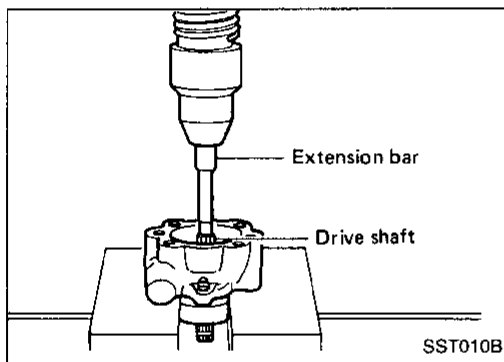
PULLEY AND PULLEY SHAFT

- If pulley is cracked or deformed, replace it.
- If fluid leak is found around the pulley shaft, replace the oil seal.

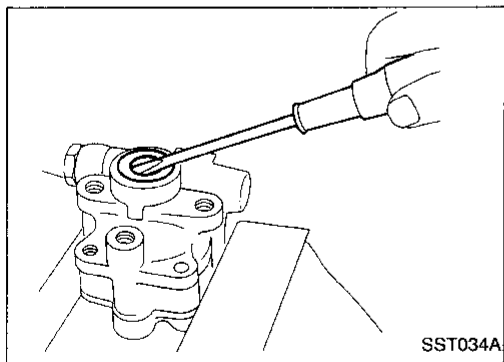
Disassembly

CAUTION:

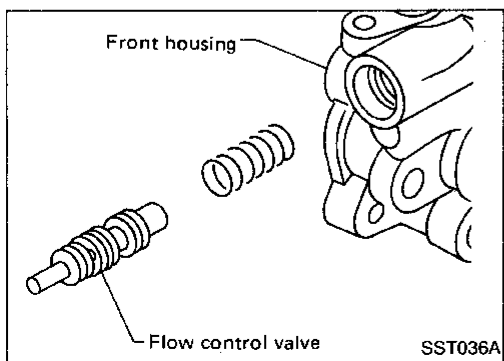
- Parts which can be disassembled are strictly limited. Never disassemble parts other than those specified.
- Disassemble in as clean a place as possible.
- Clean your hands before disassembly.
- Do not use rags; use nylon cloths or paper towels.
- When disassembling and reassembling, do not let foreign matter enter or contact the parts.



- Remove snap ring, then draw drive shaft out.
- **Be careful not to drop drive shaft.**

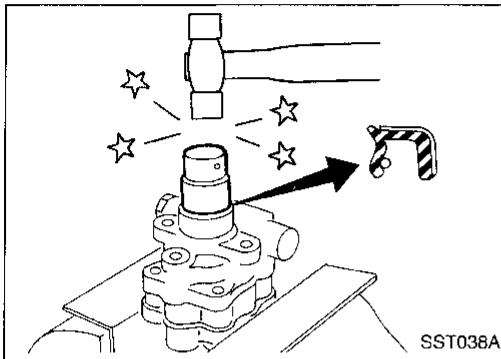


- Remove oil seal.
- **Be careful not to damage front housing.**



- Remove connector.
- **Be careful not to drop control valve.**

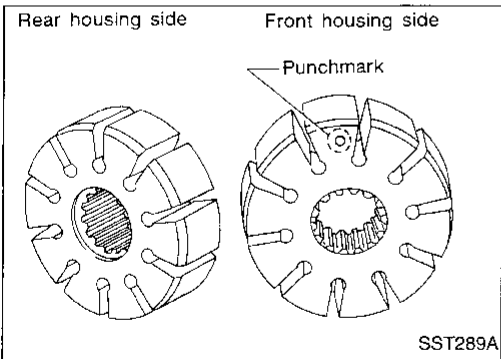
POWER STEERING OIL PUMP



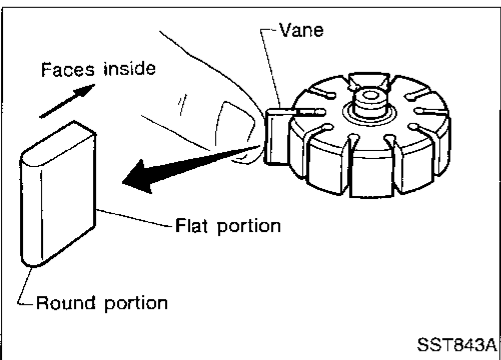
Assembly

Assemble oil pump, noting the following instructions.

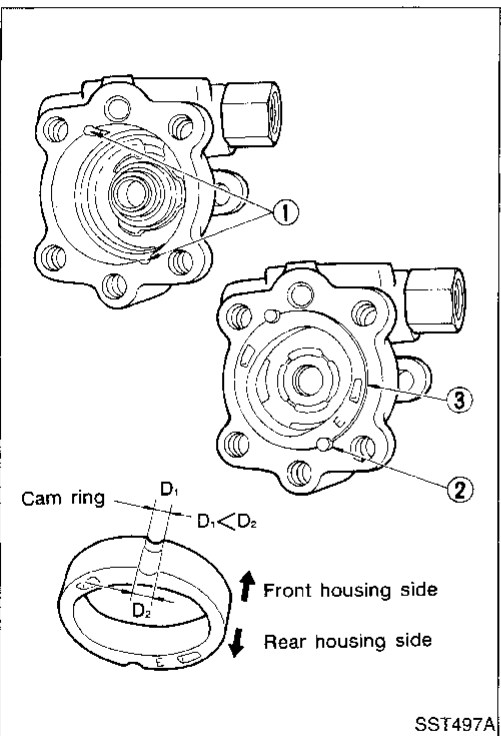
- Make sure O-rings and oil seal are properly installed.
- Always install new O-rings and oil seal.
- Be careful of oil seal direction.
- Cam ring, rotor and vanes must be replaced as a set if necessary.
- When assembling, coat each part with ATF.



- Pay attention to the direction of rotor.



- When assembling vanes to rotor, rounded surfaces of vanes must face cam ring side.



- Insert pin ② into pin groove ① of front housing and front side plate. Then install cam ring ③ as shown at left.

Cam ring:

D_1 is less than D_2

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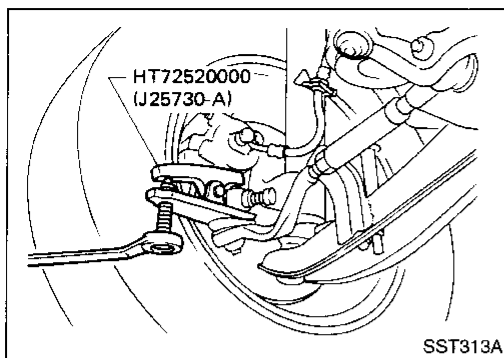
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STEERING LINKAGE

Removal and Installation (Cont'd)

Remove tie-rod from knuckle arm with Tool.



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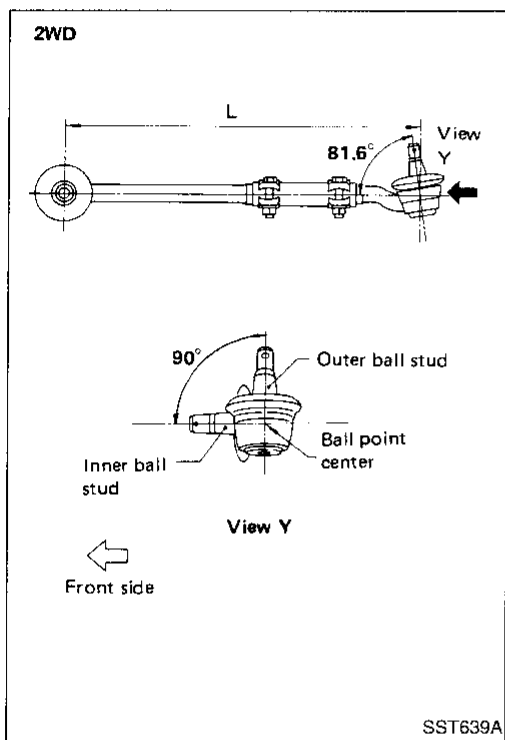
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Disassembly

IDLER ARM ASSEMBLY

- Apply coat of multi-purpose grease to bushing.
- Press bushing into idler body, and insert shaft of idler bracket carefully until bushing protrudes.

CROSS ROD AND TIE-ROD

1. When tie-rod ball joints and tie-rod bar are separated, adjust tie-rod length correctly. Adjustment should be done between ball stud centers.
2. Lock tie-rod clamp nut so that ball joint on outer ball stud is as follows with respect to that on inner ball stud.

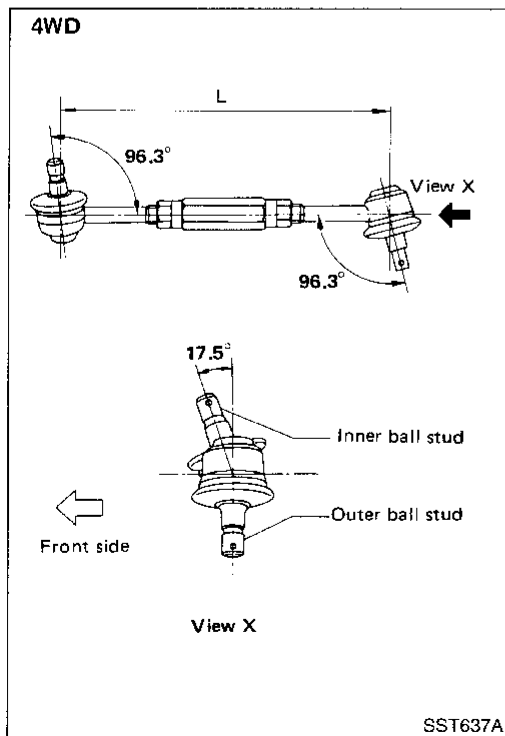
L: Standard

344 mm (13.54 in) ... 2WD

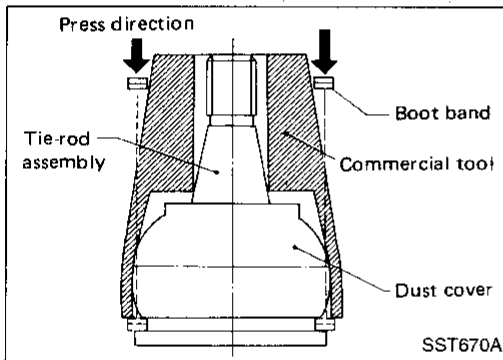
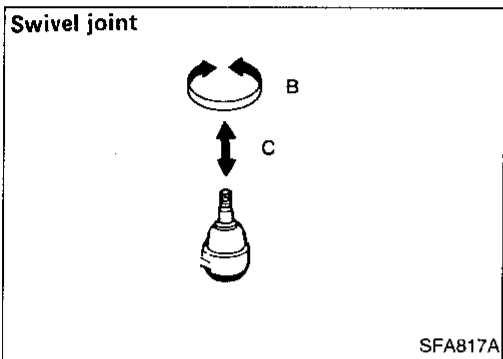
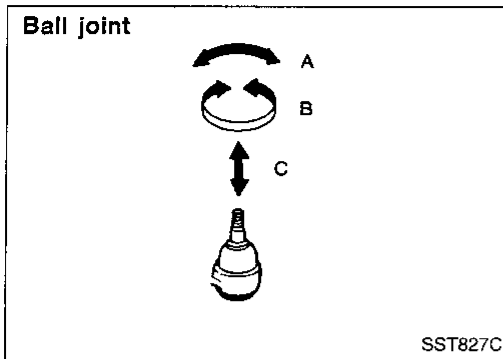
281 mm (11.06 in) ... 4WD

CAUTION:

Make sure that tie-rod bars are screwed into tie-rod tube more than 35 mm (1.38 in).



STEERING LINKAGE



Inspection

BALL JOINT AND SWIVEL JOINT

1. Check joints for play. If ball or swivel stud is worn and play in axial direction is excessive or joint is hard to swing, replace as a complete unit.

Swinging force (Measure point: Cotter pin hole) "A":

Ball joint

10.8 - 107.9 N (1.1 - 11.0 kg, 2.4 - 24.3 lb)

Rotating torque "B":

Ball joint

0.5 - 4.9 N·m (5 - 50 kg-cm, 4.3 - 43.4 in-lb)

Swivel joint

0.5 - 4.9 N·m (5 - 50 kg-cm, 4.3 - 43.4 in-lb)

Axial end play "C":

Ball joint

0.1 - 0.8 mm (0.004 - 0.031 in)

Swivel joint

0.1 - 1.0 mm (0.004 - 0.039 in)

2. Check condition of dust cover. If it is cracked excessively, replace dust cover.

- When replacing dust cover, be careful not to damage it.
- Lubricate joint with multi-purpose grease, if necessary.
- When installing boot band with commercial service tool, be careful not to overexpand it. Refer to ST-4.

CAUTION:

Be careful not to apply grease or oil to taper of joint.

IDLER ARM ASSEMBLY

- Check rubber bushing of idler arm for breakage, wear or play, and if necessary replace.
- Lubricate idler arm assembly with multi-purpose grease, if necessary.

When lubricating, refer to "BALL JOINT AND SWIVEL JOINT".

CROSS ROD AND TIE-ROD

Check tie-rod and cross rod for breakage, bends or cracks, and replace with a new one if necessary.

STEERING DAMPER

Check for oil leaking from damper, and replace if necessary.

FIXING LOCATION

- Check fixing location (nuts and cotter pins) for looseness, play or breakage.
- When looseness or play is found, check for wear on tapered portion of joints, gear arm of idler arm.
- When reassembling each joint, use new cotter pins.

SERVICE DATA AND SPECIFICATIONS (SDS)

General Specifications

Steering column type (Collapsible)	Manual steering	Power steering	
	2WD	2WD	4WD
Steering gear type	VB66K	PB48S	PB59K
Turns of steering wheel on the vehicle (Lock-to-lock)	5.8	3.7	3.4
Steering gear ratio	24.4 - 26.84	16.5	15

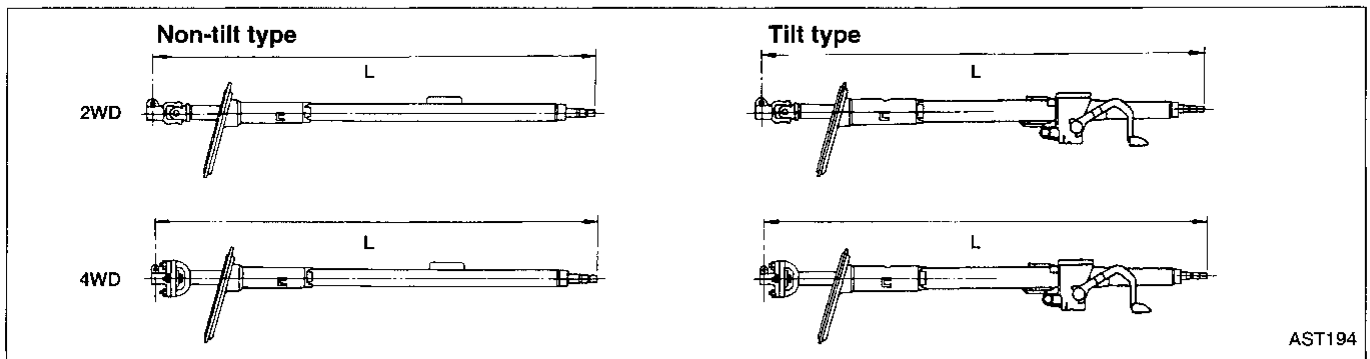
Steering wheel axial play mm (in)	0 (0)
Steering wheel play mm (in)	35 (1.38) or less

Inspection and Adjustment

STEERING COLUMN

Unit: mm (in)

	Dimension "L"
2WD model	895.0 - 898.6 (35.24 - 35.38)
4WD model	863.1 - 866.7 (33.98 - 34.12)



AST194

SERVICE DATA AND SPECIFICATIONS (SDS)

Inspection and Adjustment (Cont'd)

MANUAL STEERING GEAR (Model: VB66K)

Worm bearing preload N-m (kg-cm, in-lb)	0.69 - 0.88 (7.0 - 9.0, 6.1 - 7.8)	
Steering gear turning torque N-m (kg-cm, in-lb)		
360° position from straight-ahead position	0.69 - 0.88 (7.0 - 9.0, 6.1 - 7.8)	
Straight-ahead position (As compared with steering wheel turned 360°)	0.20 - 0.39 (2.0 - 4.0, 1.7 - 3.5)	
Maximum turning torque	1.08 (11.0, 9.5)	
Backlash at pitman arm top end (in a straight-ahead position) mm (in)	0 - 0.1 (0 - 0.004)	
End play (Between sector shaft and adjusting screw) mm (in)	0.1 (0.004) or less	
Adjusting shim thickness	Thickness mm (in)	Part number
	1.95 (0.0768)	48129-84500
	2.00 (0.0787)	48130-84500
	2.05 (0.0807)	48131-84500
Oil capacity l (US pt, Imp pt)	Approx. 0.62 (1-3/8, 1-1/8)	

STEERING LINKAGE

Applied model	2WD	4WD
Relay-rod swivel joint		
Rotating torque N-m (kg-cm, in-lb)	—	0.5 - 4.9 (5 - 50, 4.3 - 43.4)
Axial end play mm (in)	—	0.1 - 1.0 (0.004 - 0.039)
Tie-rod & relay-rod ball joint		
Swinging force at cotter pin hole N (kg, lb)	10.8 - 107.9 (1.1 - 11.0, 2.4 - 24.3)	
Rotating torque N-m (kg-cm, in-lb)	0.5 - 4.9 (5 - 50, 4.3 - 43.4)	
Axial end play mm (in)	0.1 - 0.8 (0.004 - 0.031)	
Tie-rod standard engine (L) mm (in)	344 (13.54)	281 (11.06)

POWER STEERING SYSTEM (Model: PB48S)

Steering wheel turning force (at 360° from neutral position and circumference of steering wheel) N (kg, lb)	24.5 - 29.4 (2.5 - 3.0, 5.5 - 6.6)	
Oil pump pressure kPa (kg/cm ² , psi)	7,649 - 8,238 (78 - 84, 1,109 - 1,194) at idling	
Fluid capacity ml (US fl oz, Imp fl oz)	Approximately 900 - 1,000 (30.4 - 33.8, 31.7 - 35.2)	
Normal operating temperature °C (°F)	60 - 80 (140 - 176)	
Steering gear turning torque N-m (kg-cm, in-lb)		
360° position from straight-ahead position	0.7 - 1.2 (7 - 12, 6.1 - 10.4)	
Straight-ahead position (As compared with steering wheel turned 360°)	0.1 - 0.4 (1 - 4, 0.9 - 3.5) higher	
Backlash at pitman arm top end (in a straight-ahead position) mm (in)	0 - 0.1 (0 - 0.004)	
End play (Between sector shaft and adjusting screw) mm (in)	0.01 - 0.03 (0.0004 - 0.0012)	
Adjusting shim thickness	Thickness mm (in)	Part number
	1.575 - 1.600 (0.0620 - 0.0630)	48213-B0100
	1.550 - 1.575 (0.0610 - 0.0620)	48214-B0100
	1.525 - 1.550 (0.0600 - 0.0610)	48215-B0100
	1.500 - 1.525 (0.0591 - 0.0600)	48216-B0100
	1.475 - 1.500 (0.0581 - 0.0591)	48217-B0100
	1.450 - 1.475 (0.0571 - 0.0581)	48218-B0100

SERVICE DATA AND SPECIFICATIONS (SDS)

Inspection and Adjustment (Cont'd)

POWER STEERING SYSTEM (Model: PB59K)

Steering wheel turning force (at 360° from neutral position and circumference of steering wheel) N (kg, lb)	39 (4, 9) or less
Oil pump pressure kPa (kg/cm ² , psi)	7,649 - 8,238 (78 - 84, 1,109 - 1,194) at idling
Fluid capacity ml (US fl oz, Imp fl oz)	Approximately 1,000 - 1,100 (33.8 - 37.2, 35.2 - 38.7)
Normal operating temperature °C (°F)	60 - 80 (140 - 176)
Steering gear turning torque N-m (kg-cm, in-lb)	
360° position from straight-ahead position	0.15 - 0.78 (1.5 - 8.0, 1.3 - 6.9)
Straight-ahead position (As compared with steering wheel turned 360°)	0.25 - 1.32 (2.5 - 13.5, 2.2 - 11.7) higher
Maximum turning torque	1.03 - 1.47 (10.5 - 15, 9.1 - 13.0)
Backlash at pitman arm top end (in a straight-ahead position) mm (in)	0 - 0.1 (0 - 0.004)
End play (at sector shaft end in neutral position) mm (in)	0.1 (0.004) or less

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