SECTION ST

CONTENTS

When you read wiring diagrams:
- **Read GI section, "HOW TO READ WIRING DIAGRAMS".**
- **See EL section, "POWER SUPPLY ROUTING" for power distribution circuit.**

When you perform trouble diagnoses, read GI section, "HOW TO FOLLOW FLOW CHART IN TROUBLE DIAGNOSES".

Precautions

SUPPLEMENTAL RESTRAINT SYSTEM (SRS) "AIR BAG" AND "SEAT BELT PRE-TENSIONER"

The Supplemental Restraint System "Air Bag" and "Seat Belt Pre-tensioner", used along with a seat belt, help to reduce the risk or severity of injury to the driver and front passenger in a frontal collision. The Supplemental Restraint System consists of air bag modules (located in the center of the steering wheel and on the instrument panel on the passenger side), seat belt pre-tensioners, a diagnosis sensor unit, warning lamp, wiring harness 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 INFINITI 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.**

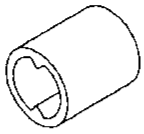
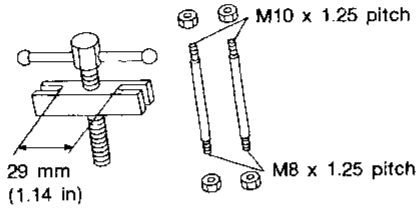
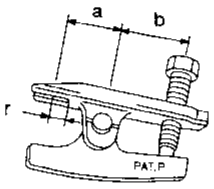
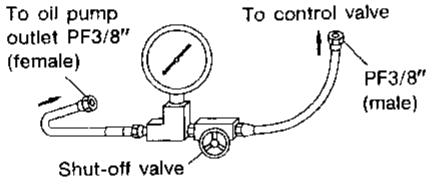
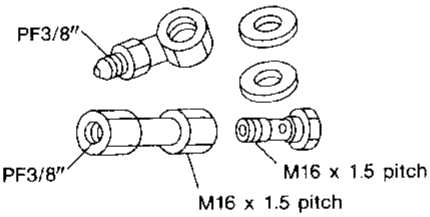
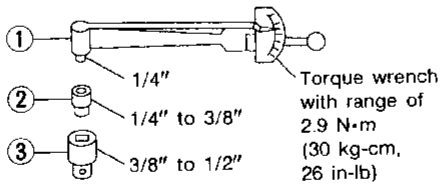
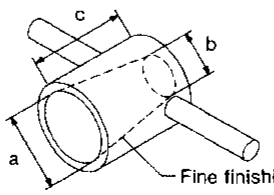
STEERING SYSTEM

- **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.**
- **Place disassembled parts in order, on a parts rack, for easier and proper assembly.**
- **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. Vaseline 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.**

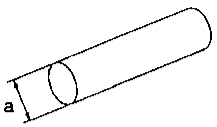
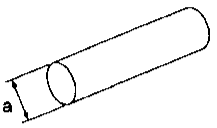
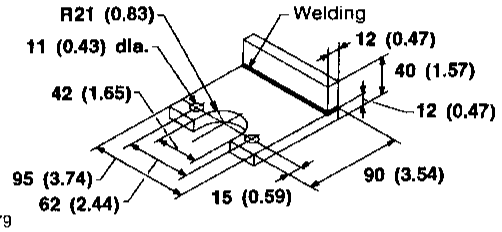
*: **Automatic transmission fluid**

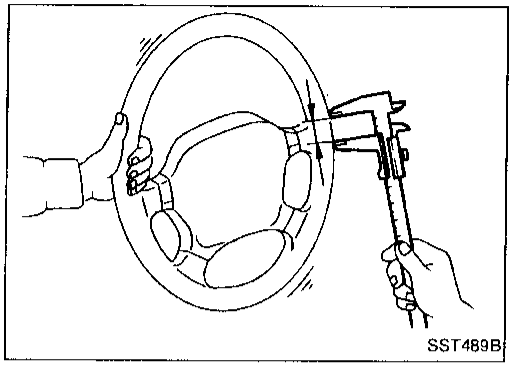
Special Service Tools

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	
KV48100700 (J26364) Torque adapter	 NT169	Measuring pinion rotating torque
ST27180001 (J25726-A) Steering wheel puller	 NT544	Removing steering wheel
HT72750000 (J24319-01) Ball joint remover	 NT546	Removing ball joint **a: 32 mm (1.26 in)** **b: 70 mm (2.76 in)** **r: R11 mm (0.43 in)**
ST27091000 (J26357 and J26357-10) Pressure gauge	 NT547	Measuring oil pressure
KV48102500 (J33914) Pressure gauge adapter	 NT542	Measuring oil pressure
ST3127S000 (See J25765-A) ① GG91030000 (J25765-A) Torque wrench ② HT62940000 (—) Socket adapter ③ HT62900000 (—) Socket adapter	 NT541	Measuring turning torque
KV48104400 (—) Rack seal ring reformer	 NT550	Reforming teflon ring **a: 50 mm (1.97 in) dia.** **b: 36 mm (1.42 in) dia.** **c: 100 mm (3.94 in)**

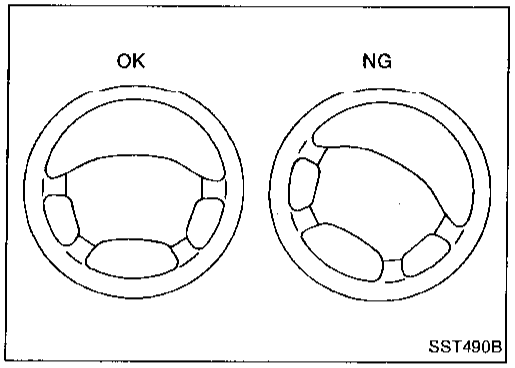
Commercial Service Tools

Tool name	Description	
Rear oil seal drift	 NT063	Installing rear oil seal **a: 28 mm (1.10 in) dia.**
Pinion oil seal drift	 NT063	Installing pinion oil seal **a: 35 mm (1.38 in) dia.**
Oil pump attachment	 NT179	Disassembling and assembling oil pump Unit: mm (in)


SST489B

Checking Steering Wheel Play

- With wheels in a straight-ahead position, 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.
  Steering gear assembly
  Steering column
  Front suspension and axle



SST490B

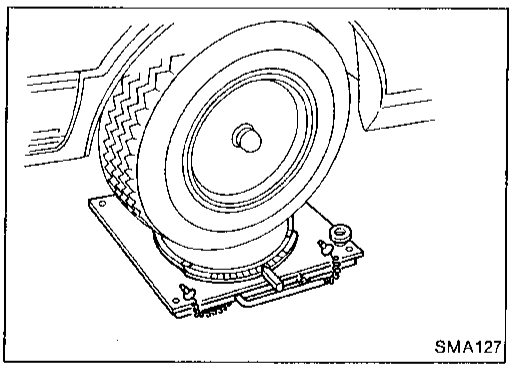
Checking Neutral Position on Steering Wheel

Pre-checking

- Make sure that wheel alignment is correct.
  Wheel alignment: Refer to SDS in FA section.
- Verify that the steering gear is centered before removing the steering wheel.

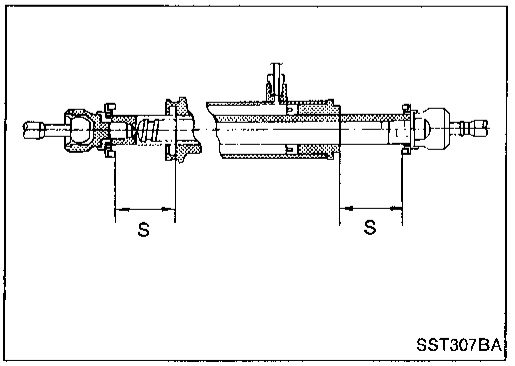
Checking

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 between two teeth, loosen tie-rods lock nuts. Turn the tie-rods by the same amount in opposite directions on both left and right sides.


SMA127

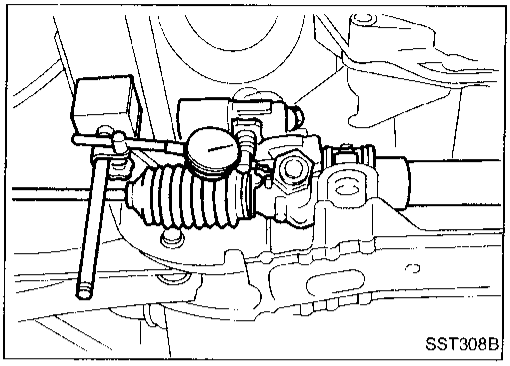
Front Wheel Turning Angle

1. Rotate steering wheel all the way right and left; measure turning angle.
   Turning angle of full turns:
   Refer to SDS in FA section.



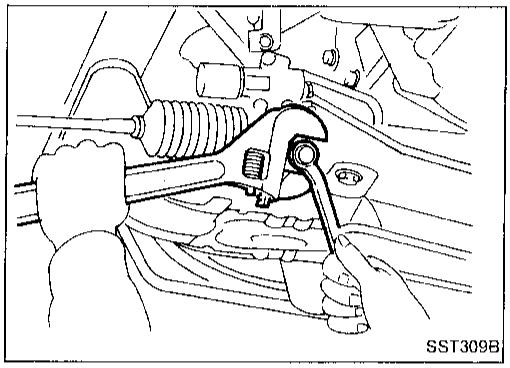
SST307BA

2. If it is not within specification, check rack stroke.
   Rack stroke "S":
   Refer to SDS (ST-42).



Checking Gear Housing Movement

1. Check the movement of steering gear housing during stationary steering on a dry paved surface.
- Apply a force of 49 N (5 kg, 11 lb) to steering wheel to check the gear housing movement.
  Turn off ignition key while checking.
  Movement of gear housing:
  ±2 mm (±0.08 in) or less
2. If movement exceeds the limit, replace mount insulator after confirming proper installation of gear housing clamps.



Adjusting Rack Retainer

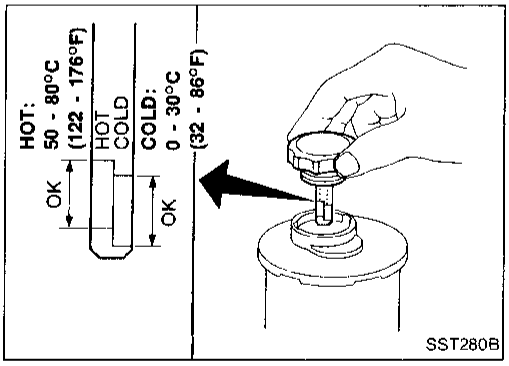
- Perform this driving test on a flat road.

1. Check whether vehicle moves in a straight line when steering wheel is released.
2. Check whether steering wheel returns to neutral position when steering wheel is released from a slightly turned (approx. 20°) position.

- If any abnormality is found, correct it by resetting adjusting screw.

Checking and Adjusting Drive Belts

Refer to "Checking Drive Belts" for "ENGINE MAINTENANCE" in MA section.

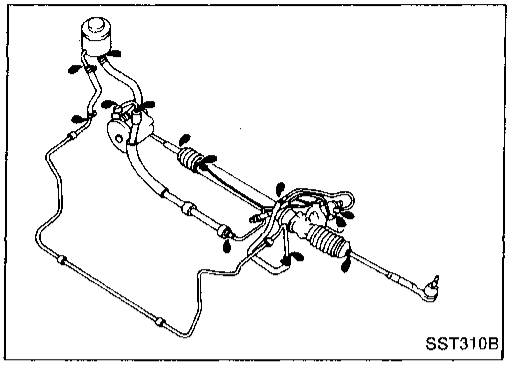


Checking Fluid Level

Check fluid level.
Check fluid level with dipstick on reservoir cap. Use "HOT" range at fluid temperatures of 50 to 80°C (122 to 176°F). Use "COLD" range at fluid temperatures of 0 to 30°C (32 to 86°F).

CAUTION:

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



Checking Fluid Leakage

Check the lines for improper attachment and for leaks, cracks, damage, loose connections, chafing or deterioration.

1. Run engine at idle speed or 1,000 rpm.
   Make sure temperature of fluid in oil 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 the steering wheel in a locked position for more than 15 seconds.

4. If fluid leakage at connectors is noticed, loosen flare nut and then retighten.

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

5. Check rack boots for accumulation of power steering fluid.

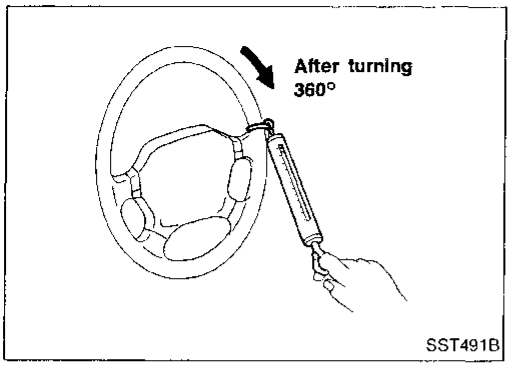
Bleeding Hydraulic System

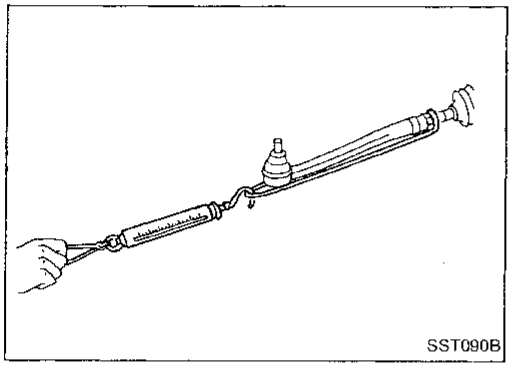
1. Raise front end of vehicle until wheels clear ground.
2. Add fluid into oil tank to specified level. Meanwhile, quickly turn steering wheel fully to right and left and lightly touch steering stoppers.
   Repeat steering wheel operation until fluid level no longer decreases.
3. Start engine.
   Repeat step 2 above.

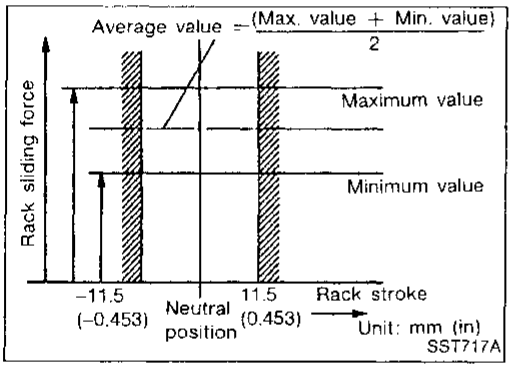
- Incomplete air bleeding will cause the following to occur. When this happens, bleed air again.

a. Generation of air bubbles in reservoir tank
b. Generation of clicking noise in oil pump
c. Excessive buzzing in oil pump

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







Checking Steering Wheel Turning Force

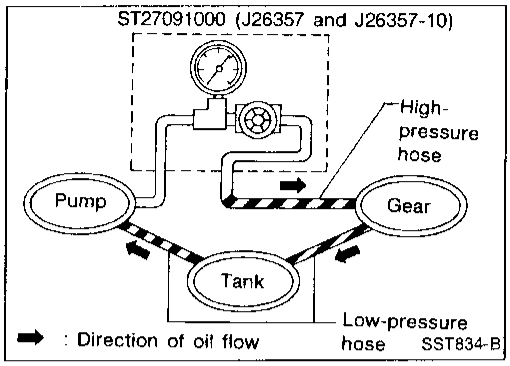
1. Park vehicle on a level, dry surface and set parking brake.
2. Start engine.
3. Bring power steering fluid up to adequate operating temperature. [Make sure temperature of fluid is approximately 60 to 80°C (140 to 176°F).]

Tires need to be inflated to normal pressure.

4. Check steering wheel turning force when steering wheel has been turned 360° from the neutral position.
   Steering wheel turning force:
   39 N (4 kg, 9 lb) or less
5. If steering wheel turning force is out of specification, check rack sliding force.

a. Disconnect steering column lower joint and knuckle arms from the gear.
b. Start and run engine at idle to make sure steering fluid has reached normal operating temperature.
c. Pull tie-rod slowly to move it from neutral position to ±11.5 mm (±0.453 in) at speed of 3.5 mm (0.138 in)/s. Check that rack sliding force is within specification.
   Average rack sliding force:
   216 - 275 N (22 - 28 kg, 49 - 62 lb)
   Maximum force deviation:
   39 N (4 kg, 9 lb)
d. Check sliding force outside above range at rack speed of 40 mm (1.57 in)/s.
   Maximum rack sliding force:
   294 N (30 kg, 66 lb)
   Maximum force deviation:
   147 N (15 kg, 33 lb)

6. If rack sliding force is not within specification, overhaul steering gear assembly.



Checking Hydraulic System

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

1. Set Tool. Open shut-off valve. Then bleed air. (See "Bleeding Hydraulic System", ST-7.)
2. Run engine.

Make sure temperature of fluid in 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 oil pump increases to maximum. This will raise oil temperature abnormally.

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

CAUTION:

Do not hold the steering wheel in a locked position for more than 15 seconds.

Oil pump maximum standard pressure:
7,649 - 8,238 kPa
(78 - 84 kg/cm^2, 1,109 - 1,194 psi)

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

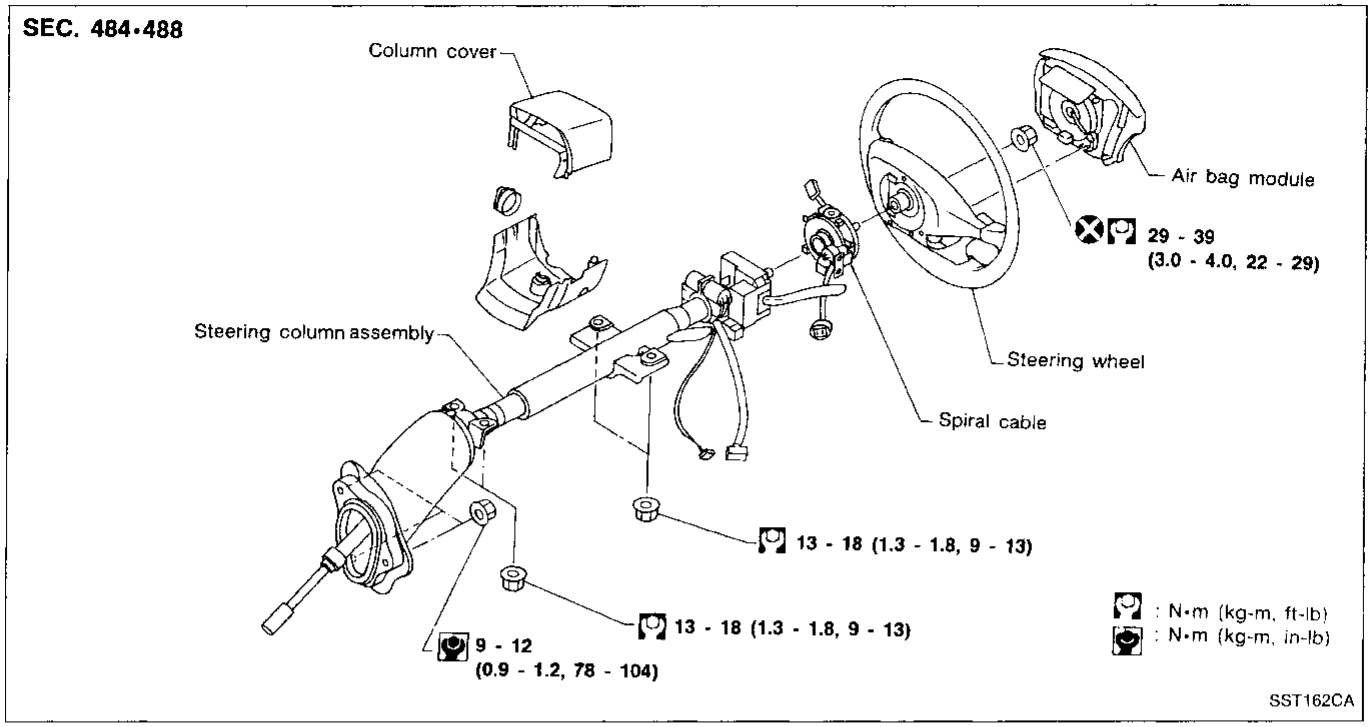
- When pressure reaches standard pressure, gear is damaged.
- When pressure remains below standard pressure, pump is damaged.

CAUTION:

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

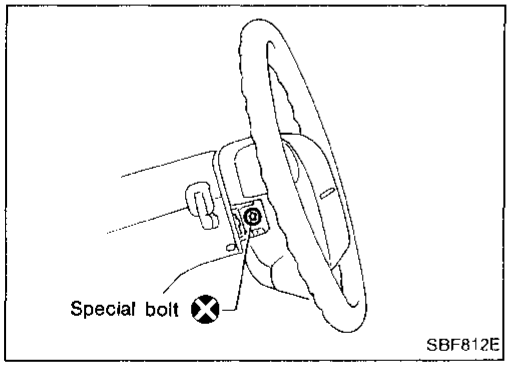
5. If oil pressure is higher than standard pressure, check oil pump flow control valve.
6. After checking hydraulic system, remove Tool and add fluid as necessary. Then completely bleed air out of system.

Removal and Installation



CAUTION:

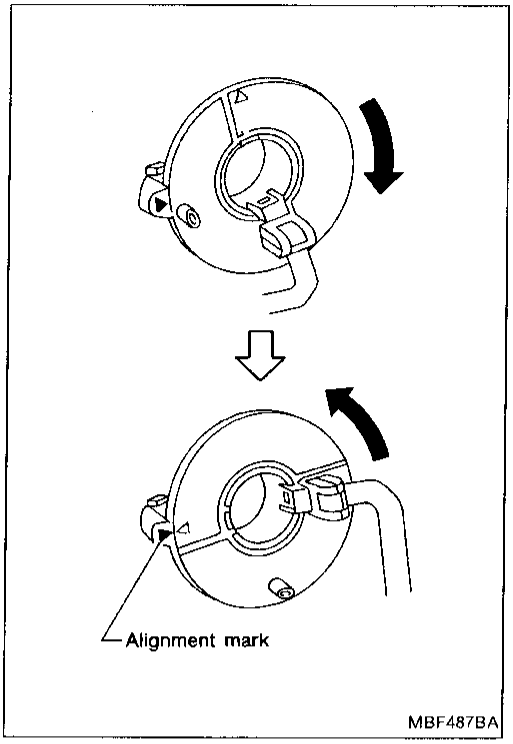
- **The rotation of the spiral cable (SRS "Air bag" component part) is limited. If the steering gear must be removed, set the front wheels in the straight-ahead direction. Do not rotate the steering column while the steering gear is removed.**
- **Remove the steering wheel before removing the steering lower joint to avoid damaging the SRS spiral cable.**



STEERING WHEEL

- Remove air bag module and spiral cable. Refer to "Removal — Air Bag Module and Spiral Cable", "SUPPLEMENTAL RESTRAINT SYSTEM" in RS section.

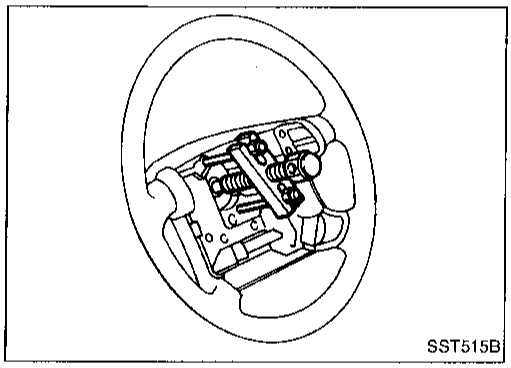
Removal and Installation (Cont'd)



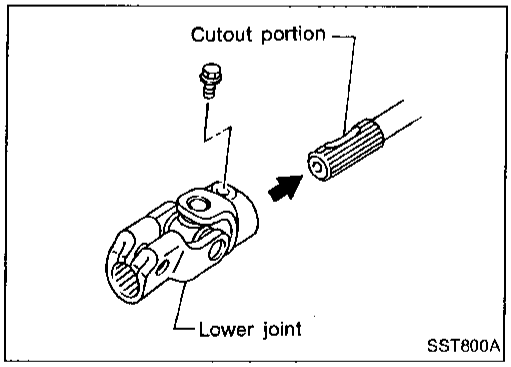
- Align spiral cable correctly when installing steering wheel.

a. Set the front wheels in the straight-ahead position.
b. Make sure that the spiral cable is in the neutral position. The neutral position is detected by turning left 2.5 revolutions from the right end position. Align the two marks (⧗).

CAUTION:
The spiral cable may snap due to steering operation if the cable is installed in an improper position.
Also, with the steering linkage disconnected, the cable may snap by turning the steering wheel beyond the limited number of turns. (The spiral cable can be turned up to 2.5 turns from the neutral position to both the right and left.)



- Remove steering wheel with Tool.

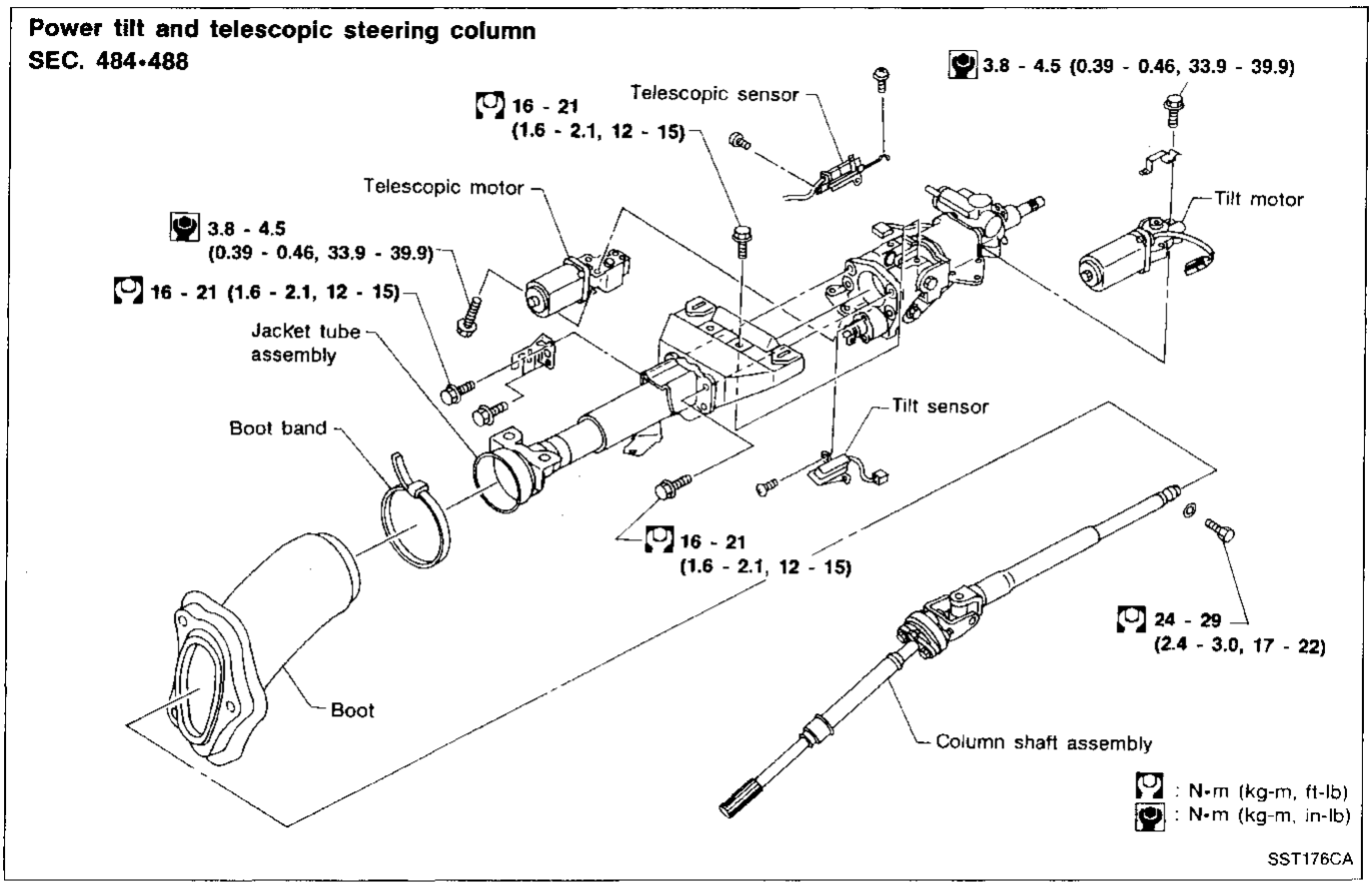


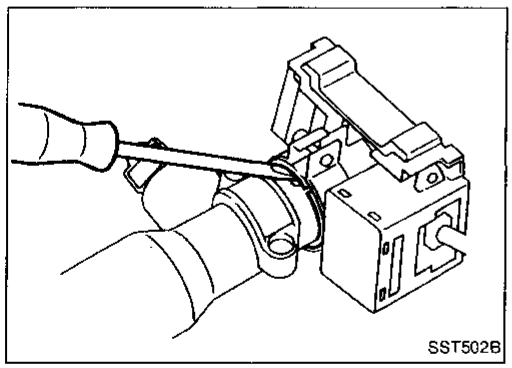
STEERING COLUMN

- When installing steering column, fingertighten all lower bracket and clamp retaining bolts; then tighten them securely. Do not apply undue stress to steering column.
- When attaching coupling joint, be sure tightening bolt faces cutout portion.

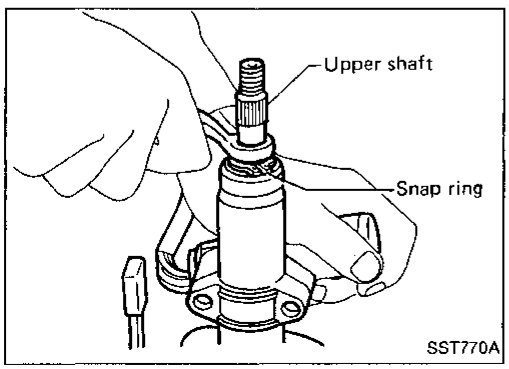
CAUTION:
After installation, turn steering wheel to make sure it moves smoothly. Ensure the number of turns are the same from the straight forward position to left and right locks.
Be sure that the steering wheel is in a neutral position when driving straight ahead.

Disassembly and Assembly



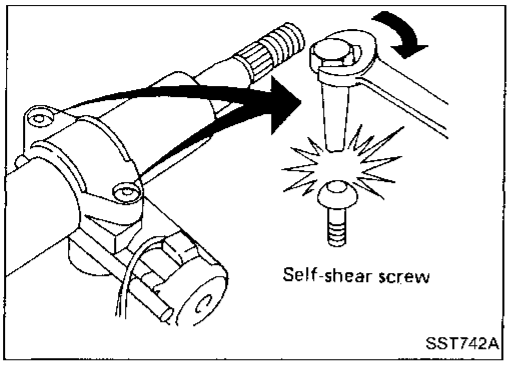


- When disassembling and assembling, unlock steering lock with key.
- To remove combination switch, insert a suitable tool between mating portion. Lift switch bracket and pull it out.



- Install snap ring on upper shaft with a suitable tool.

Disassembly and Assembly (Cont'd)

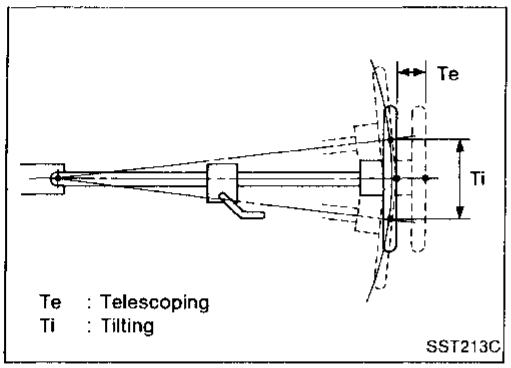


- Steering lock

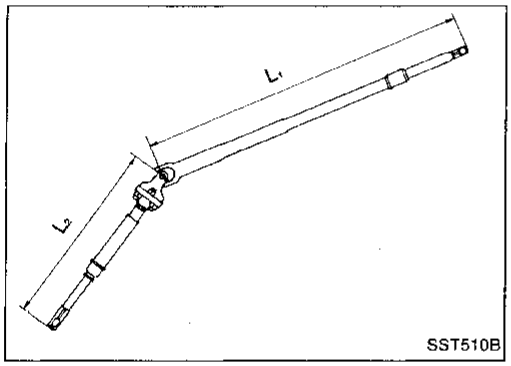
a. Break self-shear type screws with a drill or other appropriate tool.

b. Install new self-shear type screws and then cut off self-shear type screw heads.

Inspection



- After installing steering column, check tilt and telescopic mechanism operations.



- When steering wheel does not turn smoothly, check the steering column as follows and replace damaged parts.

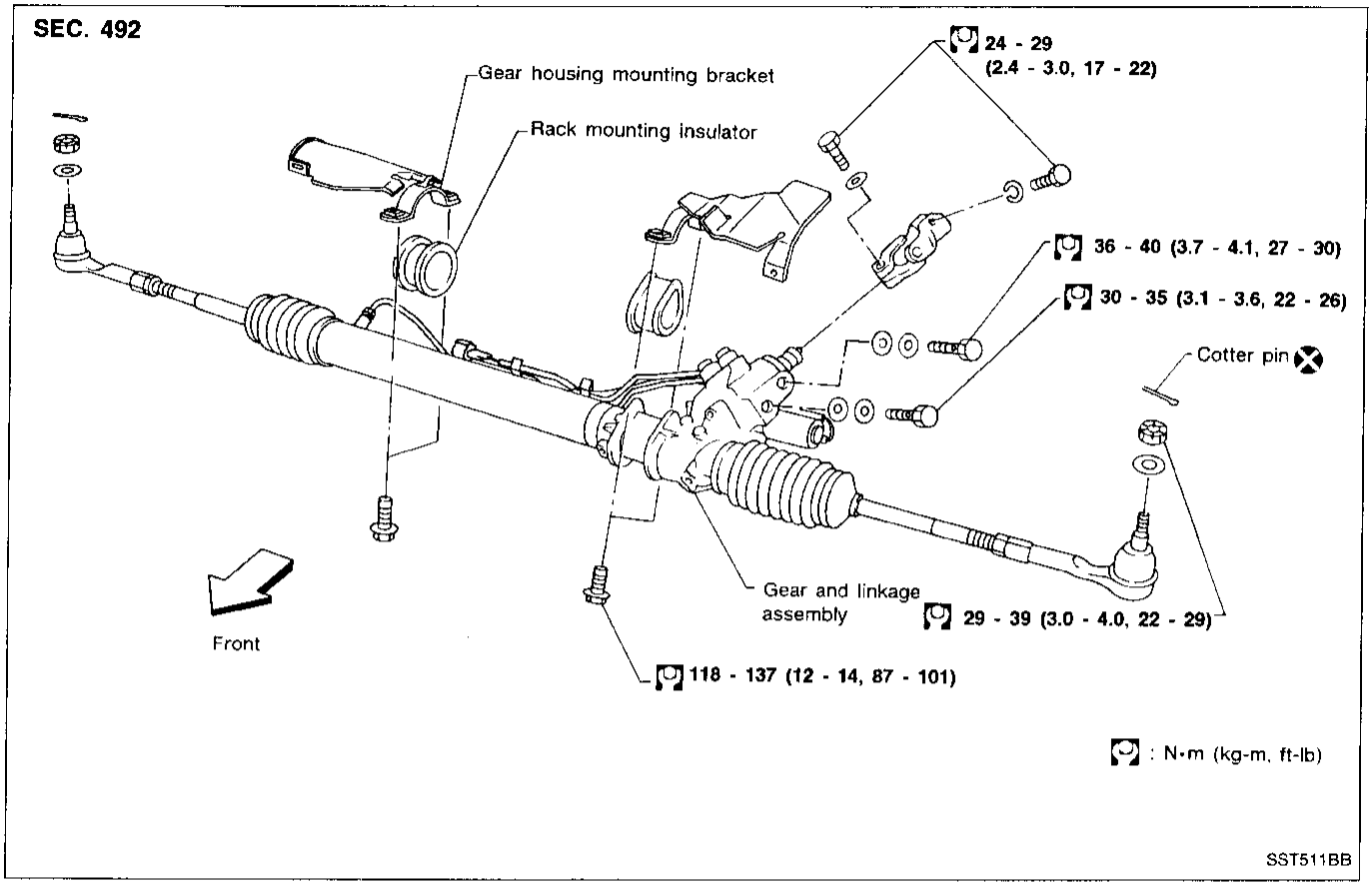
a. Check column bearings for damage or unevenness. Lubricate with recommended multi-purpose grease or replace steering column as an assembly, if necessary.

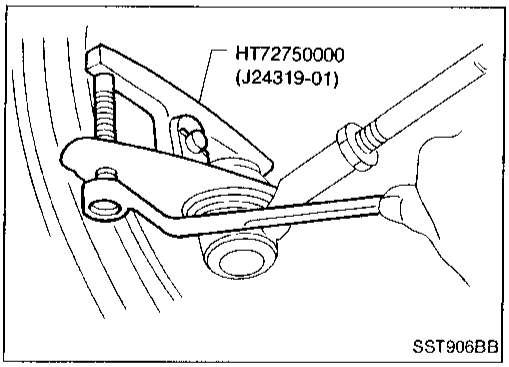
b. Check steering column lower shaft for deformation or breakage. Replace if necessary.

- When the vehicle is involved in a light collision, check steering column length "L_1" and steering column lower shaft length "L_2". If it is not within specifications, replace steering column as an assembly.

Steering column length "L_1":
618.7 - 620.3 mm (24.36 - 24.42 in)
Steering column lower shaft length "L_2":
356.8 - 358.4 mm (14.05 - 14.11 in)

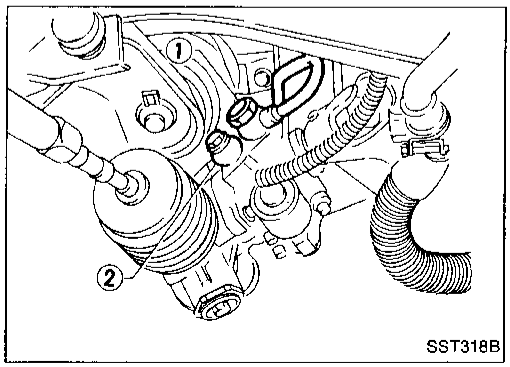
Removal and Installation





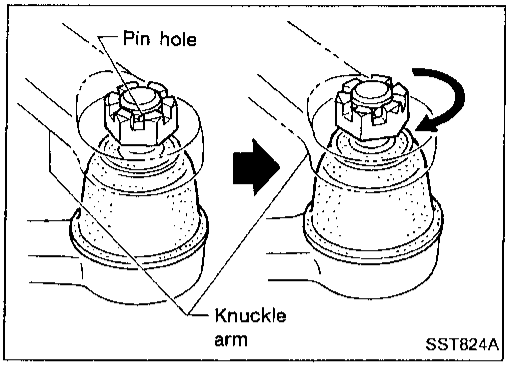
CAUTION:

- **The rotation of the spiral cable (SRS "Airbag" 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.**
- Detach tie-rod outer sockets from knuckle arms with Tool.



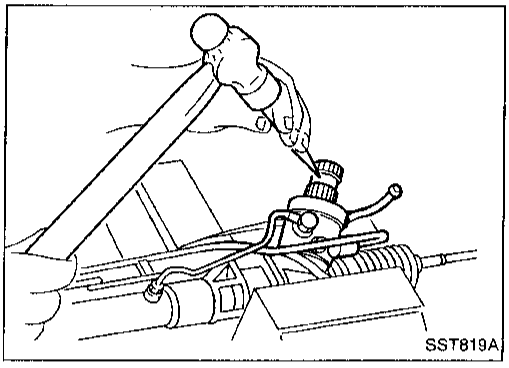
- Install pipe connector.
  - ① Low-pressure side
    : 36 - 40 N·m (3.7 - 4.1 kg-m, 27 - 30 ft-lb)
  - ② High-pressure side
    : 30 - 35 N·m (3.1 - 3.6 kg-m, 22 - 26 ft-lb)
- Observe specified tightening torque when tightening high-pressure and low-pressure pipe connectors. Excessive tightening can damage connector threads or O-ring.
- The O-ring in low-pressure pipe connector is larger than that in high-pressure connector. Take care to install the proper O-ring.

Removal and Installation (Cont'd)



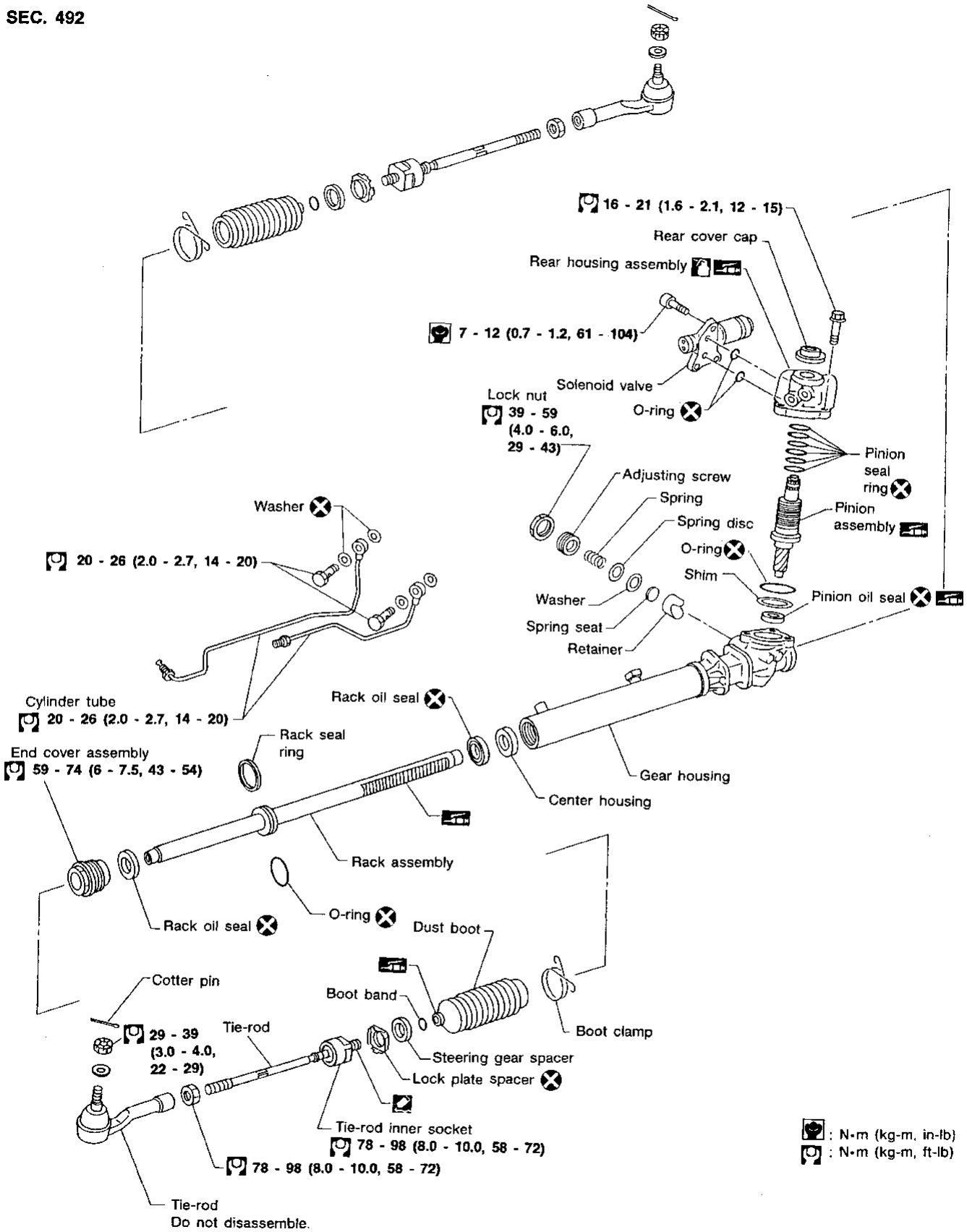
- Initially, tighten nut on tie-rod outer socket and knuckle arm to 29 to 39 N·m (3 to 4 kg-m, 22 to 29 ft-lb). Then tighten further to align nut groove with first pin hole so that cotter pin can be installed.

CAUTION:
Tightening torque must not exceed 49 N·m (5 kg-m, 36 ft-lb).



- Before removing lower joint from gear, set gear in neutral (wheels in straight-ahead position). After removing lower joint, put matching mark on pinion shaft and pinion housing to record neutral position.
- To install, set left and right dust boots to equal deflection. Attach lower joint by aligning matchmarks of pinion shaft and pinion housing.

SEC. 492



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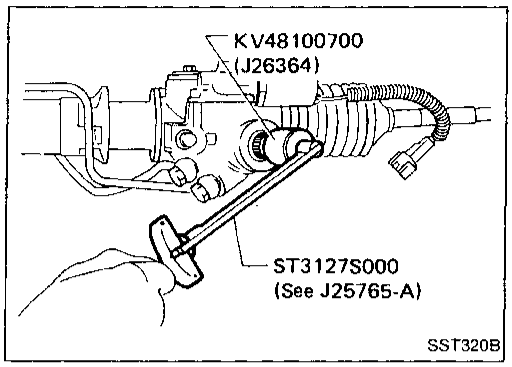


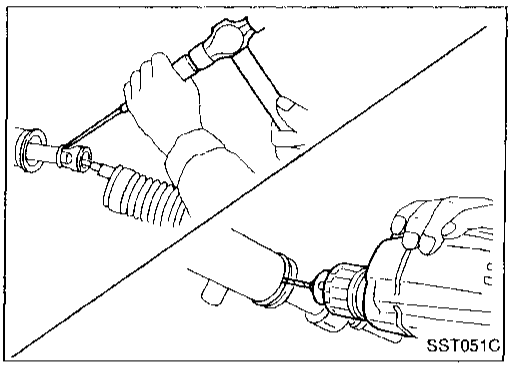
Disassembly

1. Prior to disassembling, measure pinion rotating torque. Record the pinion rotating torque as a reference.

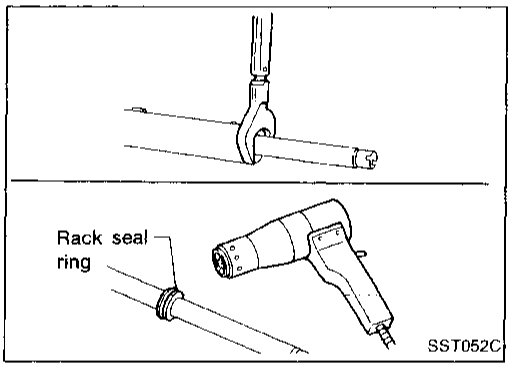
- **Before measuring, disconnect cylinder tube and drain fluid.**
- **Use soft jaws when holding steering gear housing. Handle gear housing carefully, as it is made of aluminum. Do not grip cylinder in a vise.**

2. Remove pinion gear.

- **Be careful not to damage pinion gear when removing pinion seal ring.**



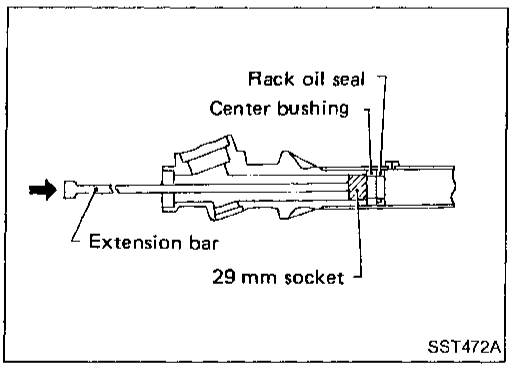
3. Remove tie-rod outer sockets and boots.
4. Loosen tie-rod inner socket by prying up staked portion, and remove socket.
5. Remove retainer.
6. Remove pinion assembly.
7. Use a 2 to 2.5 mm (0.079 to 0.098 in) diameter drill to completely remove staked portion of gear housing end.



8. Remove gear housing end cover assembly with Tool.
9. Draw out rack assembly.
10. Remove rack seal ring.

- Using a heat gun, heat rack seal to approximately 40°C (104°F).
- Remove rack seal ring.
- Replace rack seal ring and O-ring with new ones.

Be careful not to damage rack.



11. Remove center bushing and rack oil seal using tape wrapped socket and extension bar.

Do not scratch inner surfaces of pinion housing.

Inspection

Thoroughly clean all parts in cleaning solvent or automatic transmission fluid "DEXRON™ II" type or equivalent. Blow dry with compressed air, if available.

BOOT

- Check condition of boot. If cracked excessively, replace it.
- Check boots for accumulation of power steering fluid.

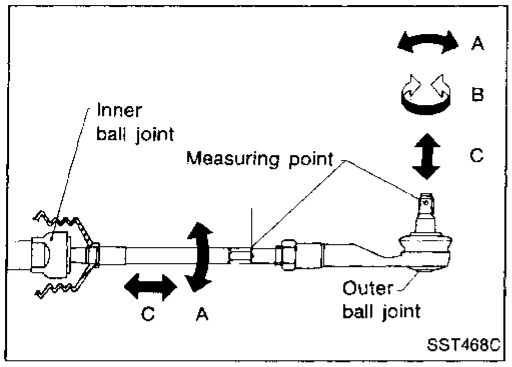
RACK

Thoroughly examine rack gear. If damaged, cracked or worn, replace it.

PINION ASSEMBLY

- Thoroughly examine pinion gear. If pinion gear is damaged, cracked or worn, replace it.
- Check that all bearings roll freely. Ensure that balls, rollers and races are not cracked, pitted or worn. Replace if necessary.

Inspection (Cont'd)



TIE ROD OUTER AND INNER SOCKETS

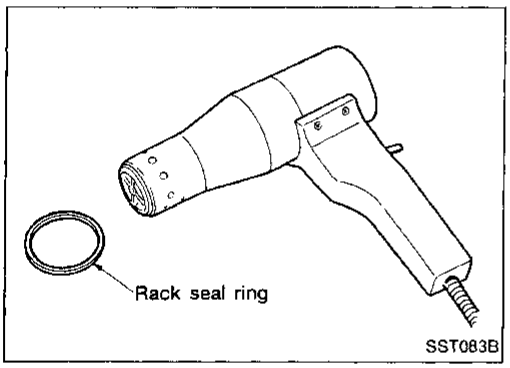
- Check ball joints for swinging force.
  Tie-rod outer and inner ball joints swinging force "A": Refer to SDS (ST-42).
- Check ball joint for rotating torque.
  Tie-rod outer ball joint rotating torque "B": Refer to SDS (ST-42).
- Check ball joints for axial end play.
  Tie-rod outer and inner ball joints axial end play "C": Refer to SDS (ST-42).
- Check condition of dust cover. If cracked excessively, replace outer tie-rod.

CYLINDER TUBES

Check cylinder tubes for scratches or other damage. Replace if necessary.

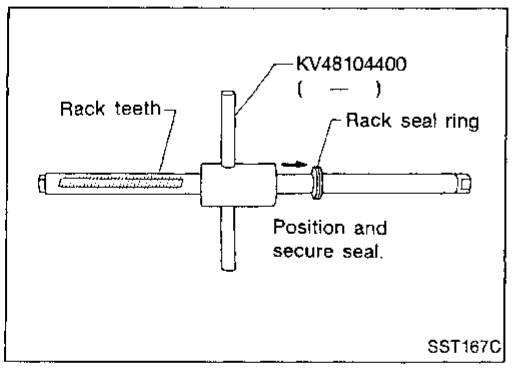
Assembly

1. Using a heat gun, heat new teflon rack seal ring to approximately 40°C (104°F). Then place it onto rack.



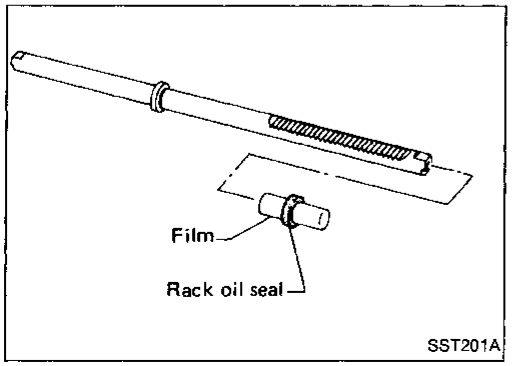
- Using Tool, compress rack seal ring securely on rack.

Always insert the tool from the rack gear side.

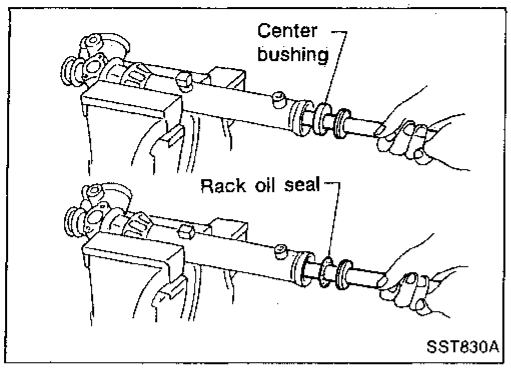


2. Insert rack oil seal.

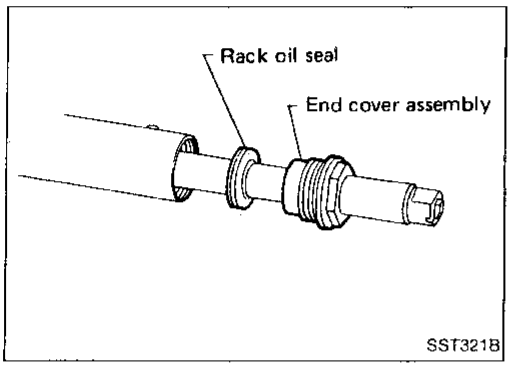
- **Place plastic film into rack oil seal to prevent damage by rack teeth.**
- **Always remove plastic film after rack oil seal is positioned properly.**
- **Make sure lips of rack oil seal face each other.**



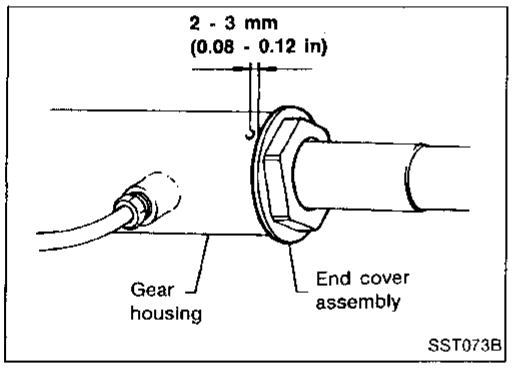
Assembly (Cont'd)



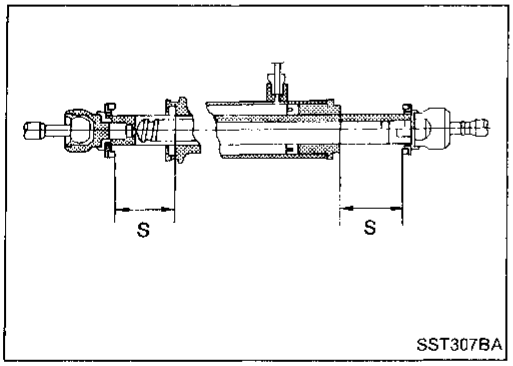
3. Install center bushing and rack oil seal with rack assembly.



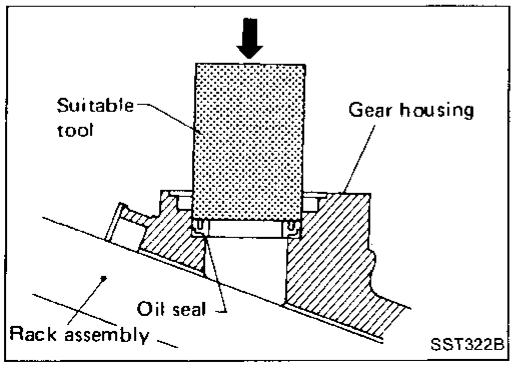
4. Insert rack oil seal and end cover assembly to rack then tighten end cover assembly.



5. Fasten cylinder end cover assembly to gear housing by staking.



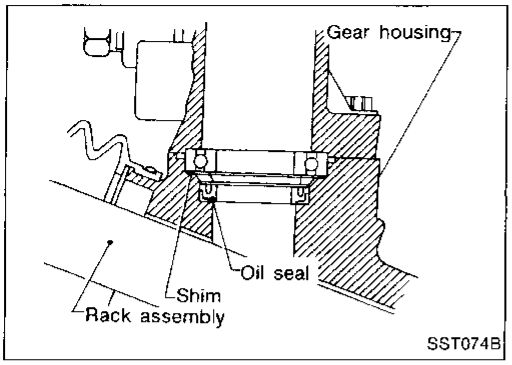
6. Set rack gear in neutral position.
   Rack stroke "S":
   Refer to SDS (ST-42).



7. Coat seal lip of new pinion oil seal with multi-purpose grease. Install it into pinion housing of gear with a suitable tool.

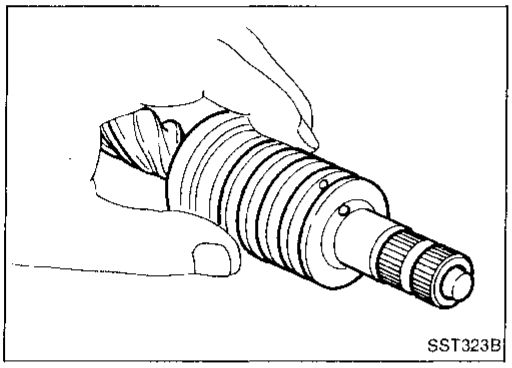
Make sure lip of oil seal faces up when installed.

Assembly (Cont'd)

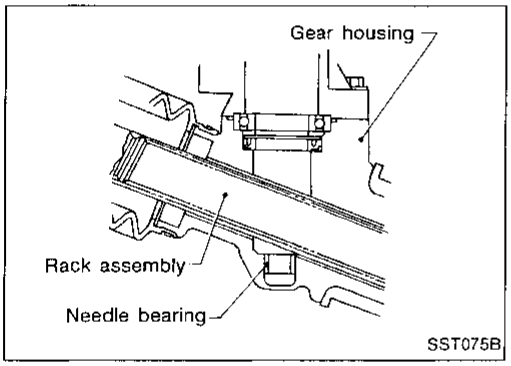


8. Install pinion bearing adjusting shim(s).

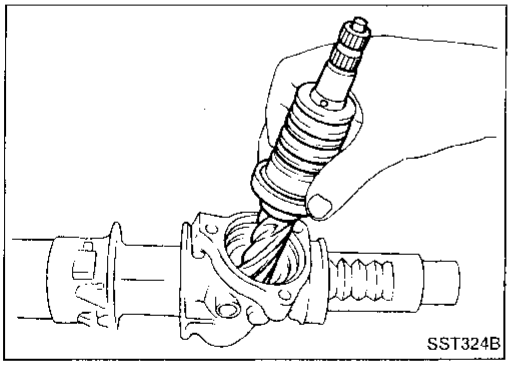
Whenever pinion assembly, gear housing and rear housing are disassembled, replace shim(s) with new ones. Always use the same number of shim(s) when replacing.



9. Install pinion seal ring on pinion gear assembly.
- Using a heat gun, heat pinion seal ring to approximately 40°C (104°F) before installing it onto pinion gear assembly.
- Make sure pinion seal ring is properly settled in valve groove.

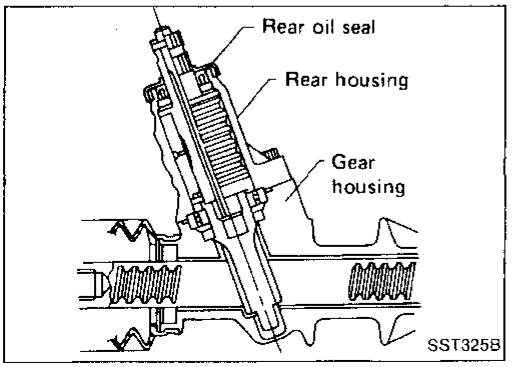


10. Apply a coat of multi-purpose grease to needle bearing roller and oil seal lip.



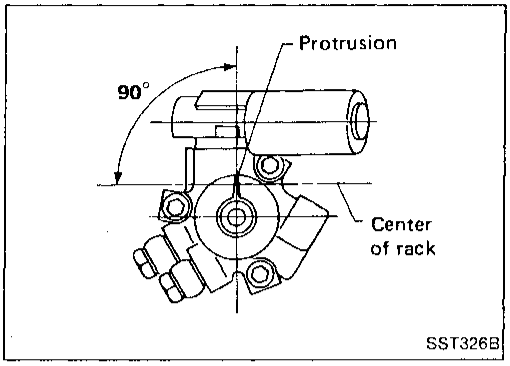
11. Install pinion assembly to pinion housing.

Be careful not to damage pinion oil seal.



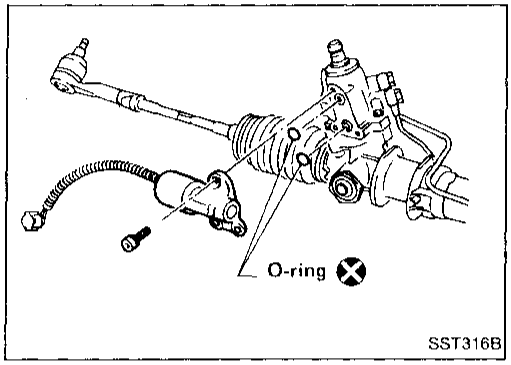
12. Apply a coat of multi-purpose grease to rear oil seal lip before installing rear housing.

Assembly (Cont'd)

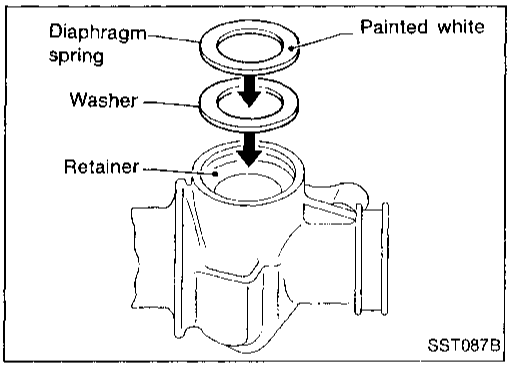


13. Ensure that the rack is centered. Install rear cover cap so that protrusion of rear housing cover is positioned as shown in figure.

Be careful not to damage worm ring and oil seal.

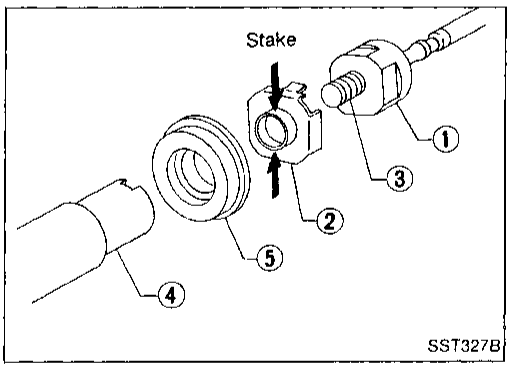


14. Install solenoid valve.



15. Install diaphragm spring at retainer.
- Always install retainer, spring washer and diaphragm spring in that order.
- Make sure convex end (painted white) of diaphragm spring faces outward when installing.

16. Install retainer spring and adjusting screw temporarily.

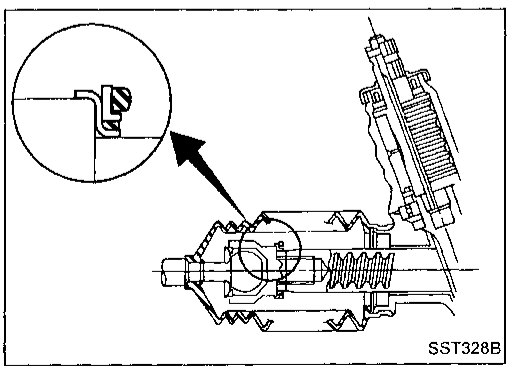


17. Install inner socket.

CAUTION:

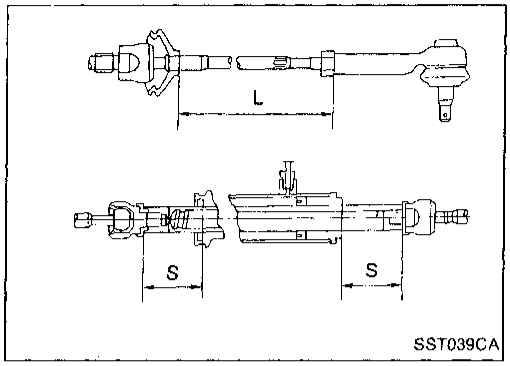
Ensure steering gear spacer is installed with rubber side facing rack.

- Attach lock plate ② to side rod inner socket ①.
- Insert steering gear spacer ⑤ to rack ④.
- Apply locking sealant to inner socket threads ③. Screw inner socket into rack ④ and tighten to specified torque.
- Stake lock plate at two places.

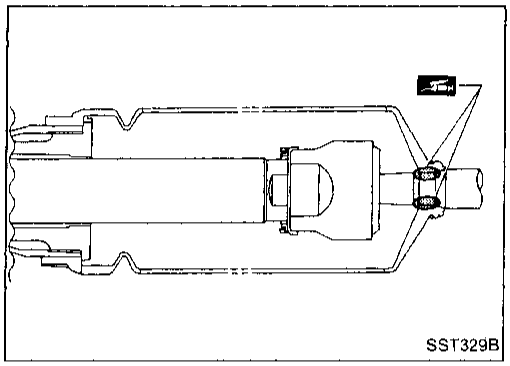


18. Install steering gear spacer ⑤ to lock plate ②.

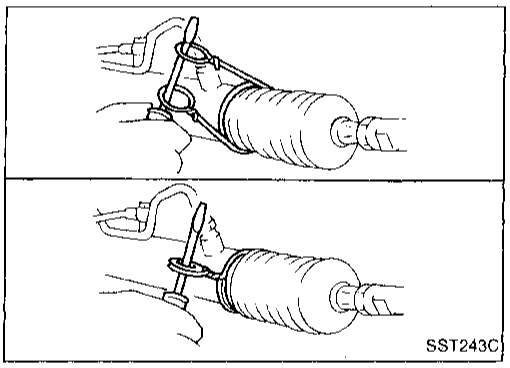
Assembly (Cont'd)



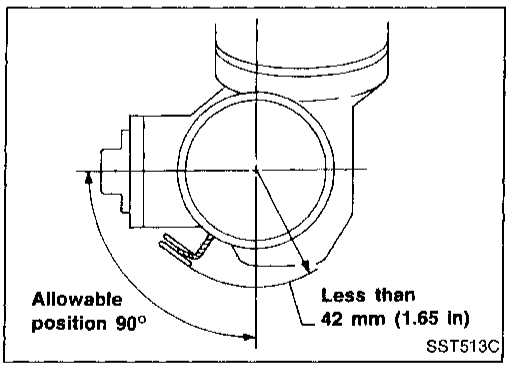
19. Tighten outer socket lock nut.
    Tie-rod length "L":
    Refer to SDS (ST-42).
20. Measure rack stroke.
    Stroke "S":
    Refer to SDS (ST-42).



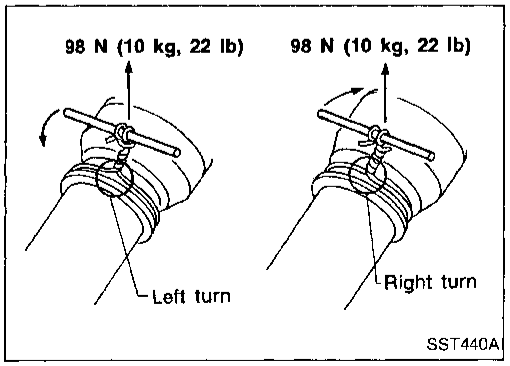
21. Before installing boot, coat the contact surfaces between boot and tie-rod with grease.



22. Install boot clamps.
- To install, wrap boot clamp around boot groove twice. To tighten clamp, place a screwdriver through both rings. Twist rings 4 to 4-1/2 turns while pulling with a force of approx. 98 N (10 kg, 22 lb).

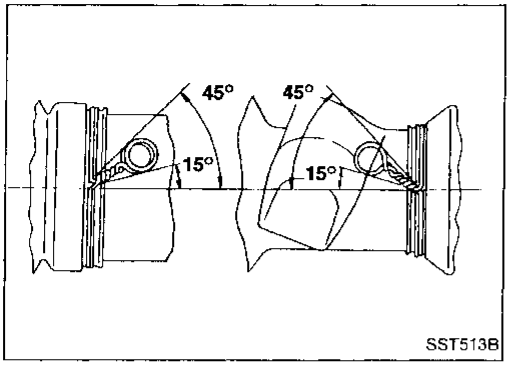


- Place twisted ends of boot clamp in the range shown. (This will prevent interference with other parts.)

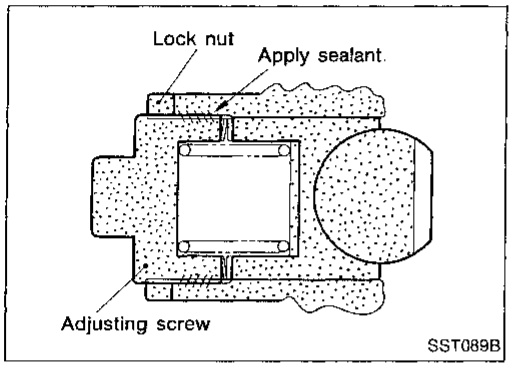


- Twist boot clamp in the direction shown in figure at left.

Assembly (Cont'd)



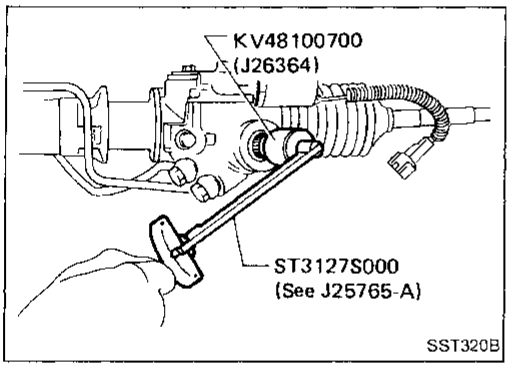
- After twisting boot clamp, bend twisted and diagonally so it does not contact boot.



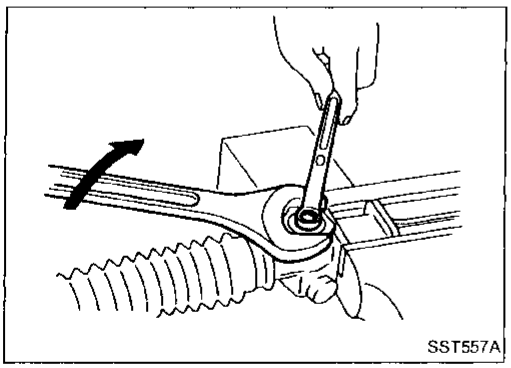
Adjustment

Adjust pinion rotating torque as follows:

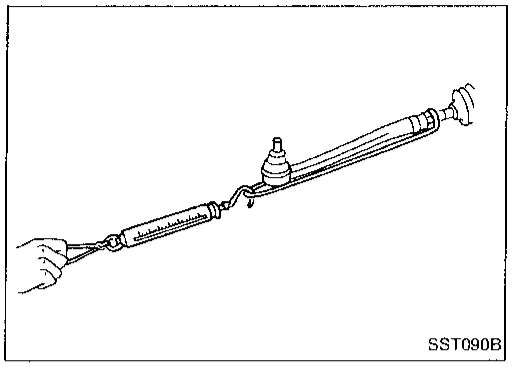
1. Set gears to Neutral without fluid in the gear.
2. Coat the adjusting screw with locking sealant and screw it in.
3. Lightly tighten lock nut.
4. Tighten adjusting screw to a torque of 4.9 to 5.9 N·m (50 to 60 kg-cm, 43 to 52 in-lb).
5. Loosen adjusting screw, then retighten it to 0.2 N·m (2 kg-cm, 1.7 in-lb).
6. Move rack over its entire stroke several times.
7. Measure pinion rotating torque within the range of 180° from neutral position.
   Stop the gear at the point of maximum torque.
8. Loosen adjusting screw, then retighten it to 4.9 N·m (50 kg-cm, 43 in-lb).
9. Loosen adjusting screw by 60° to 100°.

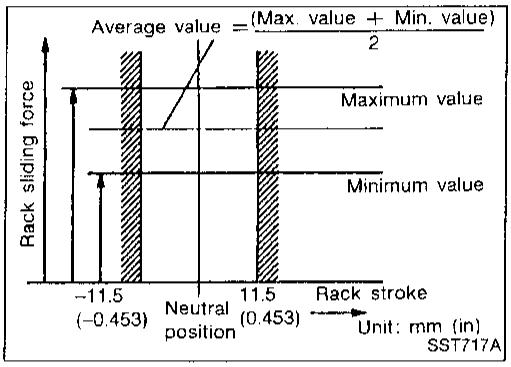


10. Prevent adjusting screw from turning, and tighten lock nut to specified torque.



Adjustment (Cont'd)


SST090B

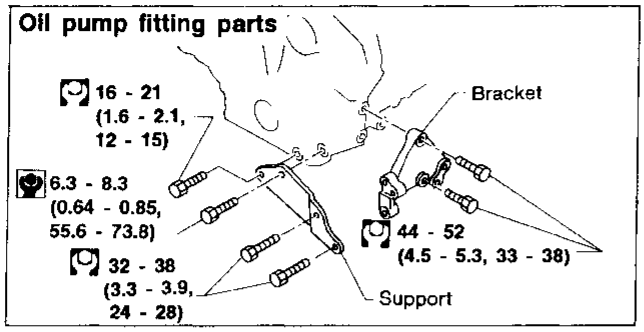


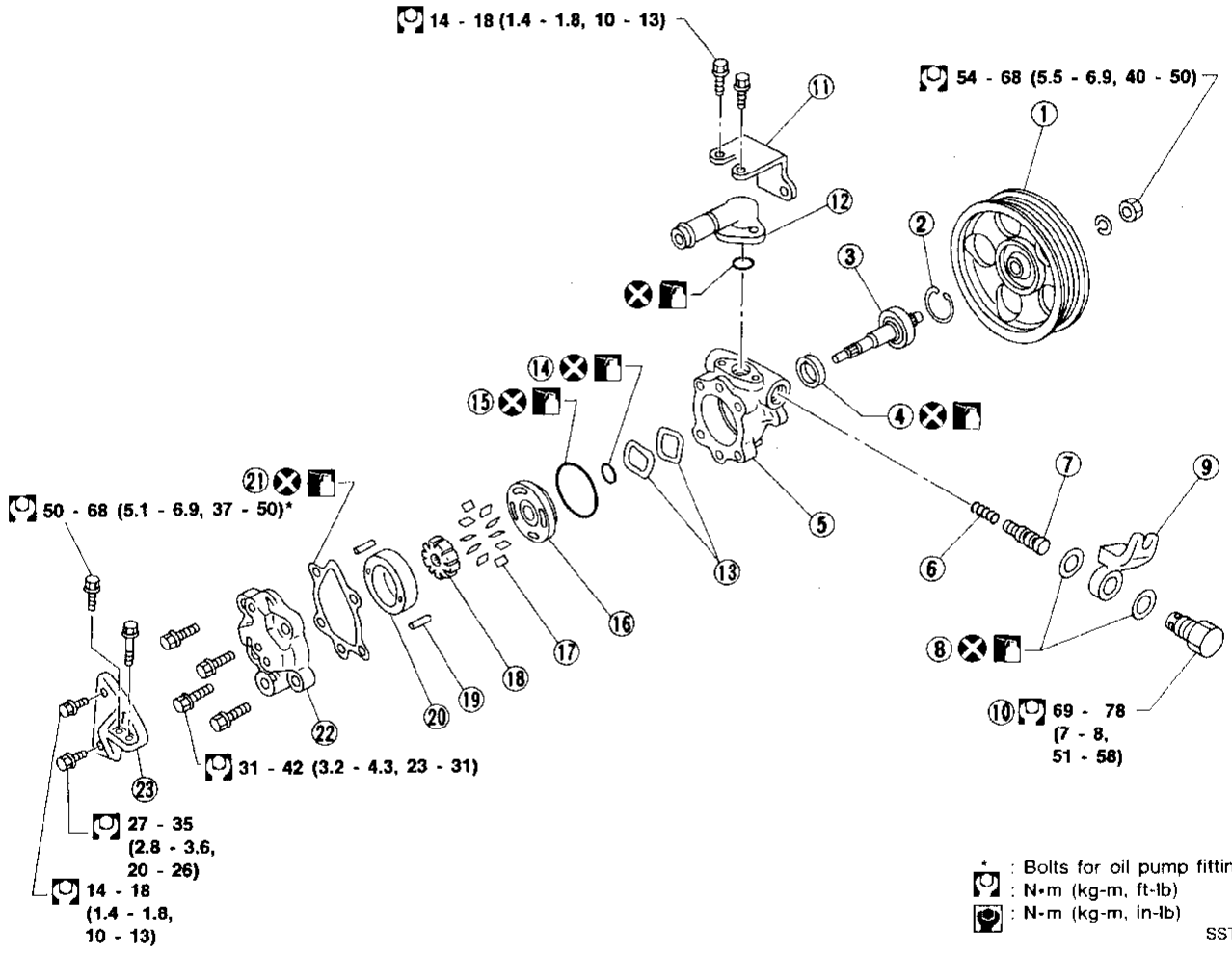
11. Check rack sliding force on vehicle as follows:
a. Install steering gear onto vehicle, but do not connect tie-rod to knuckle arm.
b. Connect all piping and fill with steering fluid.
c. Start engine and bleed air completely.
d. Disconnect steering column lower joint from the gear.
e. Keep engine at idle and make sure steering fluid has reached normal operating temperature.
f. Pull tie-rod slowly to move it from neutral position to ±11.5 mm (±0.453 in) at speed of 3.5 mm (0.138 in)/s. Check that rack sliding force is within specification.
Average rack sliding force:
216 - 275 N (22 - 28 kg, 49 - 62 lb)
Maximum force deviation: 39 N (4 kg, 9 lb)
g. Check sliding force outside above range at rack speed of 40 mm (1.57 in)/s.
Maximum rack sliding force:
294 N (30 kg, 66 lb)
Maximum force deviation:
147 N (15 kg, 33 lb)

- If rack sliding force is not within specification, readjust by repeating adjustment procedure from the beginning.
- If rack sliding force is still out of specification after readjustment, gear assembly needs to be replaced.

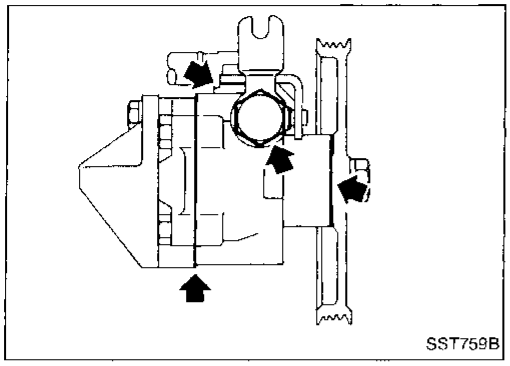
Disassembly and Assembly

SEC. 490





① Pulley
② Snap ring
③ Drive shaft
④ Oil seal
⑤ Front housing
⑥ Spring
⑦ Control valve
⑧ Copper washer
⑨ Joint
⑩ Connector bolt
⑪ Bracket
⑫ Suction pipe
⑬ Wave washer
⑭ O-ring (Inner)
⑮ O-ring (Outer)
⑯ Front side plate
⑰ Vane
⑱ Rotor
⑲ Pin
⑳ Cam ring
㉑ Gasket
㉒ Rear housing
㉓ Bracket


SST759B

Pre-disassembly Inspection

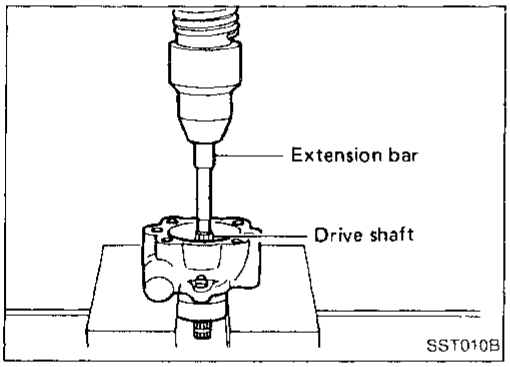
Disassemble the power steering oil pump only if the following items are found.

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

Disassembly

CAUTION:

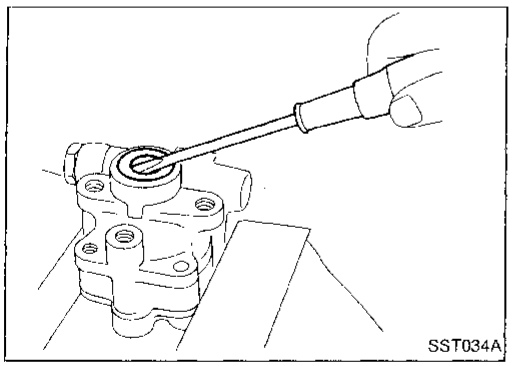
- **Parts which can be disassembled are strictly limited. Never disassemble parts other than those specified.**
- **Disassemble in as clean a place as possible.**
- **Clean your hands before disassembly.**
- **Do not use rags; use nylon cloths or paper towels.**
- **Follow the procedures and cautions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



SST010B

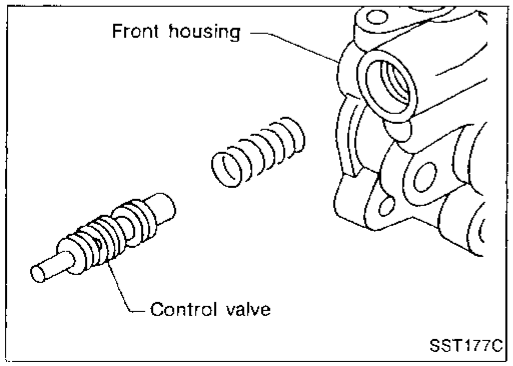
- Remove snap ring, then draw drive shaft out.

Be careful not to drop drive shaft.


SST034A

- Remove oil seal.

Be careful not to damage front housing.



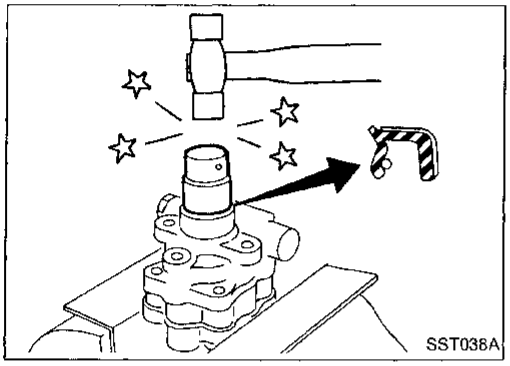
SST177C

- Remove connector and flow control valve with spring.

Be careful not to drop control valve.

Inspection

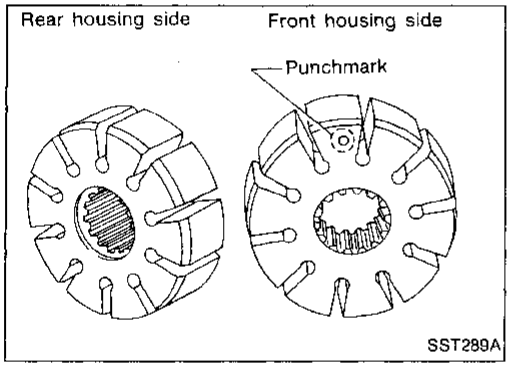
- If pulley is cracked or deformed, replace it.
- If an oil leak is found around pulley shaft oil seal, replace the seal.
- If serration on pulley or pulley shaft is deformed or worn, replace it.



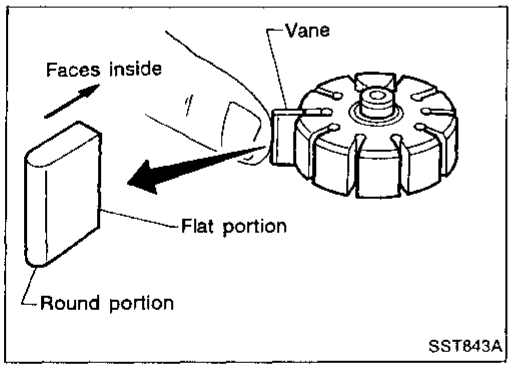
Assembly

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.
- Coat each part with ATF when assembling.

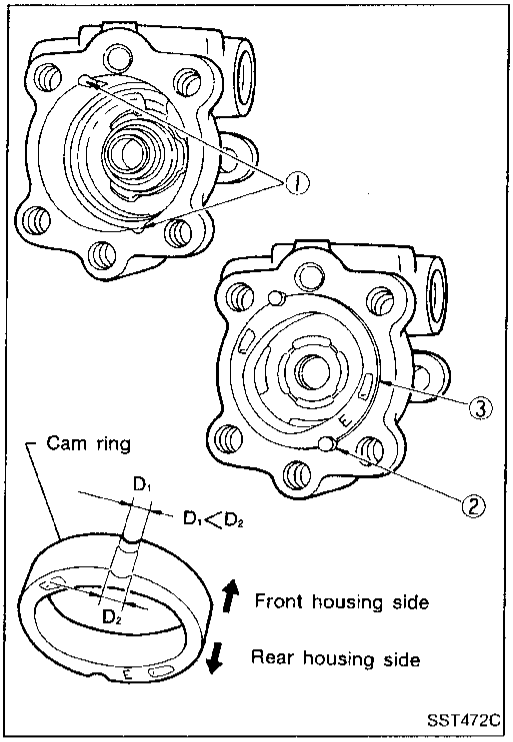


- Pay attention to rotor direction.



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

Assembly (Cont'd)

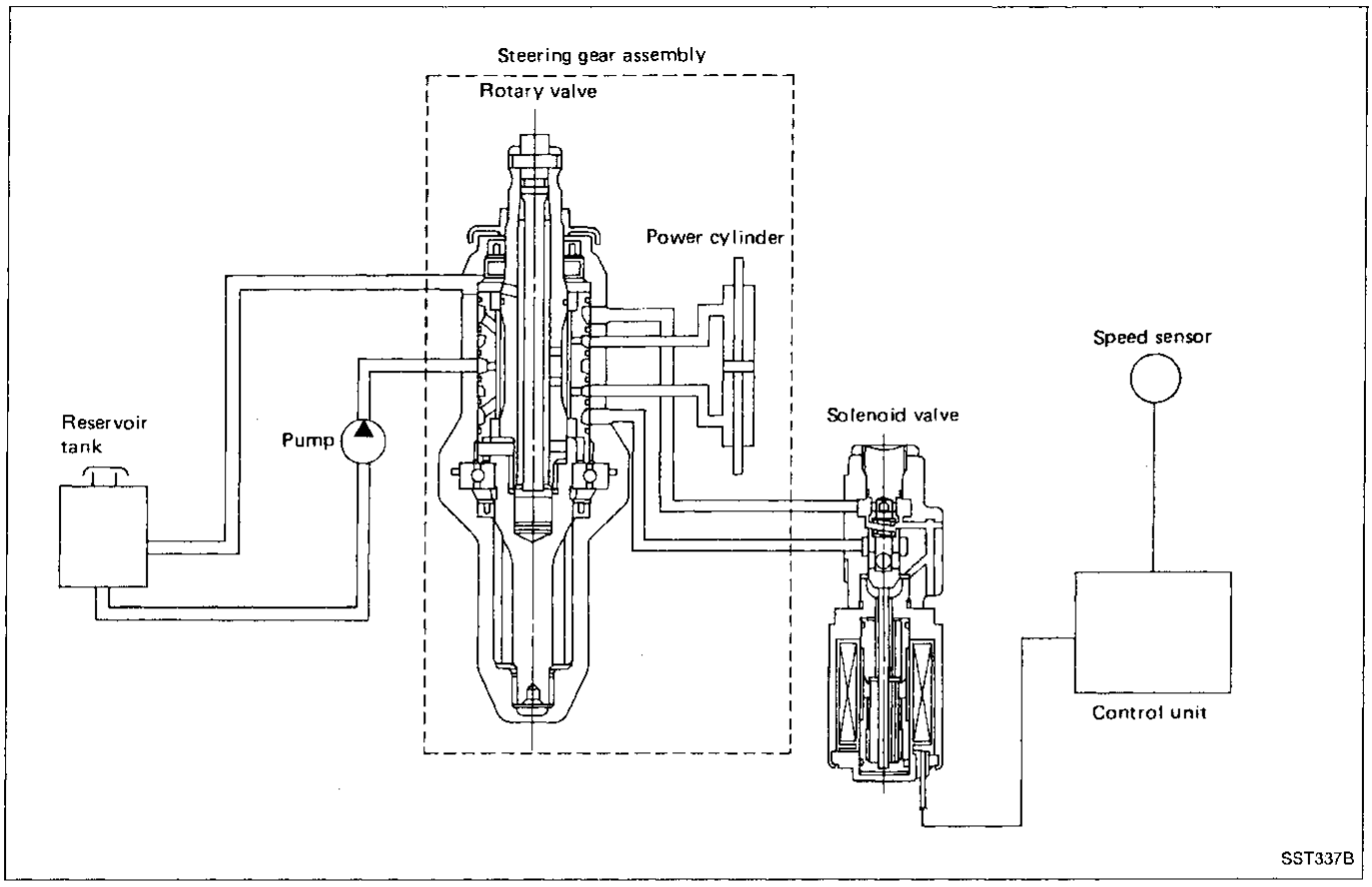


- Insert pin ② into pin groove ① of front housing and front side plate. Then install cam ring ③ as shown at left.

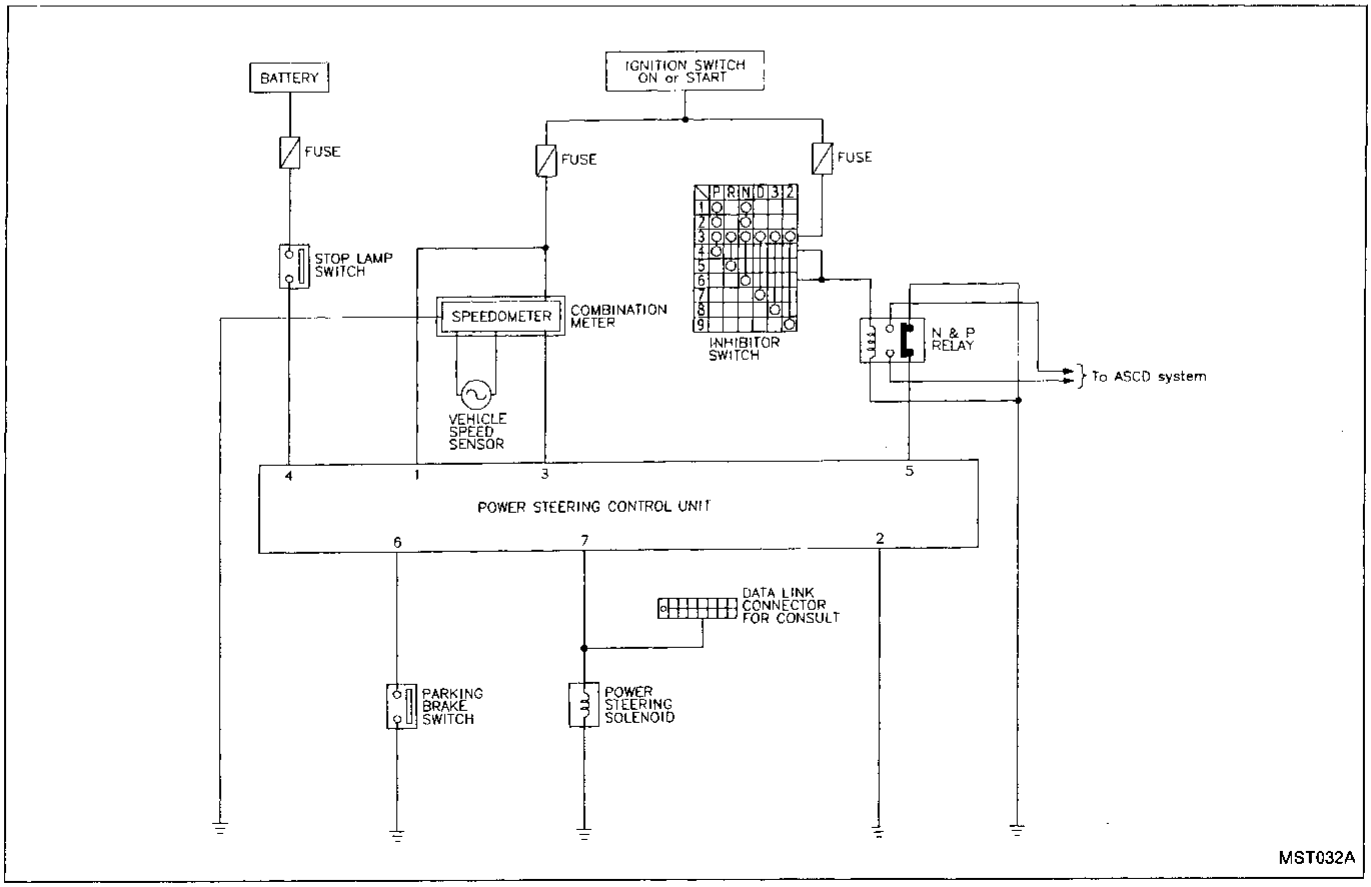
  Cam ring:

  D_1 is less than D_2

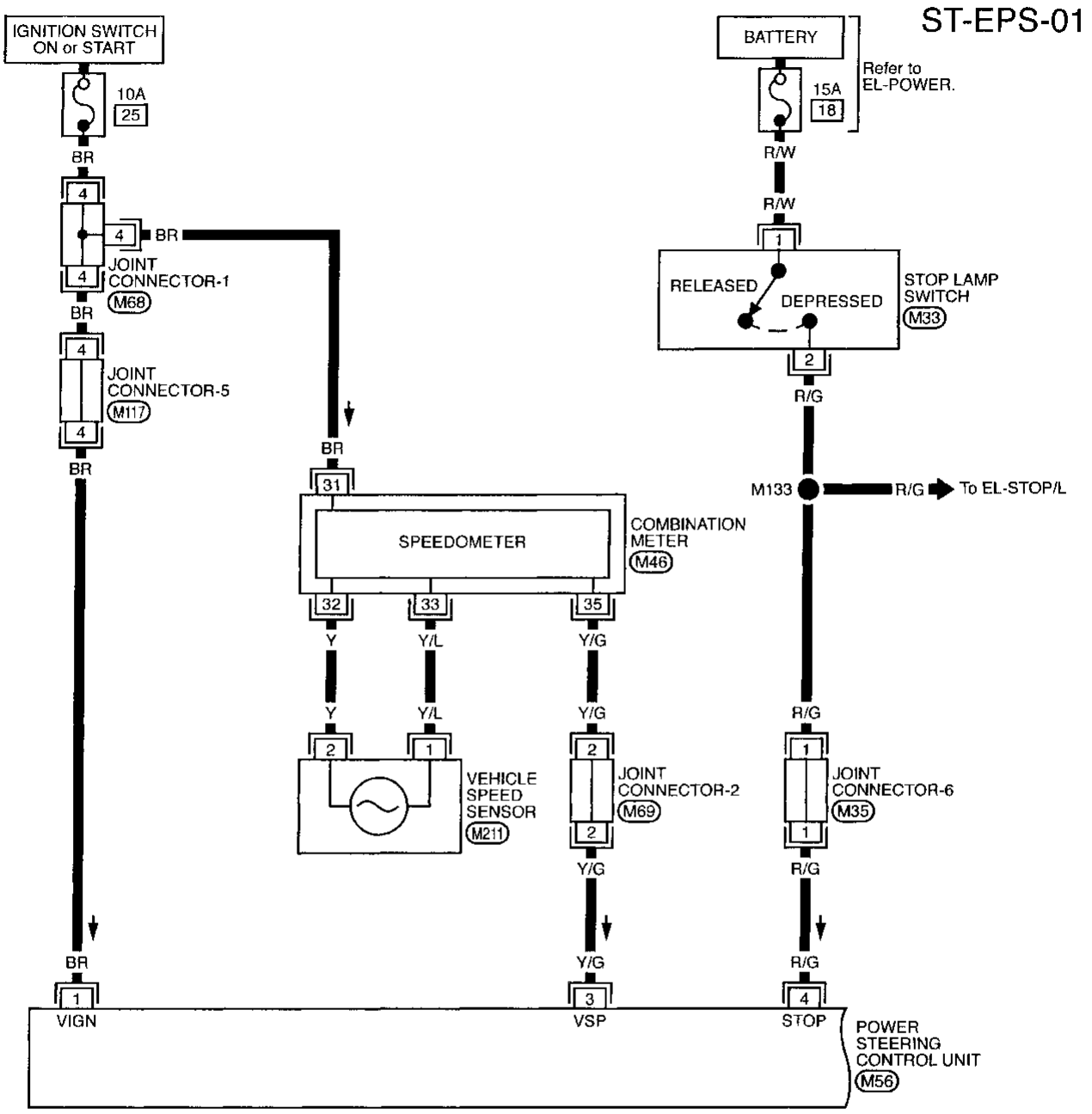
Hydraulic Circuit

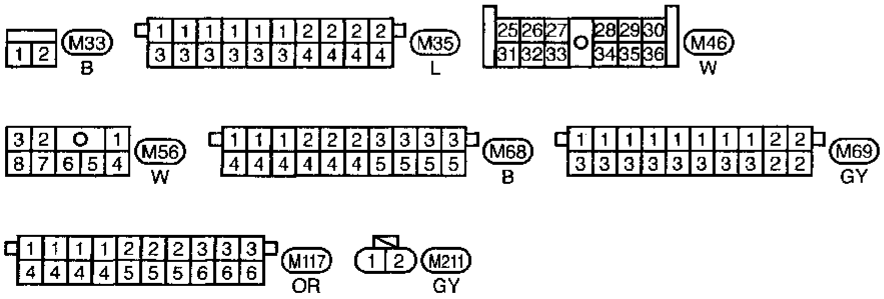


Schematic



Wiring Diagram

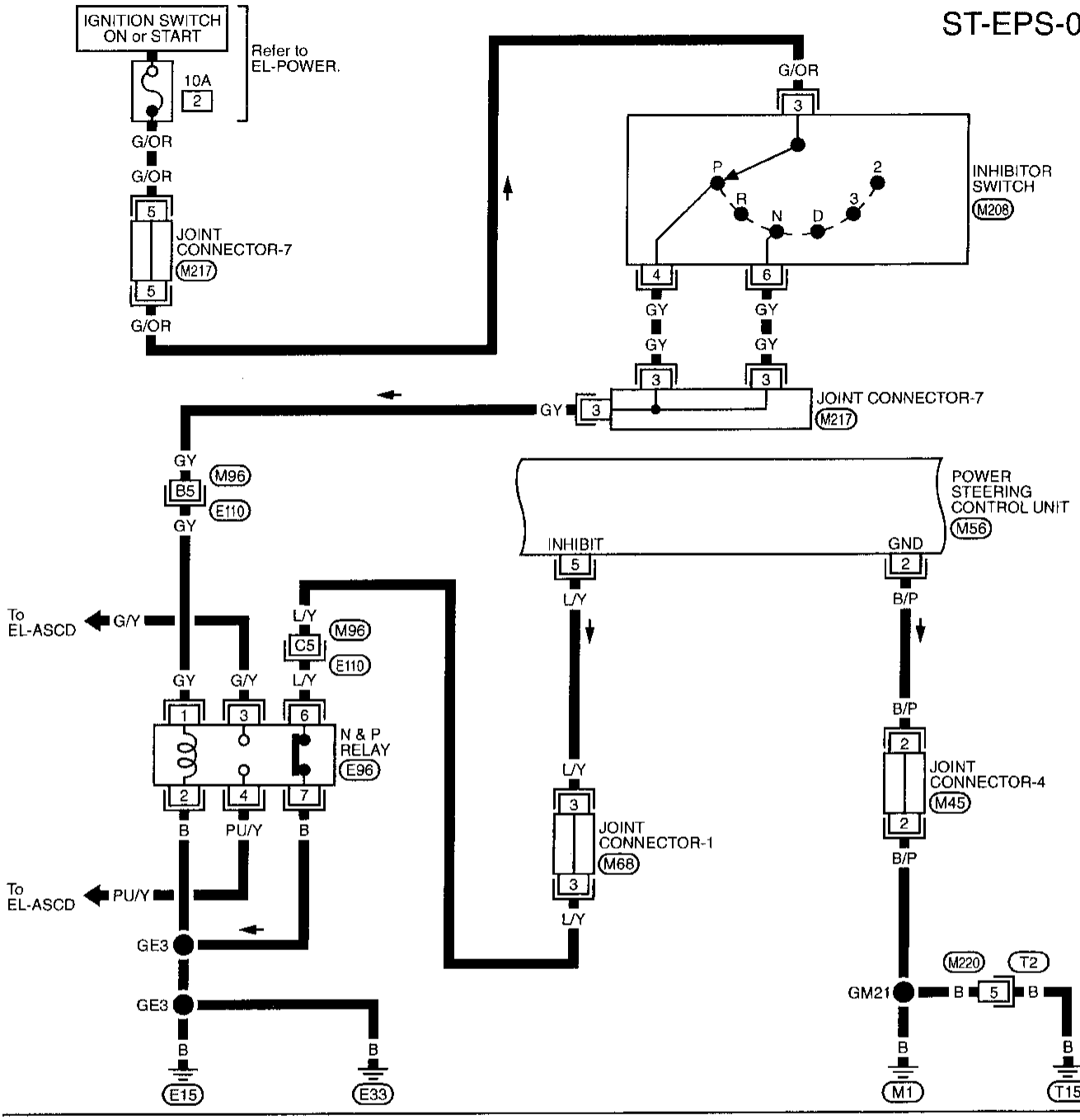


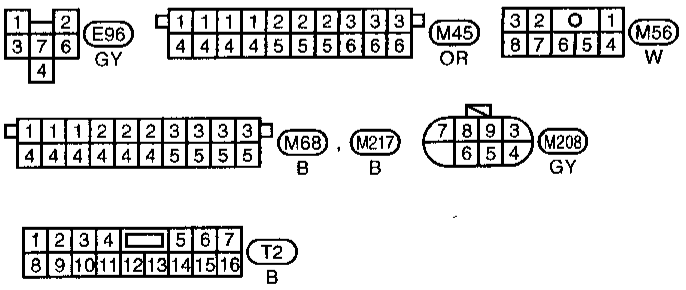


MST033A

Wiring Diagram (Cont'd)

ST-EPS-02



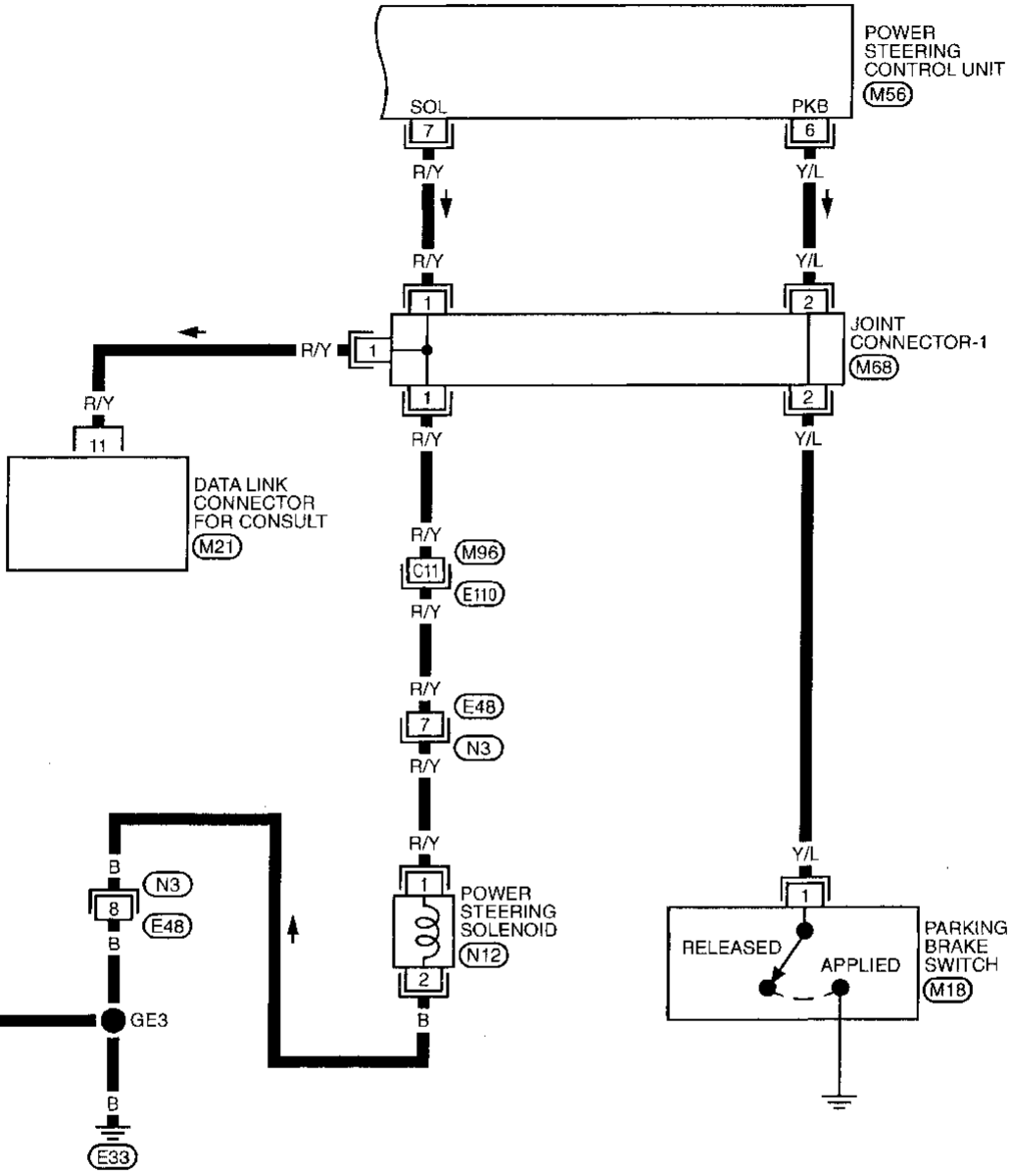


Refer to last page (Foldout page).
E110 , M96

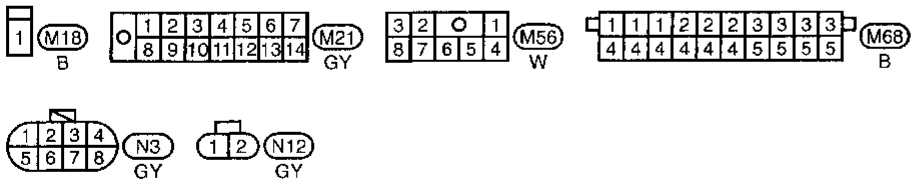
MST034A

Wiring Diagram (Cont'd)

ST-EPS-03



Refer to last page (Foldout page).
E110 , M96



MST035A

Trouble Diagnoses

PRECAUTIONS

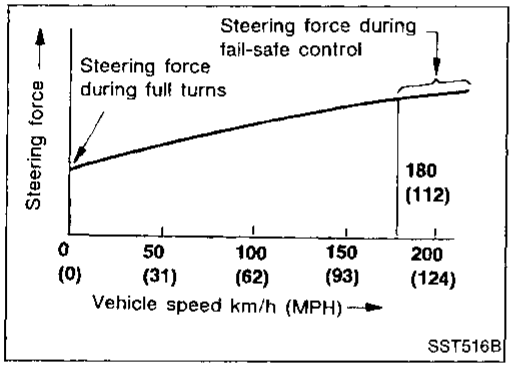
Before diagnosing the power steering system, ensure that:

Vehicle stopped

a. **Power steering components (gears, oil pump, pipes, etc.) are free from leakage, and that oil level is correct.**
b. **Tires are inflated to specified pressure and are of specified size, and that steering wheel is a genuine part.**
c. **Wheel alignment is adjusted properly.**
d. **Suspension utilizes the original design, and is free of modifications which increase vehicle weight.**

Vehicle in operation

a. **Understand the trouble symptoms.**
b. **Engine is operating properly.**



Preliminary knowledge helpful in conducting diagnoses

The power steering system is a twin orifice type, which uses a vehicle-speed sensing, electronic control design. Valve sensitivity is controlled in response to vehicle speed to achieve optimum steering effort. When a vehicle-speed signal is not entered into the power steering control unit for approximately 10 seconds during normal operation (see NOTE below.), a fail-safe system activates to maintain the steering effort at a level similar to that experienced during high-speed operation.
More precisely, if a foot-brake signal, parking-brake signal and transmission position signal (N or P-range signal) are not entered, the power steering system is held in a "fail-safe" control state. When this happens, a symptom referred to as "heavy steering during stationary turns" sometimes occurs.

NOTE:
Normal operation refers to a driving condition in which:

- **Brake pedal is released.**
- **Parking brake lever is released.**
- **Shift lever is in any position other than "P" or "N".**

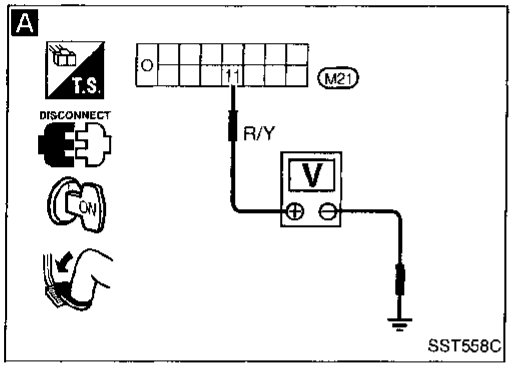
Trouble Diagnoses (Cont'd)

DIAGNOSTIC PROCEDURE 1

SYMPTOM:

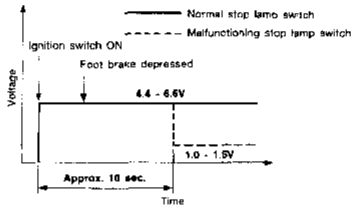
Heavy steering operation during stationary turns

1) CHECK STOP LAMP SIGNAL.
Turn ignition switch "ON" (with engine OFF), release foot brake pedal and parking brake lever.
Set shift lever to any position except "P" and "N".



A

Depress brake pedal and check solenoid valve voltage between "diagnostic" connector terminal ⑪ and body metal (ground).



Voltage:
4.4 - 6.6V (constant)

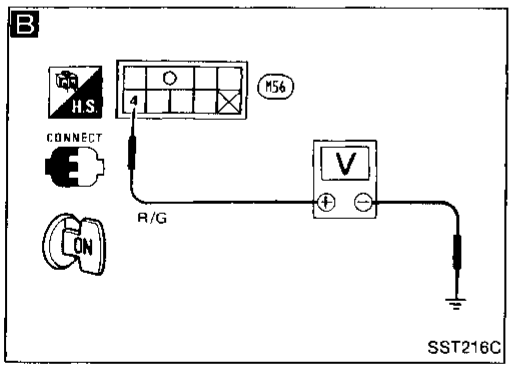
Yes → Go to 2) CHECK PARKING BRAKE SIGNAL.

No

Check if terminal voltage drops to 1 - 1.5V range approx. 10 seconds after ignition switch is turned ON.

No → Go to 5) CHECK POWER STEERING CONTROL UNIT for proper operation.

Yes



B

Check if stop lamp switch signal is present at power steering control unit terminal ④ and body metal (ground).

Voltage:
Approx. 12V
(Brake pedal depressed.)

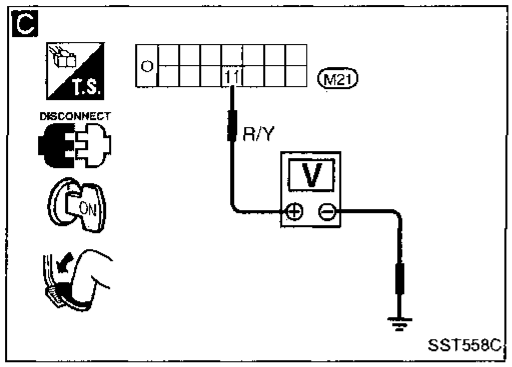
No → Malfunctioning stop lamp switch system

Yes

Ensure that power steering control unit connector is connected properly.

Ⓐ

Trouble Diagnoses (Cont'd)



Ⓐ

C

After ignition switch is turned "ON", depress brake pedal and check solenoid valve voltage between "diagnostic" connector terminal ⑪ and body metal (ground).
4.4 - 6.6V (constant)

No → Malfunctioning power steering control unit.

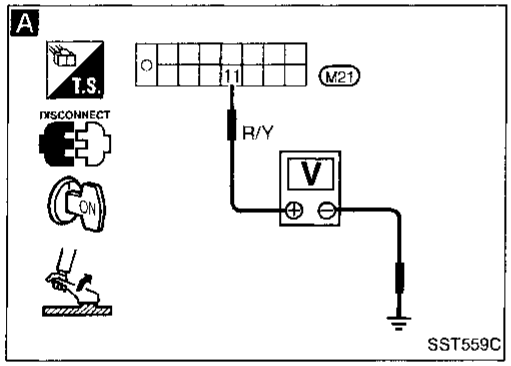
Yes

Check if heavy steering operation occurs during stationary turns.

Yes → Go to 4) CHECK POWER STEERING SOLENOID VALVE for proper operation.

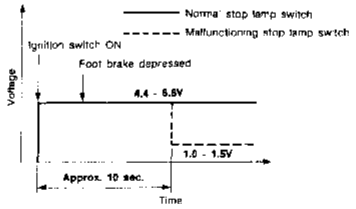
No

END



A

2) CHECK PARKING BRAKE SIGNAL.
Release foot brake pedal and apply parking brake lever.
Check solenoid valve voltage between "diagnostic" connector terminal ⑪ and body metal (ground).



Voltage:
4.4 - 6.6V (constant)

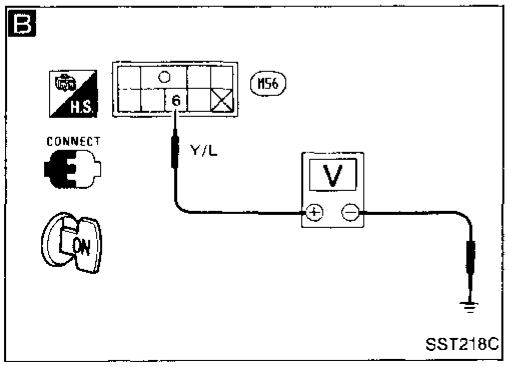
Yes → Go to 3) CHECK NEUTRAL POSITION SIGNAL.

No

Check if terminal voltage drops to 1.0 - 1.5V range approx. 10 seconds after ignition switch is turned ON.

No → Go to 5) CHECK POWER STEERING CONTROL UNIT for proper operation.

Yes



B

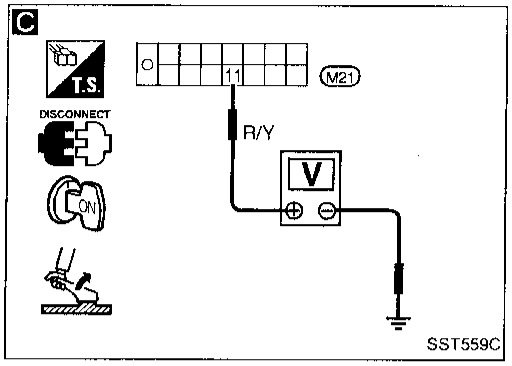
Check if parking brake switch signal is present at power steering control unit terminal ⑥ and body metal (ground).
Voltage: 0V
(Parking brake applied.)

No → Malfunctioning parking brake system

Yes

Ⓐ

Trouble Diagnoses (Cont'd)



Ⓐ

Ensure that power steering control unit connector is connected properly.

C

Turn ignition switch ON and apply parking brake lever.
Check solenoid valve voltage between "diagnostic" connector terminal ⑪ and body metal (ground).
Voltage: 4.4 - 6.6V (constant)

No → Malfunctioning power steering control unit

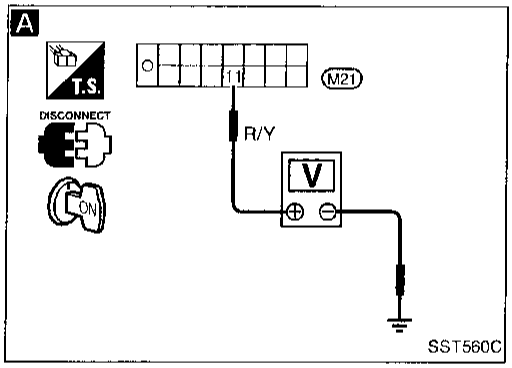
Yes

Check if heavy steering operation occurs during stationary turns.

Yes → Go to 4) CHECK POWER STEERING SOLENOID VALVE for proper operation.

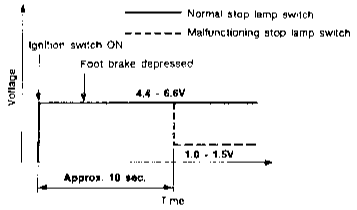
No

END



A

3) CHECK NEUTRAL POSITION SIGNAL.
Release parking brake lever.
Move shift lever to Neutral. Check solenoid valve voltage between "diagnostic" connector terminal ⑪ and body metal (ground).



Voltage: 4.4 - 6.6V (constant)

Yes → A

Move shift lever to "P".
Check solenoid valve voltage between "diagnostic" connector terminal ⑪ and body metal (ground).
Voltage: 4.4 - 6.6V (constant)

No → Ⓓ

Yes → Go to 4) CHECK POWER STEERING SOLENOID VALVE for proper operation.

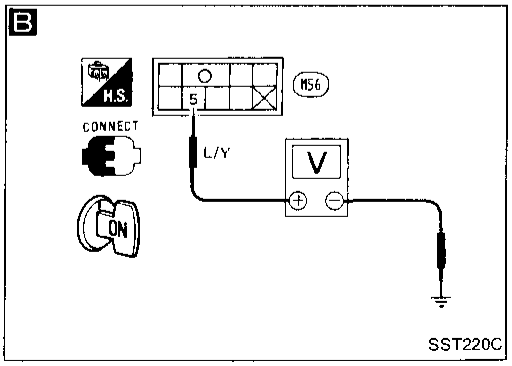
No

Ⓓ

Check if terminal voltage drops to 1.0 - 1.5V range approx. 10 seconds after ignition switch is turned ON.

No → Go to 5) CHECK POWER STEERING CONTROL UNIT for proper operation.

Yes



B

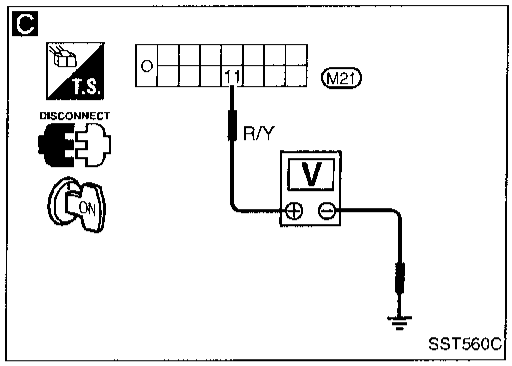
Check if neutral position switch signal is present at power steering control unit terminal ⑤ and body metal (ground).
Voltage: 0V
(When neutral position switch is ON.)

No → Malfunctioning neutral position switch system

Yes

Ⓒ

Trouble Diagnoses (Cont'd)



Ⓒ

Ensure that power steering control unit connector is connected properly.

C

Turn ignition switch ON and move shift lever to "P".
Check solenoid valve voltage between "diagnostic" connector terminal ⑪ and body metal (ground).
Voltage:
4.4 - 6.6V (constant)

No → Malfunctioning power steering control unit

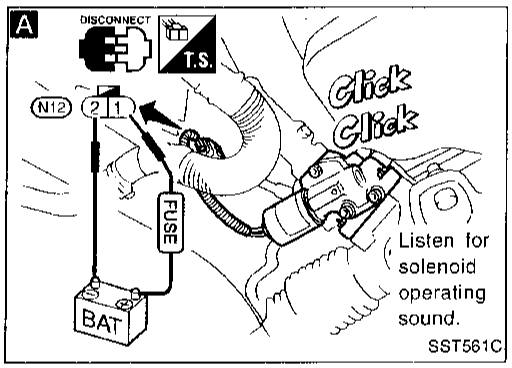
Yes

Check if heavy steering operation occurs during stationary turns.

Yes → Go to 1) CHECK STOP LAMP SIGNAL.

No

END



A

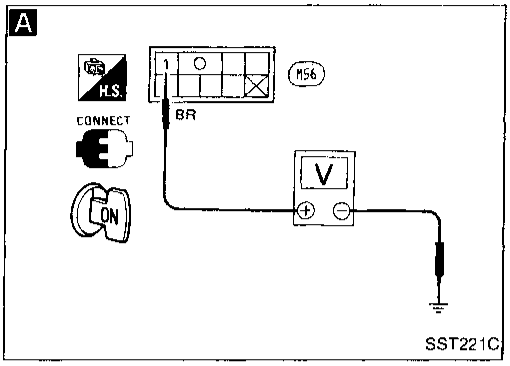
4) CHECK POWER STEERING SOLENOID VALVE.
Disconnect solenoid valve connector.
Check if plunger clicks when voltage is applied between connector terminals (on solenoid valve side) ① and ②.

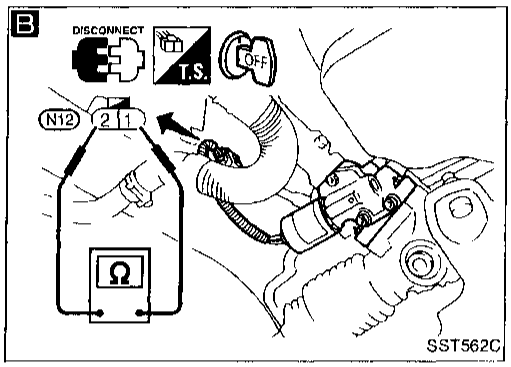
No → Malfunctioning power steering solenoid valve

Yes

- Malfunctioning steering gear assembly
- Malfunctioning oil pump

Trouble Diagnoses (Cont'd)





A

5) CHECK POWER STEERING CONTROL UNIT.
Check if power voltage is present at power steering control unit terminal ① and body metal (ground).
Voltage: 12V

No → Malfunctioning ignition power circuit

Yes ↓

B

Disconnect solenoid valve connector, and check resistance between connector terminals (on solenoid valve side) ① and ②.
Resistance: 4 - 6 Ω

No → Malfunctioning solenoid valve system

Yes ↓

Ensure that power steering control unit connector is connected properly.

Yes ↓

Check if heavy steering operation occurs during stationary turns.

No → Malfunctioning power steering control unit

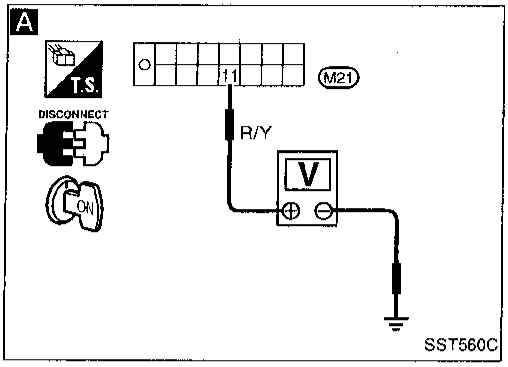
Yes ↓

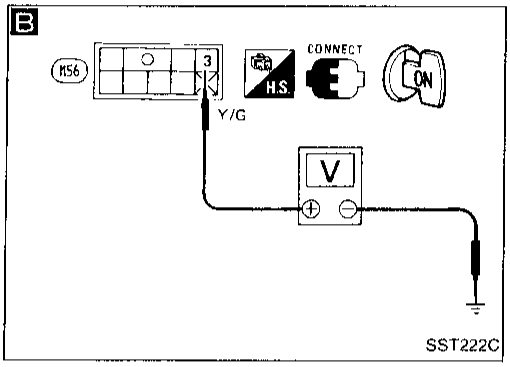
END

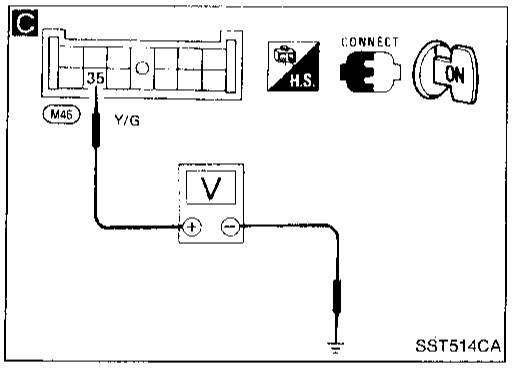
Trouble Diagnoses (Cont'd)

DIAGNOSTIC PROCEDURE 2

SYMPTOM:
Light steering operation during high-speed driving







Raise rear wheels off ground and start engine.

A

Check solenoid valve voltage between "diagnostic" connector terminal ⑪ and body metal (ground) while driving vehicle from 0 to 100 km/h (0 to 62 MPH).
Voltage:
0 km/h (0 MPH): 4.4 - 6.6V
100 km/h (62 MPH): 1.8 - 2.8V

Yes → Ⓒ

No

Check speedometer.

NG → Malfunctioning vehicle speed sensor or speedometer

OK

C

Check ASCD and vehicle speed-sensing door lock for proper operation.

NG → Check if vehicle speed signal is present at speedometer.
Disconnect speedometer from vehicle to facilitate work. Reconnect wiring.
Check voltage between speedometer terminal ㉟ and ground while driving vehicle at very slow speeds.
1 V (Min.) and 5 V (Max.) are alternately repeated

Yes → B

No → Malfunctioning speedometer

OK

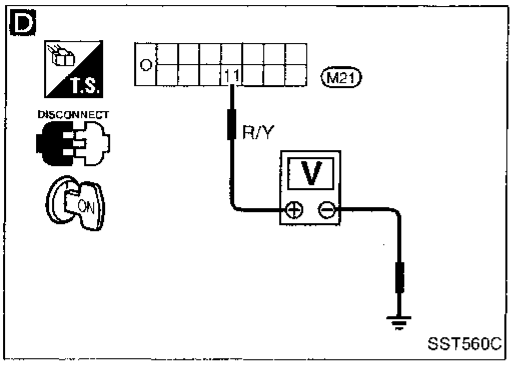
B

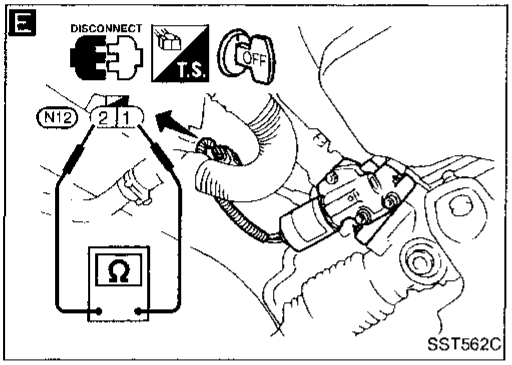
Check if vehicle speed signal is present at power steering control unit.
While driving at very slow speeds, connect power steering unit connector.
Measure voltage between power steering control unit terminal ③ and ground.
1 V (Min.) and 5 V (Max.) are alternately repeated

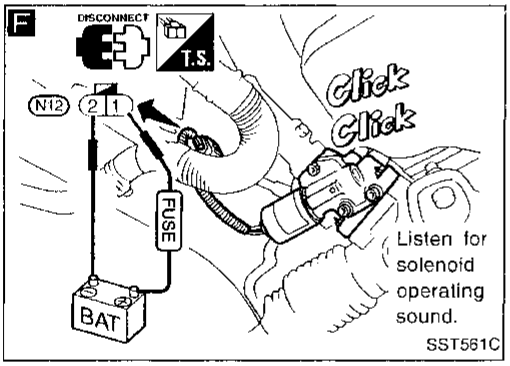
No → Improper connection between speedometer and power steering control unit

Yes → Ⓐ

Trouble Diagnoses (Cont'd)







Ⓐ

Ensure that power steering control unit connector is connected properly.

D

Check solenoid valve voltage between "diagnostic" connector terminal ⑪ and ground while driving vehicle from 0 to 100 km/h (0 to 62 MPH).
Voltage:
0 km/h (0 MPH): 4.4 - 6.6V
100 km/h (62 MPH): 1.8 - 2.8V

Yes → Check if steering operation is heavy during high-speed driving.

No → Yes → END

No

Ⓒ

E

Disconnect solenoid valve connector, and check resistance between connector terminals ① and ② (on solenoid valve side).
Resistance: 4 - 6 Ω

Yes → Malfunctioning power steering control unit

No

F

Disconnect solenoid valve connector.
Apply voltage between connector terminals ① and ② (on solenoid valve side) and check if solenoid valve clicks.

No → Malfunctioning solenoid valve

Yes

- Malfunctioning steering gear assembly
- Malfunctioning oil pump

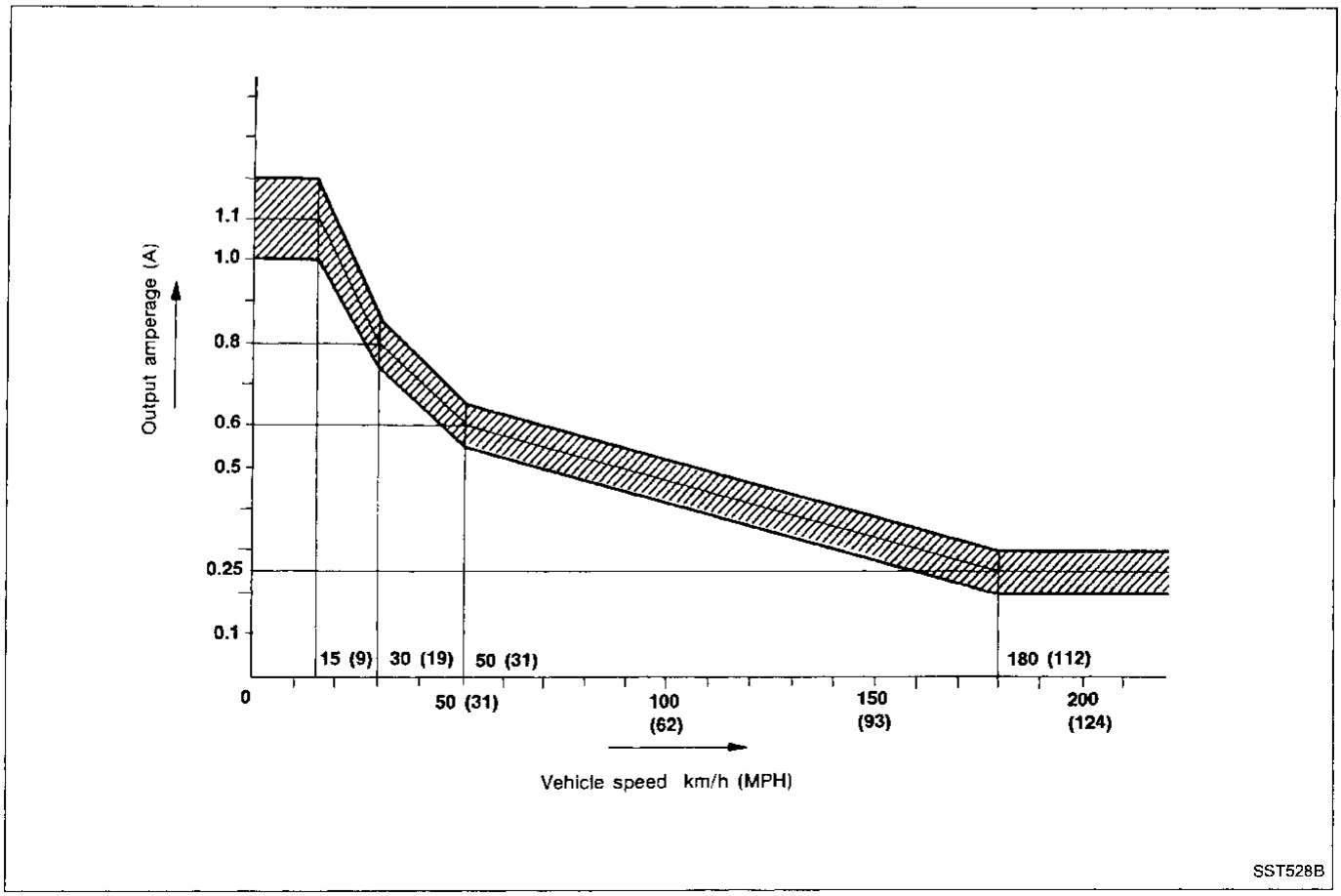
Trouble Diagnoses (Cont'd)

CONTROL UNIT INSPECTION TABLE

The standard values (voltage), measured with an analog tester in contact with the control unit terminal, are shown below:

Terminal No.	Application	Standard value
1	Power	Approx. 12V
2	Ground	0V
3	Vehicle speed sensor input	1 volt (min.) and 5 volts (max.) are alternately repeated when vehicle is driven at very slow speeds.
4	Stop lamp switch input	Pressed: Approx. 12V Released: 0V
5	Park/Neutral position relay input	0V (selector lever in "N" or "P") 4 - 5V (except for the above)
6	Parking brake switch input	Applied: 0V Released: Approx. 12V
7	Power steering solenoid valve output	0 km/h (0 MPH) 4.4 - 6.6V 100 km/h (62 MPH) 1.8 - 2.8V Fail-safe 1.0 - 1.5V
8	—	—

PERFORMANCE OF CONTROLLER



General Specifications

Steering model	Electronically controlled power steering
Steering gear type	PR26SE
Steering overall gear ratio	15.1
Turn of steering wheel (Lock to lock)	2.6
Steering column type	Collapsible

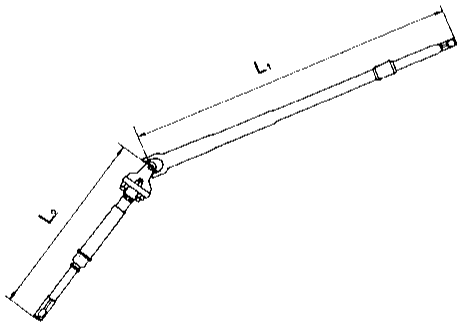
Inspection and Adjustment

GENERAL

Steering wheel axial play mm (in)	0 (0)
Steering wheel play mm (in)	35 (1.38) or less
Movement of gear housing mm (in)	±2 (±0.08) or less

STEERING COLUMN

Steering column length "L_1" mm (in)	618.7 - 620.3 (24.36 - 24.42)
Steering column lower shaft length "L_2" mm (in)	356.8 - 358.4 (14.05 - 14.11)

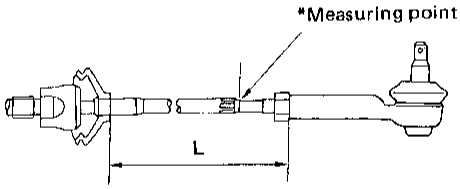


SST510B

STEERING GEAR AND LINKAGE

Steering gear type	PR26SE
Tie-rod outer ball joint "A"	
Swinging force (at cotter pin hole) N (kg, lb)	4.9 - 46.1 (0.5 - 4.7, 1.1 - 10.4)
Rotating torque "B" N·m (kg-cm, in-lb)	0.3 - 2.9 (3 - 30, 2.6 - 26.0)
Axial end play "C" mm (in)	0 (0)
Tie-rod inner ball joint	
Swinging force* "A" N (kg, lb)	8.8 - 78.5 (0.9 - 8.0, 2.0 - 17.6)
Axial end play "C" mm (in)	0 (0)
Tie-rod standard length "L" mm (in)	153.6 (6.05)

*: Measuring point



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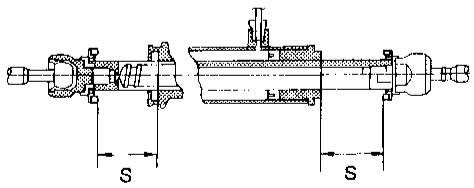
Rack stroke "S"	mm (in)	66 (2.60)



SST307BA

POWER STEERING

Steering gear type	PR26SE
Retainer adjustment	
Adjusting screw	
Initial tightening torque N·m (kg-cm, in-lb)	4.9 - 5.9 (50 - 60, 43 - 52)
Retightening torque after loosening N·m (kg-cm, in-lb)	0.2 (2, 1.7)
Tightening torque after gear has settled N·m (kg-cm, in-lb)	4.9 (50, 43)
Returning angle degree	60° - 100°
Rack sliding force N (kg, lb)	
Under normal operating oil pressure	
Range within ±11.5 mm (±0.453 in) from the neutral position	
Average rack sliding force	216 - 275 (22 - 28, 49 - 62)
Maximum force deviation	39 (4, 9)
Except for the above range	
Maximum rack sliding force	294 (30, 66)
Maximum force deviation	147 (15, 33)
Maximum steering wheel turning force N (kg, lb) (Measured at one full turn from the neutral position)	39 (4, 9)
Fluid capacity (Approximate) ℓ (US qt, Imp qt)	1.2 (1-1/4, 1-1/8)
Oil pump maximum pressure kPa (kg/cm^2, psi)	7,649 - 8,238 (78 - 84, 1,109 - 1,194)