

STEERING SYSTEM

SECTION **ST**

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PRECAUTIONS AND PREPARATION

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 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), sensors, a diagnosis 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 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.**

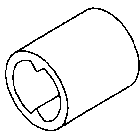
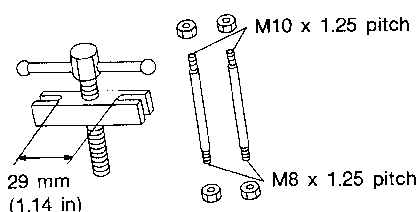
Steering System

- **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.**
- **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 type DEXRON™ II or equivalent.

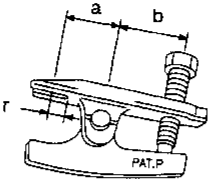
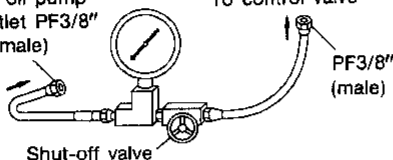
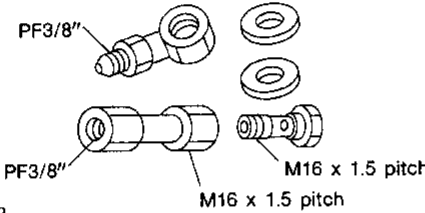
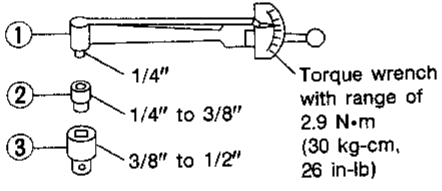
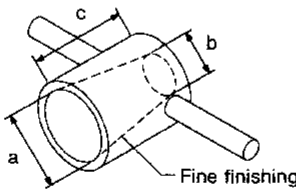
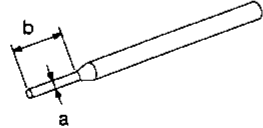
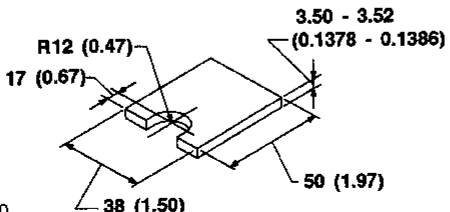
Special Service Tools

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	Measuring pinion rotating torque	
ST27180001 (J25726-A) Steering wheel puller	Removing steering wheel	

PRECAUTIONS AND PREPARATION

Special Service Tools (Cont'd)

Tool number (Kent-Moore No.) Tool name	Description	
HT72750000 (J24319-01) Ball joint remover	 <p style="text-align: right;">a: 32 mm (1.26 in) b: 70 mm (2.76 in) r: 11 mm (0.43 in) radius</p>	GI MA
ST27091000 (J26357 and J26357-10) Pressure gauge		EM LC EC
KV48102500 (—) Pressure gauge adapter		FE CL
ST3127S000 (See J25765-A) ① GG91030000 (J25765-A) Torque wrench ② HT6294000 (—) Socket adapter ③ HT62900000 (—) Socket adapter	 <p style="text-align: right;">Torque wrench with range of 2.9 N·m (30 kg-cm, 26 in-lb)</p>	MT AT PD FA
KV48104400 (—) Rack seal ring reformer	 <p style="text-align: right;">a: 50 mm (1.97 in) dia. b: 36 mm (1.42 in) dia. c: 100 mm (3.94 in)</p>	RA BR ST
KV32101100 (—) Pin punch	 <p style="text-align: right;">a: 6 mm (0.24 in) dia. b: 55 mm (2.17 in)</p>	RS BT
KV40106300 (—) Spacer	 <p style="text-align: right;">Unit: mm (in)</p>	HA EL IDX

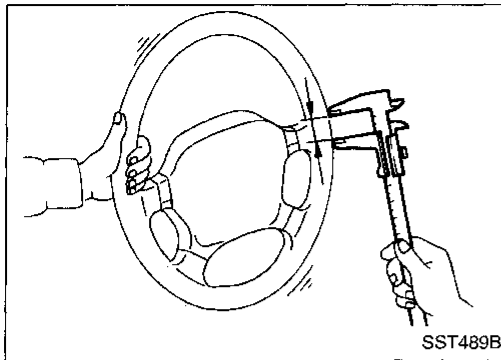
PRECAUTIONS AND PREPARATION

Commercial Service Tools

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

CONSULT Program Card

Use CONSULT program card "UE940" when CONSULT is used on SUPER HICAS system.



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

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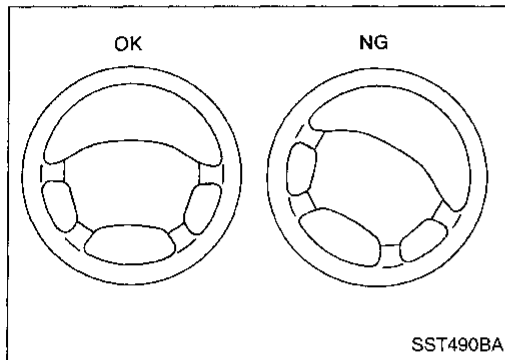
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Checking Neutral Position on Steering Wheel

Pre-checking

- Make sure that wheel alignment is correct.

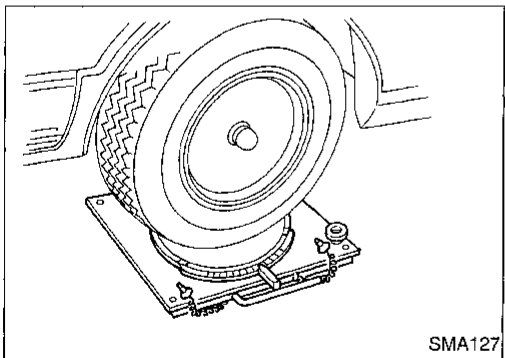
Wheel alignment:

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-rod lock nuts. Turn the tie-rods by the same amount in opposite directions on both left and right sides.

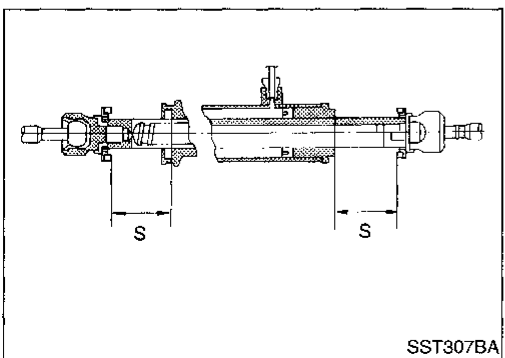


Front Wheel Turning Angle

1. Rotate steering wheel all the way right and left; measure turning angle.

Turning angle of full turns:

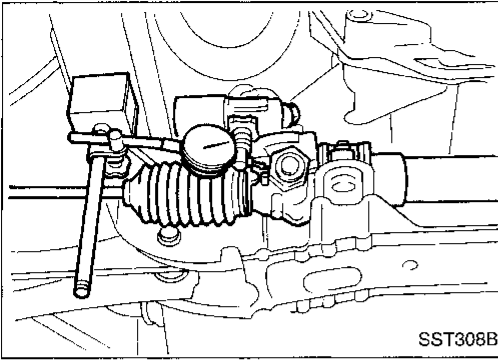
Refer to SDS in FA section.



2. If it is not within specification; check rack stroke.

Rack stroke "S":

Refer to SDS (ST-87).

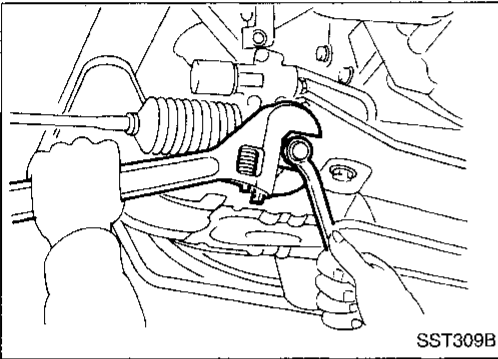


Checking Gear Housing Movement

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:
 $\pm 2 \text{ mm } (\pm 0.08 \text{ in})$ or less

2. If movement exceeds the limit, replace mount insulator after confirming proper installation of gear housing clamps.

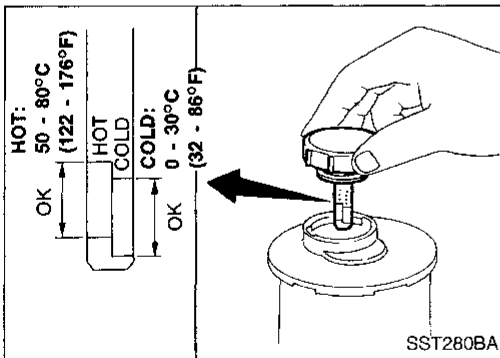


Adjusting Rack Retainer

- 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 (For power steering)

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



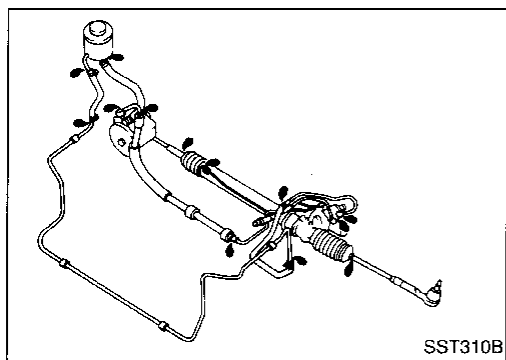
Checking Fluid Level

Check fluid level.

Use the correct range of the dipstick depending on the fluid temperature. Use the "HOT" range at 50 to 80°C (122 to 176°F), or the "COLD" range at 0 to 30°C (32 to 86°F).

CAUTION:

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



Checking Fluid Leakage

Check the lines for improper attachment and for leaks, cracks, damage, loose connections, 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 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 are clear of the ground.
2. Add fluid into oil 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.

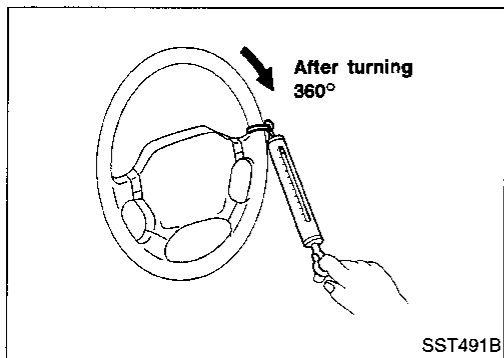
3. Start engine.

Repeat step 2 above.

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

- a. Air bubbles in reservoir tank
- b. 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 (For power steering)

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:

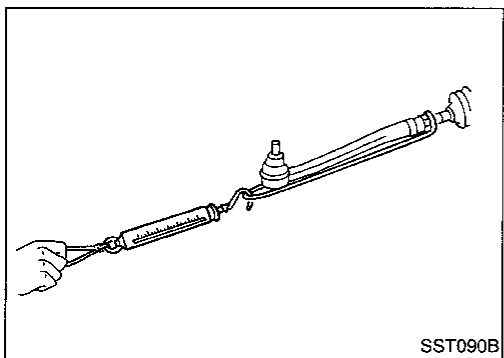
39 N (4 kg, 9 lb) or less

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.



ON-VEHICLE SERVICE

Checking Steering Wheel Turning Force (For power steering) (Cont'd)

Average rack sliding force:

Without HICAS

206 - 265 N (21 - 27 kg, 46 - 60 lb)

With HICAS

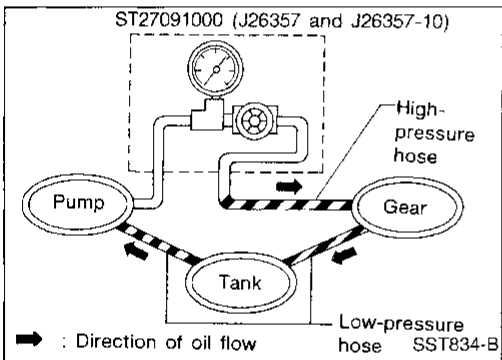
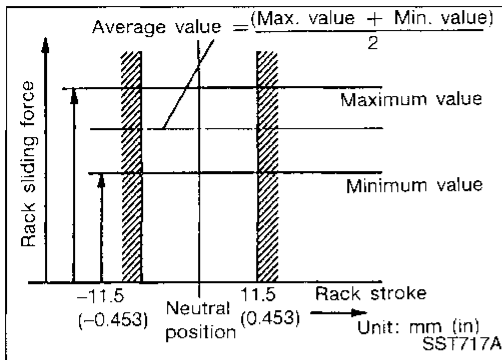
201 - 250 N (20.5 - 25.5 kg, 45.2 - 56.2 lb)

- d. Check sliding force outside above range.

Maximum rack sliding force:

Not more than 294 N (30 kg, 66 lb) beyond above value

6. If rack sliding force is not within specification, overhaul steering gear assembly.
7. If rack sliding force is OK, inspect steering column. Refer to ST-12.



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".)
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 will increase 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/cm², 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.

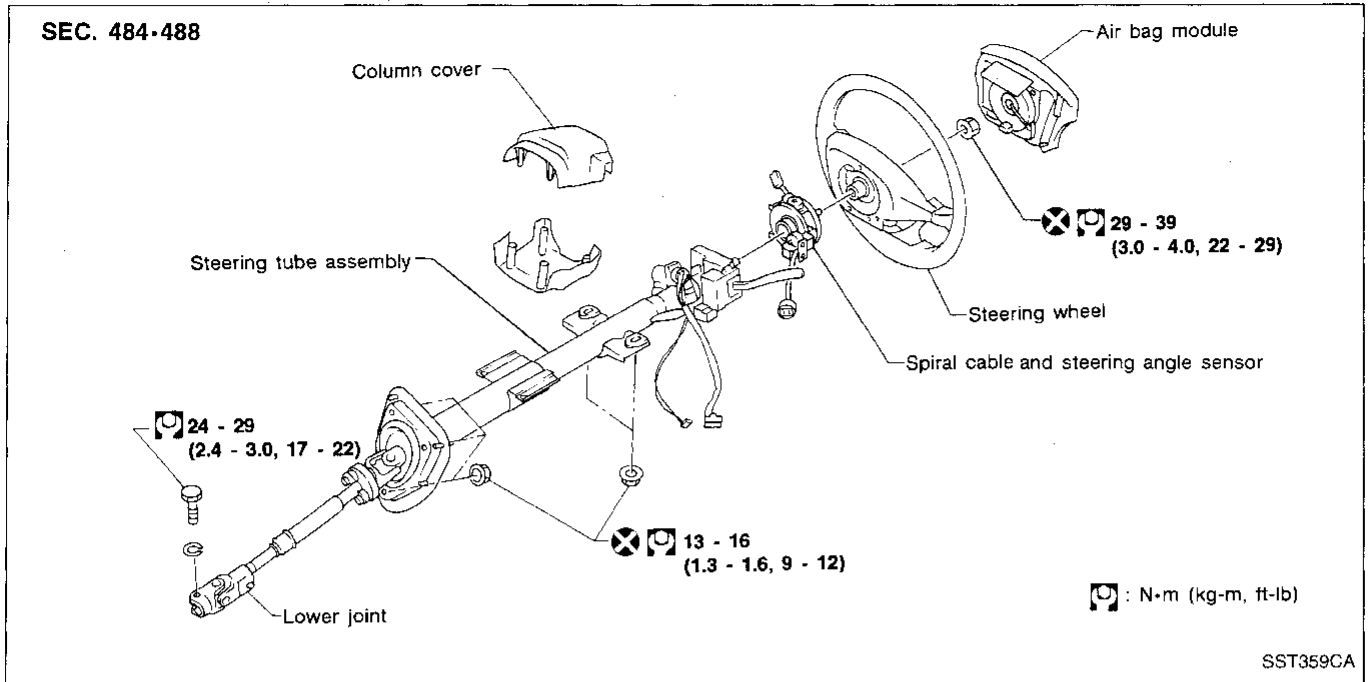
CAUTION:

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.

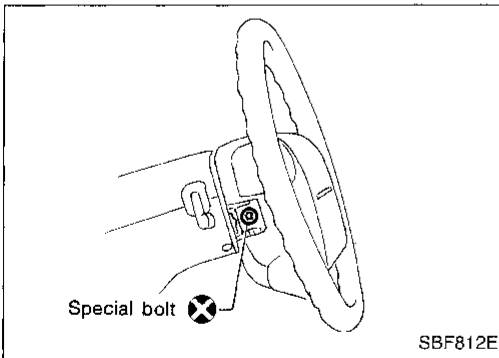
STEERING WHEEL AND STEERING COLUMN

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 RS section ("Removal — Air Bag Module and Spiral Cable", "SUPPLEMENTAL RESTRAINT SYSTEM").

STEERING WHEEL AND STEERING COLUMN

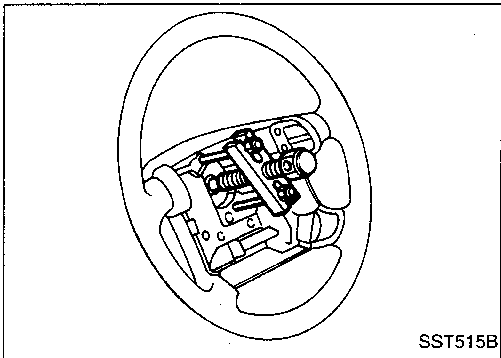
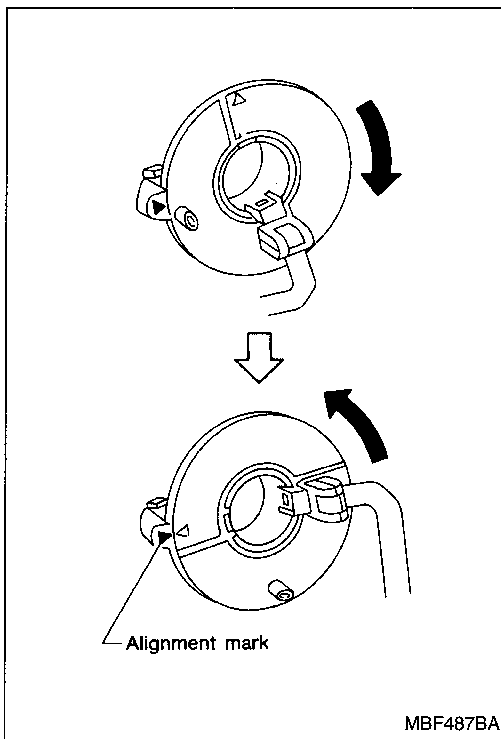
Removal and Installation (Cont'd)

- 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 (X).

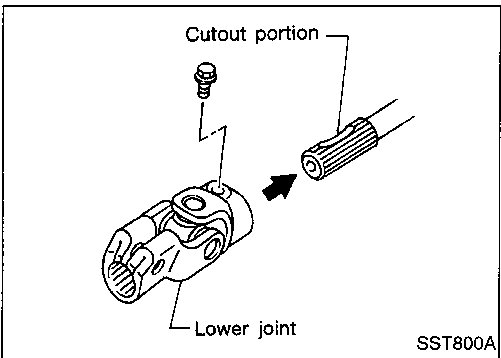
CAUTION:

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.

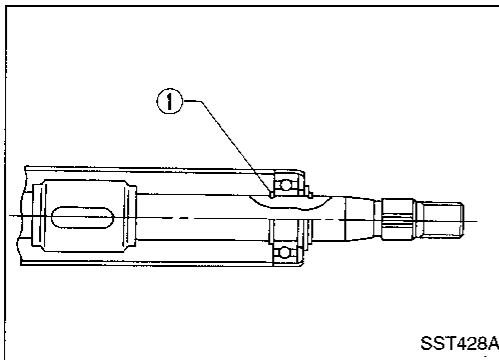
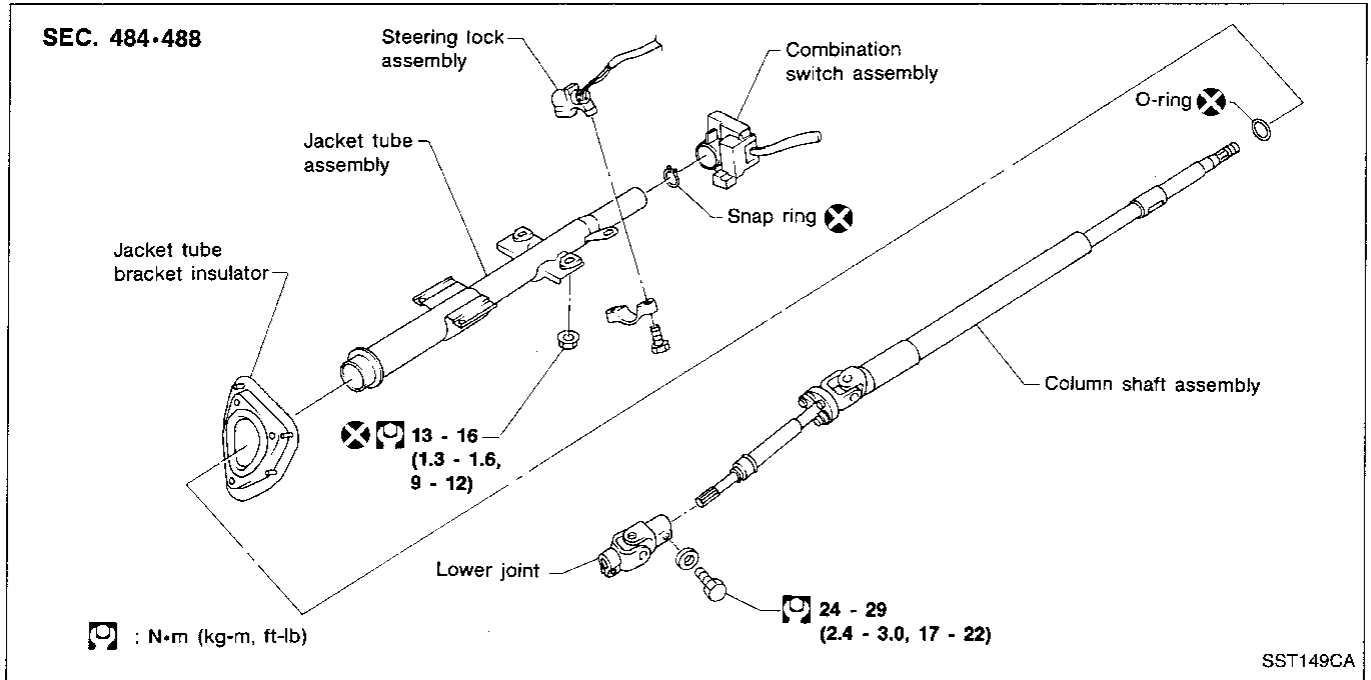
CAUTION:

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.

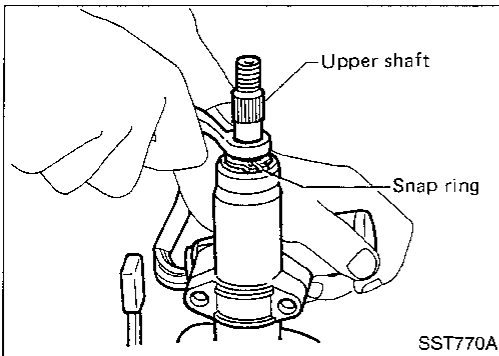
Be sure that the steering wheel is in a neutral position when driving straight ahead.

STEERING WHEEL AND STEERING COLUMN

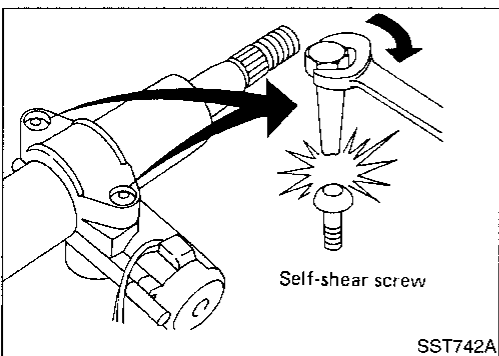
Disassembly and Assembly



- When disassembling and assembling, unlock steering lock with key.
- Install O-ring ① before inserting shaft into jacket tube. Ensure that rounded surface of snap ring faces toward bearing when snap ring is installed.



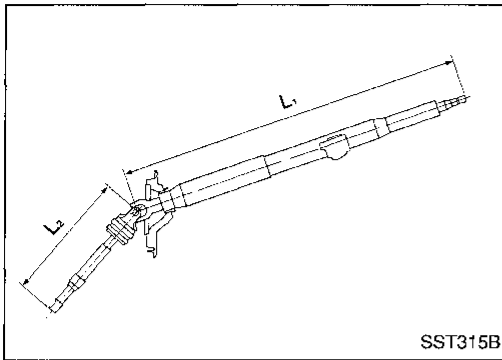
- Install snap ring on upper shaft with a suitable tool.



- 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.

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STEERING WHEEL AND STEERING COLUMN



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 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 ":

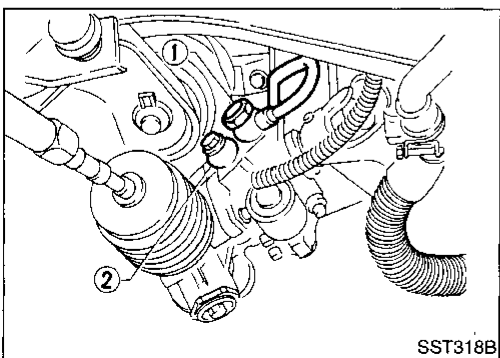
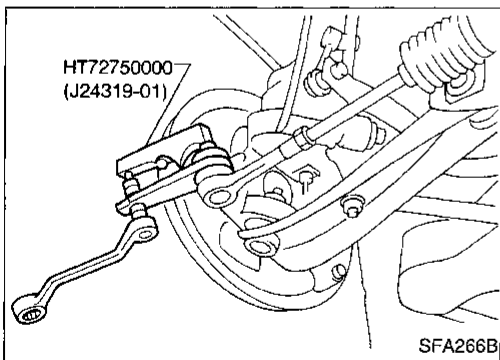
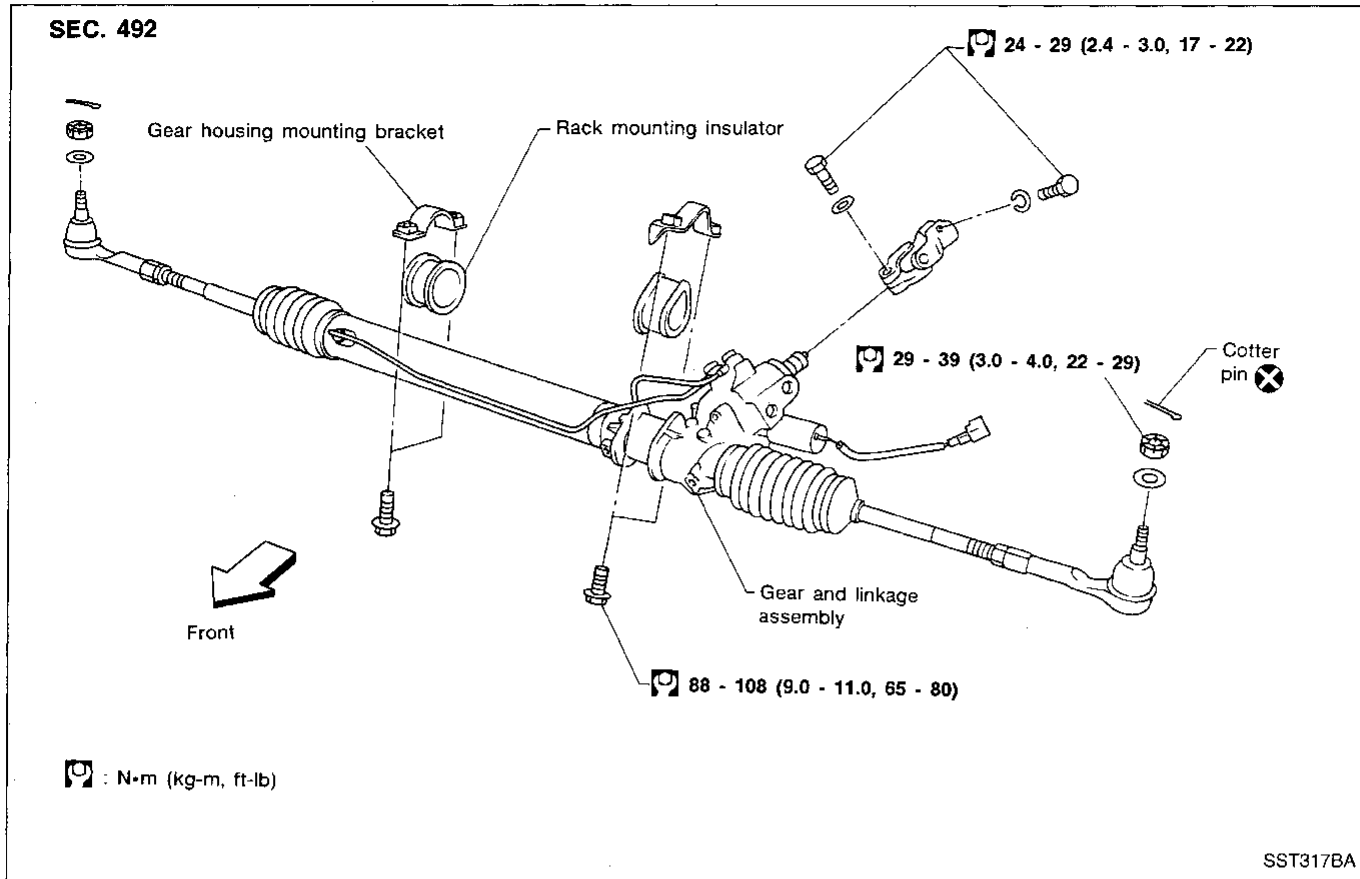
749.4 - 751.0 mm (29.50 - 29.57 in)

Steering column lower shaft length " L_2 ":

280.6 - 282.2 mm (11.05 - 11.11 in)

POWER STEERING GEAR AND LINKAGE (Model PR26AE)

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.
- Detach tie-rod outer sockets from knuckle arms with Tool.

- Install pipe connector.
- Observe specified tightening torque when tightening high-pressure and low-pressure pipe connectors. Excessive tightening will damage threads of connector or O-ring.

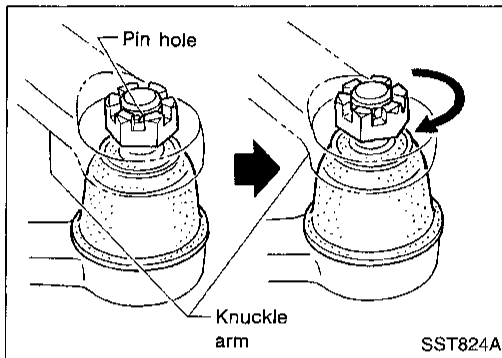
Connector tightening torque:

- 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)

POWER STEERING GEAR AND LINKAGE (Model PR26AE)

Removal and Installation (Cont'd)

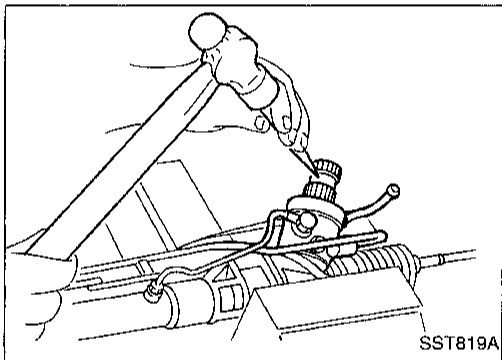
- The O-ring in low-pressure pipe connector is larger than that in high-pressure connector. Take care to install the proper O-ring.



- 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:

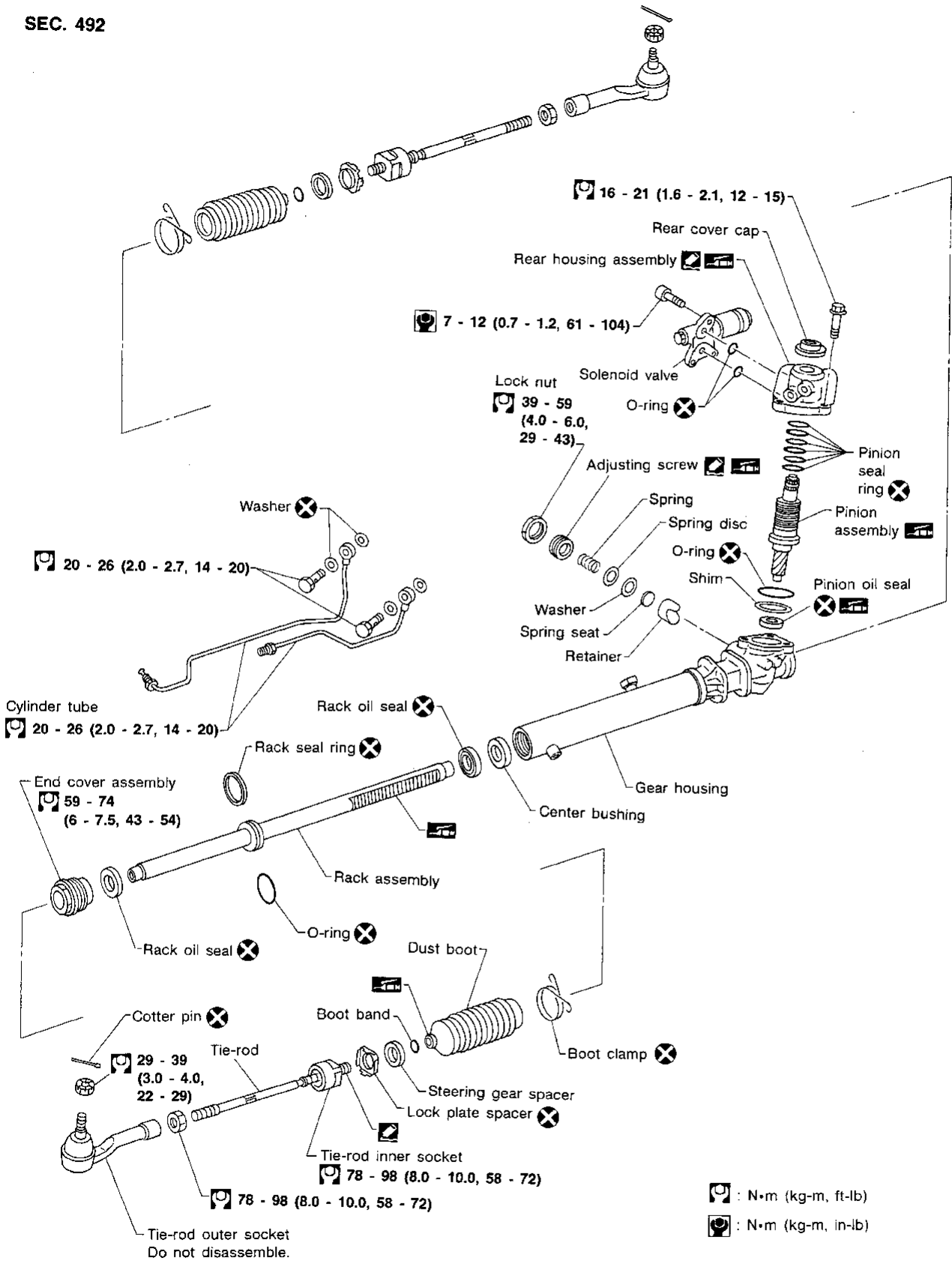
Tightening torque must not exceed 49 N·m (5 kg-m, 36 ft-lb).



- 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 matching marks of pinion shaft and pinion housing.

POWER STEERING GEAR AND LINKAGE (Model PR26AE)

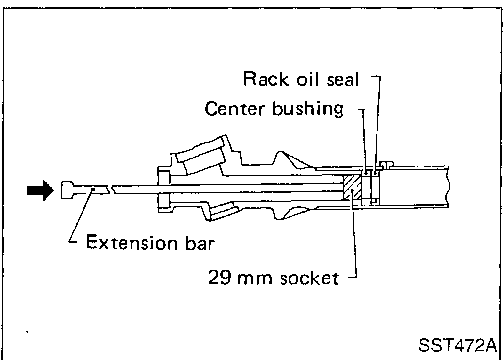
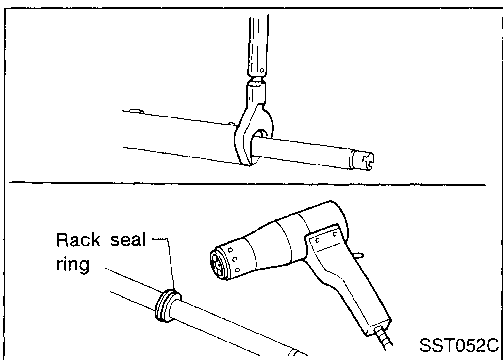
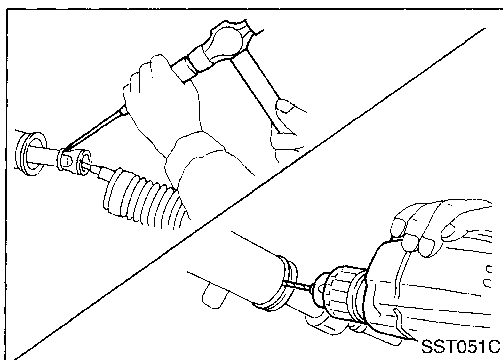
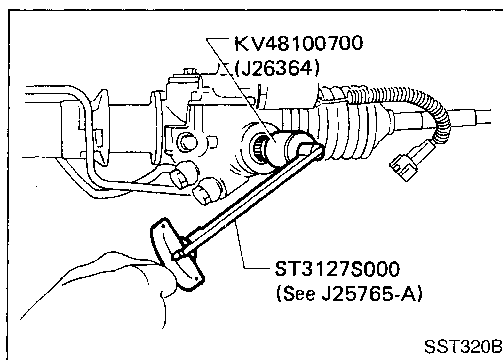
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POWER STEERING GEAR AND LINKAGE (Model PR26AE)



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 a suitable 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 type DEXRON™II 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.

POWER STEERING GEAR AND LINKAGE (Model PR26AE)

Inspection (Cont'd)

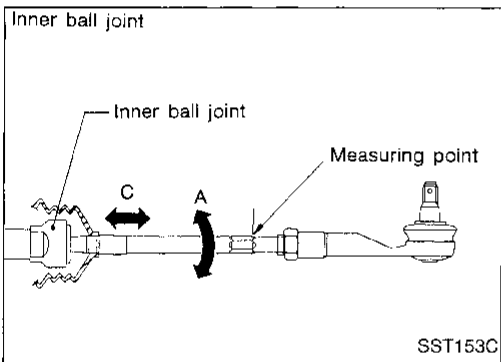
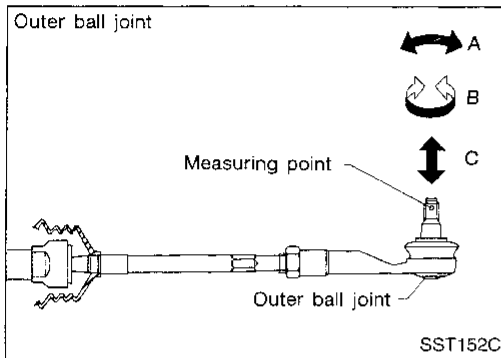
PINION ASSEMBLY

- 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.

GEAR HOUSING CYLINDER

Check gear housing cylinder bore for scratches or other damage. Replace if necessary.

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TIE-ROD OUTER AND INNER SOCKETS

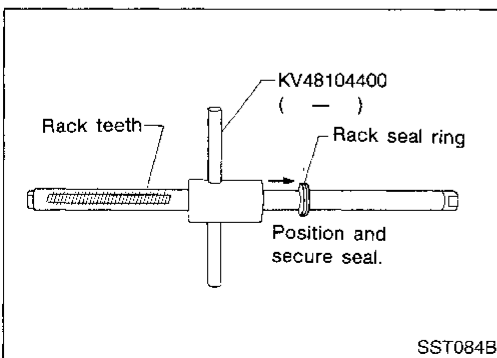
- Check ball joints for swinging force.
Tie-rod outer and inner ball joints swinging force "A":
Refer to SDS (ST-87).
- Check ball joint for rotating torque.
Tie-rod outer ball joint rotating torque "B":
Refer to SDS (ST-87).
- Check ball joints for axial end play.
Tie-rod outer and inner ball joints axial end play "C":
Refer to SDS (ST-87).
- 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

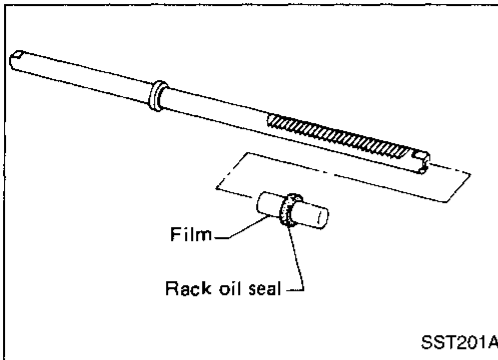
1. Using a heat gun, heat new teflon rack seal ring to approximately 40°C (104°F). Then place it onto rack.



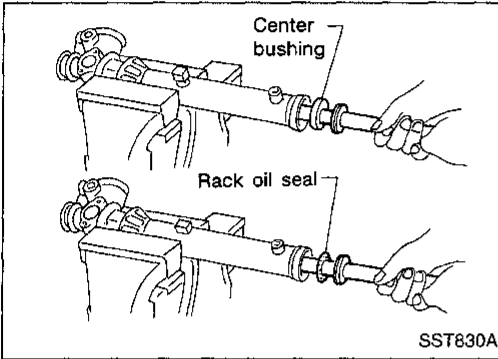
2. Using Tool, compress rack seal ring securely on rack.
Always insert the tool from the rack gear side.

POWER STEERING GEAR AND LINKAGE (Model PR26AE)

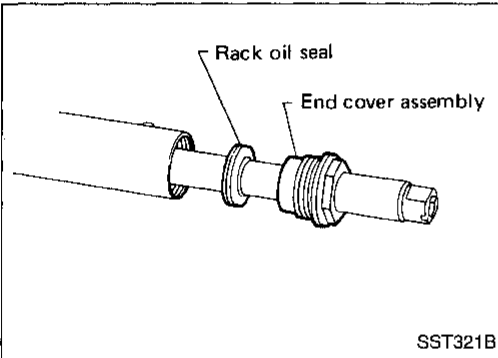
Assembly (Cont'd)



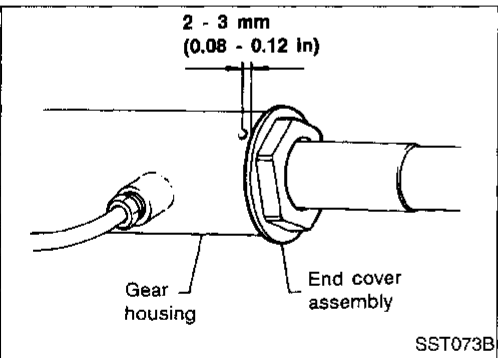
3. Insert new rack oil seal.
 - Place plastic film into rack oil seal to prevent damage by rack teeth.
 - Do not forget to remove plastic film after rack oil seal is positioned properly.
 - Make sure lips of rack oil seal face each other.



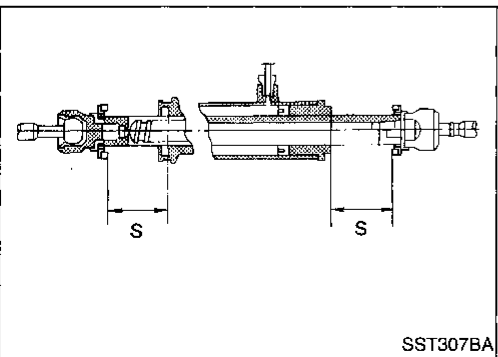
4. Install center bushing and rack oil seal with rack assembly.



5. Insert rack oil seal and end cover assembly to rack. Then tighten end cover assembly.



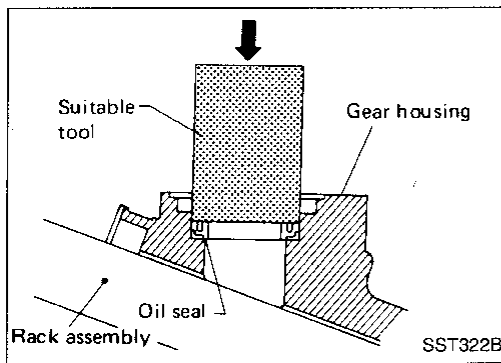
6. Fasten cylinder end cover assembly to gear housing by staking.



7. Set rack gear in neutral position.
Rack stroke "S":
Refer to SDS (ST-87).

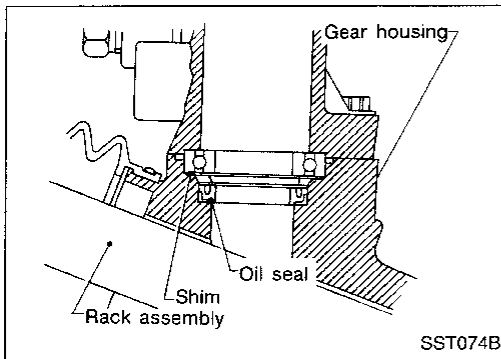
POWER STEERING GEAR AND LINKAGE (Model PR26AE)

Assembly (Cont'd)

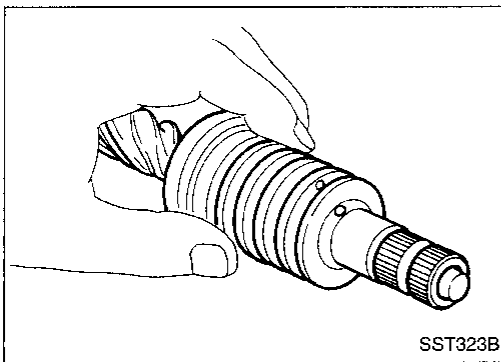


8. Coat seal lip of new pinion oil seal with multi-purpose grease. Install it into pinion housing of gear with a suitable tool.

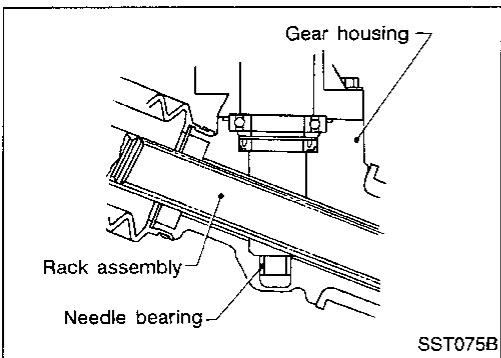
Make sure lip of oil seal faces up when installed.



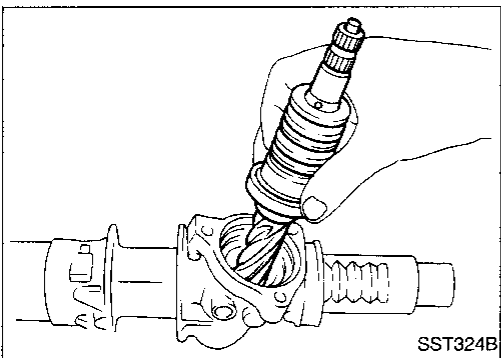
9. Install pinion bearing adjusting shim(s).
- Whenever pinion assembly, gear housing and rear housing are disassembled, replace shim(s) with new ones. Always use the same number of shim(s) when replacing.



10. Install new 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.



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

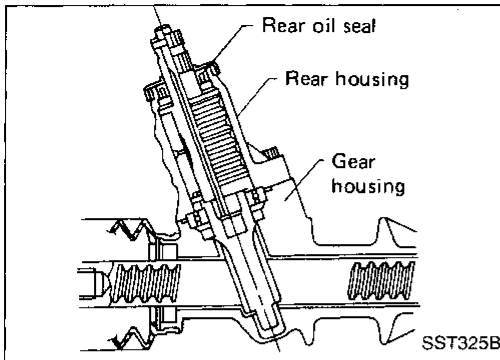


12. Install pinion assembly to pinion housing.
- Be careful not to damage pinion oil seal.**

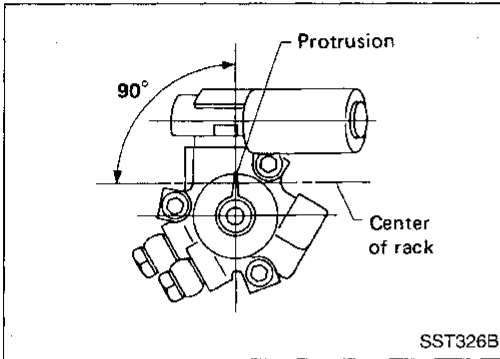
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POWER STEERING GEAR AND LINKAGE (Model PR26AE)

Assembly (Cont'd)

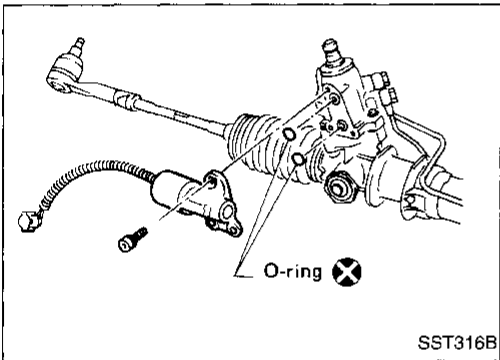


13. Apply a coat of multi-purpose grease to new rear oil seal lip before installing rear housing.

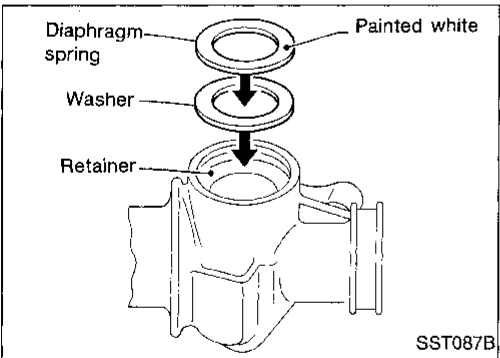


14. Ensure that the rack is centered. Install rear cover cap so that its protrusion is positioned as shown in figure.

Be careful not to damage worm ring and oil seal.



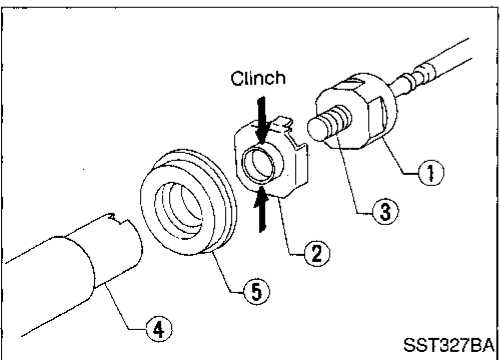
15. Install solenoid valve.



16. Install diaphragm spring into gear housing.

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

17. Install retainer spring and adjusting screw temporarily.



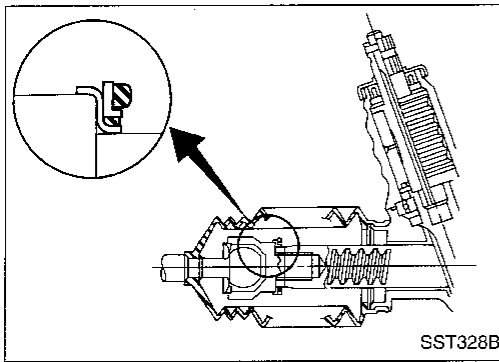
18. Install new lock plate.

CAUTION:

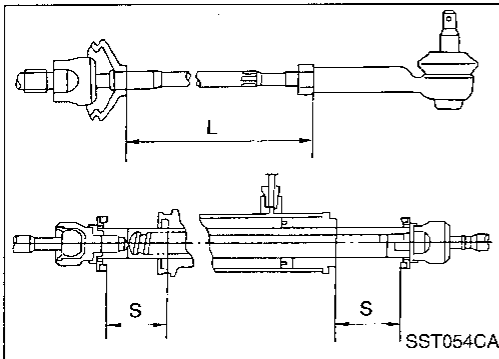
- Ensure steering gear spacer is installed with rubber side facing rack.
- To prevent scratching the boot, remove burrs from lock plate.
- Attach lock plate ② to tie-rod inner socket ①.
- Insert steering gear spacer ⑤ to rack ④.
- Apply locking sealant to inner socket threads ③. Screw inner socket into rack ④ and tighten to specified torque.
- Clinch lock plate at two places.

POWER STEERING GEAR AND LINKAGE (Model PR26AE)

Assembly (Cont'd)



19. Install steering gear spacer (5) to lock plate (2).



20. Tighten outer socket lock nut.

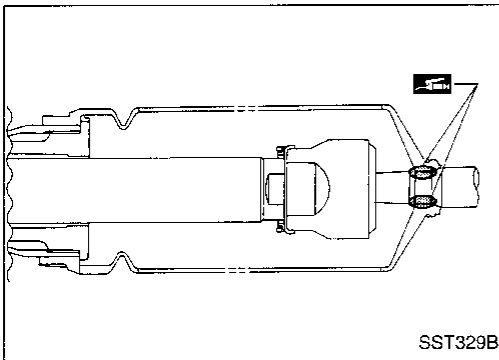
Tie-rod length "L":

Refer to SDS (ST-87).

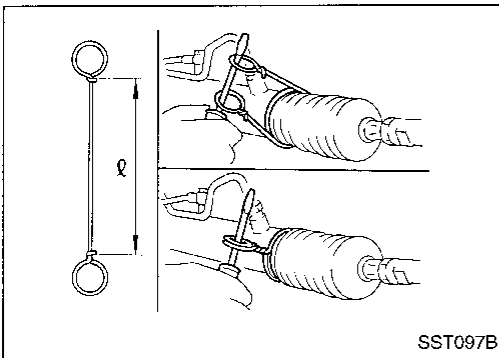
21. Measure rack stroke.

Rack stroke "S":

Refer to SDS (ST-87).

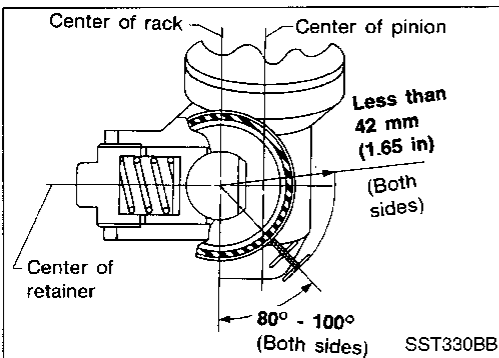


22. Before installing boot, coat the contact surfaces between boot and tie-rod with grease.



23. 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 them with a force of approx. 98 N (10 kg, 22 lb).

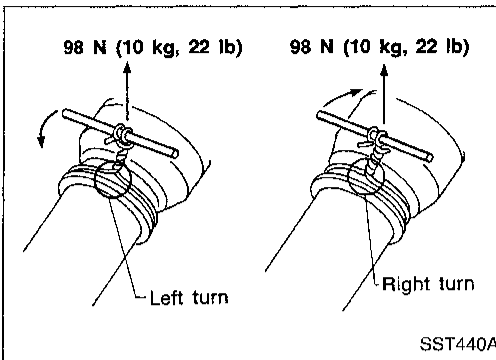


- Install boot clamp so that it is to the rear of the vehicle when gear housing is attached to the body. (This will prevent interference with other parts.)

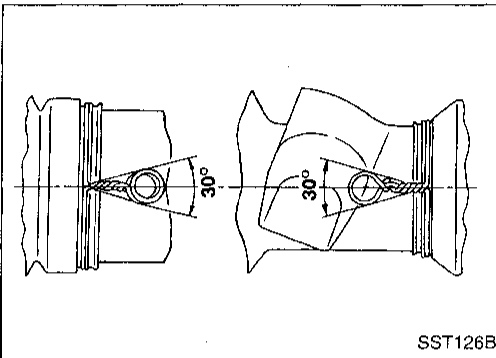
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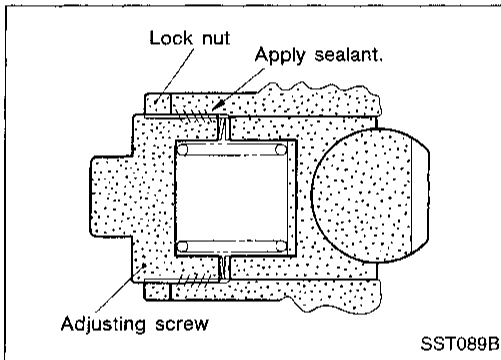
Assembly (Cont'd)



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



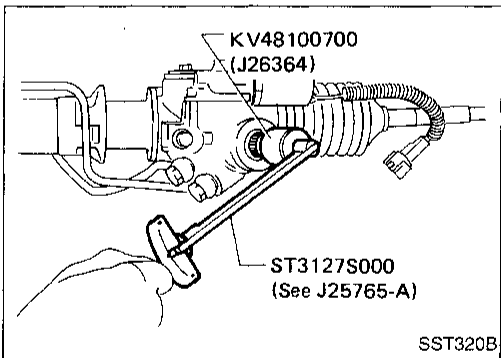
- After twisting boot clamp, bend twisted and diagonally so it does not contact boot.



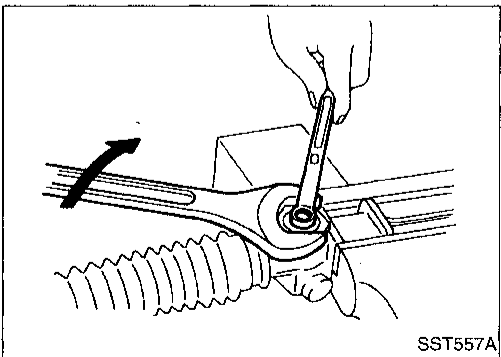
Adjustment

Adjust pinion rotating torque as follows:

1. Set rack to the neutral position 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°.

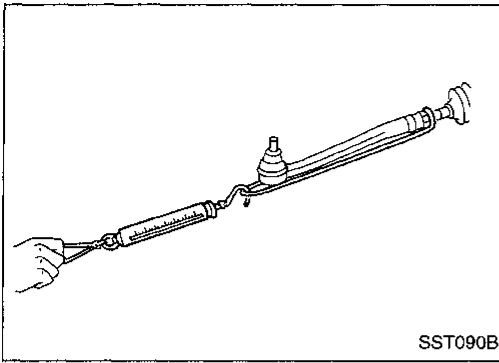


10. Prevent adjusting screw from turning, and tighten lock nut to specified torque.



POWER STEERING GEAR AND LINKAGE (Model PR26AE)

Adjustment (Cont'd)



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:

Without HICAS

206 - 265 N (21 - 27 kg, 46 - 60 lb)

With HICAS

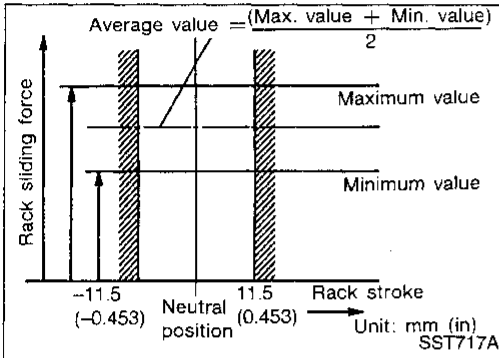
201 - 250 N (20.5 - 25.5 kg, 45.2 - 56.2 lb)

- g. Check sliding force outside above range.

Maximum rack sliding force:

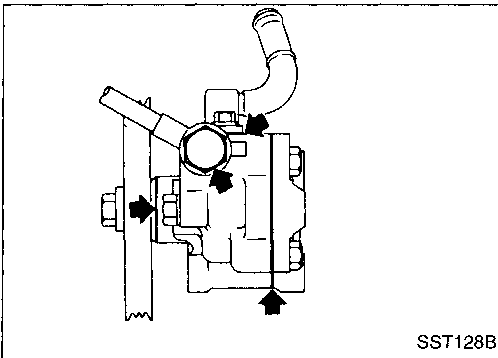
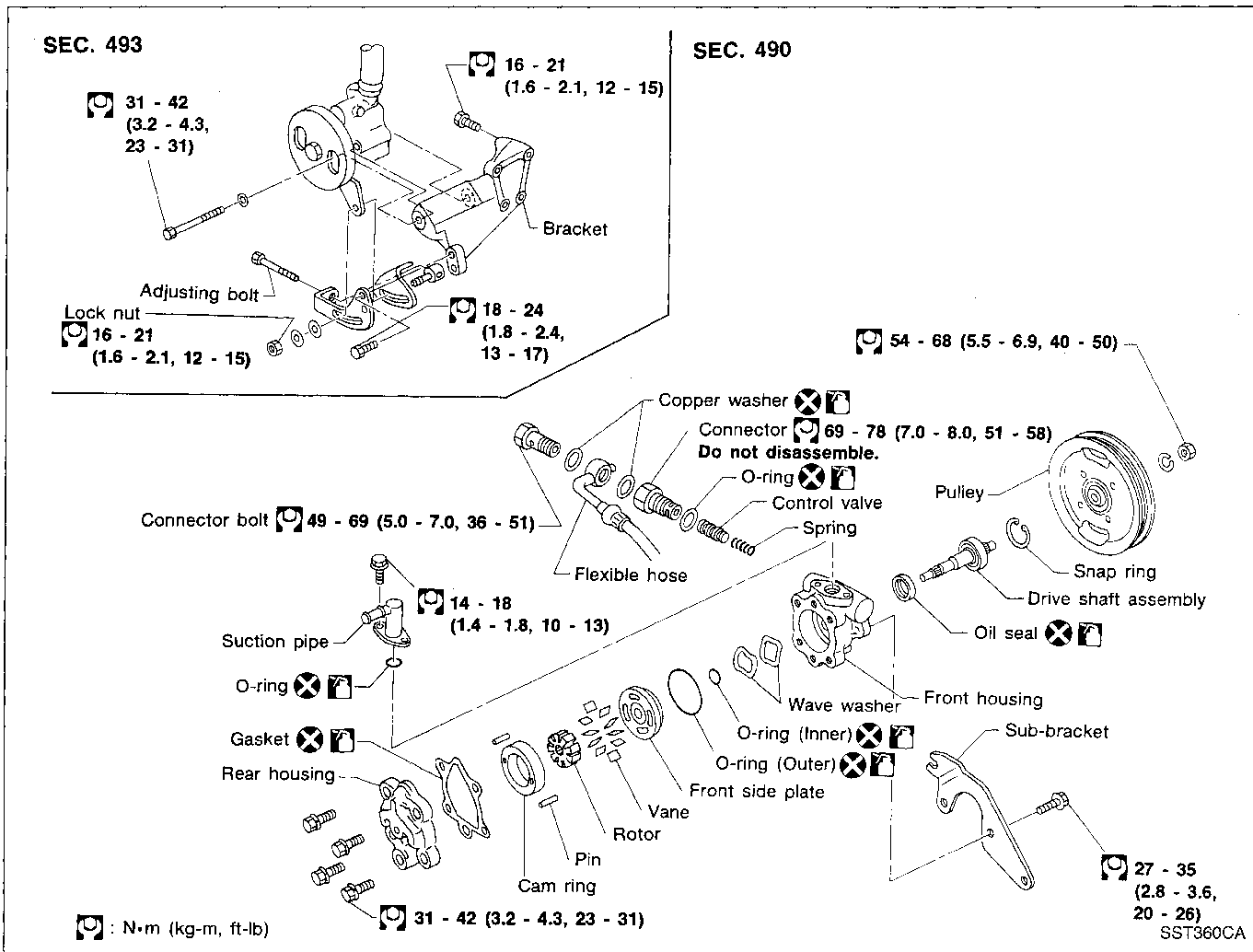
Not more than 294 N (30 kg, 66 lb) beyond above value

- 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.



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POWER STEERING OIL PUMP



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:

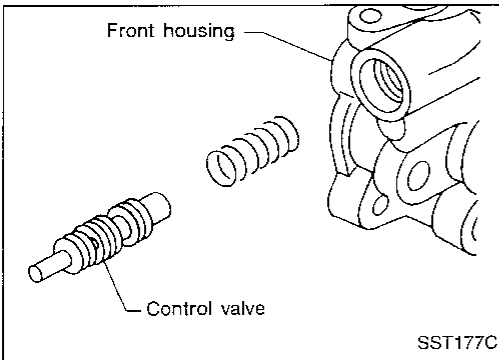
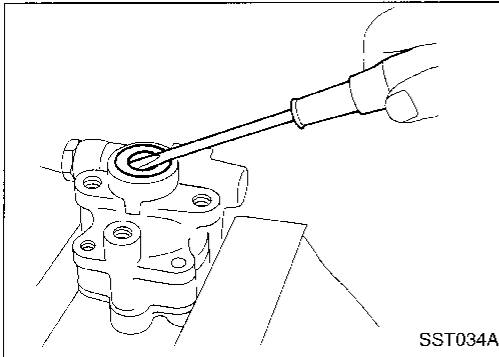
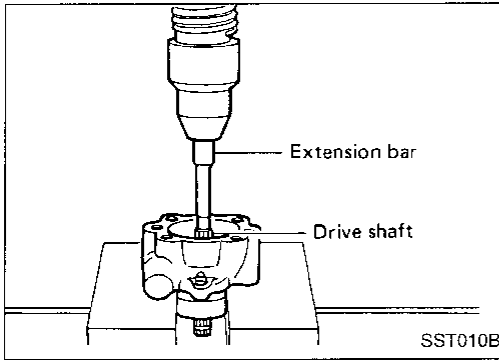
- Parts which can be disassembled are strictly limited. Never disassemble parts other than those specified.
- Disassemble in as clean a place as possible.
- Clean your hands before disassembly.
- Do not use rags; use nylon cloths or paper towels.
- Follow the procedures and cautions in the Service Manual.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

POWER STEERING OIL PUMP

Disassembly (Cont'd)

- 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 and flow control valve with spring.

Be careful not to drop control valve.

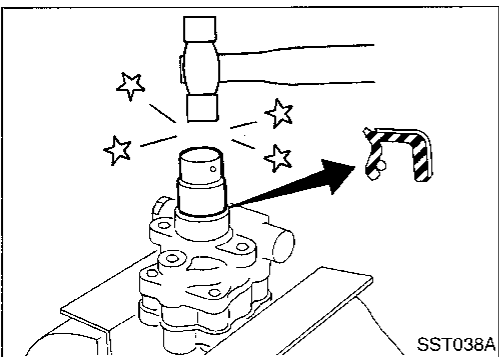
Inspection

- 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.



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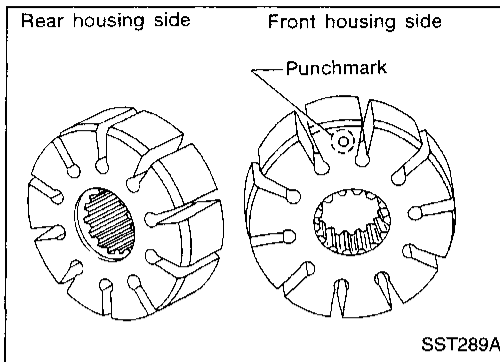
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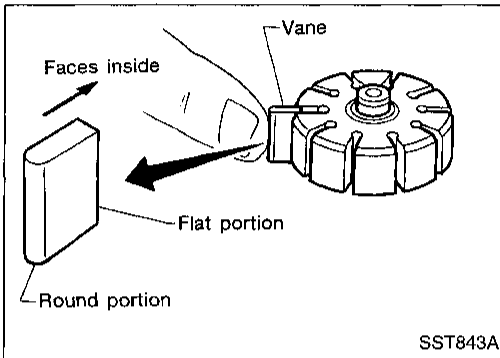
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POWER STEERING OIL PUMP

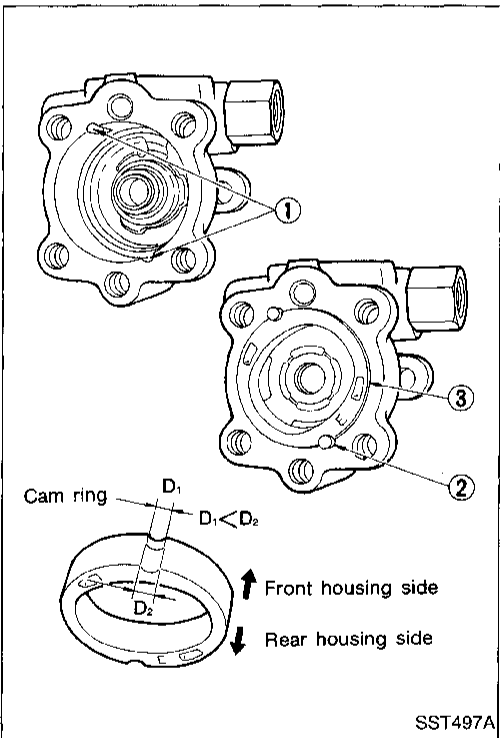
Assembly (Cont'd)



- Pay attention to the direction of rotor.



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



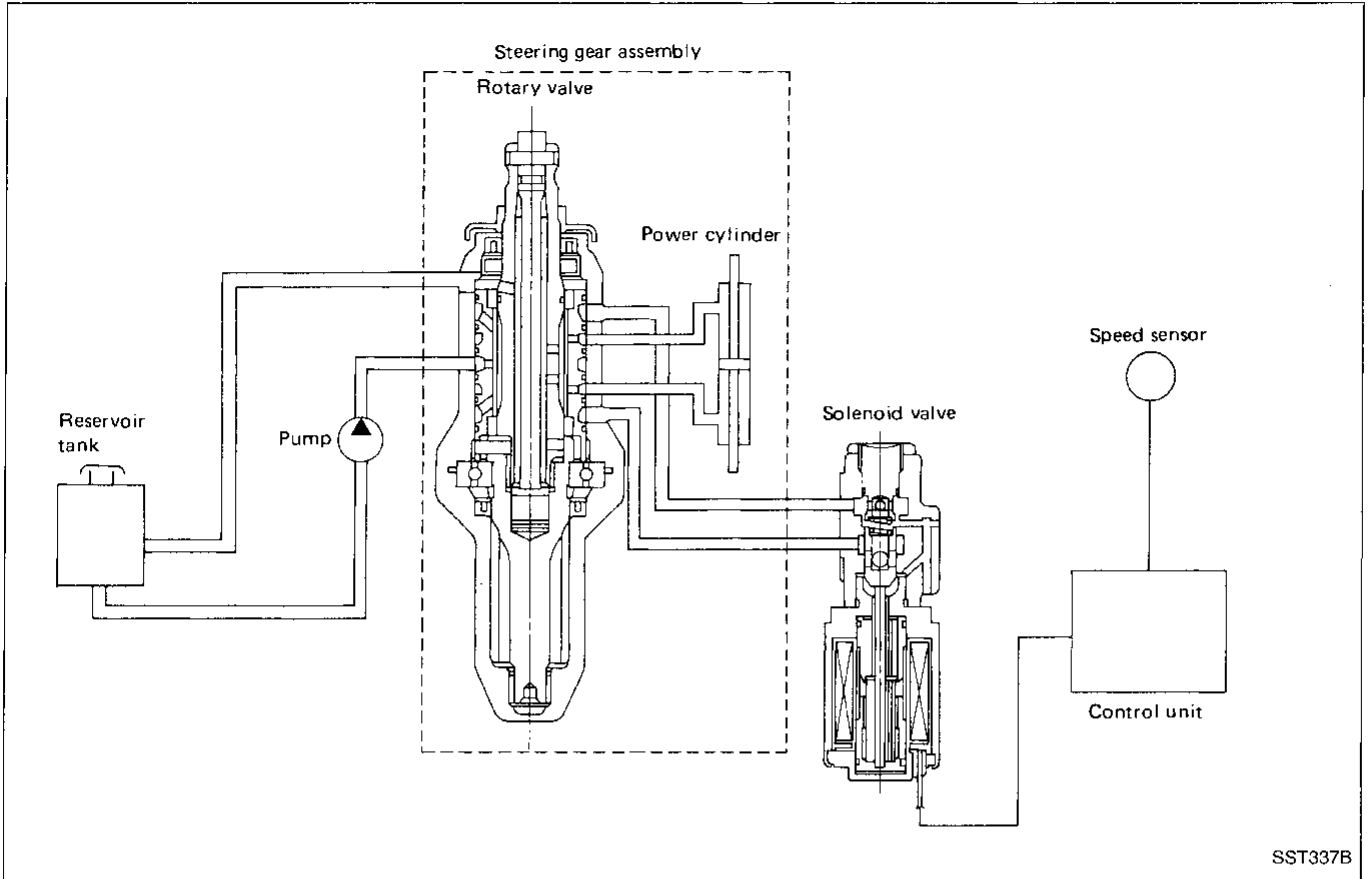
- Insert pin ② into pin groove ① of front housing and front side plate. Then install cam ring ③ as shown at left.

Cam ring:

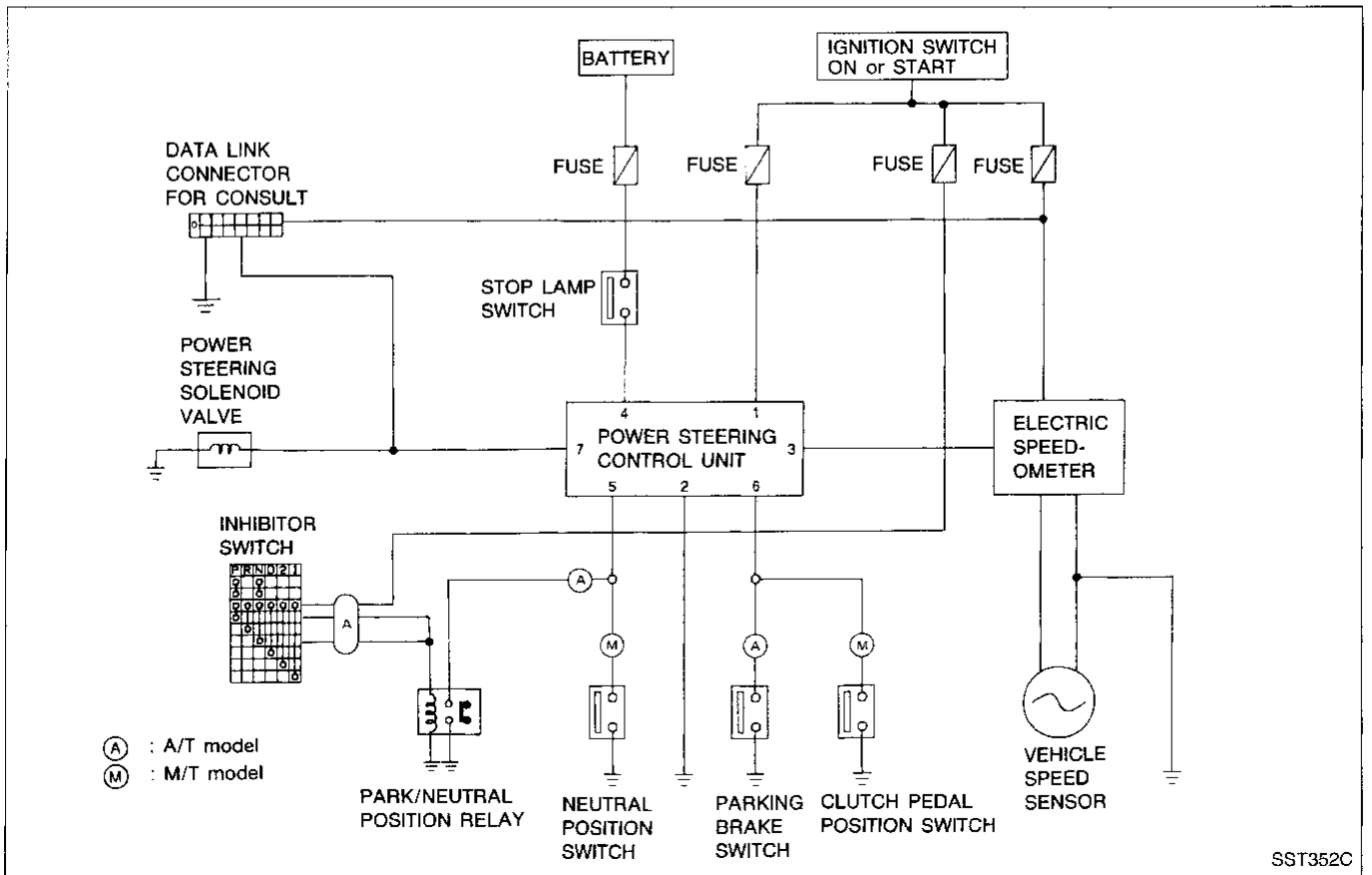
D_1 is less than D_2 .

TWIN ORIFICE POWER STEERING SYSTEM

Hydraulic Circuit



Schematic

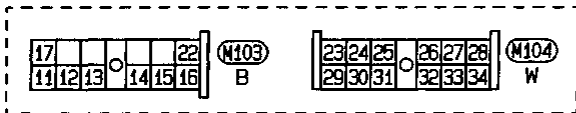
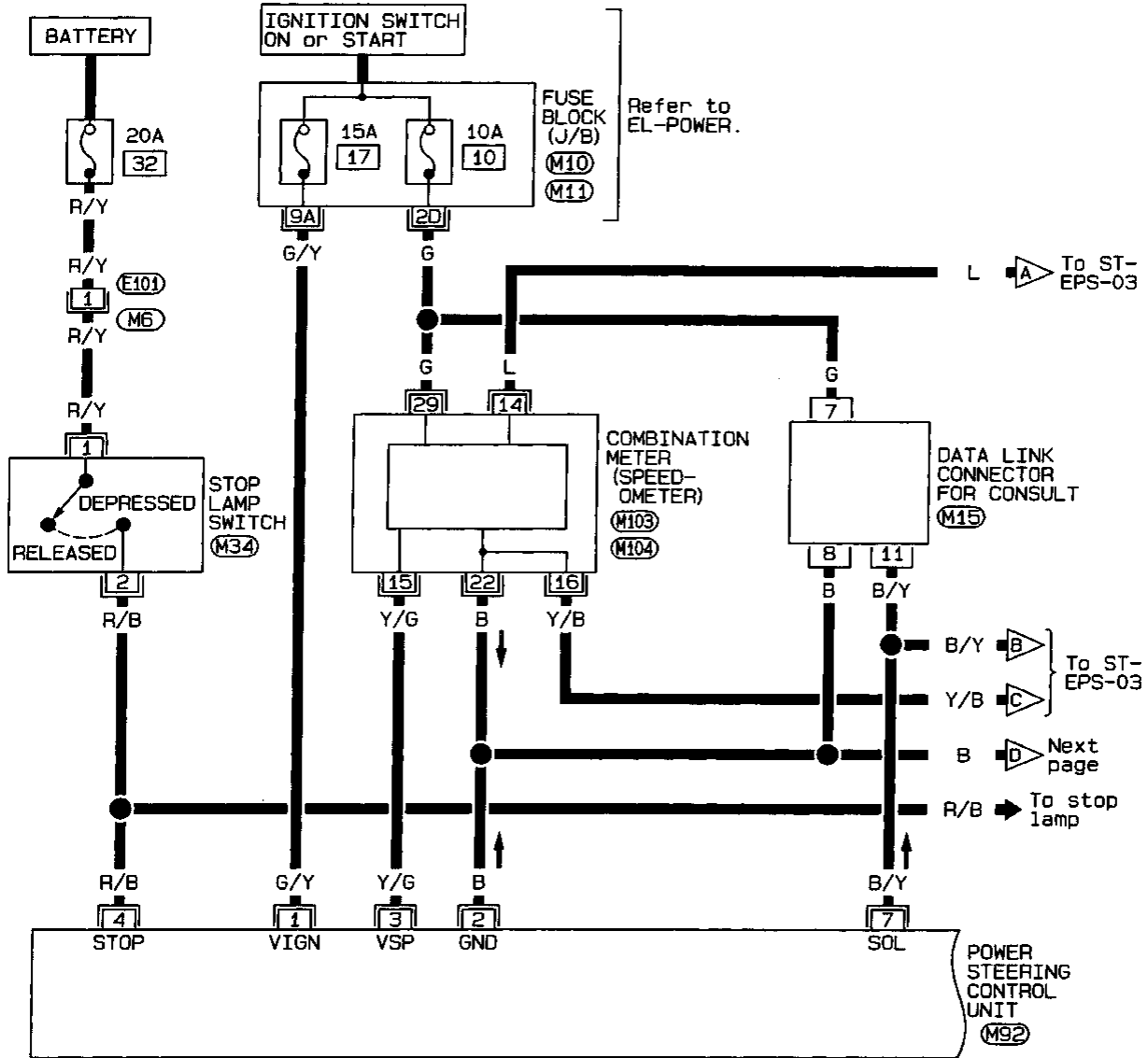


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TWIN ORIFICE POWER STEERING SYSTEM

Wiring Diagram

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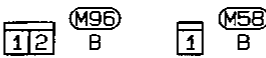
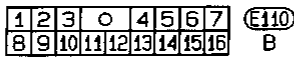
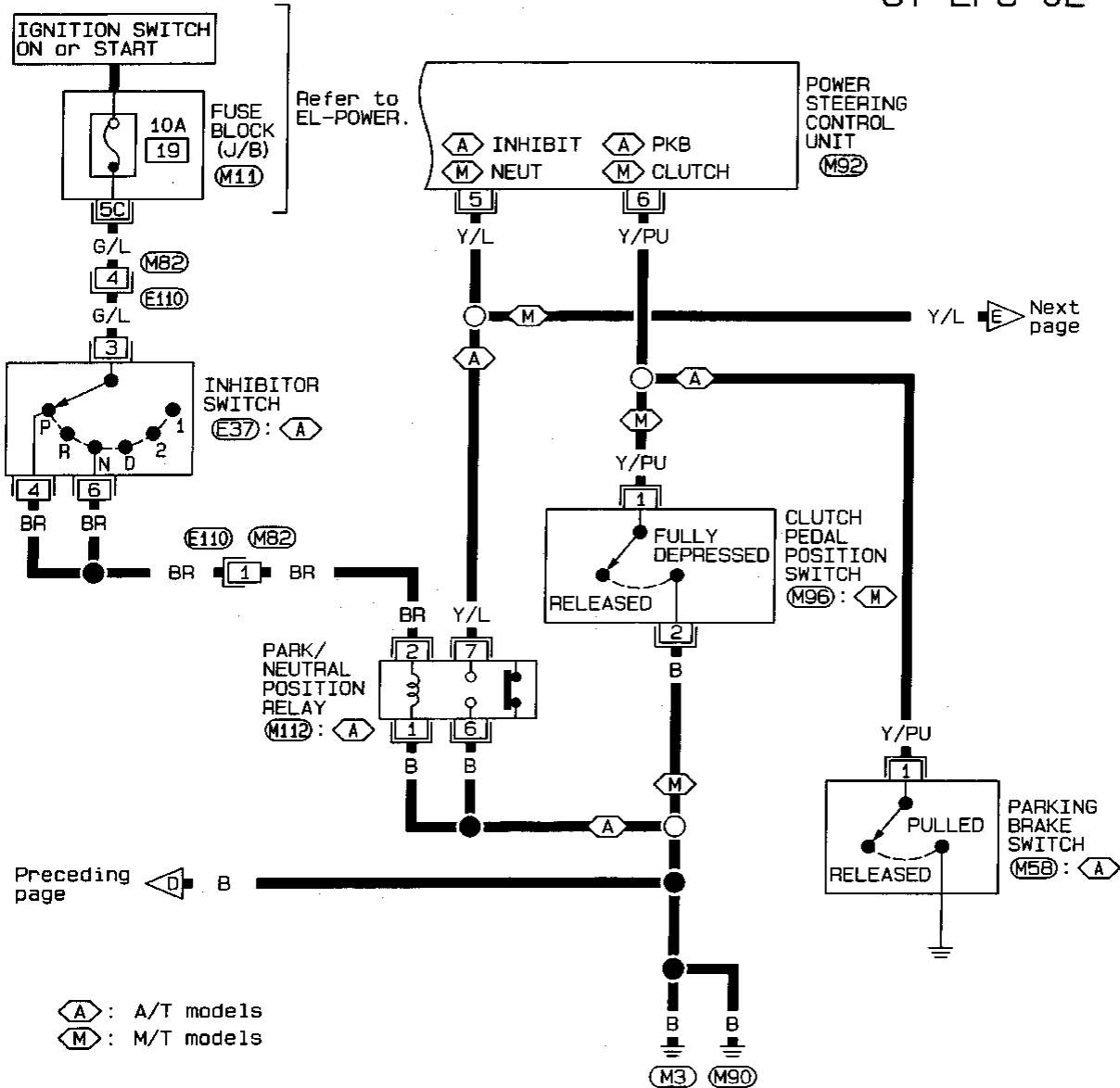
Refer to last page (Foldout page).

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TWIN ORIFICE POWER STEERING SYSTEM

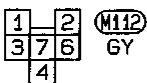
Wiring Diagram (Cont'd)

ST-EPS-02



Refer to last page (Foldout page).

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Trouble Diagnoses

PRECAUTIONS

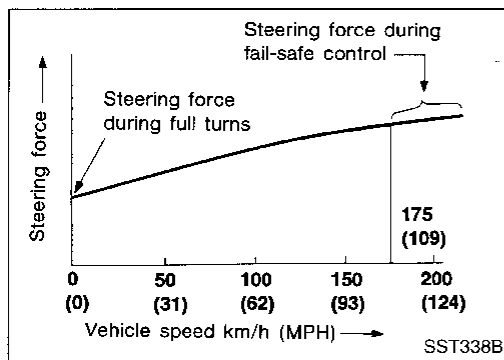
Before diagnosing the power steering system, ensure that:

Vehicle stopped

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

Vehicle in operation

- Understand the trouble symptoms.
- 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/or transmission position signal (N or P-position signal on automatic transmission models and a neutral or clutch signal on manual transmission models) 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:

A/T models

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

M/T models

- Shift lever is set in any position other than "Neutral" position.
- Clutch pedal is released.

TWIN ORIFICE POWER STEERING SYSTEM

Trouble Diagnoses (Cont'd)

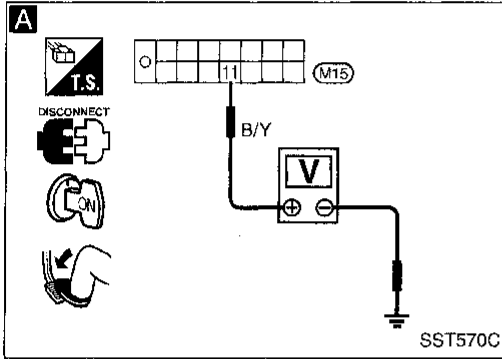
DIAGNOSTIC PROCEDURE 1

SYMPTOM:

Heavy steering operation during stationary turns

START

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" on automatic transmission models or set shift lever to any position except "N" on manual transmission models, and ensure clutch pedal is released.



Depress brake pedal and check voltage between solenoid valve terminals of data link connector for CONSULT.

Voltage:
4.4 - 6.6V (constant)

Yes → Go to 2) on page ST-34.

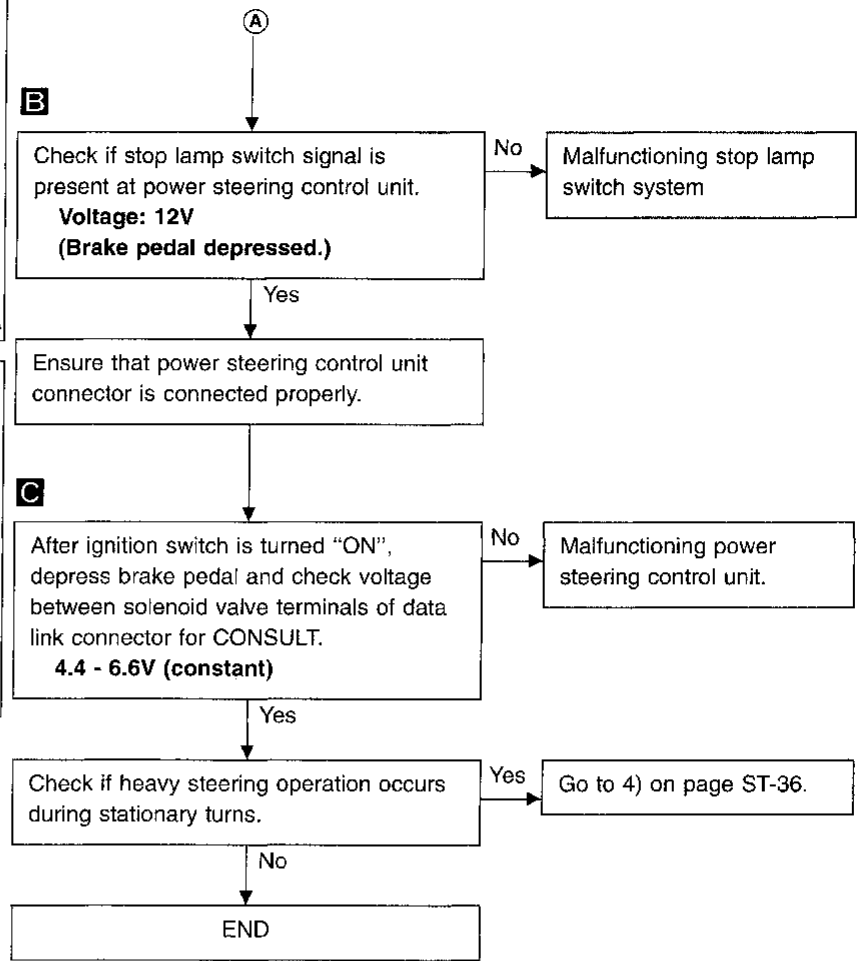
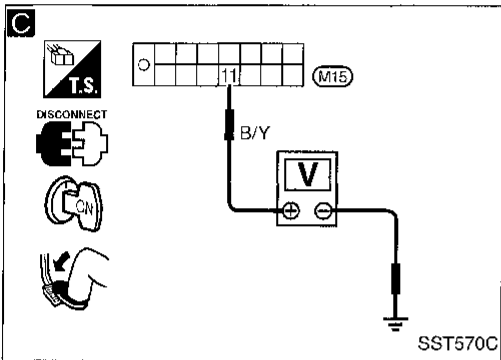
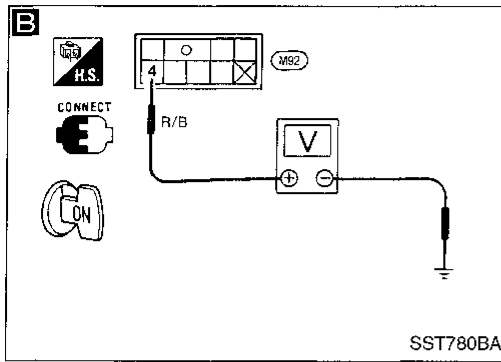
No
Does terminal voltage drop to 1 - 1.5V range approx. 10 seconds after ignition switch is turned ON?

No → Go to 5) on page ST-36.

Yes
A

TWIN ORIFICE POWER STEERING SYSTEM

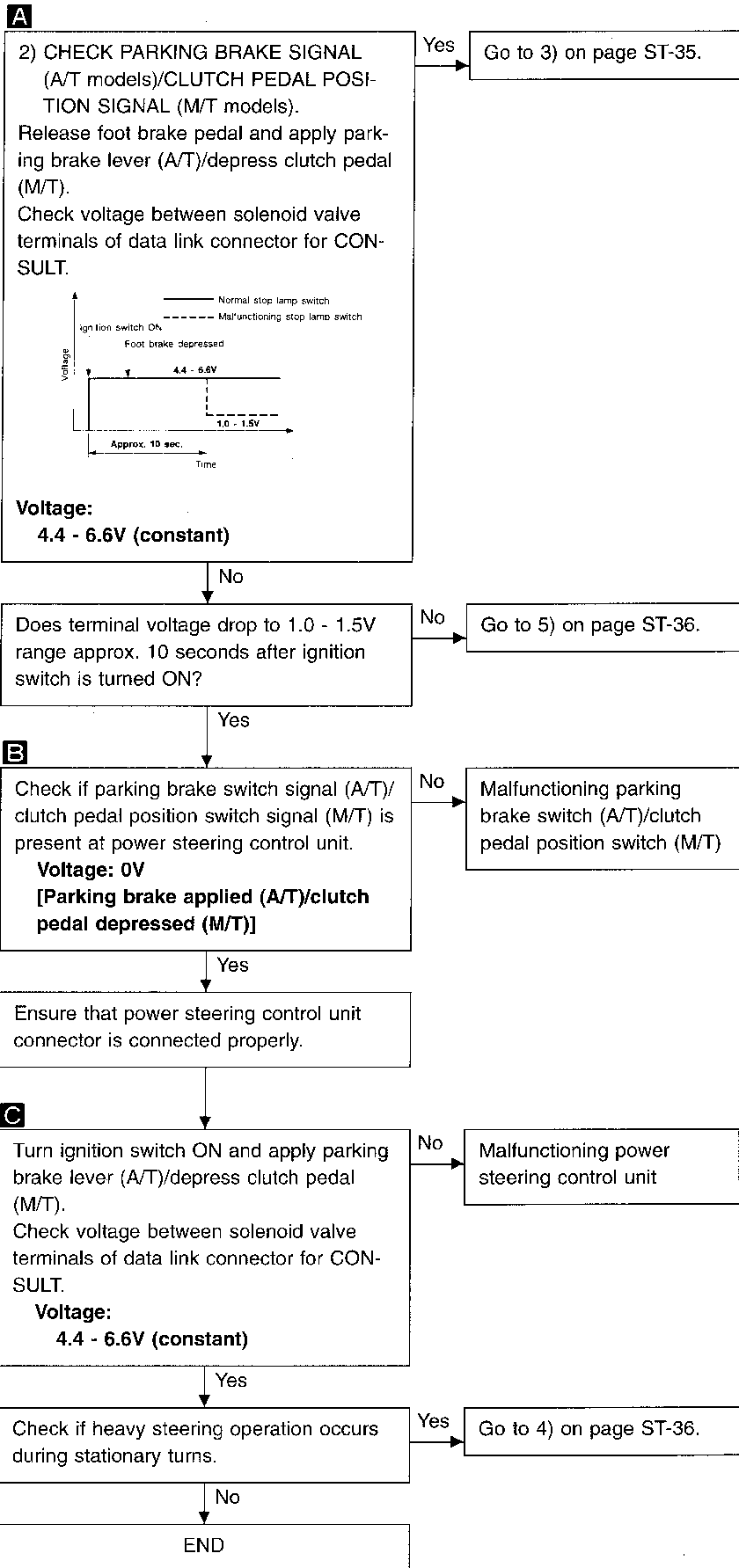
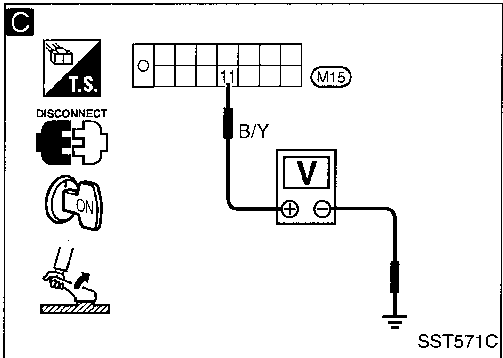
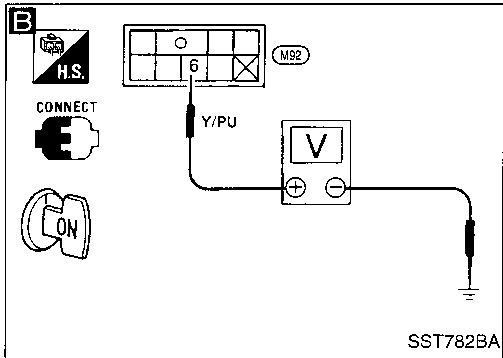
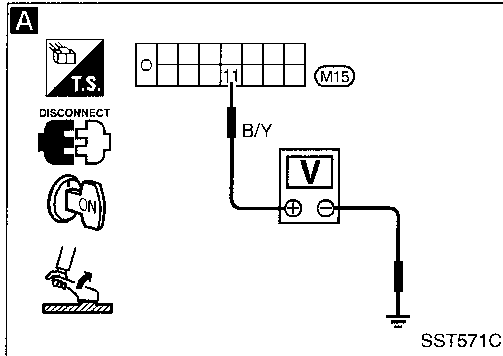
Trouble Diagnoses (Cont'd)



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TWIN ORIFICE POWER STEERING SYSTEM

Trouble Diagnoses (Cont'd)

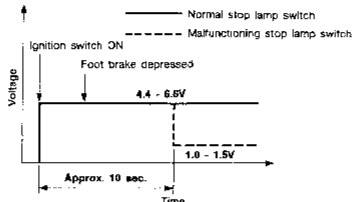


TWIN ORIFICE POWER STEERING SYSTEM

Trouble Diagnoses (Cont'd)

A

3) CHECK NEUTRAL POSITION SIGNAL.
Release parking brake lever.
Move shift lever to Neutral position (A/T and M/T models). Check voltage between solenoid valve terminals of data link connector for CONSULT.



Voltage:
4.4 - 6.6V (constant)

Yes → Move shift lever to "P" position (A/T model). Check voltage between solenoid valve terminals at data link connector for CONSULT.
Voltage:
4.4 - 6.6V (constant)
Yes →

Go to 4) on page ST-36.

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) on page ST-36.

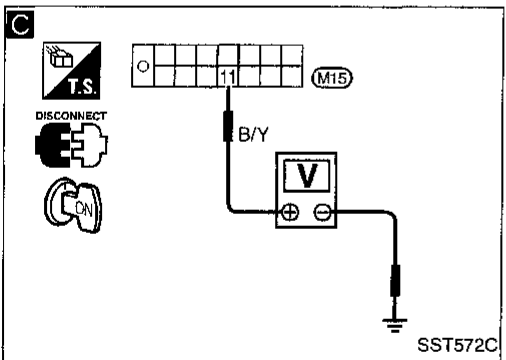
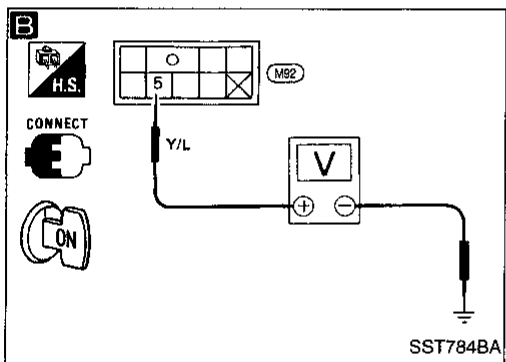
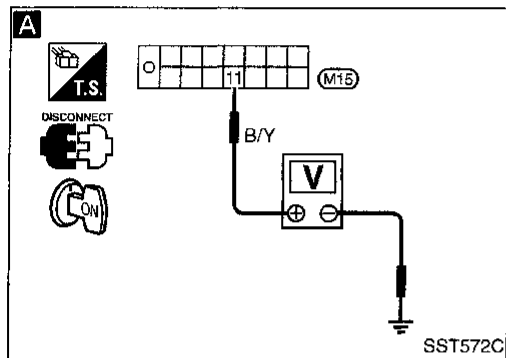
B
Check if position switch signal is present at power steering control unit.
Voltage: 0V (Position switch is ON.)

Yes → Ensure that power steering control unit connector is connected properly.

C
Turn ignition switch ON, depress clutch pedal (M/T model) or move shift lever to "P" position (A/T model). Check voltage between solenoid valve terminals of data link connector for CONSULT.
Voltage:
4.4 - 6.6V (constant)

Yes → Check if heavy steering operation occurs during stationary turns.
Yes → Go to 1) on page ST-32.
No →

END



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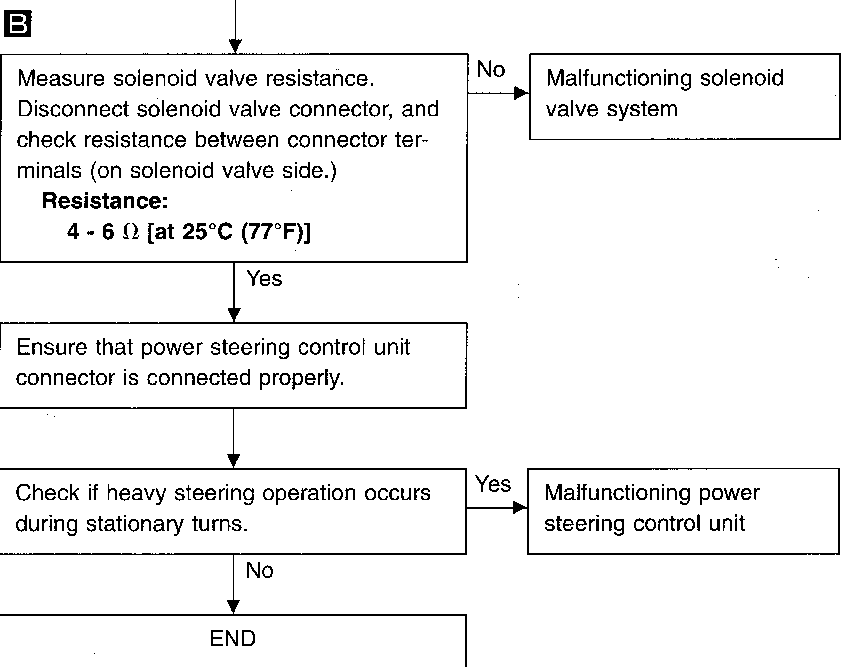
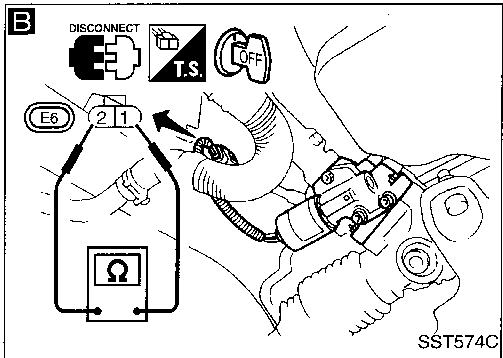
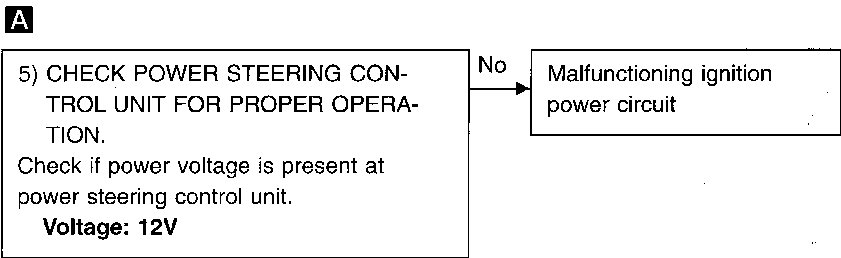
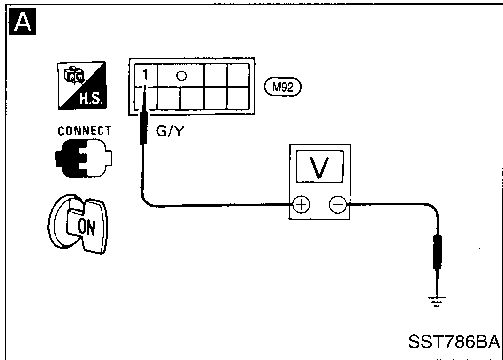
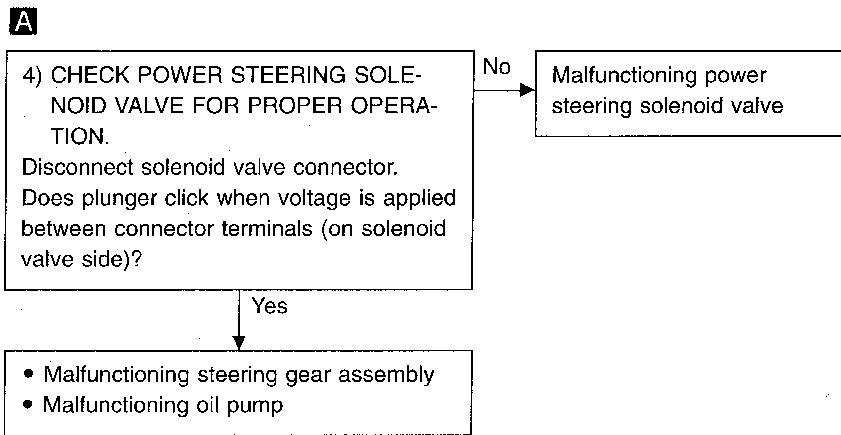
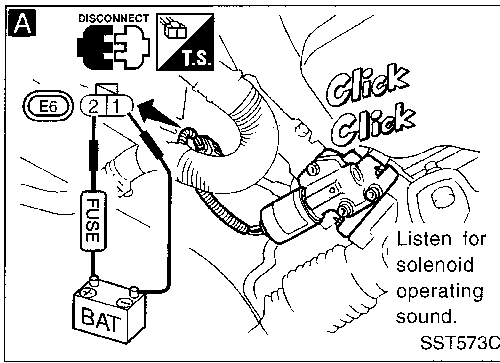
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TWIN ORIFICE POWER STEERING SYSTEM

Trouble Diagnoses (Cont'd)



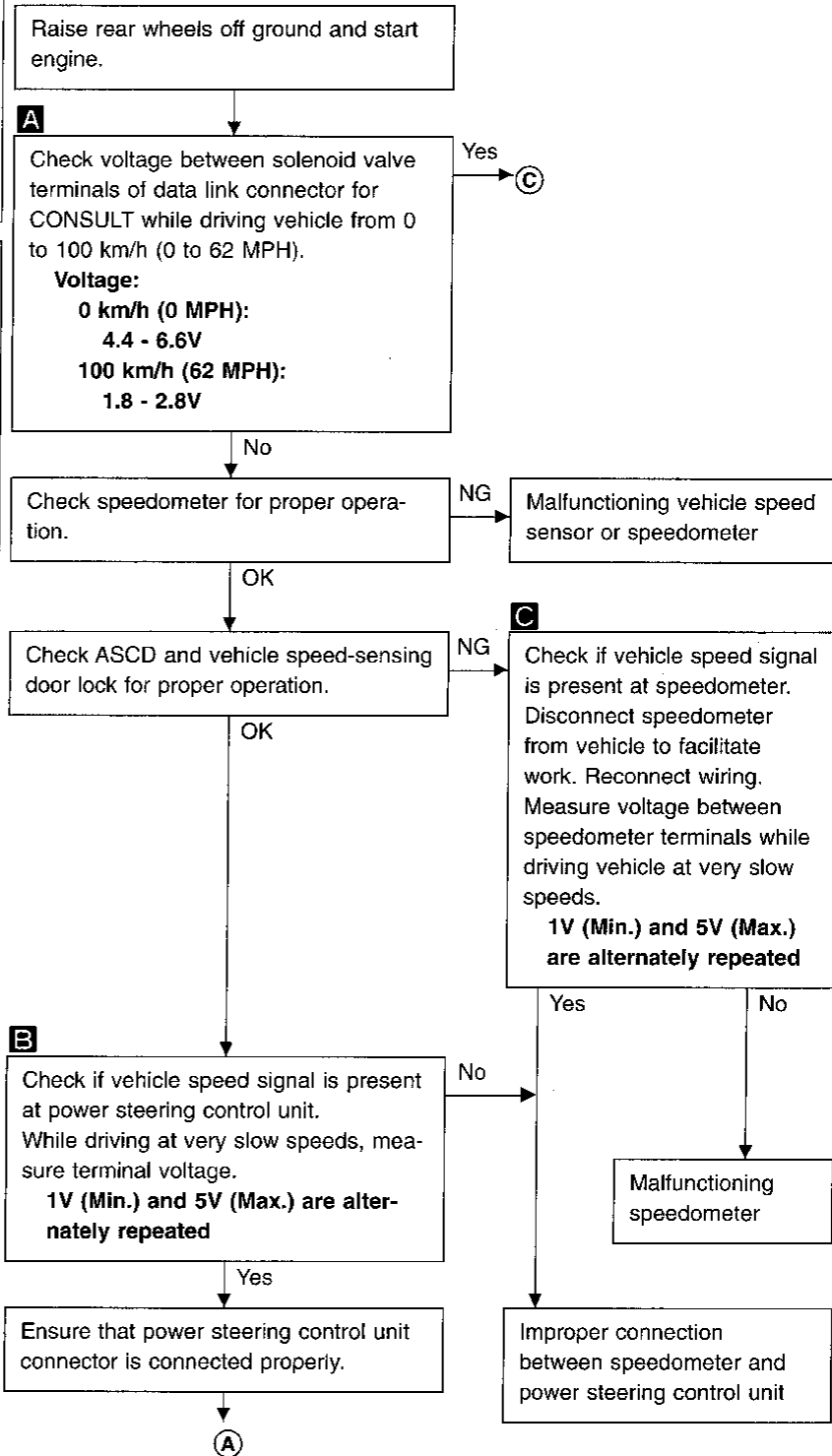
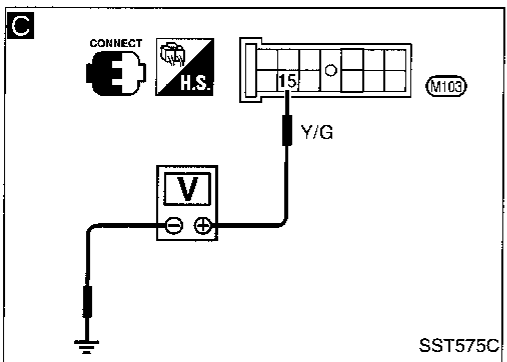
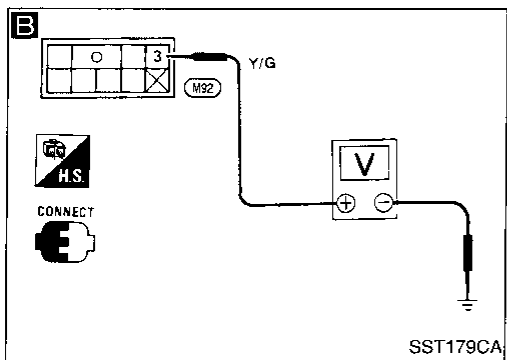
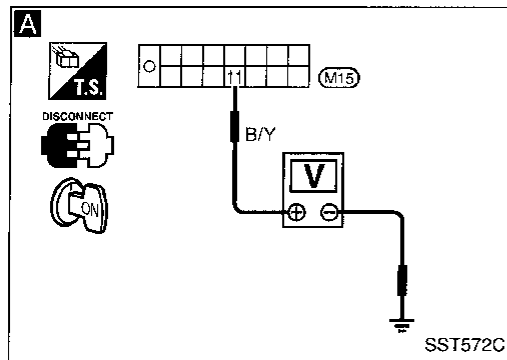
TWIN ORIFICE POWER STEERING SYSTEM

Trouble Diagnoses (Cont'd)

DIAGNOSTIC PROCEDURE 2

SYMPTOM:

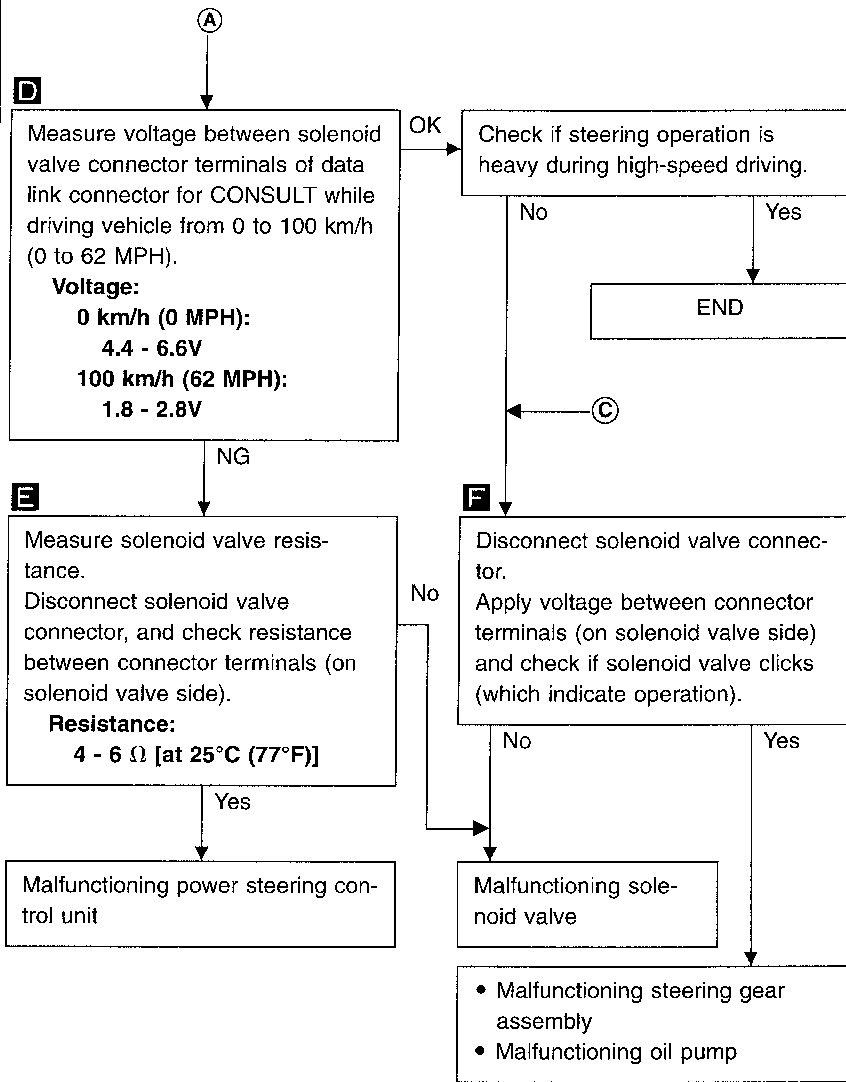
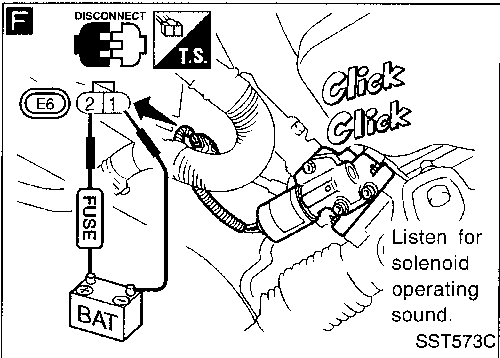
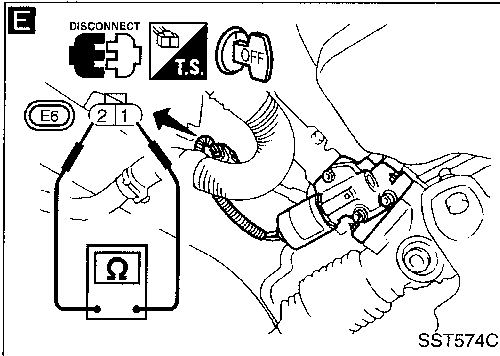
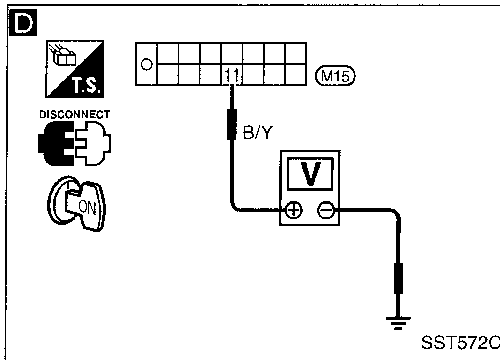
Light steering operation during high-speed driving



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TWIN ORIFICE POWER STEERING SYSTEM

Trouble Diagnoses (Cont'd)



TWIN ORIFICE POWER STEERING SYSTEM

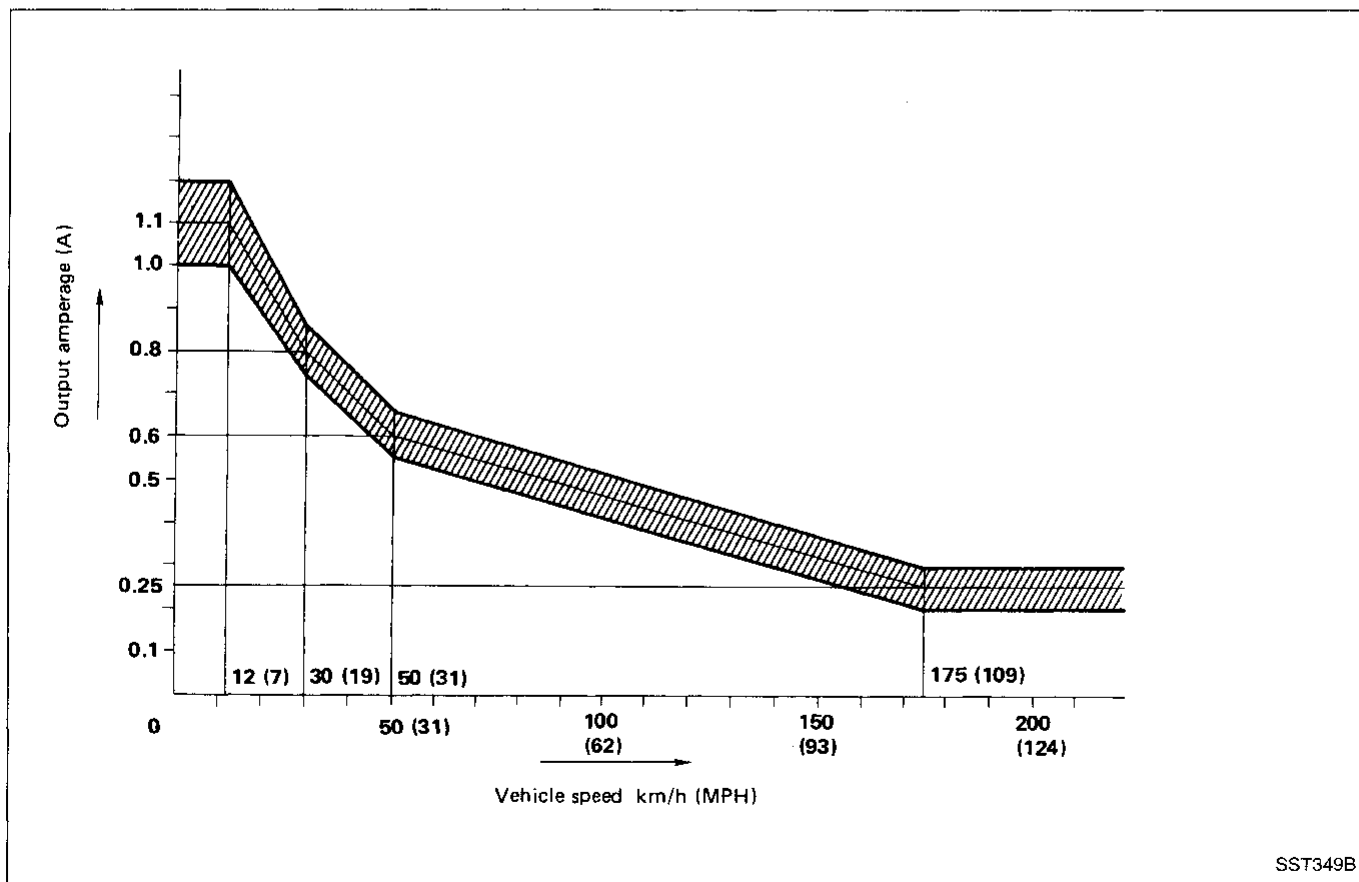
Trouble Diagnoses (Cont'd)

CONTROL UNIT INSPECTION TABLE

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

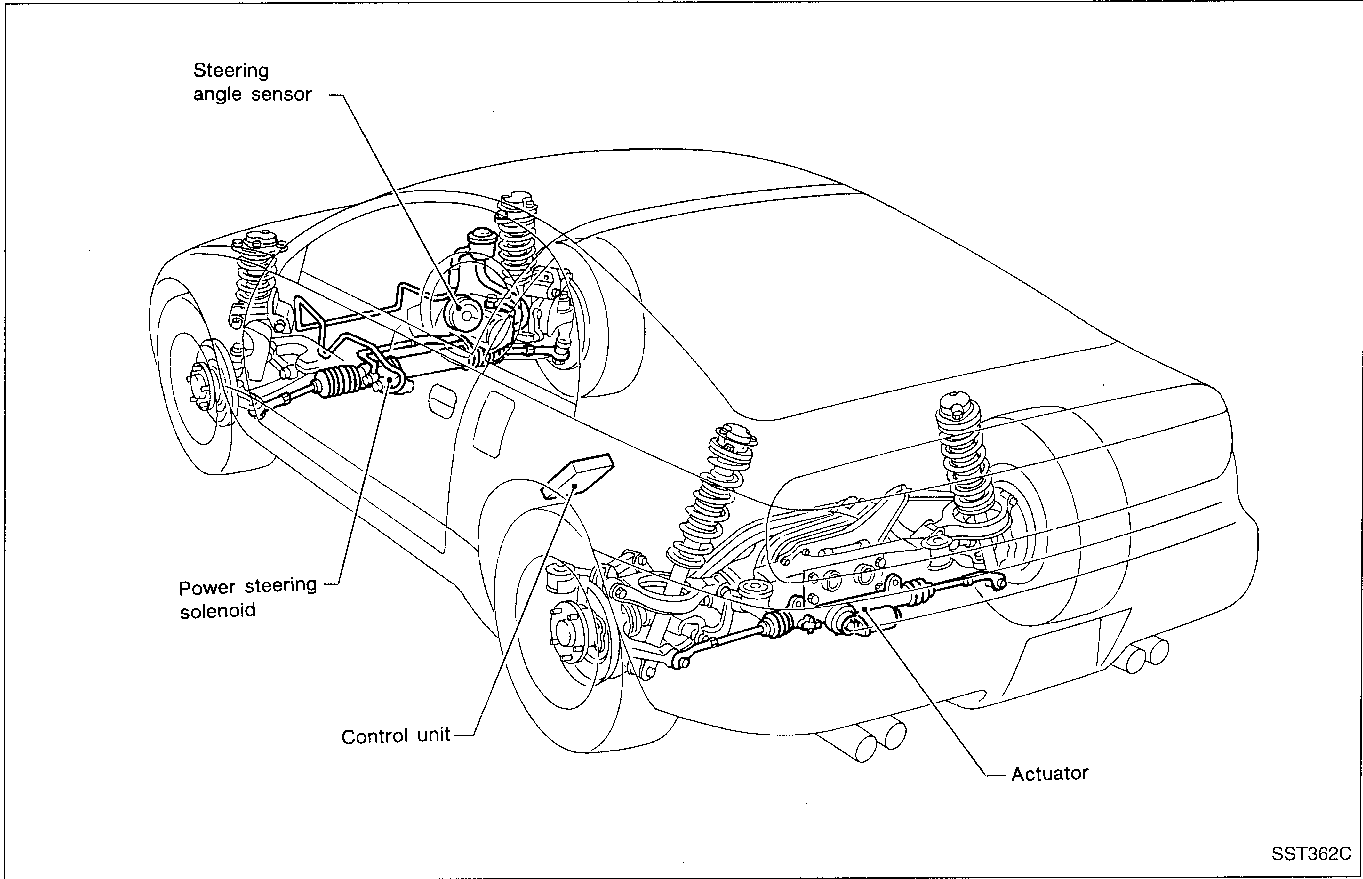
Terminal No.	Application	Standard value
1	Power	Approx. 12V
2	Ground	0V
3	Vehicle speed sensor input	1 volt (min.) and 5 volts (max.) are alternately repeated when vehicle is driven at very slow speeds.
4	Stop lamp switch input	Depressed: Approx. 12V Released: 0V
5	Park/Neutral position switch input	0V (clutch engaged and shift lever in "N" position) ... M/T models 0V (selector lever in "N" or "P" position) ... A/T models 4 - 5V (except for the above)
6	Parking brake switch input (A/T) Clutch pedal position switch input (M/T)	Applied or depressed: 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

PERFORMANCE OF CONTROLLER

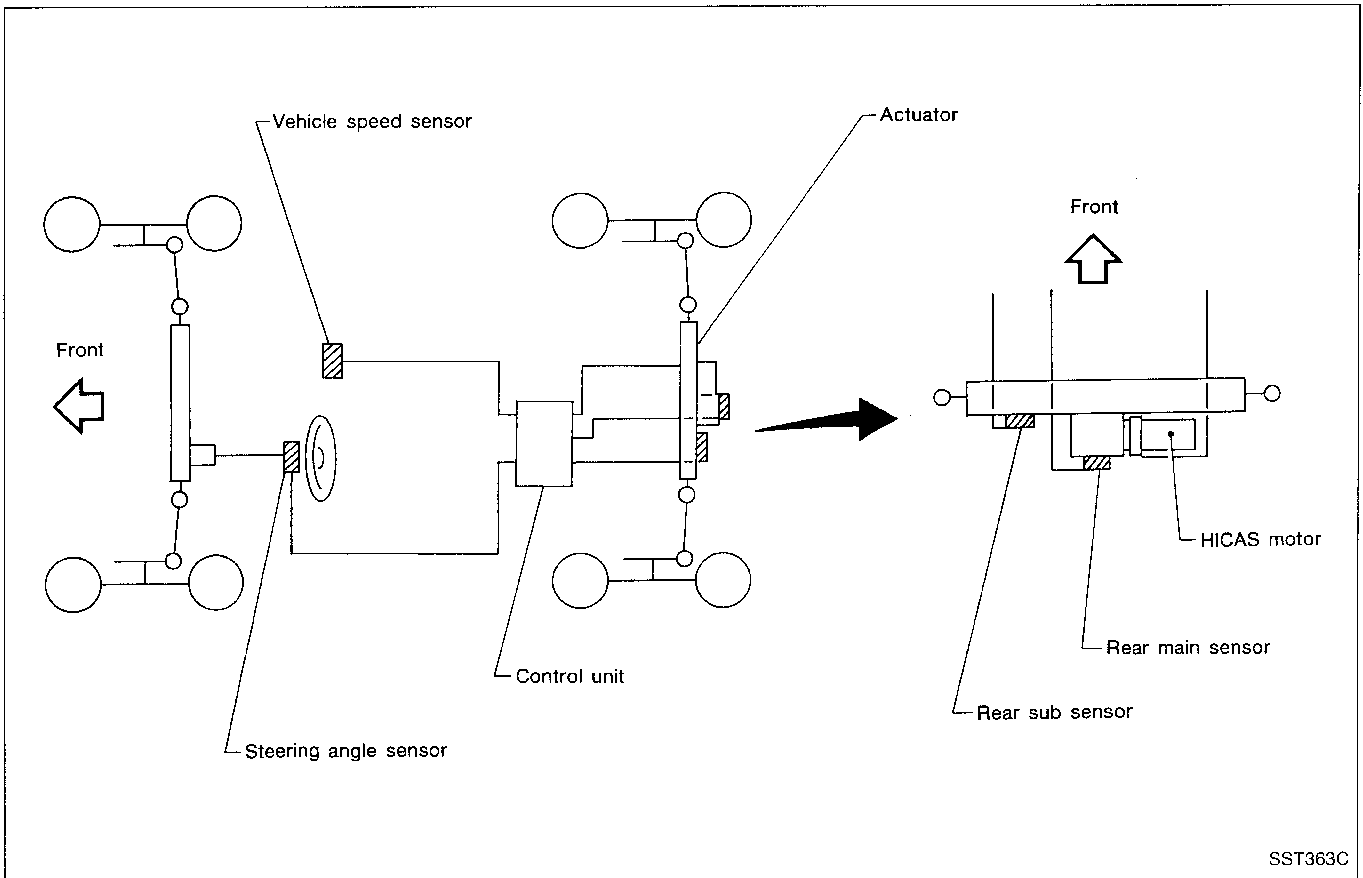


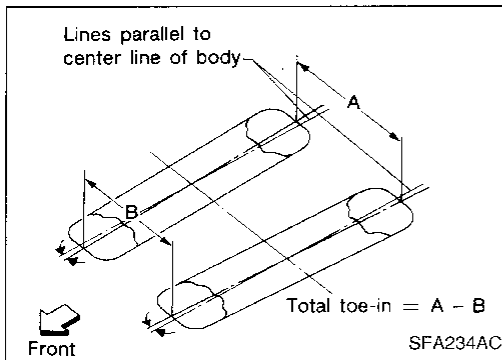
SUPER HICAS SYSTEM

HICAS Component Parts Location



System Diagram





On-vehicle Service

MEASURING REAR TOE-IN

Measure distance "A" and "B" at the same height as hub center.

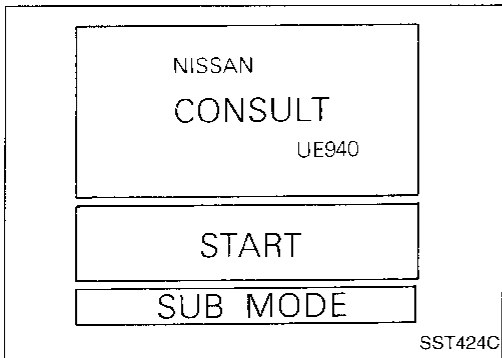
Total toe-in:

Refer to SDS in RA section.

CI

MA

EM



INSPECTION OF HICAS SYSTEM OPERATION

CAUTION:

- Ensure that shift lever is set to "P" position (A/T model) or "Neutral" position (M/T model) before checking HICAS system operation.
- Use CONSULT program card "UE940" when CONSULT is used.

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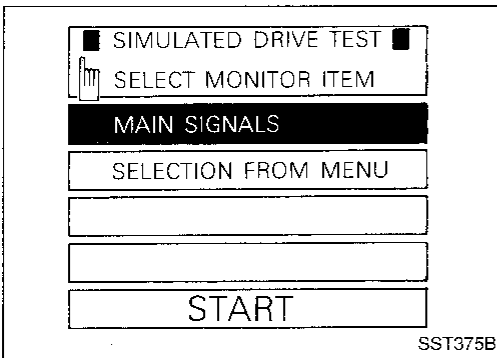
When CONSULT is used:

1. Have a helper sit in the driver's compartment and raise vehicle. (Use a two-pole lift or a center pole lift so that the four wheels are free to rotate.)
2. Connect CONSULT unit to data link connector for CONSULT and start engine.
3. Touch "START" on CONSULT display.
4. Touch "HICAS", "ACTIVE TEST" and "SIMULATED DRIVE" in that order.

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5. Touch "START" when MAIN SIGNALS display is reversed.

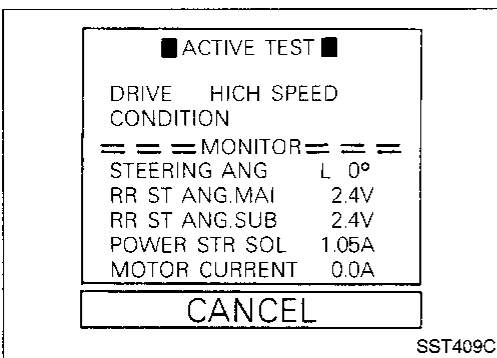
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6. Touch "START".

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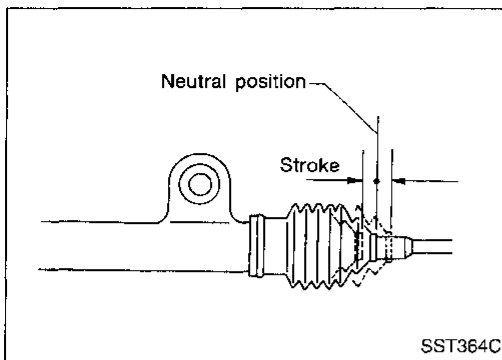
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SUPER HICAS SYSTEM

On-vehicle Service (Cont'd)



7. Operate engine, and turn steering wheel more than 180° in one direction from the neutral position. Measure extension value of one actuator rod and retraction value of the other. Then, turn steering wheel 180° in the other direction from the neutral position, and measure extension value of one cylinder rod and retraction value of the other. Determine strokes of respective actuator by adding (measured) extension and retraction values.

Measure rod strokes in as short a period of time as possible.

Specifications:

When turned to the right

3 mm (0.12 in)

When turned to the left

3 mm (0.12 in)

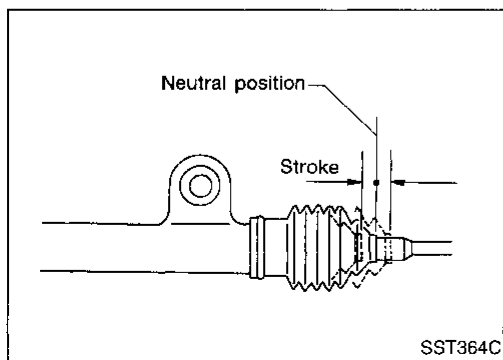
Total stroke

6 mm (0.24 in)

When CONSULT is not used:



1. Have a helper sit in the driver's compartment and raise vehicle. (Use a 2-pole lift or a center pole lift so that the four wheels are free to rotate.)
2. Set HICAS system in self-diagnosis mode.
 - (1) Turn ignition switch "OFF".
 - (2) Set shift lever to "P" position (A/T model), or "Neutral" position (M/T model).
 - (3) Turn ignition switch "ON".
 - (4) Immediately start engine.
 - (5) Turn steering wheel from left to right (at least 20° from the neutral position) 5 times or more, then depress foot brake pedal at least 5 times all within 10 seconds after ignition switch has been turned "ON".
3. Turn steering wheel to a point approximately 30° from the neutral position, then set steering wheel back to the neutral position and check to ensure that rear wheels turn to the left and right alternately.
4. Operate engine, and turn steering wheel more than 180° in one direction from the neutral position. Measure extension value of one actuator rod and retraction value of the other. Then, turn steering wheel 180° in the other direction from the neutral position, and measure extension value of one cylinder rod and retraction value of the other. Determine strokes of respective actuator by adding (measured) extension and retraction values.



Measure rod strokes in as short a period of time as possible.

Specifications:

When turned to the right

3 mm (0.12 in)

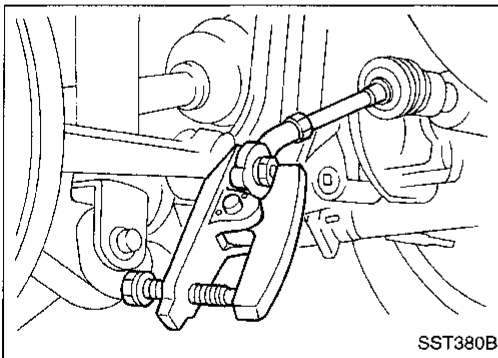
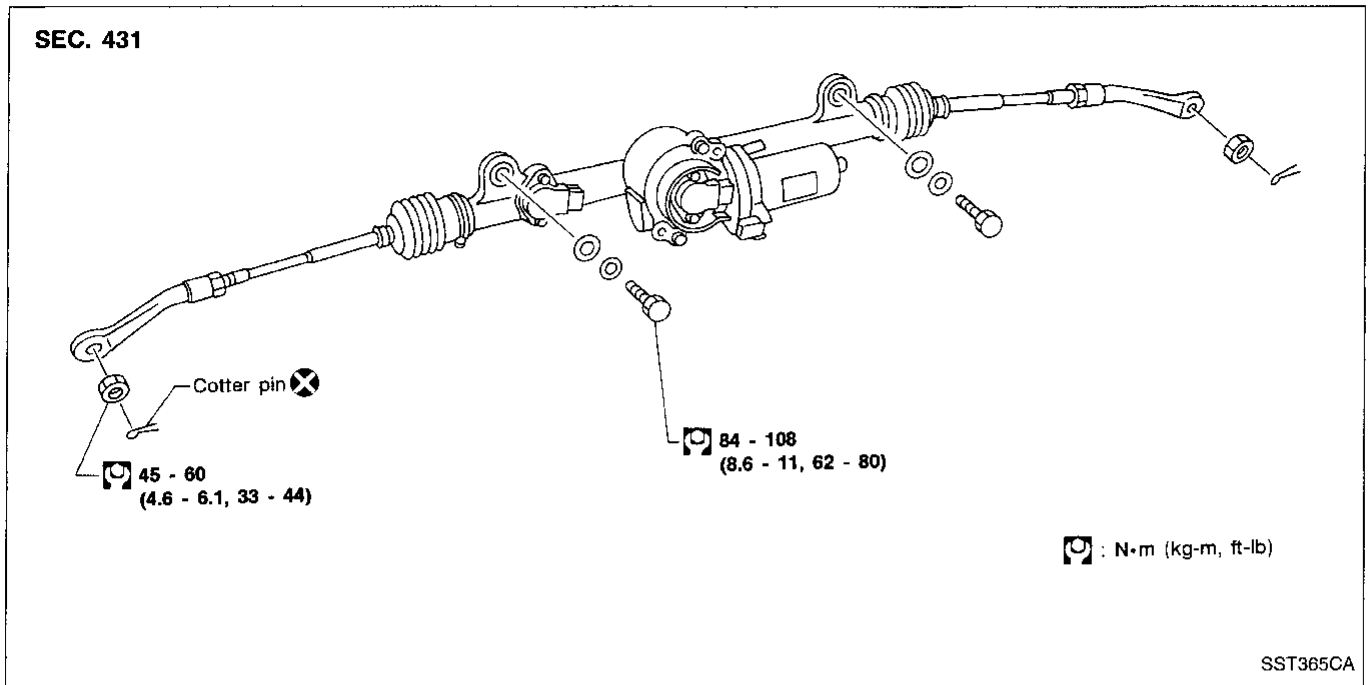
When turned to the left

3 mm (0.12 in)

Total stroke

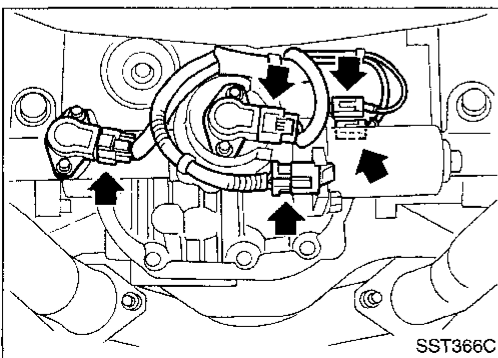
6 mm (0.24 in)

Repair of Component Parts ACTUATOR



Removal

- Detach actuator lower links from axle housing sockets with Tool.



- Disconnect harness connectors and remove actuator.

CAUTION:

Remove one side of rear tire and draw out actuator through the space where tire is removed.

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SUPER HICAS SYSTEM

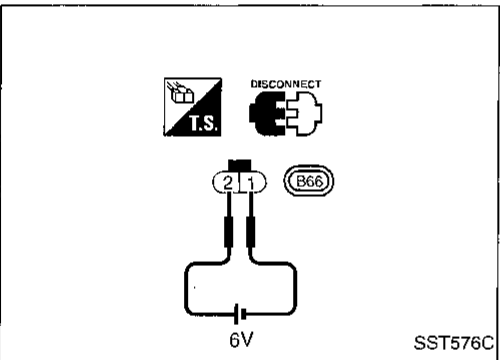
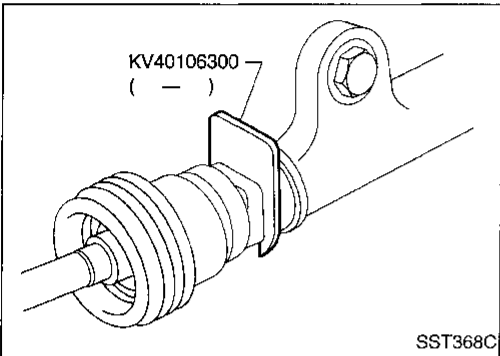
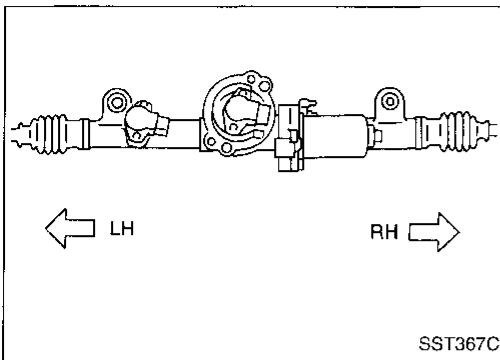
Repair of Component Parts (Cont'd)

Installation

1. Before installing actuator on suspension member, wipe actuator bracket and mating surface of suspension member. Using the left side of the bracket as a reference point, locate the right side (oblong hole side) and install actuator.

CAUTION:

- To prevent entry of foreign particles, clean harness connectors using dry compressed air.
2. Install actuator and harness connectors.



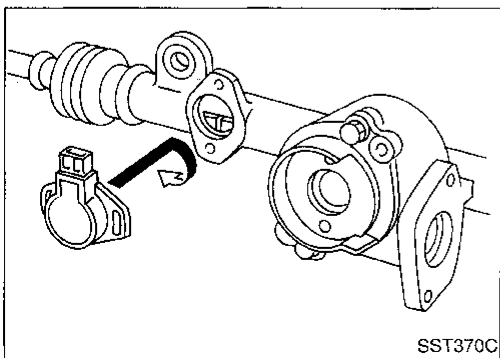
3. If sensors were removed, perform the following operations:
 - (1) Remove inner side boot clamp of either boot, and set Tool between actuator and inner socket as shown at left.

- (2) Remove sensor connectors, then remove sensors.
- (3) Remove HICAS motor connector, and set ignition switch to ON.
- (4) Connect 6V source (four 1.5V dry cells connected in series) to HICAS motor, and actuate motor in the direction that will cause the Tool to clamp, thereby setting rack in neutral.
Alternate method: Remove HICAS motor, and move rack using a screwdriver.

CAUTION:

Never apply 12V (battery voltage) to HICAS motor.

If positive voltage is applied to HICAS motor connector terminal ①, rack will move to the left. If positive voltage is applied to terminal ②, rack will move to the right.



- (5) Install each sensor together with a new O-ring, and tighten temporarily with mounting screw.

CAUTION:


Install each sensor as shown at left so that sensor pawl will engage with actuator pawl.

- (6) Install harness connector.

SUPER HICAS SYSTEM

Repair of Component Parts (Cont'd)

(7) Adjust each sensor to the reference value.

 Read sensor data on data monitor.

CAUTION:

“FAILURE” will be displayed during data monitoring. This will not interfere with this operation.

 Read data by applying circuit tester leads to sensor connector.

Front steering angle (degree):

L-0, R-0

Rear main sensor (V):

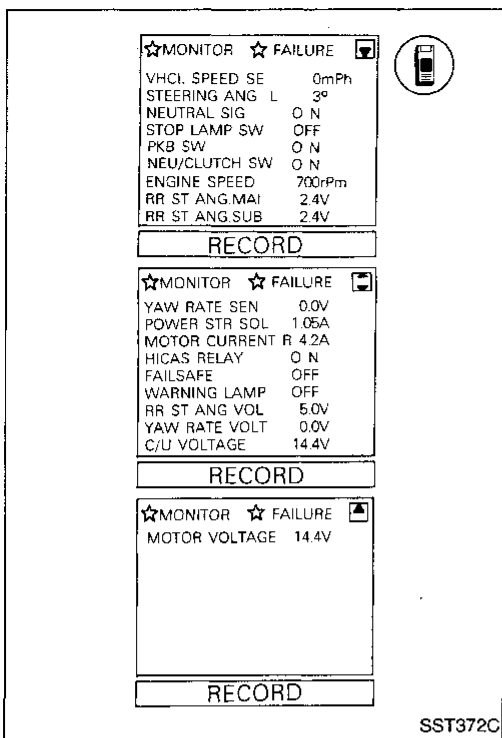
Approx. 2.44

Rear sub sensor (V):

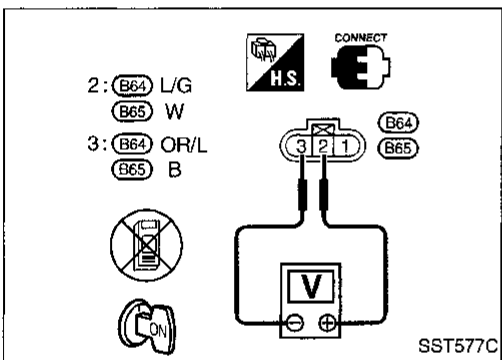
Approx. 2.44

Rear sensor source voltage (V):

Approx. 5.0




SST372C



SST577C

(8) Tighten each sensor mounting screw to the specified torque.

 : 1.5 - 1.9 N·m (0.15 - 0.19 kg-m, 13.0 - 16.5 in-lb)

(9) Remove Tool.

CAUTION:

If the Tool is difficult to remove, tap it lightly.

Never attempt to apply reverse voltage to the motor to move the rack in the opposite direction.

(10) Perform “ERASE” using CONSULT so that past sensor error data will be erased. Alternative method: Disconnect battery negative cable, and leave the cable disconnected for more than 30 minutes.

(11) Perform self-diagnosis to check sensor condition.

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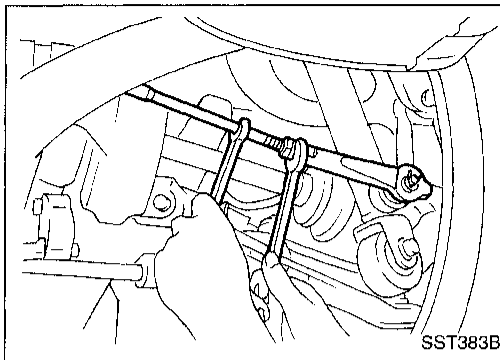
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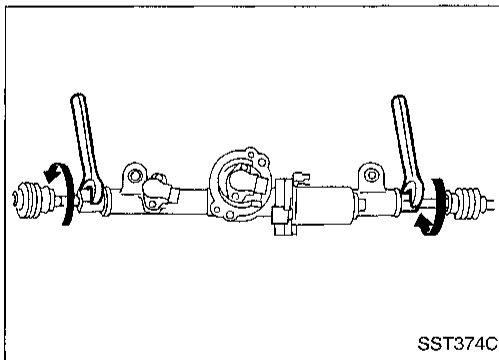
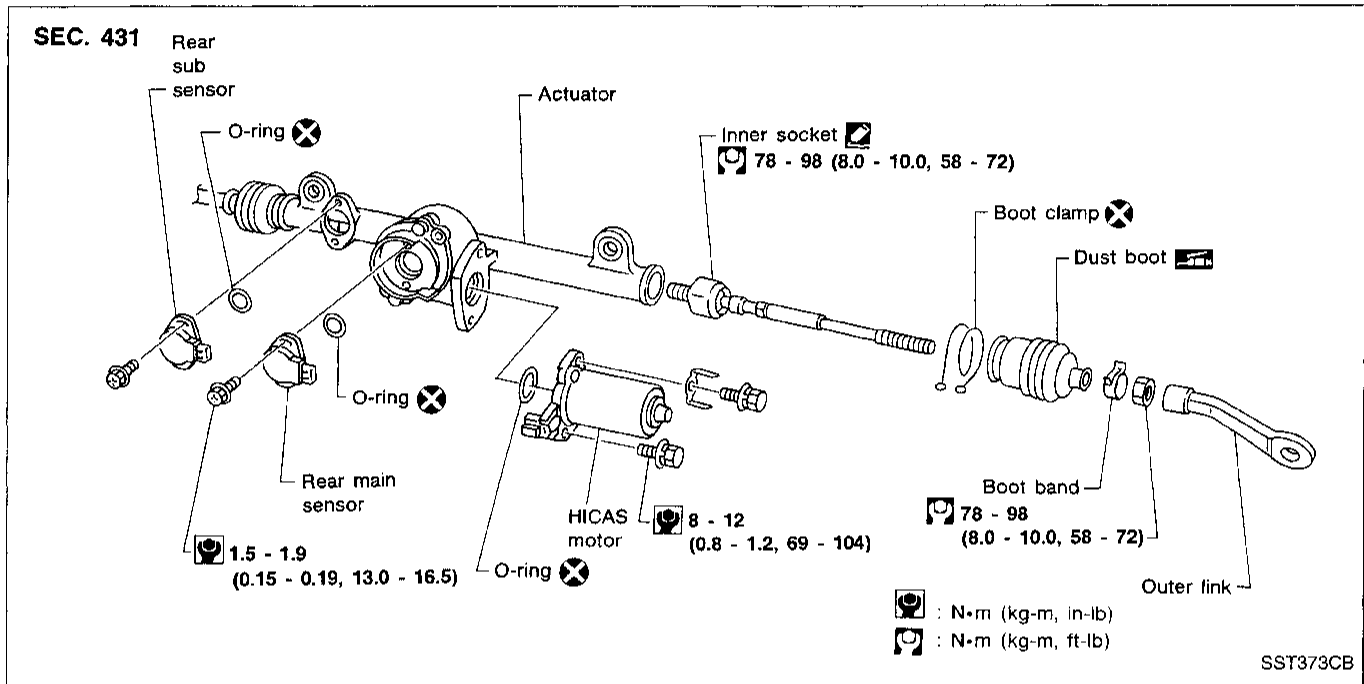
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SUPER HICAS SYSTEM

Repair of Component Parts (Cont'd)



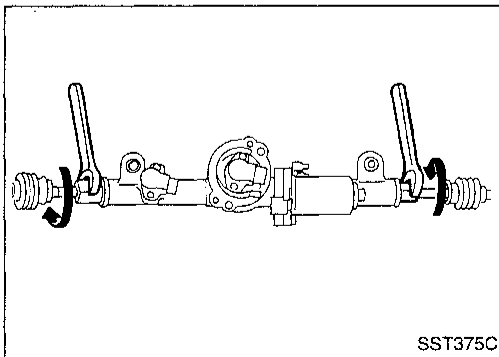
- After installing lower link assemblies, check toe-in to ensure that it is within specifications. If it is not within specifications, perform proper adjustments. Refer to "SUPER HICAS" in RA section.



Actuator cannot be disassembled beyond limit shown above.

Disassembly

- Loosen outer link lock nut.
- Remove outer link and outer link lock nut.
- Remove clamps and dust boots.
- Attach wrenches to left and right ball joint sockets, and turn in directions that loosen lower links. Remove one of loosened lower link assemblies.
- Remove HICAS motor.
- Remove main and sub sensors.



Assembly

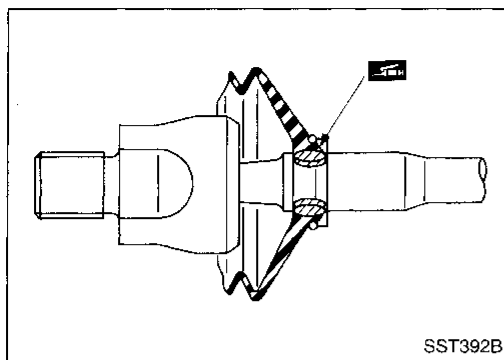
- Apply Locktite to inner ball joint thread. Install lower link assembly. Attach a wrench to inner ball joint (to prevent it from turning), tighten inner socket to specified torque.

Inner socket:

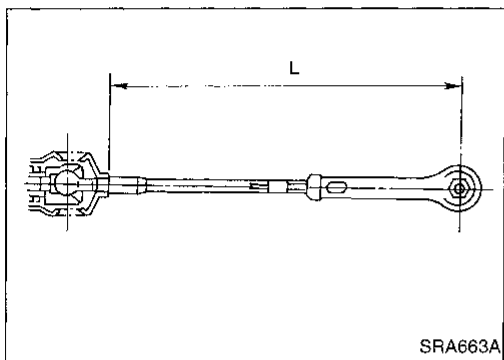
□: 78 - 98 N·m (8 - 10 kg-m, 58 - 72 ft-lb)

SUPER HICAS SYSTEM

Repair of Component Parts (Cont'd)

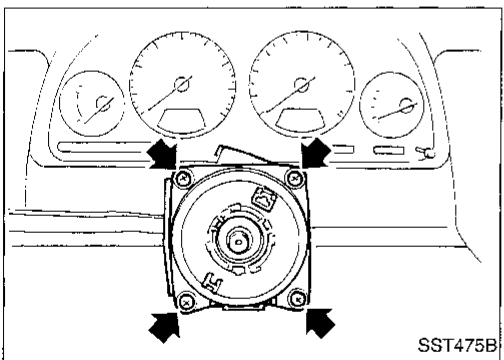


2. Install dust boot using new boot band and clamp.
 - Apply a coat of grease to grooves at boot location.
 - If main sensor and sub sensor are removed, do not install inner boot clamp. Install it after completing sensor installation and adjustment.



3. Install outer link lock nut and outer socket. Tighten outer link lock nut.
Link standard length "L":
Refer to SDS (ST-88).

4. Install HICAS motor.
5. Install main and sub sensors.
Refer to ST-44.



STEERING ANGLE SENSOR

- Ensure that steering angle sensor is mounted securely on spiral cable unit. Also ensure that spiral cable unit is installed properly.
- If any part of steering angle sensor is malfunctioning, replace steering angle sensor assembly.

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Trouble Diagnoses

CONTENTS

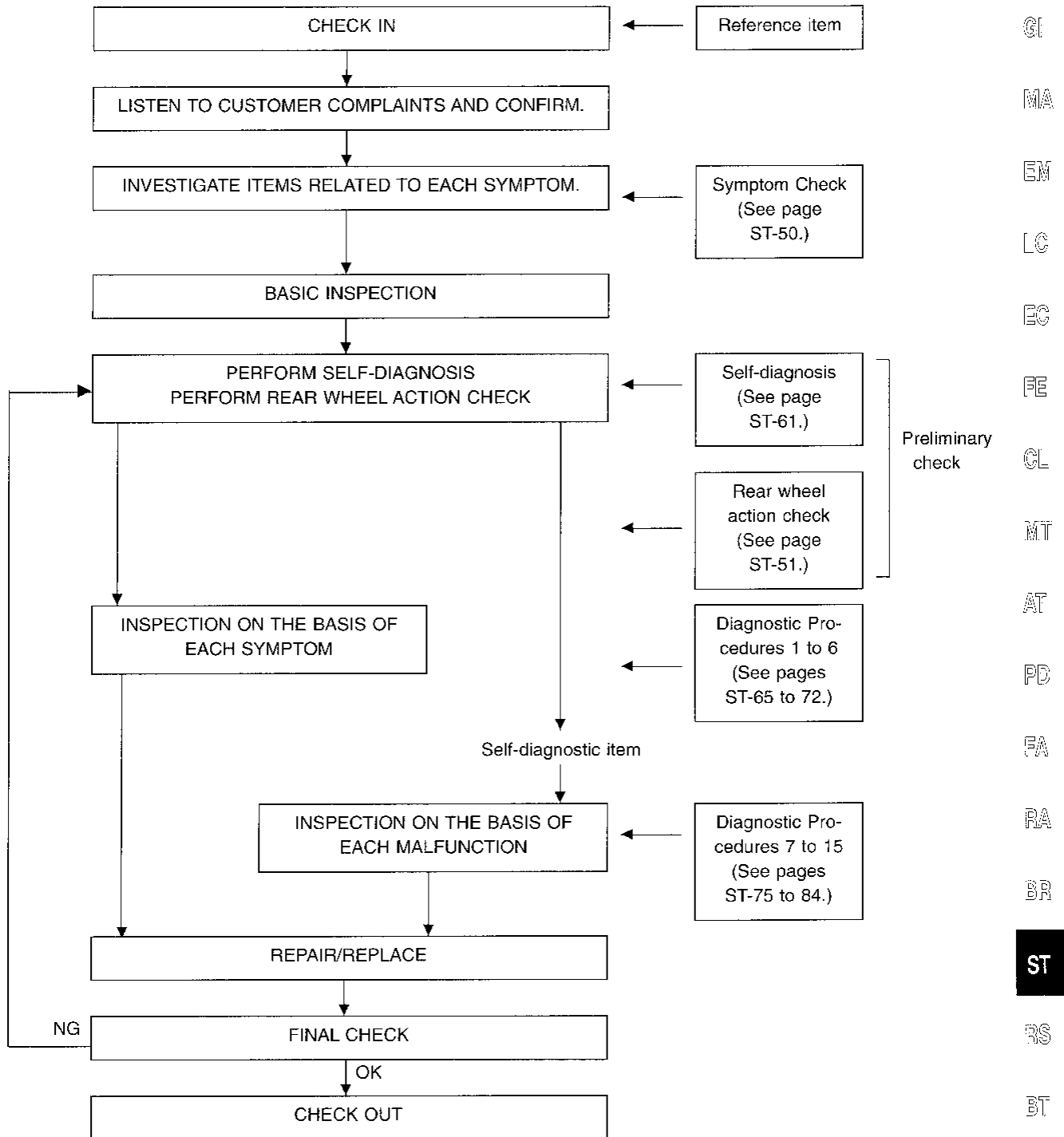
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SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)

HOW TO PERFORM TROUBLE DIAGNOSES FOR QUICK AND ACCURATE REPAIR

Work flow



SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)

SYMPTOM CHART

Diagnostic table

PROCEDURE			Preliminary Check		Diagnostic Procedure														
REFERENCE PAGE (ST-)			51	51	65	65	67	68	69	72	75	75	76	77	78	79	82	83	84
SYMPTOM			Preliminary check 1	Preliminary check 2	Diagnostic procedure 1	Diagnostic procedure 2	Diagnostic procedure 3	Diagnostic procedure 4	Diagnostic procedure 5	Diagnostic procedure 6	Diagnostic procedure 7	Diagnostic procedure 8	Diagnostic procedure 9	Diagnostic procedure 10	Diagnostic procedure 11	Diagnostic procedure 12	Diagnostic procedure 13	Diagnostic procedure 14	Diagnostic procedure 15
No warning lamp comes on when ignition switch is turned "ON"					○														
Warning lamp comes on when engine is running			○	○		○													
Considerable resistance is felt during stationary steering operation.							○							○					
Small resistance is felt when steering during high speed driving.														○					
Abnormal noise is emitted.			○	○				○											
Other abnormalities			○	○					○										
System is not set in self-diagnosis mode.										○									
Self-diagnostic results	Self-diagnosis code No.	Diagnosed part	CONSULT indication																
	11	HICAS control unit	CONTROL UNIT									○							
	12	HICAS motor power supply is not present.	MOTOR VOLTAGE [LOW VOLTAGE] (a)										○						
	13	HICAS motor output is not present.	MOTOR OUTPUT [ABNORMAL SIG] (a) MOTOR OUTPUT [MOTOR LOCK] (b)											○					
	21	Vehicle speed signal is not present.	VEHICLE SPEED SEN [NO SIGNAL] (a) VEHICLE SPEED SEN [SIG-SUDDEN TURN] (b)												○				
	22	Steering angle sensor input is not present.	STEERING ANGLE SEN [NO ANG SIGNAL] (a) STEERING ANGLE SEN [ANG SIG FIX] (e)													○			
	23		STEERING ANGLE SEN [NO NEUT SIGNAL] (b) STEERING ANGLE SEN [NEUT SIG-360° OFF] (c) STEERING ANGLE SEN [NEUT SIG-30° ON] (d) STEERING ANGLE SEN [OFFSET NEUT] (f)													○			
	24		Rear main sensor input is not present.	RR ST ANGLE SENSOR [MAIN SIGNAL] (a) RR ST ANGLE SENSOR [OFFSET SIG] (c) RR ST ANGLE SENSOR [ABNORMAL VOL] (d)													○		
	25	Rear sub sensor input is not present.	RR ST ANGLE SENSOR [SUB SIGNAL] (b) RR ST ANGLE SENSOR [OFFSET SIG] (c) RR ST ANGLE SENSOR [ABNORMAL VOL] (d)														○		
	31	Parking brake input is not present.	—															○	
32	Inhibitor switch (A/T) or neutral and clutch switch (M/T) input is not present.	—																○	
33	Engine speed signal is not present.	ENG REV SIGNAL [ABNORMAL SIGNAL]																	○

SUPER HICAS SYSTEM

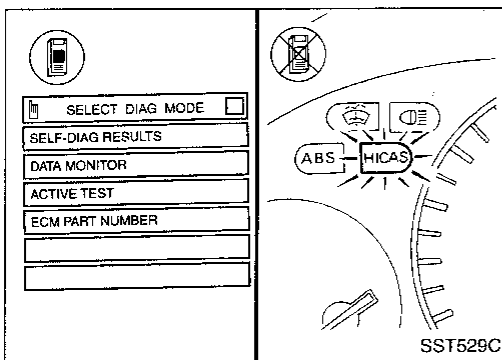
Trouble Diagnoses (Cont'd)

PRELIMINARY CHECK

Check 1

Perform self-diagnosis.

Refer to "Self-diagnosis" on page ST-61.



Check 2

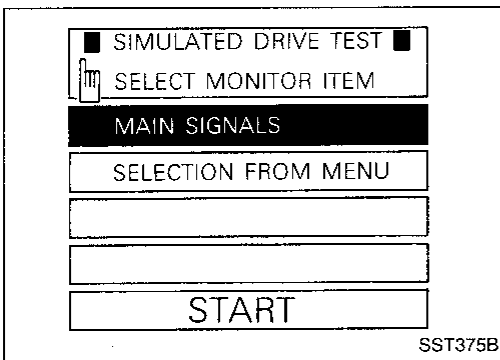
Perform rear wheel action check.

CAUTION:

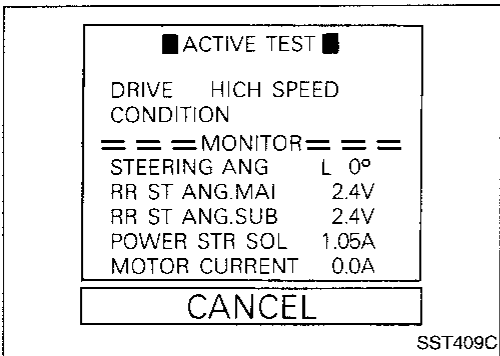
Ensure that shift lever is set to "P" position (A/T model) or "Neutral" position (M/T model) before checking HICAS system operation.

When CONSULT is used: 

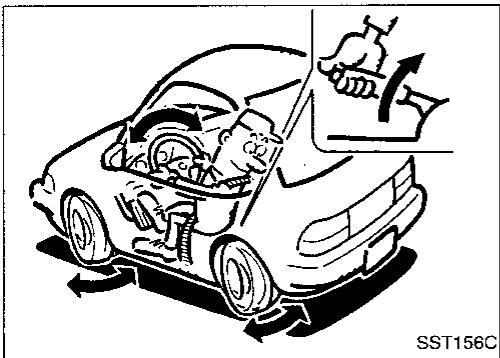
1. Have a helper sit in the driver's compartment, and raise vehicle.
(Use a two-pole lift or a center pole lift so that the four wheels are free to rotate.)
2. Connect CONSULT unit to data link connector for CONSULT and start engine.
3. Touch "START" on CONSULT display.
4. Touch "HICAS", "ACTIVE TEST" and "SIMULATED DRIVE" in that order.
5. Touch "START" when "MAIN SIGNALS" display is reversed.



6. Touch "START".



7. While running engine, turn steering wheel more than 180° to the left and right from the neutral position. Ensure that rear wheels steer in response to rotation of steering wheel.



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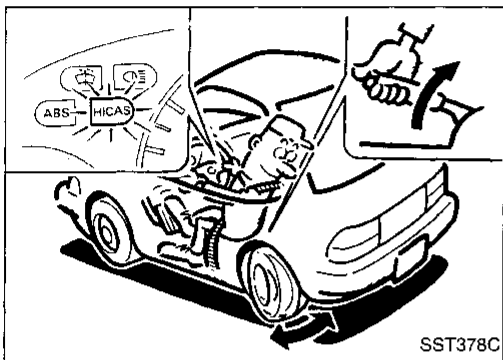
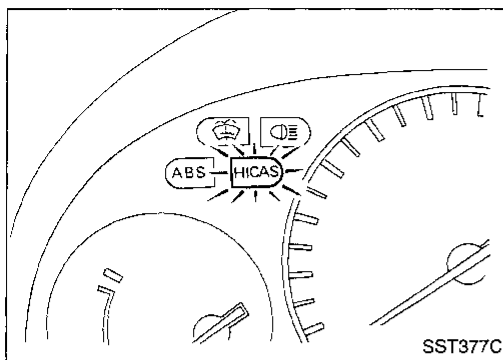
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SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)

When CONSULT is not used: 

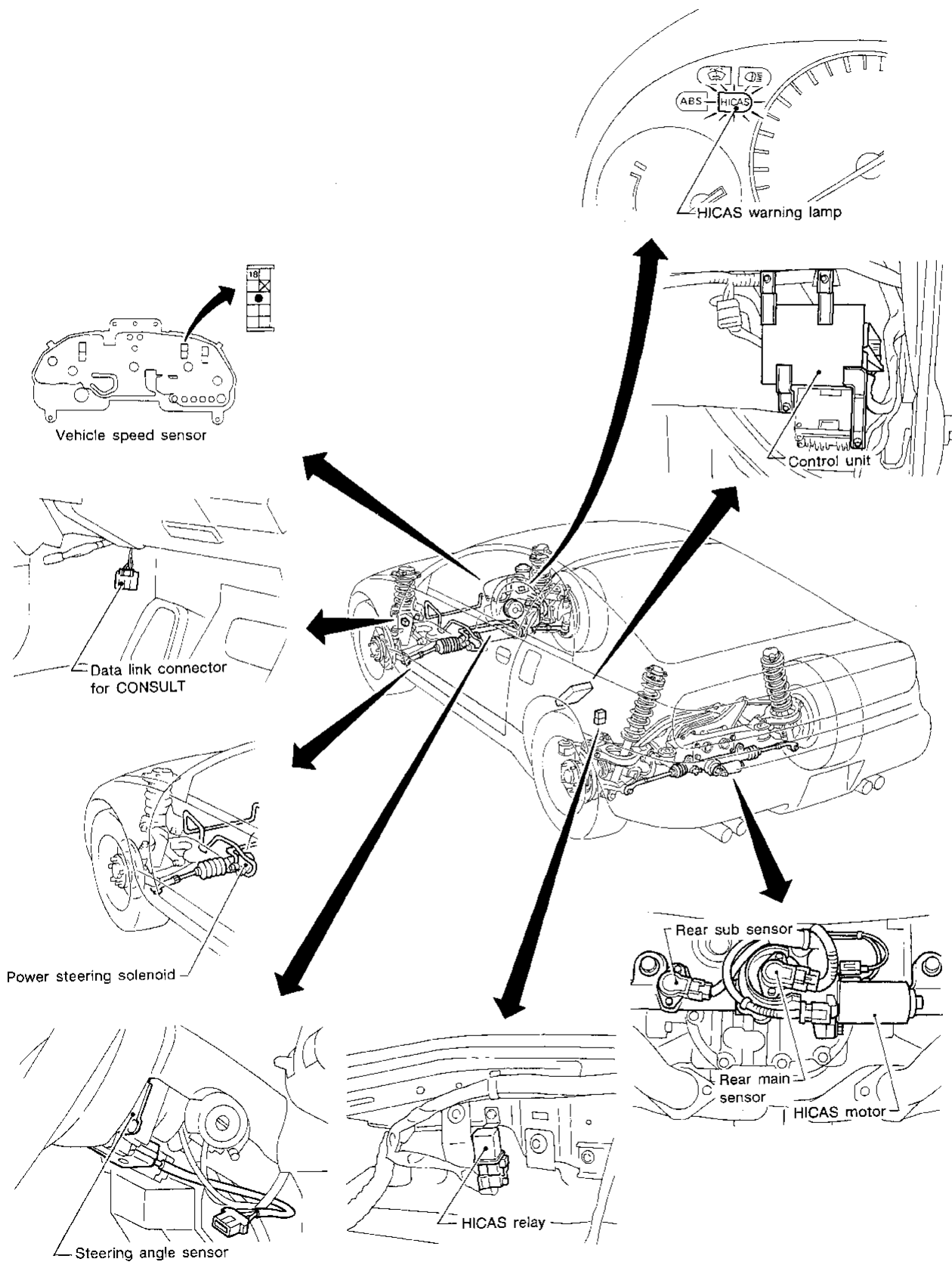
1. Turn key switch "OFF".
2. Set HICAS system in self-diagnosis mode.
 - (1) Turn ignition switch "OFF".
 - (2) Set shift lever to "P" position (A/T model), or "Neutral" position (M/T model).
 - (3) Turn ignition switch "ON".
 - (4) Immediately start engine.
 - (5) Turn steering wheel from left to right (at least 20° from the neutral position) 5 times or more, then depress foot brake pedal at least 5 times all within 10 seconds after ignition switch has been turned "ON".
3. Turn steering wheel to a point approximately 30° from the neutral position, then set steering wheel back to the neutral position and check to ensure that rear wheels turn to the left and right alternately.



SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)

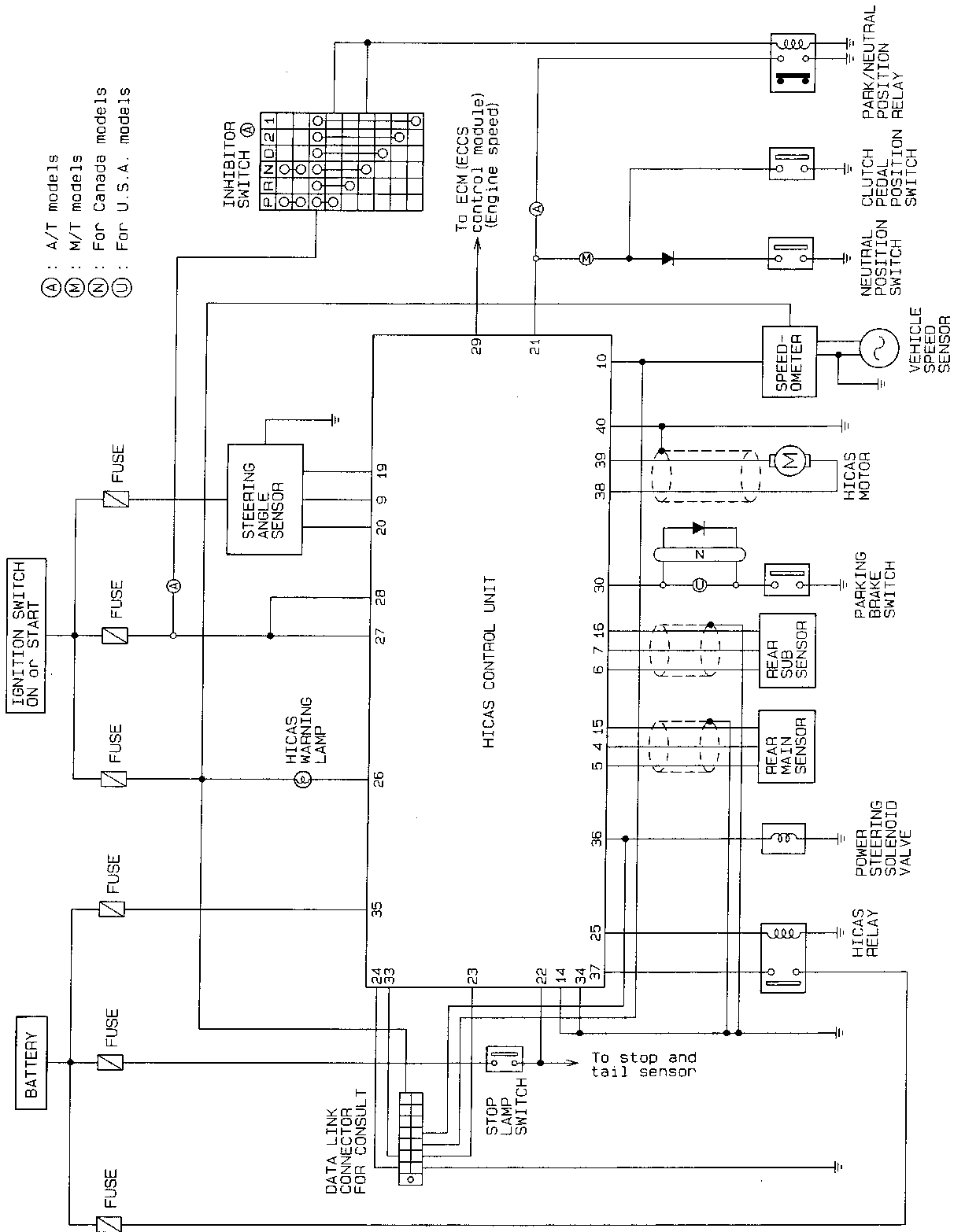
COMPONENT PARTS AND HARNESS CONNECTOR LOCATIONS



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SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd) CIRCUIT DIAGRAM

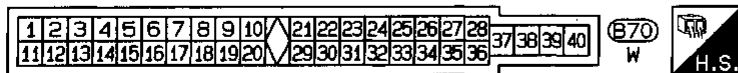
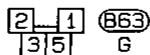
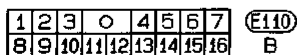
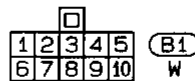
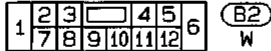
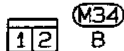
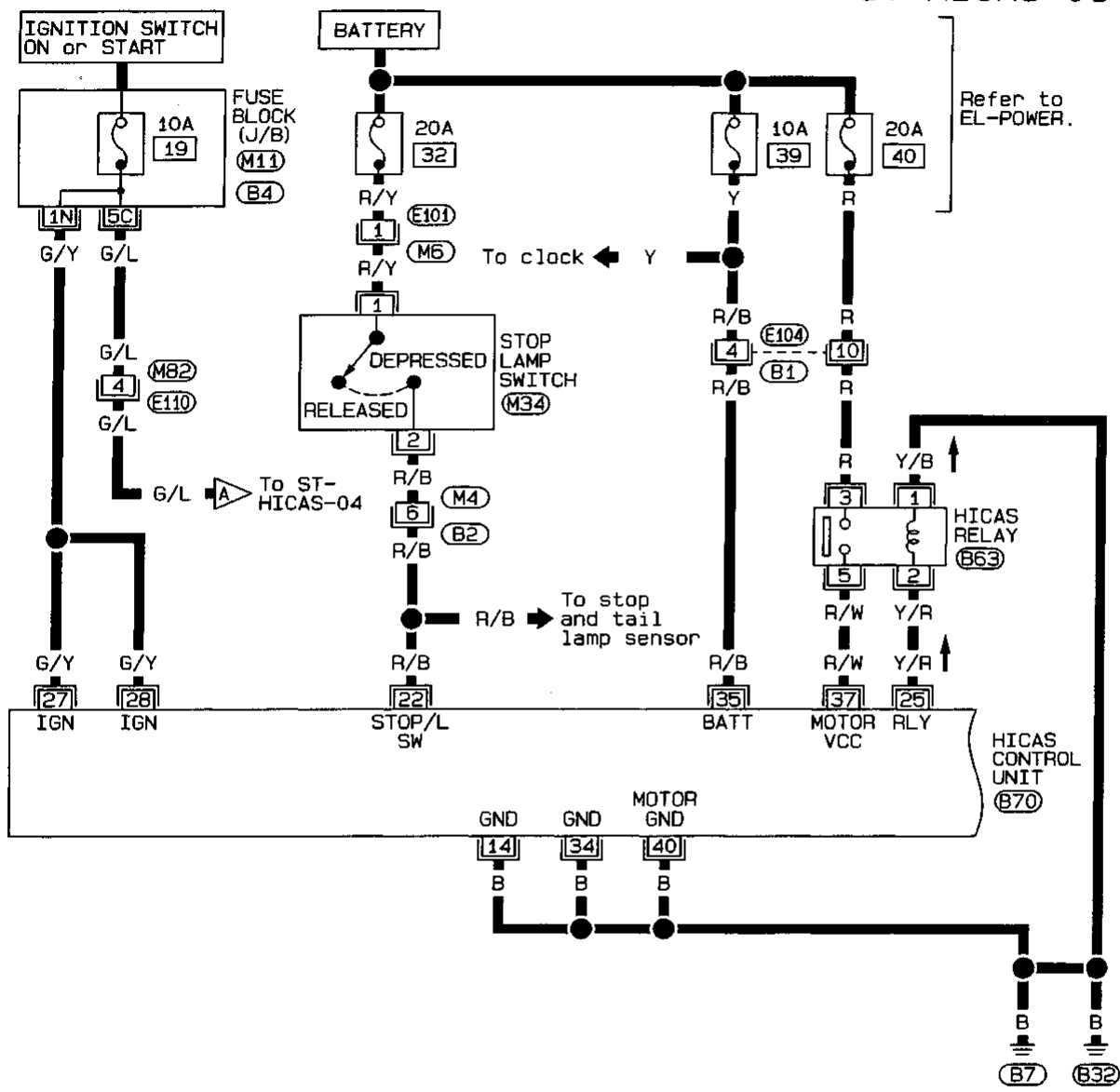


SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)

WIRING DIAGRAM

ST-HICAS-01



Refer to last page (Foldout page).

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SUPER HICAS SYSTEM

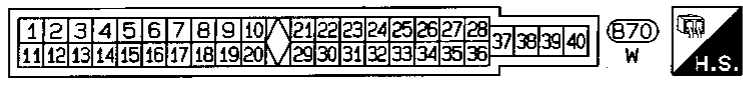
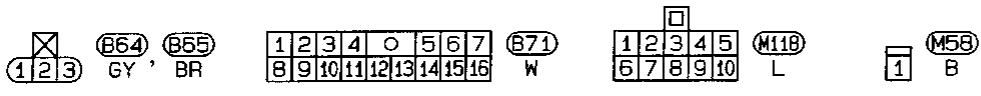
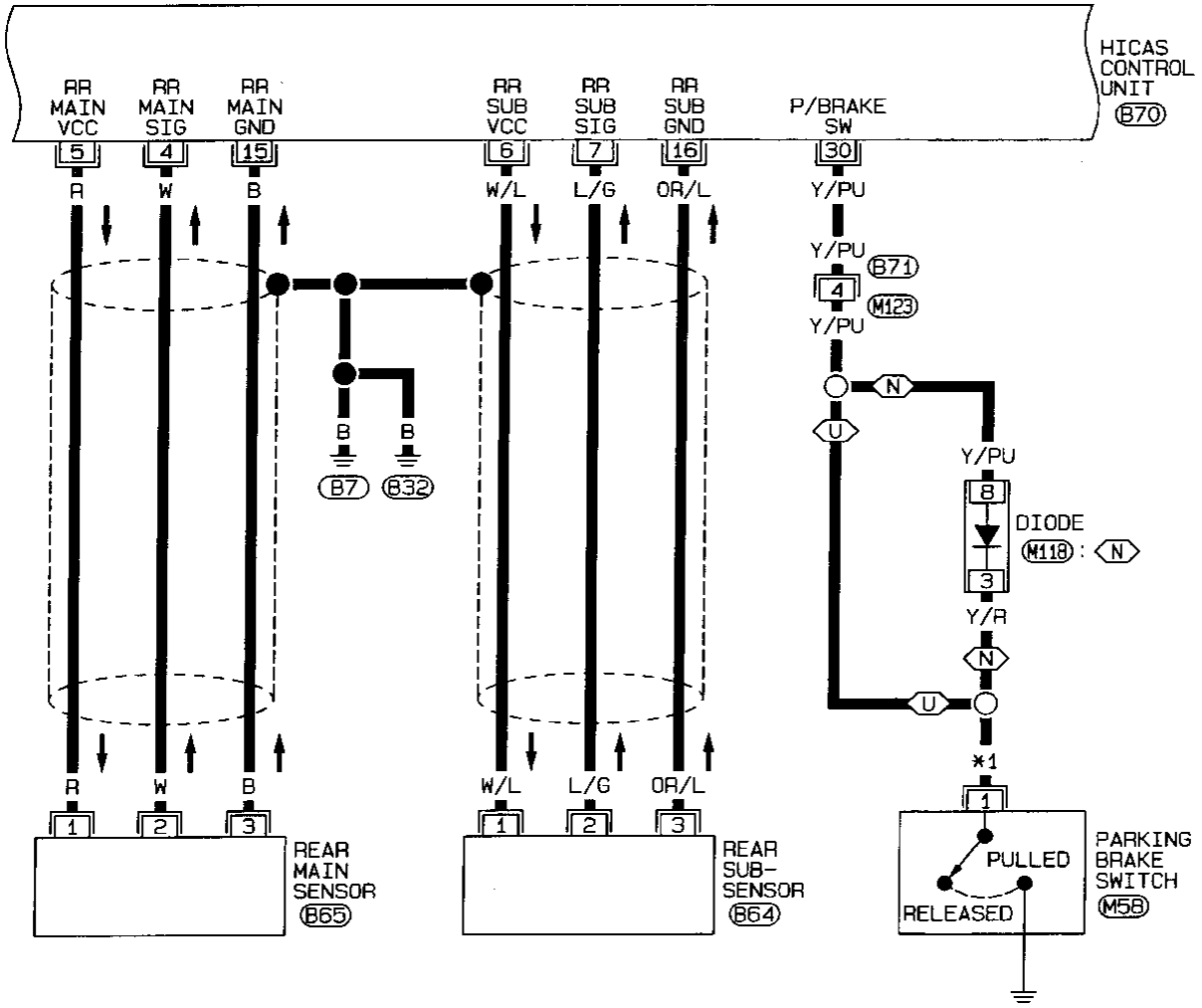
Trouble Diagnoses (Cont'd)

ST-HICAS-03

Ⓢ: For U.S.A. models

Ⓝ: For Canada models

*1... Ⓢ Y/PU, Ⓝ Y/R

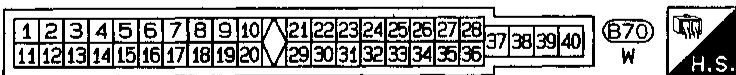
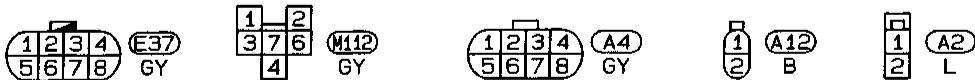
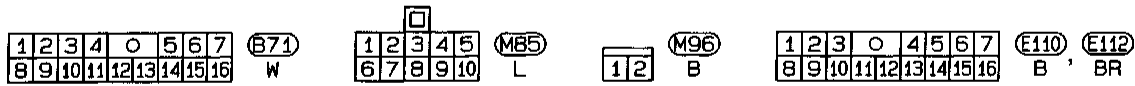
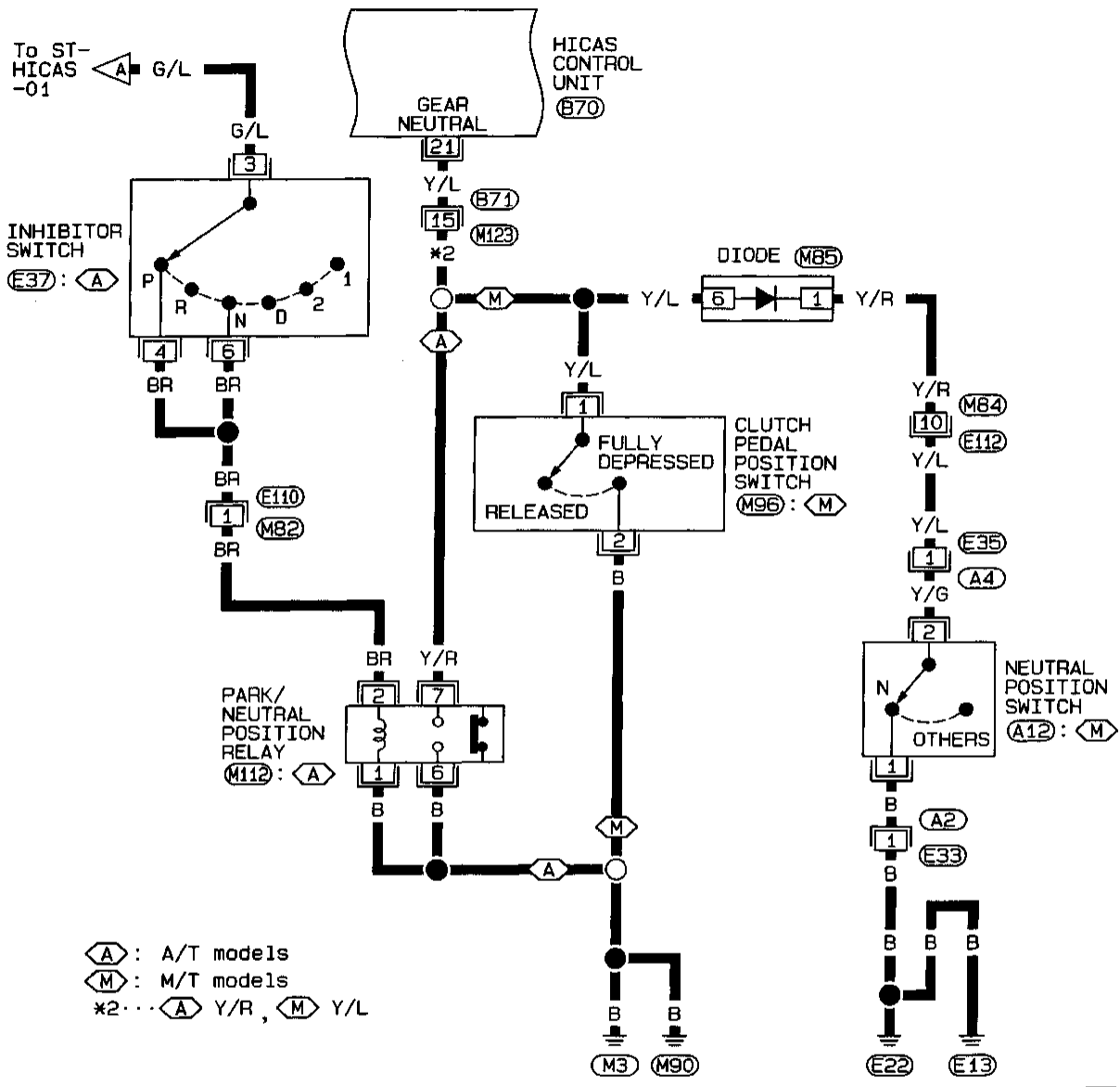


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SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)

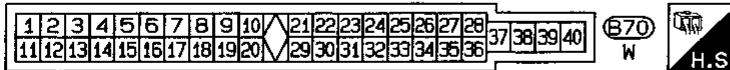
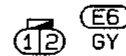
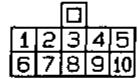
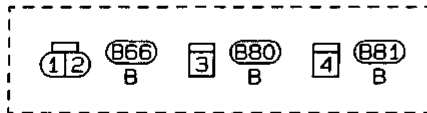
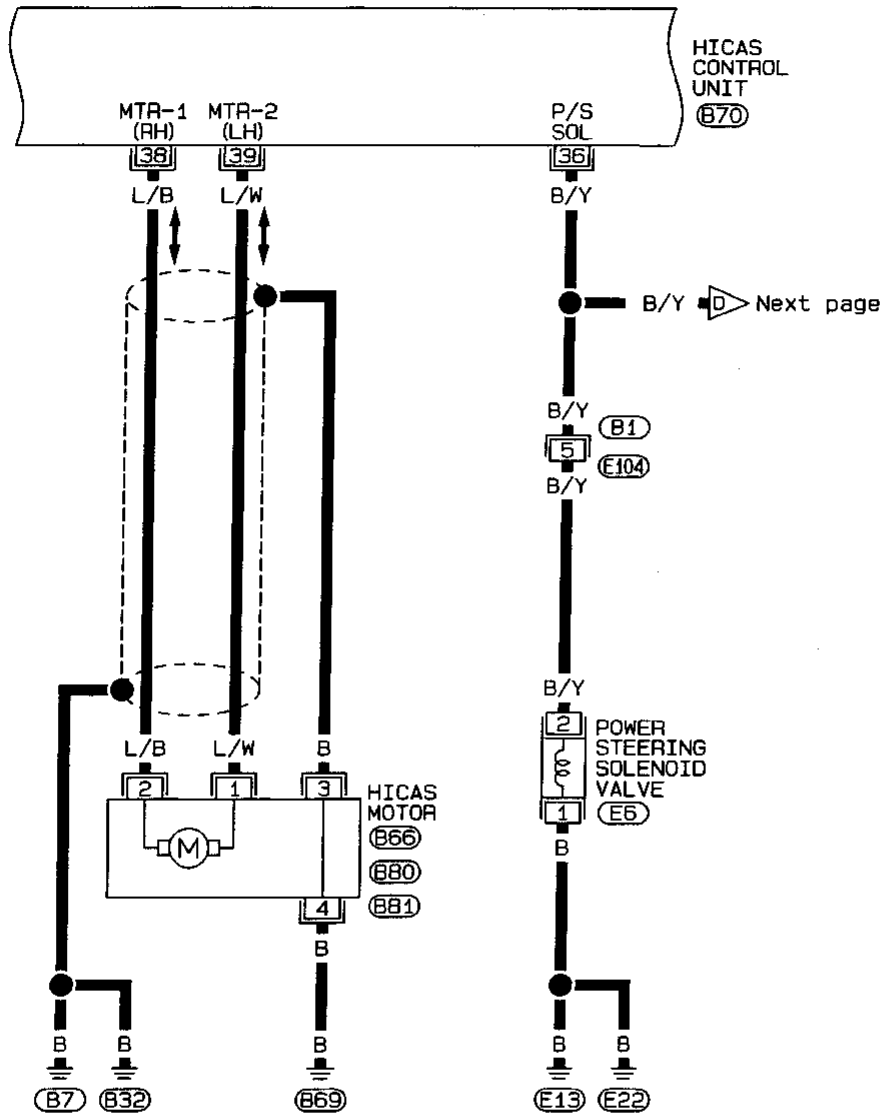
ST-HICAS-04



SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)

ST-HICAS-05



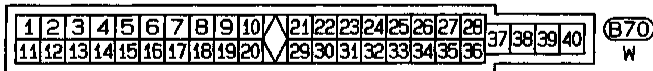
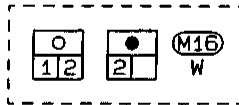
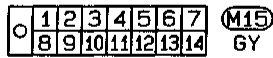
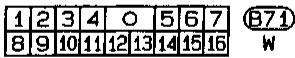
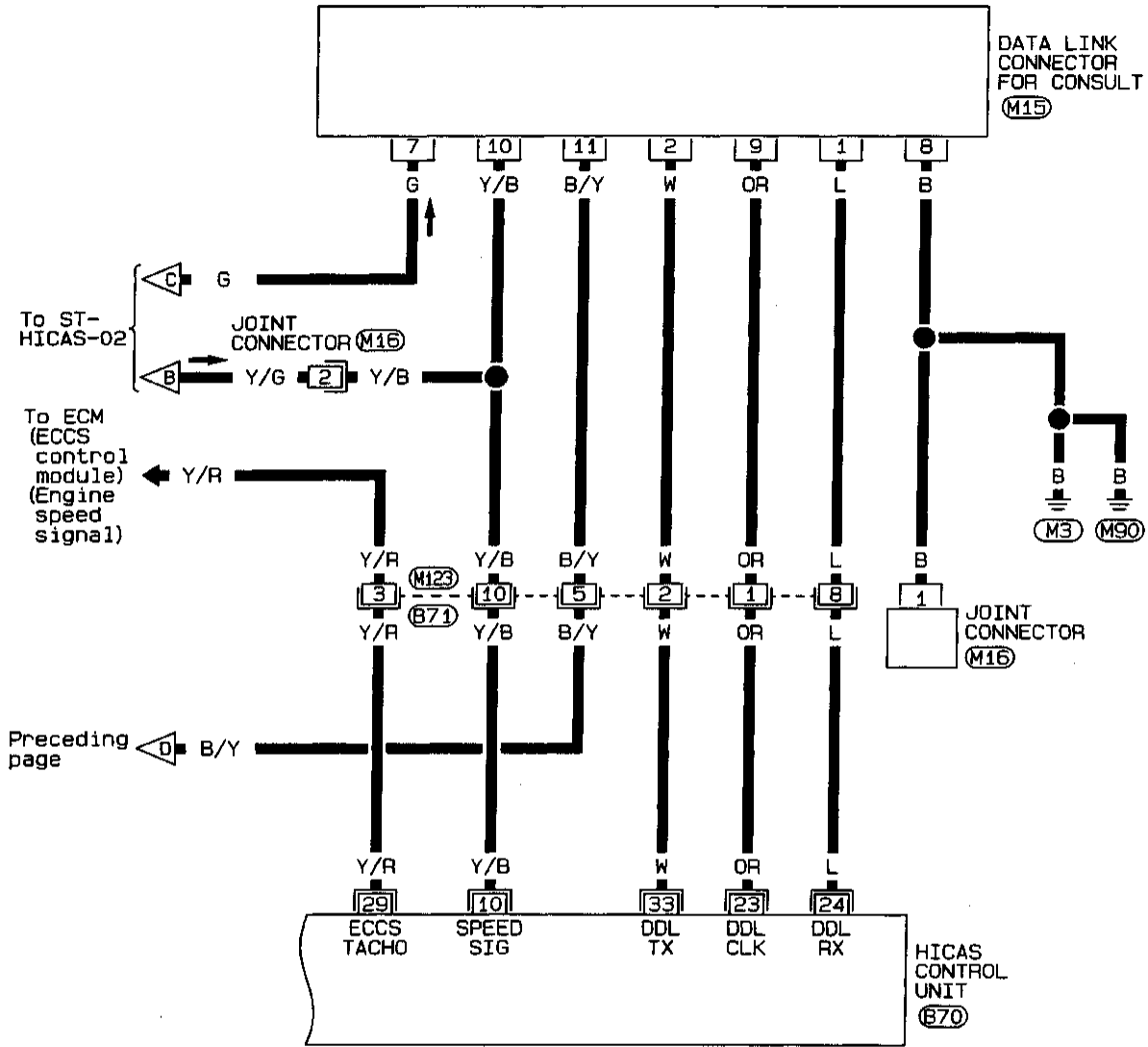
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SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)

ST-HICAS-06



SUPER HICAS SYSTEM

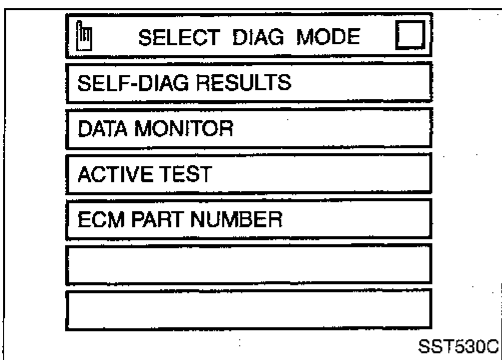
Trouble Diagnoses (Cont'd)


SELF-DIAGNOSIS

When CONSULT is used: 

- Start engine.
- Touch START (on CONSULT display).
- Touch HICAS.
- Touch SELF-DIAG RESULTS.

Refer to CONSULT operation manual "HICAS" for details.



When CONSULT is not used: 

1. Input starting conditions for self-diagnosis.
 - (1) Turn ignition switch "OFF".
 - (2) Set shift lever to "P" position (A/T model), or "Neutral" position (M/T model).
 - (3) Turn ignition switch "ON".
 - (4) Immediately start engine.
 - (5) Turn steering wheel from left to right (at least 20° from the neutral position) 5 times or more, then depress foot brake pedal at least 5 times all within 10 seconds after ignition switch has been turned "ON".
2. Input self-diagnosis item.
 - (1) Depress and release foot brake pedal.
 - (2) Turn steering wheel from left to right (at least 20°) from the neutral position.
 - (3) (M/T model)
Depress clutch pedal and move gear shift lever to any position other than Neutral and return to Neutral. Release clutch pedal. (A/T model)
Disengage and engage parking brake lever. Move shift lever to any position other than Neutral or Parking and return to Parking.
 - (4) Move car at least 3 meters (10 ft) forward and proceed at an indicated speed of at least 2 km/h (1 MPH) in self-diagnosis mode.

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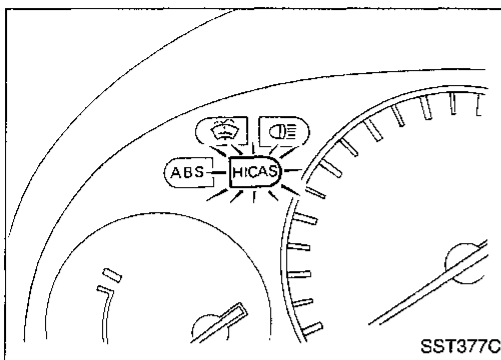
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SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)



3. The self-diagnosis mode will then appear in the "HICAS" warning lamp.

When all systems are normal:

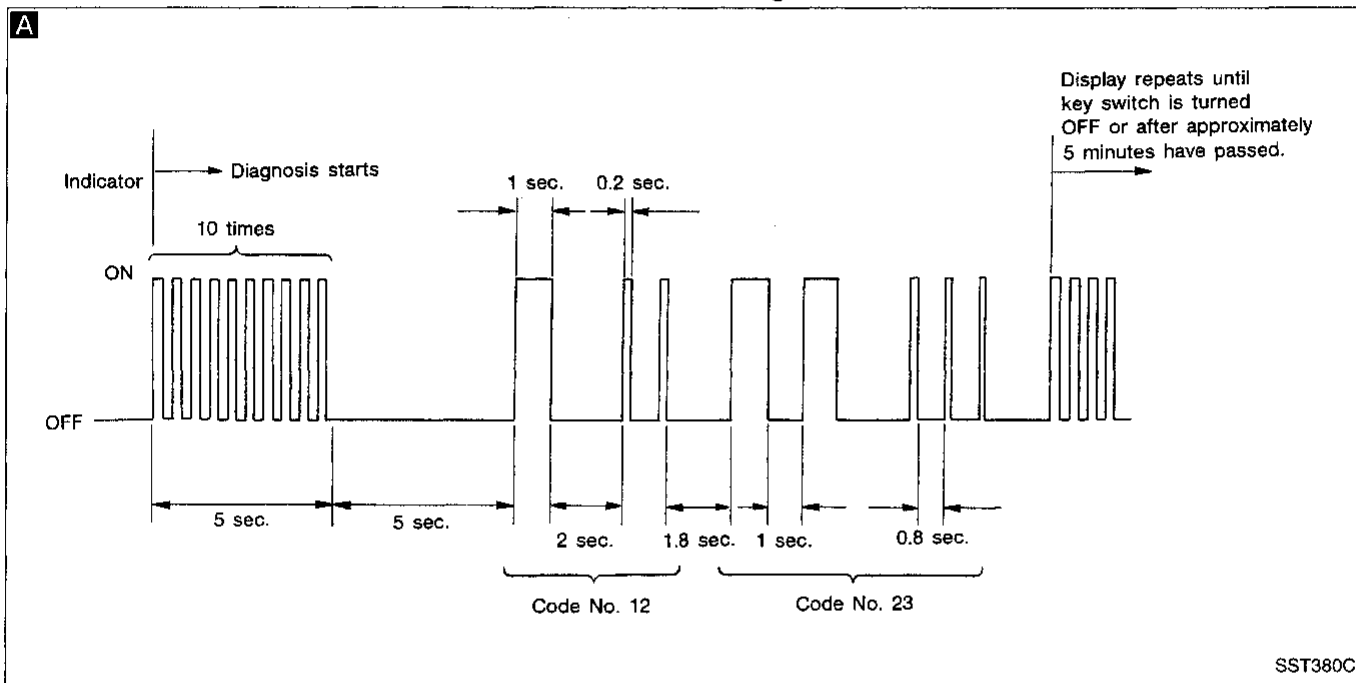
HICAS warning lamp flashes at 0.25-second intervals.

When there is a system malfunction:

Example: In case of code No. 12 (Motor power supply) and code No. 23 (Steering neutral position)

A If past fail-safe data is stored in memory, only troubled items will be displayed in the illustrated sequence, and this display will be repeated again.

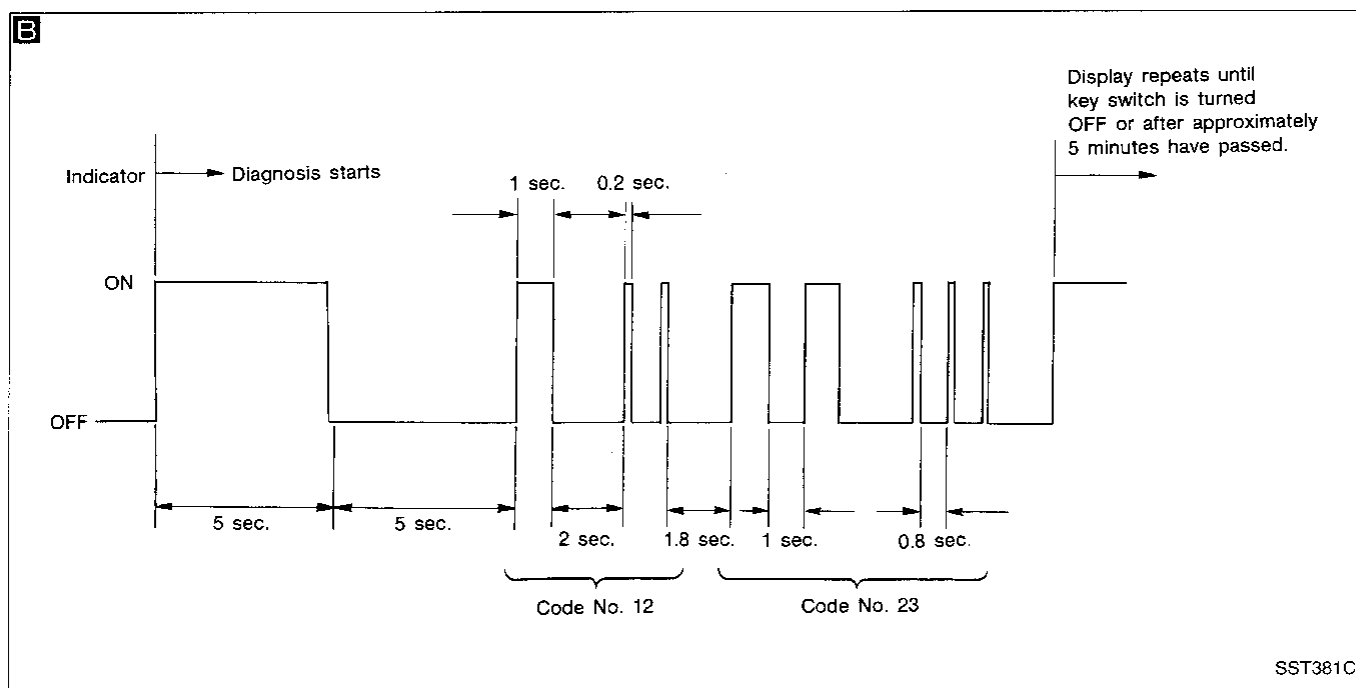
- Tens digit code: 1 sec. ON (1 sec. OFF)
- Units digit code: 0.2 sec. ON (0.8 sec. OFF)
- Pause between tens digit and units digit: 2 sec. OFF
- Code change: 1.8 sec. OFF



B If fail-safe function is currently being activated for the first time, and if no past fail-safe history data is stored in the memory, only troubled items will be displayed in the illustrated sequence, and this display will be repeated again.

SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)



CAUTION:

When steering angle sensor Error in self-diagnosis (Code: "No neutral signal (*b)") is detected, check output of steering angle sensor.

If output is not good, replace steering angle sensor.

If output is OK, disconnect connector of HICAS control unit and connect it surely. Then perform SELF-DIAGNOSIS again to check whether steering angle sensor Error is detected or not.

Self-diagnosis code and diagnosed part indicated by flashing of HICAS warning lamp

Self-diagnosis code No.	Diagnosed part	Self-diagnosis code No.	Diagnosed part
11	HICAS control unit	24	Rear main sensor input is not present.
12	HICAS motor power supply is not present.	25	Rear sub sensor input is not present.
13	HICAS motor output is not present.	31	Parking brake input is not present.
21	Vehicle speed signal is not present.	32	Inhibitor switch (A/T) or neutral and clutch switch (M/T) input is not present.
22	Steering angle sensor (steering angle signal) is not present.	33	Engine speed signal is not present.
23	Steering angle sensor (steering neutral signal) is not present.		

How to end the self-diagnosis mode

The self-diagnosis mode is ended by performing one of the following:

- Turning ignition switch "OFF".
- After self-diagnosing has been operated for approximately 5 minutes, the self-diagnosis mode will end automatically.
- Running a vehicle at speed of 15 km/h (9 MPH) or over.

The self-diagnostic results will remain in memory of HICAS control unit.

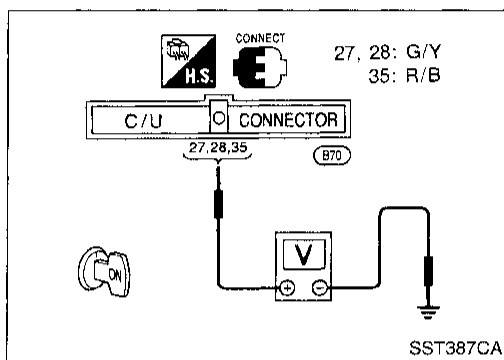
SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)

How to erase self-diagnostic results

The self-diagnostic results are erased when one of the following is performed:

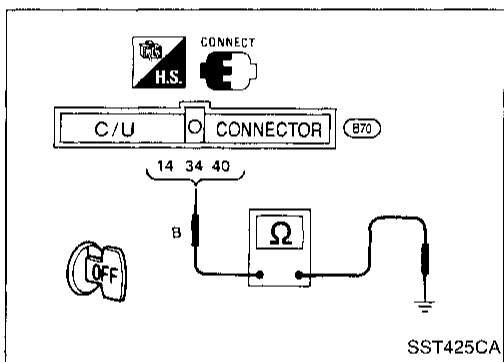
- Disconnecting battery terminal for more than 30 minutes.
- Touching "ERASE" on CONSULT display of SELF-DIAGNOSTIC RESULTS.



CONTROL UNIT POWER SUPPLY AND GROUND CIRCUIT CHECK

Control unit power supply

Terminals	Battery voltage existence
②7 - Ground ②8 - Ground ③5 - Ground	Yes



Control unit ground circuit

Terminals	Continuity
①4 - Ground ③4 - Ground ④0 - Ground	Yes

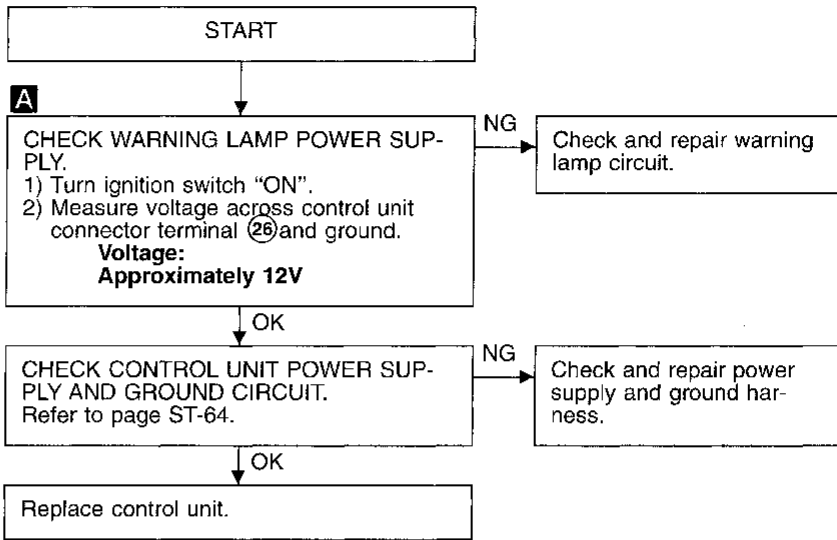
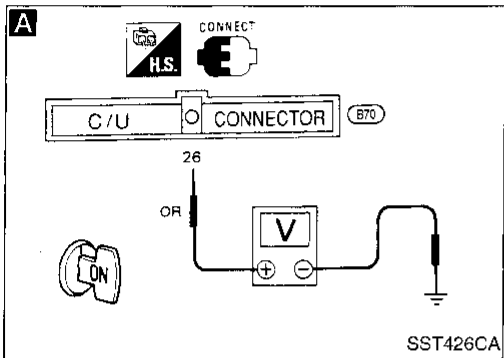
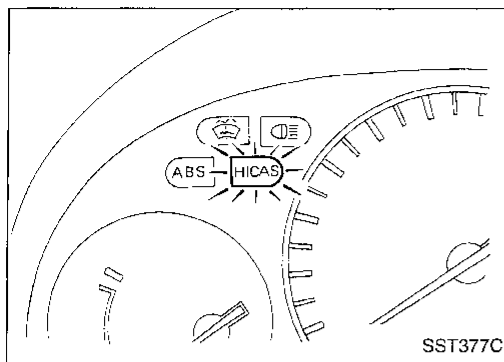
SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)

DIAGNOSTIC PROCEDURE 1

SYMPTOM:

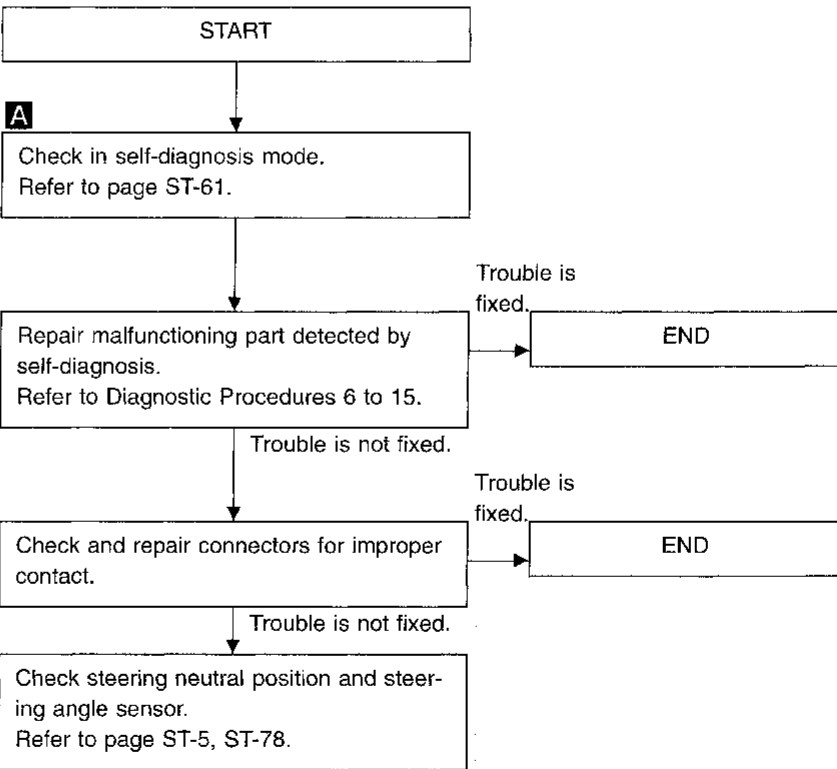
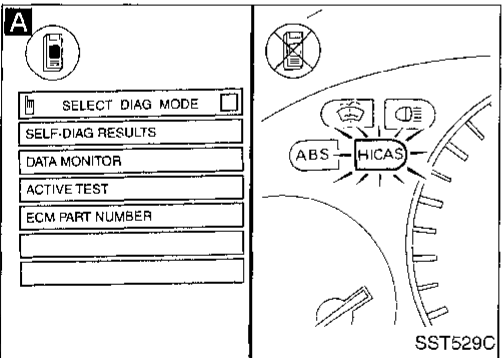
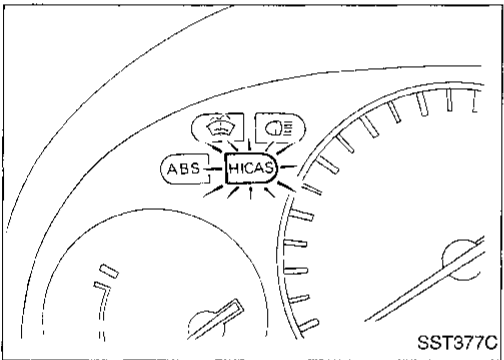
No warning lamp comes on when ignition switch is turned "ON".



DIAGNOSTIC PROCEDURE 2

SYMPTOM (A):

Warning lamp comes on during operation.



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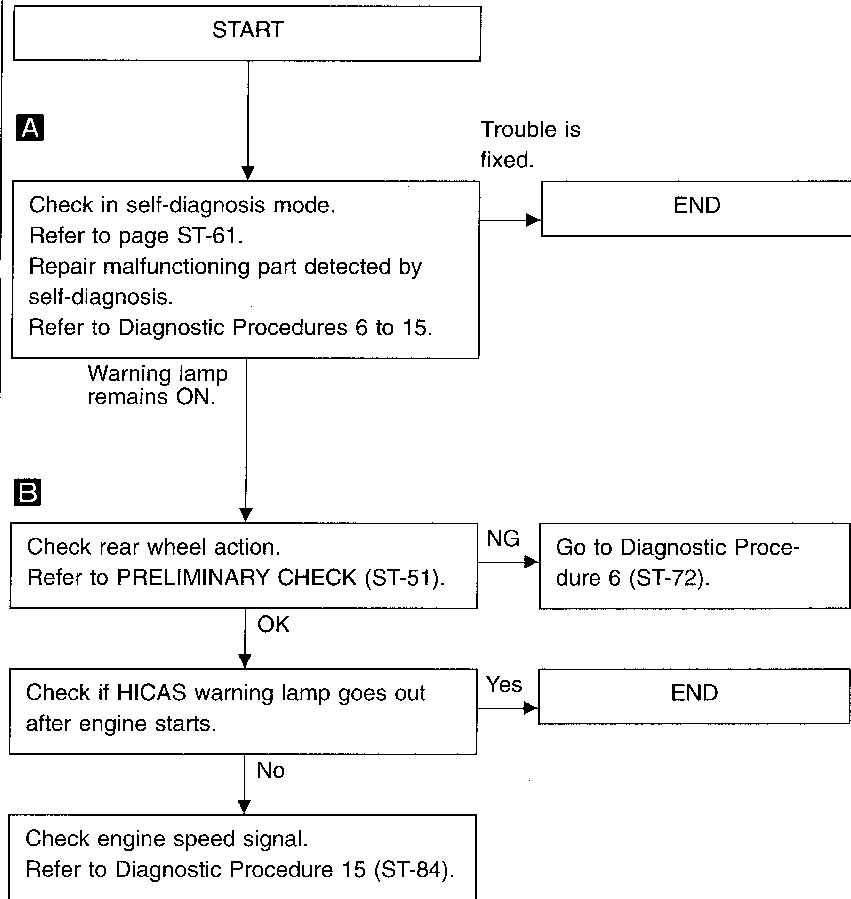
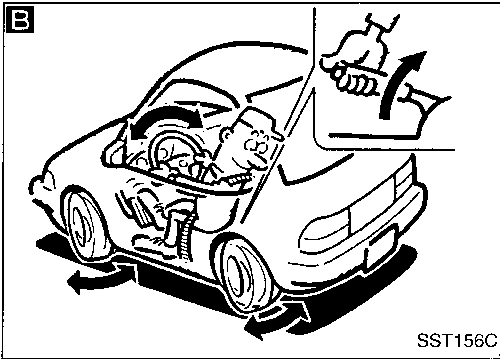
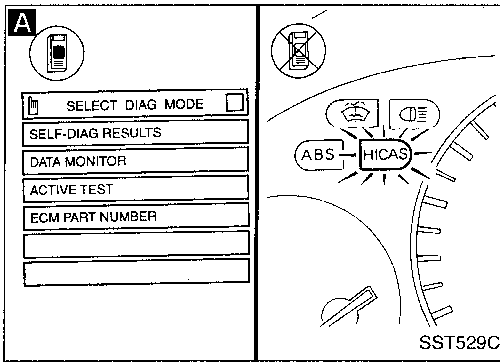
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SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)

SYMPTOM (B):

Warning lamp stays on after engine starts.



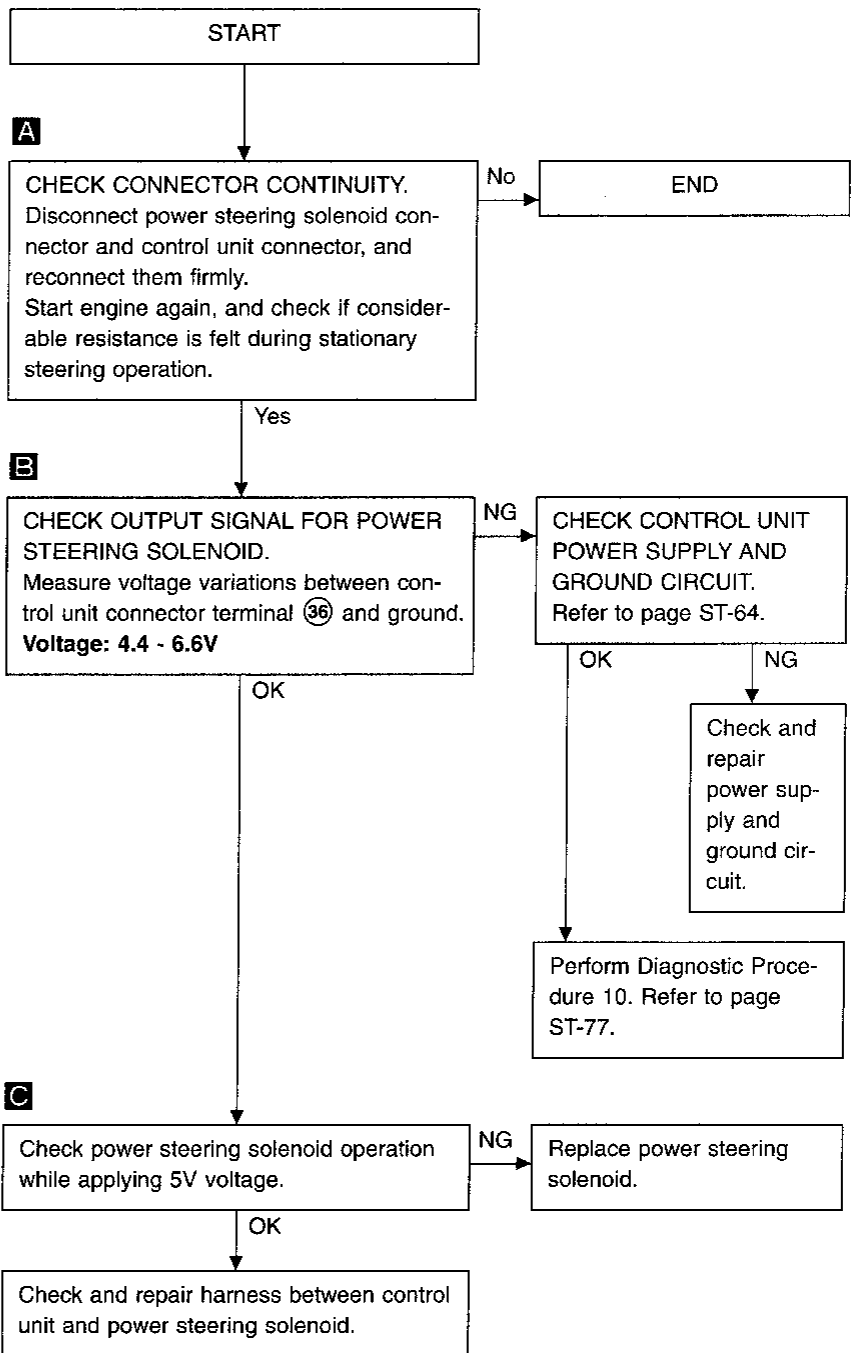
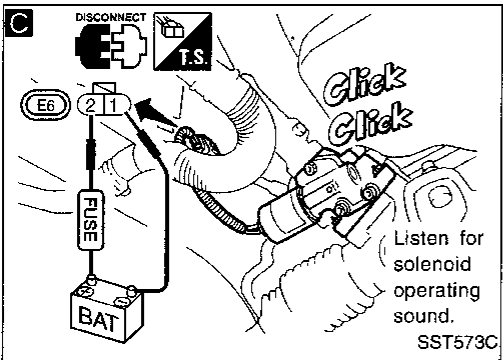
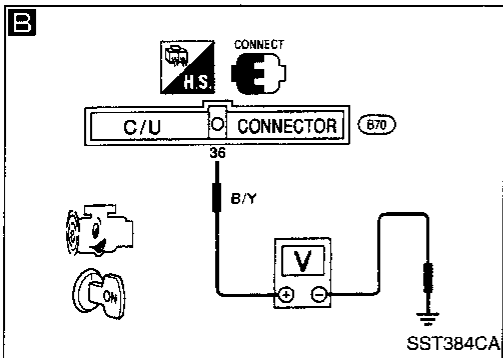
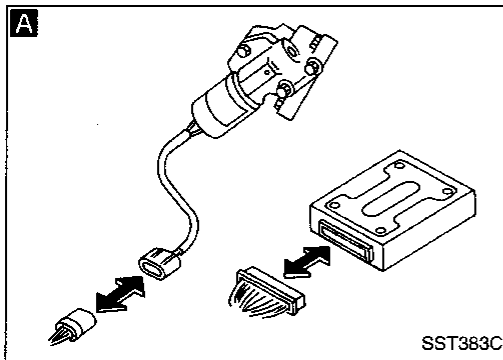
SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)

DIAGNOSTIC PROCEDURE 3

SYMPTOM:

Considerable resistance is felt during stationary steering operation.



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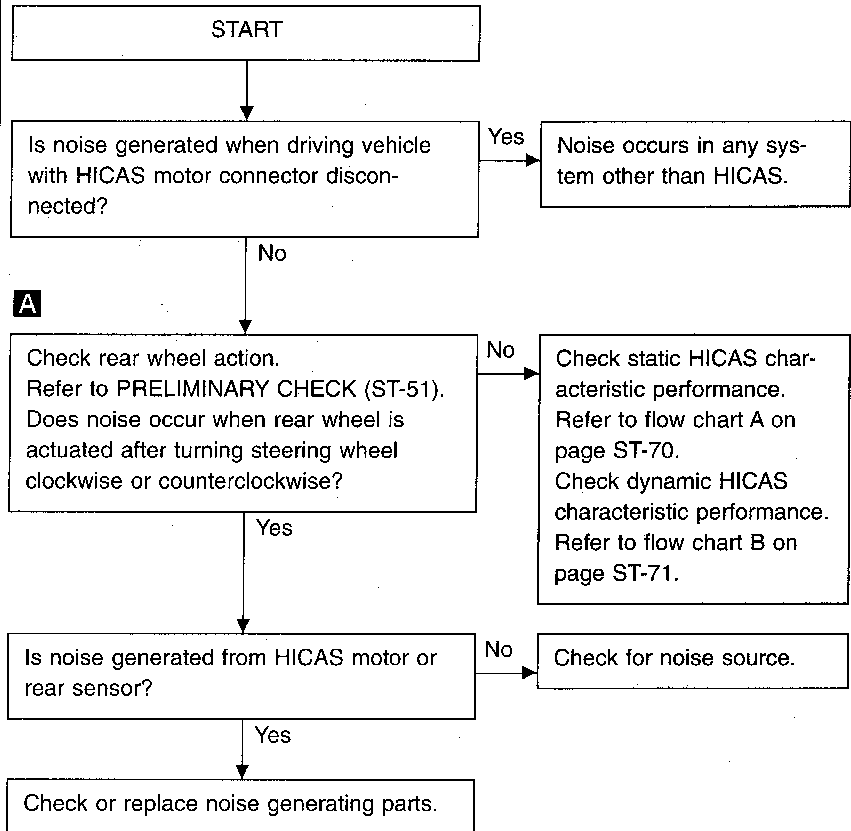
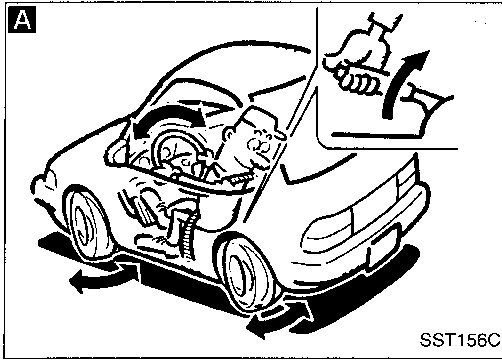
SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)

DIAGNOSTIC PROCEDURE 4

SYMPTOM:

Abnormal noise occurs.



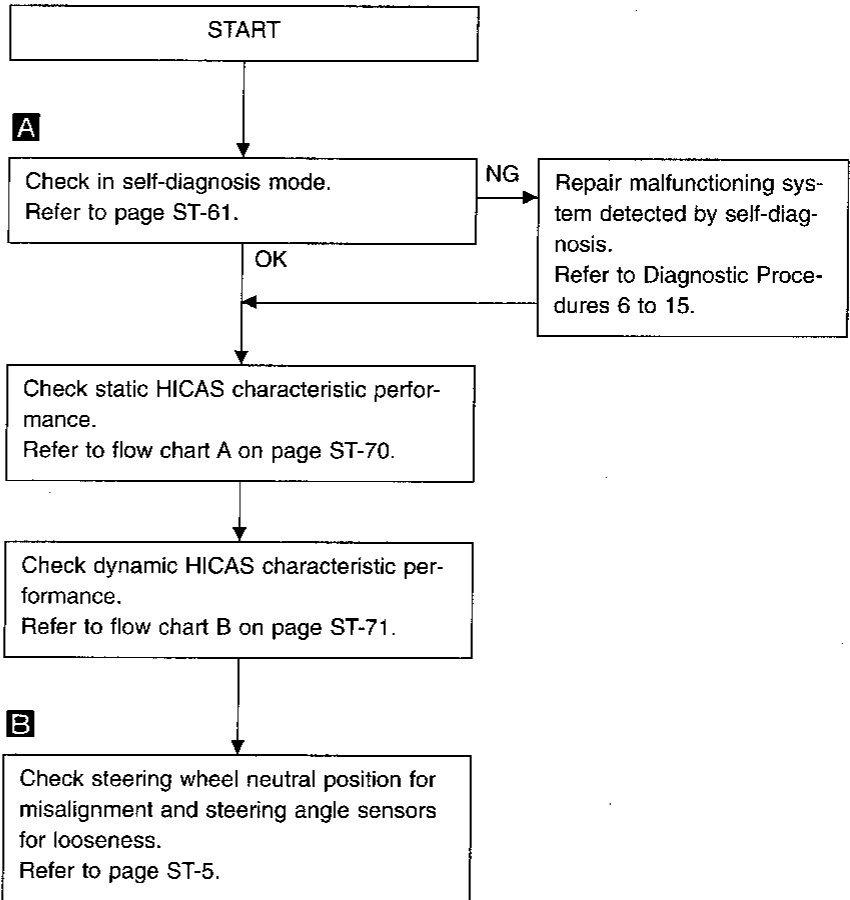
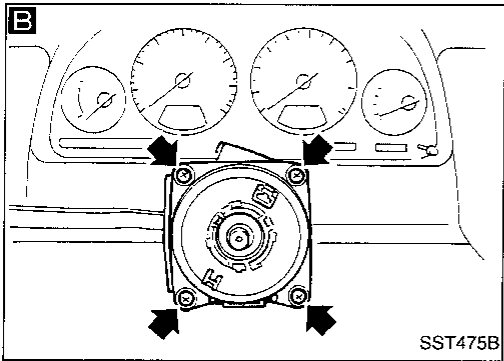
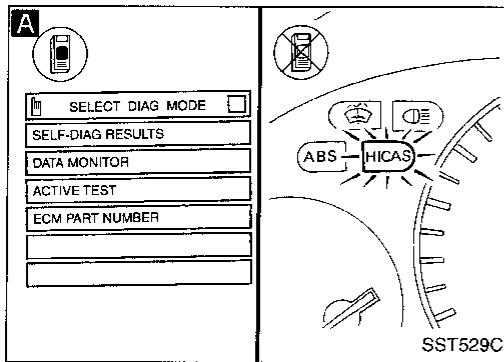
SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)

DIAGNOSTIC PROCEDURE 5

SYMPTOM:

Other abnormalities

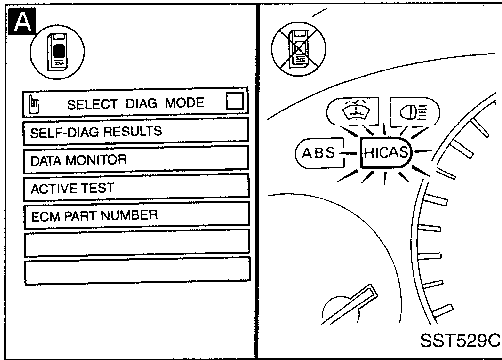


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SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)

A. Static HICAS characteristic performance check



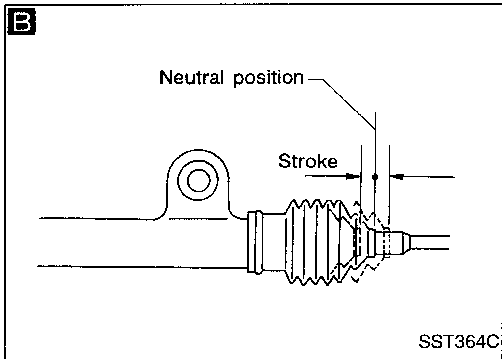
START

A

Set CONSULT in ACTIVE TEST mode.

OR

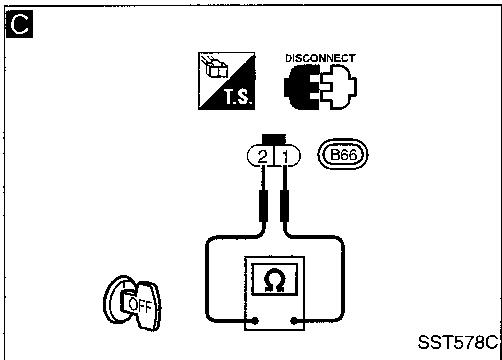
Set self-diagnosis mode.
Refer to page ST-61.



B

CHECK ACTUATOR STROKES.
Turn steering wheel approximately 180° to the left or right.
Each stroke from neutral position:
Approximately 3 mm (0.12 in)

OK → END



C

CHECK RESISTANCE OF HICAS MOTOR.
1) Disconnect HICAS motor connector.
2) Measure resistance between connector terminals ① and ②.
Resistance:
Approximately 0.2 - 2.0Ω

NG → Replace HICAS motor.

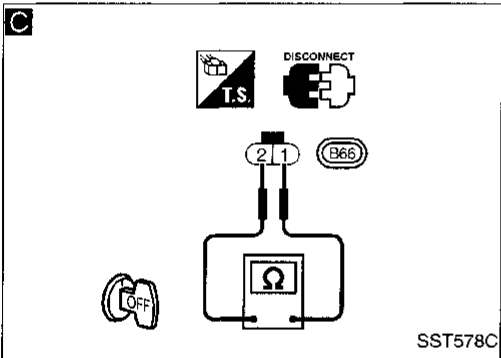
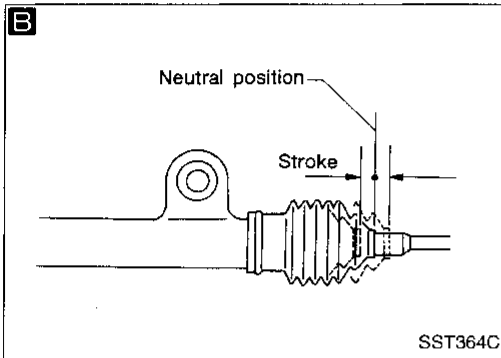
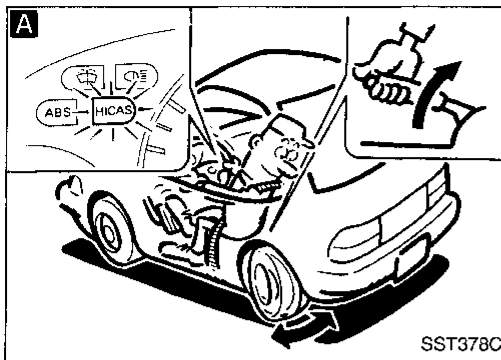
OK

CHECK REAR SENSOR.
Go to Diagnostic Procedure 12 (ST-79).

SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)

B. Dynamic HICAS characteristic performance check



START

Set in self-diagnosis mode.
Refer to page ST-61.

A
CHECK REAR WHEELS FOR PROPER MOVEMENT.
Rear wheels will turn to the left and right periodically if steering wheel is returned to neutral after being turned by approximately 30° in either direction.

B
CHECK ACTUATOR STROKES.
Each stroke from neutral position:
More than 1.9 mm (0.075 in)

OK → END

C
CHECK RESISTANCE OF HICAS MOTOR.
1) Disconnect HICAS motor connector.
2) Measure resistance between connector terminals ① and ②.
Resistance:
Approximately 2Ω

NG → Replace HICAS motor.

OK
CHECK REAR SENSOR.
Go to Diagnostic Procedure 12 (ST-79).

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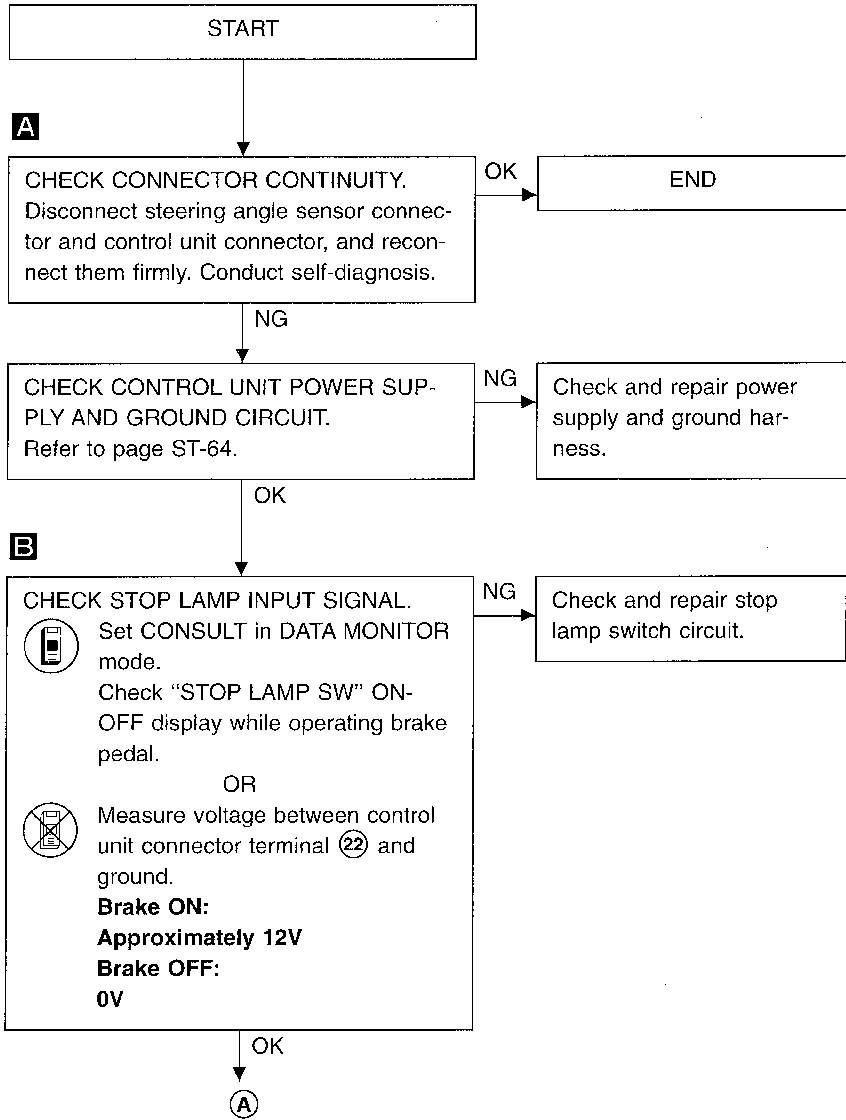
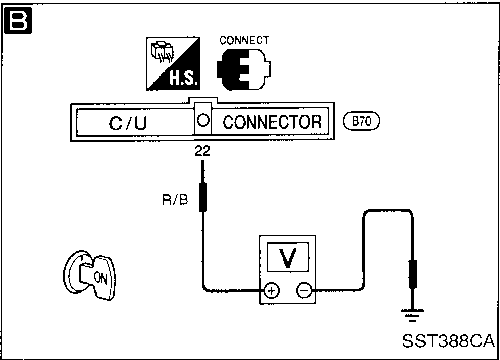
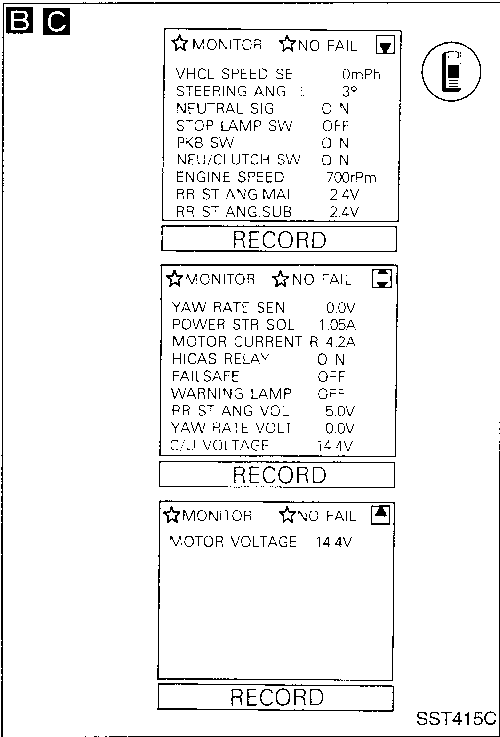
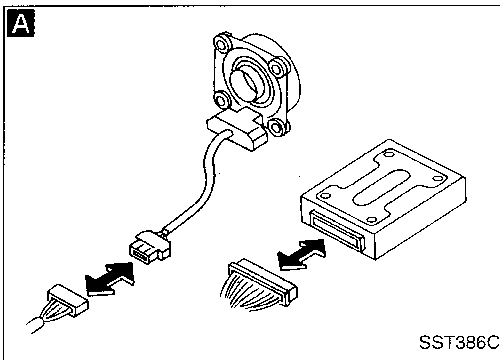
SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)

DIAGNOSTIC PROCEDURE 6

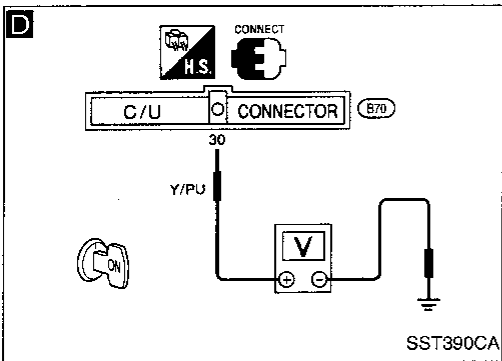
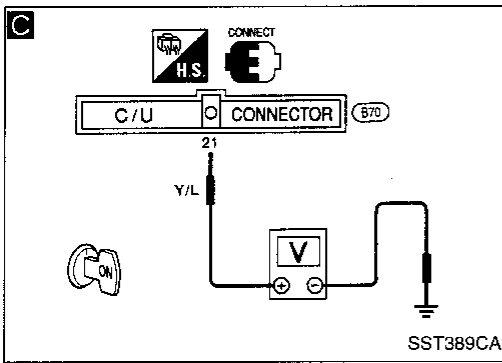
SYMPTOM:

System is not set in self-diagnosis mode.



SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)



C

CHECK PARK/NEUTRAL POSITION INPUT SIGNAL.

Set CONSULT in DATA MONITOR mode.
Check "NEU/CLUTCH SW" ON-OFF display while operating shift lever.

OR

Measure voltage between control unit connector terminal (21) and ground.

"Neutral" position (M/T):
"P" and "N" position (A/T):
0V
Except those position:
Approximately 4.8V

NG → Check and repair neutral position switch (M/T) or park/neutral position switch (A/T) circuit. Refer to "Position Switch Check" in MT section or "Electrical Components Inspection" of TROUBLE DIAGNOSES in AT section.

C

CHECK CLUTCH INPUT SIGNAL. (M/T model)

Set CONSULT in DATA MONITOR mode.
Check "NEU/CLUTCH SW" ON-OFF display while operating clutch pedal.

OR

Measure voltage between control unit connector terminal (21) and ground.

Clutch ON:
0V
Clutch OFF:
Approximately 4.8V

NG → Check and repair clutch switch circuit.

D

CHECK PARKING BRAKE INPUT SIGNAL.

Set CONSULT in DATA MONITOR mode.
Check "PKB SW" ON-OFF display while operating parking brake lever.

OR

Measure voltage between control unit connector terminal (30) and ground.

Parking brake ON:
0V
Parking brake OFF:
Approximately 12V

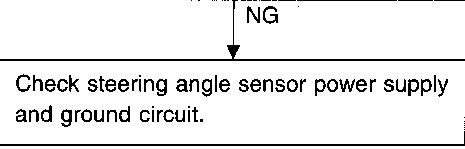
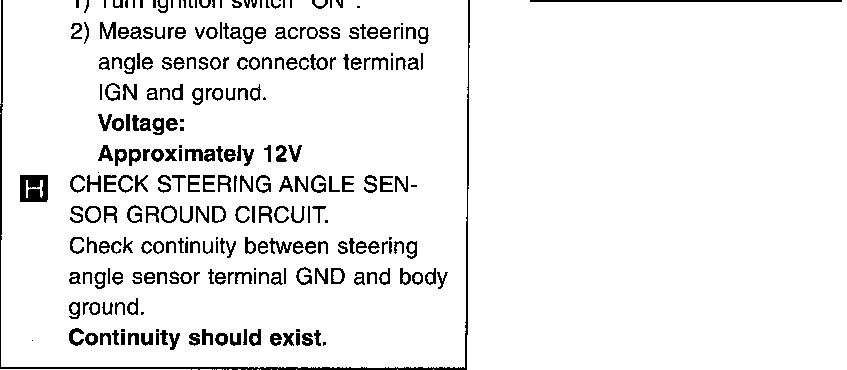
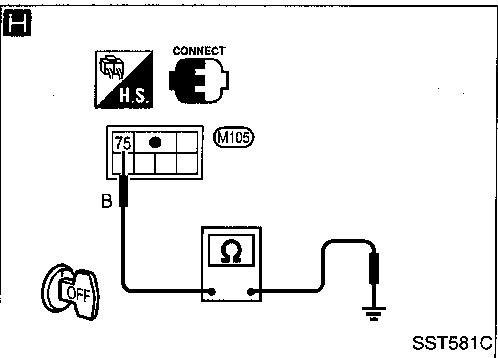
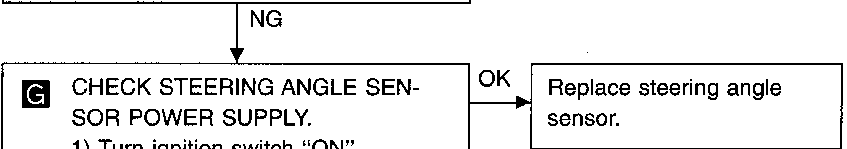
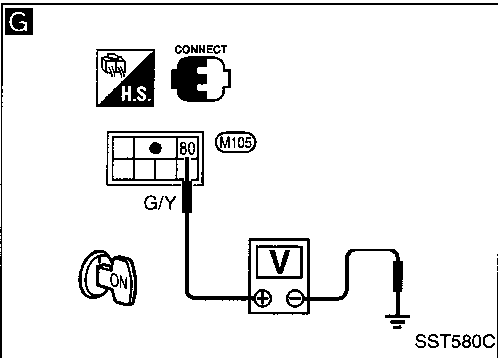
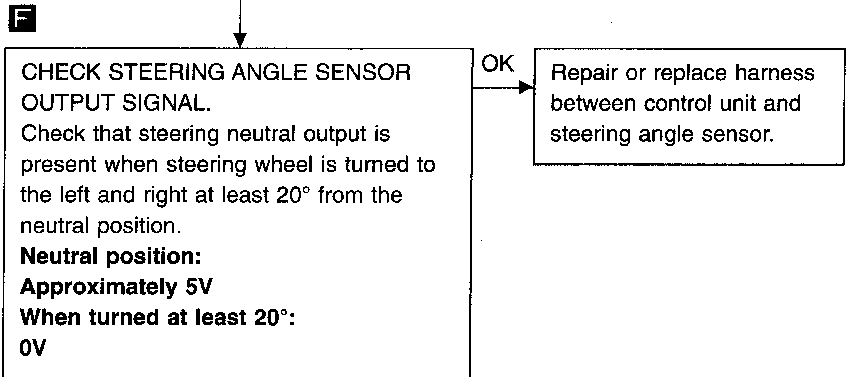
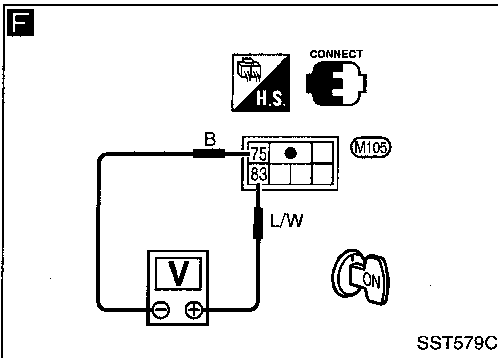
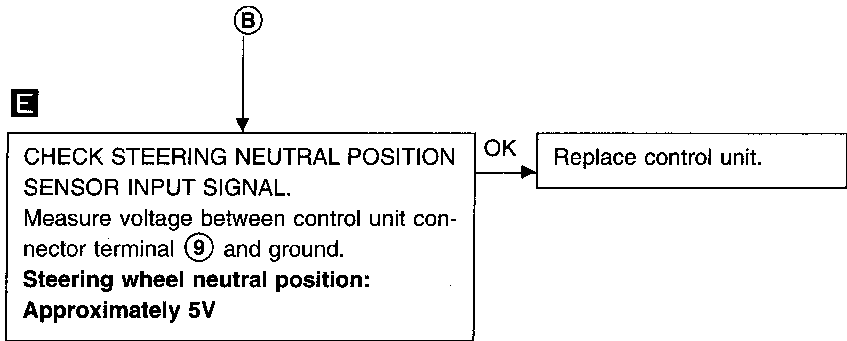
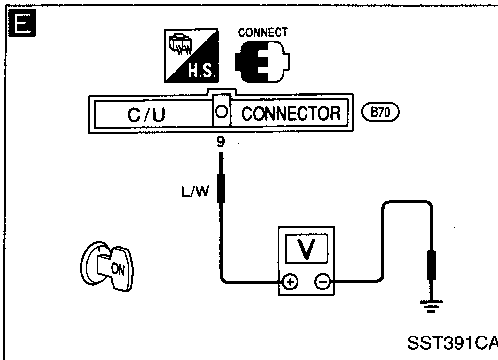
NG → Check and repair parking brake switch circuit.

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SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)



SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)

DIAGNOSTIC PROCEDURE 7

SYMPTOM:

Control unit is abnormal. (Code No. 11)

Replace control unit if it is determined abnormal by self-diagnosis.

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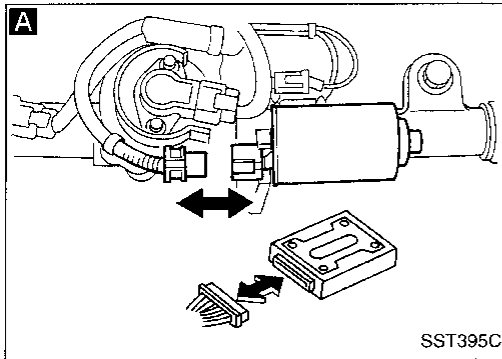
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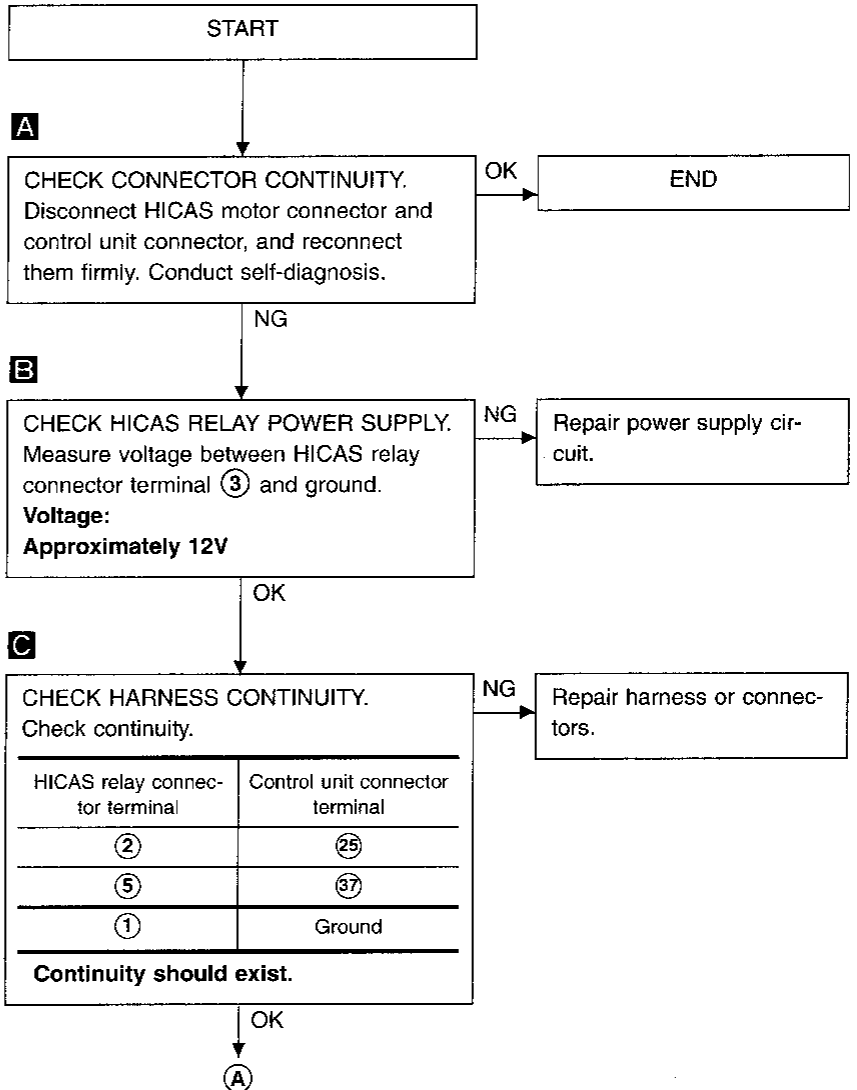
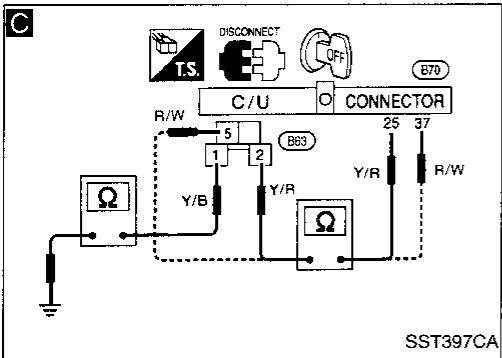
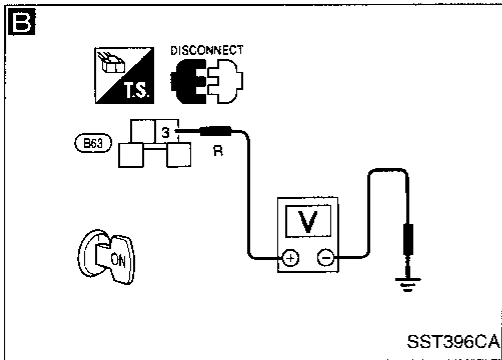
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DIAGNOSTIC PROCEDURE 8

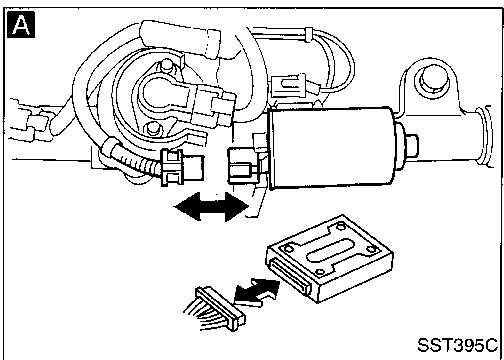
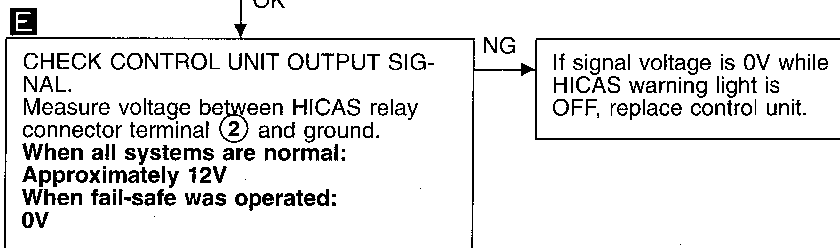
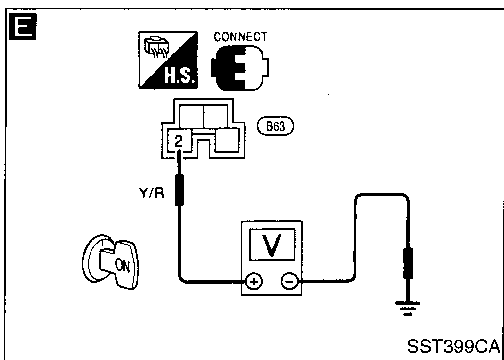
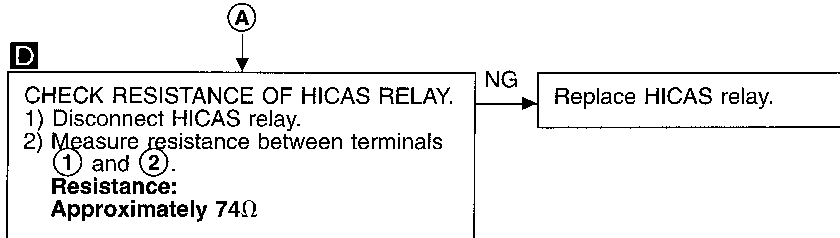
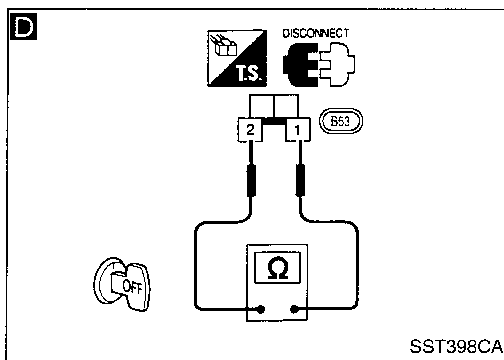
SYMPTOM:

HICAS motor power supply is not present. (Code No. 12)



SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)



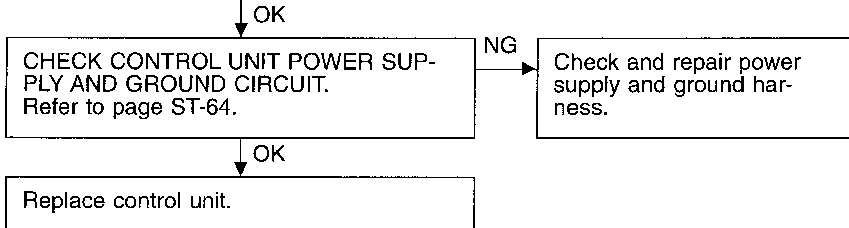
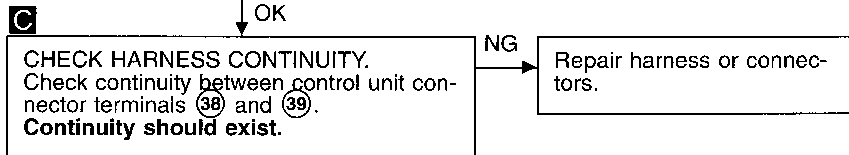
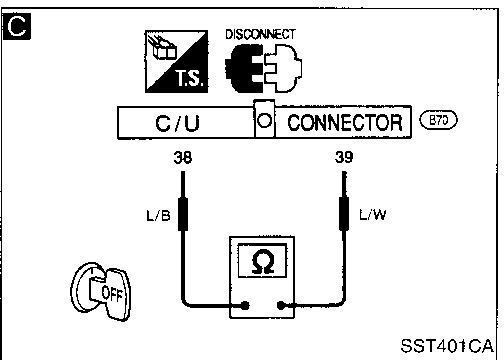
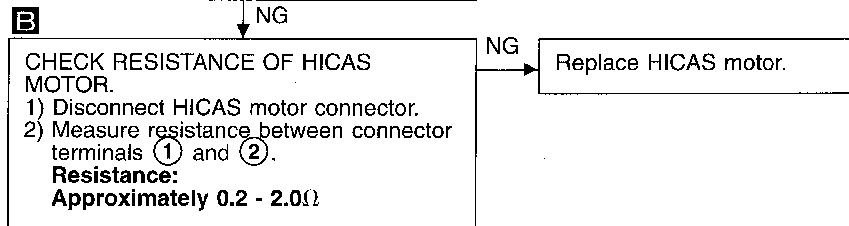
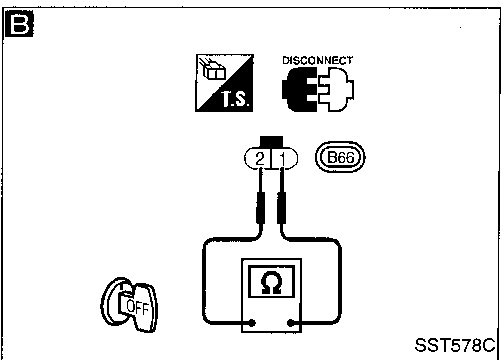
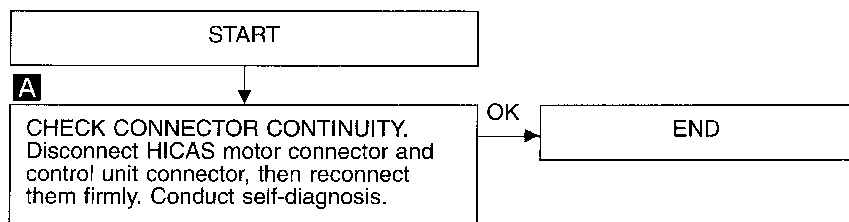
DIAGNOSTIC PROCEDURE 9

SYMPTOM:

HICAS motor output is not present. (Code No. 13)

CAUTION:

If "MOTOR LOCK" is displayed on CONSULT, replace actuator assembly.



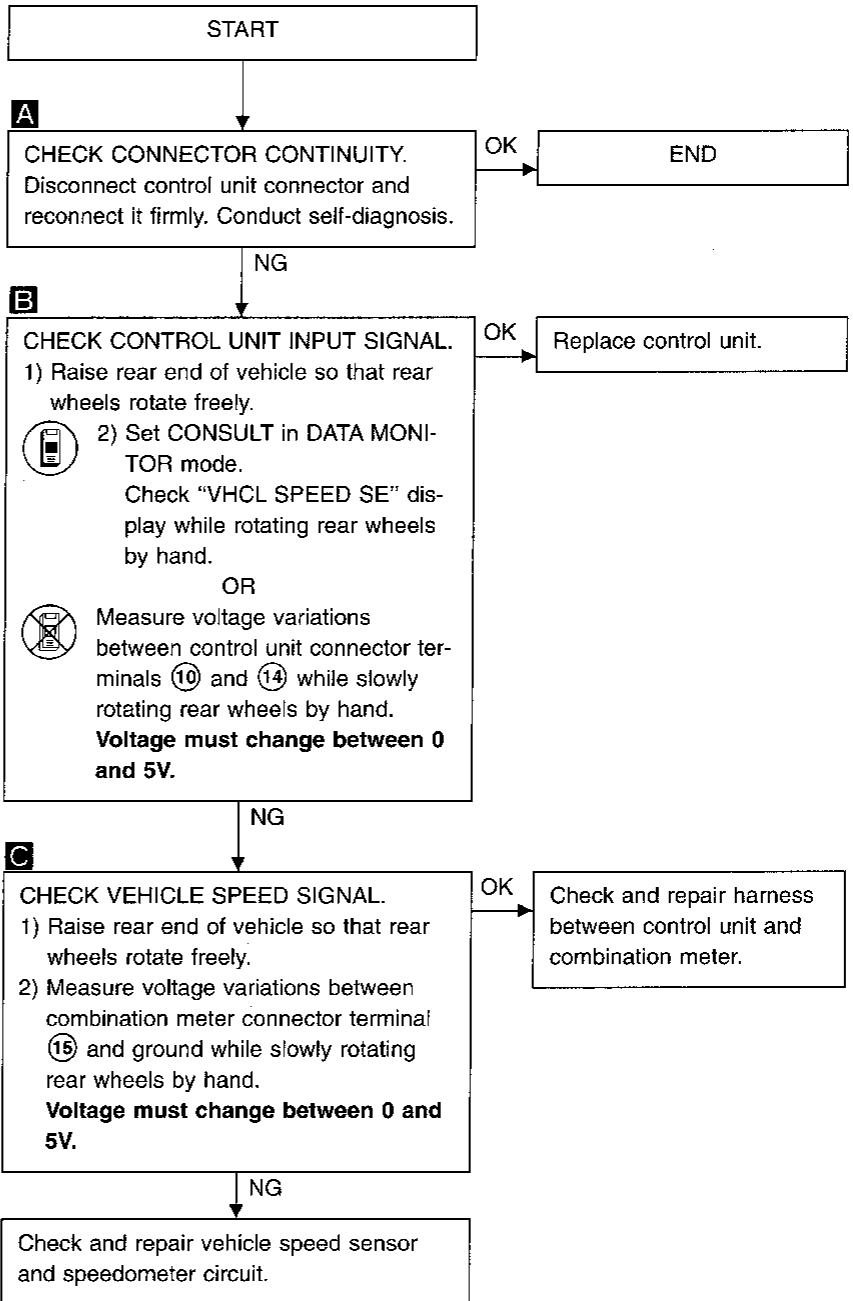
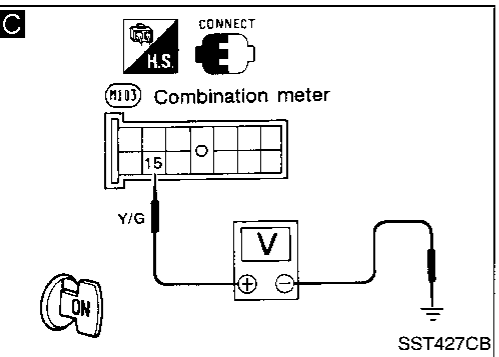
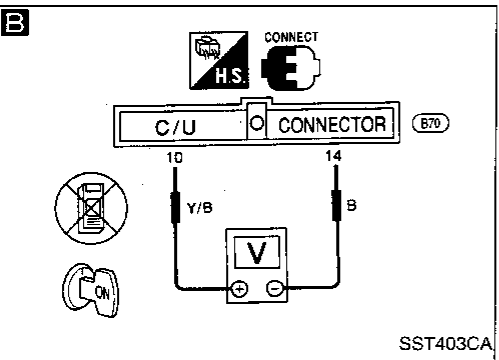
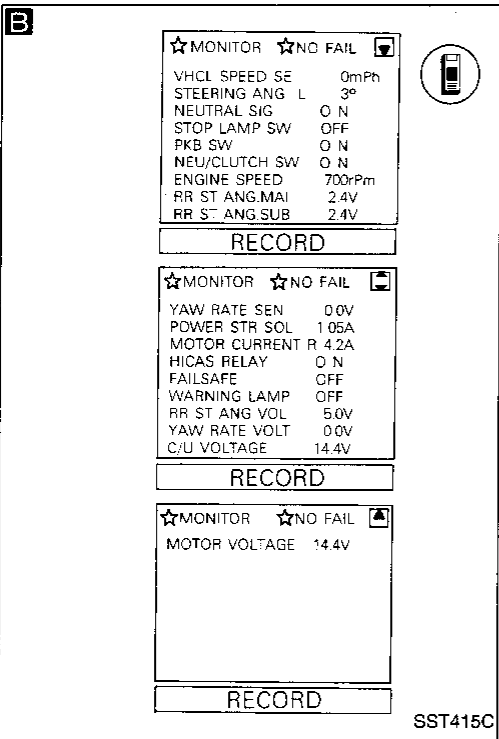
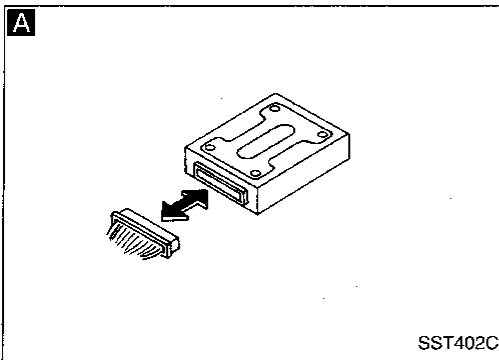
SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)

DIAGNOSTIC PROCEDURE 10

SYMPTOM:

Vehicle speed signal is not present. (Code No. 21)



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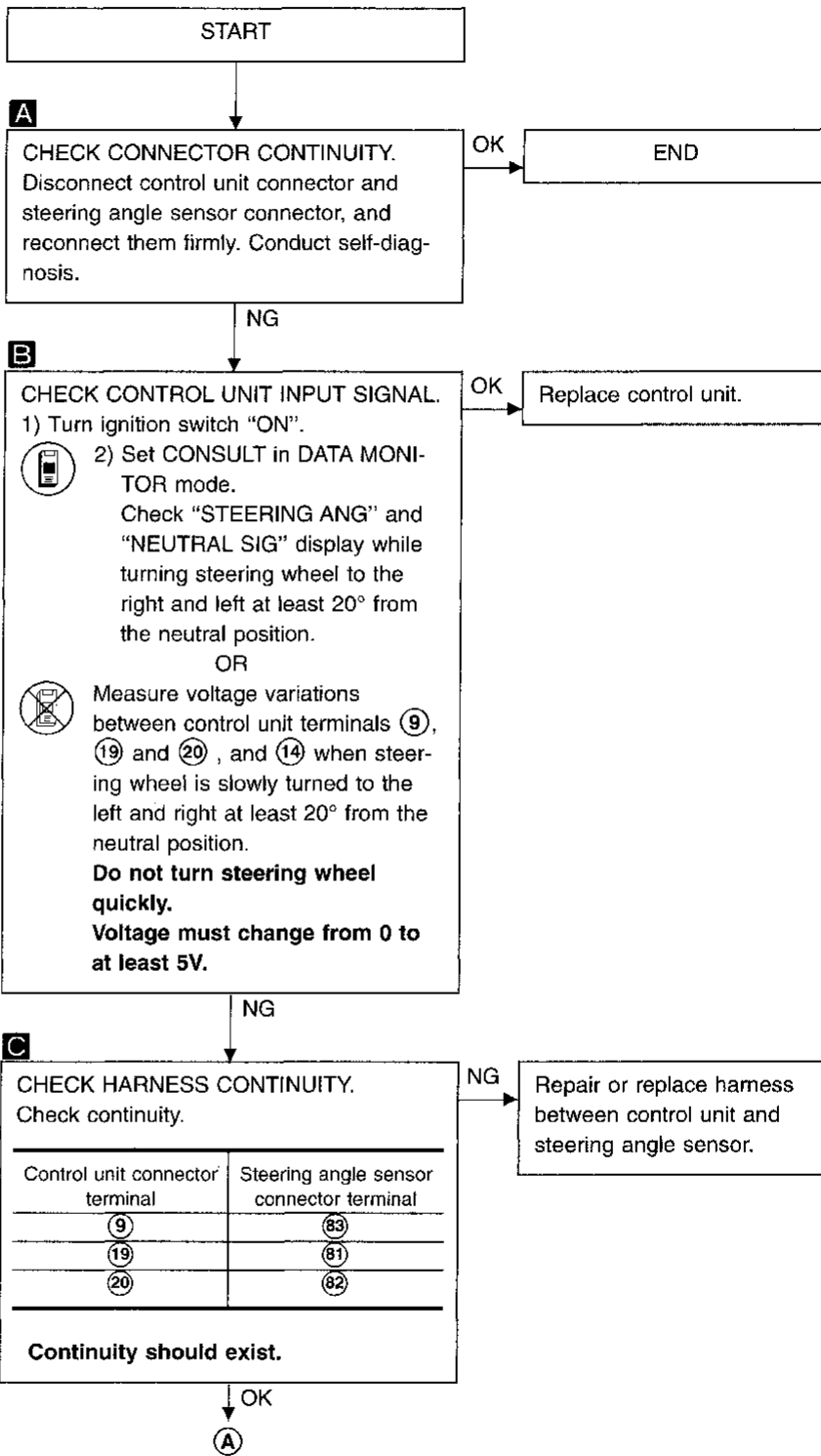
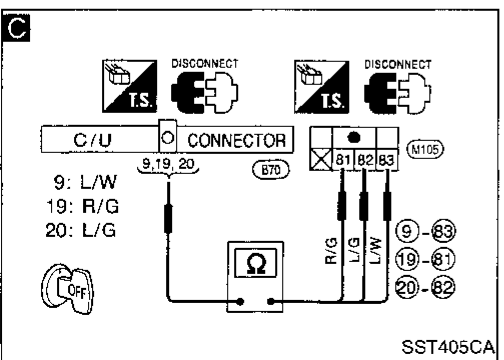
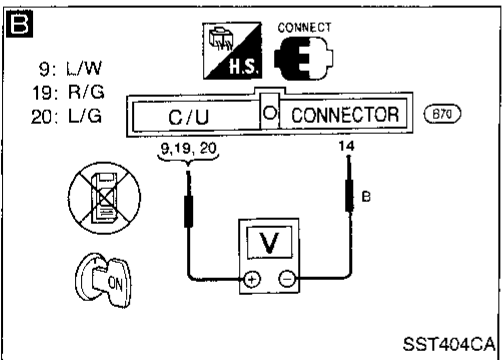
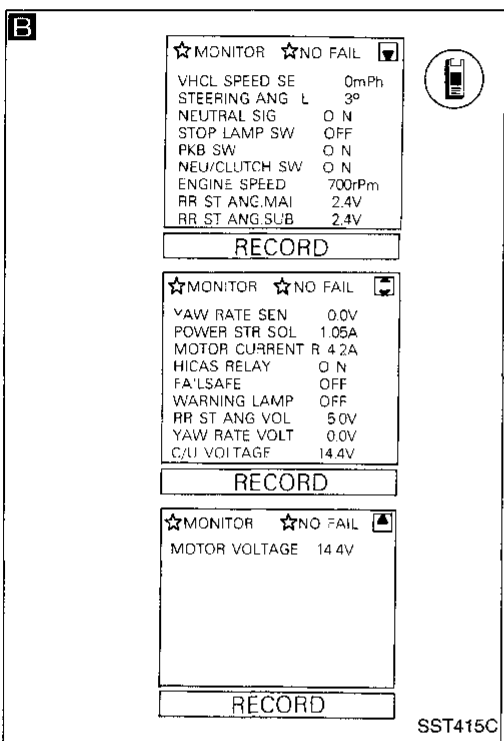
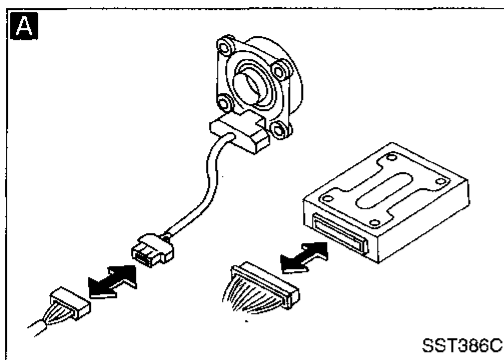
SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)

DIAGNOSTIC PROCEDURE 11

SYMPTOM:

Steering angle sensor input is not present. (Code No. 22, 23)

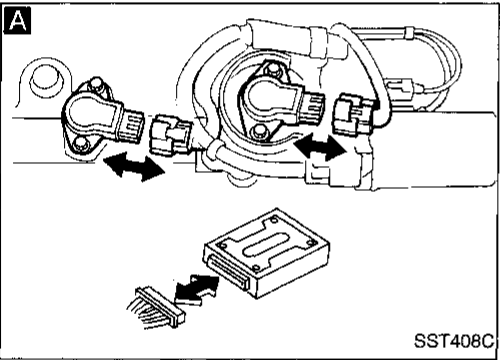
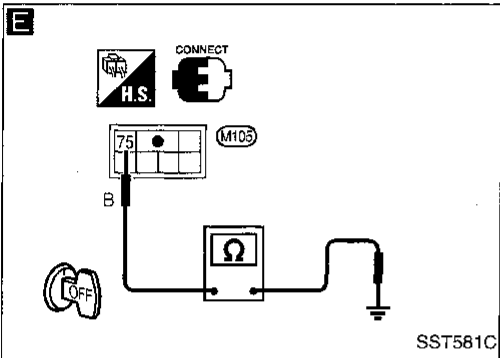
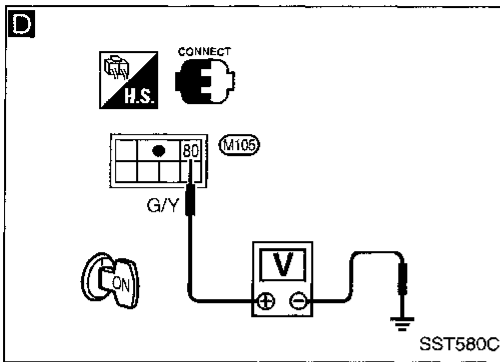


Control unit connector terminal	Steering angle sensor connector terminal
9	83
19	81
20	82

Continuity should exist.

SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)



D CHECK STEERING ANGLE SENSOR POWER SUPPLY.

- 1) Turn ignition switch "ON".
- 2) Measure voltage across steering angle sensor connector terminal ⑧ and ground.

Voltage:
Approximately 12V

E CHECK STEERING ANGLE SENSOR GROUND CIRCUIT.

Check continuity between steering angle sensor terminal ⑦ and body metal (ground).

Continuity should exist.

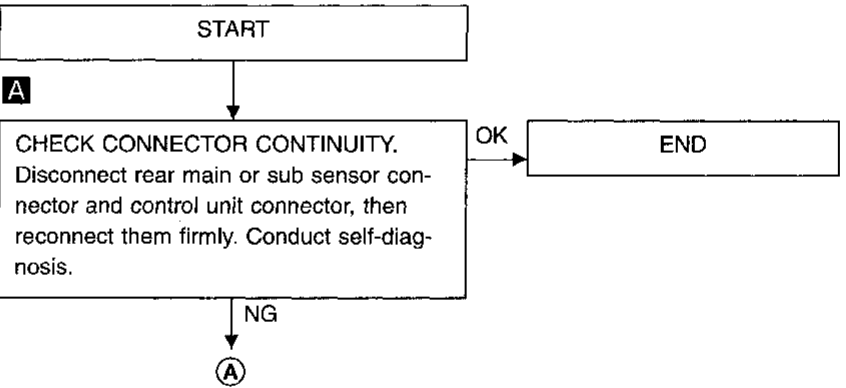
OK → Replace steering angle sensor.

NG → Repair steering angle sensor power supply and ground circuit.

DIAGNOSTIC PROCEDURE 12

SYMPTOM:

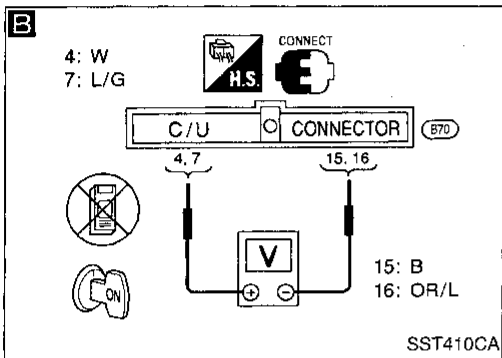
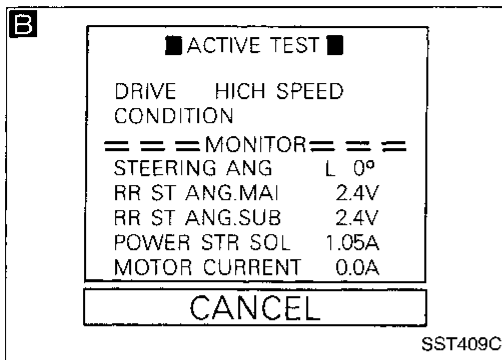
Rear main or sub sensor input is not present. (Code No. 24: main sensor, 25: sub sensor)



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SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)



(A)

B

CHECK CONTROL UNIT INPUT SIGNAL.

OK → Replace control unit.

- 1) Set CONSULT in ACTIVE TEST mode.
- 2) Touch SELECTION FROM MENU.
- 3) While monitoring steering angle sensor and rear main or sub sensor, turn steering wheel right and left 90° from neutral. Read rear main or sub sensor signal each time the steering wheel is turned.

Neutral position:
Approximately 2.4V

Left 90° from the neutral position:
Approximately 0.5V

Right 90° from the neutral position:
Approximately 4.4V

OR

- 1) Set in self-diagnosis mode.
- 2) Turn steering wheel right and left 180° from neutral. Check voltage between terminals (4) and (15), and between (7) and (16) of control unit each time steering wheel is turned.

Neutral position:
Approximately 2.44V

Left 180° from the neutral position:
Approximately 0.49V

Right 180° from the neutral position:
Approximately 4.43V

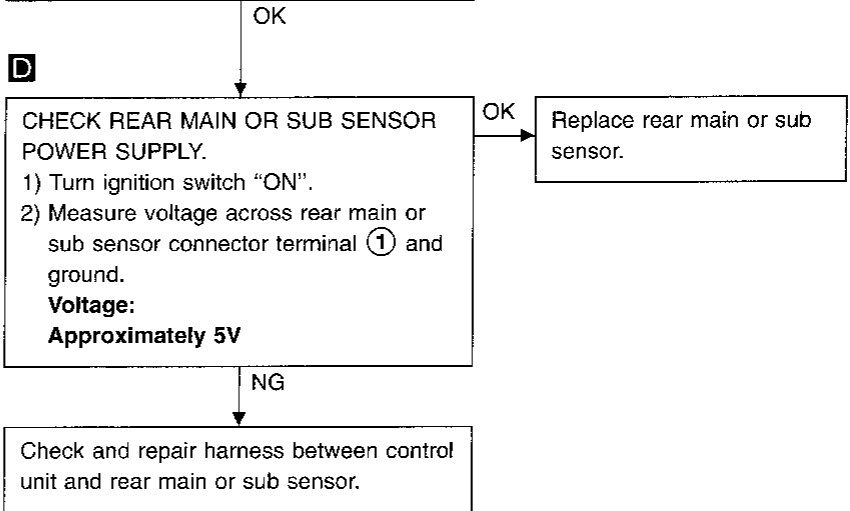
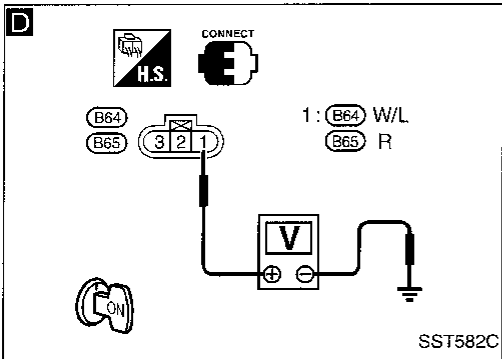
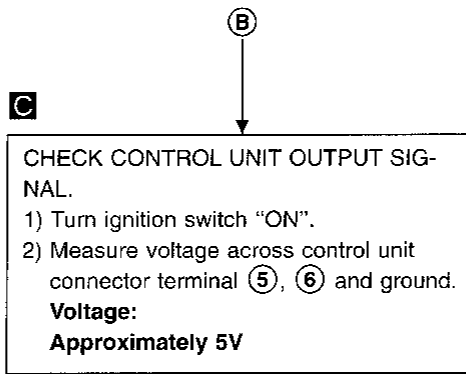
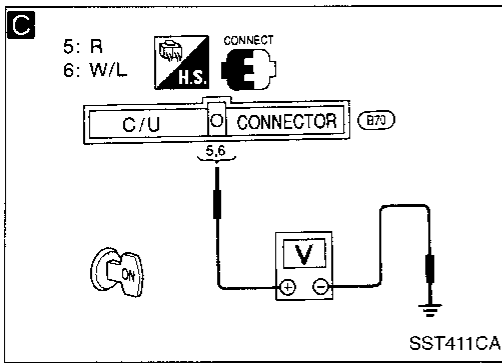
The potential difference must not exceed 1V between main and sub sensors.

NG

(B)

SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)



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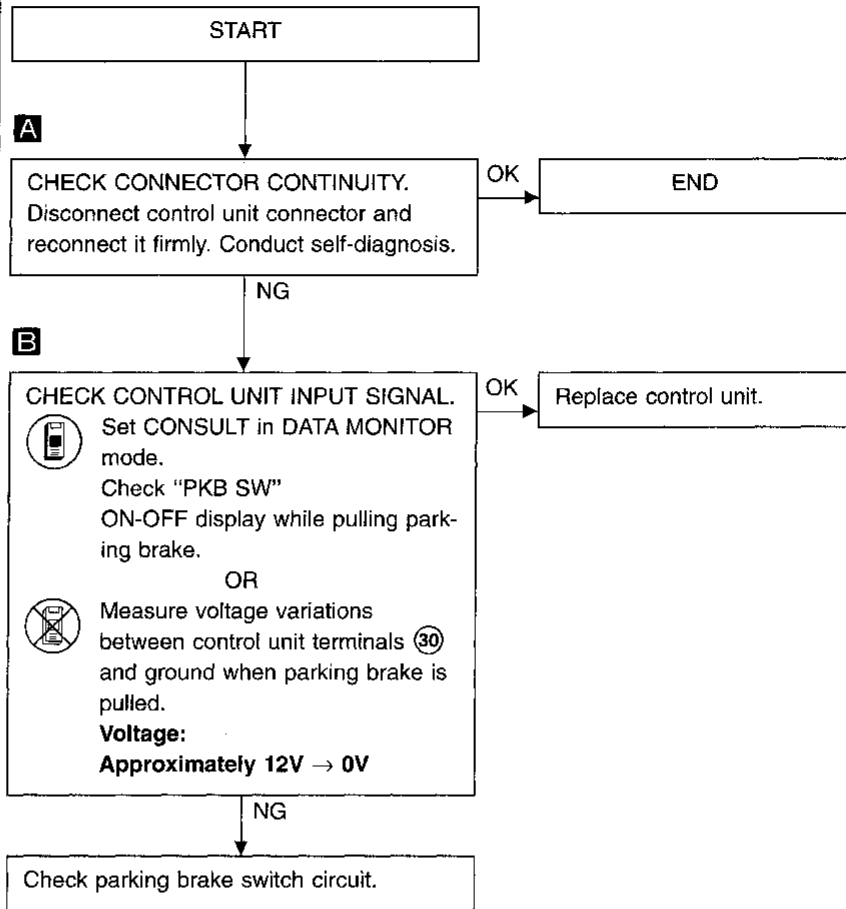
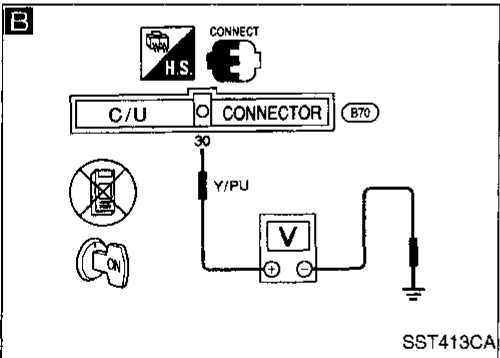
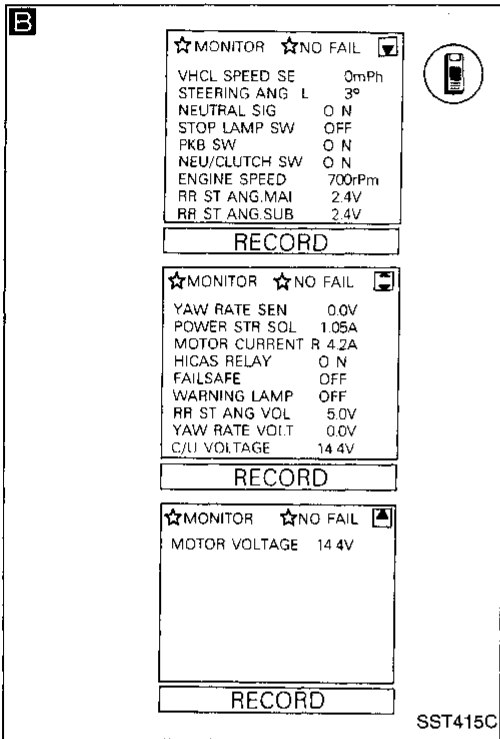
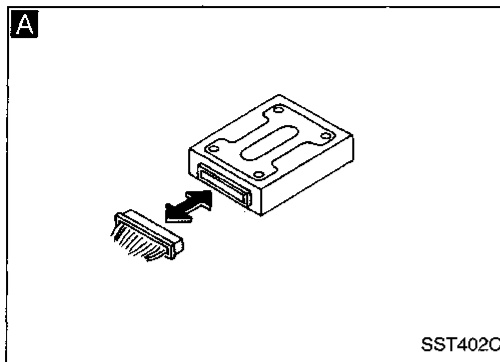
SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)

DIAGNOSTIC PROCEDURE 13

SYMPTOM:

Parking brake input is not present. (Code No. 31)



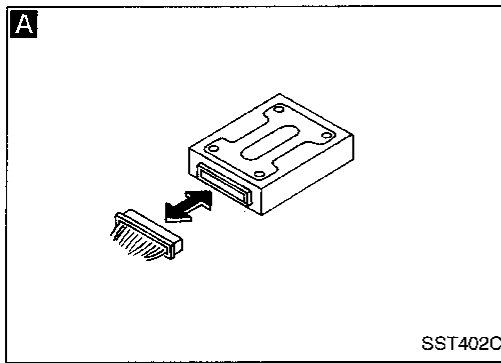
SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)

DIAGNOSTIC PROCEDURE 14

SYMPTOM:

Inhibitor switch (A/T) or neutral position switch and clutch switch (M/T) input is not present. (Code No. 32)



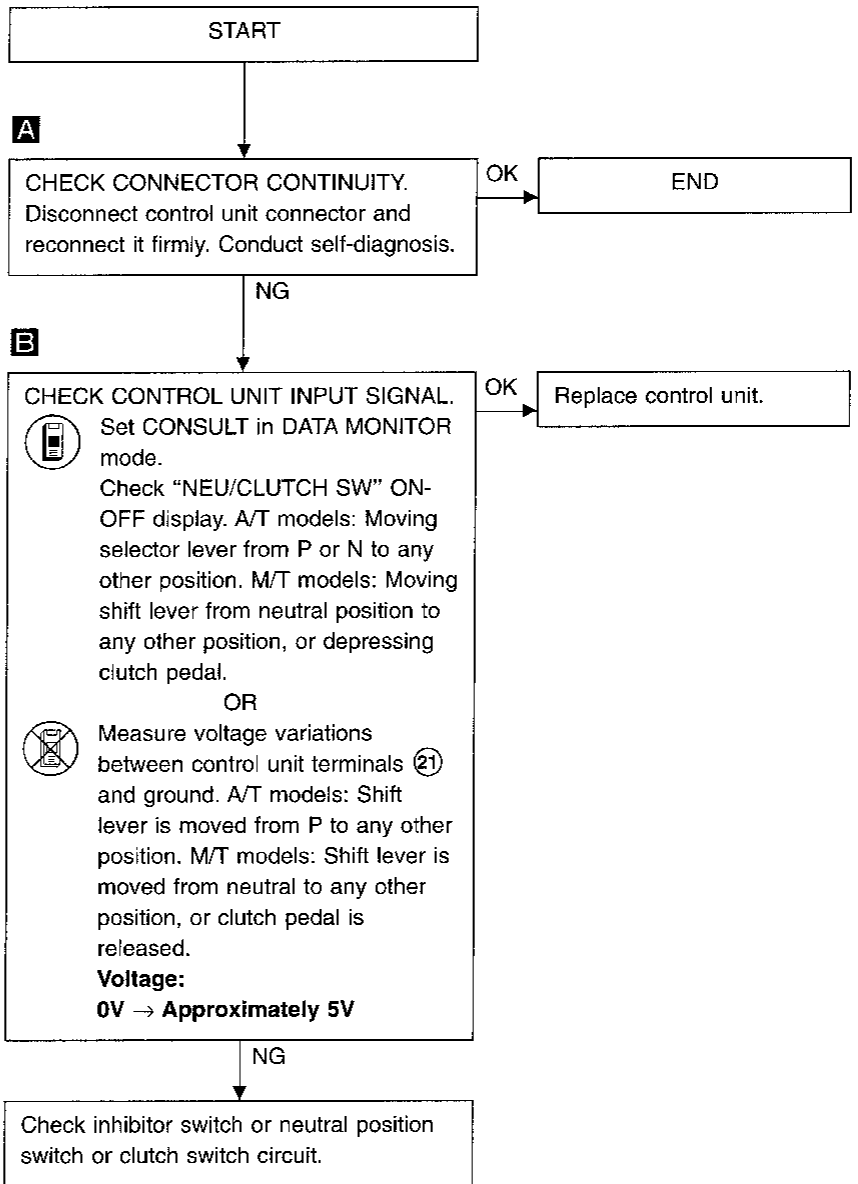
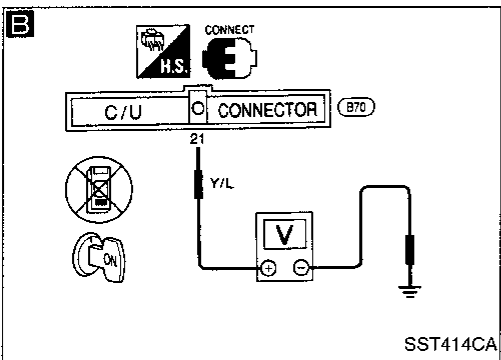
B

☆ MONITOR ☆ NO FAIL	▼
VHCL SPEED SE	0mPh
STEERING ANG L	3°
NEUTRAL SIG	O N
STOP LAMP SW	OFF
PKB SW	O N
NEU/CLUTCH SW	O N
ENGINE SPEED	700rPm
RR ST ANG MAI	2.4V
RR ST ANG SUB	2.4V
RECORD	

☆ MONITOR ☆ NO FAIL	▶
YAW RATE SEN	0.0V
POWER STR SOL	1.05A
MOTOR CURRENT R	4.2A
HICAS RELAY	O N
FAILSAFE	OFF
WARNING LAMP	OFF
RR ST ANG VOL	5.0V
YAW RATE VOLT	0.0V
C/U VOLTAGE	14.4V
RECORD	

☆ MONITOR ☆ NO FAIL	▲
MOTOR VOLTAGE	14.4V
RECORD	

SST415C



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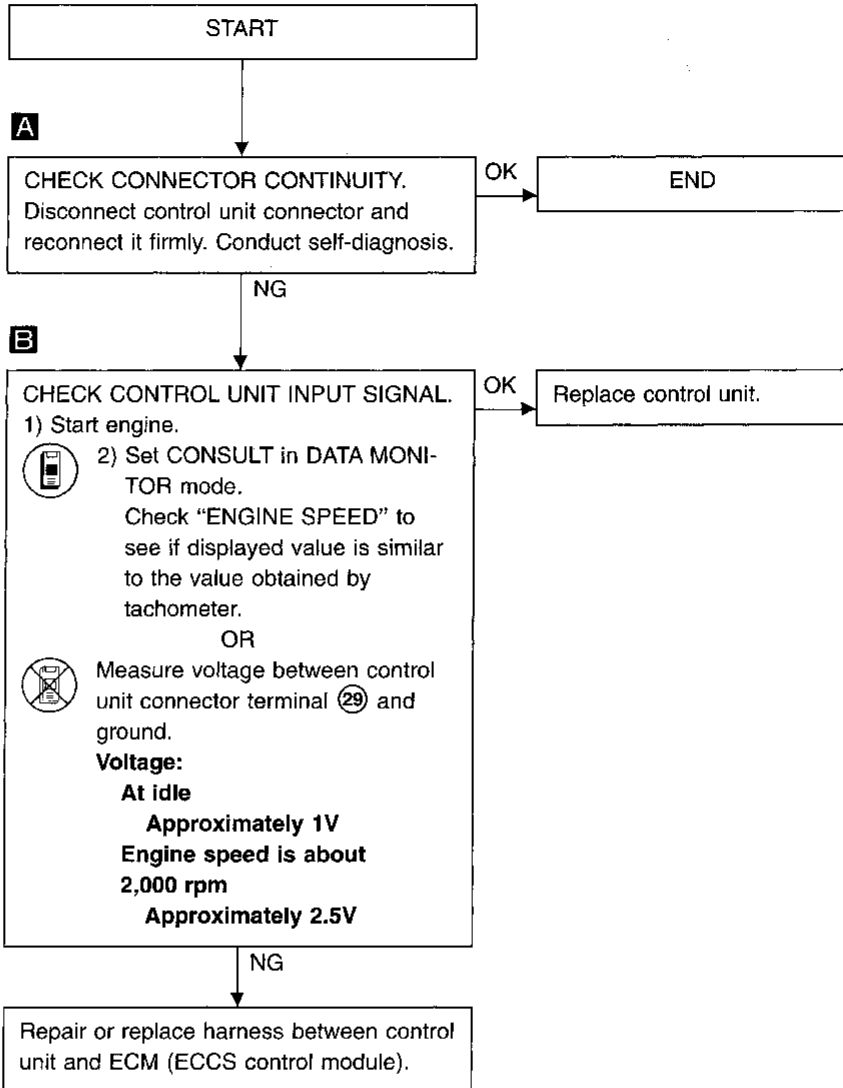
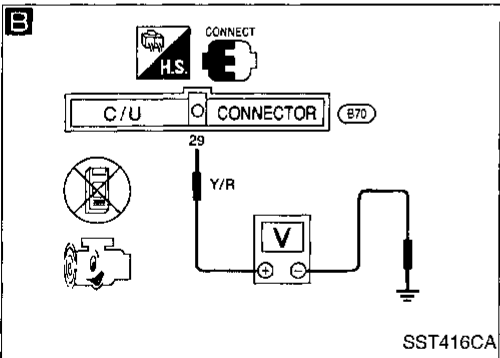
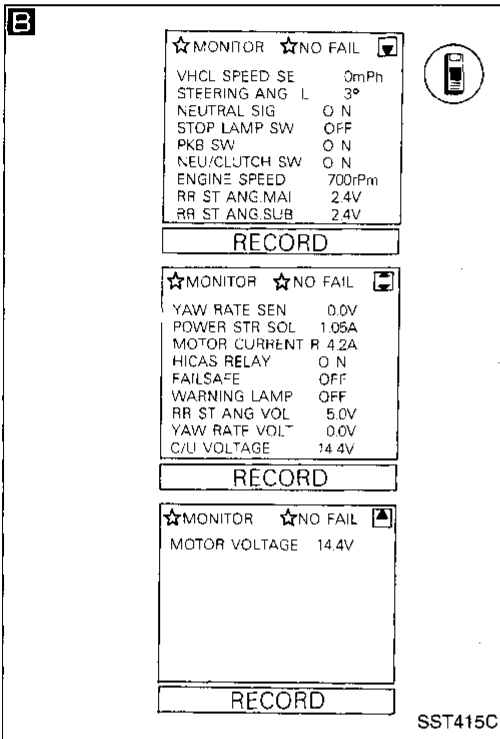
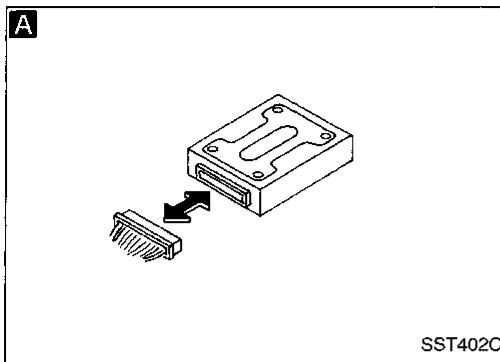
SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)

DIAGNOSTIC PROCEDURE 15

SYMPTOM:

Engine speed signal is not present. (Code No. 33)



SUPER HICAS SYSTEM

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:

*Data are reference values.

Terminal No.	Application	*Data	
4	Rear main sensor signal	Neutral position: Approximately 2.44V	GI
5	Rear main sensor power supply	Ignition switch ON: Approximately 5V Ignition switch in other position: 0V	WA
6	Rear sub sensor power supply	Ignition switch ON: Approximately 5V Ignition switch in other position: 0V	EM
7	Rear sub sensor signal	Neutral position: Approximately 2.44V	
9	Steering neutral position sensor	Neutral position: Approximately 5V	
10	Vehicle speed signal	Rear wheel rotating 0V ↔ greater than 5V (approx.), intermittent	LC
14	Ground	0V	EC
15	Rear main sensor ground	0V	
16	Rear sub sensor ground	0V	
19	Steering angle sensor-1 signal	Steering wheel turned 0V ↔ Approximately 5V, intermittent	FE
20	Steering angle sensor-2 signal	Steering wheel turned 0V ↔ Approximately 5V, intermittent	CL
21	Inhibitor switch signal (A/T), Neutral position signal (M/T), Clutch switch signal (M/T)	Shift lever in any position other than parking (A/T) or neutral (M/T): Approximately 5V Clutch disengaged (M/T): Approximately 5V	MT
22	Stop lamp switch signal	Brake ON: Approximately 12V Brake OFF: 0V	AT
23	Data link connector	—	
24	Data link connector	—	
25	HICAS relay output	Ignition switch ON: Approximately 12V (Fail-safe operation: 0V)	PD
26	HICAS warning lamp	Lamp ON: 0V Lamp OFF: Approximately 12V	FA
27	IGN power supply	Ignition switch ON: Approximately 12V	RA
28		Ignition switch in other position: 0V	
29	Engine speed (ECM) signal	At idle: Approximately 1V Engine speed is about 2,000 rpm: Approximately 2.5V	
30	Parking brake signal	Parking brake engaged: 0V Parking brake released: Approximately 12V	BR
33	Data link connector	—	
34	Ground	0V	ST
35	Battery	Approximately 12V	
36	Power steering output	Vehicle speed 0 km/h (0 MPH): Approximately 1.05A Vehicle speed 100 km/h (62 MPH): Approximately 0.43A	RS
37	HICAS motor power supply	Ignition switch ON: Approximately 12V (Fail-safe operation: 0V)	BT
38	Resistance of HICAS motor	Approximately 0.2 - 2.0Ω	HA
39			
40	HICAS motor ground	0V	

EL

IDX

SUPER HICAS SYSTEM

Trouble Diagnoses (Cont'd)



X	X	X	4	5	6	7	X	9	10	21	22	23	24	25	26	27	28				
X	X	X	14	15	16	X	X	19	20	29	30	X	X	33	34	35	36	37	38	39	40

SST417C

SERVICE DATA AND SPECIFICATIONS (SDS)

General Specifications

	Without SUPER HICAS	With SUPER HICAS
Steering model	Power steering	
Steering gear type	PR26AE	
Steering overall gear ratio	16.9	14.8
Turn of steering wheel (Lock to lock)	2.7	2.4
Steering column type	Collapsible	

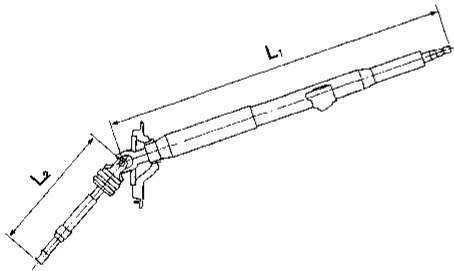
Inspection and Adjustment

STEERING WHEEL

Steering wheel axial play mm (in)	0 (0)
Steering wheel play mm (in)	0 - 35 (0 - 1.38)

STEERING COLUMN

Steering column length "L ₁ " mm (in)	749.4 - 751.0 (29.50 - 29.57)
Steering column lower shaft length "L ₂ " mm (in)	280.6 - 282.2 (11.05 - 11.11)

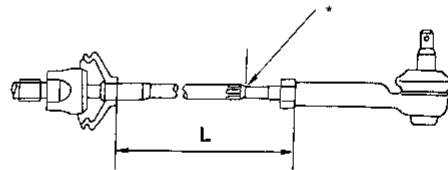


SST315B

STEERING GEAR AND LINKAGE

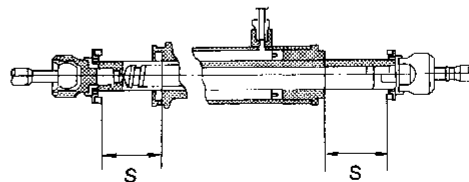
Steering gear type	PR26AE
Tie-rod outer ball joint	
Swinging force "A" (at cotter pin hole) N (kg, lb)	4.61 - 46.09 (0.47 - 4.7, 1.04 - 10.36)
Rotating torque "B" N·m (kg·cm, in·lb)	0.29 - 2.94 (3.0 - 30.0, 2.6 - 26.0)
Axial end play "C" mm (in)	0 (0)
Tie-rod inner ball joint	
Swinging force* "A" N (kg, 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)	155 (6.10)

*: Measuring point



SST161CA

Rack stroke "S" mm (in)	59.5 (2.343)
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SST307BA

SERVICE DATA AND SPECIFICATIONS (SDS)

Inspection and Adjustment (Cont'd)

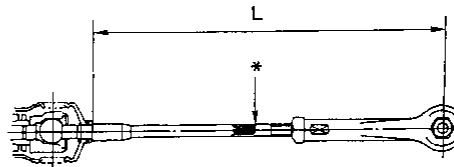
POWER STEERING

	Without SUPER HICAS	With SUPER HICAS
Rack sliding force N (kg, lb)		
Under normal operating oil pressure		
Range within ± 11.5 mm (± 0.453 in) from the neutral position	206 - 265 (21 - 27, 46 - 60)	201 - 250 (20.5 - 25.5, 45.2 - 56.2)
Except above range	Not more than 294 (30, 66) beyond above value	
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	0.2 (2, 1.7)	
Tightening torque after gear has settled	4.9 (50, 43)	
Returning angle degree	60° - 100°	
Steering wheel turning force (Measured at one full turn from the neutral position) N (kg, lb)	39 (4, 9) or less	
Fluid capacity (Approximate) l (US qt, Imp qt)	1.3 (1-3/8, 1-1/8)	
Oil pump maximum pressure kPa (kg/cm ² , psi)	7,649 - 8,238 (78 - 84, 1,109 - 1,194)	

POWER CYLINDER LOWER LINK (SUPER HICAS)

Power cylinder lower link ball joint		
Swinging force* N (kg, lb)		2.9 - 41.2 (0.3 - 4.2, 0.7 - 9.3)
Axial end play mm (in)		0 (0)
Power cylinder lower link standard length "L" mm (in)		290.4 (11.43)
Stroke mm (in)		3.0 (0.118)

*: Measuring point



SST486B