

# STEERING SYSTEM

## SECTION **ST**

GI

MA

EM

LC

EF &  
EC

FE

CL

MT

AT

PD

FA

RA

BR

**ST**

BF

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EL

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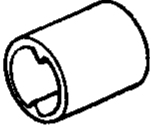
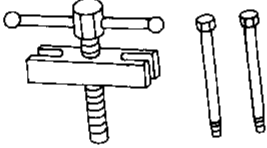
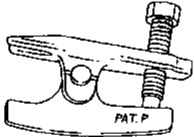
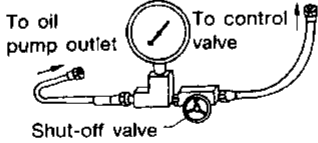
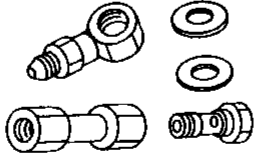
# PRECAUTIONS AND PREPARATION

## Precautions

- 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.
- When disassembling parts, be sure to place them in order in a parts rack so they can be reinstalled in their proper positions.
- 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 A.T.F.\* to hydraulic parts. Vaseline may be applied to O-rings and seals. Do not use any grease.
- Replace all gaskets, seals and O-rings. Avoid damaging O-rings, seals and gaskets during installation. Perform functional tests whenever designated.

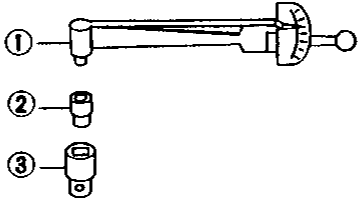
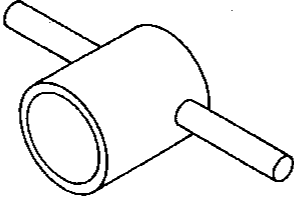
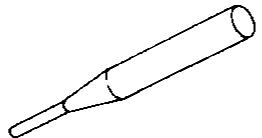
\*: Automatic transmission fluid

## Special Service Tools

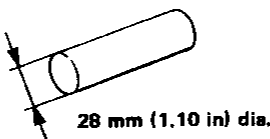
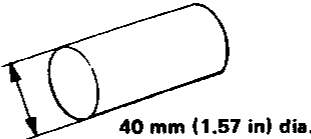
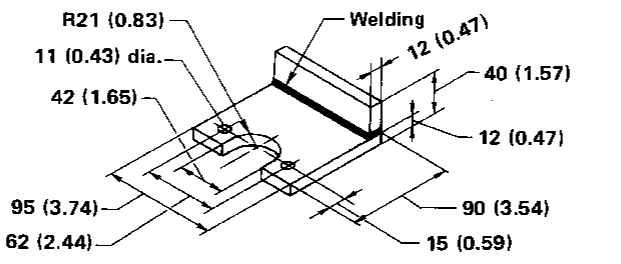
Tool number (Kent-Moore No.) Tool name	Description	
KV48100700 (J26364) Torque adapter		Measuring pinion rotating torque
ST27180001 (J25726-A) Steering wheel puller		Removing and installing steering wheel
HT72520000 (J25730-A) Ball joint remover		Removing ball joint
ST27091000 (J26357) Pressure gauge		Measuring oil pressure
KV48102500 ( — ) Pressure gauge adapter		Measuring oil pressure

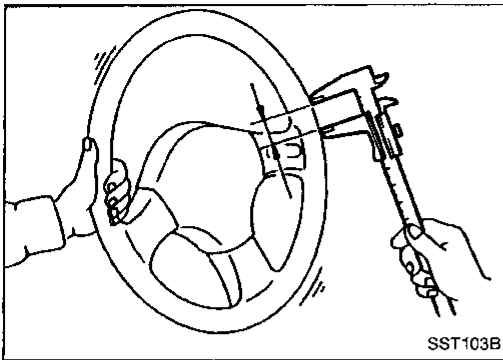
# PRECAUTIONS AND PREPARATION

## Special Service Tools (Cont'd)

Tool number (Kent-Moore No.) Tool name	Description	
ST327S000 (See J25765-A) ① GG91030000 (J25765-A) Torque wrench ② HT62940000 ( — ) Socket adapter ③ HT62900000 ( — ) Socket adapter	 <p>① ② ③</p>	Measuring turning torque        GI         MA         EM         LC
KV48104400 ( — ) Rack seal ring reformer		Reforming teflon ring         EF & EC         FE
KV32101100 ( — ) Pin punch		Removing and installing tube seat         CL         MT

## Commercial Service Tools

Tool name	Description	
Rear oil seal drift	 <p>28 mm (1.10 in) dia.</p>	Installing rear oil seal         PD         FA
Pinion oil seal drift	 <p>40 mm (1.57 in) dia.</p>	Installing pinion oil seal         RA         BR
Oil pump attachment	 <p>Unit: mm (in)</p> <p style="text-align: right;">SST481A</p>	Disassembling and assembling oil pump         <span style="background-color: black; color: white; padding: 2px;">ST</span>         BF         HA         EL

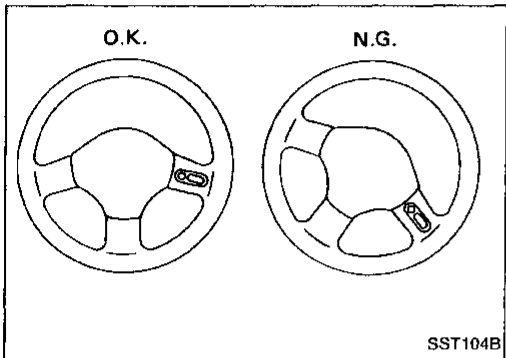


## Checking Steering Wheel Play

1. With wheels in a straight-ahead position, check steering wheel play.

**Steering wheel play:**  
**35 mm (1.38 in) or less**

2. If it is not within specification, check steering gear assembly when front suspension and axle, steering gear assembly and steering column are mounted correctly.



## Checking Neutral Position on Steering Wheel

### Pre-checking

- Make sure that wheel alignment is correct.

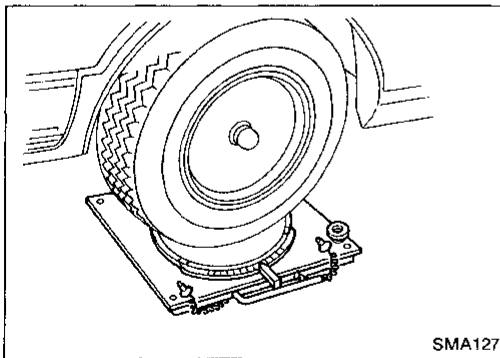
**Wheel alignment:**

**Refer to section FA for S.D.S.**

- Verify that the steering gear is centered before removing the steering wheel.

### Checking

- Check that the steering wheel is in the neutral position when driving straight ahead.
- If it is not in the neutral position, remove the steering wheel and reinstall it correctly.
- If the neutral position is between two serrated teeth, loosen tie-rod lock nut and move tie-rod in the opposite direction by the same amount on both left and right sides to compensate for error in the neutral position.

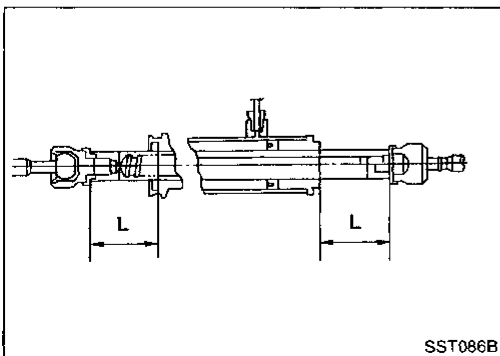


## Front Wheel Turning Angle

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

**Turning angle of full turns:**

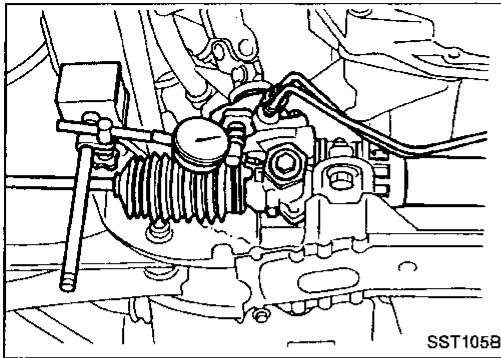
**Refer to section FA for S.D.S.**



- If it is not within specification, check rack stroke.

**Measured length "L":**

**Refer to S.D.S.**



## 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:

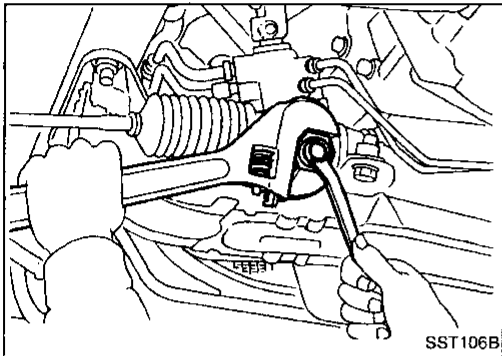
$\pm 2 \text{ mm } (\pm 0.08 \text{ in})$  or less

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

GI

MA

EM



## 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.

LC

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## Checking and Adjusting Drive Belts

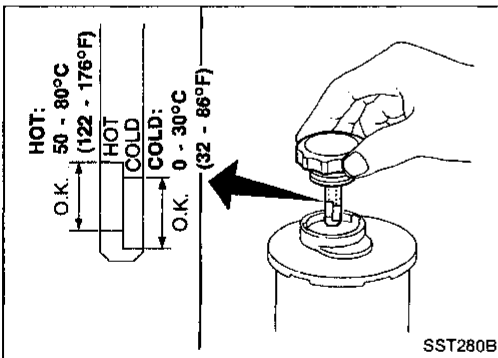
Refer to section MA for Drive Belt Inspection.

MT

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PD

FA



## Checking Fluid Level

Check fluid level.

Fluid level should be checked using "HOT" range on dipstick at fluid temperatures of 50 to 80°C (122 to 176°F) or using "COLD" range on dipstick at fluid temperatures of 0 to 30°C (32 to 86°F).

### CAUTION:

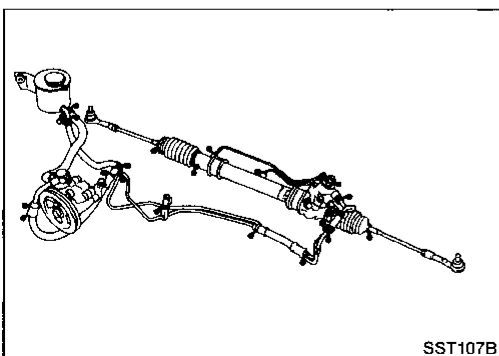
- Do not overfill.
- Recommended fluid is Automatic Transmission Fluid "DEXRON™ II" type.

RA

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## Checking Fluid Leakage

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

1. Run engine at idle speed or 1,000 rpm.

**Make sure temperature of fluid in oil tank rises to 60 to 80°C (140 to 176°F).**

2. Turn steering wheel right-to-left several times.
3. Hold steering wheel at each "lock" position for five seconds and carefully check for fluid leakage.

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## ON-VEHICLE SERVICE

### Checking Fluid Leakage (Cont'd)

#### CAUTION:

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

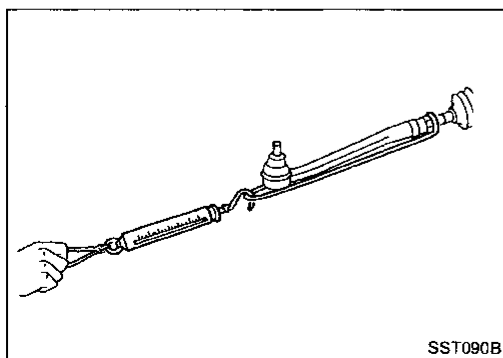
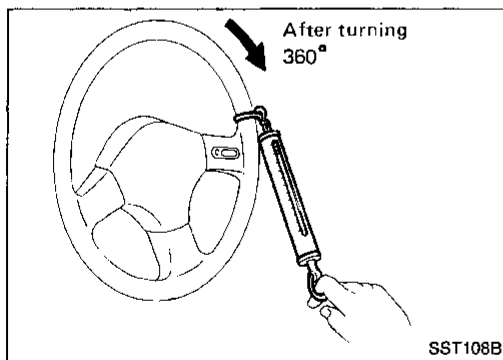
4. If fluid leakage at connectors is noticed, loosen flare nut and then retighten.

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

### Bleeding Hydraulic System

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

While the vehicle is stationary or while turning the steering wheel slowly, fluid noise may occur in the valve or oil pump. This noise is inherent in this steering system, and it will not affect performance or durability of the system.



### Checking Steering Wheel Turning Force

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

**Tires need to be inflated to normal pressure.**

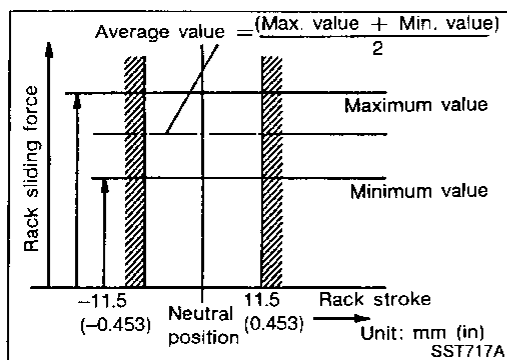
4. Check steering wheel turning force when steering wheel has been turned 360° from the neutral position.

**Steering wheel turning force:**

**39 N (4 kg, 9 lb) or less**

5. If steering wheel turning force is out of specifications, check rack sliding force to detect condition of steering gear assembly.
  - 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. While pulling tie-rod slowly in the  $\pm 11.5$  mm ( $\pm 0.453$  in) range from the neutral position, make sure rack sliding force is within specification.

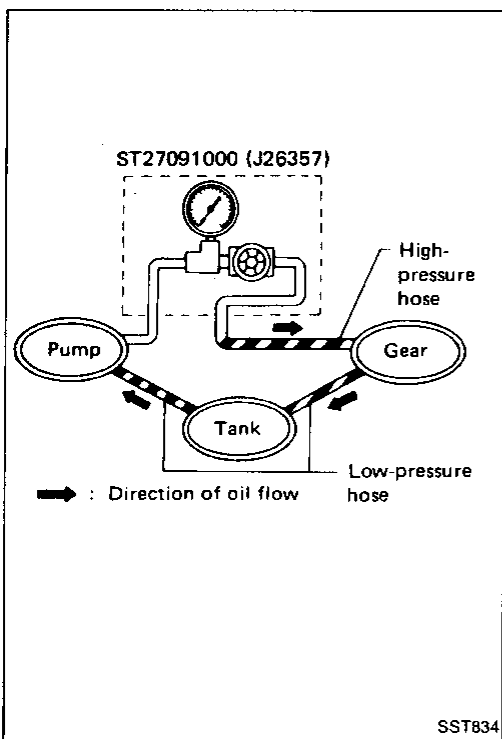
## Checking Steering Wheel Turning Force (Cont'd)



### Average rack sliding force:

167 - 226 N (17 - 23 kg, 37 - 51 lb)

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



## Checking Hydraulic System

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

- Set Tool. Open shut-off valve. Then bleed air. (See "Bleeding Hydraulic System".)
- 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, oil pressure in oil pump will increase to relief pressure, resulting in an abnormal rise in oil temperature.

- 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.

Refer to S.D.S.

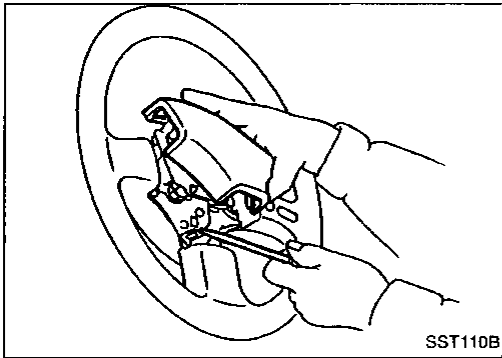
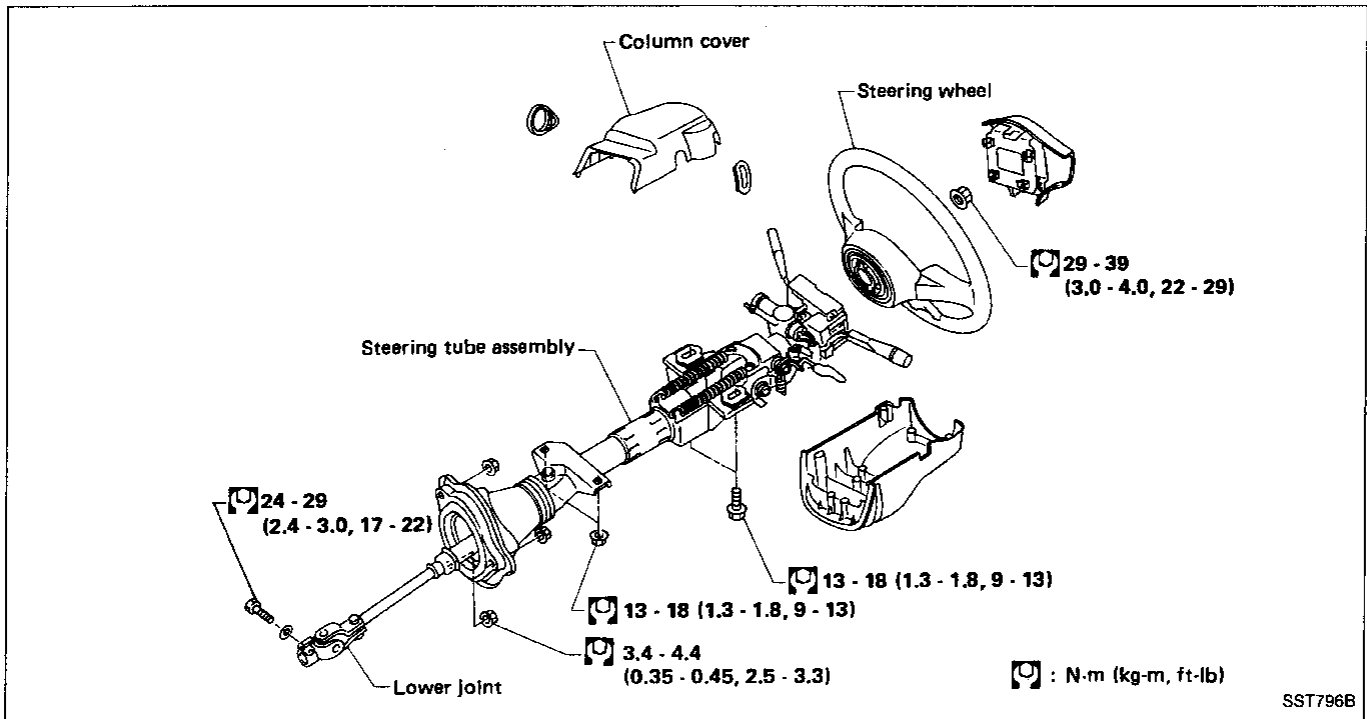
- If oil pressure is below the standard pressure, slowly close shut-off valve and check pressure.
  - When pressure reaches standard pressure, gear is damaged.
  - When pressure remains below standard pressure, pump is damaged.

### CAUTION:

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

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

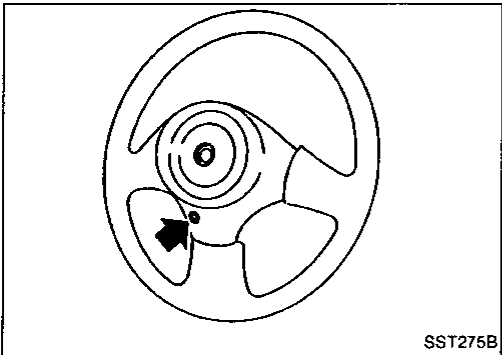
# STEERING WHEEL AND STEERING COLUMN



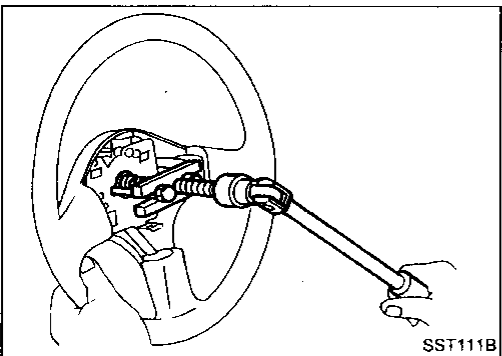
## Removal

### STEERING WHEEL

- Pull out horn pad.



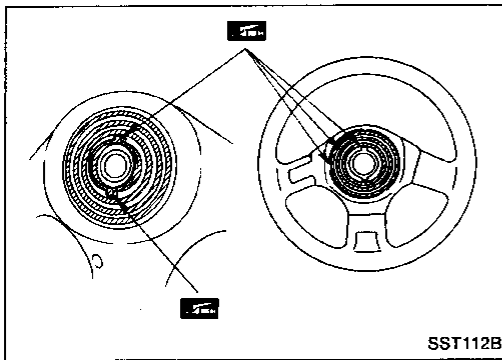
If it is hard to pull out horn pad, temporarily loosen fixing screw of horn pad retaining spring.



- Remove steering wheel with Tool.



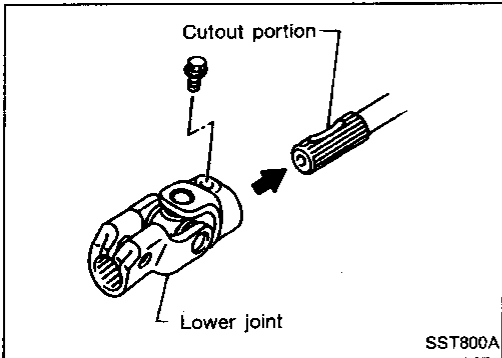
# STEERING WHEEL AND STEERING COLUMN



## Installation

### STEERING WHEEL

When installing steering wheel, apply multi-purpose grease to entire surface of turn signal cancel pin (both portions) and also to horn contact slip ring.



### 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:

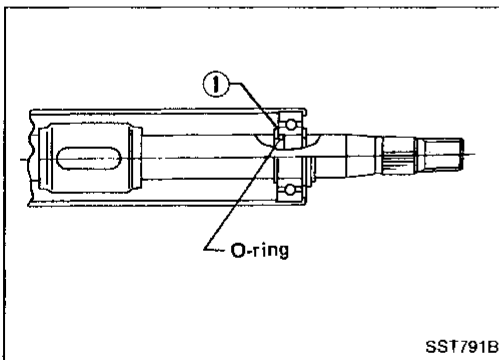
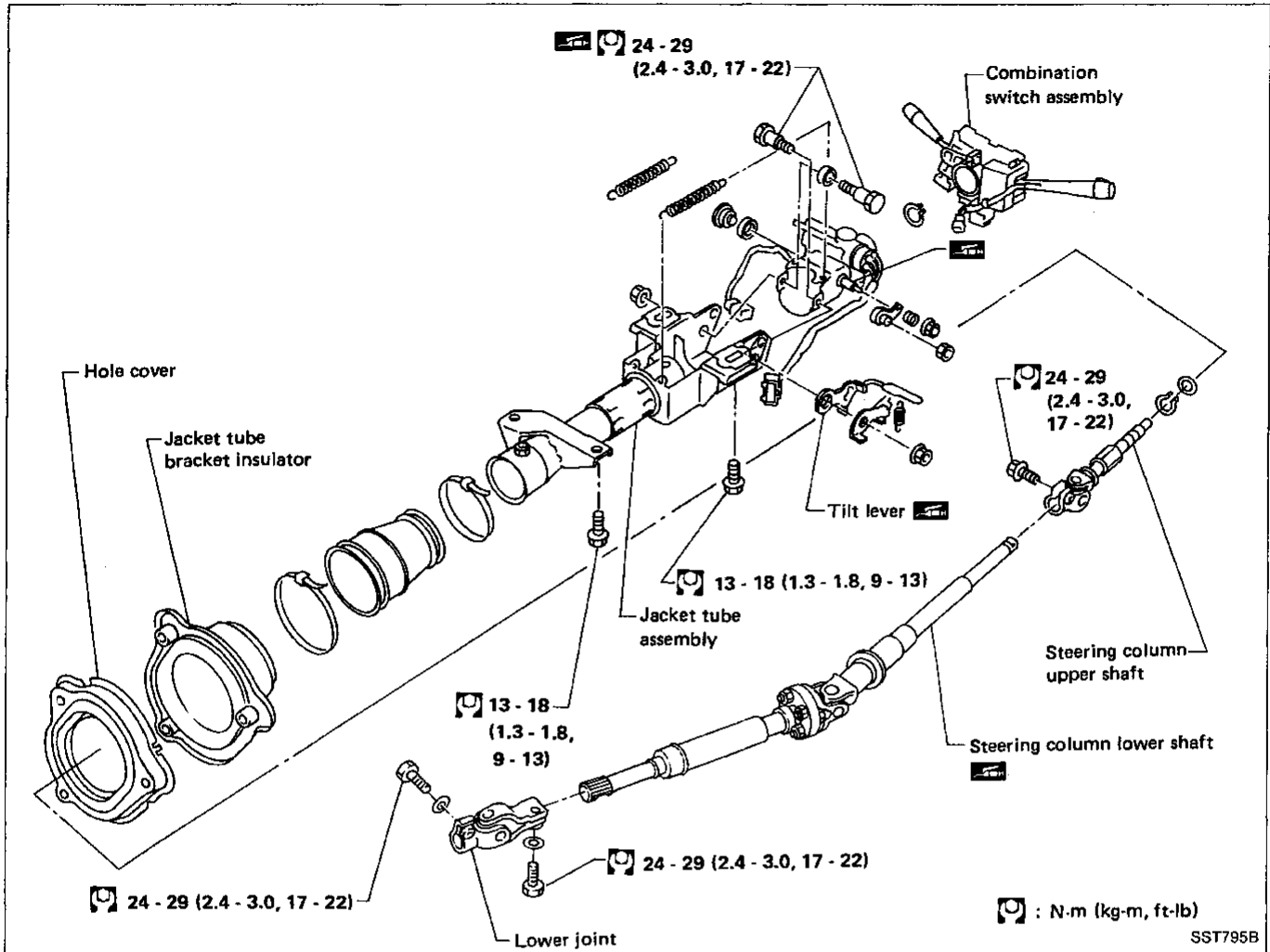
After installing steering column, turn steering wheel to make sure it moves smoothly and that the number of turns from the straight forward position to left and right locks are equal.

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

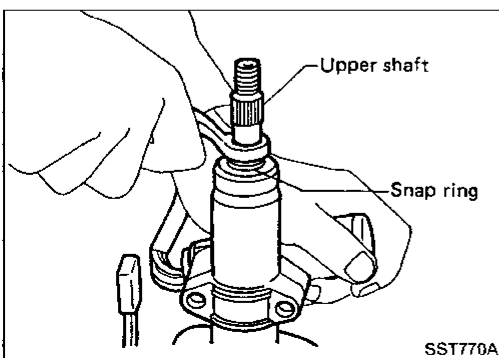
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# STEERING WHEEL AND STEERING COLUMN

## Disassembly and Assembly



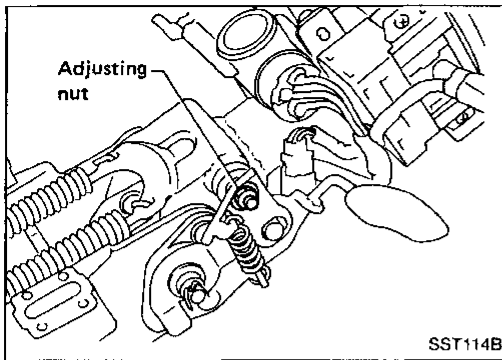
- When disassembling and assembling, unlock steering lock with key.
- Ensure that rounded surface of snap ring faces toward bearing when snap ring is installed.
- Install snap ring ①, then install O-ring into groove before inserting shaft into jacket tube.



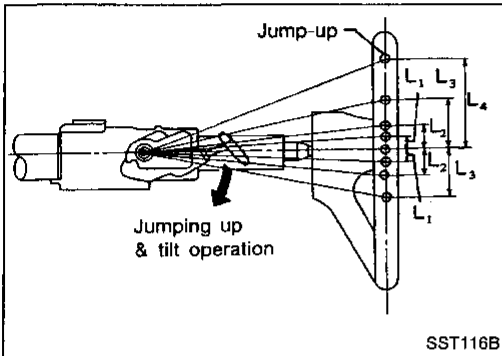
- Install snap ring on upper shaft with box wrench.

# STEERING WHEEL AND STEERING COLUMN

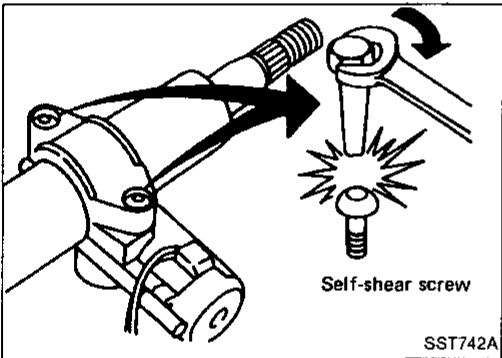
## Disassembly and Assembly (Cont'd)



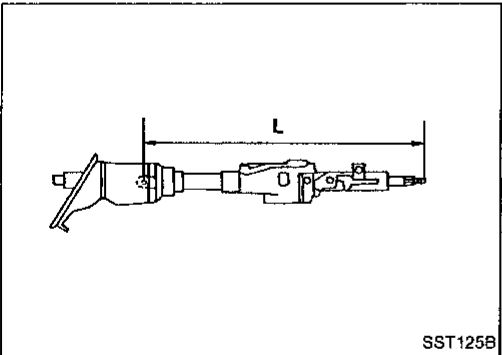
- Tilt mechanism  
Tighten adjusting nut to specification.  
 □: 4 - 5 N·m  
 (0.4 - 0.5 kg-m, 2.9 - 3.6 ft-lb)



- After installing steering column, check tilt mechanism operation.  
 L<sub>1</sub>: 9.8 mm (0.386 in)  
 L<sub>2</sub>: 19.5 mm (0.768 in)  
 L<sub>3</sub>: 29.3 mm (1.154 in)  
 L<sub>4</sub>: 58.2 mm (2.291 in)

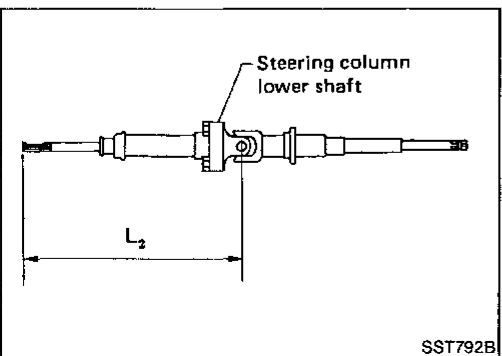


- Steering lock  
 a) Break self-shear type screws with a drill or other appropriate tool.  
 b) Install self-shear type screws and then cut off self-shear type screw heads.



## Inspection

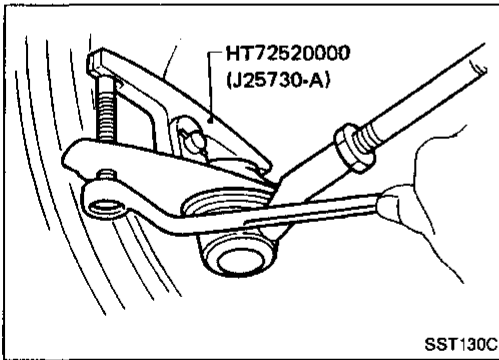
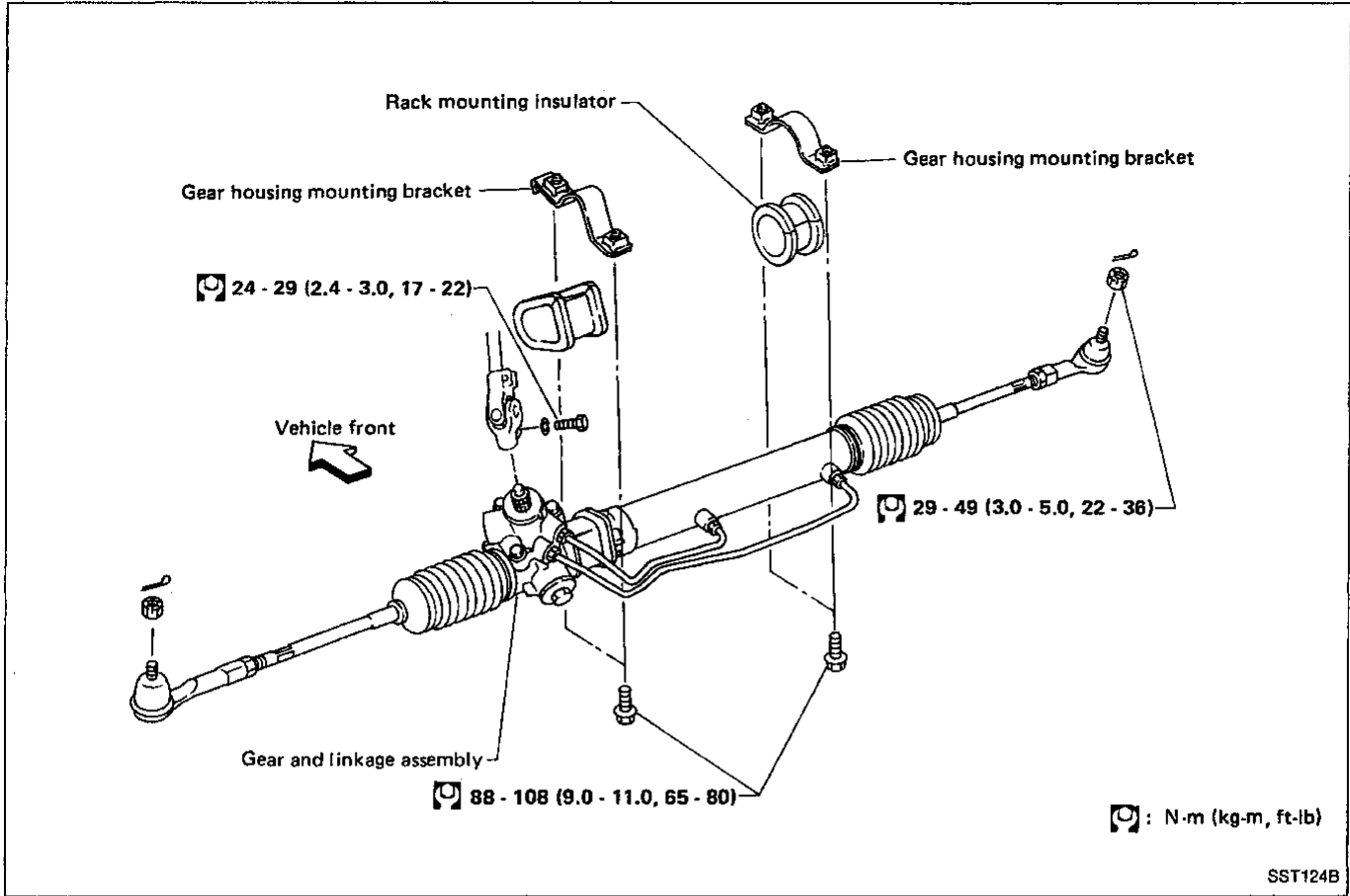
- When steering wheel can not be rotated smoothly, check the steering column for the following matters and replace damaged parts.  
 a. Check column bearings for damage or unevenness. Lubricate with recommended multi-purpose grease or replace steering column as an assembly, if necessary.  
 b. Check 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<sub>1</sub>" and steering column lower shaft length "L<sub>2</sub>". If it is not within specifications, replace steering column as an assembly.



- Steering column length "L<sub>1</sub>":  
 652.9 - 654.5 mm (25.70 - 25.77 in)  
 Steering column lower shaft length "L<sub>2</sub>":  
 323.9 - 325.5 mm (12.75 - 12.81 in)

# POWER STEERING GEAR AND LINKAGE (Model PR24SC)

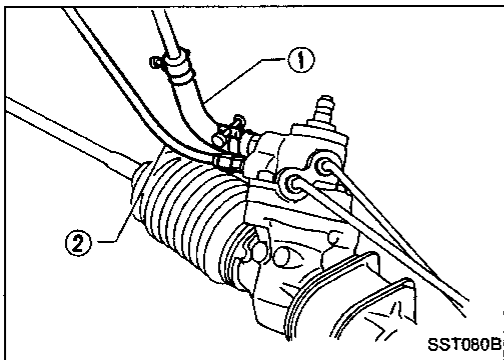
## Removal and Installation



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

# POWER STEERING GEAR AND LINKAGE (Model PR24SC)

## Removal and Installation (Cont'd)



- Install pipe connector.
- Observe specified tightening torque when tightening high-pressure and low-pressure pipe connectors. Excessive tightening can damage threads or damaged connector O-ring.
- The O-ring in low-pressure pipe connector is larger than that in high-pressure connector. Take care to install the proper O-ring.

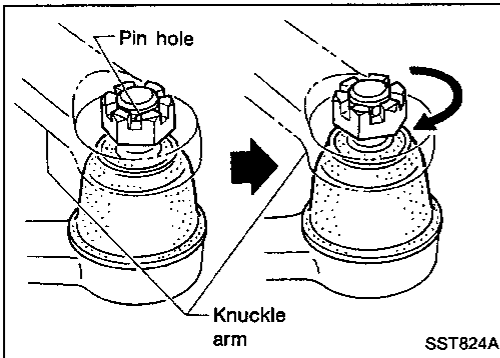
### Connector tightening torque:

#### Low-pressure side "1"

27 - 39 N·m (2.8 - 4.0 kg-m, 20 - 29 ft-lb)

#### High-pressure side "2"

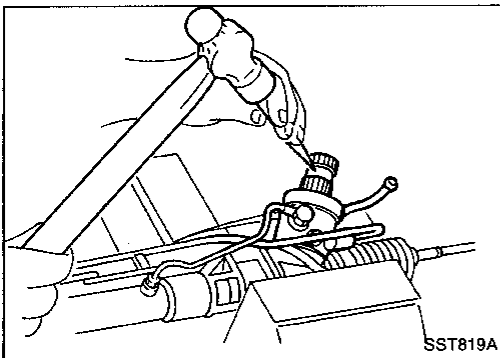
15 - 25 N·m (1.5 - 2.5 kg-m, 11 - 18 ft-lb)



- 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:

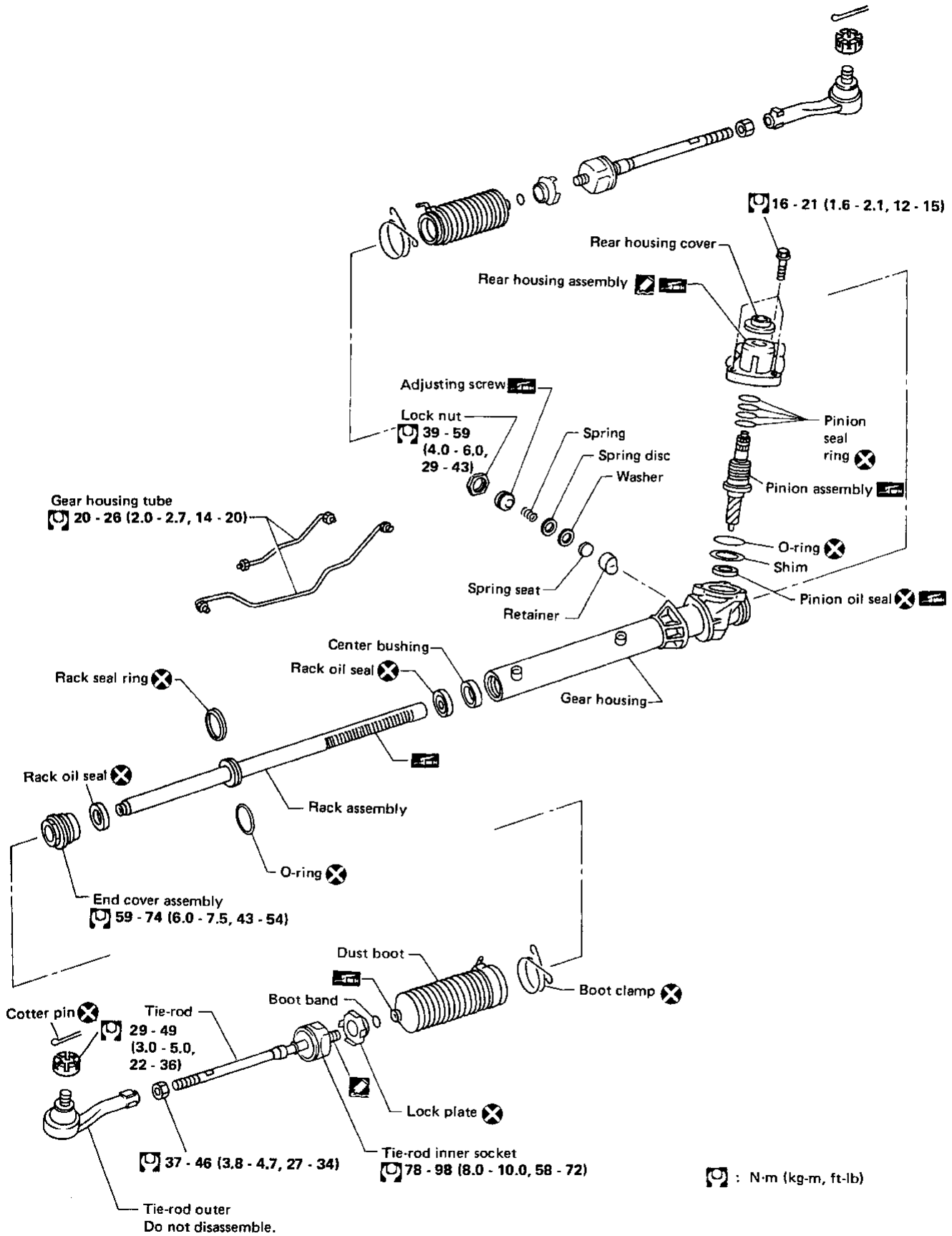
Tightening torque must not exceed 49 N·m (5 kg-m, 36 ft-lb).



- 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 of gear.
- To install, set left and right dust boots to equal deflection, and attach lower joint by aligning matching marks of pinion shaft and pinion housing.

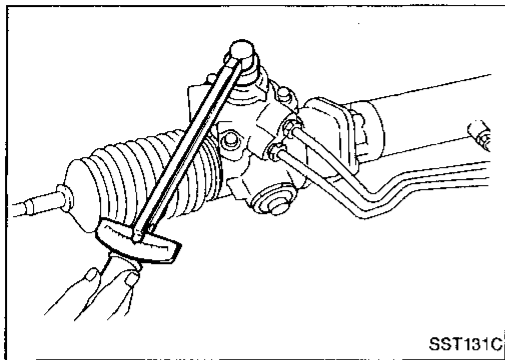
# POWER STEERING GEAR AND LINKAGE (Model PR24SC)

## Disassembly and Assembly



SST897B

# POWER STEERING GEAR AND LINKAGE (Model PR24SC)



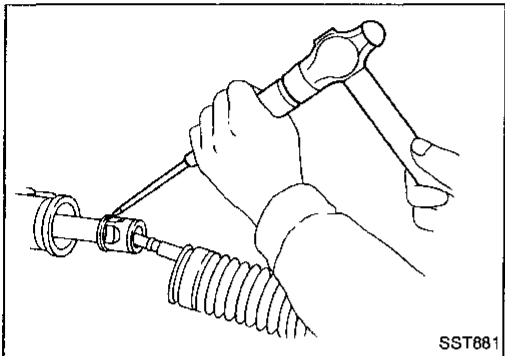
## Disassembly

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

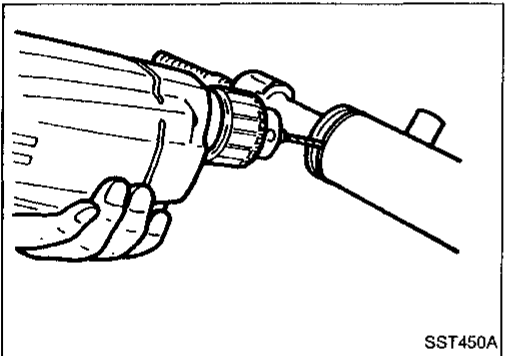
- Before measuring, disconnect cylinder tube and drain fluid.
- Use soft jaws when holding steering gear housing. Handle gear housing carefully, as it is made of aluminum. Do not grip cylinder in a vise.

2. Remove pinion gear.

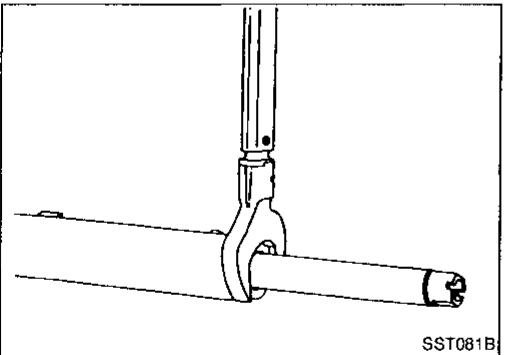
**Be careful not to damage pinion gear when removing pinion seal ring.**



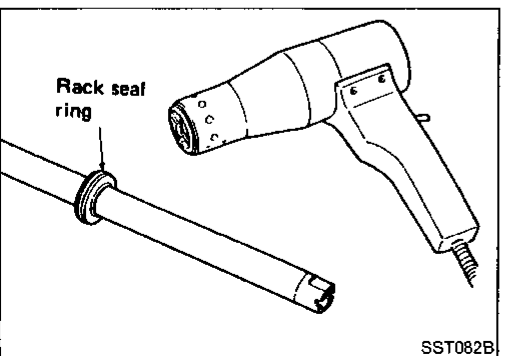
3. Remove tie-rod outer sockets and boots.
4. Loosen tie-rod inner socket by prying up staked portion, and remove socket.
5. Remove retainer.
6. Remove pinion assembly.



7. Drill staked portion of cylinder end cover with drill of 2 to 2.5 mm (0.079 to 0.098 in) diameter, until the staking is eliminated.



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



10. Remove rack seal ring.
- Using a heat gun, heat rack seal to approximately 40°C (104°F).
- Remove rack seal ring.

**Be careful not to damage rack.**

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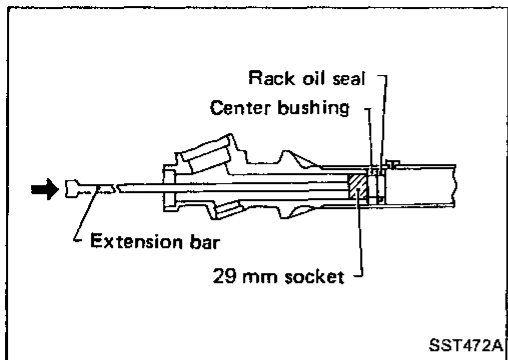
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## POWER STEERING GEAR AND LINKAGE (Model PR24SC)

### Disassembly (Cont'd)

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

**Do not scratch inner surfaces of pinion housing.**



### Inspection

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

### BOOT

Check condition of boot. If cracked excessively, replace it.

### RACK

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

### PINION ASSEMBLY

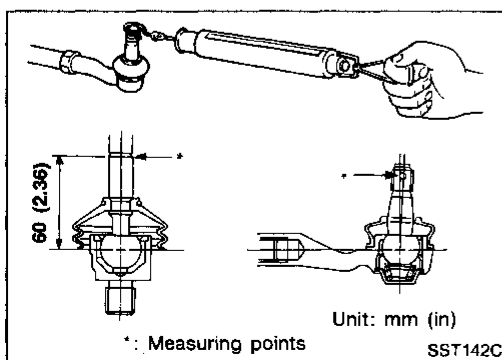
- Thoroughly examine pinion gear. If pinion gear is damaged, cracked or worn, replace it.
- Inspect bearings to see that they roll freely and are free from cracked, pitted, or worn balls, rollers and races. Replace if necessary.

### GEAR HOUSING CYLINDER

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

### CYLINDER TUBES

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



### TIE-ROD OUTER AND INNER SOCKET

- Check ball joint for swinging force.

**Tie-rod outer ball joint:**

6.9 - 64.7 N

(0.7 - 6.6 kg, 1.5 - 14.6 lb)

**Tie-rod inner ball joint:**

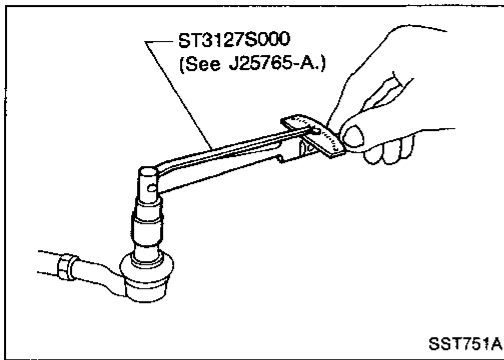
7.8 - 122.6 N

(0.8 - 11.3 kg, 1.8 - 24.9 lb)



# POWER STEERING GEAR AND LINKAGE (Model PR24SC)

## Inspection (Cont'd)



- Check ball joint for rotating torque.
  - Tie-rod outer ball joint:**  
0.3 - 2.9 N·m  
(3 - 30 kg-cm, 2.6 - 26.0 in-lb)
  - Tie-rod inner ball joint:**  
7.4 N·m (75 kg-cm, 65 in-lb) or less

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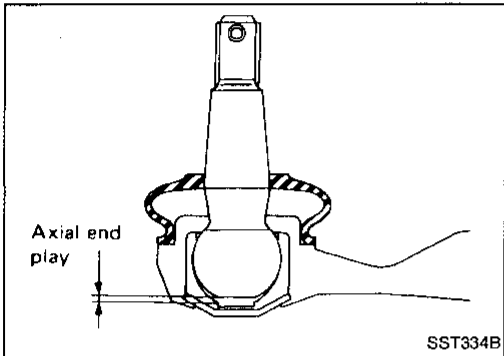
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- Check ball joint for axial end play.
  - Tie-rod outer ball joint:**  
0.5 mm (0.020 in) or less
  - Tie-rod inner ball joint:**  
0 mm (0 in)
- Check condition of dust cover. If cracked excessively, replace it.

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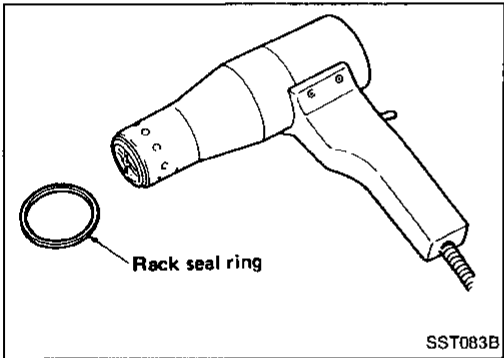
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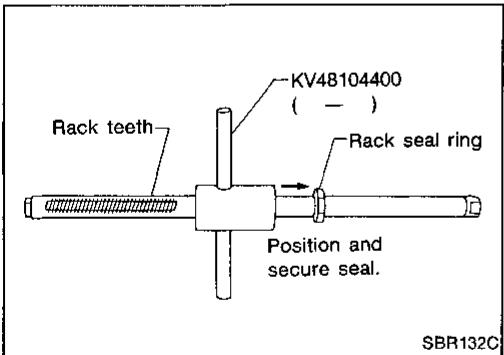
## Assembly

- Using a heat gun, heat rack seal ring (made of Teflon) to approximately 40°C (104°F) and install it onto rack with your hand.



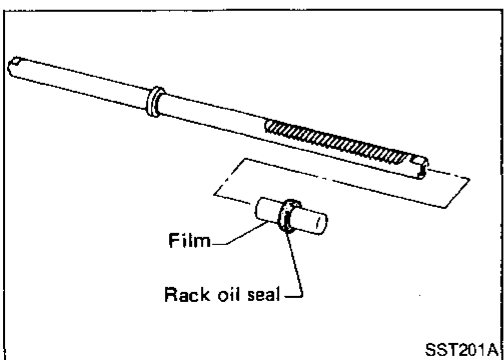
- Using Tool, compress periphery of rack seal ring (made of Teflon) to position and secure it on rack.

**Always insert the tool from the rack gear side.**



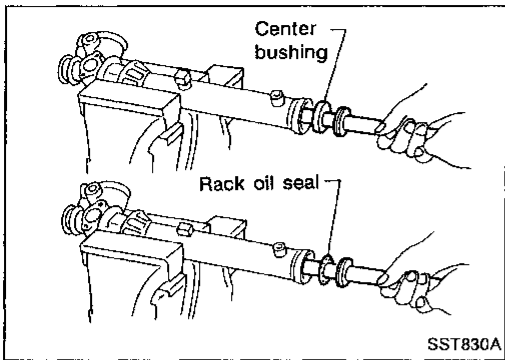
- Insert rack oil seal.

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

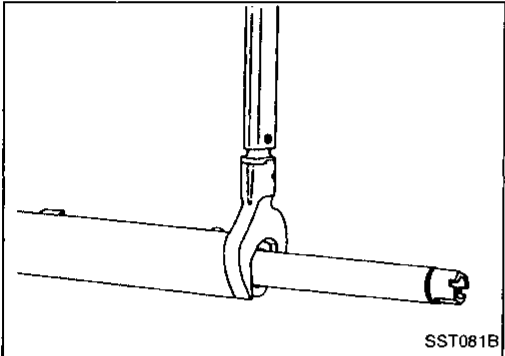


## POWER STEERING GEAR AND LINKAGE (Model PR24SC)

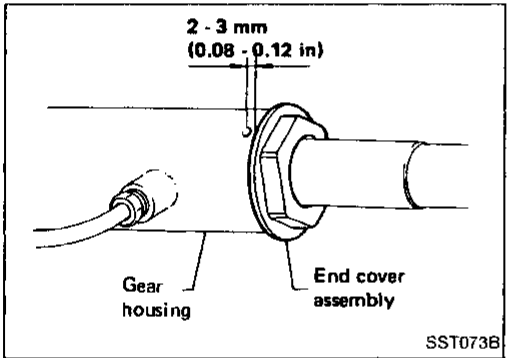
### Assembly (Cont'd)



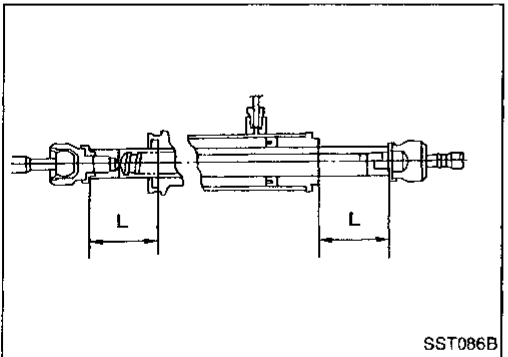
4. Install center bushing and rack oil seal with rack assembly.



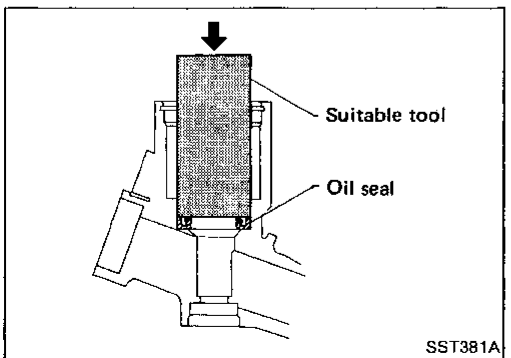
5. Tighten cylinder end cover assembly with Tool.



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



7. Set rack gear in the neutral position.  
**Measured length "L":**  
**Refer to S.D.S.**

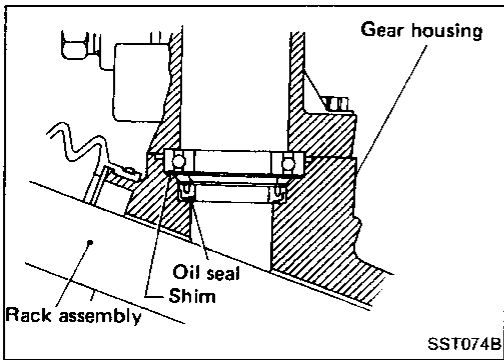


8. Coat seal lip of oil seal with multi-purpose grease and install new pinion oil seal to pinion housing with a suitable tool.

**Make sure lip of oil seal faces up when installed.**

# POWER STEERING GEAR AND LINKAGE (Model PR24SC)

## Assembly (Cont'd)



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.**

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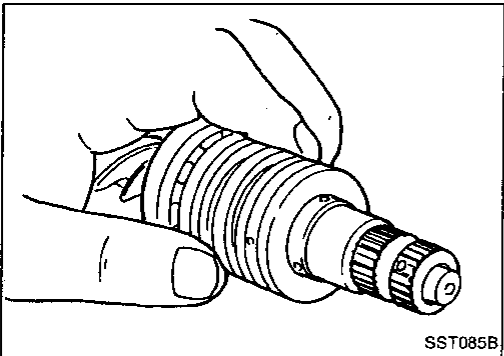
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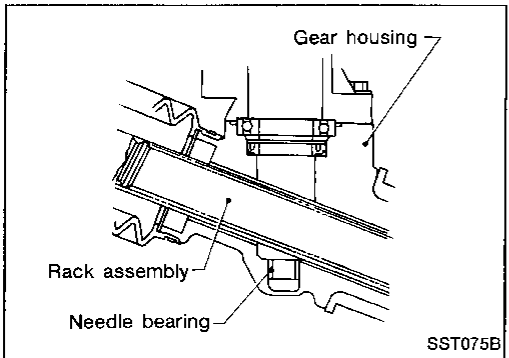
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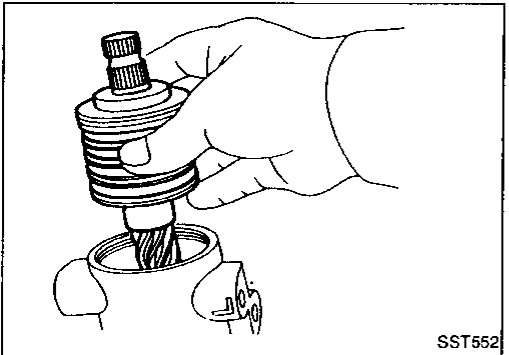


10. Install new pinion seal ring on pinion gear assembly.

- 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.

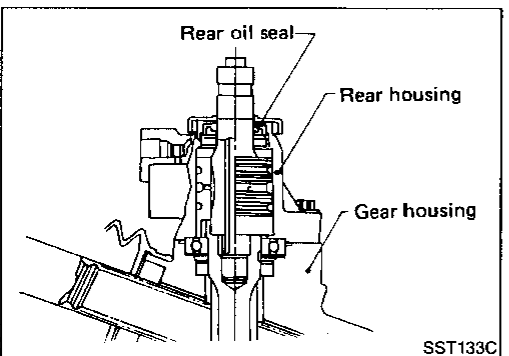


11. Apply a coat of multi-purpose grease to needle bearing roller and oil seal lip before installing pinion assembly in gear housing.



12. Install pinion assembly to pinion housing.

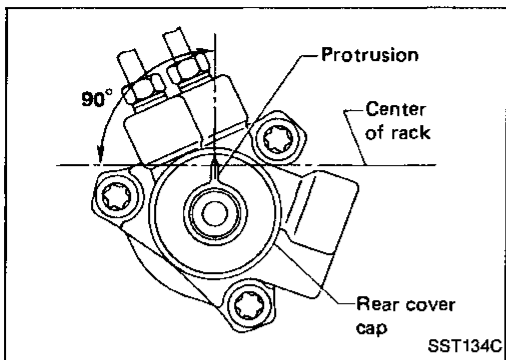
**Be careful not to damage pinion oil seal.**



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

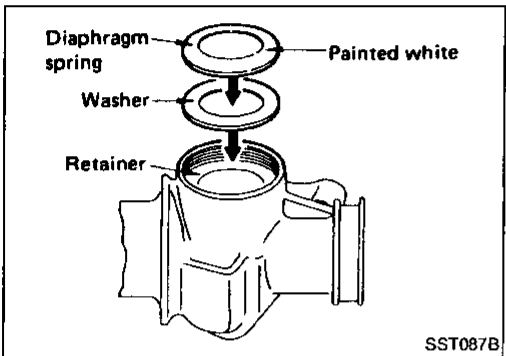
## POWER STEERING GEAR AND LINKAGE (Model PR24SC)

### Assembly (Cont'd)



14. Install rear cover cap so that protrusion of rear housing cover is positioned as shown in figure at left when rack is centralized.

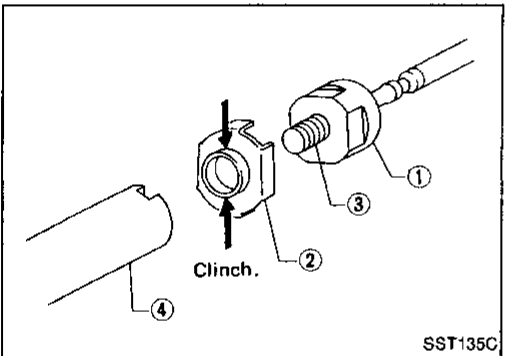
**Be careful not to damage worm ring and oil seal.**



15. Install diaphragm spring at retainer.

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

16. Install retainer spring and adjusting screw temporarily.

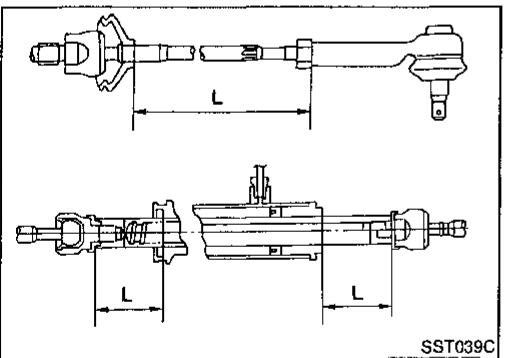


17. Install new lock plate.

- Attach lock plate (2) to side rod inner socket (1).
- Apply locking sealant to inner socket threads (3). Screw inner socket into rack (4) and tighten to specified torque.
- Clinch two places of lock plate at rack's groove.

**CAUTION:**

**To prevent scratching the boot, remove burrs from lock plate.**



18. Tighten outer socket lock nut.

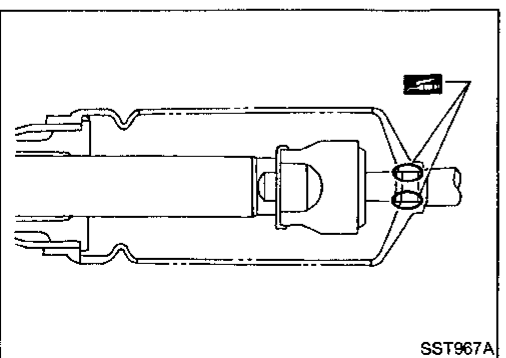
**Tie-rod length "L":**

**Refer to S.D.S.**

19. Measure rack stroke.

**Measured length "L":**

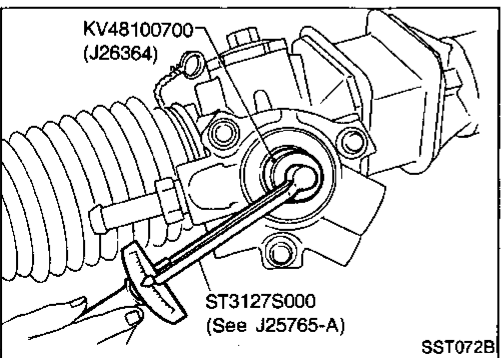
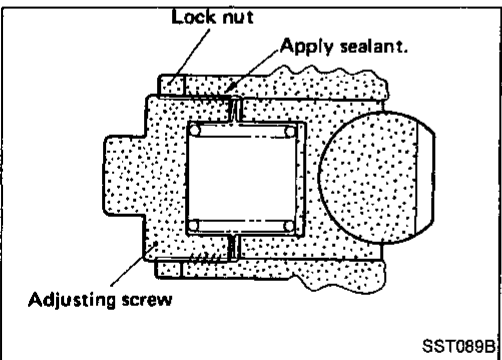
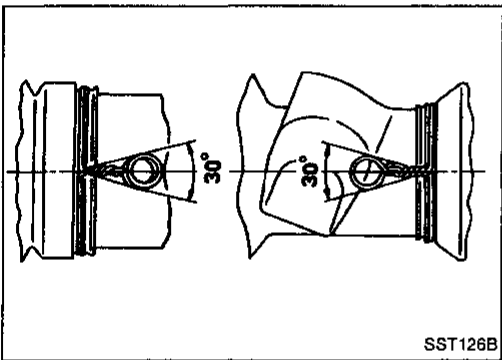
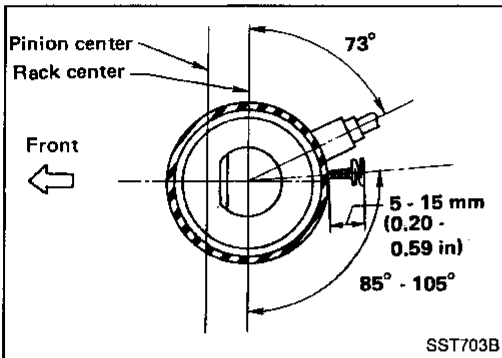
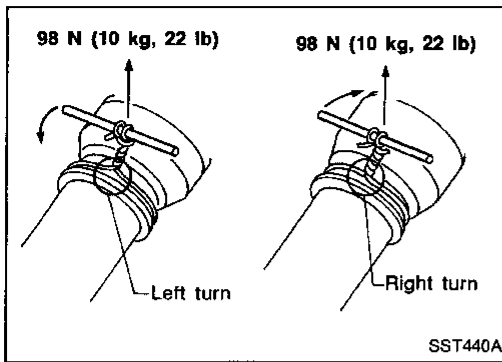
**Refer to S.D.S.**



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

# POWER STEERING GEAR AND LINKAGE (Model PR24SC)

## Assembly (Cont'd)



### 21. Install boot clamps.

- To install, wrap boot clamp around boot groove twice. Tighten clamp by twisting rings at both ends 4 to 4-1/2 turns with suitable tool while pulling with a force of approx. 98 N (10 kg, 22 lb).
- Twist boot clamp in the direction shown in figure at left.

- Install boot clamps so they are behind the gear housing when gear assembly is attached to the body. (This will prevent interference with other parts.)

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

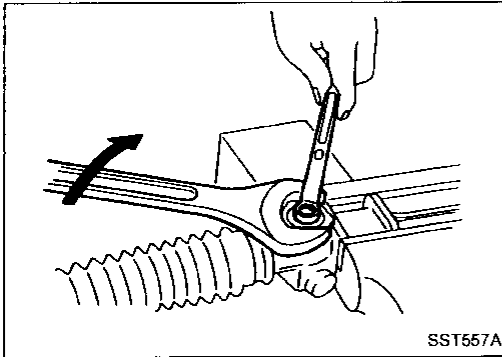
## Adjustment

Adjust pinion rotating torque as follows:

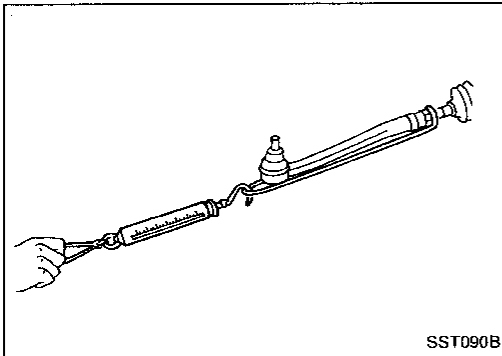
- Set gears to Neutral without fluid in the gear.
- Coat the adjusting screw with locking sealant and screw it in.
- Lightly tighten lock nut.
- Tighten adjusting screw to a torque of 4.9 to 5.9 N·m (50 to 60 kg-cm, 43 to 52 in-lb).
- Loosen adjusting screw, then retighten it to 0.05 to 0.20 N·m (0.5 to 2 kg-cm, 0.43 to 1.74 in-lb).
- Move rack over its entire stroke several times.
- Measure pinion rotating torque within the range of 180° from neutral position.  
Stop the gear at the point of maximum torque.
- Loosen adjusting screw, then retighten it to 4.9 N·m (50 kg-cm, 43 in-lb).
- Loosen adjusting screw by 70° to 110°.

## POWER STEERING GEAR AND LINKAGE (Model PR24SC)

### Adjustment (Cont'd)



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



11. Check steering gear for rack sliding frictional force.

**Around neutral point of rack stroke**

**± 5.5 mm (± 0.217 in):**

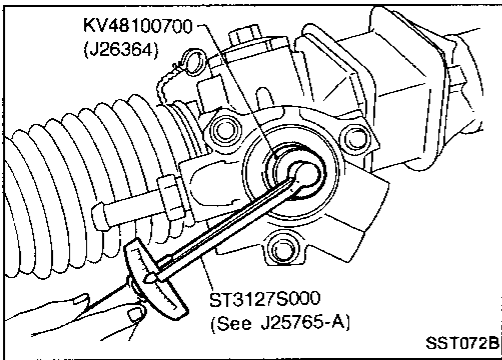
**122.6 - 166.7 N (12.5 - 17 kg, 27.6 - 37.5 lb)**

**Except above range:**

**122.6 - 186.3 N (12.5 - 19 kg, 27.6 - 41.9 lb)**

If sliding frictional force is out of specification, repeat the adjustment procedure, starting from No. 4.

After the readjustment, if sliding force is still out of specification, steering gear is damaged.



12. Measure pinion rotating torque within the range of ± 100° from the neutral point.

**Average rotating torque**

**[(Max. measured value + Min. measured value) x 0.5]:**

**0.8 - 1.3 N·m (8 - 13 kg-cm, 6.9 - 11.3 in-lb)**

**Maximum torque increment:**

**Less than 0.4 N·m (4 kg-cm, 3.5 in-lb)**

**Except for above mentioned measuring range:**

**Maximum rotating torque**

**1.9 N·m (19 kg-cm, 16 in-lb)**

**Maximum torque increment**

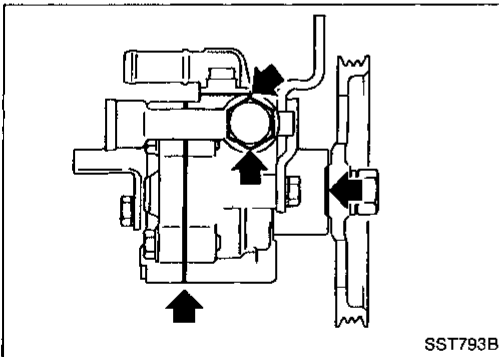
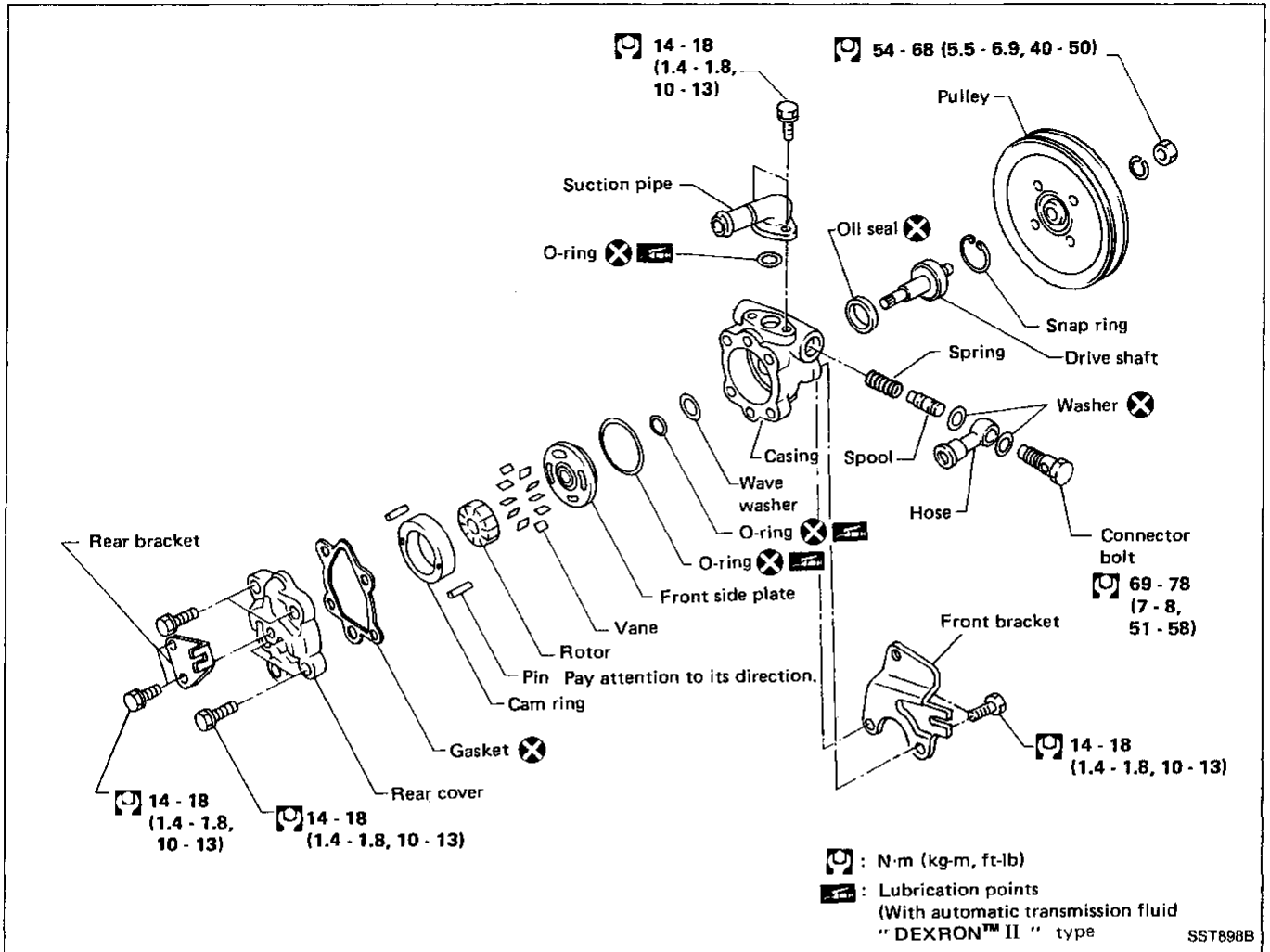
**Less than 0.6 N·m (6 kg-cm, 5.2 in-lb)**

- If pinion rotating torque is not within specification, readjust it.
- After the readjustment, if pinion rotating torque is still out of specification, steering gear is damaged.

13. As a final check, measure rack sliding force and steering wheel turning force under normal operating conditions. Refer to Checking Steering Wheel Turning Force in ON-VEHICLE SERVICE.

# POWER STEERING OIL PUMP

## Disassembly and Assembly



### 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

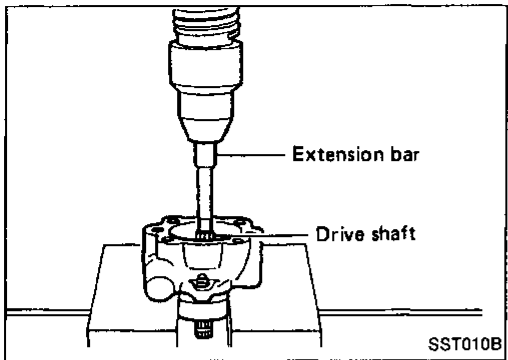
#### CAUTION:

- 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.

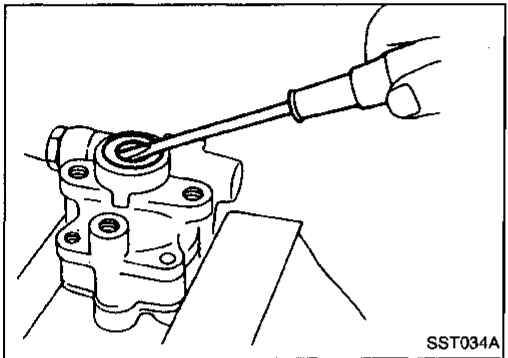
## POWER STEERING OIL PUMP

### Disassembly (Cont'd)

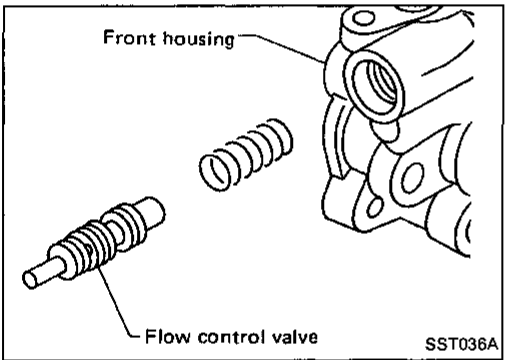
- Remove snap ring, then draw pulley shaft out.  
**Be careful not to drop pulley shaft.**



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



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



### Inspection

#### PULLEY AND PULLEY SHAFT

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

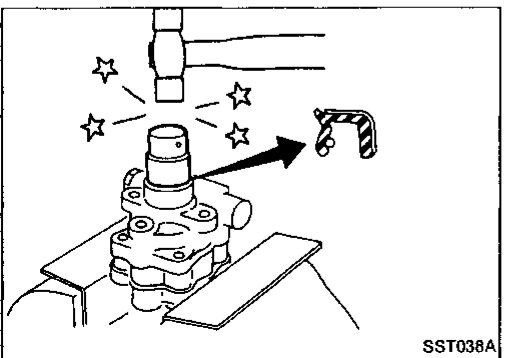
### Assembly

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.**

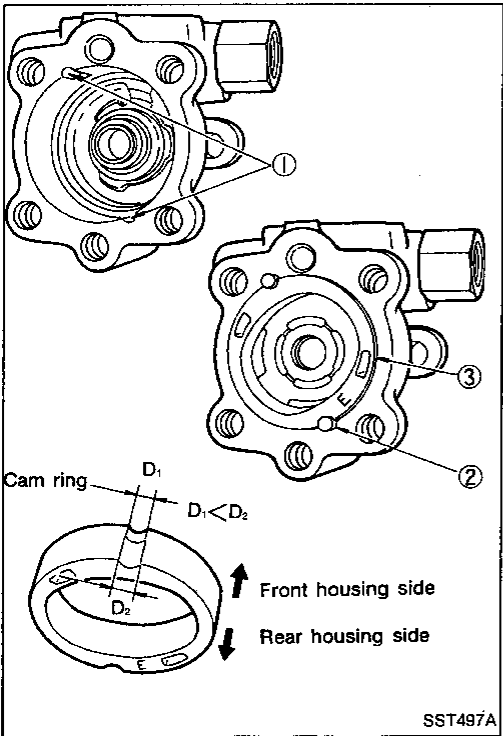
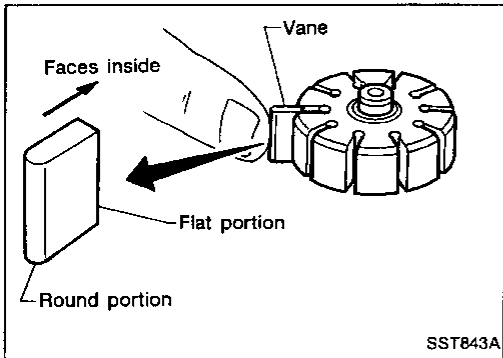
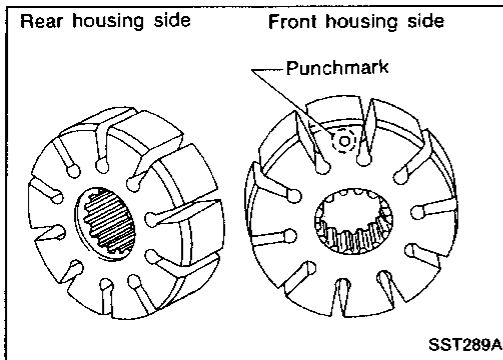
- Cam ring, rotor and vanes must be replaced as a set if necessary.
- Coat each part with A.T.F. when assembling.





# 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.

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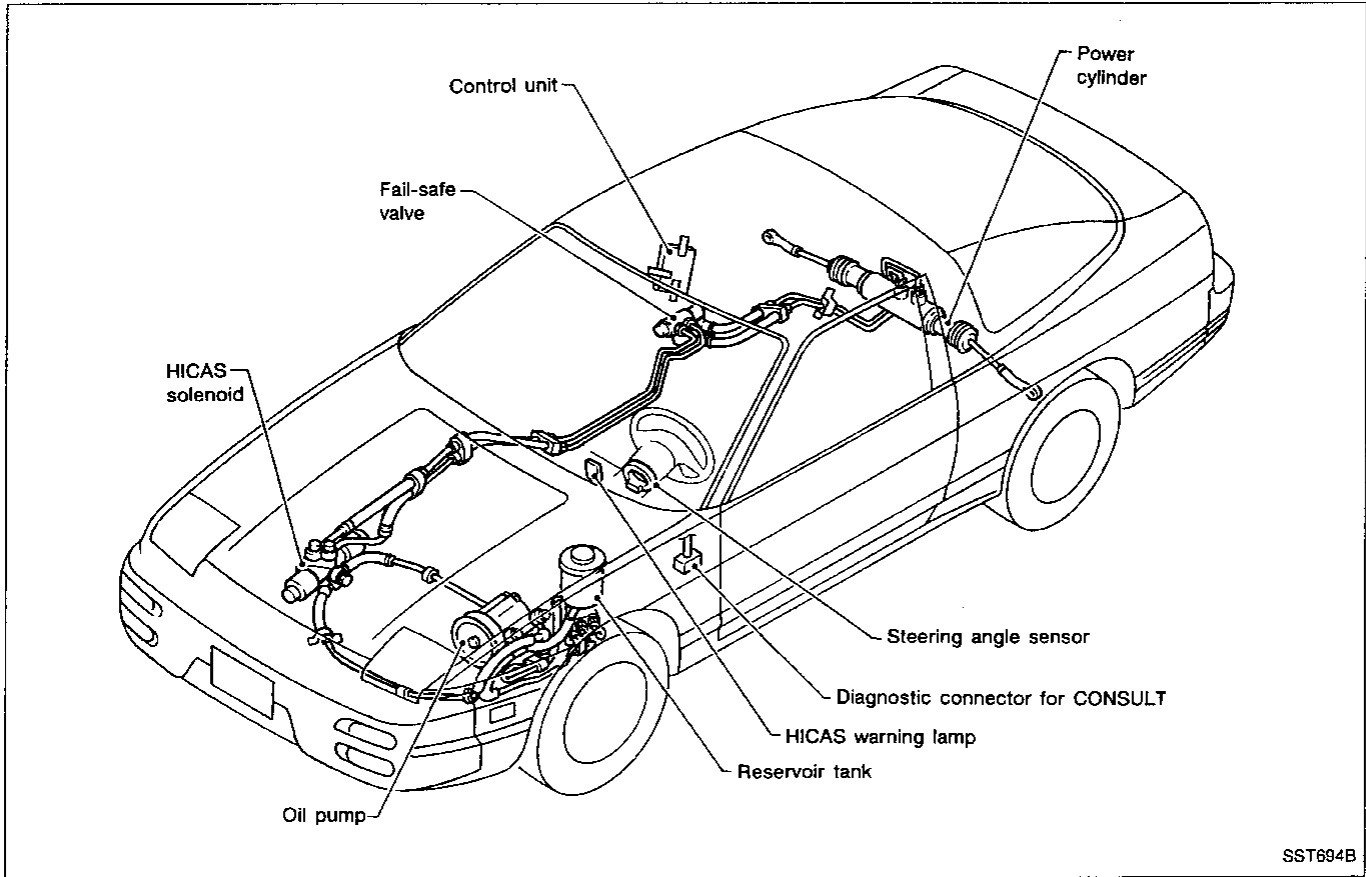
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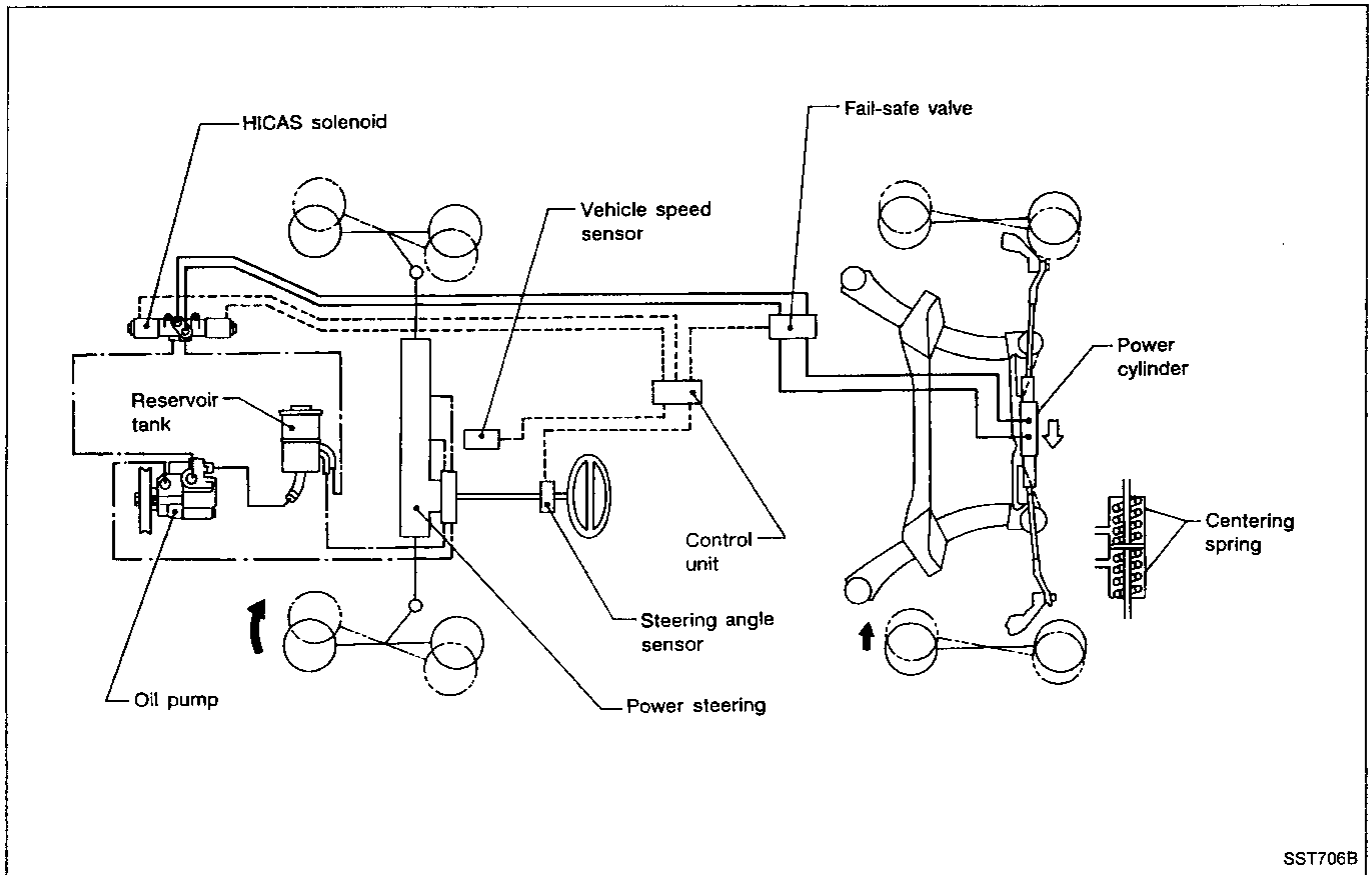
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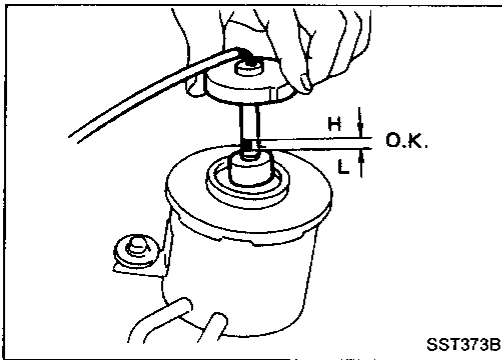
# SUPER HICAS SYSTEM

## HICAS Component Parts Location



## System Diagram





## On-vehicle Service

### CHECKING FLUID LEVEL

Maintain the fluid level so that the lower surface of the float is maintained between the "L" and "H" marks on the gauge rod. The fluid level should be checked when the engine is stopped and the fluid temperature is normal.

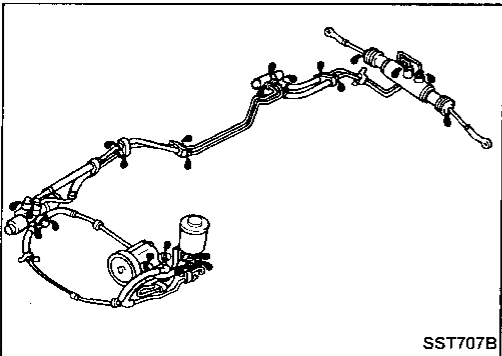
#### CAUTION:

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

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### CHECKING FLUID LEAKAGE

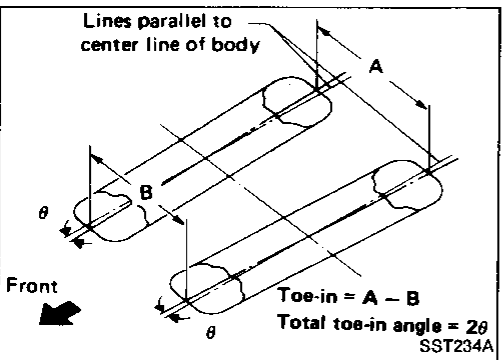
Check lines for proper attachment, leaks, cracks, damage, loose connections, chafing and deterioration. Fluid leakage should be checked for when the oil temperature is normal with the engine idling.

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### MEASURING REAR TOE-IN

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

#### Toe-in:

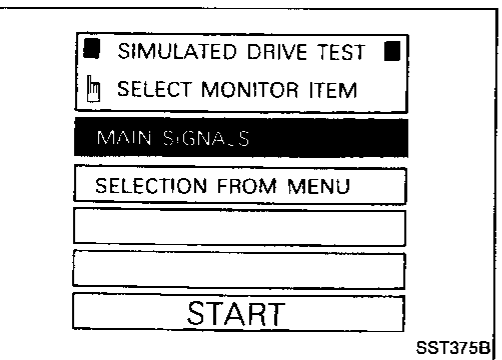
Refer to S.D.S. in section RA.

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### INSPECTION OF HICAS SYSTEM OPERATION

#### CAUTION:

Ensure that shift lever is set to "P" (A/T model) or "Neutral" (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 diagnostic connector 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".

RA

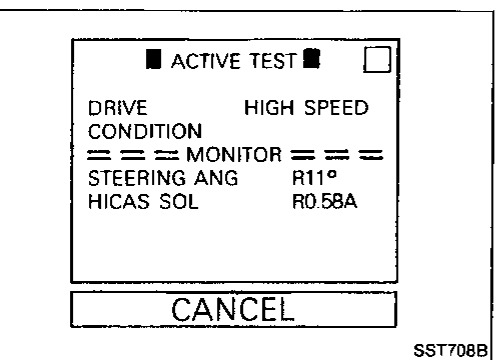
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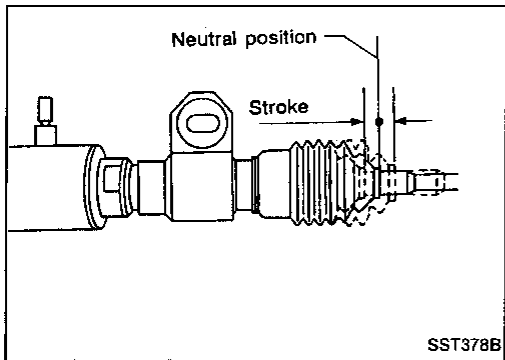
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After simulated drive condition has continued for 5 minutes, it will automatically cancel and CONSULT unit will then show "TEST IS INTERRUPTED TO AVOID OIL TEMP. RISE" display. To cancel this mode during self-diagnosis, simply touch "CANCEL".

## SUPER HICAS SYSTEM

### On-vehicle Service (Cont'd)



- Operate engine at speeds greater than 2,000 rpm, and turn steering wheel 180° in one direction from the neutral position. Measure extension value of one power cylinder 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 power cylinders 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

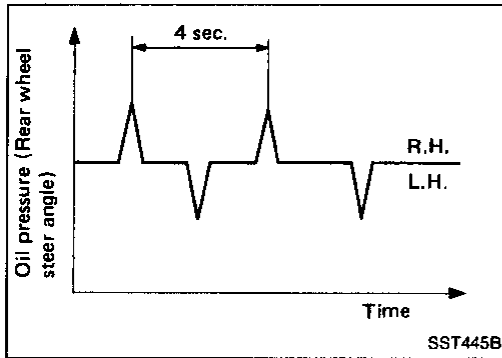
3 mm (0.12 in)

When turned to the left

3 mm (0.12 in)

Total stroke

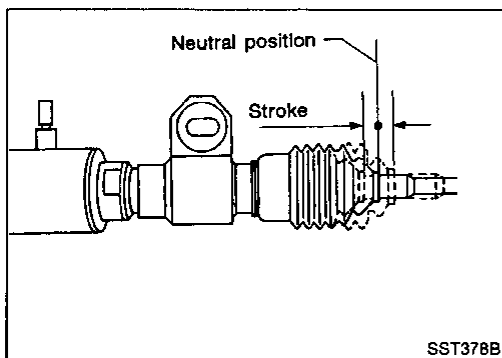
6 mm (0.24 in)



#### When CONSULT is not used:



- 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.)
- Set HICAS system in self-diagnosis mode.
  - Turn ignition switch "OFF".
  - Set shift lever to "P" or "N" position (A/T model), or "Neutral" position (M/T model).
  - Turn ignition switch "ON".
  - Immediately start engine.
  - 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".
- Set steering wheel to a point approximately 10° from the neutral position and check to ensure that rear wheels turn to the left and right alternately.



- Operate engine at speeds greater than 2,000 rpm, and turn steering wheel 180° in one direction from the neutral position. Measure extension value of one power cylinder 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 power cylinder rods by adding (measured) extension and retraction values.

# SUPER HICAS SYSTEM

## On-vehicle Service (Cont'd)

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

### Specifications:

When turned to the right

3 mm (0.12 in)

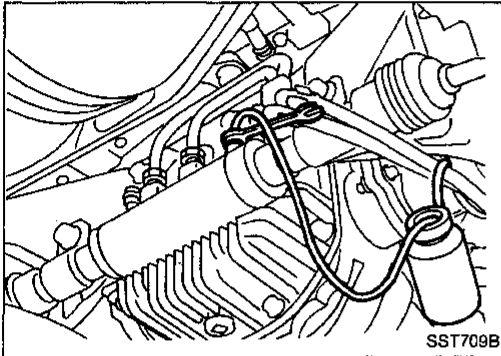
When turned to the left

3 mm (0.12 in)

Total stroke

6 mm (0.24 in)

Do not depress foot brake pedal during operation check, otherwise the operation will be stopped.

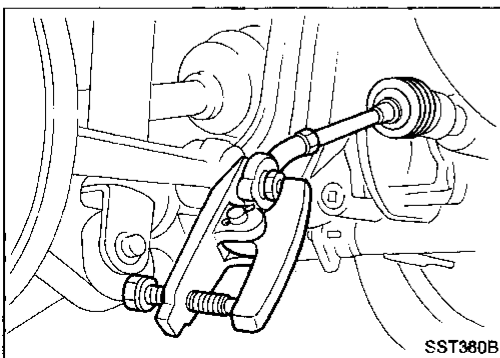
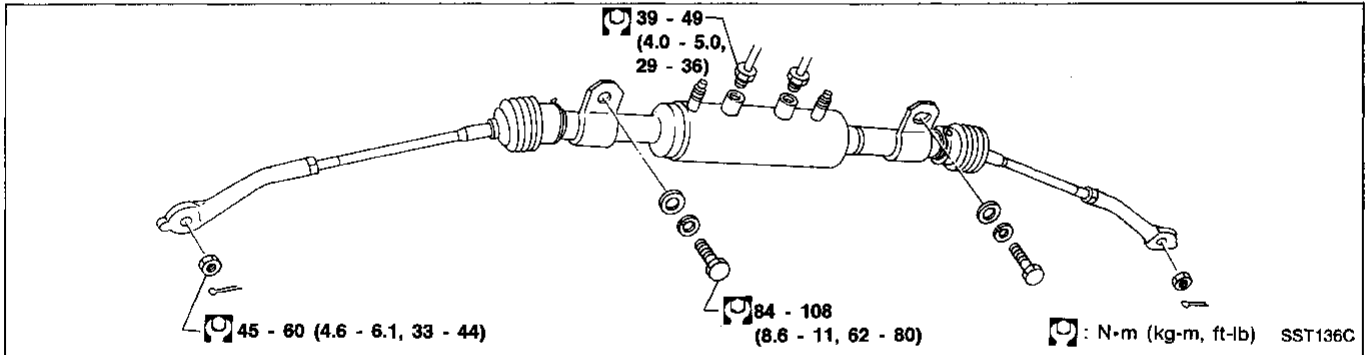


## BLEEDING HYDRAULIC SYSTEM

Before bleeding air from the HICAS system, be sure to bleed air from the power steering system. Refer to "SUPER HICAS SYSTEM — Repair of Component Parts".

## Repair of Component Parts

### POWER CYLINDER



### Removal

- Detach power cylinder lower links from axle housing sockets with Tool.

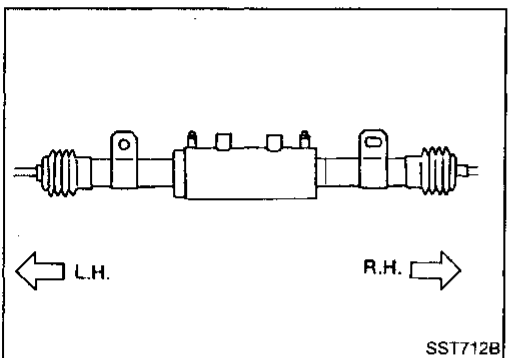
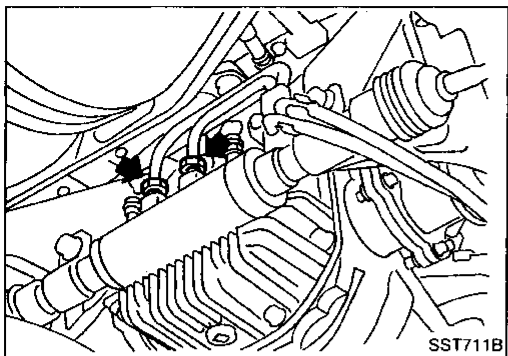
## SUPER HICAS SYSTEM

### Repair of Component Parts (Cont'd)

- Disconnect oil pipes from power cylinders and remove power cylinders.

#### CAUTION:

Plug openings of oil pipes and power cylinders to prevent entry of foreign particles after removal.

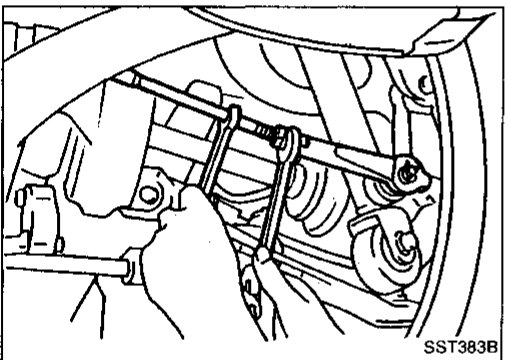


### Installation

1. Before installing power cylinder on suspension member, wipe power cylinder 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 power cylinder.

#### CAUTION:

- a. To prevent entry of foreign particles, clean oil pipes and connectors using dry compressed air.
  - b. Ensure that your hands are clean and free from foreign particles when connecting oil pipes.
2. Install power cylinders and oil pipes.
  3. 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 section RA.



### Bleeding hydraulic system

Before bleeding air from the HICAS system, be sure to bleed air from the power steering system.

#### CAUTION:

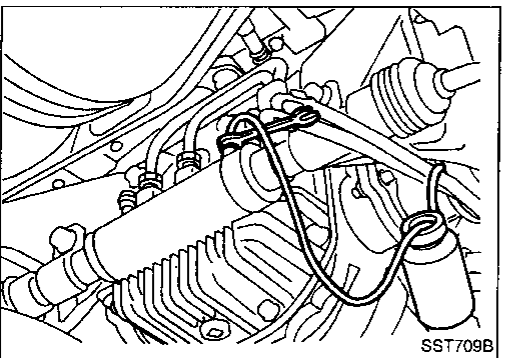
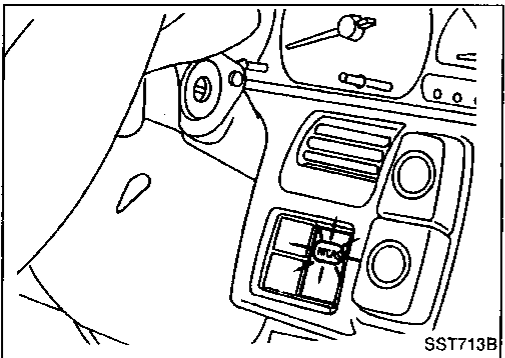
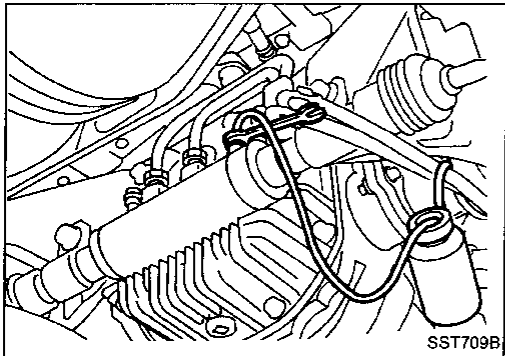
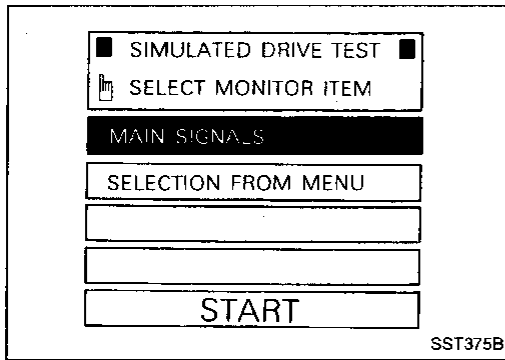
Ensure that shift lever is set to "P" (A/T model) or "Neutral" (M/T model).

When CONSULT is used: 

1. Connect CONSULT unit to diagnostic connector on body side.
2. Have a helper sit in the driver's compartment and raise vehicle.

# SUPER HICAS SYSTEM

## Repair of Component Parts (Cont'd)



Use a two-pole lift or a center pole lift so that the four wheels are free to rotate.

3. Start engine.
4. Touch "START" on CONSULT display. (Display will then change.)
5. Touch "HICAS", "ACTIVE TEST", "SIMULATED DRIVE" and "START" in that order.

Before touching "START", ensure that MAIN SIGNALS display is reversed.

6. Touch "START".
7. Operate engine at speeds greater than 2,000 rpm, and turn steering wheel 180° to the right from the neutral position. Loosen right power cylinder bleeder valve to bleed air, then retighten. Return steering wheel to the neutral position.
8. Operate engine at speeds greater than 2,000 rpm, and turn steering wheel 180° to the left from the neutral position. Loosen left power cylinder bleeder valve to bleed air, then retighten. Return steering wheel to the neutral position.
9. Repeat steps 7. and 8. until there are no air bubbles in fluid. While bleeding air from power cylinders, never allow fluid level to drop below inlet port of reservoir tank (by adding fluid as required).
10. Touch "CANCEL" on CONSULT display and turn ignition switch OFF.

When CONSULT is not used: 

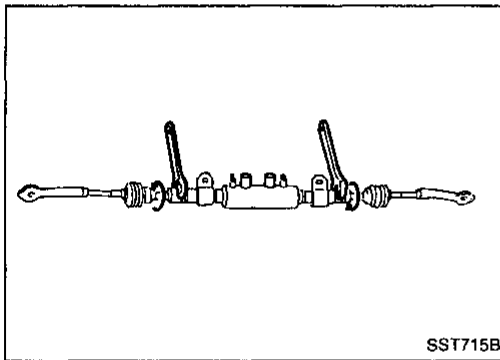
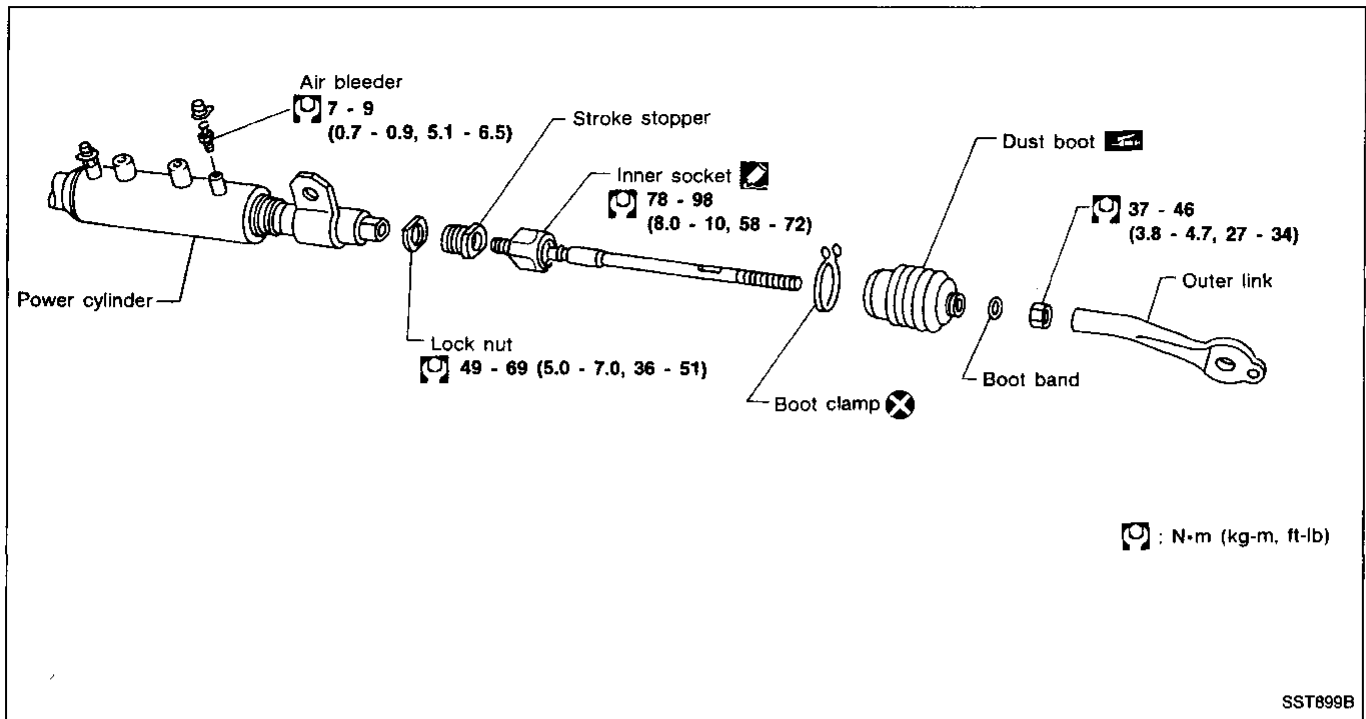
1. Have a helper sit in the driver's compartment, and raise vehicle.

Use a two-pole lift or 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" or "N" 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. Set steering wheel within 10° from the neutral position. Ensure that rear wheels turn to the left and right alternately.
4. Operate engine at idling speed, and turn steering wheel 180° to the right from the neutral position. Loosen right power cylinder bleeder valve to bleed air, then retighten. Return steering wheel to the neutral position.
5. Operate engine at idling speed, and turn steering wheel 180° to the left from the neutral position. Loosen left power cylinder bleeder valve to bleed air, then retighten. Return steering wheel to the neutral position.
6. Repeat steps 4. and 5. above until there are no air bubbles in fluid. While bleeding air from power cylinders, never allow fluid level to drop below inlet port of reservoir tank (by adding fluid as required).
7. Turn ignition switch OFF to complete self-diagnosis operation.

# SUPER HICAS SYSTEM

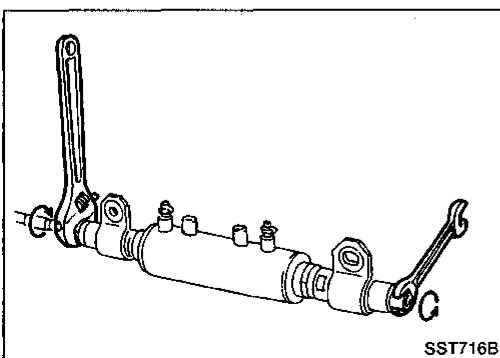
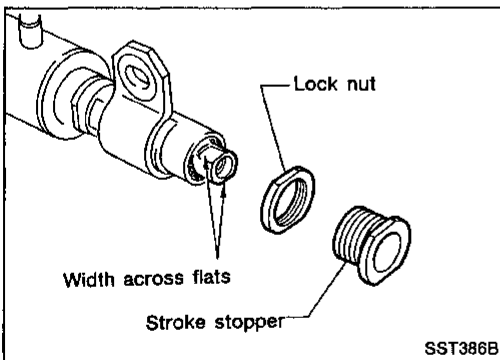
## Repair of Component Parts (Cont'd)



### Disassembly

**Power cylinder assembly cannot be disassembled. When it is malfunctioning, replace power cylinder as an assembly.**

1. Remove clamps from left and right dust boots, and move dust boots toward outer links.
2. Attach wrenches to left and right ball joint sockets, and turn in directions that loosen lower links. Remove one of loosened lower link assemblies.
3. Loosen stroke stopper lock nut from which lower link assembly was removed, and remove stroke stopper.



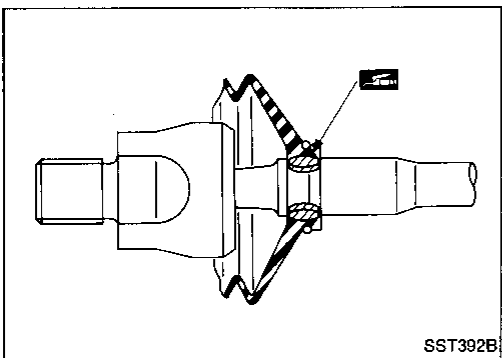
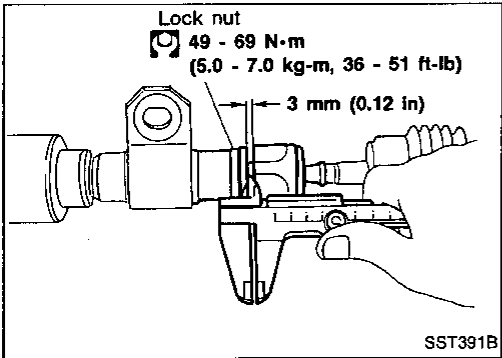
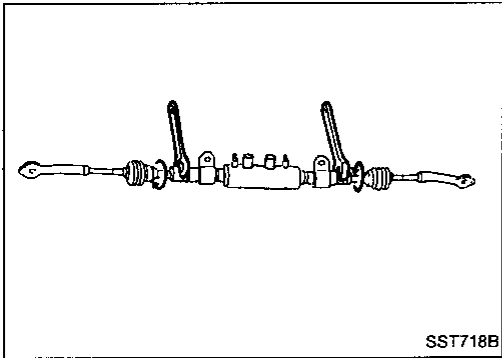
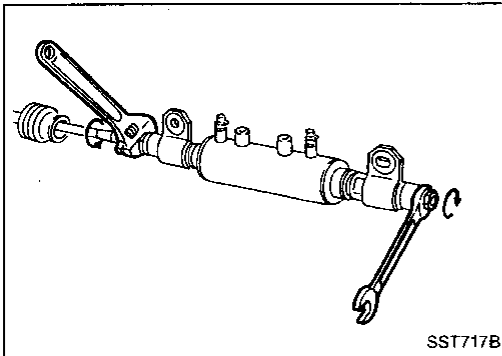
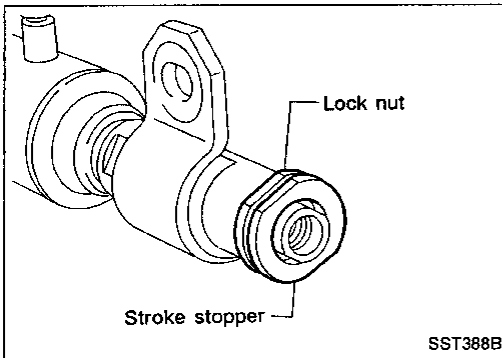
- While attaching a wrench to "width across flats" section of rod end from which stroke stopper was removed, remove the other lower link assembly.



# SUPER HICAS SYSTEM

## Repair of Component Parts (Cont'd)

### Assembly



1. Install stroke stopper and lock nut on the lower link assembly to be assembled.

2. Apply Locktite to inner ball joint thread. Attach a wrench to "width across flats" section of piston rod (located on the other side) to prevent rod from turning. Install lower link assembly.

3. After installing stroke stopper and lock nut on the other lower link assembly, 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)

4. If stroke stopper was moved during removal of lower link, adjust it after installation, as described below:

- (1) Loosen lock nut which secures stroke stopper.
- (2) Turn stroke stopper until clearance between inner ball joint and stroke stopper is 3 mm (0.12 in) on each side.
- (3) Tighten lock nut securely.

#### Lock nut:

: 49 - 69 N·m (5.0 - 7.0 kg-m, 36 - 51 ft-lb)

- (4) Recheck clearance between inner ball joint and stroke stopper on each side.

5. Install dust boot using new boot band and clamp.

- Apply a coat of grease to grooves at boot location.

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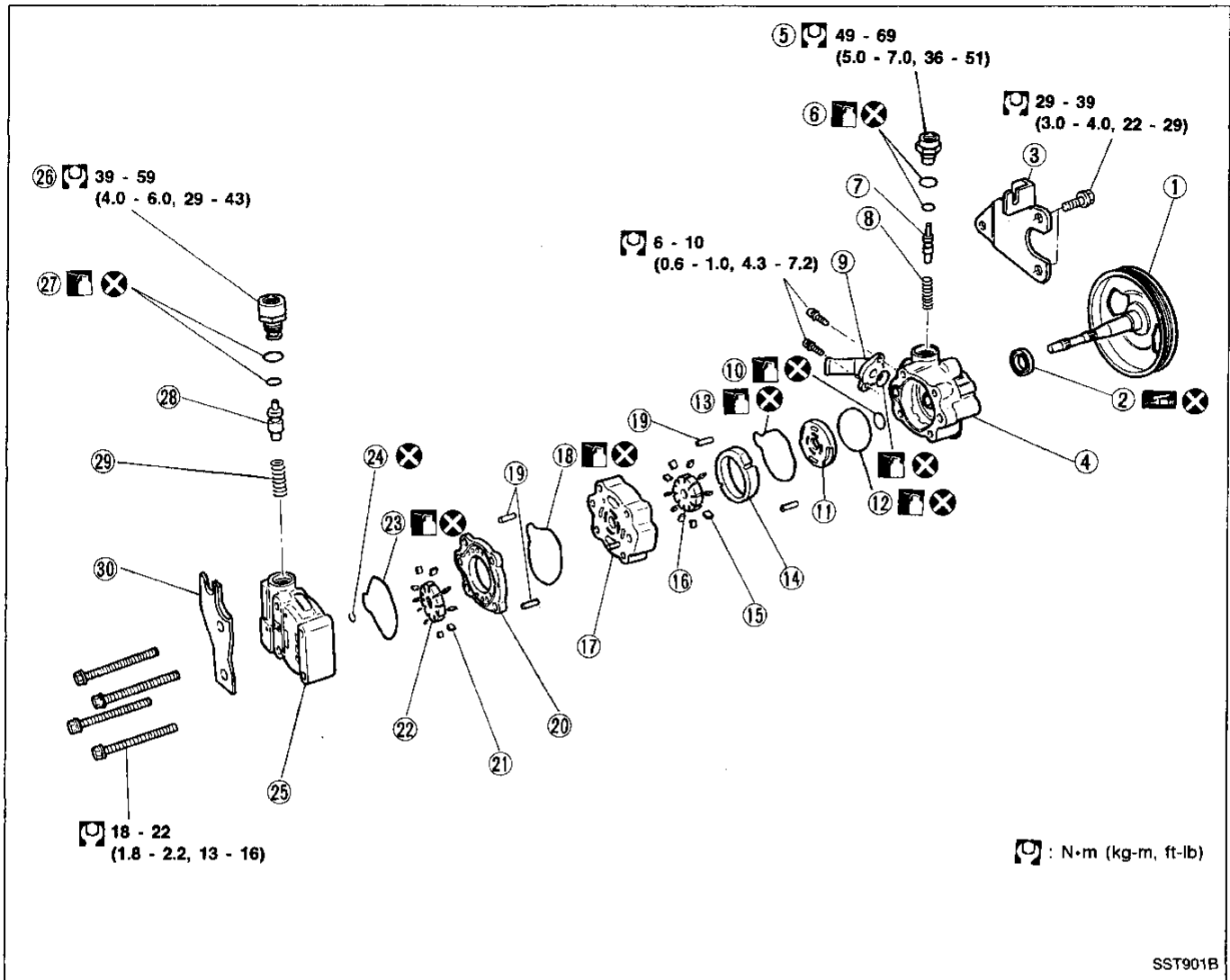
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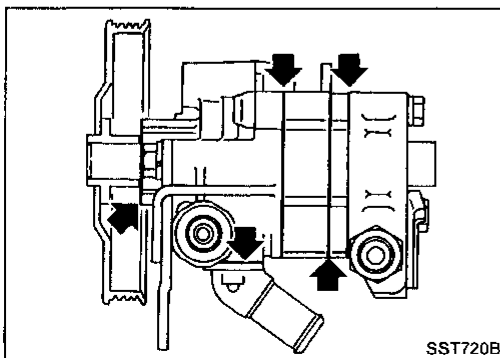
# SUPER HICAS SYSTEM

## Repair of Component Parts (Cont'd)

### OIL PUMP



- |                      |                  |                      |
|----------------------|------------------|----------------------|
| ① Pulley             | ⑪ Side plate     | ⑳ Vane               |
| ② Oil seal           | ⑫ O-ring         | ㉑ Rotor              |
| ③ Bracket            | ⑬ O-ring         | ㉒ O-ring             |
| ④ Front housing      | ⑭ Cam            | ㉓ Snap ring          |
| ⑤ Outlet connector   | ⑮ Vane           | ㉔ Rear housing       |
| ⑥ O-ring             | ⑯ Rotor          | ㉕ Outlet connector   |
| ⑦ Flow control valve | ⑰ Center housing | ㉖ O-ring             |
| ⑧ Spring             | ⑱ O-ring         | ㉗ Flow control valve |
| ⑨ Inlet connector    | ㉒ Pin            | ㉘ Spring             |
| ⑩ O-ring             | ㉓ Cam            | ㉙ Bracket            |



#### 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

# SUPER HICAS SYSTEM

## Repair of Component Parts (Cont'd)

### 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.

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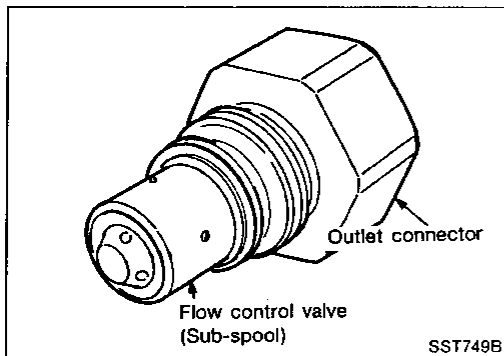
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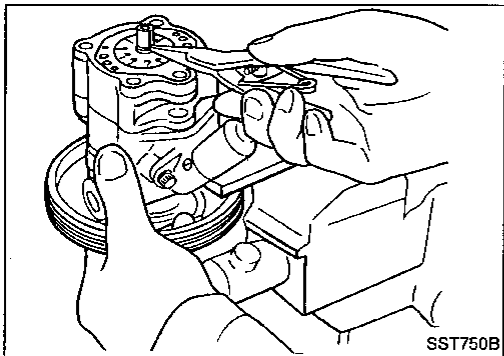
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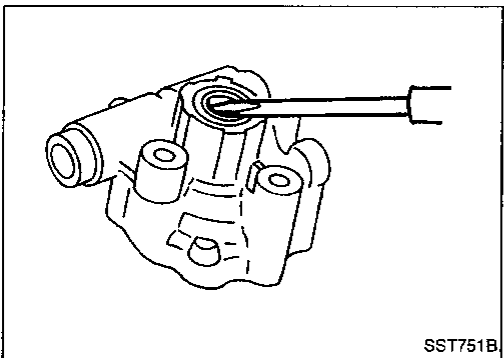


- Remove connector.
- The discharge connector incorporates a flow control valve (sub-spool). Pay attention so as not to drop connector, as this may cause deformation.
- Do not disassemble discharge connector and flow control valve.

Be careful not to confuse main side with sub side.



- Remove snap ring, then remove shaft with pulley.



- Remove oil seal.

Be careful not to damage front housing.

### Inspection

If any of the following parts are scratched or damaged, replace oil pump assembly.

- Mating surfaces of front housing and cam center housing
- Mating surfaces of rear housing and cam center housing
- Front housing oil seal
- Flow control valve
- Drive shaft
- Rotor

# SUPER HICAS SYSTEM

## Repair of Component Parts (Cont'd)

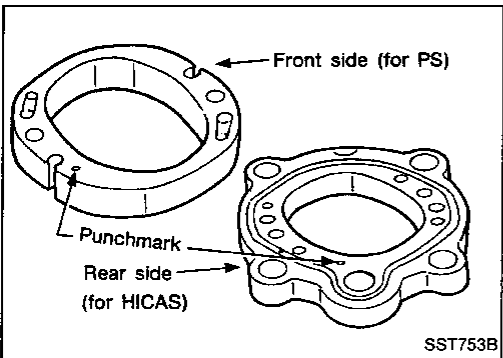
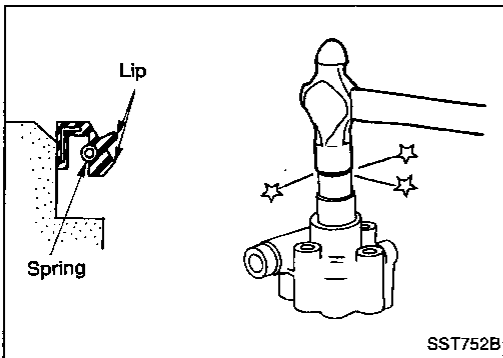
### Assembly

Assemble oil pump, noting the following instructions.

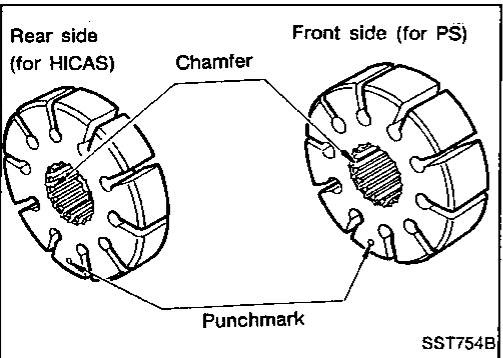
- Make sure O-rings and oil seal are properly installed.
- Always install new O-rings and oil seal.

**Be careful of oil seal direction.**

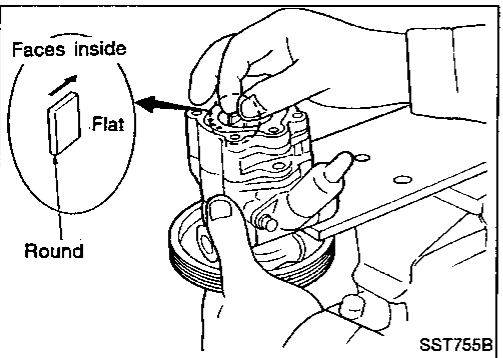
- Cam ring, rotor and vanes must be replaced as a set if necessary.
- Coat each part with A.T.F. when assembling.



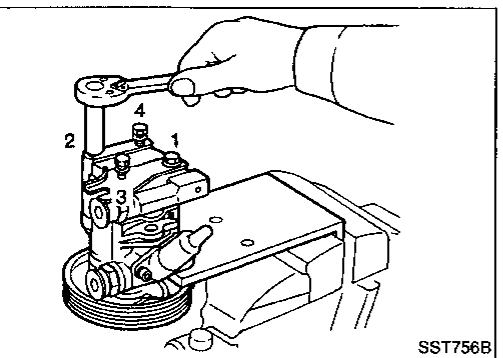
- The cam ring shape is different between front side cam (for PS) and rear side cam (for HICAS). Install front side cam ring with punchmark set on the pulley side, and install rear side cam ring with punchmark set on rear housing side.



- Pay attention to rotor direction.



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

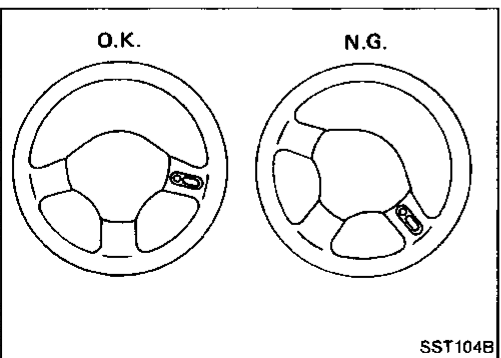
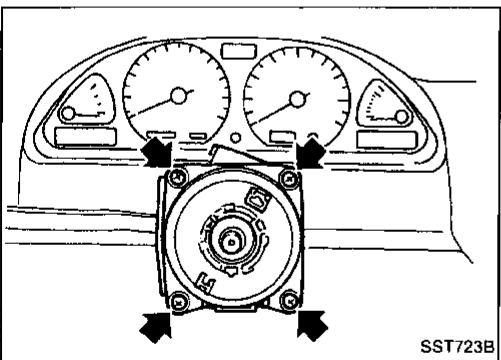
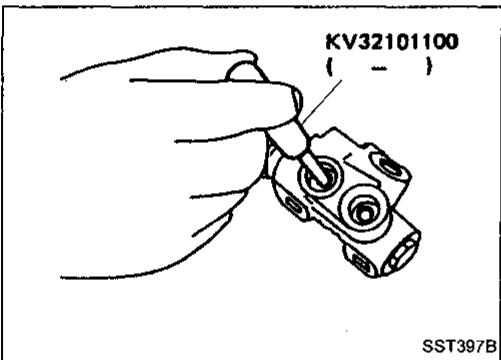
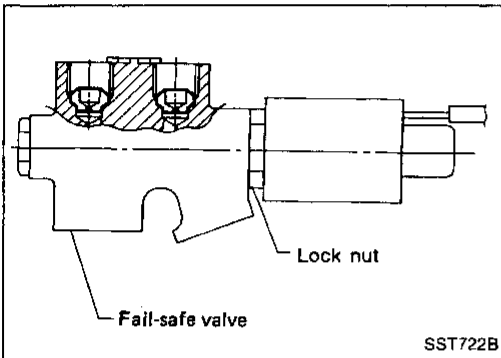
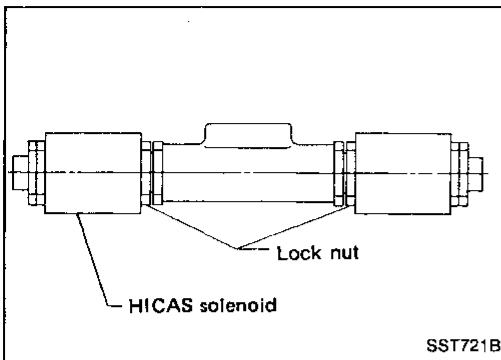


- Tighten rear housing bolts in diagonal sequence. First tighten bolts to about a half of the standard tightening torque, then tighten them again to the standard torque.

# SUPER HICAS SYSTEM

## Repair of Component Parts (Cont'd)

### HICAS SOLENOID AND FAIL-SAFE VALVE



- Do not loosen lock nut which secures solenoid since HICAS solenoid and fail-safe valves are of types that should not be disassembled.
- If any part is found to be malfunctioning, always replace as a valve assembly.

- Whenever tubes are disconnected from fail-safe valve check tube seat for scratches or damage. A scratched or cracked tube seat may cause oil leakage. Replace it using pin punch.

### STEERING ANGLE SENSOR

- Ensure that steering angle sensor bolts are secure and tight.
- If any part of steering angle sensor is malfunctioning, replace steering angle sensor assembly.

### STEERING WHEEL

#### Checking neutral position

- Check that steering wheel is in neutral position when driving straight ahead at a speed of at least 70 km/h (43 MPH).
- If it is not in neutral position, remove steering wheel and reinstall it correctly.
- If neutral position is between two serrated teeth, loosen tie-rod lock nut and move tie-rod in opposite direction by the same amount on both left and right sides to compensate for error in neutral position.

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## Trouble Diagnoses

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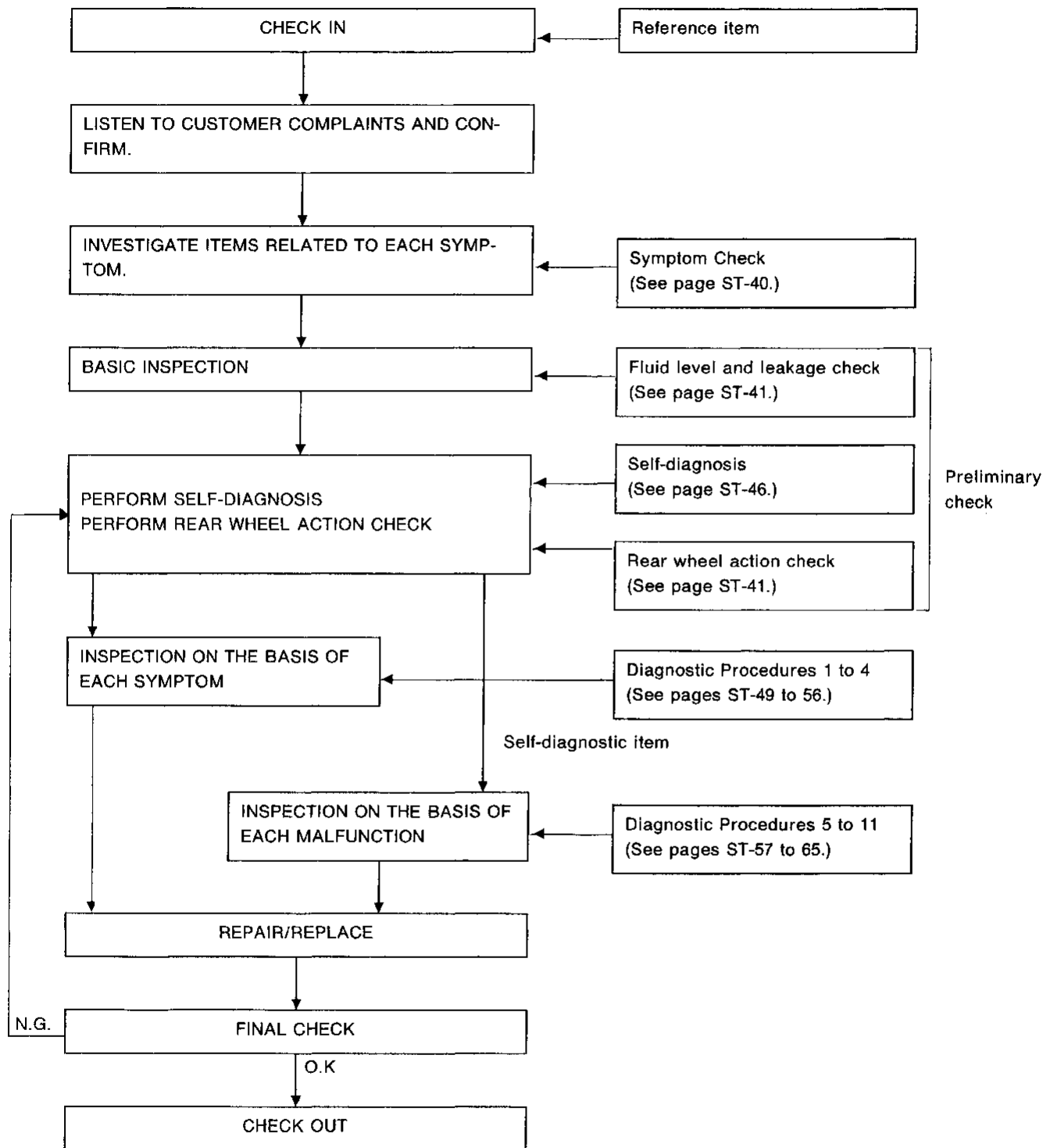
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# SUPER HICAS SYSTEM

## Trouble Diagnoses (Cont'd)

### HOW TO PERFORM TROUBLE DIAGNOSES FOR QUICK AND ACCURATE REPAIR

#### Work flow



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# SUPER HICAS SYSTEM

## Trouble Diagnoses (Cont'd) SYMPTOM CHART

### Diagnostic table

PROCEDURE			Preliminary Check			Diagnostic Procedure										
REFERENCE PAGE (ST-)			41	41	41	49	49	51	52	57	59	60	61	62	64	65
SYMPTOM			Preliminary check 1	Preliminary check 2	Preliminary check 3	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
No warning lamp comes on when ignition switch is turned "ON".			<input type="radio"/>			<input type="radio"/>										
Warning lamp comes on when engine is running.			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Abnormal noise is emitted.			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			<input type="radio"/>								
Vehicle behavior is unusual (due to malfunctioning HICAS system.)			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Self-diagnostic results	System is not set in self-diagnosis mode.									<input type="radio"/>						
	Self-diagnosis code No.	Diagnosed part	CONSULT indication													
	1	HICAS solenoid (RH) output is not present.	HICAS SOLENOID-R [ABNORMAL SIGNAL]								<input type="radio"/>					
	2	HICAS solenoid (LH) output is not present.	HICAS SOLENOID-L [ABNORMAL SIGNAL]								<input type="radio"/>					
	3	Fail-safe valve output is not present.	FAIL-SAFE VALVE [ABNORMAL SIGNAL]									<input type="radio"/>				
	4	(Constantly normal mode)	—													
	5	Vehicle speed signal is not present.	VEHICLE SPEED SENSOR [NO SIGNAL] (-a) CAR SPEED SENSOR [SIG-SUDDEN TURN] (-b)											<input type="radio"/>		
	6	Steering angle sensor input is not present.	STEERING ANGLE SEN [NO ANG SIGNAL] (-a) STEERING ANGLE SEN [NO NEUT SIGNAL] (-b)												<input type="radio"/>	
	7		STEERING ANGLE SEN [NEUT SIG-360° OFF] (-c) STEERING ANGLE SEN [NEUT SIG-30° ON] (-d)													
	8	Parking brake (AT) or clutch switch (MT) input is not present.	—													<input type="radio"/>
9	Inhibitor switch (AT) or neutral switch (MT) input is not present.	—													<input type="radio"/>	



# SUPER HICAS SYSTEM

## Trouble Diagnoses (Cont'd)

### PRELIMINARY CHECK

#### Check 1

#### Checking fluid level and fluid leakage

Refer to "SUPER HICAS SYSTEM — On-vehicle Service" on page ST-27.

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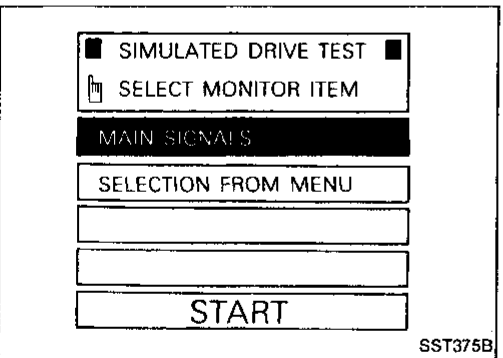
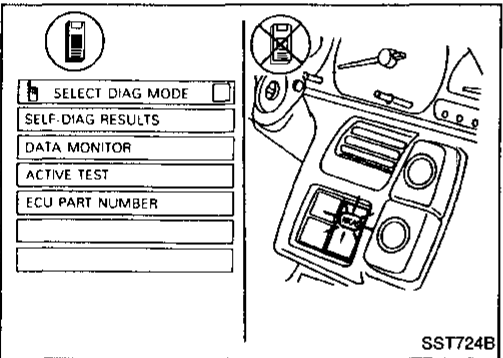
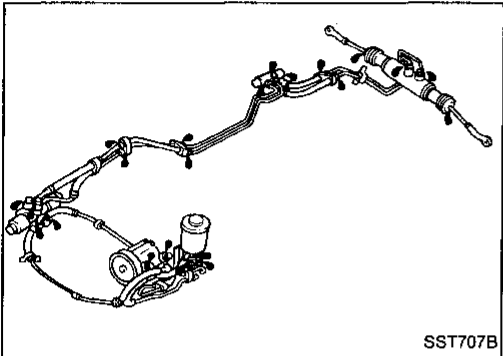
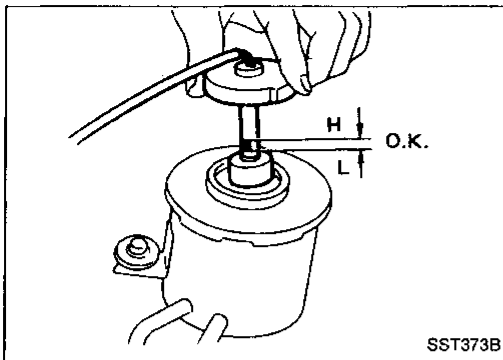
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#### Check 2

#### Perform self-diagnosis.

Refer to "Self-diagnosis" on page ST-46.

#### Check 3

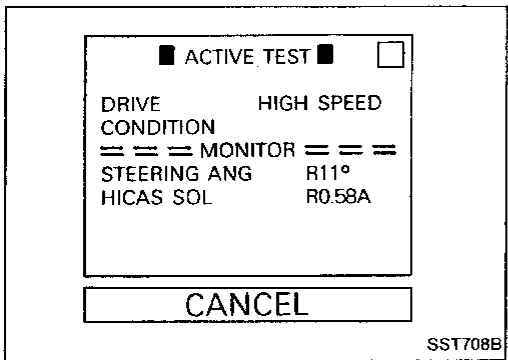
#### Perform rear wheel action check.

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 diagnostic connector 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.

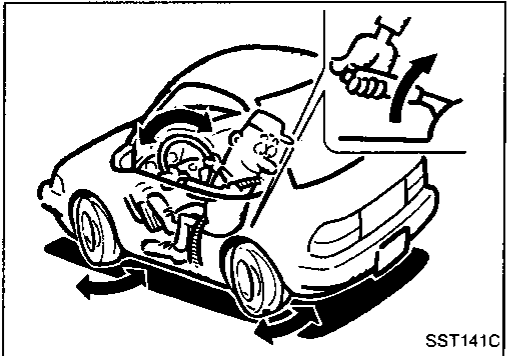
# SUPER HICAS SYSTEM

## Trouble Diagnoses (Cont'd)

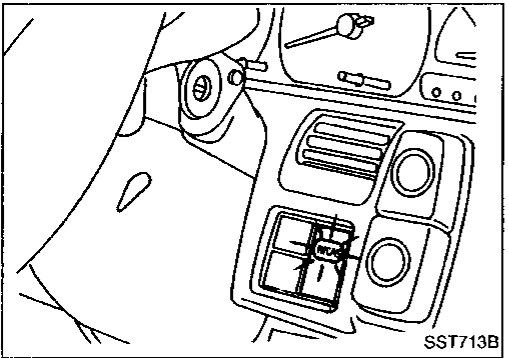


6. Touch "START."

After simulated drive condition has continued for 5 minutes, it will automatically cancel and CONSULT unit will then show "TEST IS INTERRUPTED TO AVOID OIL TEMP RISE" display. To cancel this mode during self-diagnosis, simply touch "CANCEL".

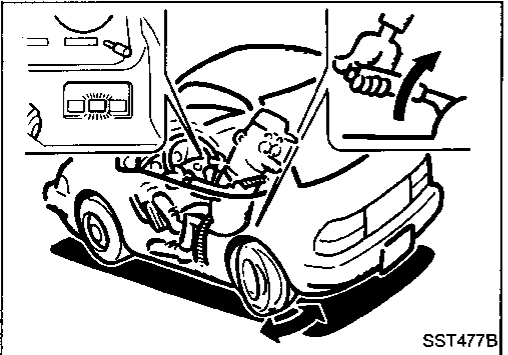


7. While running engine at speeds greater than 2,000 rpm, turn steering wheel 180° to the left and right from the neutral position. Ensure that rear wheels steer in response to rotation of steering wheel.



When CONSULT is not used: 

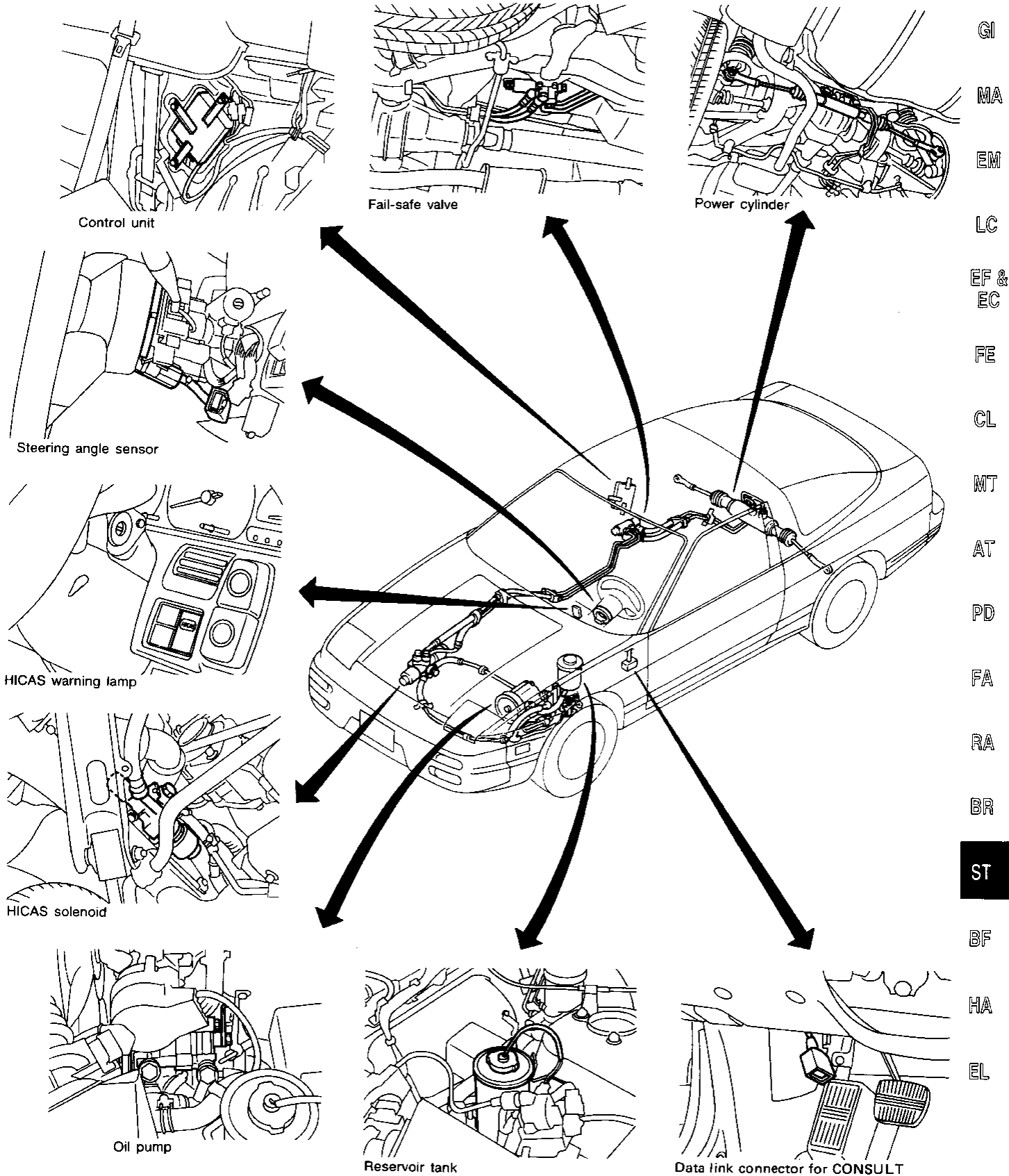
1. Turn key switch "OFF".
2. Set HICAS system in self-diagnosis mode.
  - (1) Turn ignition switch "OFF".
  - (2) Set shift lever to "P" or "N" position (A/T model), or "Neutral" position (M/T model).
  - (3) Turn ignition switch "ON".
  - (4) Immediately start engine.
  - (5) Turn steering wheel from 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. Set steering wheel to a point approximately 10° from 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 LOCATION



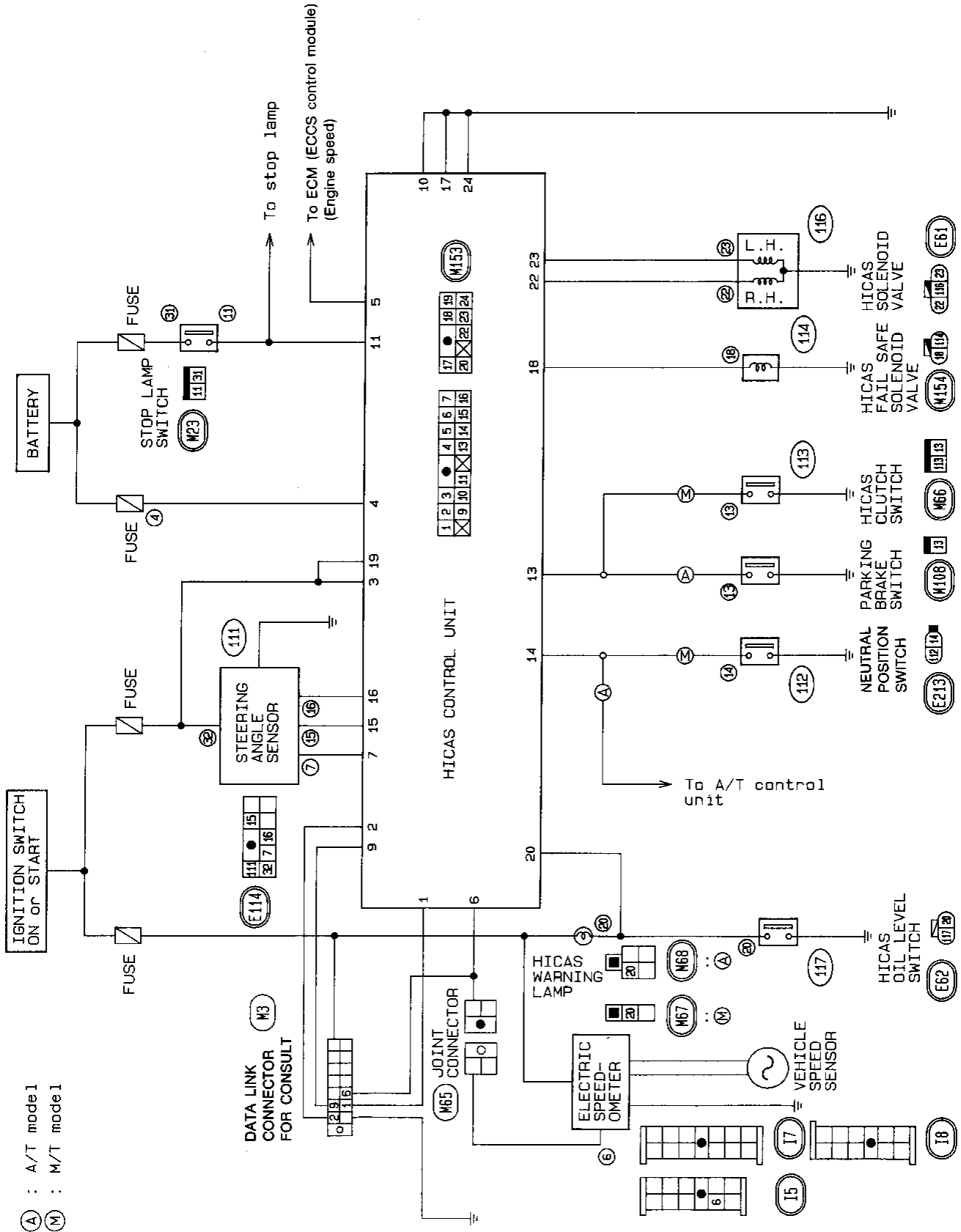
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SST695B

# SUPER HICAS SYSTEM

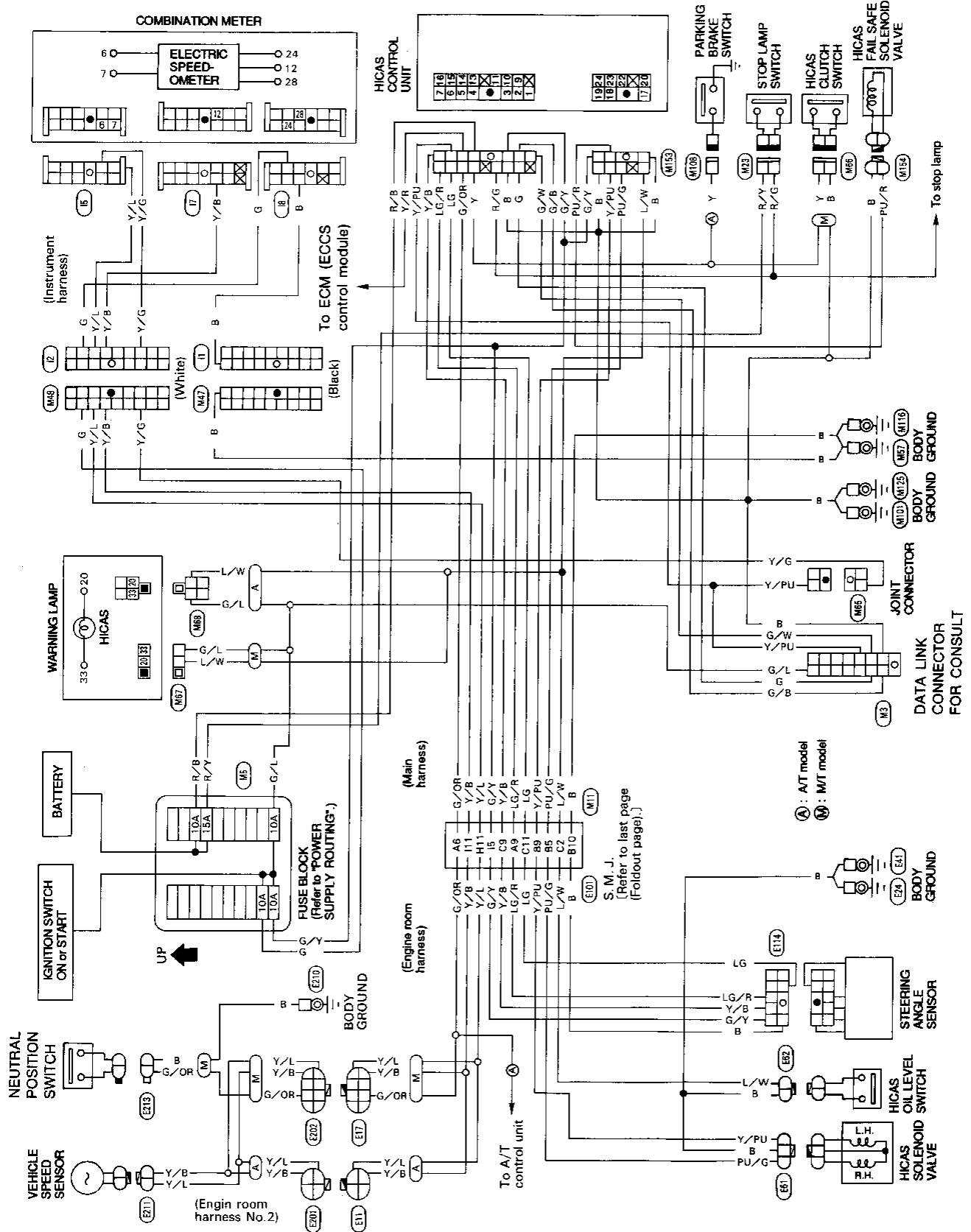
## Trouble Diagnoses (Cont'd)

### CIRCUIT DIAGRAM FOR QUICK PINPOINT CHECK



# SUPER HICAS SYSTEM

## Trouble Diagnoses (Cont'd) WIRING DIAGRAM



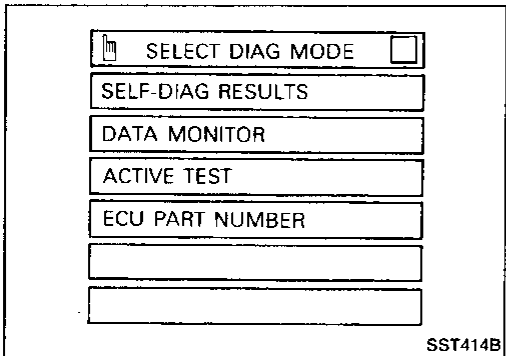
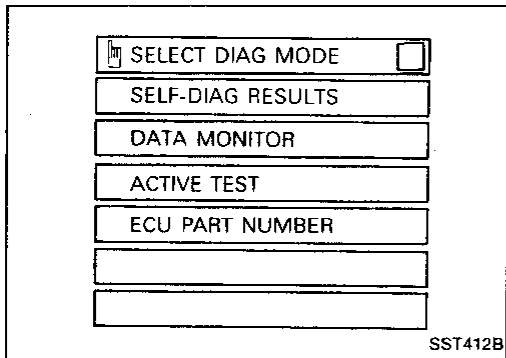
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# SUPER HICAS SYSTEM

## 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.



#### For reference:

#### Recording input/output signals using data monitor function

- Start engine.
  - Touch START (on CONSULT display).
  - Touch HICAS.
  - Touch DATA MONITOR.
- Refer to CONSULT operation manual "HICAS" for details.

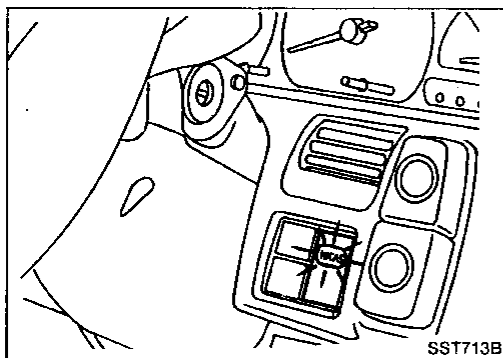
### SELF-DIAGNOSIS (When CONSULT is not used)

#### Self-diagnosis procedures

1. Input starting conditions for self-diagnosis.
  - (1) Turn ignition switch "OFF".
  - (2) Set shift lever to "P" or "N" 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.
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.



# SUPER HICAS SYSTEM

## Trouble Diagnoses (Cont'd)

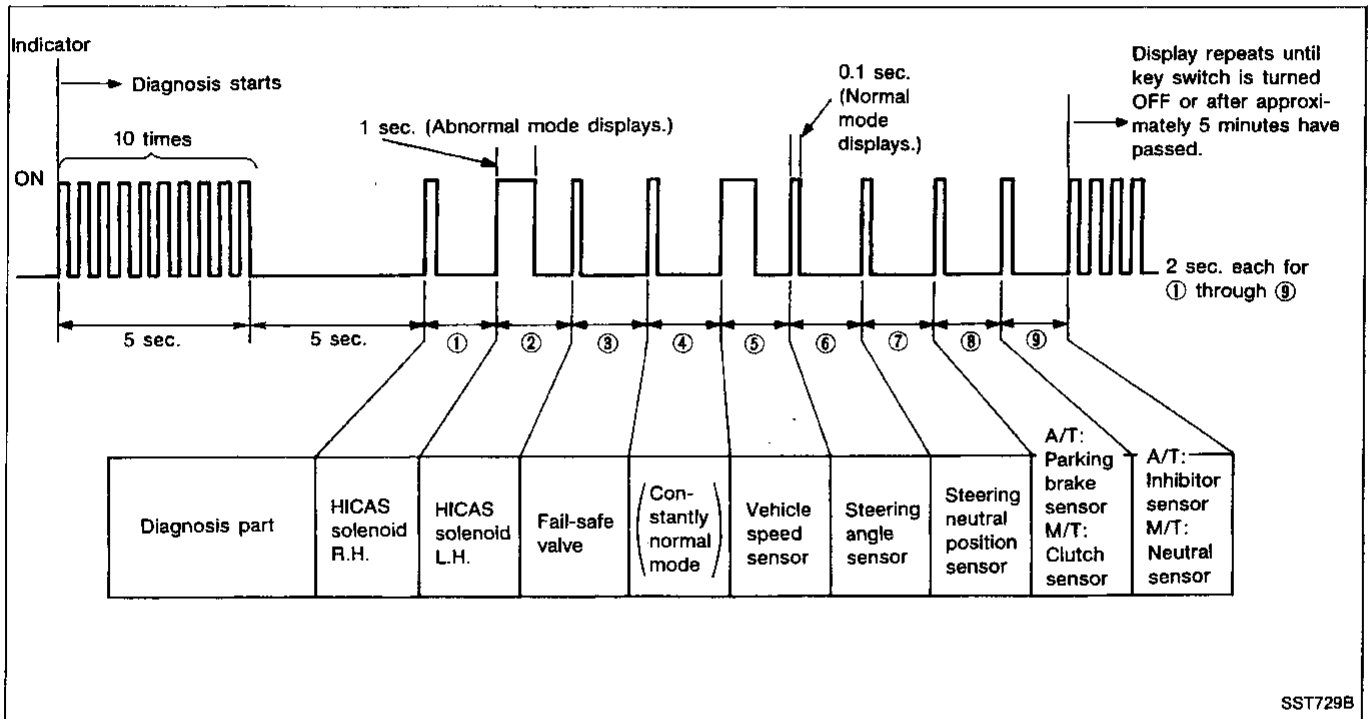
When there is a system malfunction:

Example: When ② HICAS solenoid LH, and ⑤ vehicle speed sensor have experienced a malfunction.

The warning lamp displays abnormal mode (1 sec. ON).

**A** If fail-safe system was operated (fail-safe valve is operating) when ignition switch was turned OFF for the last time, fail-safe items will be displayed in numerical order in modes indicated. After all items are displayed, display is repeated again.

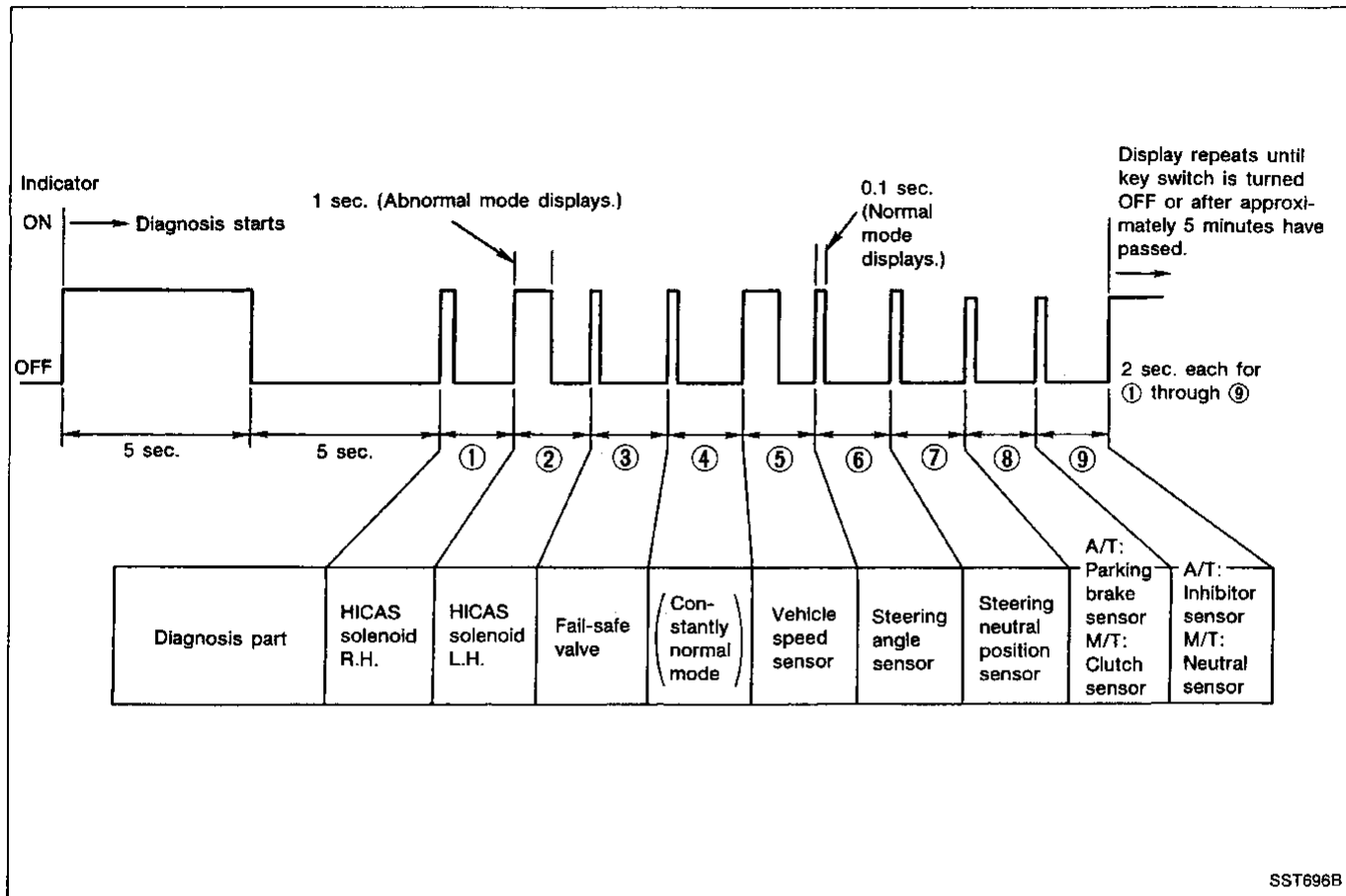
- To change the display mode to **A**, turn OFF ignition switch after mode **B** is displayed.
- When battery charge is insufficient, mode **B** is displayed.



# SUPER HICAS SYSTEM

## Trouble Diagnoses (Cont'd)

■ If fail-safe system was not operated when ignition switch was turned OFF for the last time, display will show self-diagnosis results in numerical sequence in modes indicated below. After all self-diagnosis results are shown, display is repeated again.



### Canceling the self-diagnosis function

There are three methods for canceling the self-diagnosis function, as described below:

- The self-diagnosis system is canceled by the turning ignition switch "OFF".
- After self-diagnosing has been operated for approximately 5 minutes, the self-diagnosis system will be automatically canceled.
- The self-diagnosis system is canceled by a vehicle speed of 30 km/h (19 MPH) or over.



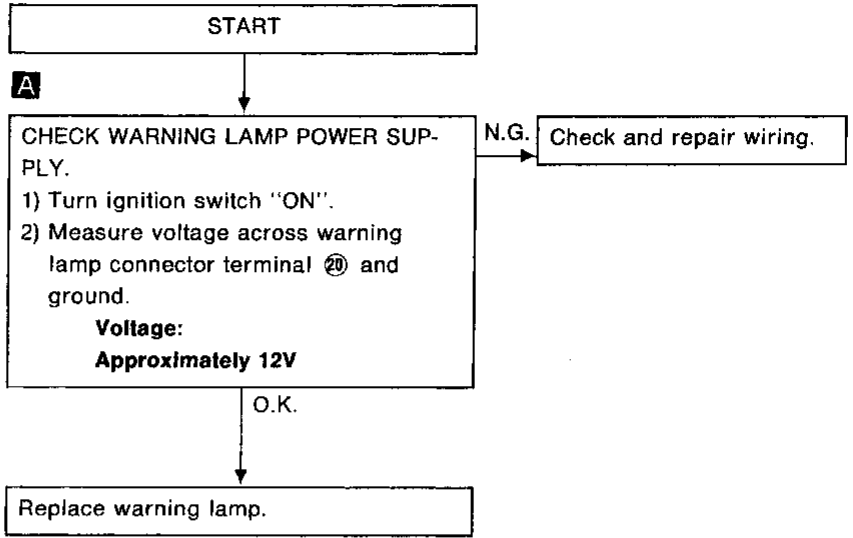
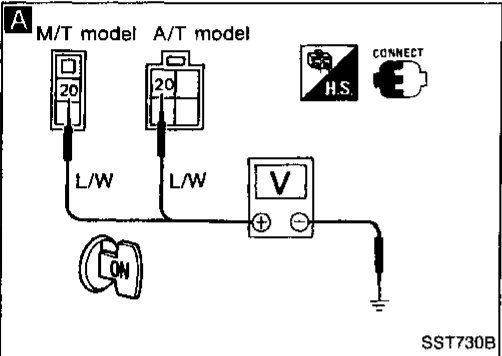
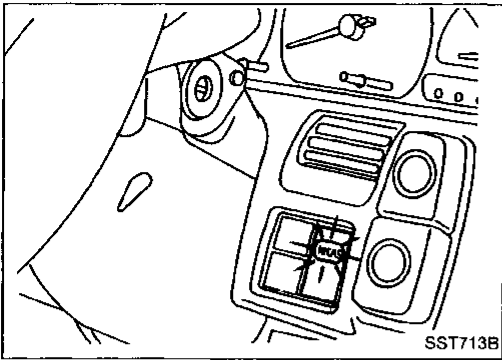
# SUPER HICAS SYSTEM

## Trouble Diagnoses (Cont'd)

### DIAGNOSTIC PROCEDURE 1

#### SYMPTOM:

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

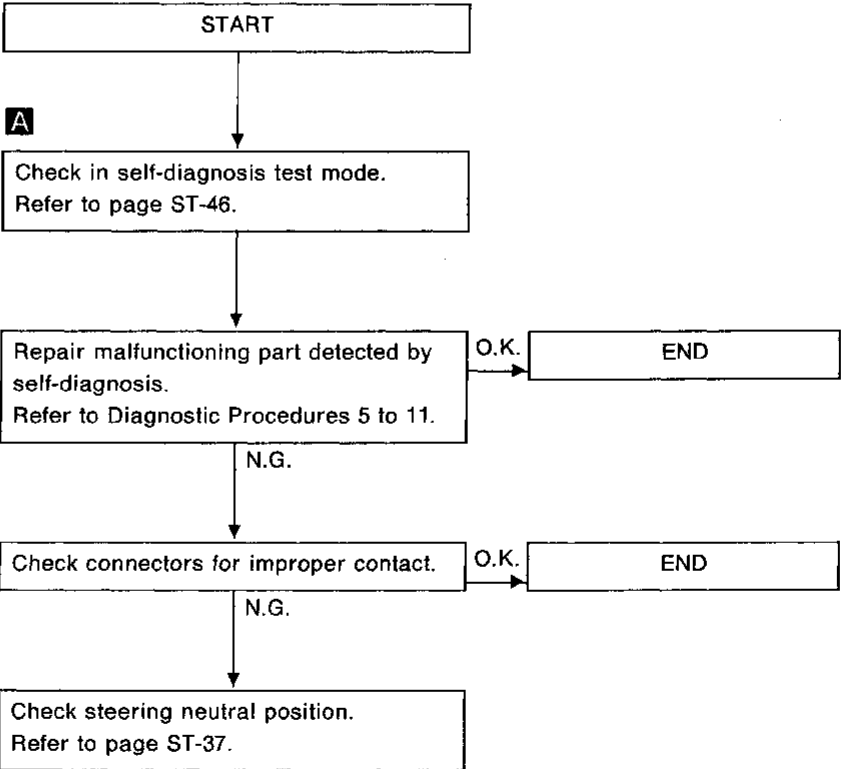
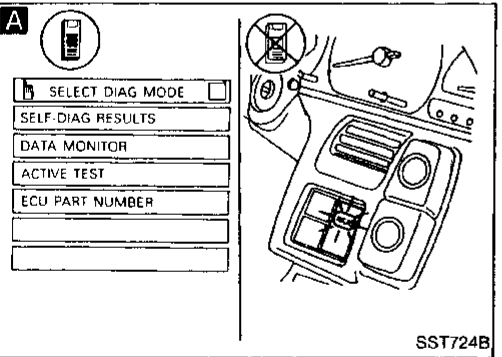
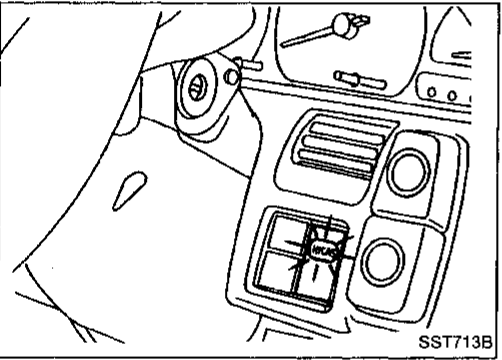


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### DIAGNOSTIC PROCEDURE 2

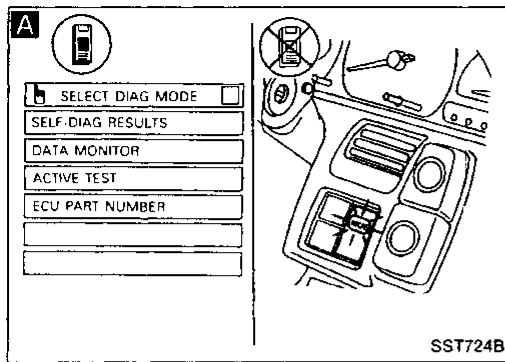
#### SYMPTOM (A):

Warning lamp comes on during operation.



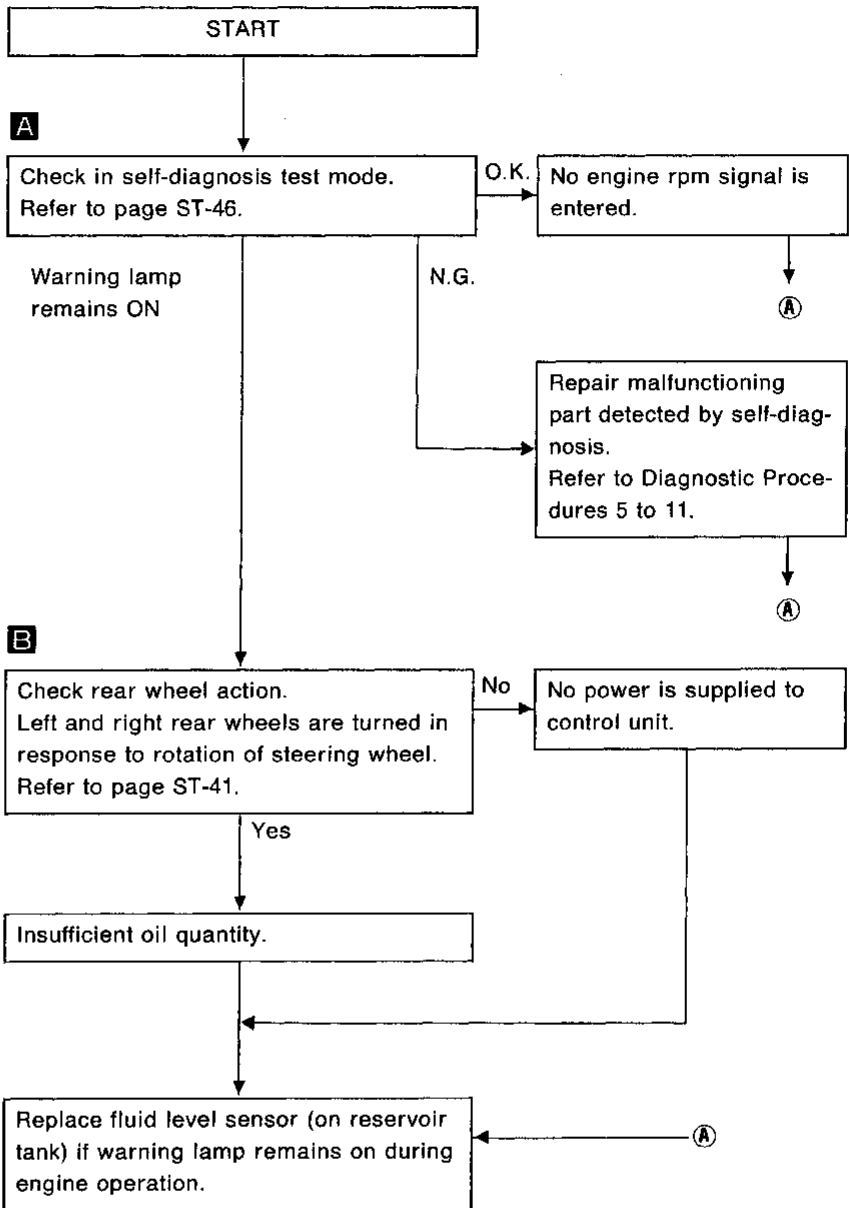
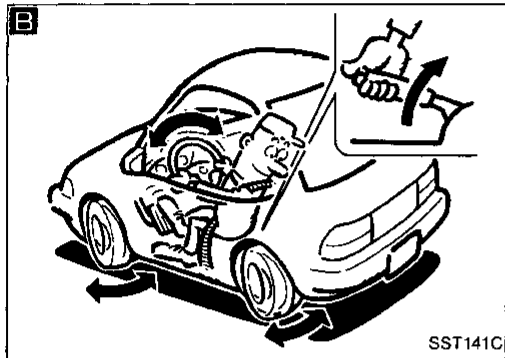
# SUPER HICAS SYSTEM

## Trouble Diagnoses (Cont'd)



### SYMPTOM (B):

Warning lamp comes on when ignition switch is turned ON; however, it does not go out after engine start.



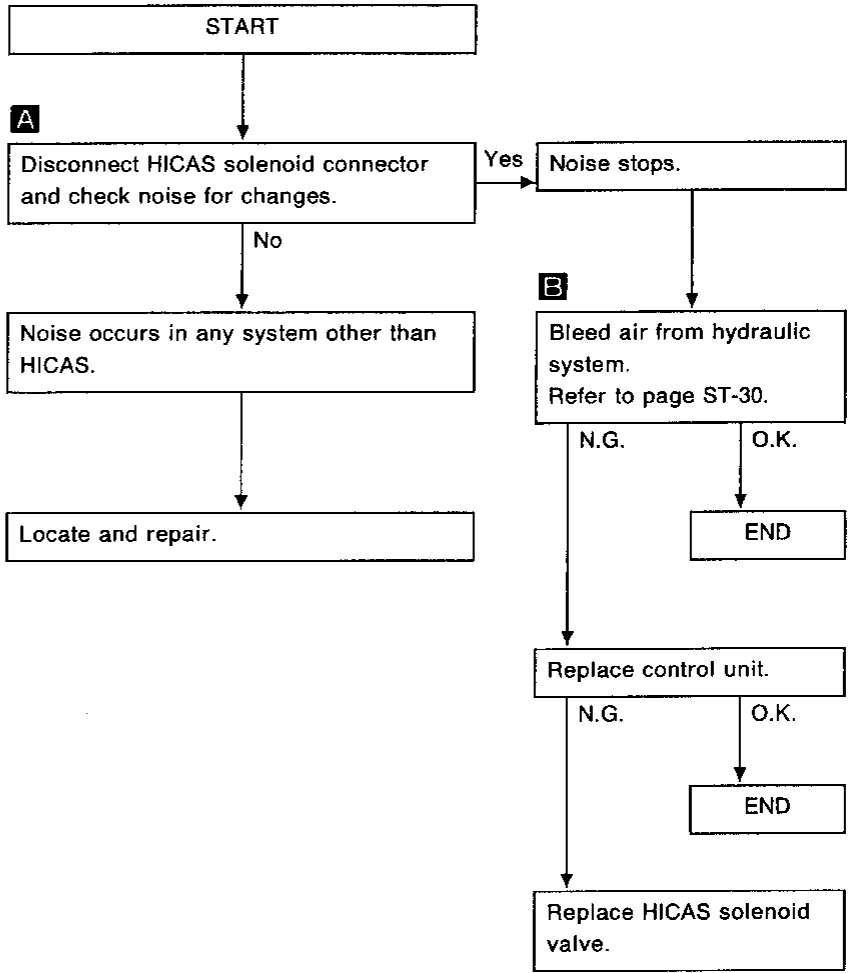
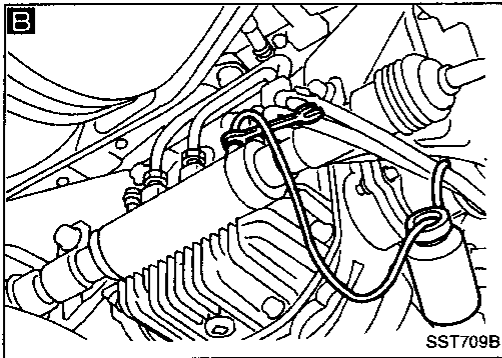
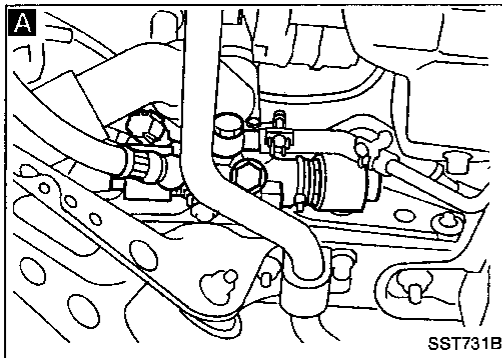
# SUPER HICAS SYSTEM

## Trouble Diagnoses (Cont'd)

### DIAGNOSTIC PROCEDURE 3

#### SYMPTOM:

Abnormal noise occurs.



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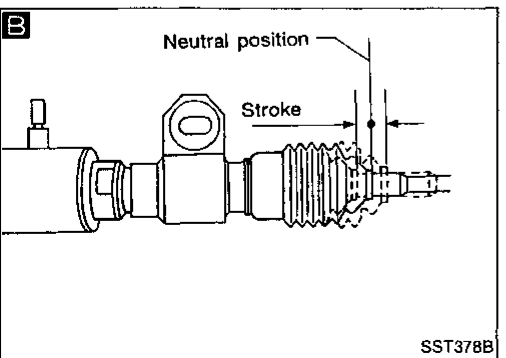
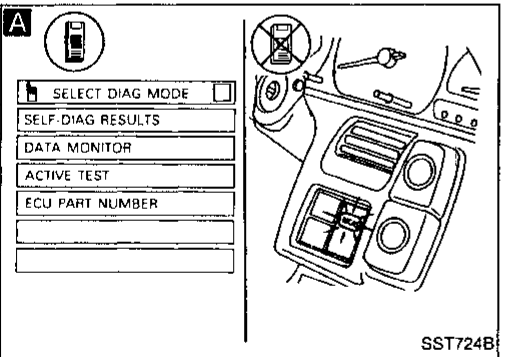
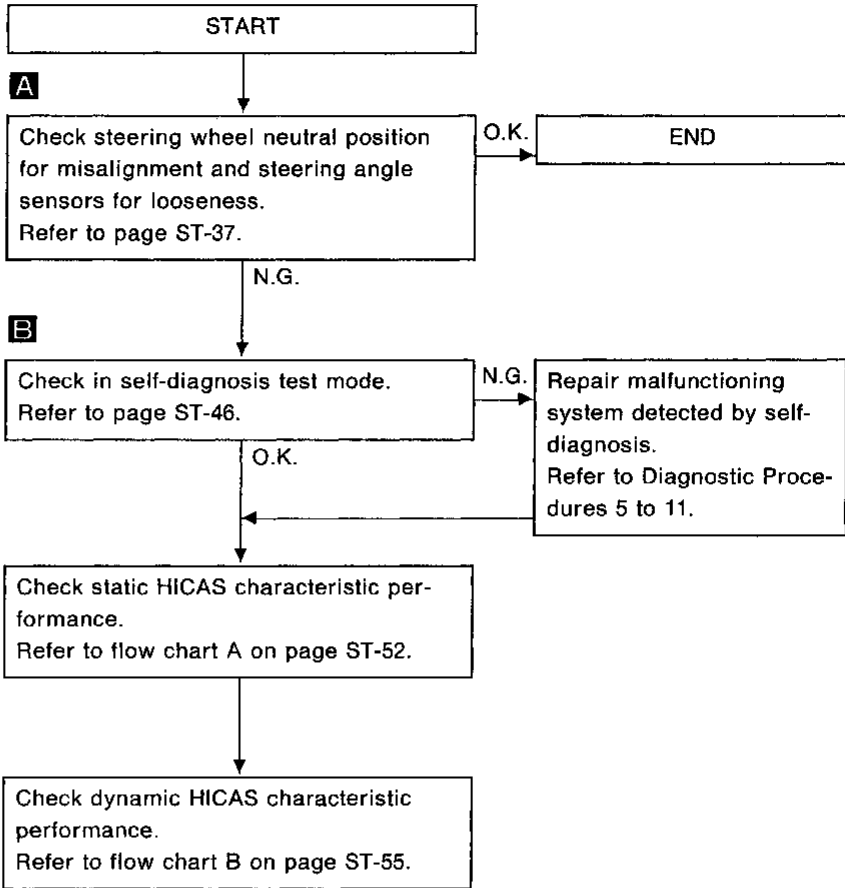
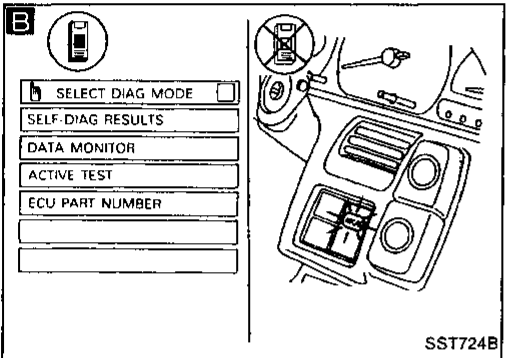
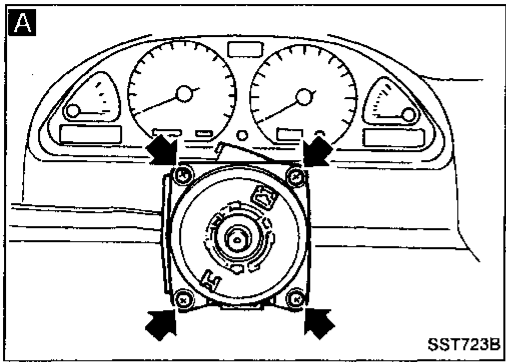
# SUPER HICAS SYSTEM

## Trouble Diagnoses (Cont'd)

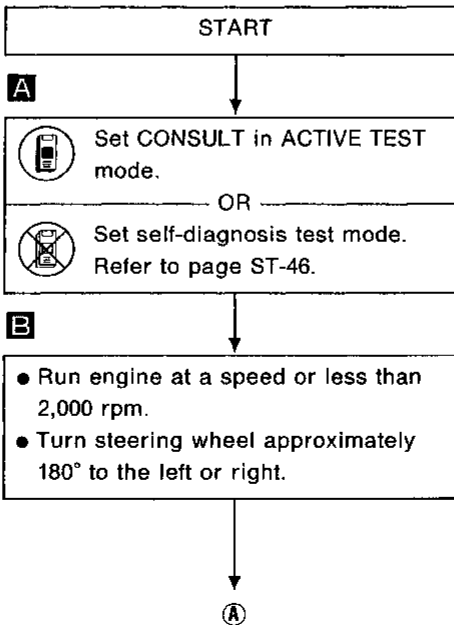
### DIAGNOSTIC PROCEDURE 4

#### SYMPTOM:

Vehicle behavior is abnormal. (Vehicle sways or jerks.)

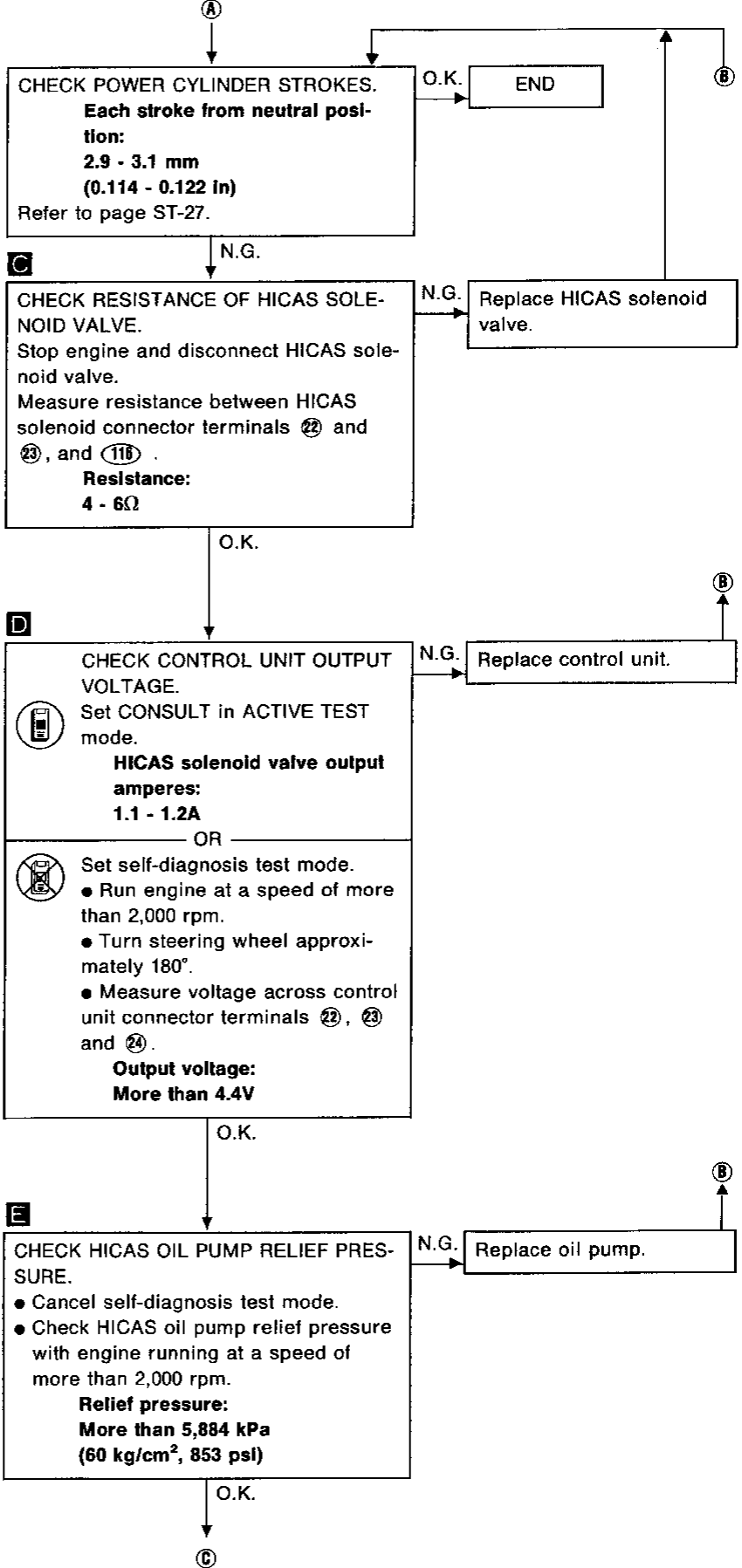
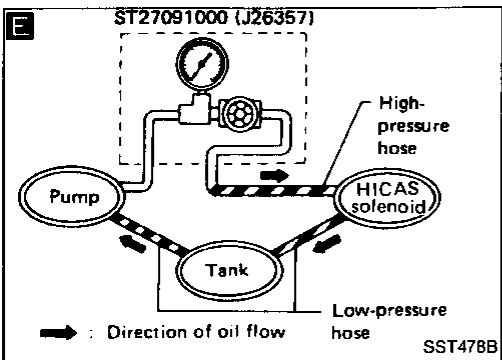
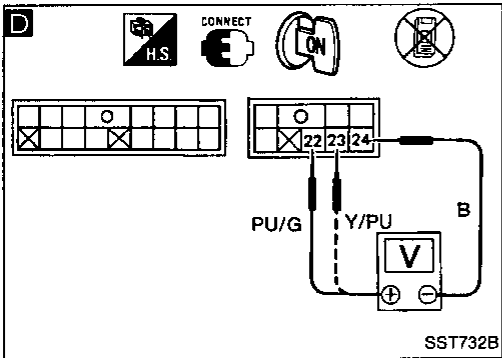
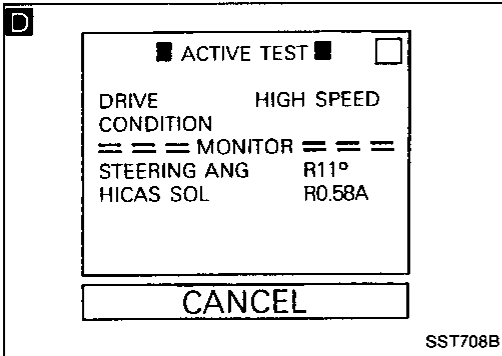
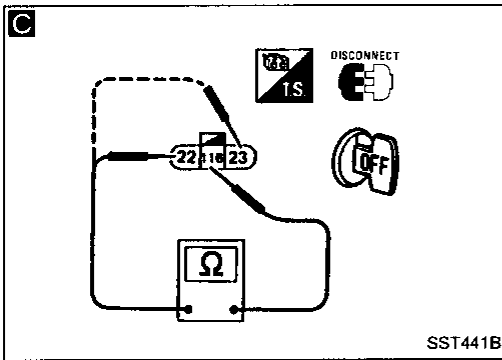


#### A. Static HICAS characteristic performance check



# SUPER HICAS SYSTEM

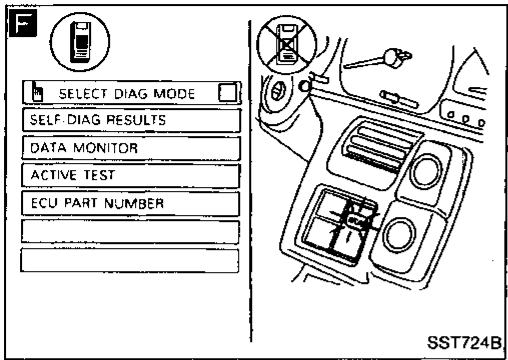
## Trouble Diagnoses (Cont'd)



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# SUPER HICAS SYSTEM

## Trouble Diagnoses (Cont'd)



**F**

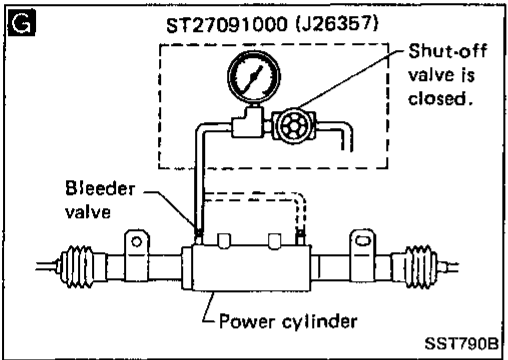
ⓐ

CHECK OIL PRESSURE AT FAIL-SAFE VALVE.

Set CONSULT in ACTIVE TEST mode.

OR

Set self-diagnosis test mode.



**G**

- Run engine at a speed of more than 2,000 rpm and turn steering wheel approximately 180° to the left and right.
- Check oil pressure at bleeder valve of power cylinder.

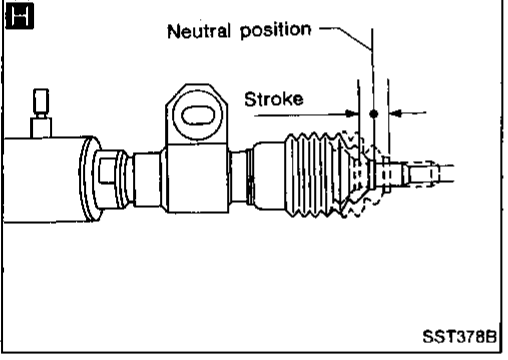
**Oil pressure:**  
**More than 5,394 kPa**  
**(55 kg/cm<sup>2</sup>, 782 psi)**

N.G. Replace HICAS solenoid valve.

**H**

CHECK POWER CYLINDER STROKE.

Each stroke from neutral position:  
**2.9 - 3.1 mm**  
**(0.114 - 0.122 in)**  
 Refer to page ST-27.



O.K.

Replace power cylinder.

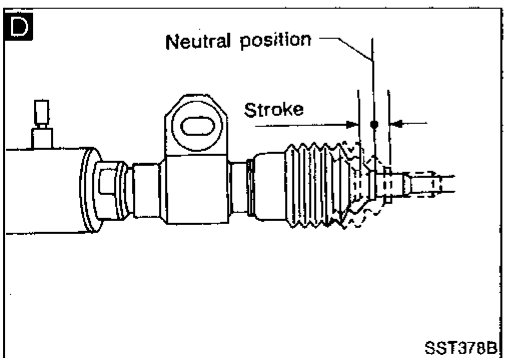
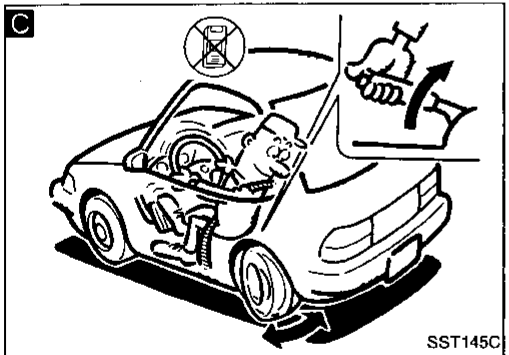
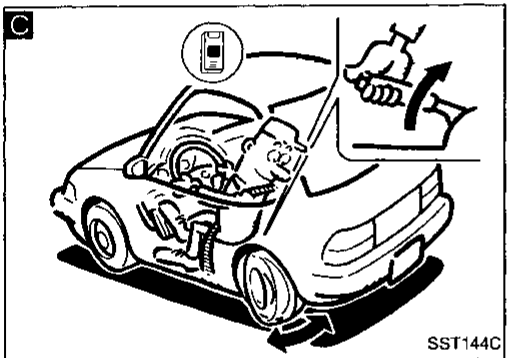
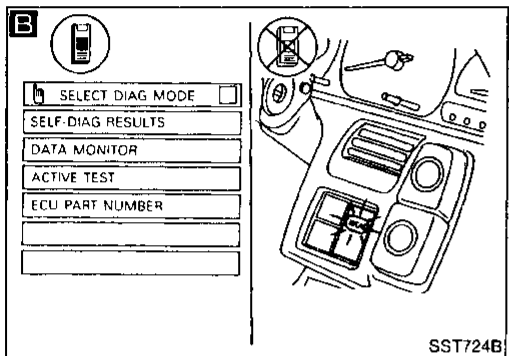
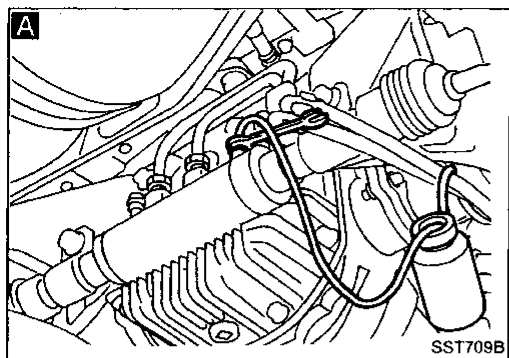
N.G. Replace fail-safe valve.

O.K. ⓑ

# SUPER HICAS SYSTEM

## Trouble Diagnoses (Cont'd)

### B. Dynamic HICAS characteristic performance check



START

**A** CHECK PIPING AND CONNECTIONS. ALSO BLEED AIR FROM HYDRAULIC SYSTEM.

- Replace piping or connectors which are found to be damaged.
- Bleed air from hydraulic system. Refer to page ST-30.

**B** Set CONSULT in ACTIVE TEST mode. OR Set in self-diagnosis mode. Refer to page ST-46.

Run engine at a speed of more than 2,000 rpm.

**C** CHECK REAR WHEELS FOR PROPER MOVEMENT.

Ensure that rear wheel turns to the left or right when steering wheel is turned to the left or right.

OR

Ensure that rear wheels intermittently turn to the left and right when steering wheel is set to the neutral position.

**D** CHECK POWER CYLINDER STROKES. Each stroke from neutral position: More than 2.0 mm (0.079 in)

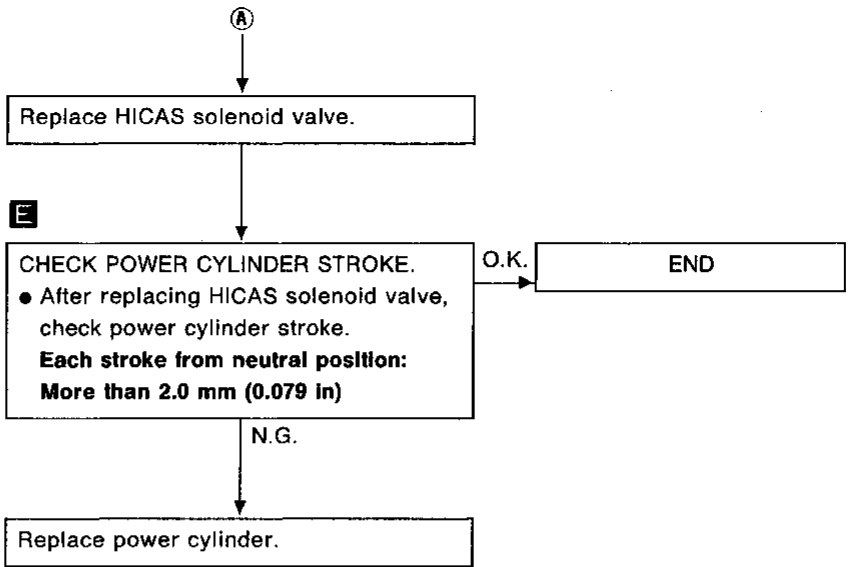
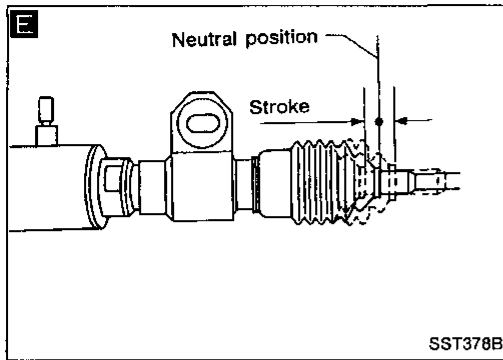
O.K. → END

N.G. → **A**

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# SUPER HICAS SYSTEM

## Trouble Diagnoses (Cont'd)





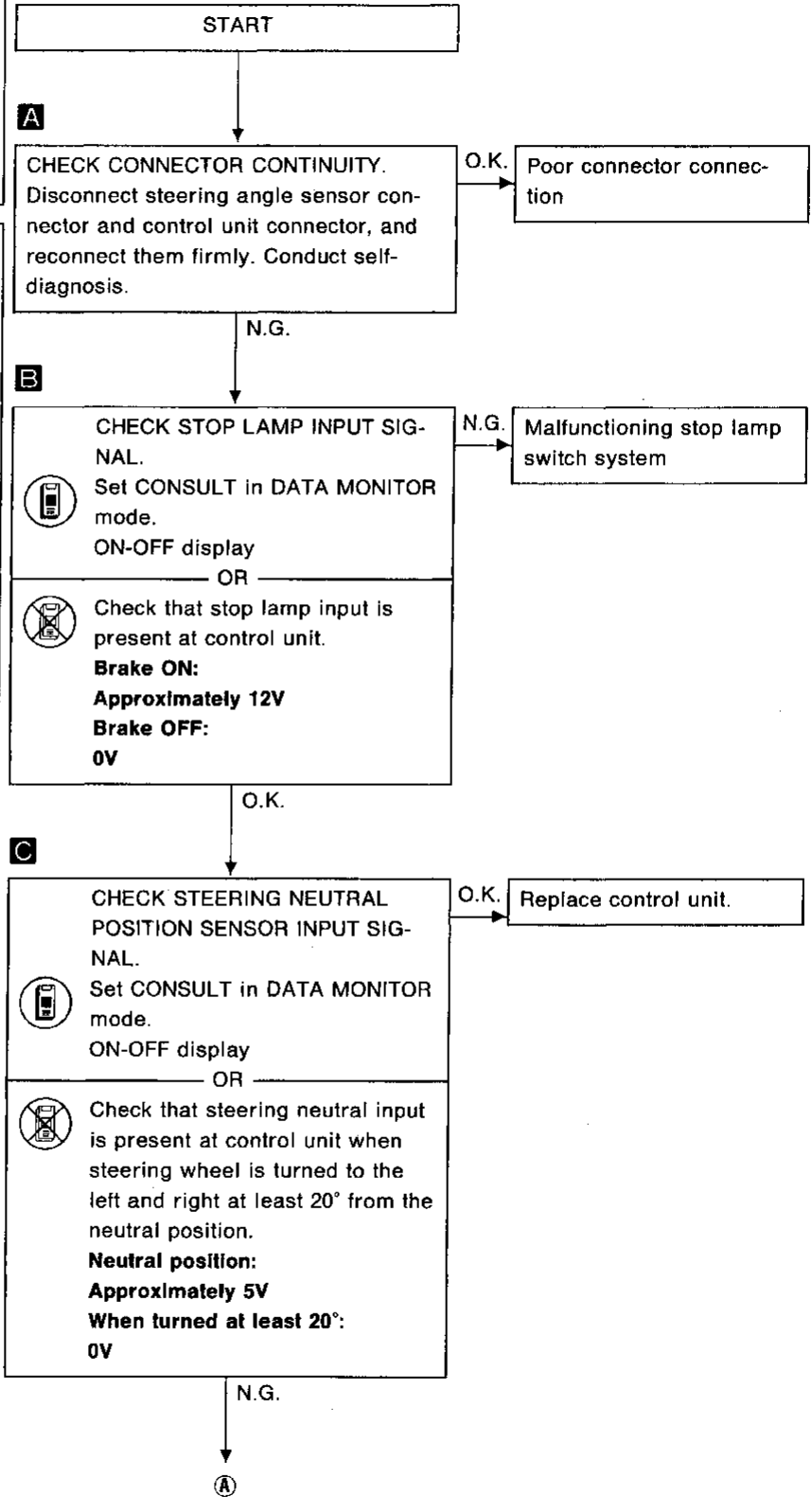
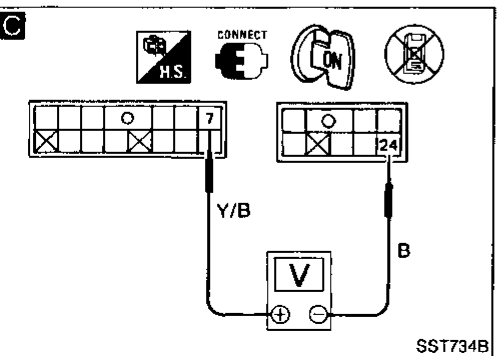
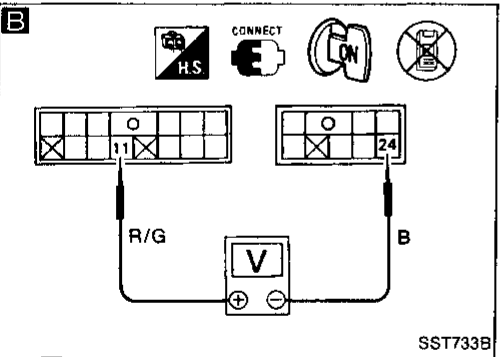
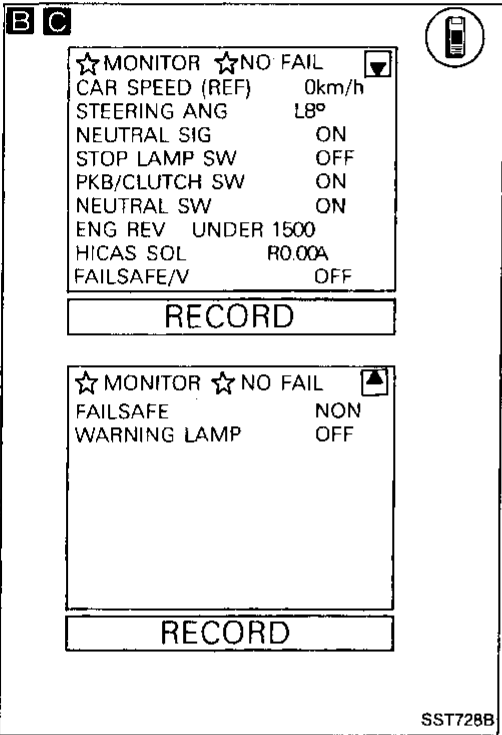
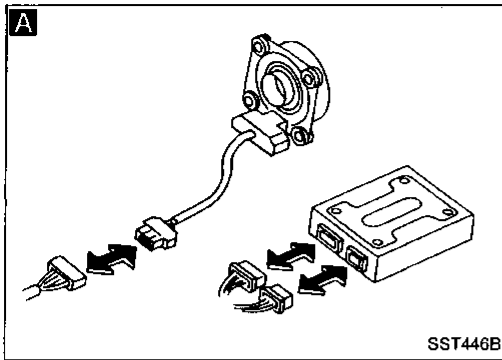
# SUPER HICAS SYSTEM

## Trouble Diagnoses (Cont'd)

### DIAGNOSTIC PROCEDURE 5

#### SYMPTOM:

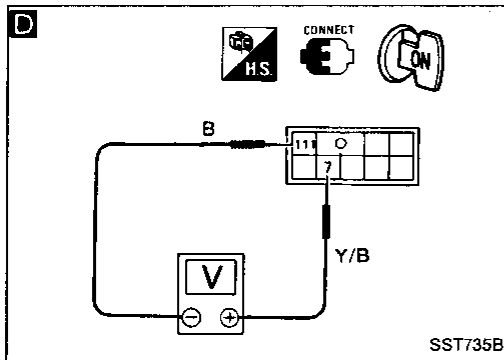
System is not set in self-diagnosis test mode.



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# SUPER HICAS SYSTEM

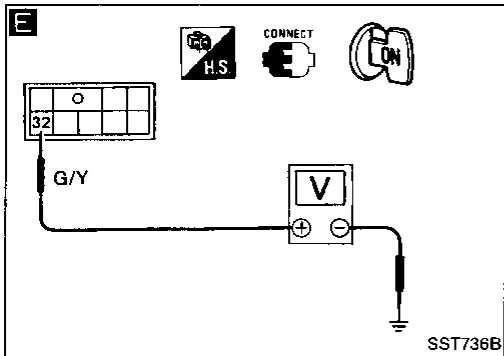
## Trouble Diagnoses (Cont'd)



**D**

**CHECK STEERING NEUTRAL POSITION SENSOR OUTPUT SIGNAL.**  
Check that steering neutral output is present when steering wheel is turned to the left and right at least 20° from the neutral position.  
**Neutral position:**  
**Approximately 5V**  
**When turned at least 20°:**  
**0V**

O.K. → Repair or replace harness between control unit and steering angle sensor.

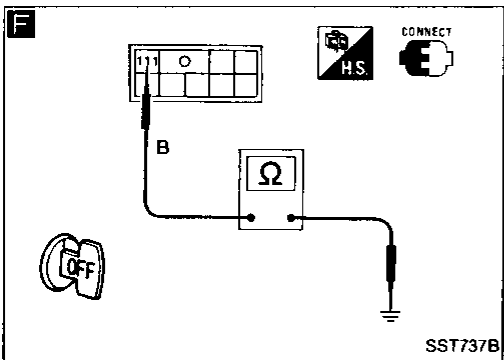


N.G. ↓

**E**

**CHECK STEERING ANGLE SENSOR POWER SUPPLY.**  
1) Turn ignition switch "ON".  
2) Measure voltage across steering angle sensor connector terminal IGN and ground.  
**Voltage:**  
**Approximately 12V**

O.K. → Replace steering angle sensor.



**F**

**CHECK STEERING ANGLE SENSOR GROUND CIRCUIT.**  
Check continuity between steering angle sensor terminal GND and body metal (ground).  
**Continuity should exist.**

N.G. ↓

Check and repair power supply harness or ground harness.

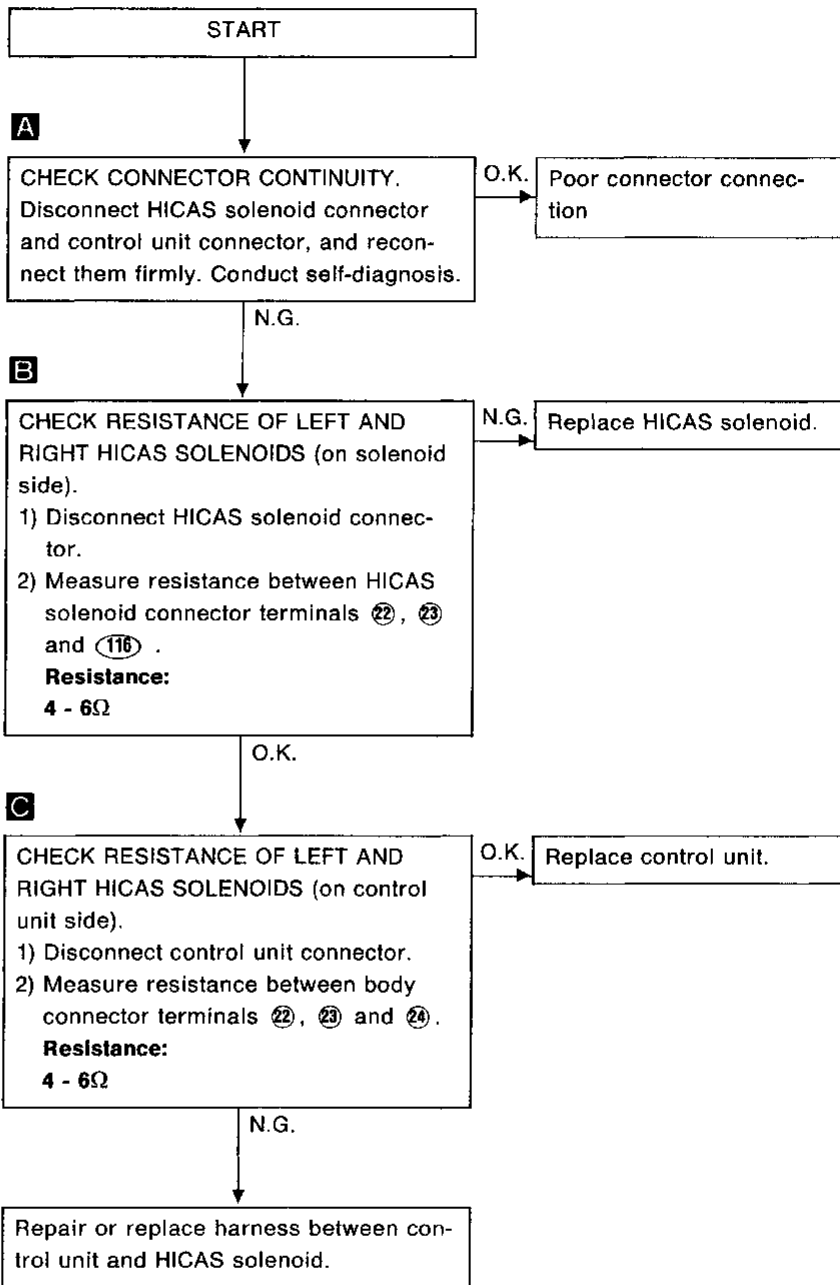
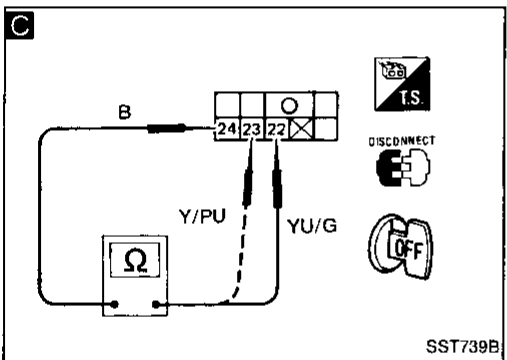
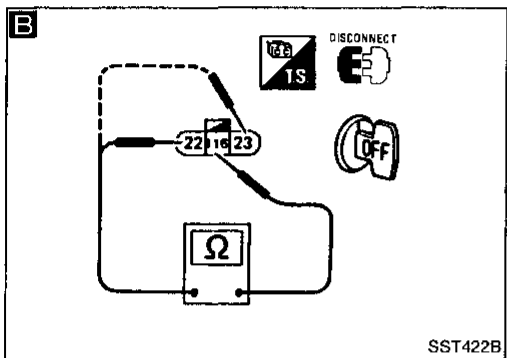
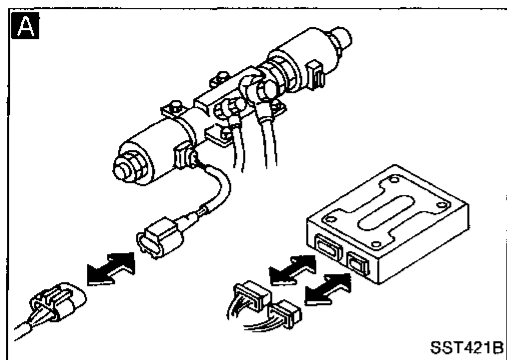
# SUPER HICAS SYSTEM

## Trouble Diagnoses (Cont'd)

### DIAGNOSTIC PROCEDURE 6

#### SYMPTOM:

HICAS solenoid (left and right) output is not present.



GI

MA

EM

LC

EF &  
EC

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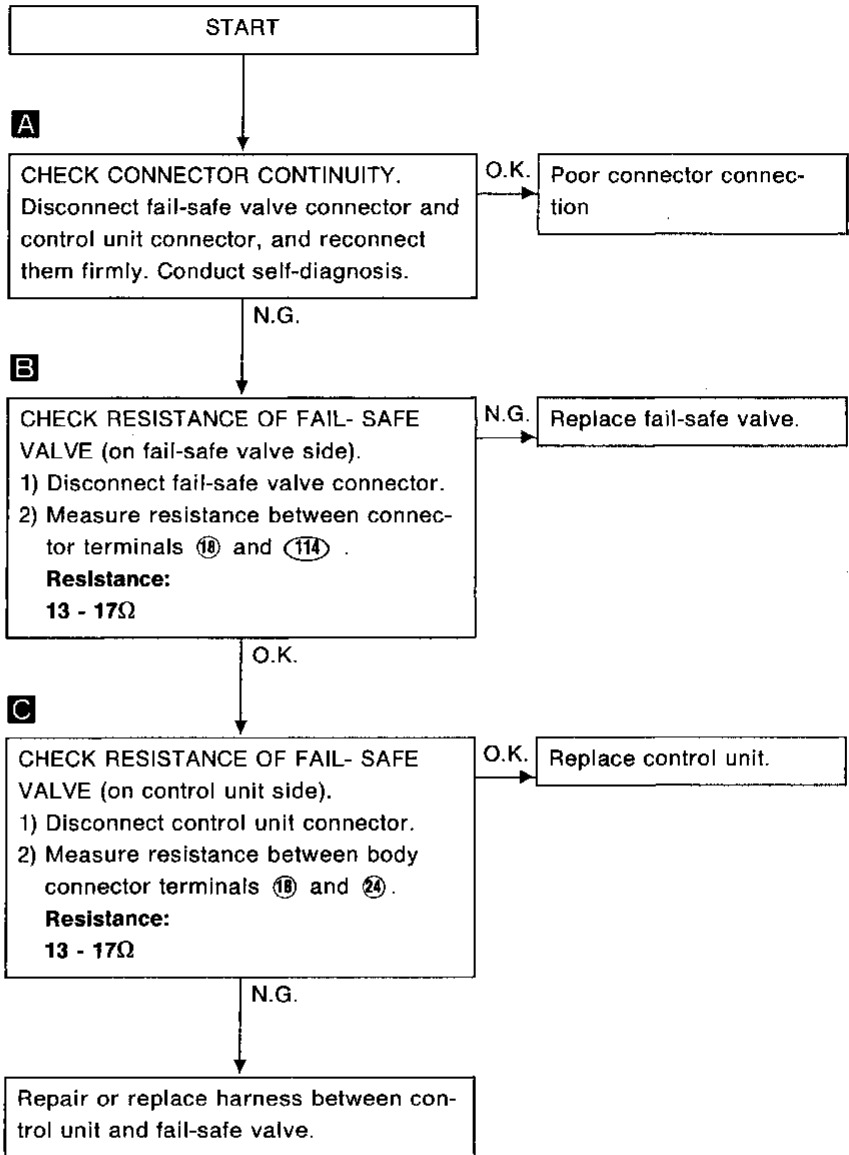
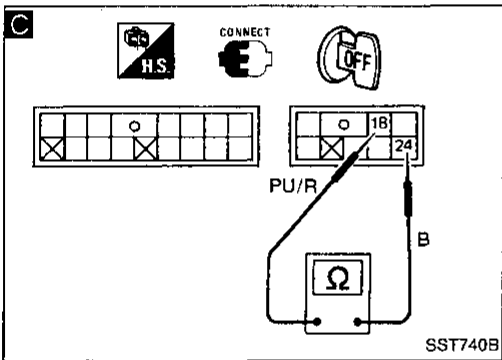
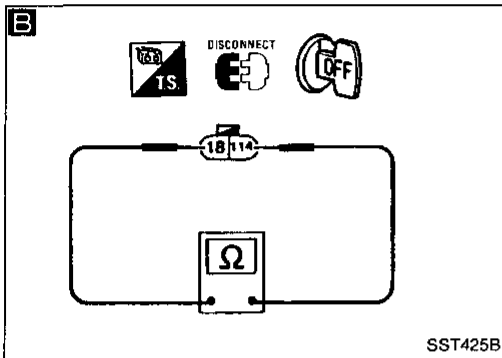
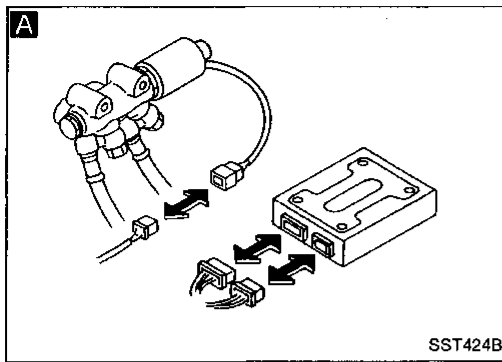
# SUPER HICAS SYSTEM

## Trouble Diagnoses (Cont'd)

### DIAGNOSTIC PROCEDURE 7

#### SYMPTOM:

Fail-safe valve output is not present.



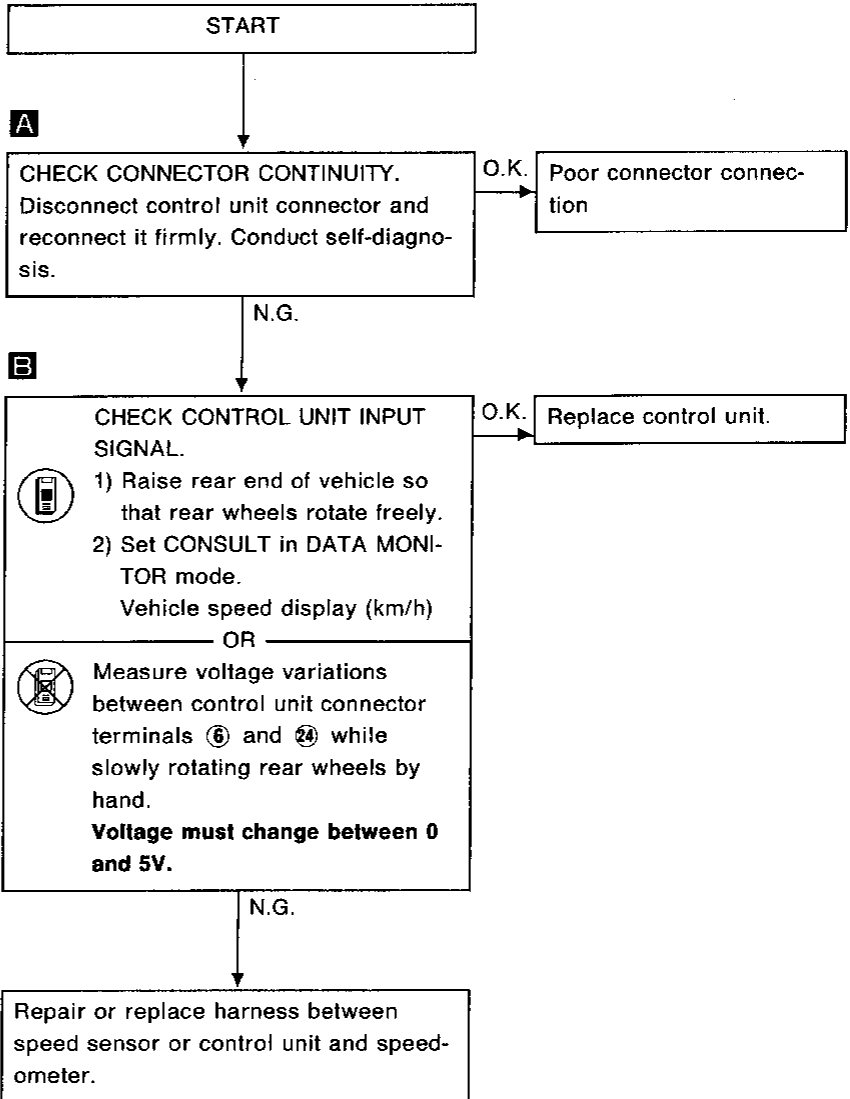
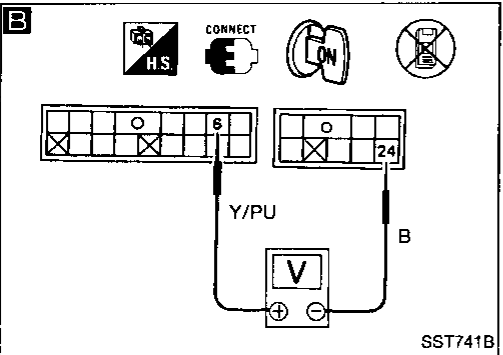
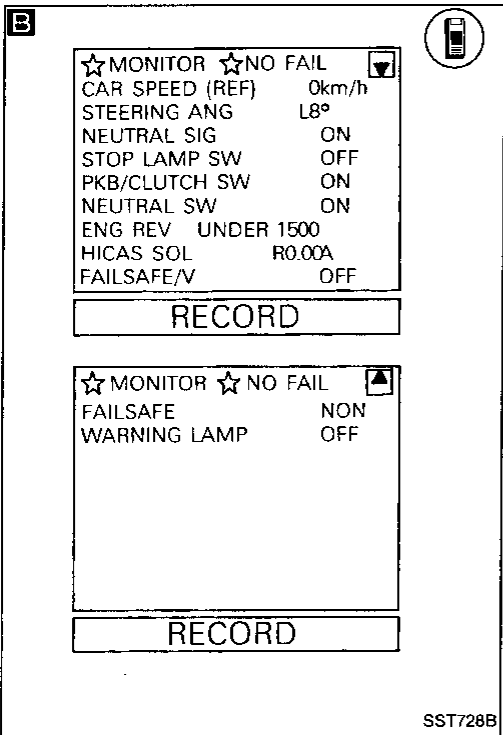
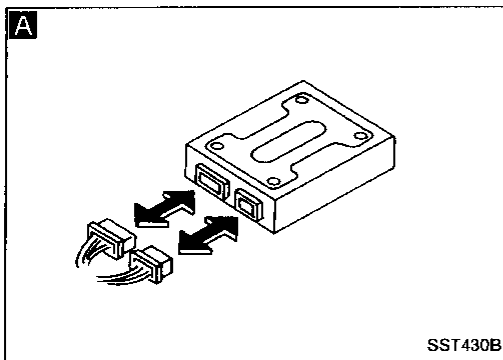
# SUPER HICAS SYSTEM

## Trouble Diagnoses (Cont'd)

### DIAGNOSTIC PROCEDURE 8

#### SYMPTOM:

Vehicle speed signal is not present.



GI  
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EL

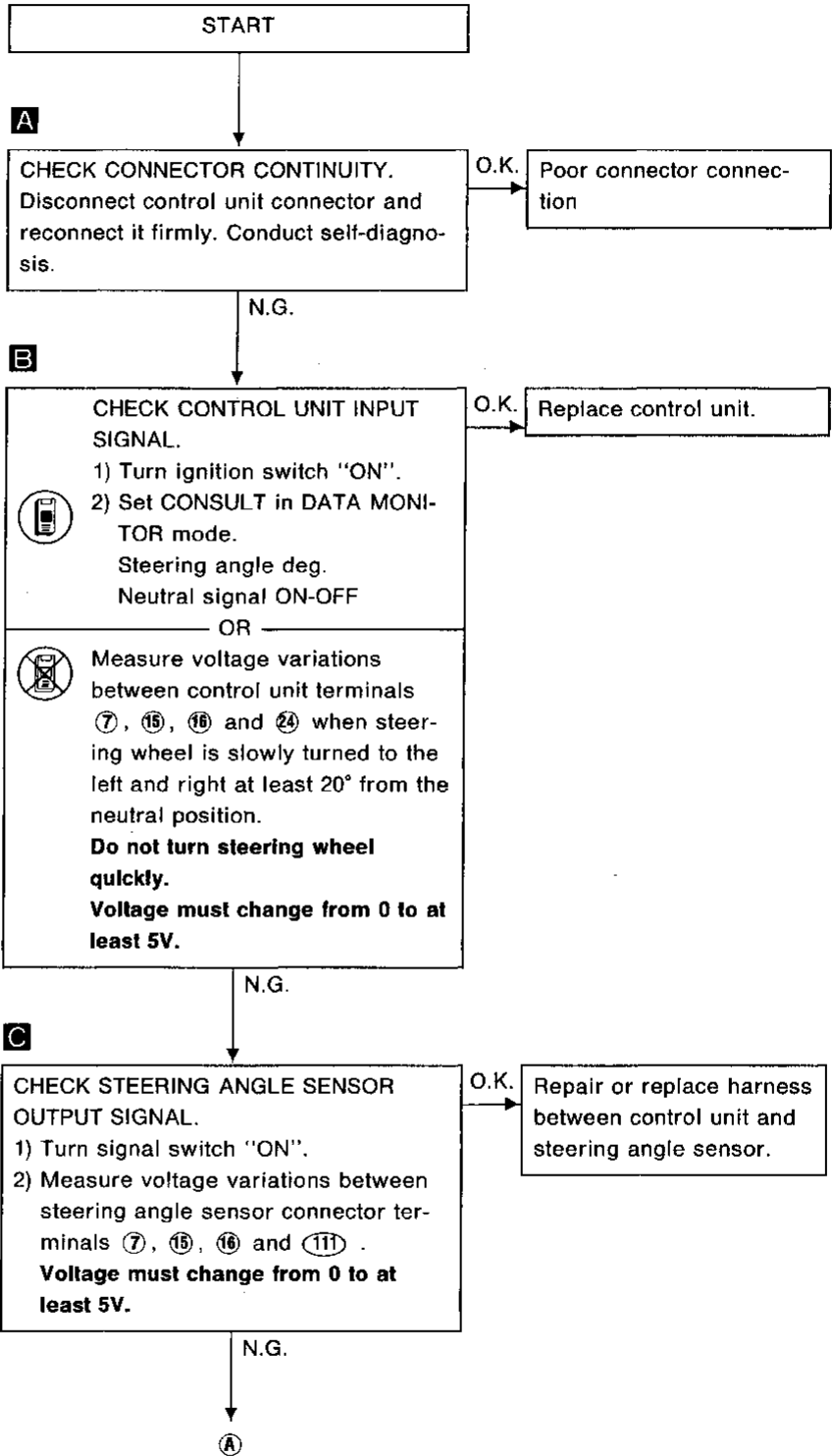
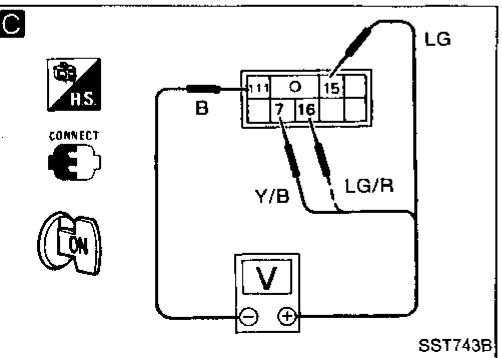
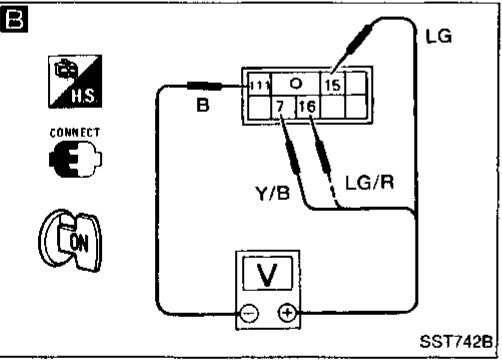
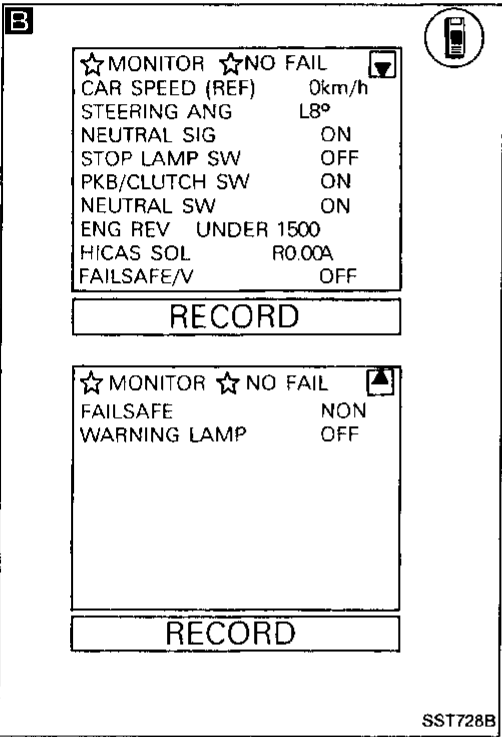
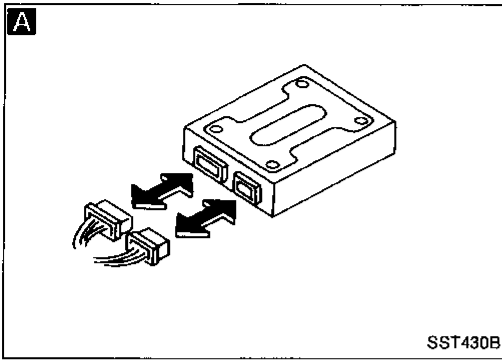
# SUPER HICAS SYSTEM

## Trouble Diagnoses (Cont'd)

### DIAGNOSTIC PROCEDURE 9

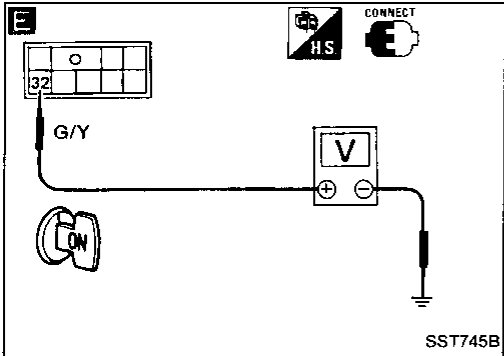
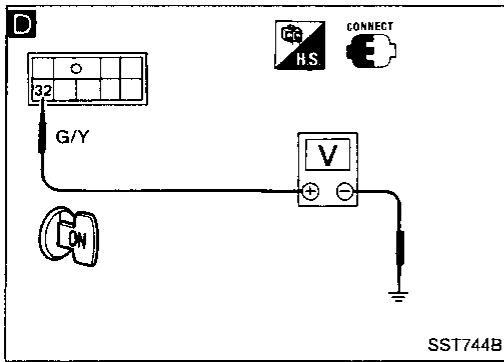
#### SYMPTOM:

Steering angle sensor input is not present.



# 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 ⑩ and ground.

**Voltage:**

**Approximately 12V**

**E** CHECK STEERING ANGLE SENSOR GROUND CIRCUIT.

Check continuity between steering angle sensor terminal ⑪ and body metal (ground).

**Continuity should exist.**

O.K.

Replace steering angle sensor.

N.G.

Repair or replace power supply harness or ground harness.

GI

MA

EM

LC

EF &  
EC

FE

CL

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**ST**

BF

HA

EL

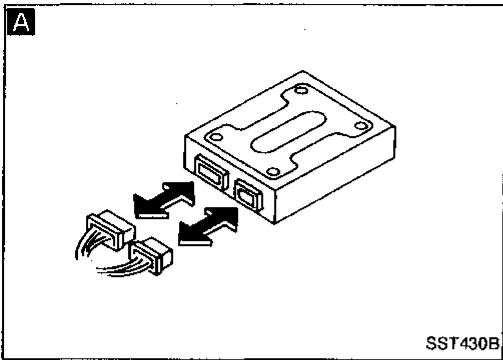
# SUPER HICAS SYSTEM

## Trouble Diagnoses (Cont'd)

### DIAGNOSTIC PROCEDURE 10

#### SYMPTOM:

Parking brake position (A/T) or clutch position switch (M/T) input is not present.



**B**

☆ MONITOR	☆ NO FAIL	
CAR SPEED (REF)	0km/h	
STEERING ANG	L8°	
NEUTRAL SIG	ON	
STOP LAMP SW	OFF	
PKB/CLUTCH SW	ON	
NEUTRAL SW	ON	
ENG REV	UNDER 1500	
HICAS SOL	R0.00A	
FAILSAFE/V	OFF	

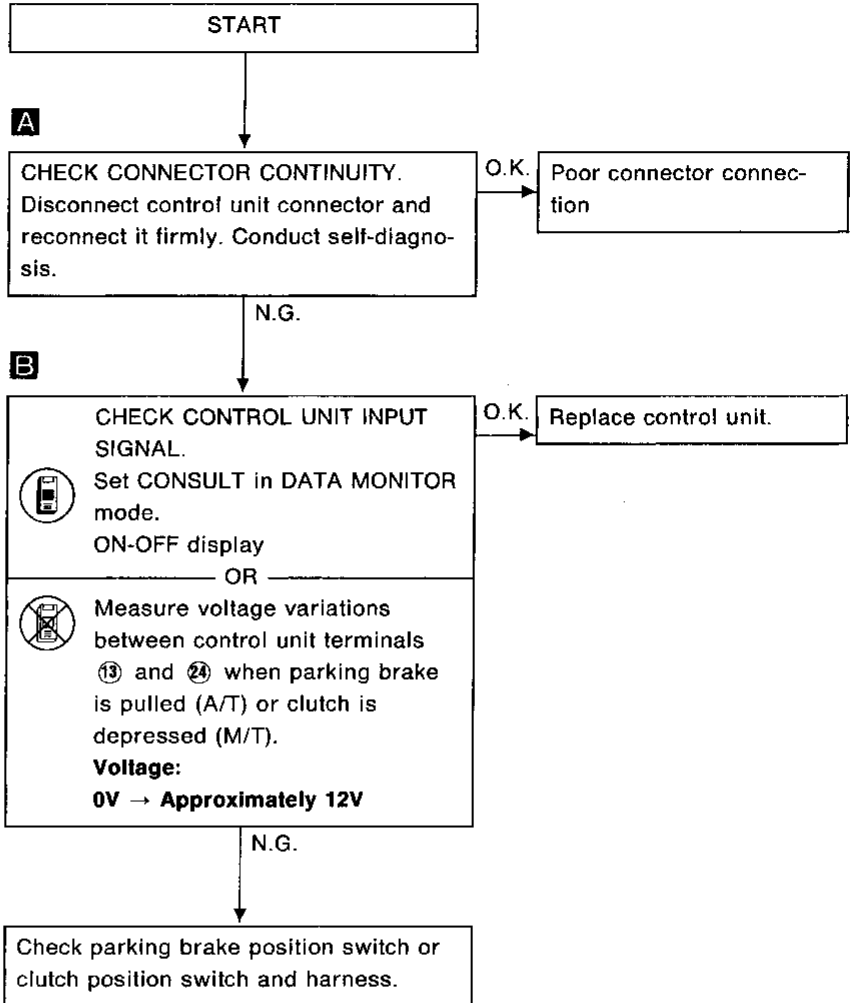
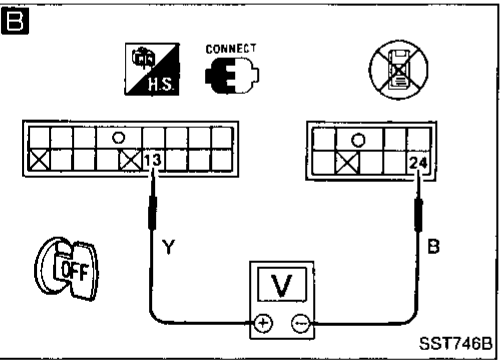
**RECORD**

☆ MONITOR	☆ NO FAIL	
FAILSAFE	NON	
WARNING LAMP	OFF	

**RECORD**

SST728B





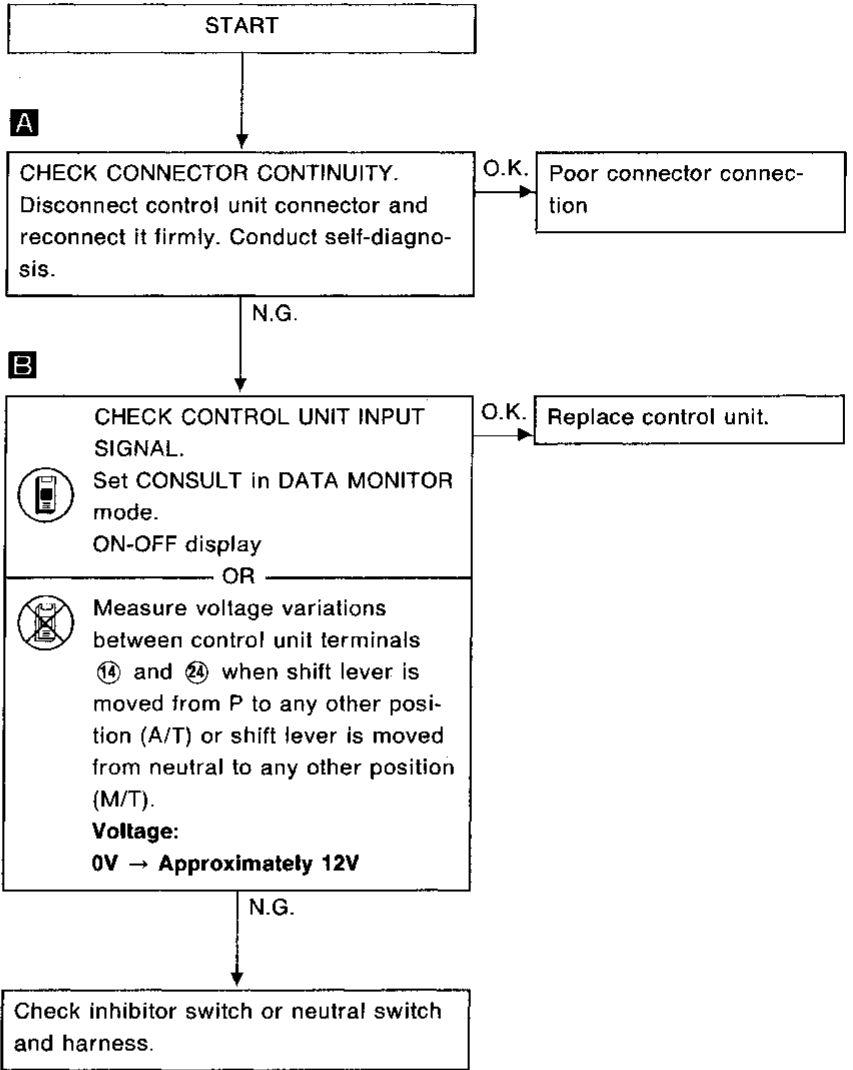
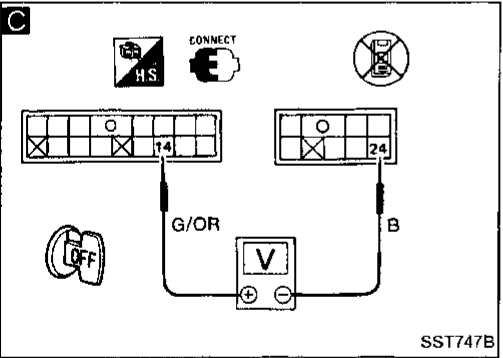
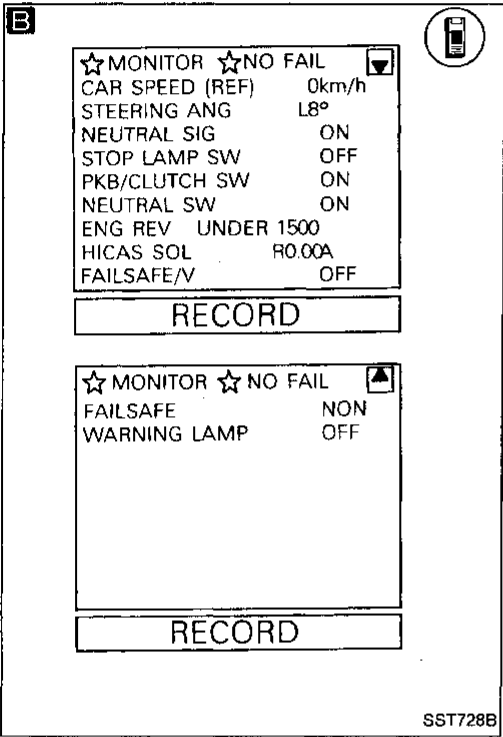
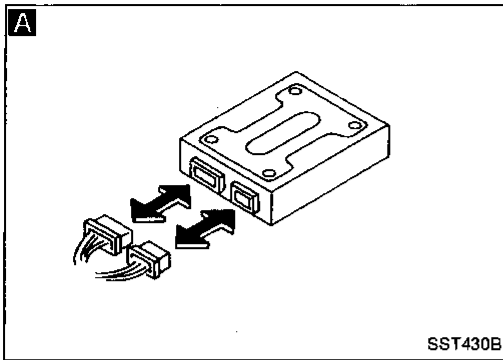
# SUPER HICAS SYSTEM

## Trouble Diagnoses (Cont'd)

### DIAGNOSTIC PROCEDURE 11

#### SYMPTOM:

Inhibitor position switch (A/T) or neutral position switch (M/T) input is not present.



GI  
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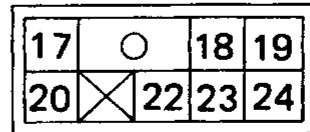
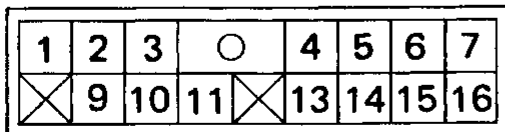
# SUPER HICAS SYSTEM

## 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:

Terminal No.	Application	Standard value
1	Service support CLK input	Pulse wave (153.6 KHz Approximately 7V)
2	Service support RX output (Reception from Consult)	(Not specified serial pulse data)
3	IGN power supply	Key switch ON: Approximately 12V Key switch in other position: 0V
4	Battery	Approximately 12V
5	ECM revolution signal	Refer to "Electrical components inspection" Trouble diagnosis EF & EC section
6	Vehicle speed signal	Rear wheel rotating 0V ←→ greater than 5V (approx.), intermittent
7	Steering neutral position sensor	Approximately 5V (Neutral position)
9	Service support TX output (Transmission for Consult)	(Not specified serial pulse data)
10	Ground	0V
11	Stop lamp switch signal	Brake ON: Approximately 12V Brake OFF: 0V
13	Parking brake signal (A/T), Clutch signal (M/T)	Parking brake engaged (A/T)/ clutch disengaged (M/T): Approximately 12V
14	Inhibitor signal (A/T), Neutral signal (M/T)	Shift lever in any position other than Parking (A/T) or neutral (M/T): Approximately 12V
15	Steering angle sensor-1 signal	Steering wheel turned 0 ←→ Approximately 5V, intermittent
16	Steering angle sensor-2 signal	Steering wheel turned 0 ←→ Approximately 5V, intermittent
17	Ground	0V
18	Resistance of fail-safe valve	13 - 17Ω
19	IGN power supply	Ignition switch ON: Approximately 12V Ignition switch in other position: 0V
20	HICAS warning lamp	Lamp OFF: Approximately 12V Lamp ON: 0V
22	Resistance of HICAS solenoid (R.H.)	4 - 6Ω (Voltage varies with steering operation)
23	Resistance of HICAS solenoid (L.H.)	4 - 6Ω (Voltage varies with steering operation)
24	Ground	0V



SST748B

# SERVICE DATA AND SPECIFICATIONS (S.D.S.)

## General Specifications

Applied model	Without HICAS	With HICAS
Steering model	Power steering	
Steering gear type	PR24SC	
Steering overall gear ratio	17.1	14.9
Turns of steering wheel (Lock to lock)	3.1	2.6
Steering column type	Collapsible, tilt	

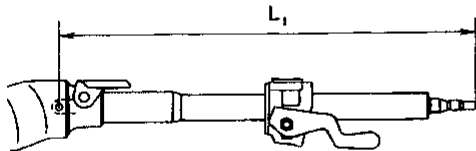
## Inspection and Adjustment

### GENERAL

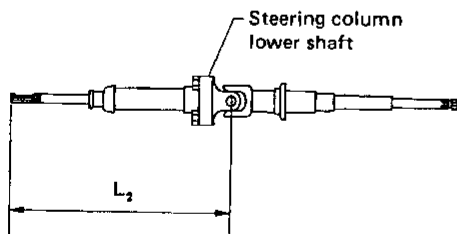
Steering wheel axial play mm (in)	0 (0)
Steering wheel play mm (in)	0 - 35 (0 - 1.38)
Allowable movement of gear housing mm (in)	± 2 (± 0.08)

### STEERING COLUMN

Steering column length "L <sub>1</sub> " mm (in)	652.9 - 654.5 (25.70 - 25.77)
Steering column lower shaft length "L <sub>2</sub> " mm (in)	323.9 - 325.5 (12.75 - 12.81)



SST900B

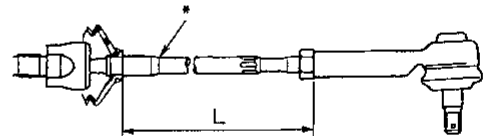


SST137C

### STEERING GEAR AND LINKAGE

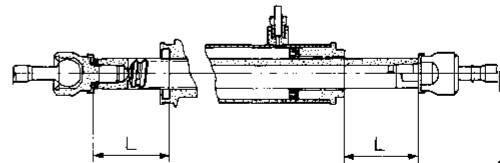
Steering gear type	PR24SC
Tie-rod outer ball joint	
Swinging force at cotter pin hole N (kg, lb)	6.9 - 64.7 (0.7 - 6.6, 1.5 - 14.6)
Rotating torque N·m (kg-cm, in-lb)	0.29 - 2.94 (3.0 - 30.0, 2.6 - 26.0)
Axial end play mm (in)	0 (0)
Tie-rod inner ball joint	7.8 - 110.8
Swinging force* N (kg, lb)	(0.8 - 11.3, 1.8 - 24.9)
Rotating torque N·m (kg-cm, in-lb)	7.4 (75, 65) or less
Axial end play mm (in)	0 (0)
Tie-rod standard length "L" mm (in)	174.8 (6.88)

\*: Measuring point



SST487B

Rack stroke "L"	mm (in)	68.5 (2.697)
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SST086B

# SERVICE DATA AND SPECIFICATIONS (S.D.S.)

## Inspection and Adjustment (Cont'd)

### STEERING GEAR AND LINKAGE (Cont'd)

Pinion gear preload without gear oil	
N·m (kg-cm, in-lb)	
Within ±100° from the neutral position	
Average rotating torque	0.8 - 1.3 (8 - 13, 6.9 - 11.3)
Maximum torque deviation	0.4 (4, 3.5)
Except above range	
Maximum rotating torque	1.9 (19, 16)
Maximum torque deviation	0.6 (6, 5.2)
Rack sliding force without gear oil	
N (kg, lb)	
Within ±5.5 mm (±0.217 in) from the neutral position	122.6 - 166.7 (12.5 - 17, 27.6 - 37.5)
Except above range	122.6 - 186.3 (12.5 - 19, 27.6 - 41.9)

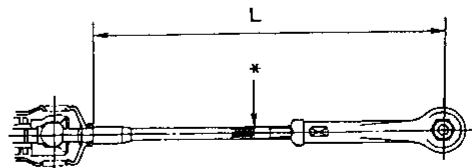
### POWER STEERING

Rack sliding force	N (kg, lb)	
Under normal operating oil pressure		
Range within ±11.5 mm (±0.453 in) from the neutral position		167 - 226 (17 - 23, 37 - 51)
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	70° - 110°
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)	0.9 (1, 3/4)
Oil pump maximum pressure	kPa (kg/cm <sup>2</sup> , psi)	
Without HICAS		7,159 - 7,748 (73 - 79, 1,038 - 1,123)
With HICAS		
Main (For power steering)		7,159 - 7,748 (73 - 79, 1,038 - 1,123)
Sub (For HICAS)		6,375 - 6,865 (65 - 70, 924 - 995)

### 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)	309.5 (12.19)
Stroke	mm (in)	3.0 (0.118)

\*: Measuring point



SST486B