

SECTION **CL**  
CLUTCH

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B  
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# PRECAUTIONS

## PRECAUTIONS

PFP:00001

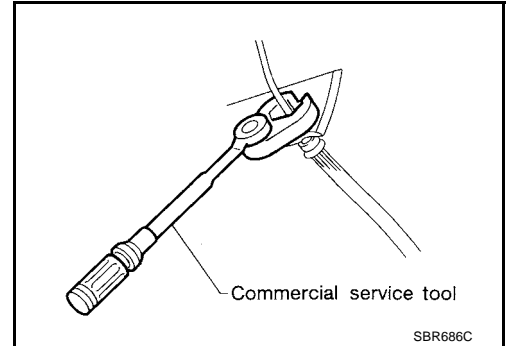
### Caution

ACS0014T

- Recommended fluid is brake fluid “DOT 3”.
- Never reuse drained brake fluid.
- Be careful not to splash brake fluid on painted areas.
- When removing and installing clutch piping, use Tool.
- Use new brake fluid to clean or wash all parts of master cylinder and operating cylinder.
- Never use mineral oils such as gasoline or kerosene. It will ruin the rubber parts of the hydraulic system.

### **WARNING:**

After cleaning clutch disc, wipe it with a dust collector. Do not use compressed air.



# PREPARATION

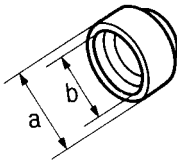

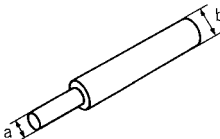
## PREPARATION

PFP:00002

### Special Service Tools


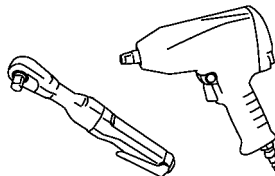
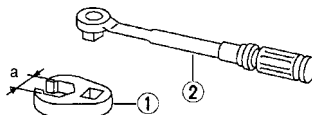
ACS0014U

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

Tool name (Kent-Moore No.) Tool number		Description
Drift KV30101400 (      —      ) a: 51 mm (2.01 in) dia. b: 44 mm (1.73 in) dia.	 ZZA0838D	Installing clutch release bearing
Diaphragm adjusting wrench ST20050240 (      —      )	 ZZA0508D	Adjusting unevenness of diaphragm spring of clutch cover
Clutch aligning bar ST20670000 (      —      ) a: 15 mm (0.59 in) dia. b: 23 mm (0.91 in) dia.	 ZZA1178D	Installing clutch disc

## Commercial Service Tool

ACS0014V

Tool name		Description
Pin punch Tip diameter: 4.5 mm (0.177 in) dia.	 ZZA0515D	Removing and installing master cylinder spring pin
Power tool	 PBIC0190E	Loosening bolts and nuts
1. Flare nut crowfoot 2. Torque wrench a: 10 mm (0.39 in)	 S-NT360	Removing and installing clutch piping

# NOISE, VIBRATION, AND HARSHNESS (NVH) TROUBLESHOOTING

## NOISE, VIBRATION, AND HARSHNESS (NVH) TROUBLESHOOTING

PFP:00003

### NVH Troubleshooting Chart

ACS0014W

Use the chart below to help you find the cause of the symptom. The numbers indicate the order of the inspection. If necessary, repair or replace these parts.

#### CLUTCH

Reference page		<a href="#">CL-5</a>	<a href="#">CL-8</a>	<a href="#">CL-10</a>	<a href="#">CL-12</a>	<a href="#">EM-89</a>	<a href="#">CL-14</a>	<a href="#">CL-16</a>	<a href="#">CL-16</a>	<a href="#">CL-16</a>	<a href="#">CL-16</a>	<a href="#">CL-16</a>	<a href="#">CL-16</a>	<a href="#">CL-16</a>	<a href="#">CL-16</a>	<a href="#">CL-16</a>	<a href="#">CL-16</a>	<a href="#">EM-118</a>	
SUSPECTED PARTS (Possible cause)		CLUTCH PEDAL (Free play out of adjustment)	CLUTCH LINE (Air in line)	MASTER CYLINDER PISTON CUP (Damaged)	OPERATING CYLINDER PISTON CUP (Damaged)	ENGINE MOUNTING (Loose)	RELEASE BEARING (Worn, dirty or damaged)	CLUTCH DISC (Out of true)	CLUTCH DISC (Runout is excessive)	CLUTCH DISC (Lining broken)	CLUTCH DISC (Dirty or burned)	CLUTCH DISC (Oily)	CLUTCH DISC (Worn out)	CLUTCH DISC (Hardened)	CLUTCH DISC (Lack of spline grease)	DIAPHRAGM SPRING (Damaged)	DIAPHRAGM SPRING (Out of tip alignment)	PRESSURE PLATE (Distortion)	FLYWHEEL (Distortion)
Symptom	Clutch grabs/chatters					1			2			2	2	2			2		
	Clutch pedal spongy		1	2	2														
	Clutch noisy						1												
	Clutch slips	1										2	2			3		4	5
	Clutch does not disengage	1	2	3	4			5	5	5	5	5			5	6	6	7	

# CLUTCH PEDAL

## CLUTCH PEDAL

PFP:46540

### On-Vehicle Inspection and Adjustment HEIGHT ADJUSTMENT

ACS0014X

1. Check that clutch pedal height H<sub>1</sub> from the melt sheet is within the specified range.


**Pedal height H<sub>1</sub> : 171 - 179 mm (6.73 - 7.05 in)**

2. If pedal height H<sub>1</sub> is outside the specification, loosen ASCD cancel switch lock nut B and turn ASCD cancel switch. next loosen clevis lock nut A and turn push rod to adjust.
3. When pedal height comes into the specified range, tighten ASCD cancel switch lock nut B and clevis lock nut A to the specified torque.

**Lock nut A:**

 **7.8 - 11 N·m (0.80 - 1.1 kg-m, 69 - 97 in-lb)**

**Lock nut B:**

 **12 - 14 N·m (1.3 - 1.4 kg-m, 9 - 10 ft-lb)**

4. Check that free play A at pedal pad top surface and pedal height H<sub>2</sub> when clutch is disengaged are within the specified ranges below.

**Pedal free play (measured at pedal pad) A:**

**9 - 16 mm (0.35 - 0.63 in)**

**Pedal free play (clevis pin free play):**

**1.0 - 3.0 mm (0.04 - 0.12 in)**

**Pedal height H<sub>2</sub> when clutch is disengaged:**

**100 mm (3.94 in) or more**

5. Check that free play A at pedal pad top surface and pedal height H<sub>2</sub> when clutch is disengaged are within the specified ranges below. If it is outside the specification, loosen lock nut A and turn push rod to adjust.

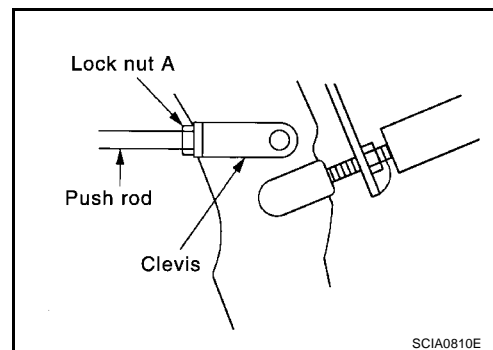
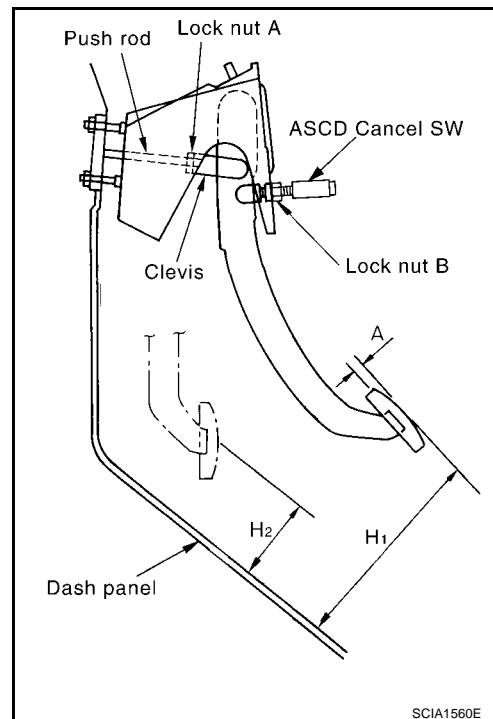
#### **CAUTION:**

**Threaded end of the push rod must be positioned inside the clevis.**

6. Tighten lock nut A to the specified torque.

**Lock nut A:**


 **7.8 - 11 N·m (0.80 - 1.1 kg-m, 69 - 97 in-lb)**

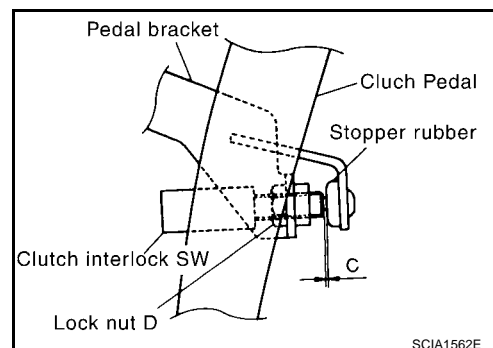


### CLUTCH INTER LOCK SWITCH POSITION ADJUSTMENT

- With the pedal depressed, adjust the switch position so that the distance between the stopper rubber and the clutch inter lock switch screw end is dimension C, and then tighten lock nut D.

**Dimension C: 0.1 - 1.0 mm (0.004 - 0.04 in)**

 **12 - 14 N·m (1.3 - 1.4 kg-m, 9 - 10 ft-lb)**

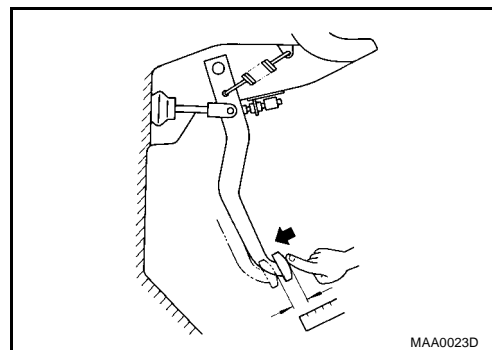


# CLUTCH PEDAL

## FREE PLAY INSPECTION

- Press the clutch pedal by hand until certain push rod is activated can be felt. Using a scale, check that the free play is within the specified range.

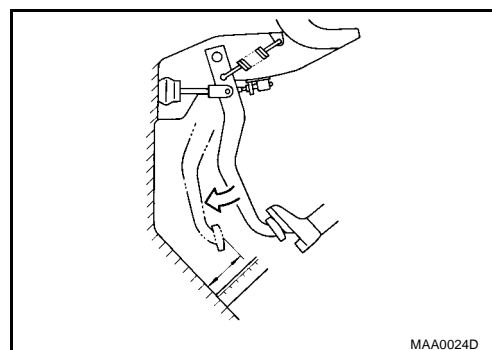
**Pedal free play [looseness at clevis pin]:**  
**1.0 - 3.0 mm (0.04 - 0.12 in)**



## CLEARANCE CHECK

- Start the engine and let it idle.
- Apply parking brake.
- Depress the brake pedal.
- Fully depress clutch pedal and shift to 1st gear.
- Release clutch pedal gradually. Stop releasing the pedal at the point where the clutch is about to be engaged. Using a scale, check the clearance between the clutch pedal and floor panel to see if it is within the specified range.

**Pedal height when the clutch disengages:**  
**100 mm (3.94 in) or more**

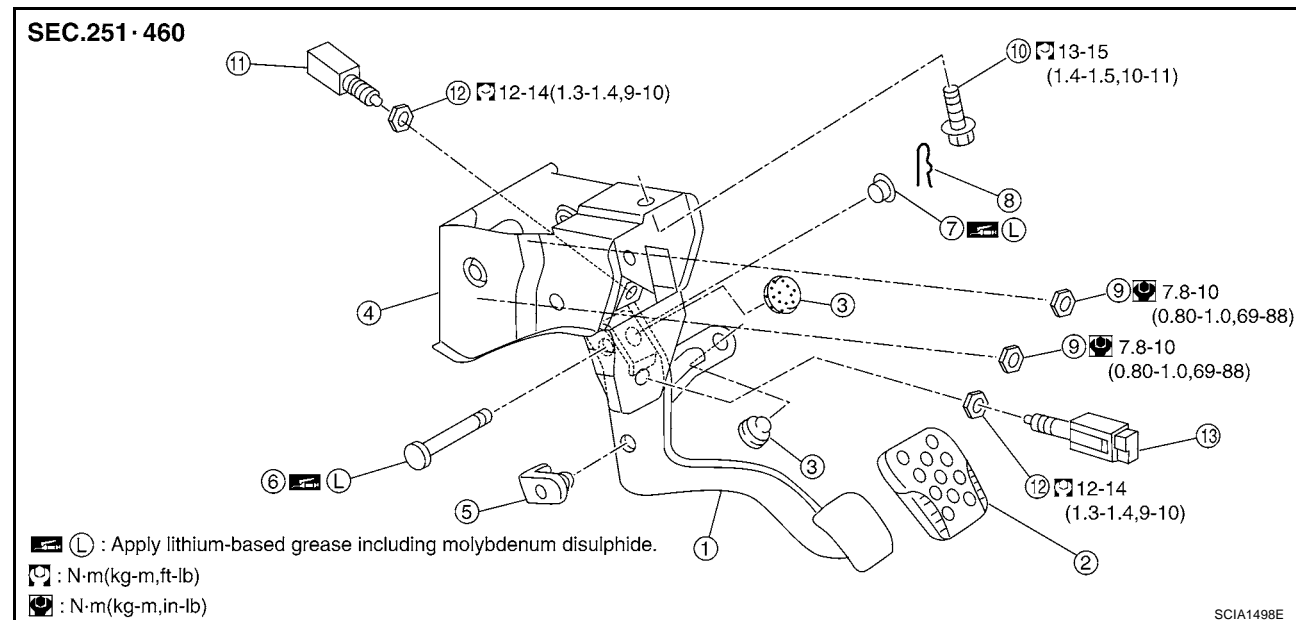


### NOTE:

Pedal height at clutch disengagement varies slightly from the clutch engagement point. Despite this, pedal height at clutch engagement is commonly used for both cases in order to simplify the inspection.

## Removal and Installation

ACS0014Y



- |                        |                              |                   |
|------------------------|------------------------------|-------------------|
| 1. Clutch pedal        | 2. Pedal pad                 | 3. Stopper rubber |
| 4. Bracket             | 5. Stopper rubber            | 6. Clevis pin     |
| 7. Bushing             | 8. Snap pin                  | 9. Nut            |
| 10. Bolt               | 11. Clutch inter lock switch | 12. Lock nut      |
| 13. ASCD cancel switch |                              |                   |

### NOTE:

Tighten the ASCD cancel switch lock nut to the specified torque after installing the clutch pedal assembly in the vehicle and adjusting the pedal height.

# CLUTCH PEDAL

## REMOVAL

1. Remove driver side kicking plate inner. Refer to [EI-30, "Removal and Installation"](#) .
2. Remove foot rest. Refer to [IP-12, "Removal and Installation"](#) .
3. Remove dash side finisher (LH). Refer to [IP-12, "Removal and Installation"](#) .
4. Remove instrument driver panel lower. Refer to [IP-12, "Removal and Installation"](#) .
5. Remove VDC/TCS/ABS control unit. (VDC/TCS/ABS model) Refer to [BRC-150, "Removal and Installation"](#) .
6. Remove the clutch inter lock switch and ASCD cancel switch connector and harness.
7. Remove the snap pin and clevis pin.
8. Remove the pedal bracket mounting bolt and nut and then remove the clutch pedal assembly.

## INSPECTION AFTER REMOVAL

- Check clutch pedal for bend, damage, or a cracked weld. If bend, damage, or a cracked weld is found, replace the clutch pedal assembly.

## INSTALLATION

To install, reverse the removal procedure, following the cautions below:

- Install clutch pedal assembly and adjust the pedal height. Tighten ASCD cancel switch lock nut to the specified torque.
- After installing the clutch inter lock switch, adjust the switch position.

# CLUTCH FLUID

## CLUTCH FLUID

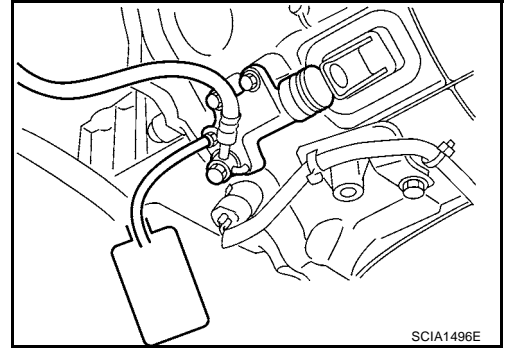
PFP:00017

### Bleeding


ACS0014Z

#### CAUTION:

- Monitor fluid level in the reservoir tank to make sure it does not empty.
- Do not spill clutch fluid onto painted surfaces. If it spills, wipe up immediately and wash the affected area with water.
- Bleed the operating cylinder.
  1. Fill the master cylinder reservoir tank with new clutch fluid.
  2. Connect a transparent vinyl hose to the air bleeder.
  3. Depress the clutch pedal quickly and fully a few times and hold it.
  4. With clutch pedal depressed, open air bleeder.
  5. Close air bleeder.
  6. Release clutch pedal and wait for 5 seconds.
  7. Repeat steps 3 to 6 until no bubbles can be observed in the brake fluid.



#### Air bleeder:

: 5.9 - 9.8 N·m (0.61 - 0.99 kg-m, 53 - 86 in-lb)



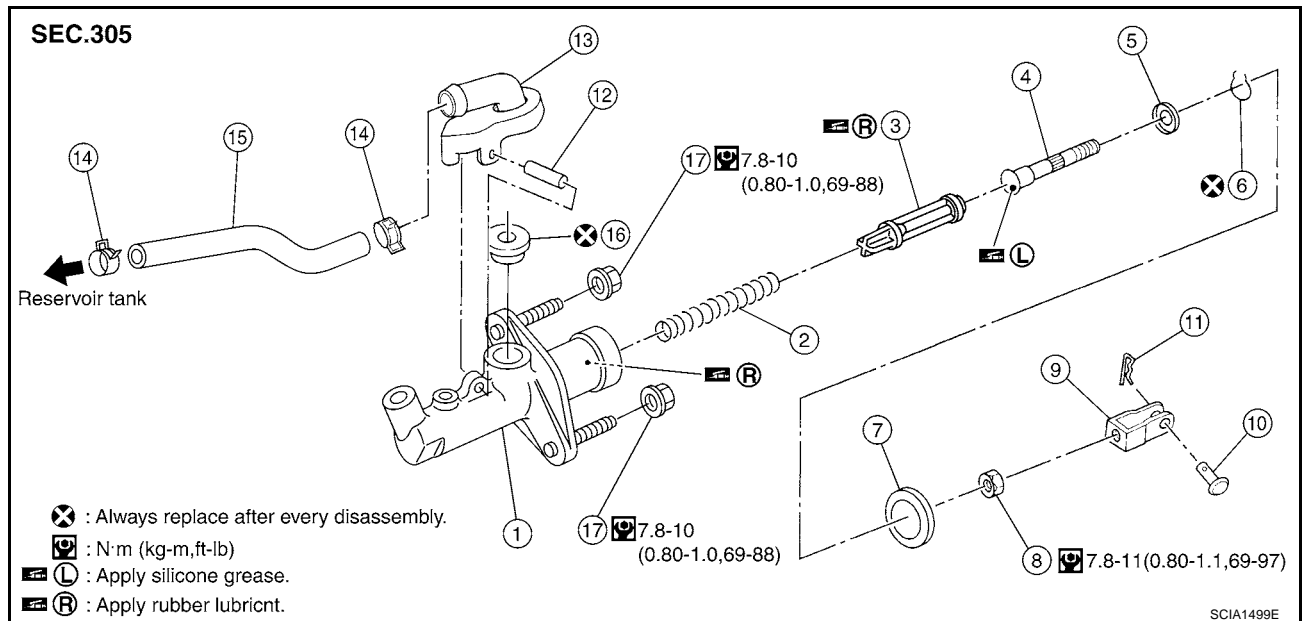
# CLUTCH MASTER CYLINDER

## CLUTCH MASTER CYLINDER

PFP:30610

### Removal and Installation

ACS00150



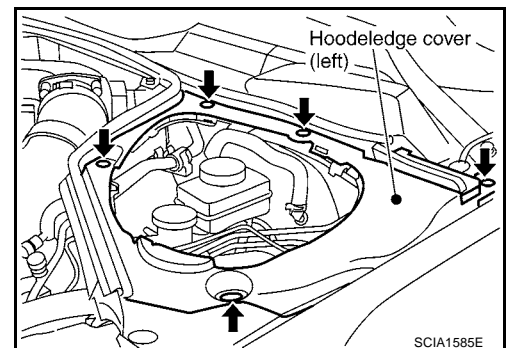
- |                    |                  |                    |
|--------------------|------------------|--------------------|
| 1. Cylinder body   | 2. Return spring | 3. Piston assembly |
| 4. Push rod        | 5. Stopper       | 6. Stopper ring    |
| 7. Seat            | 8. Lock nut      | 9. Clevis          |
| 10. Clevis pin     | 11. Snap pin     | 12. Spring pin     |
| 13. Nipple         | 14. Clamp        | 15. Reservoir hose |
| 16. Reservoir seal | 17. Nut          |                    |

### REMOVAL

1. Remove driver side kicking plate. Refer to [EI-30, "Removal and Installation"](#).
2. Remove footrest. Refer to [IP-11, "INSTRUMENT PANEL ASSEMBLY"](#).
3. Remove dash side finisher (LH). Refer to [IP-12, "Removal and Installation"](#).
4. Remove instrument driver panel lower. Refer to [IP-12, "Removal and Installation"](#).
5. Remove VDC/TCS/ABS control unit. (VDC/TCS/ABS model) Refer to [BRC-150, "Removal and Installation"](#).
6. Remove snap pin and clevis pin from the clevis, and separate it from clutch pedal.
7. Remove clips (5), and remove hood ledge cover (left).
8. Drain clutch fluid in the reservoir tank and remove hose from nipple.

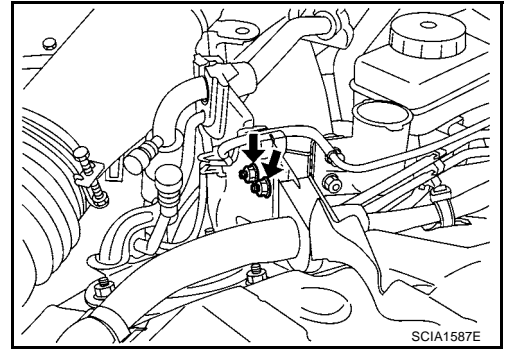
#### CAUTION:

**Do not spill clutch fluid onto painted surfaces. If it spills, wipe up immediately and wash the affected area with water.**



# CLUTCH MASTER CYLINDER

9. Remove the reservoir tank mounting nut and then remove the reservoir tank.
10. Using a flare nut wrench, remove clutch tube.
11. First remove nuts on master cylinder assembly, and then master cylinder assembly from the vehicle.




## INSTALLATION

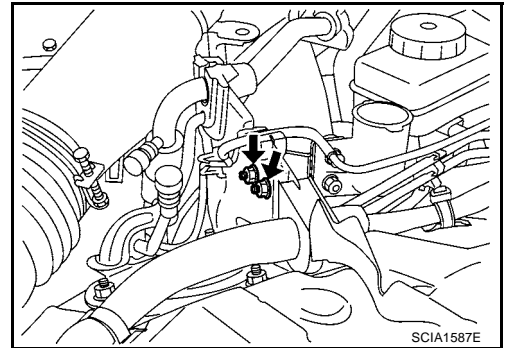
1. Connect clutch tube to master cylinder assembly and temporarily tighten flare nut.
2. Install master cylinder assembly and tighten mounting nut to the specified torque.

 **7.8 - 10 N·m (0.80 - 1.0 kg-m, 69 - 88 in-lb)**

3. Using a flare nut torque wrench, tighten clutch tube flare nut to the specified torque.

 **15 - 17 N·m (1.6 - 1.7 kg-m, 11 - 12 ft-lb)**

4. Attach clevis of the clevis pin to the clutch pedal.
5. Attach snap pin to the clevis pin.
6. After mounting the hose over the nipple, install the reservoir tank in the vehicle.
7. After completing this procedure, inspect and adjust pedal height and then bleed the clutch tube.
  - Refer to [CL-5, "On-Vehicle Inspection and Adjustment"](#) and [CL-8, "Bleeding"](#).
8. Install hood ledge cover (left).
9. Install VDC/TCS/ABS control unit. (VDC/TCS/ABS model) Refer to [BRC-150, "Removal and Installation"](#).
10. Install instrument driver panel lower. Refer to [IP-12, "Removal and Installation"](#).
11. Install dash side finisher (LH). Refer to [IP-12, "Removal and Installation"](#).
12. Install foot rest. Refer to [IP-11, "INSTRUMENT PANEL ASSEMBLY"](#).
13. Install driver side kicking plate. Refer to [EI-30, "Removal and Installation"](#).



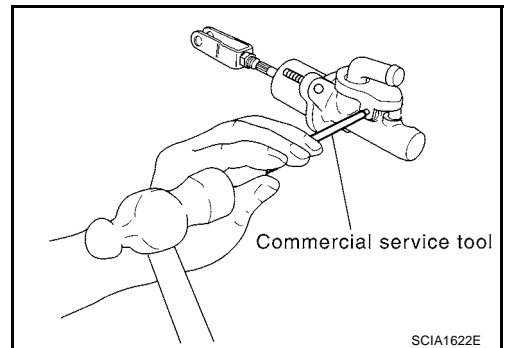
## Disassembly and Assembly

### DISASSEMBLY

1. Using a pin punch (commercial service tool), remove spring pin, nipple and reservoir seal from the cylinder body.
2. Loosen push rod lock nut. Remove clevis and lock nut.
3. Remove the seat from the cylinder body.
4. Remove the stopper ring and stopper, and then remove the push rod, piston assembly, and return spring from the cylinder body.

### CAUTION:

**Restrain the push rod while doing this because there is a danger the piston assembly will fly out of the master cylinder.**



ACS00151

# CLUTCH MASTER CYLINDER

## INSPECTION AFTER DISASSEMBLY

Check for any of the conditions shown below. If any malfunction is found, replace the part concerned.

- Damaged cylinder internal wall, foreign matter, wear, corrosion, or pin hole
- Damaged or deformed nipple or reservoir tank
- Settling of the spring
- Cracked and deformed seat


## ASSEMBLY

1. Apply rubber lubricant to internal surface of the cylinder body, sliding surface of piston assembly, and the piston cup. Insert piston assembly and return spring to the cylinder body.
2. Apply silicone grease to the push rod and install the stopper before installing the stopper ring.

### CAUTION:

**Restrain the push rod while doing this because there is a danger the piston assembly will fly out of the master cylinder.**

3. Install seat to the cylinder body.
4. Install clevis to the push rod and tighten lock nut to the specified torque.

: **7.8 - 11 N·m (0.80 - 1.1 kg-m, 69 - 97 in-lb)**

5. Install reservoir seal and nipple to the cylinder body. Using a pin punch (commercial service tool), install spring pin.

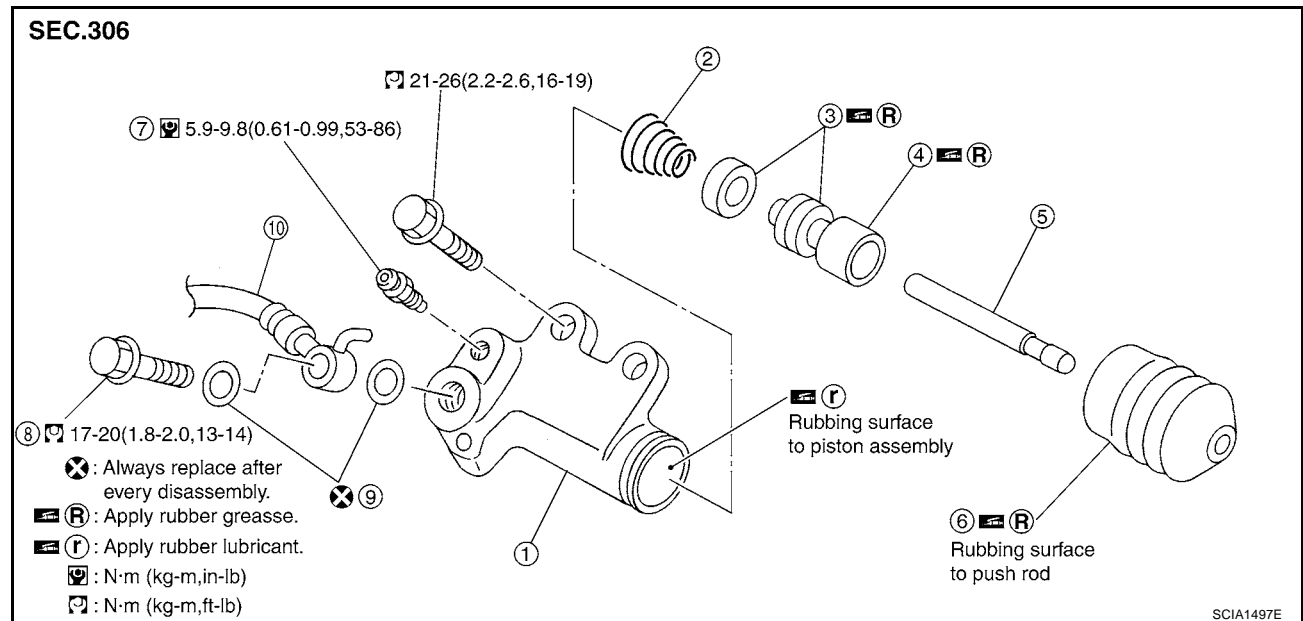
# OPERATING CYLINDER

## OPERATING CYLINDER

PFP:30620

### Removal and Installation

ACS00152



- |                  |                  |                  |
|------------------|------------------|------------------|
| 1. Cylinder body | 2. Piston spring | 3. Piston cup    |
| 4. Piston        | 5. Push rod      | 6. Dust cover    |
| 7. Air bleeder   | 8. Union bolt    | 9. Copper washer |
| 10. Clutch hose  |                  |                  |

### REMOVAL

1. Drain clutch fluid.

#### CAUTION:

**Do not spill clutch fluid onto painted surfaces. If it spills, wipe up immediately and wash the affected area with water.**

2. Remove clutch hose from the operating cylinder.
3. Remove operating cylinder mounting bolt and remove operating cylinder from the vehicle.

### INSTALLATION

To install, reverse the removal procedure, following the cautions below:

- Install hose with care so that it will not be bent or twisted. Refer to [CL-13, "Removal and Installation"](#).
- After completing the procedure, bleed the clutch tube. Refer to [CL-8, "Bleeding"](#).

### Disassembly and Assembly

#### DISASSEMBLY

ACS00153

- Remove dust cover and push rod. Remove piston, piston cup, and piston spring from inside the cylinder body.

#### INSPECTION AFTER DISASSEMBLY

Check for any of the conditions shown below. If any malfunction is found, replace the part concerned.

- Damage to cylinder inner surface or piston sliding surface. Foreign matter, wear, corrosion, or pin hole
- Settling of the spring
- Cracked or deformed dust cover

#### ASSEMBLY

1. Apply rubber lubricant to cylinder body inner surface and rubber grease to the piston cup and piston. Insert piston assembly and piston spring into the cylinder body.
2. Apply rubber grease to dust cover and install push rod and dust cover.

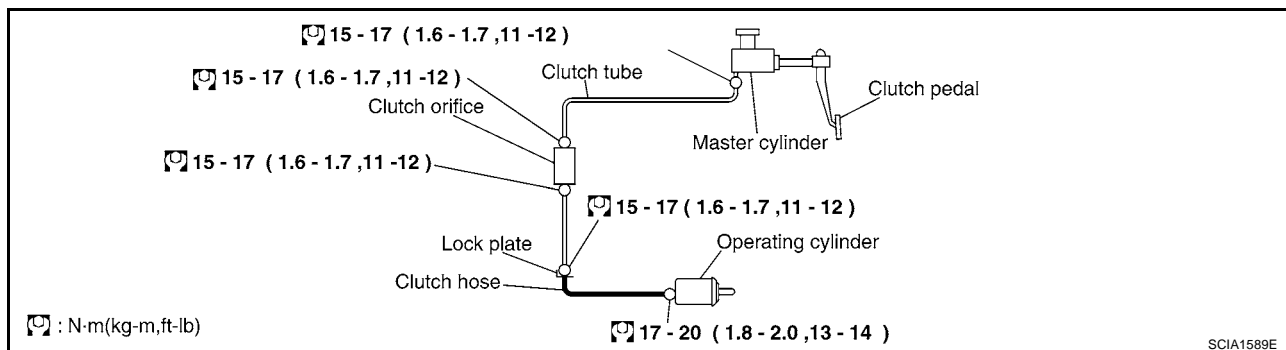
# CLUTCH PIPING

## CLUTCH PIPING

PFP:30650

### Removal and Installation

ACS00154



Carefully observe the following steps during clutch tube removal and installation.

- Do not spill clutch fluid onto painted surfaces. If it spills, wipe up immediately and wash the affected area with water.
- When fixing clutch hose to bracket, align hose metal fittings with bracket positioning emboss and drive lock plate to secure. At this time, prevent twisting or damage of hose. In addition, be careful not to damage clutch hose.
- Tighten clutch tube flare nut to the specified torque below:

**15 - 17 N·m (1.6 - 1.7 kg-m, 11 - 12 ft-lb)**

#### CAUTION:

**Be careful not to damage flare nut and clutch tube.**

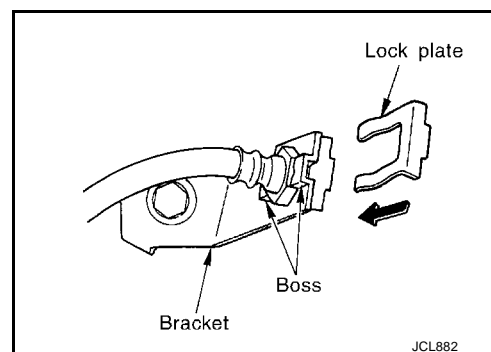
- Tighten the union bolt hose to the specified torque below.

**17 - 20 N·m (1.8 - 2.0 kg-m, 13 - 14 ft-lb)**

#### CAUTION:

**Do not reuse the copper washer.**

- After installation, bleed the clutch tube. Refer to [CL-8, "Bleeding"](#).



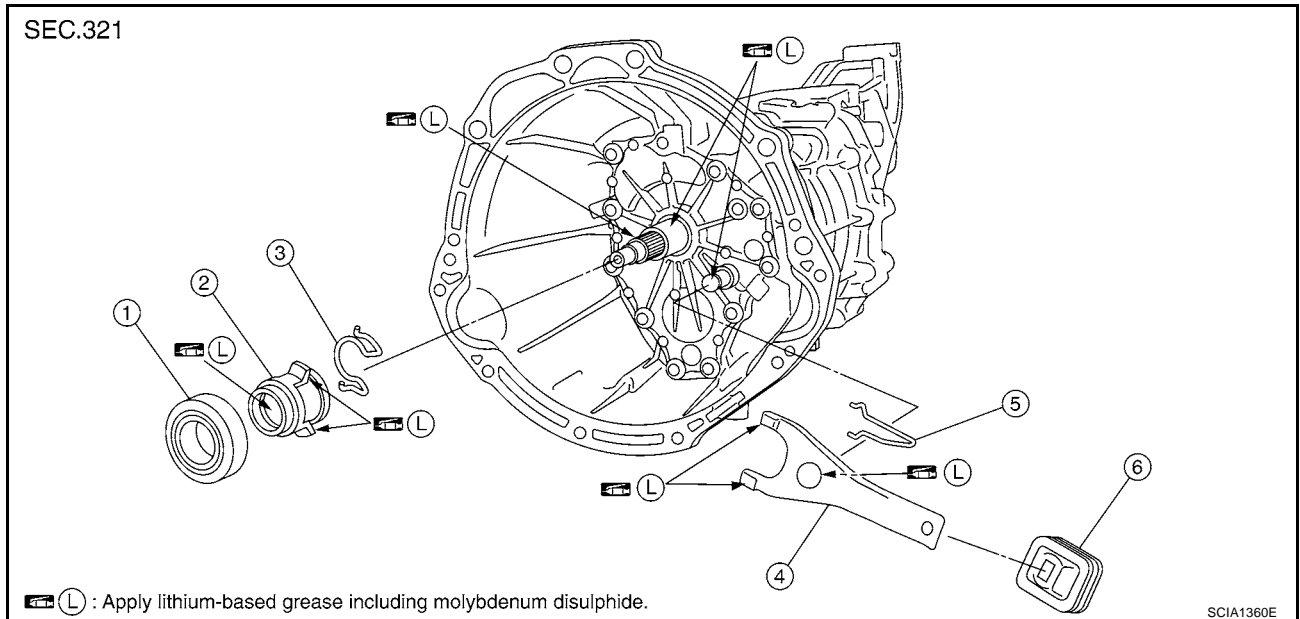
# CLUTCH RELEASE MECHANISM

## CLUTCH RELEASE MECHANISM

PFP:30502

### Removal and Installation

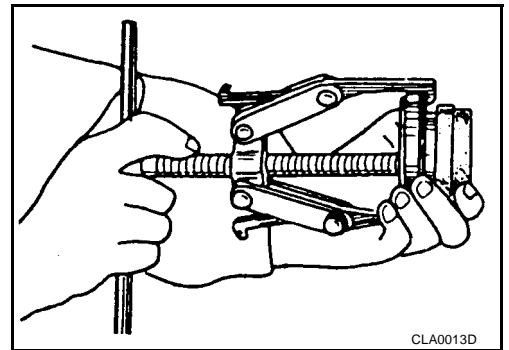
ACS00155



- |                     |                           |                  |
|---------------------|---------------------------|------------------|
| 1. Release bearing  | 2. Release bearing sleeve | 3. Holder spring |
| 4. Withdrawal lever | 5. Retainer spring        | 6. Dust cover    |

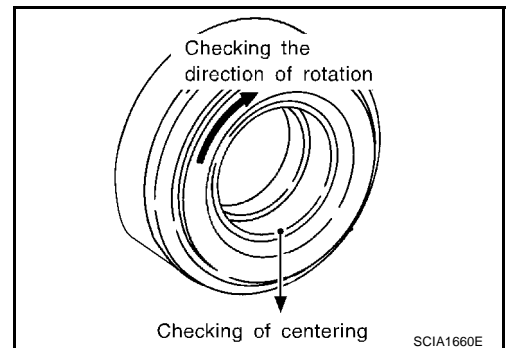
### REMOVAL

1. Remove manual transmission from the vehicle. Refer to [MT-15, "Removal and Installation from Vehicle"](#).
2. Remove release bearing, release bearing sleeve, holder spring, and withdrawal lever from inside the clutch housing.
3. Remove dust cover.
4. Remove retainer spring from withdrawal lever.
5. Using a puller as shown in the figure, remove release bearing from release bearing sleeve.



### INSPECTION AFTER REMOVAL

- If release bearing is seized, damaged, not properly centered or does not rotate smoothly, replace it.
- If contact surface of withdrawal lever is excessively worn out, replace it.
- If dust cover is cracked or deformed, replace it.



# CLUTCH RELEASE MECHANISM

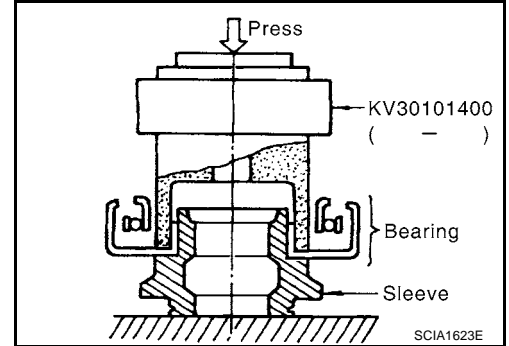
## INSTALLATION

### CAUTION:

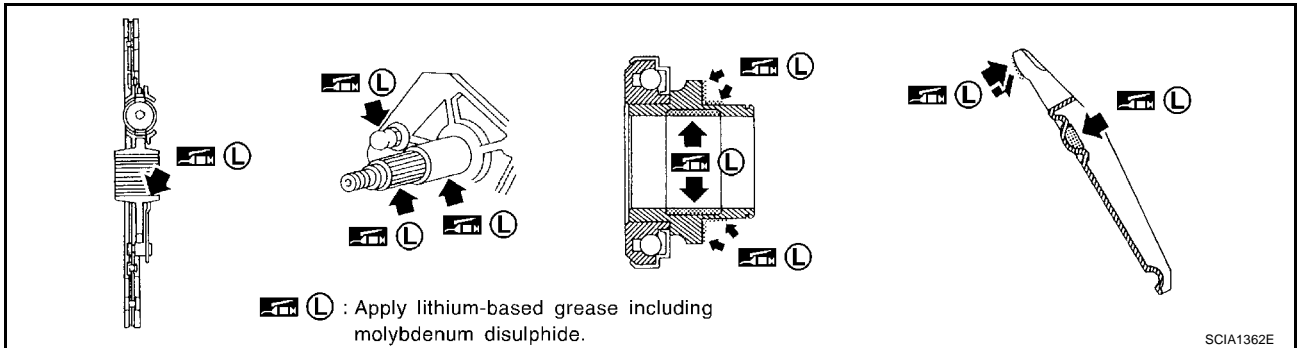
- Be sure to apply grease to the points specified. Otherwise, noise, poor disengagement, or damage to the clutch may result. Excessive grease may cause slip or quiver. Wipe off any grease oozing from the parts.
  - Be careful not to bring any grease into contact with the clutch disc facing, pressure plate surface, or flywheel surface.
1. Using a drift (special service tool), install release bearing to release bearing sleeve.

### CAUTION:

Press bearing inner race by pushing with a drift (special service tool).



2. Following the instructions below, apply grease to the specified points.



### CAUTION:

Wipe off any old grease, debris, or powdery residue left on the surfaces.

- Evenly apply a 1 mm thick coating of recommended grease to withdrawal lever and release bearing sleeve or holder spring sliding surface.
  - Apply recommended grease to ball pin contact surface of the withdrawal lever and inner slots of the release bearing. The grease surface should be level with the surrounding area.
  - Evenly apply a thin coat of recommended grease to the release bearing sliding surface. Install release bearing. Wipe off any excess grease that oozes from the parts and then remove release bearing.
3. Install in the reverse order of the removal.

### CAUTION:

Before installing manual transmission to the vehicle, check that each sliding surface slides smoothly by operating withdrawal lever.

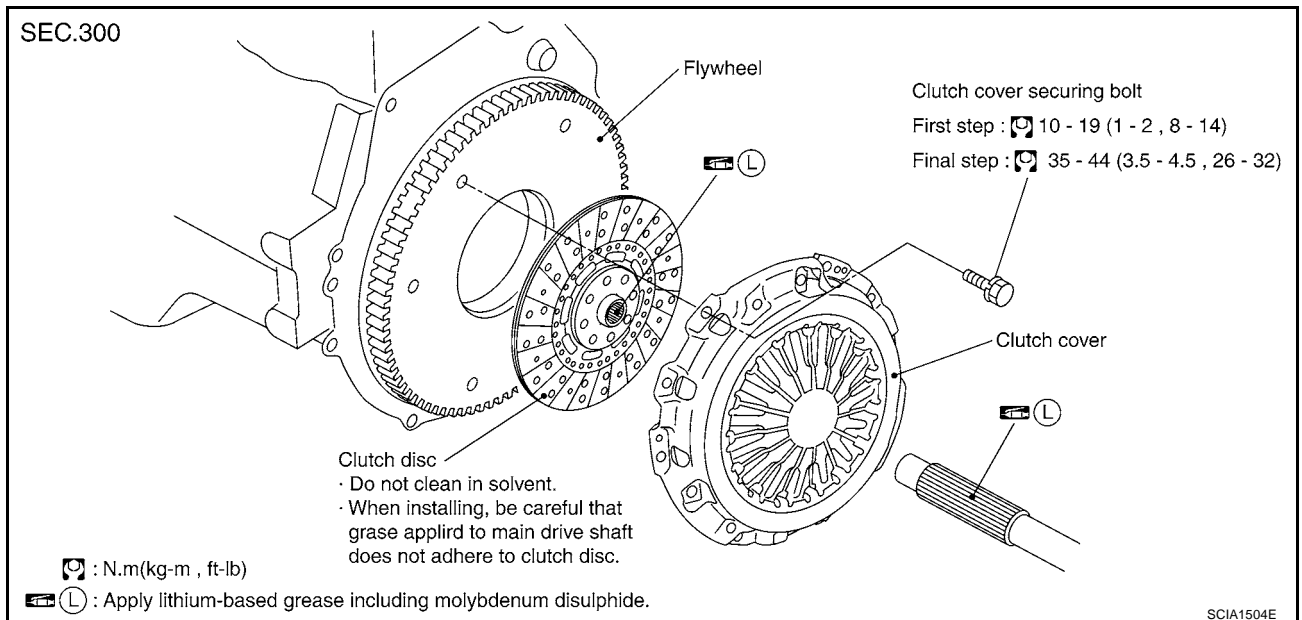
# CLUTCH DISC, CLUTCH COVER

## CLUTCH DISC, CLUTCH COVER

PFP:30100

### Removal and Installation

ACS00156



### CAUTION:

Be careful not to bring any grease into contact with the clutch disc facing, pressure plate surface, or flywheel surface.

### REMOVAL

1. Remove manual transmission from the vehicle. Refer to [MT-15, "Removal and Installation from Vehicle"](#).
2. Loosen clutch cover mounting bolts with power tool. Remove clutch cover and clutch disc.

### INSPECTION AND ADJUSTMENT AFTER REMOVAL

#### Clutch Disc

- Measure circumference runout relative to the clutch disc center spline. If it is outside the specification, replace the clutch disc.

**Runout limit/diameter of the area to be measured:**

**0.7 mm (0.028 in) or less/240 mm (9.45 in) dia.**

- Measure backlash for clutch disc spline and main drive shaft spline at the circumference of the disc. If it is outside the specified range, replace the clutch disc.

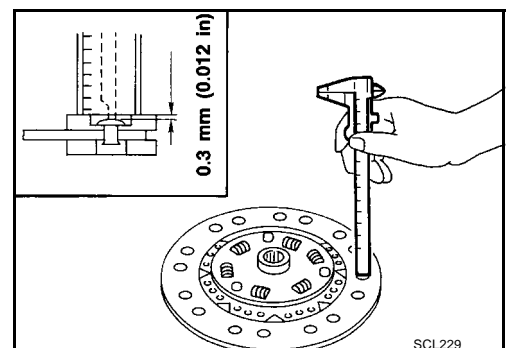
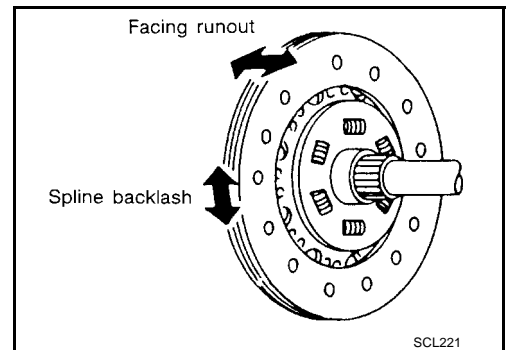
**Maximum backlash of spline:**

**1.0 mm (0.039 in)**

- Using calipers, measure the depth to the clutch disc facing rivet heads. If it exceeds the allowable wear limit, replace the clutch disc.

**Facing wear limit (depth to the rivet head):**

**0.3 mm (0.012 in)**





# CLUTCH DISC, CLUTCH COVER

## Clutch Cover

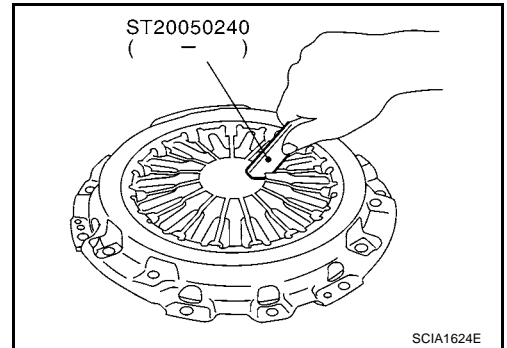
Check diaphragm spring lever claws for unevenness with the lever still on the vehicle. If they exceed the tolerance, adjust lever height using a diaphragm adjusting wrench (special service tool).

**Tolerance for diaphragm spring lever unevenness:**  
**0.7 mm (0.028 in)**

- Check clutch cover thrust ring for wear or breakage. If wear or breakage is found, replace clutch cover assembly.

### NOTE:

- Worn thrust ring will generate a beating noise when tapped at the rivet with a hammer.
- Broken thrust ring will make a clinking sound when cover is shaken up and down.
- If a trace of burn or discoloration is found on the clutch cover pressure plate to clutch disc contact surface, repair the surface with sandpaper. If surface is damaged or distorted, replace the assembly.



## INSTALLATION

1. Apply recommended grease to clutch disc and main drive shaft spline.

### CAUTION:

**Be sure to apply grease to the points specified. Otherwise, noise, poor disengagement, or damage to the clutch may result. Excessive grease may cause slip or quiver. Wipe off any grease oozing from the parts.**

2. Install clutch disc and clutch cover. Pre-tighten mounting bolts and install clutch aligning bar (special service tool).
3. Tighten clutch cover attaching bolts evenly in two steps in the order shown in the figure.

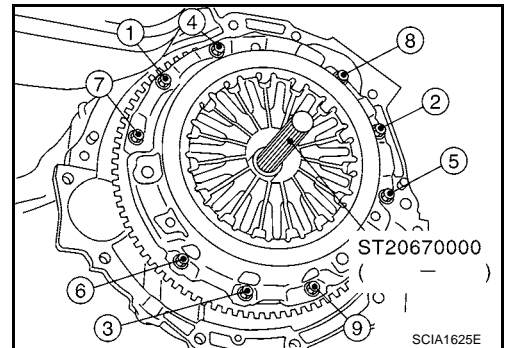
### First step:

: **10 - 19 N·m (1.0 - 2.0 kg-m, 8 - 14 ft-lb)**

### Second step:

: **35 - 44 N·m (3.5 - 4.5 kg-m, 26 - 32 ft-lb)**

4. Install manual transmission. Refer to [MT-15, "Removal and Installation from Vehicle"](#).



# SERVICE DATA AND SPECIFICATIONS (SDS)

## SERVICE DATA AND SPECIFICATIONS (SDS)

PFP:00030

### Clutch Control System

ACS00157

Type of clutch control	Hydraulic
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### Clutch Master Cylinder

ACS00158

Unit: mm (in)

Inner diameter	15.87 (5/8)
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### Clutch Operating Cylinder

ACS00159

Unit: mm (in)

Inner diameter	19.05 (3/4)
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### Clutch Disc

ACS0015A

Unit: mm (in)

Engine model	VQ35DE
Model	250
Facing size (Outer dia. × inner dia. × thickness)	250 × 160 × 3.5 (9.84 × 6.30 × 0.138)
Wear limit (depth to the rivet head)	0.3 (0.012)
Runout limit/diameter of the area to be measured	0.7 (0.028) or less/240 (9.45) dia.
Maximum backlash of spline (at outer edge disc)	1.0 (0.039)

### Clutch Cover

ACS0015B

Unit: mm (in)

Engine model	VQ35DE
Model	250
Set-load	8,630 N (880 kg)
Diaphragm spring lever height	39.5 - 41.5 (1.555 - 1.634)
Uneven limit of diaphragm spring toe height	0.7 (0.028)

### Clutch Pedal

ACS0015C

Unit: mm (in)

Pedal height	171 - 179 (6.73 - 7.05)
Pedal height at clutch disengagement	100 (3.94) or more
Pedal free play (clevis pin free play)	1.0 - 3.0 (0.04 - 0.12)