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# SECTION **EM**

## ENGINE MECHANICAL

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PRECAUTION

PRECAUTIONS

Precaution for Supplemental Restraint System (SRS) "AIR BAG" and "SEAT BELT PRE-TENSIONER"

INFOID:000000005806072

The Supplemental Restraint System such as "AIR BAG" and "SEAT BELT PRE-TENSIONER", used along with a front seat belt, helps to reduce the risk or severity of injury to the driver and front passenger for certain types of collision. This system includes seat belt switch inputs and dual stage front air bag modules. The SRS system uses the seat belt switches to determine the front air bag deployment, and may only deploy one front air bag, depending on the severity of a collision and whether the front occupants are belted or unbelted. Information necessary to service the system safely is included in the SR and SB section of this Service Manual.

**WARNING:**

- To avoid rendering the SRS inoperative, which could increase the risk of personal injury or death in the event of a collision which would result in air bag inflation, all maintenance must be performed by an authorized NISSAN/INFINITI dealer.
- Improper maintenance, including incorrect removal and installation of the SRS, can lead to personal injury caused by unintentional activation of the system. For removal of Spiral Cable and Air Bag Module, see the SR section.
- Do not use electrical test equipment on any circuit related to the SRS unless instructed to in this Service Manual. SRS wiring harnesses can be identified by yellow and/or orange harnesses or harness connectors.

PRECAUTIONS WHEN USING POWER TOOLS (AIR OR ELECTRIC) AND HAMMERS

**WARNING:**

- When working near the Airbag Diagnosis Sensor Unit or other Airbag System sensors with the Ignition ON or engine running, DO NOT use air or electric power tools or strike near the sensor(s) with a hammer. Heavy vibration could activate the sensor(s) and deploy the air bag(s), possibly causing serious injury.
- When using air or electric power tools or hammers, always switch the Ignition OFF, disconnect the battery, and wait at least 3 minutes before performing any service.

Precautions For High-Voltage System

INFOID:000000005441550

Refer to [GI-24, "Precautions For High-Voltage System"](#).

Precaution for Draining Coolant

INFOID:000000005441552

- Drain coolant when engine is cooled.

Precaution for Disconnecting Fuel Piping

INFOID:000000005441553

- Before starting work, make sure no fire or spark producing items are in the work area.
- Release fuel pressure before any removal or disassembly.
- After disconnecting pipes, plug openings to stop fuel leakage.

Precaution for Removal and Disassembly

INFOID:000000005441554

- When instructed to use special service tools, use the specified tools. Always be careful to work safely, avoid forceful operations.
- Use maximum care to avoid damage to mating or sliding surfaces.
- Cover openings of engine system with tape or equivalent, if necessary, to seal out foreign materials.
- Mark and arrange disassembly parts in an organized way for easy troubleshooting and assembly.
- When loosening nuts and bolts, as a basic rule, start with the one furthest outside, then the one diagonally opposite, and so on. If the order of loosening is specified, follow the specifications.

Precaution for Inspection, Repair and Replacement

INFOID:000000005441555

- Before repairing or replacing, thoroughly inspect parts. Inspect new replacement parts in the same way, and replace if necessary.

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# PRECAUTIONS

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< PRECAUTION >

## Precaution for Assembly and Installation

INFOID:000000005441557

- Use torque wrench to tighten bolts or nuts.
- When tightening nuts and bolts, as a basic rule, equally tighten in several different steps starting with the ones in center, then ones on inside and outside diagonally in this order. If the order of tightening is specified, follow the specifications.
- Always replace the old with a new gasket, packing, oil seal or O-ring.
- Thoroughly wash, clean, and air-blow each part. Carefully check oil or coolant passages for any restriction and blockage.
- Avoid damaging sliding or mating surfaces. Completely remove foreign materials such as cloth lint or dust. Before assembly, oil sliding surfaces well.
- Bleed the air trapped within the system after draining the coolant.
- Before starting engine, apply fuel pressure to fuel lines with turning ignition switch ON (with engine stopped). Then make sure that there are no leaks at fuel line connections.
- After repairing, start engine and increase engine speed to check coolant, fuel, oil, and exhaust systems for leakage or rattles.

## Parts Requiring Angular Tightening

INFOID:000000005441557

- Use an angle wrench for the final tightening of the following engine parts.
  - Cylinder head bolts
  - Lower cylinder block bolts
  - Connecting rod cap bolts
  - Crankshaft pulley bolt (No angle wrench is required as the bolt flange is provided with notches for angular tightening)
- Do not use a torque value for final tightening.
- The torque value for these parts are for a preliminary step.
- Ensure thread and seat surfaces are clean and coated with engine oil.

## Precaution for Liquid Gasket

INFOID:000000005441558

### REMOVAL OF LIQUID GASKET SEALING

- After removing the bolts and nuts, separate the mating surface and remove the sealant using Tool.

**Tool number : KV10111100 (J-37228)**

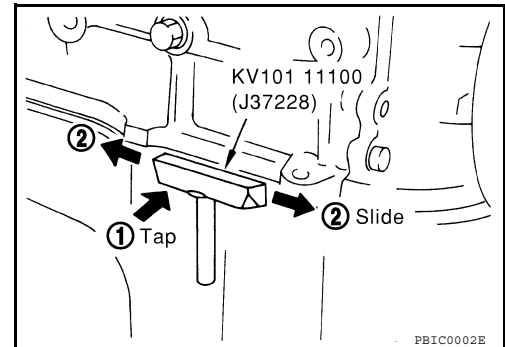
#### **CAUTION:**

**Be careful not to damage the mating surfaces.**

- In areas where the cutter is difficult to use, use a plastic hammer to lightly tap (1) the cutter where the RTV Silicone Sealant is applied. Use a plastic hammer to slide the cutter (2) by tapping on the side.

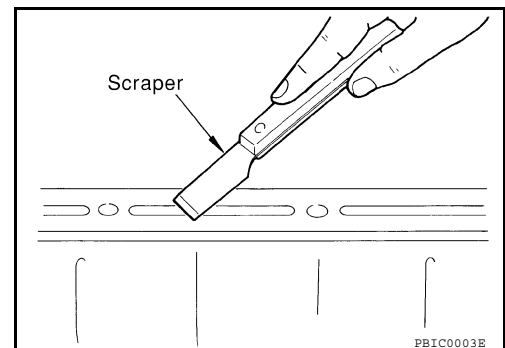
#### **CAUTION:**

**If for some unavoidable reason a tool such as a flat-bladed screwdriver is used, be careful not to damage the mating surfaces.**



### LIQUID GASKET APPLICATION PROCEDURE

1. Using a scraper, remove the old Silicone RTV Sealant adhering to the gasket application surface and the mating surface.
  - Remove the sealant completely from the groove of the gasket application surface, mounting bolts, and bolt holes.
2. Thoroughly clean the gasket application surface and the mating surface and remove adhering moisture, grease and foreign materials.
3. Attach the sealant tube to the tube presser.  
**Use Genuine Silicone RTV Sealant or equivalent. Refer to [GI-15, "Recommended Chemical Products and Sealants"](#).**



# PRECAUTIONS

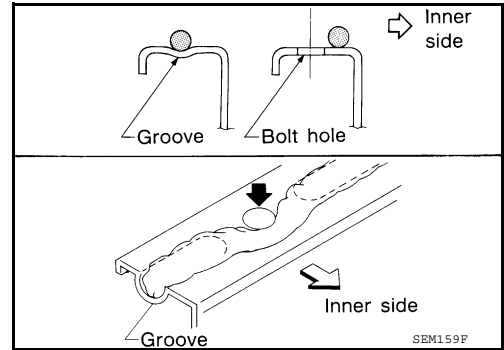
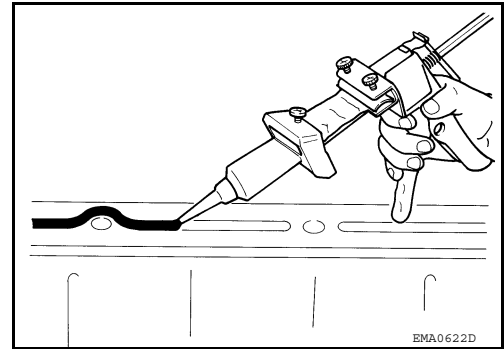
[QR25DE]

## < PRECAUTION >

4. Apply the sealant using Tool without breaks to the specified location.

### Tube presser WS39930000 ( - )

- If there is a groove for the sealant application, apply the sealant to the groove.
- As for the bolt holes, normally apply the sealant inside the holes. If specified, it should be applied outside the holes. Make sure to read the text of this manual.
- Within five minutes of the sealant application, install the mating component.
- If the sealant protrudes, wipe it off immediately.
- Do not retighten after the installation.
- After 30 minutes or more have passed from the installation, fill the engine with the specified oil and coolant. Refer to [MA-11, "Fluids and Lubricants"](#).



### CAUTION:

Follow all specific instructions in this manual.

# PREPARATION

< PREPARATION >

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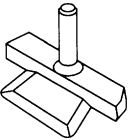
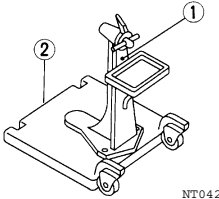
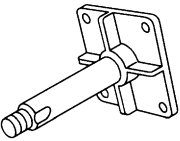
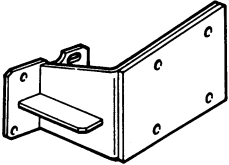
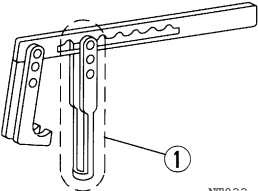
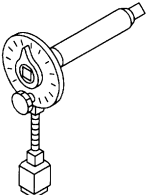
## PREPARATION

### PREPARATION

#### Special Service Tool

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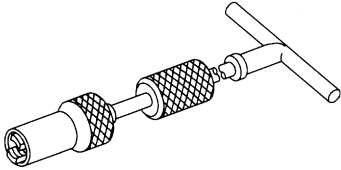
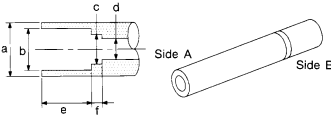
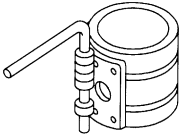
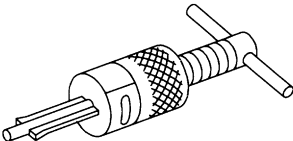
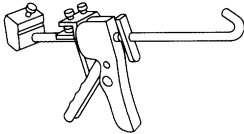

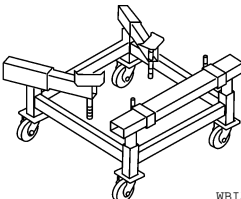
The actual shapes of the Kent-Moore tools may differ from those of the special service tools illustrated here.

Tool number (Kent-Moore No.) Tool name	Description
KV10111100 (J-37228) Seal cutter	Removing steel oil pan and rear timing chain case   S-NT046
ST0501S000 Engine stand assembly 1. ST05011000 ( — ) Engine stand 2. ST05012000 ( — ) Base	Disassembling and assembling   NT042
KV10106500 ( — ) Engine stand shaft	 NT028
KV10115300 ( — ) Engine sub-attachment	 ZZA1078D
KV10116200 (J-26336-B) Valve spring compressor 1. KV10115900 (J-26336-20) Attachment	Disassembling valve mechanism   NT022
KV10112100 (BT-8653-A) Angle wrench	Tightening bolts for bearing cap, cylinder head, etc.   S-NT014

# PREPARATION

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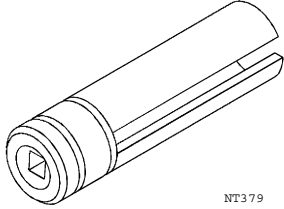
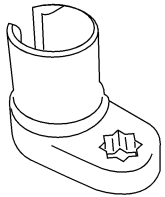
[QR25DE]

Tool number (Kent-Moore No.) Tool name	Description	
KV10107902 (J-38959) Valve oil seal puller   S-NT011	Removing valve oil seal	A EM C
KV10115600 (J-38958) Valve oil seal drift   S-NT603	Installing valve oil seal <b>Use side A.</b>  Unit: mm (in) <b>a: 20 (0.79) dia.</b> <b>d: 8 (0.31) dia.</b> <b>b: 13 (0.51) dia.</b> <b>e: 10.7 (0.421) dia.</b> <b>c: 10.3 (0.406) dia.</b> <b>f: 5 (0.20) dia.</b>	D E F
EM03470000 (J-8037) Piston ring compressor   S-NT044	Installing piston assembly into cylinder bore	G H
ST16610001 (J-23907) Pilot bushing puller   S-NT045	Removing crankshaft pilot bushing	I J K
WS39930000 ( — ) Tube presser   S-NT052	Pressing the tube of liquid gasket	L M
16441 6N210 (J-45488) Quick connector release   PBIC0198E	Removing fuel tube quick connectors in engine room (Available in SEC. 164 of PARTS CATALOG: Part No. 16441 6N210)	N O
— (J-47242) Engine support table   WBIA0658E	Removing engine and transaxle assembly	P

# PREPARATION

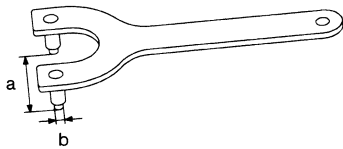
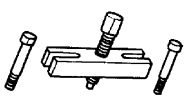
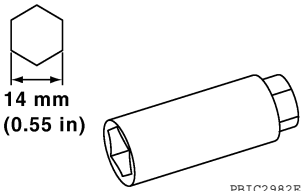
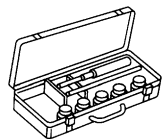
< PREPARATION >

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Tool number (Kent-Moore No.) Tool name	Description
KV10117100 (J-36471-A) Heated oxygen sensor wrench   <p style="text-align: right; font-size: small;">NT379</p>	Loosening or tightening heated oxygen sensor <b>For 22 mm (0.87 in) hexagon nut</b>
— (J-44626) Air fuel ratio (A/F) sensor wrench   <p style="text-align: right; font-size: small;">LEM054</p>	Loosening or tightening air fuel ratio (A/F) sensor 1

## Commercial Service Tool

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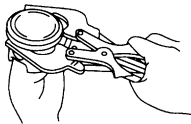
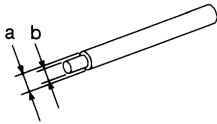
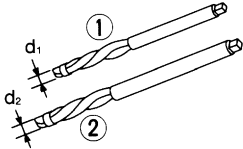
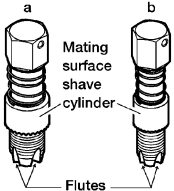
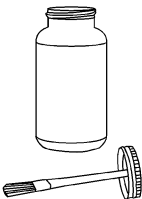
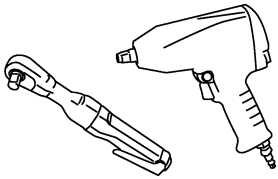
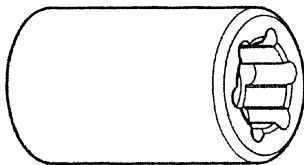
Tool number (Kent-Moore No.) Tool name	Description
Pulley holder   <p style="text-align: right; font-size: x-small;">NT628</p>	Crankshaft pulley removing and installing <b>a: 68 mm (2.68 in) dia.</b> <b>b: 8 mm (0.31 in) dia.</b>
Crank puller   <p style="text-align: right; font-size: x-small;">ZZA0010D</p>	Crankshaft pulley removing
Spark plug wrench   <p style="text-align: right; font-size: x-small;">PBIC2982E</p>	Removing and installing spark plug
Valve seat cutter set   <p style="text-align: right; font-size: x-small;">S-NT048</p>	Finishing valve seat dimensions



# PREPARATION

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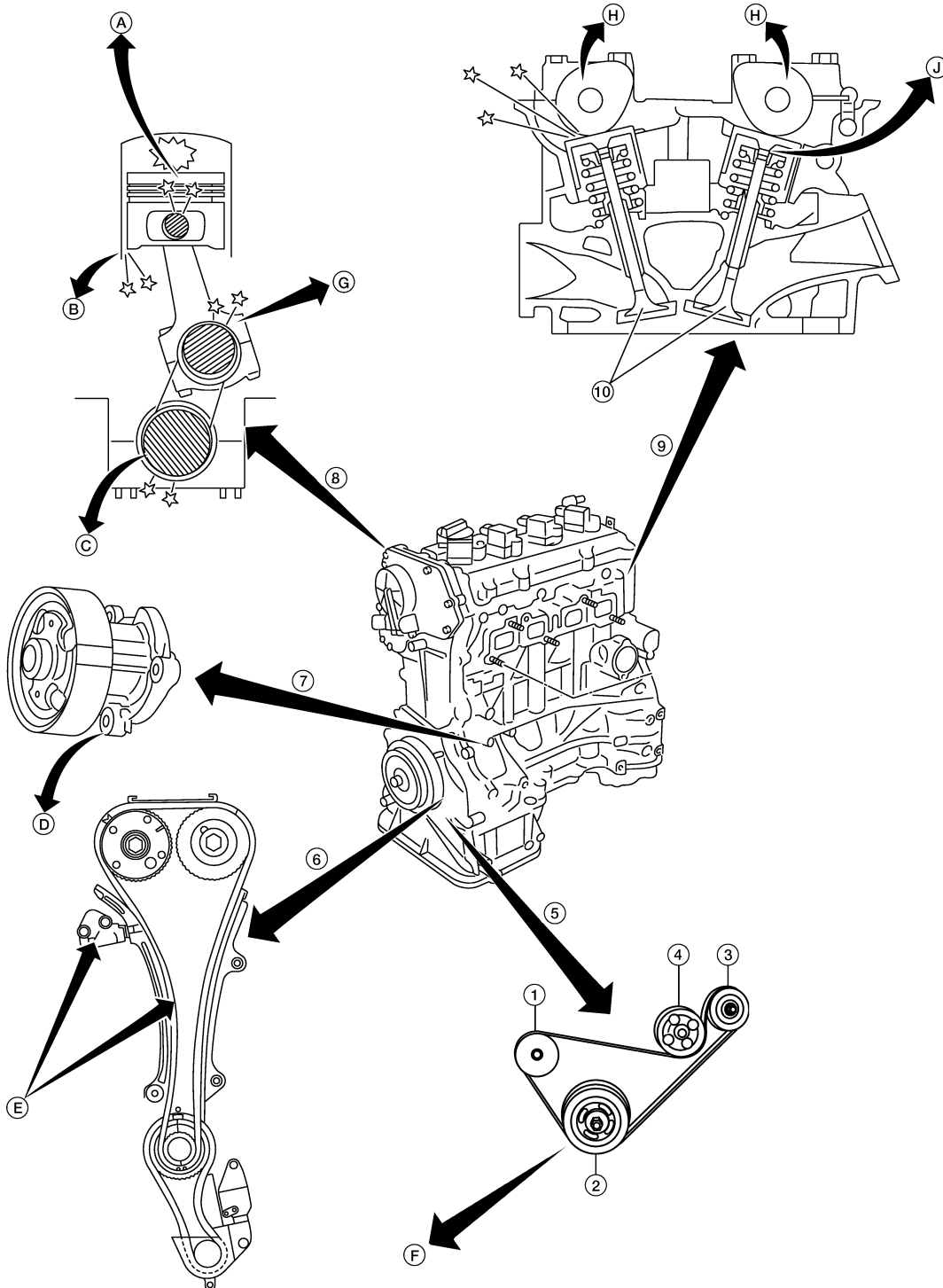
Tool number (Kent-Moore No.) Tool name	Description	
Piston ring expander   S-NT030	Removing and installing piston ring	A <b>EM</b> C
Valve guide drift   S-NT015	Removing and installing valve guide <b>Intake &amp; Exhaust:</b> <b>a: 9.5 mm (0.374 in) dia.</b> <b>b: 5.5 mm (0.217 in) dia.</b>	D E F
Valve guide reamer   S-NT016	1: Reaming valve guide inner hole 2: Reaming hole for oversize valve guide <b>Intake &amp; Exhaust:</b> <b>d1: 6.0 mm (0.236 in) dia.</b> <b>d2: 10.2 mm (0.402 in) dia.</b>	G H
(J-43897-18) (J-43897-12) Oxygen sensor thread cleaner   AEM488	Reconditioning the exhaust system threads before installing a new heated oxygen sensor (Use with anti-seize lubricant shown below.) <b>a: J-43897-18 [18 mm (0.71 in) dia.] for zirconia heated oxygen sensor</b> <b>b: J-43897-12 [12 mm (0.47 in) dia.] for titania heated oxygen sensor</b>	I J K
Anti-seize lubricant (Permatex 133AR or equivalent meeting MIL specification MIL-A-907)   AEM489	Lubricating oxygen sensor thread cleaning tool when reconditioning exhaust system threads	L M
Power tool   FBIC0190E	Loosening bolts and nuts	N O
E20 Torx® Socket (J-45816)   LBIA0285E	Removing and installing CVT flywheel damper bolts	P

FUNCTION DIAGNOSIS

NOISE, VIBRATION, AND HARSHNESS (NVH) TROUBLESHOOTING

NVH Troubleshooting - Engine Noise

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- |                              |                       |                    |
|------------------------------|-----------------------|--------------------|
| 1. Water pump auto tensioner | 2. Crankshaft         | 3. Idler pulley    |
| 4. Water pump pulley         | 5. Drive belt         | 6. Timing chain    |
| 7. Water pump                | 8. Rotation mechanism | 9. Valve mechanism |

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# NOISE, VIBRATION, AND HARSHNESS (NVH) TROUBLESHOOTING

< FUNCTION DIAGNOSIS >

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- |                       |                                 |   |
|-----------------------|---------------------------------|---|
| 10. Valve             | A. Piston pin noise             | B. Piston pin slap                        |
| C. Main bearing noise | D. Water pump noise             | E. Timing chain and chain tensioner noise |
| F. Drive belt noise   | G. Connecting rod bearing noise | H. Camshaft bearing noise                 |
| J. Tappet noise       |                                 |   |

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## Use the Chart Below to Help You Find the Cause of the Symptom

INFOID:000000005441562

1. Locate the area where noise occurs.
2. Confirm the type of noise.
3. Specify the operating condition of engine.
4. Check specified noise source.

If necessary, repair or replace these parts.

Location of noise	Type of noise	Operating condition of Hybrid System			Using Consult III			Source of noise	Check item	Reference page
		Before warm-up	After warm-up	When starting	When idling	When racing	While driving			
Top of engine Rocker cover Cylinder head	Ticking or clicking	C	A	—	A	B	—	Tappet noise	Valve clearance	<a href="#">EM-48</a>
	Rattle	C	A	—	A	B	C	Camshaft bearing noise	Camshaft journal clearance Camshaft runout	<a href="#">EM-40</a> <a href="#">EM-47</a>
Crankshaft pulley Cylinder block (Side of engine) Oil pan	Slap or knock	—	A	—	B	B	—	Piston pin noise	Piston and piston pin clearance Connecting rod bushing clearance	<a href="#">EM-84</a> <a href="#">EM-84</a>
	Slap or rap	A	—	—	B	B	A	Piston slap noise	Piston-to-bore clearance Piston ring side clearance Piston ring end gap Connecting rod bend and torsion	<a href="#">EM-84</a> <a href="#">EM-84</a> <a href="#">EM-84</a> <a href="#">EM-84</a>
	Knock	A	B	C	B	B	B	Connecting rod bearing noise	Connecting rod bushing clearance (Small end) Connecting rod bearing clearance (Big end)	<a href="#">EM-84</a> <a href="#">EM-84</a>
	Knock	A	B	—	A	B	C	Main bearing noise	Main bearing oil clearance Crankshaft runout	<a href="#">EM-84</a> <a href="#">EM-84</a>
Front of engine Timing chain cover	Tapping or ticking	A	A	—	B	B	B	Timing chain and chain tensioner noise	Timing chain cracks and wear Timing chain tensioner operation	<a href="#">EM-51</a>
Front of engine	Squeaking or fizzing	A	B	—	B	—	B	Drive belts (Sticking or slipping)	Drive belts deflection	<a href="#">EM-14</a>
	Creaking	A	B	A	B	A	B	Drive belts (Slipping)	Idler pulley bearing operation	
	Squall Creak	A	B	—	B	A	B	Water pump noise	Water pump operation	<a href="#">CO-17</a>

A: Closely related B: Related C: Sometimes related —: Not related

# SPARK PLUG

< ON-VEHICLE MAINTENANCE >

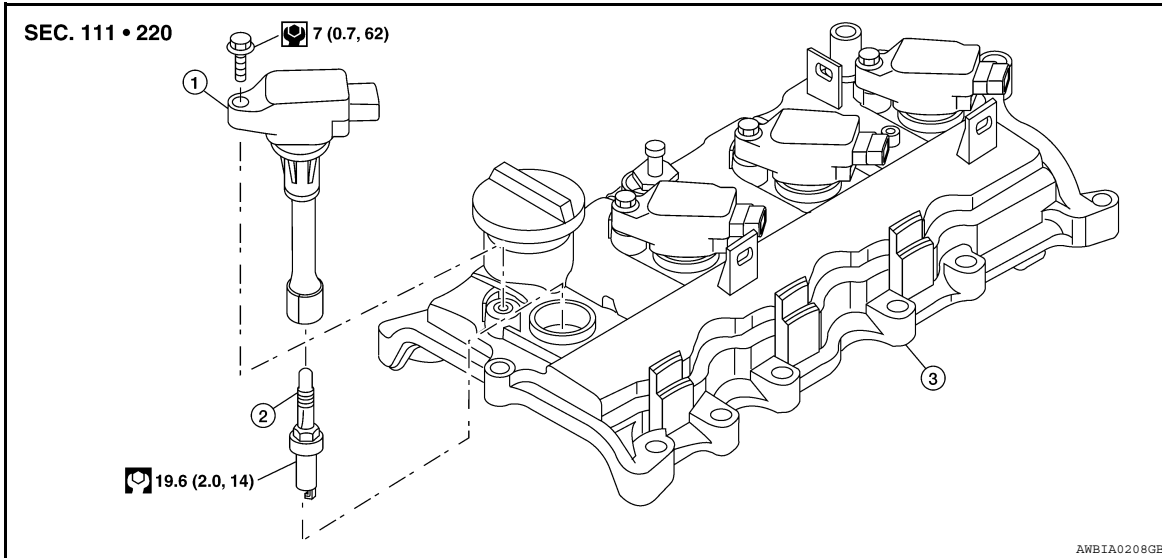
[QR25DE]

## ON-VEHICLE MAINTENANCE

### SPARK PLUG

#### Removal and Installation

INFOID:000000005441563



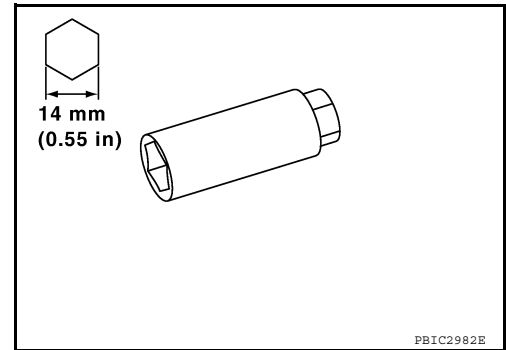
1. Ignition coil

2. Spark plug

3. Rocker cover

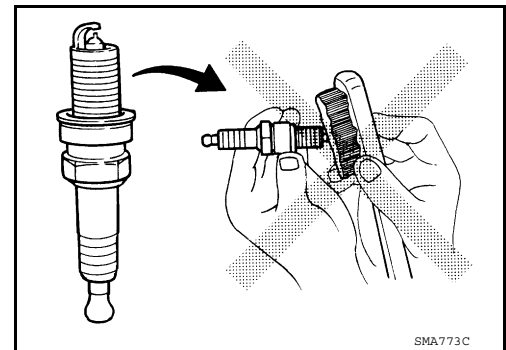
#### REMOVAL

1. Remove the ignition coil. Refer to [EM-34. "Removal and Installation"](#).
2. Remove the spark plug with a suitable spark plug wrench.



#### INSPECTION AFTER REMOVAL

- Do not use a wire brush for cleaning the spark plugs. Replace as necessary.



- If plug is covered with carbon, a spark plug cleaner may be used.

**Cleaner air pressure** : less than 588 kPa (6 kg/cm<sup>2</sup>, 85 psi)

**Cleaning time** : less than 20 seconds

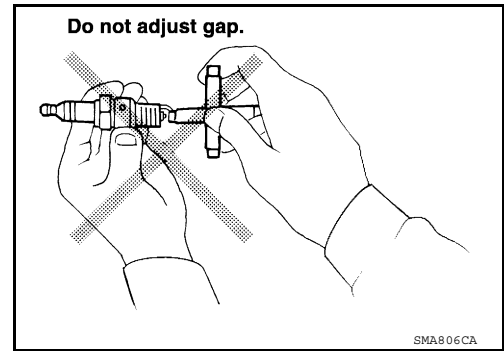
# SPARK PLUG

< ON-VEHICLE MAINTENANCE >

[QR25DE]

- Checking and adjusting plug gap is not required between change intervals. If the gap is out of specification, replace the spark plug.

**Gap (nominal) : 1.1 mm (0.043 in)**



## INSTALLATION

Installation is in the reverse order of removal.

Standard type*	NGK
	DILKAR6A-11
Gap (nominal)	1.1 mm (0.043 in)

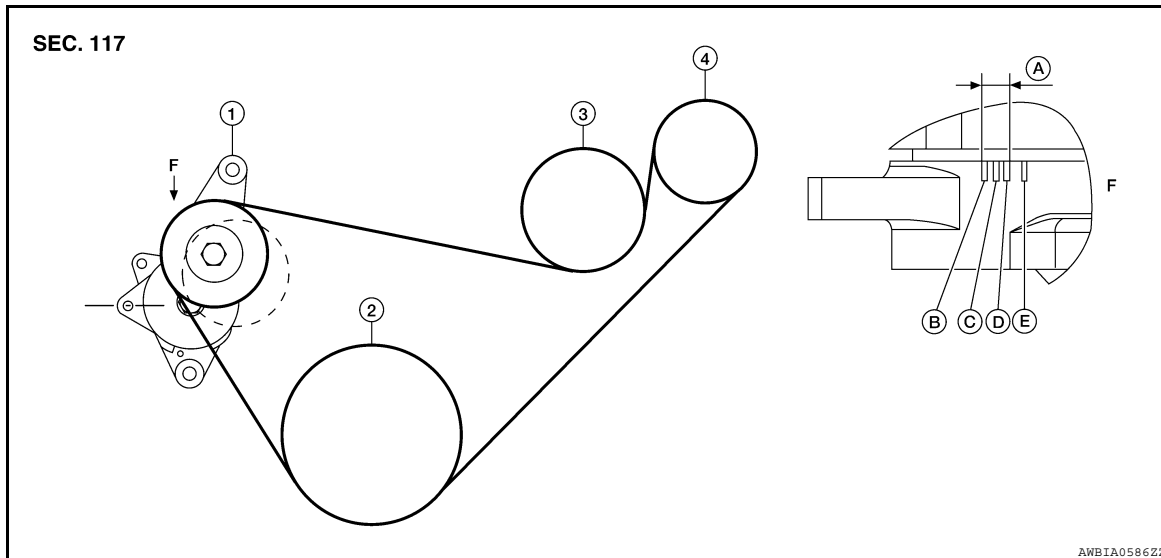
\*: Always check with the Parts Department for the latest parts information

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## DRIVE BELTS

### Checking Drive Belts

INFOID:000000005441564



- |                              |                                  |                              |
|------------------------------|----------------------------------|------------------------------|
| 1. Drive belt auto-tensioner | 2. Crankshaft                    | 3. Water pump                |
| 4. Idler pulley              | A. Water pump belt working range | B. Minimum belt length       |
| C. Nominal position          | D. Maximum belt length           | E. Maximum belt length +0.8% |
| F. View F                    |                                  |                              |

**WARNING:**

**Inspect the drive belt only when the Hybrid System is off.**

- Make sure that the stamp mark of drive belt auto-tensioner is within the usable range.

**NOTE:**

- Check the drive belt auto-tensioner indicator (notch) when the engine is cold.
- When the new drive belt is installed, the range should be (A) as shown.
- Visually check entire belt for wear, damage or cracks.
- If the indicator is out of allowable use range or belt is damaged, replace the belt.

### Tension Adjustment

INFOID:000000005441565

- Belt tension is not manually adjustable, it is automatically adjusted by the drive belt auto-tensioner.

### Removal and Installation of Drive Belt

INFOID:000000005441566

#### REMOVAL

1. Remove the fender protector side cover (RH). Refer to [EXT-19, "Removal and Installation"](#).
2. Securely hold the hexagonal part in pulley center of drive belt auto-tensioner, move in loosening direction of tensioner using suitable tool.

**WARNING:**

- **Avoid placing hand in a location where pinching may occur if the holding tool accidentally comes off.**

**CAUTION:**

- **Do not loosen the auto-tensioner pulley bolt. (Do not turn it counterclockwise) If turned counterclockwise, the complete auto-tensioner must be replaced as a unit, including pulley.**

3. Insert a rod approximately 6 mm (0.24 in) in diameter through the rear of tensioner into retaining boss to lock tensioner pulley.
  - Leave tensioner pulley arm locked until drive belt is installed again.
4. Loosen drive belt from water pump pulley and then remove it from the other pulleys.

#### INSTALLATION

# DRIVE BELTS

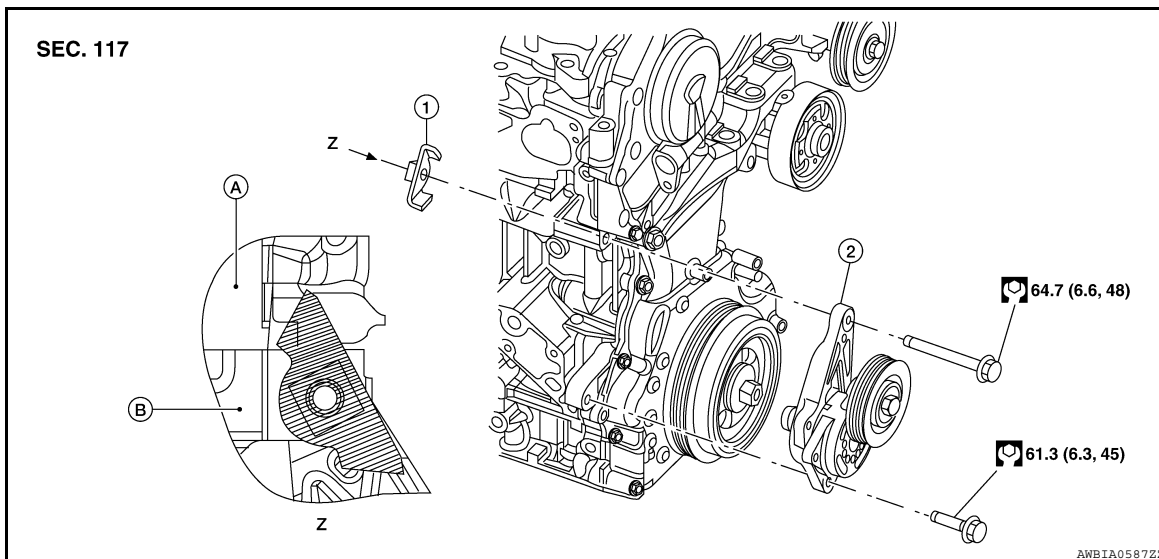
< ON-VEHICLE MAINTENANCE >

[QR25DE]

1. Hook the auxiliary drive belt onto all of the pulleys except for the water pump pulley. Hook the drive belt onto water pump pulley last.  
**CAUTION:**  
**Confirm belts are completely set on the pulleys.**
2. Release tensioner, and apply tension to belt.  
**WARNING:**
  - Avoid placing hand in a location where pinching may occur if the holding tool accidentally comes off.**CAUTION:**
  - Do not loosen the auto-tensioner pulley bolt. (Don't turn it counterclockwise). If turned counterclockwise, the complete auto-tensioner must be replaced as a unit, including pulley.
3. Turn crankshaft pulley clockwise several times to equalize tension between each pulley.
4. Confirm tensions of belt at indicator is within the allowable use range. Refer to [EM-14, "Checking Drive Belts"](#).
5. Install the fender protector side cover (RH). Refer to [EXT-19, "Removal and Installation"](#).

## Removal and Installation of Drive Belt Auto-tensioner

INFOID:000000005441567



- |                   |                              |                  |
|-------------------|------------------------------|------------------|
| 1. Nut bracket    | 2. Drive belt auto-tensioner | A. Cylinder head |
| B. Cylinder block | Z. Back view                 |                  |

### **CAUTION:**

**The complete drive belt auto-tensioner must be replaced as a unit, including the pulley, do not disassemble.**

### REMOVAL

1. Disconnect the 12-volt battery negative terminal.
2. Remove the front RH wheel and tire assembly. Refer to [WT-60, "Adjustment"](#).
3. Remove the fender protector side cover (RH). Refer to [EXT-19, "Removal and Installation"](#).
4. Remove the engine room cover.
5. Remove the drive belt. Refer to [EM-14, "Removal and Installation of Drive Belt"](#).
  - Insert a rod approximately 6 mm (0.24 in) in diameter through the rear of the tensioner into the retaining boss to lock the tensioner pulley.
6. Remove the brake ECU and position aside. Refer to [BRC-193, "Removal and Installation"](#).
7. Remove the RH engine mounting bracket. Refer to [EM-71, "Removal and Installation"](#).
8. Remove the drive belt auto-tensioner, with power tool.

### **CAUTION:**

# DRIVE BELTS

< ON-VEHICLE MAINTENANCE >

[QR25DE]

- Do not loosen the auto-tensioner pulley bolt. (Do not turn it counterclockwise). If turned counterclockwise, the complete auto-tensioner must be replaced as a unit, including pulley.
- Do not swap the pulley between the new and old auto-tensioner units

## INSTALLATION

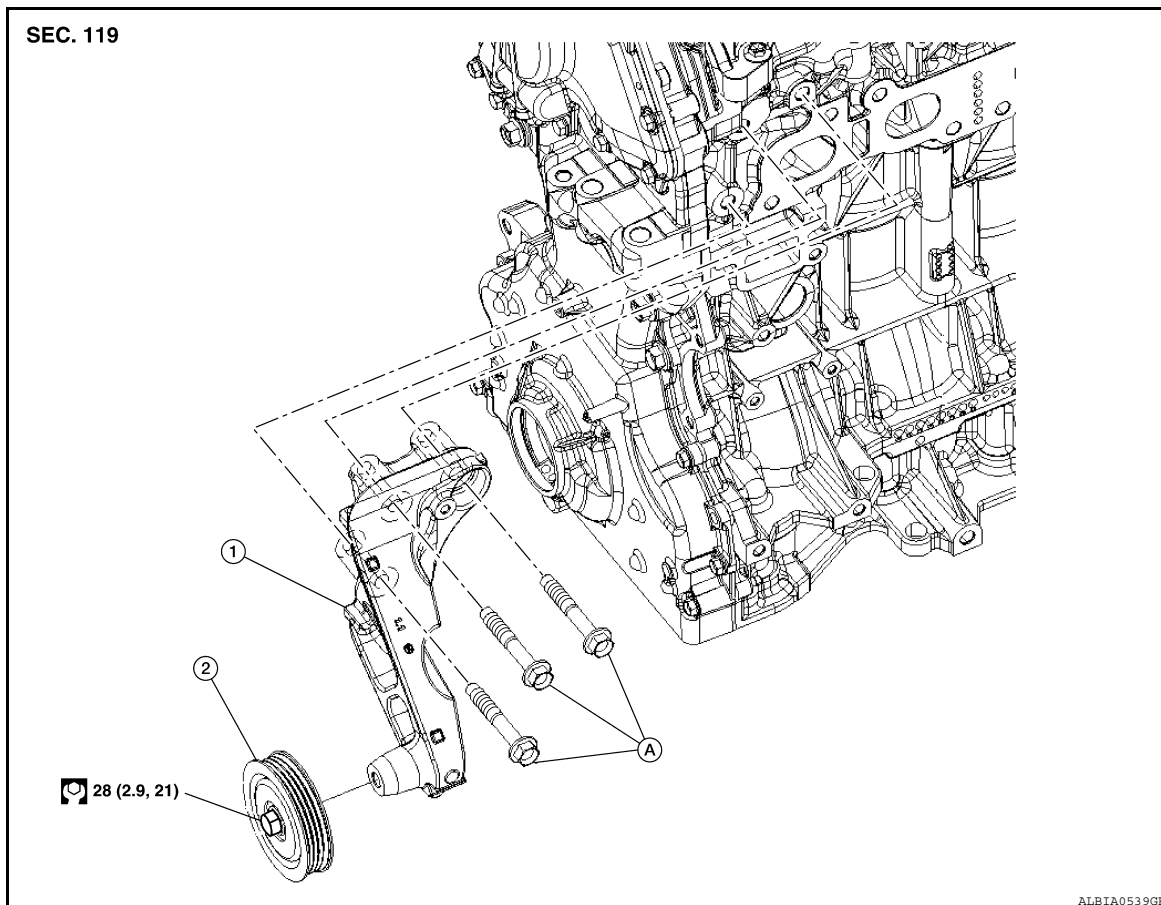
Installation is in the reverse order of removal.

### CAUTION:

If there is damage greater than peeled paint, replace drive belt auto-tensioner units

## Removal and Installation of Idler Pulley

INFOID:000000005441568



1. Idler pulley bracket

2. Idler pulley

A. Refer to Installation

## REMOVAL

1. Remove the front RH wheel and tire assembly. Refer to [WT-60, "Adjustment"](#).
2. Remove the fender protector side cover (RH). Refer to [EXT-19, "Removal and Installation"](#).
3. Remove the drive belt. Refer to [EM-14, "Removal and Installation of Drive Belt"](#).
4. Remove the front air duct. Refer to [EM-24, "Removal and Installation"](#).
5. Disconnect the engine compartment ground harness and remove the engine compartment ground harness bracket.

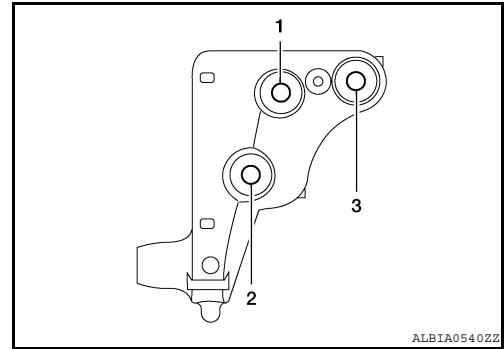


# DRIVE BELTS

< ON-VEHICLE MAINTENANCE >

[QR25DE]

6. Remove the idler pulley bracket bolts in the reverse order as shown. Then remove the idler pulley assembly.



## INSTALLATION

Installation is in the reverse order of removal.

### CAUTION:

Tighten the idler pulley bracket bolts using the following steps:

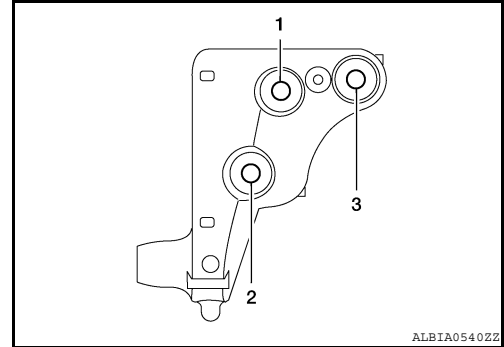
**Idler pulley bracket bolts : 55.0 N·m (5.6 kg·m, 41 ft·lb)**

**Step 1: Temporarily tighten bolt 1 to hold the idler pulley assembly in place.**

**Step 2: Tighten bolt 2 to specification.**

**Step 3: Tighten bolt 3 to specification.**

**Step 4: Tighten bolt 1 to specification.**



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# AIR CLEANER FILTER

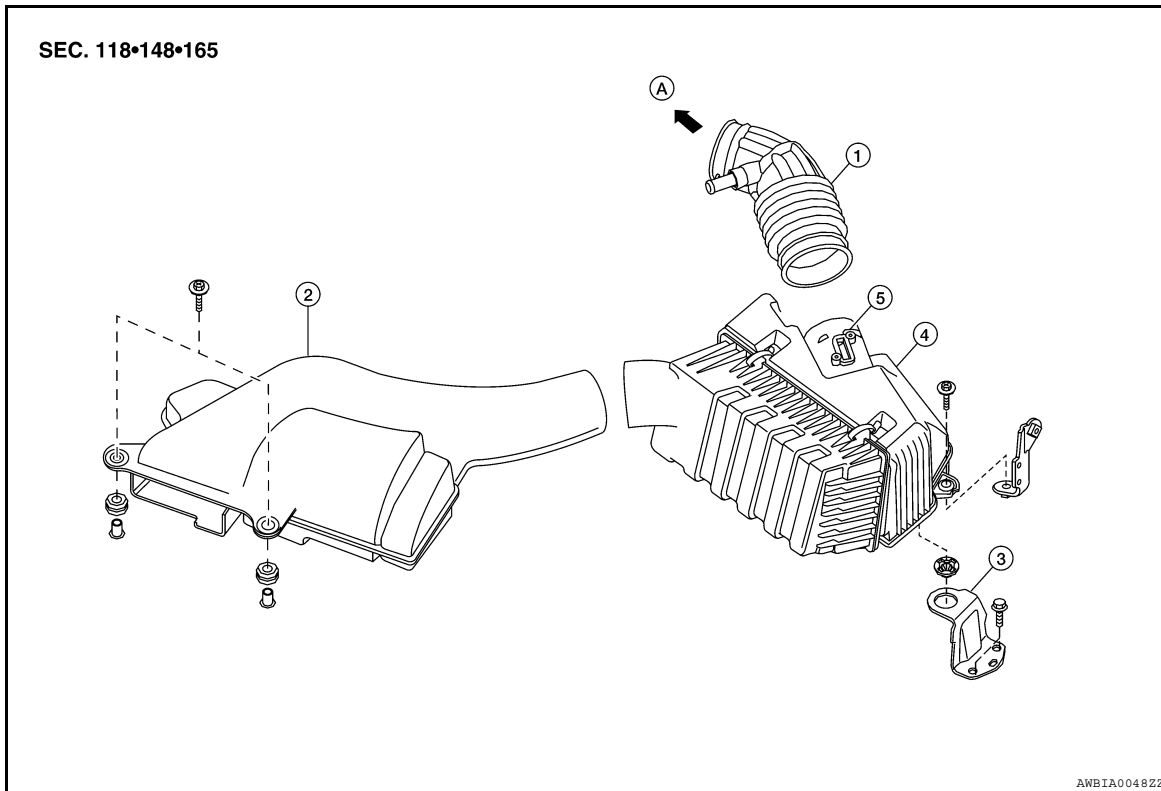
< ON-VEHICLE MAINTENANCE >

[QR25DE]

## AIR CLEANER FILTER

### Removal and Installation

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- |                         |                         |  |
|-------------------------|-------------------------|--|
| 1. Air duct hose        | 2. Front air duct       | 3. Air cleaner mounting bracket          |
| 4. Air cleaner assembly | 5. Mass air flow sensor | A. To electric throttle control actuator |

### CHANGING THE AIR CLEANER ELEMENT

1. Remove the front air duct.
2. Unhook the air cleaner case side clips.
3. Remove the air cleaner filter.
4. Install a new air cleaner filter.
5. Lock the air cleaner case side clips.
6. Install the front air duct.

# CAMSHAFT VALVE CLEARANCE

< ON-VEHICLE MAINTENANCE >

[QR25DE]

## CAMSHAFT VALVE CLEARANCE

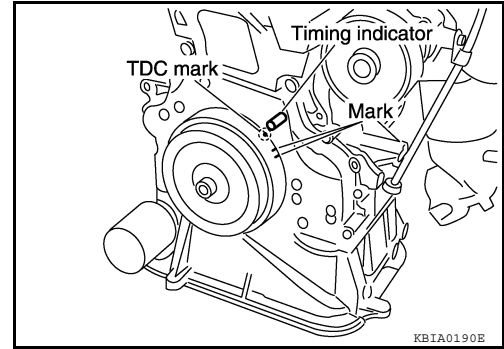
### Camshaft Valve Clearance

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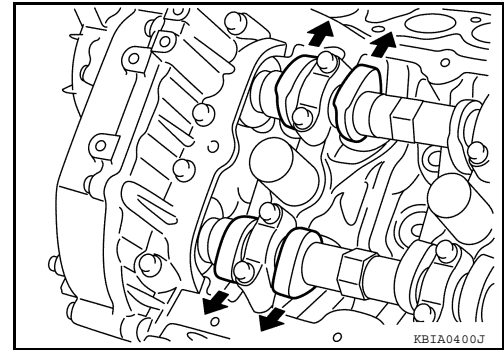
#### INSPECTION

- Perform this inspection as follows after removal, installation, or replacement of the camshaft or any valve-related parts, or if there are any unusual engine conditions due to changes in valve clearance over time (starting, idling, and/or noise).

- Warm up the engine, then stop it.
- Remove fender protector side cover (RH). Refer to [EXT-19, "Removal and Installation"](#).
- Remove the rocker cover using power tool. Refer to [EM-38, "Removal and Installation"](#).
- Turn crankshaft pulley in normal direction (clockwise when viewed from front) to align TDC identification mark (without paint mark) with timing indicator.

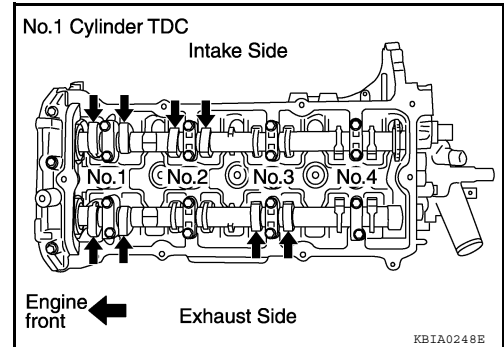


- At this time, check that the both intake and exhaust cam lobes of No. 1 cylinder face outside.
  - If they do not face outside, turn crankshaft pulley once more.



- Measure valve clearances with a feeler gauge at locations marked X as shown in the table below.
  - No.1 cylinder compression TDC.

Cylinder	No.1		No.2		No.3		No.4	
	INT	EXH	INT	EXH	INT	EXH	INT	EXH
Measurable	x	x	x			x		



# CAMSHAFT VALVE CLEARANCE

[QR25DE]

## < ON-VEHICLE MAINTENANCE >

- Use a feeler gauge to measure the clearance between valve and camshaft.

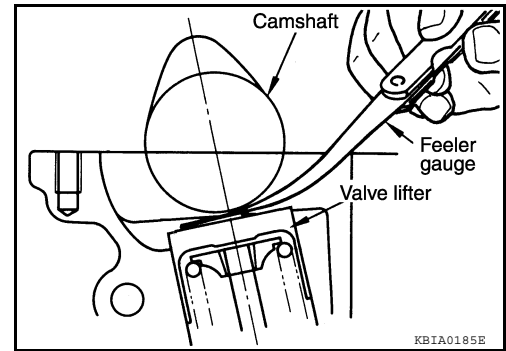
### Valve clearance standard:

<b>Cold</b>	<b>Intake</b>	<b>: 0.24 - 0.32 mm (0.009 - 0.013 in)</b>
	<b>Exhaust</b>	<b>: 0.26 - 0.34 mm (0.010 - 0.013 in)</b>
<b>Hot*</b>	<b>Intake</b>	<b>: 0.304 - 0.416 mm (0.012 - 0.016 in)</b>
	<b>Exhaust</b>	<b>: 0.308 - 0.432 mm (0.012 - 0.017 in)</b>

\*Reference data at approximately 80°C (176°F)

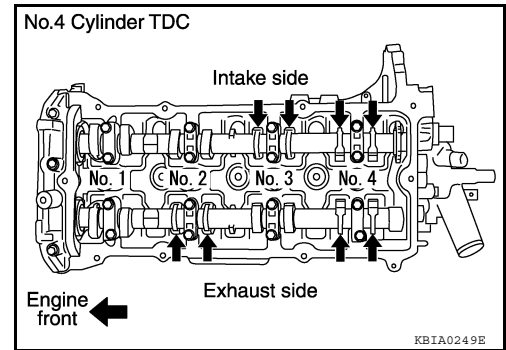
### CAUTION:

If inspection was carried out with cold engine, check that values with fully warmed up engine are still within specifications.



- Turn crankshaft one complete revolution (360°) and align mark on crankshaft pulley with pointer.
- Measure valve clearances with a feeler gauge at locations marked X as shown in the table below.
  - No.4 cylinder compression TDC.

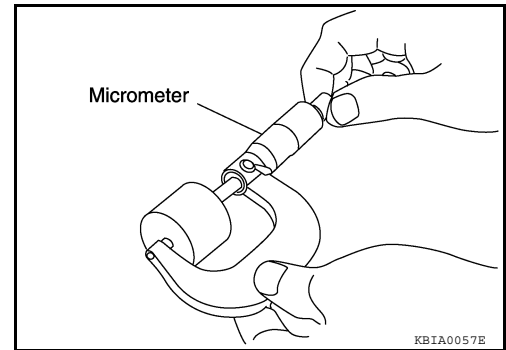
Cylinder	No.1		No.2		No.3		No.4	
	INT	EXH	INT	EXH	INT	EXH	INT	EXH
Measurable				x	x		x	x



- If out of specifications, adjust as follows.

### ADJUSTMENT

- Perform adjustment depending on selected head thickness of valve lifter.
  - The specified valve lifter thickness is the dimension at normal temperatures. Ignore dimensional differences caused by temperature. Use the specifications for hot engine condition to adjust.
- Remove camshaft. Refer to [EM-40, "Removal and Installation"](#).
  - Remove the valve lifters at the locations that are outside the standard.
  - Measure the center thickness of the removed valve lifters with a micrometer.



- Use the equation below to calculate valve lifter thickness for replacement.

- Valve lifter thickness calculation.

$$t = t_1 + (C_1 - C_2)$$

t = Thickness of replacement valve lifter.

t<sub>1</sub> = Thickness of removed valve lifter.

C<sub>1</sub> = Measured valve clearance.

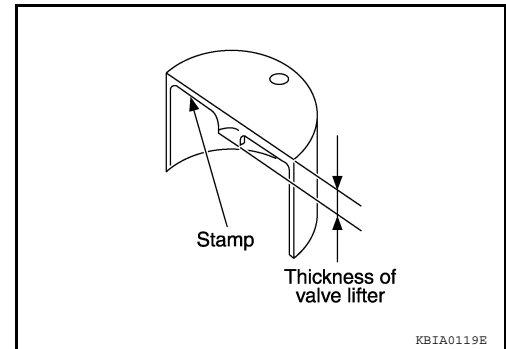
C<sub>2</sub> = Standard valve clearance.

# CAMSHAFT VALVE CLEARANCE

[QR25DE]

< ON-VEHICLE MAINTENANCE >

- Thickness of a new valve lifter can be identified by stamp marks on the reverse side (inside the cylinder).  
Stamp mark 696 indicates a thickness of 6.96 mm (0.2740 in)  
**Available thickness of valve lifter: 26 sizes with a range of 7.88 to 8.38 mm (0.3102 to 0.3299 in), in steps of 0.02 mm (0.0008 in), when assembled at the factory.**



5. Install the selected valve lifter.
6. Install camshaft.
7. Manually turn crankshaft pulley a few turns.
8. Check that valve clearances for cold engine are within specifications, by referring to the specified values.
9. After completing the repair, check valve clearances again with the specifications for warmed engine. Use a feeler gauge to measure the clearance between the valve and camshaft. Make sure the values are within specifications.

### Valve clearance standard:

Cold	Intake	: 0.24 - 0.32 mm (0.009 - 0.013 in)
	Exhaust	: 0.26 - 0.34 mm (0.010 - 0.013 in)
Hot*	Intake	: 0.304 - 0.416 mm (0.012 - 0.016 in)
	Exhaust	: 0.308 - 0.432 mm (0.012 - 0.017 in)

\*: Reference data at approximately 80°C (176°F)

# COMPRESSION PRESSURE

< ON-VEHICLE MAINTENANCE >

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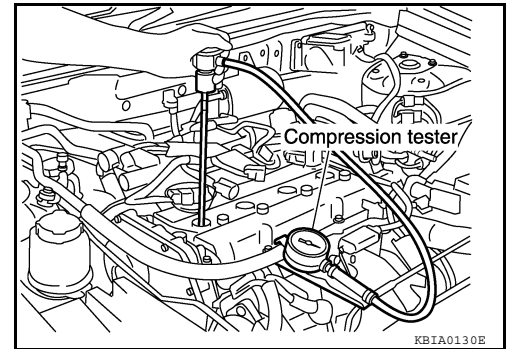
## COMPRESSION PRESSURE

### Compression Pressure

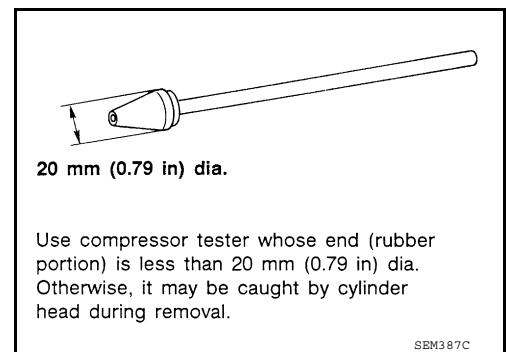
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#### CHECKING COMPRESSION PRESSURE

1. Connect CONSULT-III.
2. Set in the inspection mode (mode 1). Refer to [HBC-104, "MODE 1 : Diagnosis Description"](#).
3. Warm up the engine to full operating temperature.
4. Release the fuel pressure.  
**NOTE:**  
If following procedure performed, a certain DTC may be detected.
  - a. Turn ignition switch OFF.
  - b. Remove fuel pump fuse located in IPDM E/R.
  - c. Turn ignition switch ON (READY).
  - d. Depress the accelerator pedal and keep it.
  - e. After engine stalls, turn ignition switch OFF.
5. Remove the ignition coil and spark plug from each cylinder.  
Refer to [EM-12, "Removal and Installation"](#).
6. Disconnect the fuel injector harness connector to avoid any residual fuel injection during the measurement.
7. Install the compression tester with the adapter into the spark plug hole.



- Use compression tester whose end (rubber portion) is smaller than 20 mm (0.79 in) in diameter. Otherwise, it may be caught by cylinder head during removal.



8. With CONSULT-III crank over the engine. Refer to [HBC-81, "CONSULT-III Function"](#).
  - When the gauge pointer stabilizes, read the compression pressure and engine rpm. Perform these steps to check each cylinder.

Unit: kPa (kg/cm<sup>2</sup>, psi) / rpm

Standard	Minimum	Difference limit between cylinders
900 (9.2, 130.5) / 250	710 (7.3, 103) / 250	100 (1.0, 14) / 250

#### **CAUTION:**

**Always use a fully charged battery to obtain specified engine cranking speed.**

# COMPRESSION PRESSURE

< ON-VEHICLE MAINTENANCE >

[QR25DE]

- If the engine speed is out of specified rpm range, check the battery. Check engine speed again with a fully charged battery.
  - If compression pressure is below minimum value, check valve clearances and parts associated with combustion chamber (valve, valve seat, piston, piston ring, cylinder bore, cylinder head, cylinder head gasket). After the checking, measure compression pressure again.
  - If some cylinders have low compression pressure, pour small amount of engine oil into the spark plug hole of the cylinder to re-check it for compression.
  - If the added engine oil improves the compression, the piston rings may be worn or damaged. Check the piston rings and replace if necessary.
  - If the compression pressure remains at low level despite the addition of engine oil, the valves may be malfunctioning. Check the valves for damage. Replace the valve or valve seat accordingly.
  - If two adjacent cylinders have respectively low compression pressure and their compression remains low even after the addition of engine oil, the head gasket is leaking. In such a case, replace the cylinder head gasket.
9. Install spark plug, ignition coil, fuel pump fuse and harness connectors.

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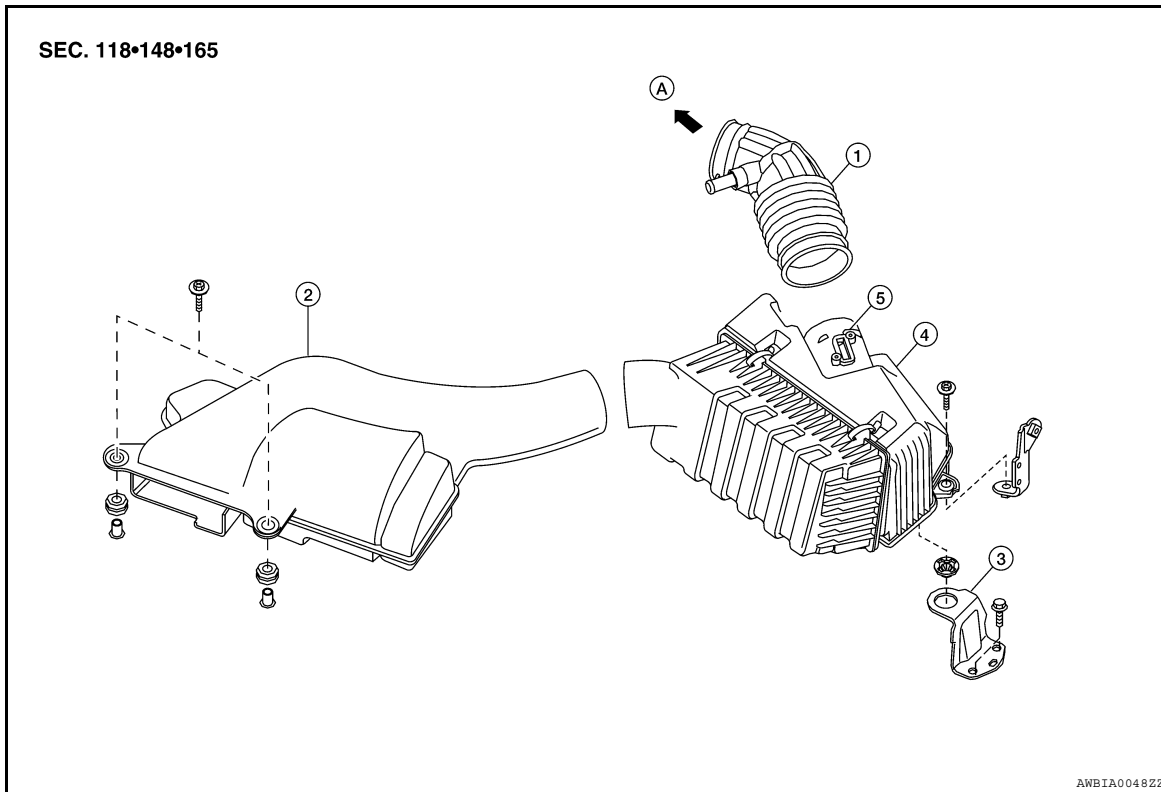
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## ON-VEHICLE REPAIR

### AIR CLEANER AND AIR DUCT

#### Removal and Installation

INFOID:000000005441572



- |                         |                         |  |
|-------------------------|-------------------------|--|
| 1. Air duct hose        | 2. Front air duct       | 3. Air cleaner mounting bracket          |
| 4. Air cleaner assembly | 5. Mass air flow sensor | A. To electric throttle control actuator |

#### REMOVAL

1. Remove the engine room cover.
2. Remove front air duct.
3. Disconnect the air duct hose clamps at the electric throttle control actuator and the air cleaner assembly.
4. Disconnect the blow-by hose.
5. Remove the air duct hose.
6. Disconnect the mass air flow sensor.
7. Remove mass air flow sensor from air cleaner assembly, as necessary.

**CAUTION:**

**Handle the mass air flow sensor with care:**

- Do not shock it.
- Do not disassemble it.
- Do not touch the internal sensor.

8. Release the harness retainers on air cleaner assembly.
9. Remove the air cleaner assembly.

#### INSTALLATION

Installation is in the reverse order of removal.



# INTAKE MANIFOLD

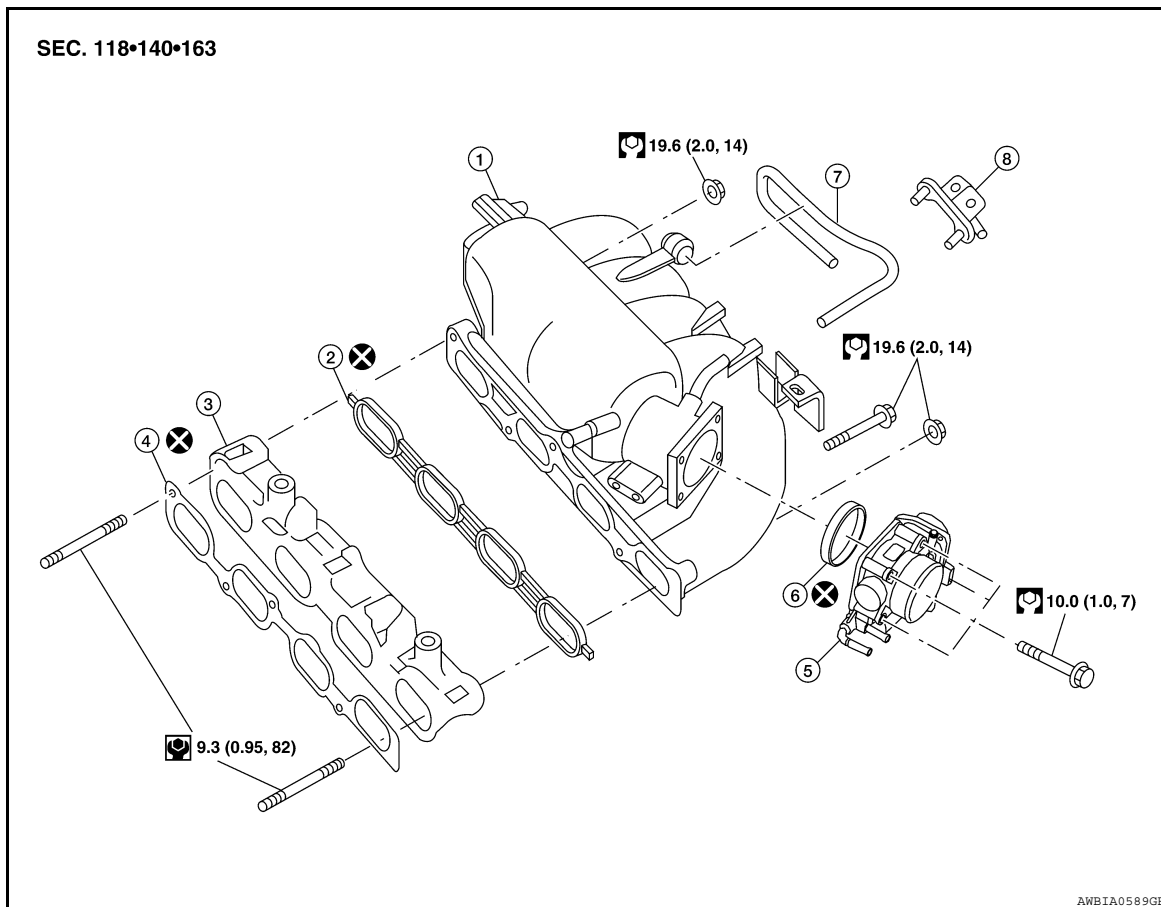
< ON-VEHICLE REPAIR >

[QR25DE]

## INTAKE MANIFOLD

### Removal and Installation

INFOID:000000005441573



- |                    |  |                            |
|--------------------|--|----------------------------|
| 1. Intake manifold | 2. Rubber seal                                       | 3. Intake manifold adapter |
| 4. Gasket          | 5. Electric throttle control actuator                | 6. Rubber seal             |
| 7. EVAP hose       | 8. EVAP canister purge volume control solenoid valve |                            |

### REMOVAL

#### **WARNING:**

**To avoid the danger of being scalded, never drain the coolant when the engine is hot.**

1. Release the fuel pressure. Refer to [EC-465, "Inspection"](#).
2. Disconnect the 12-volt battery negative terminal. Refer to [PG-71, "Removal and Installation"](#).
3. Partially drain coolant when engine is cooled. Refer to [CO-11, "Changing Engine Coolant"](#).
4. Remove blow-by hose, air duct hose and front air duct. Refer to [EM-24, "Removal and Installation"](#).
5. Remove cowl top finisher. Refer to [EXT-18, "Removal and Installation"](#).
6. Disconnect the following components at the intake side:
  - PCV hose
  - EVAP hose and EVAP canister purge volume control solenoid
  - Electric throttle control actuator
7. Remove EVAP canister purge volume control solenoid valve.
8. Disconnect the fuel quick connector on the engine side.
  - Using Tool perform the following steps to disconnect the quick connector.

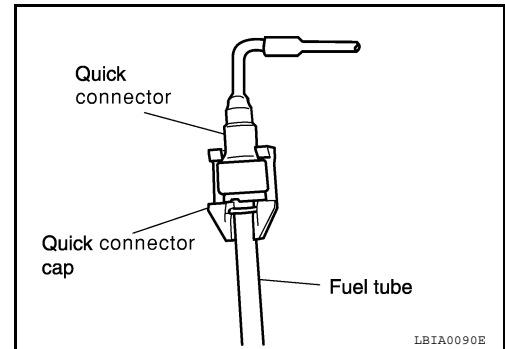
**Tool number : 16441 6N210 (J-45488)**

# INTAKE MANIFOLD

< ON-VEHICLE REPAIR >

[QR25DE]

- a. Remove quick connector cap.



- b. With the sleeve side of Tool facing quick connector, install Tool onto fuel tube.  
c. Insert Tool into quick connector until sleeve contacts and goes no further. Hold the Tool on that position.

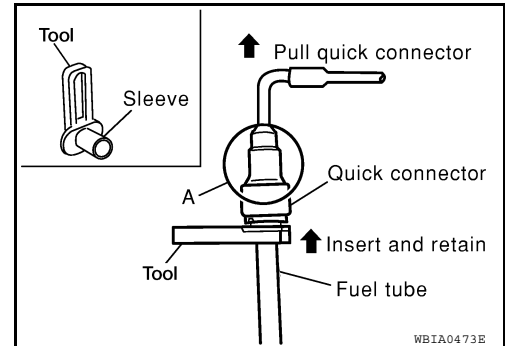
**CAUTION:**

**Inserting the Tool hard will not disconnect quick connector. Hold Tool where it contacts and goes no further.**

- d. Pull the quick connector straight out from the fuel tube.

**CAUTION:**

- Pull quick connector holding it at the (A) position, as shown.
- Do not pull with lateral force applied. O-ring inside quick connector may be damaged.
- Prepare container and cloth beforehand as fuel will leak out.
- Avoid fire and sparks.
- Be sure to cover openings of disconnected pipes with plug or plastic bag to avoid fuel leakage and entry of foreign materials.

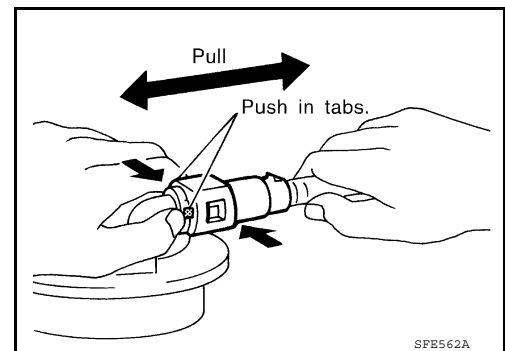


9. When removing fuel hose quick connector at vehicle piping side, perform as follows.

- a. Remove quick connector cap.  
b. Hold the sides of the connector, push in tabs and pull out the tube. (The figure is shown for reference only.)
  - If the connector and the tube are stuck together, push and pull several times until they start to move. Then disconnect them by pulling.

**CAUTION:**

- The tube can be removed when the tabs are completely depressed. Do not twist it more than necessary.
- Do not use any tools to remove the quick connector.
- Keep the resin tube away from heat. Be especially careful when welding near the tube.
- Prevent acid liquid such as battery electrolyte etc. from getting on the resin tube.
- Do not bend or twist the tube during installation and removal.
- Do not remove the remaining retainer on tube.
- When the tube is replaced, also replace the retainer with a new one.  
Retainer color: Green.
- To keep clean the connecting portion and to avoid damage and foreign materials, cover them completely with plastic bags or something similar.



10. Disconnect electric throttle control actuator coolant hoses.

11. Loosen bolts diagonally, and remove the electric throttle control actuator.

**CAUTION:**

**Handle carefully to avoid any damage.**

# INTAKE MANIFOLD

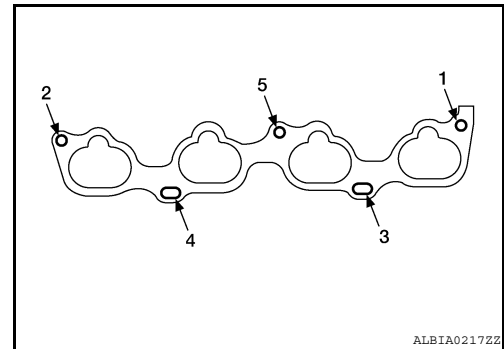
[QR25DE]

< ON-VEHICLE REPAIR >

12. Remove the bolts and nuts in the order shown and remove the intake manifold assembly, using power tools.

**CAUTION:**

Cover engine openings to avoid entry of foreign materials.



## Inspection After Removal

### Surface Distortion

- Using straightedge and feeler gauge, inspect surface distortion of intake manifold collector and intake manifold surface. Refer to [EM-98, "Standard and Limit"](#).

## INSTALLATION

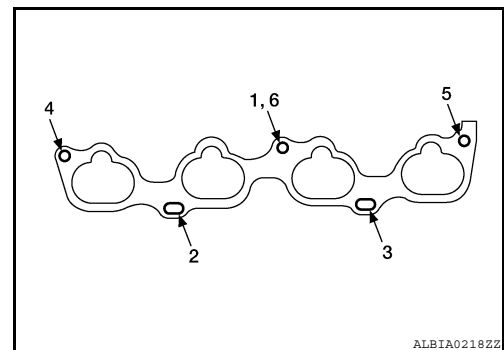
Installation is in the reverse order of removal. Follow the tightening sequences below.

### Tightening Intake Manifold Bolts and Nuts

- Tighten in numerical order as shown.

**CAUTION:**

After tightening the five bolts in the order shown, the 1, 6 position designates that the first bolt tightened is to be retightened to specification.



- **Installation of Electric Throttle Control Actuator:**

- Tighten the bolts of electric throttle control actuator equally and diagonally in several steps.
- After installation perform procedure in "INSPECTION AFTER INSTALLATION".

## CONNECTING QUICK CONNECTOR ON THE FUEL HOSE (ENGINE SIDE)

1. Make sure no foreign substances are deposited in and around the fuel tube and quick connector, and there is no damage to them.
2. Thinly apply new engine oil around the fuel tube tip end.
3. Align center to insert quick connector straight into fuel tube.
  - Insert fuel tube into quick connector until the top spool on fuel tubes is inserted completely and the second level spool is positioned slightly below the quick connector bottom end.

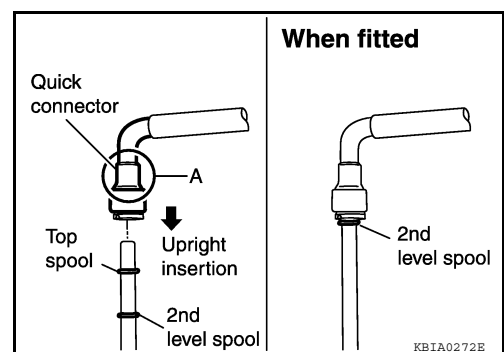
**CAUTION:**

- Hold at position (A) as shown, when inserting the fuel tube into the quick connector.
- Carefully align to center to avoid inclined insertion to prevent damage to the O-ring inside the quick connector.
- Insert the fuel tube until you hear a "click" sound and actually feel the engagement.
- To avoid misidentification of engagement with a similar sound, be sure to perform the next step.

4. Before clamping the fuel hose with the hose clamp, pull the quick connector hard by hand, holding at the (A) position, as shown. Make sure it is completely engaged (connected) so that it does not come off of the fuel tube.

**NOTE:**

Recommended pulling force is 50 N (5.1 kg, 11.2 lb).

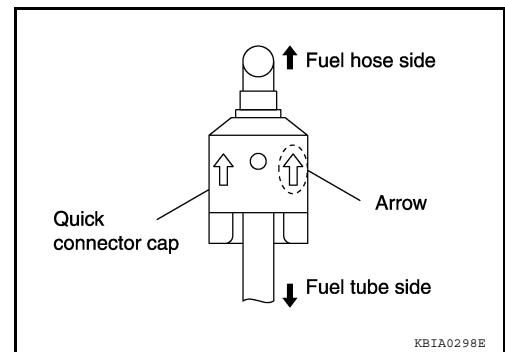


# INTAKE MANIFOLD

[QR25DE]

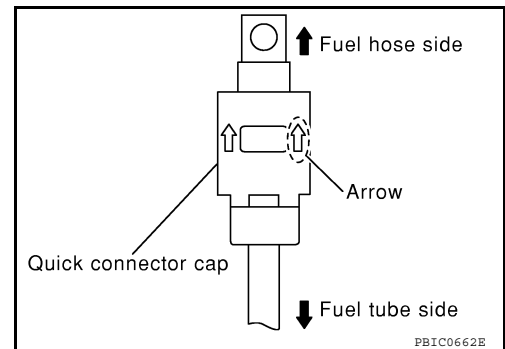
## < ON-VEHICLE REPAIR >

5. Install quick connector cap on quick connector joint.
  - Direct arrow mark on quick connector cap to upper side (fuel hose side).
6. Install fuel hose to hose clamp.



## CONNECTING QUICK CONNECTOR ON THE FUEL HOSE (VEHICLE PIPING SIDE)

1. Make sure no foreign substances are deposited in and around the fuel tube and quick connector, and there is no damage to them.
2. Align center to insert quick connector straight into fuel tube.
  - Insert fuel tube until a click is heard.
  - Install quick connector cap on quick connector joint. Direct arrow mark on quick connector cap upper side.
  - Install fuel hose to hose clamp.



## INSPECTION AFTER INSTALLATION

Make sure there is no fuel leakage at connections as follows:

1. Apply fuel pressure to fuel lines using CONSULT III. Then check for fuel leaks at connections.
2. Start the Hybrid System and rev it up using CONSULT III and check for fuel leaks at connections.
  - Perform procedures for "Throttle Valve Closed Position Learning" after finishing repairs. Refer to [EC-15, "THROTTLE VALVE CLOSED POSITION LEARNING : Special Repair Requirement"](#).
  - If electric throttle control actuator is replaced, perform procedures for "Idle Air Volume Learning" after finishing repairs. Refer to [EC-16, "IDLE AIR VOLUME LEARNING : Special Repair Requirement"](#).

### **WARNING:**

**Do not touch engine immediately after stopping as engine is extremely hot.**

### **NOTE:**

Use mirrors for checking on connections out of the direct line of sight.

# EXHAUST MANIFOLD AND THREE WAY CATALYST

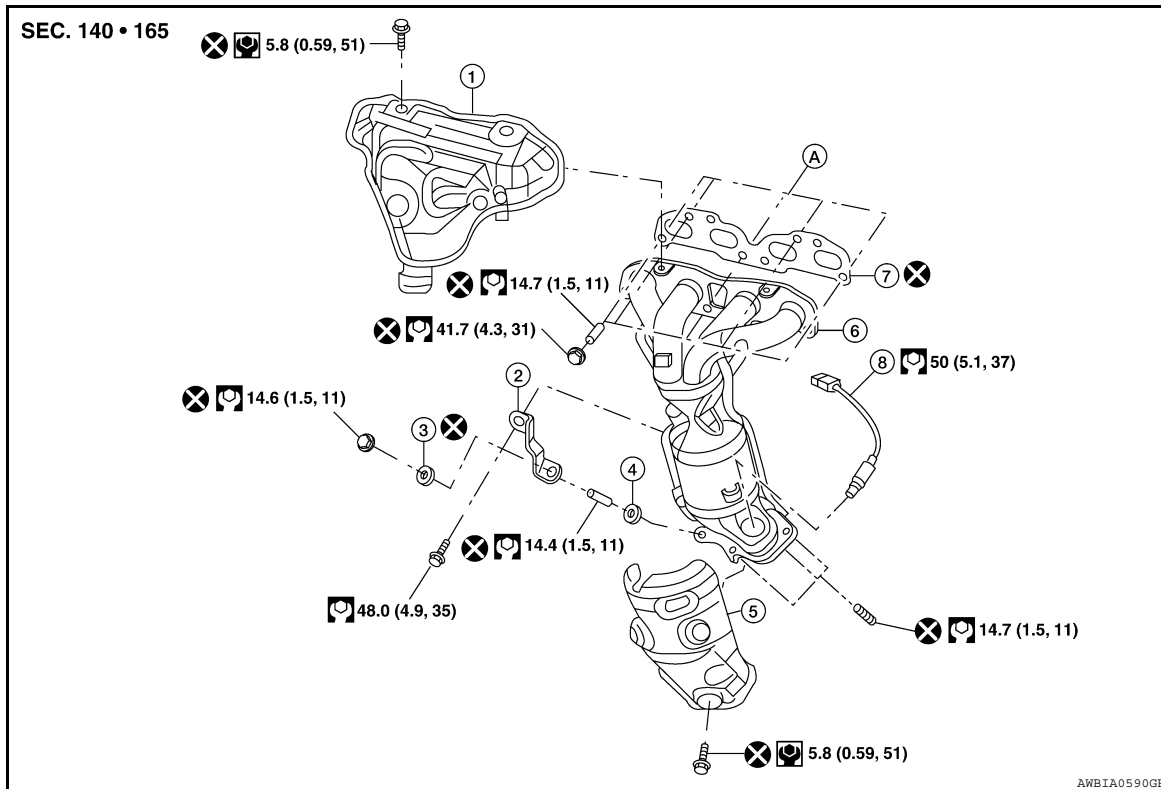
< ON-VEHICLE REPAIR >

[QR25DE]

## EXHAUST MANIFOLD AND THREE WAY CATALYST

### Removal and Installation

INFOID:000000005441574



- |                                   |                                   |   |
|-----------------------------------|-----------------------------------|---|
| 1. Exhaust manifold cover (upper) | 2. Exhaust manifold stay          | 3. Manifold yoke (type B)                           |
| 4. Manifold yoke (type A)         | 5. Exhaust manifold cover (lower) | 6. Exhaust manifold and three way catalyst assembly |
| 7. Exhaust manifold gasket        | 8. Air fuel ratio (A/F) sensor 1  | A. To cylinder head                                 |

### REMOVAL

1. Remove the engine under cover. Refer to [EXT-13. "Removal and Installation"](#).
2. Remove front RH wheel and tire. Refer to [WT-60. "Adjustment"](#).
3. Remove fender protector side cover (RH). Refer to [EXT-19. "Removal and Installation"](#).
4. Remove drive belt. Refer to [EM-14. "Removal and Installation of Drive Belt"](#).
5. Remove front air duct. Refer to [EM-24. "Removal and Installation"](#).
6. Disconnect the electrical connector of air fuel ratio (A/F) sensor 1, and unhook the harness from the bracket and middle clamp on the cover.
7. Remove the air fuel ratio (A/F) sensor 1 using Tools.

**Tool numbers** : — (J-44626)  
: KV10117100 (J-36471-A)

### CAUTION:

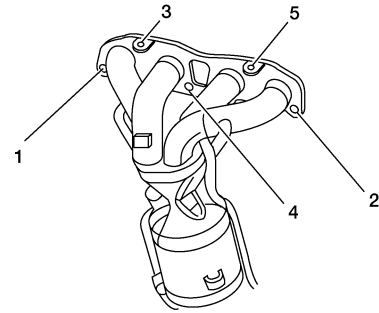
- Be careful not to damage air fuel ratio (A/F) sensor.
  - Discard any air fuel ratio (A/F) sensor which has been dropped from a height of more than 0.5 m (19.7 in) onto a hard surface such as a concrete floor; replace with a new one.
8. Remove the exhaust manifold cover (lower).
  9. Remove the exhaust front tube. Refer to [EX-6. "Removal and Installation"](#).
  10. Remove the exhaust manifold cover (upper).
  11. Remove the exhaust manifold stay.

# EXHAUST MANIFOLD AND THREE WAY CATALYST

[QR25DE]

## < ON-VEHICLE REPAIR >

12. Loosen the nuts in the reverse order as shown, on the exhaust manifold and three way catalyst assembly.
13. Remove the exhaust manifold and three way catalyst assembly and gasket. Discard the gasket.



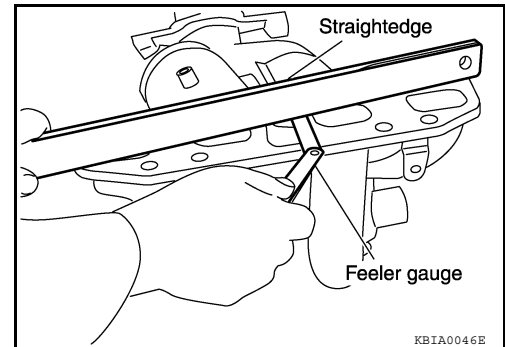
AWBIA0559ZZ

## INSPECTION AFTER REMOVAL

### Surface Distortion

- Use a reliable straightedge and feeler gauge to check the flatness of exhaust manifold fitting surface.

**Limit : 0.3 mm (0.012 in)**



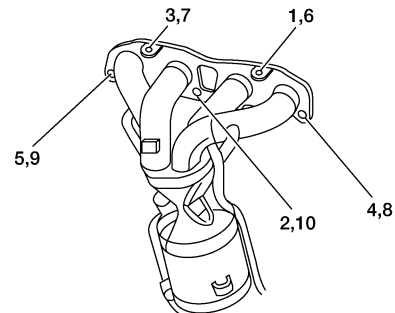
KBIA0046E

## INSTALLATION

Installation is in the reverse order of removal.

### Tightening Exhaust Manifold Nuts

- Tighten the nuts to specification in the numerical order as shown, on the exhaust manifold and three way catalyst assembly.



AWBIA0560ZZ

### Installation of Air Fuel Ratio (A/F) Sensor 1

Clean the air fuel ratio (A/F) sensor 1 threads with suitable tool, then apply the anti-seize lubricant to the threads before installing the air fuel ratio (A/F) sensor 1.

**Oxygen sensor thread cleaner : J-43897 - 18**

**Oxygen sensor thread cleaner : J-43897 - 12**

### CAUTION:

Do not over-tighten the air fuel ratio (A/F) sensor 1. Doing so may cause damage to the air fuel ratio (A/F) sensor 1, resulting in a malfunction and the MIL coming on.

# OIL PAN AND OIL STRAINER

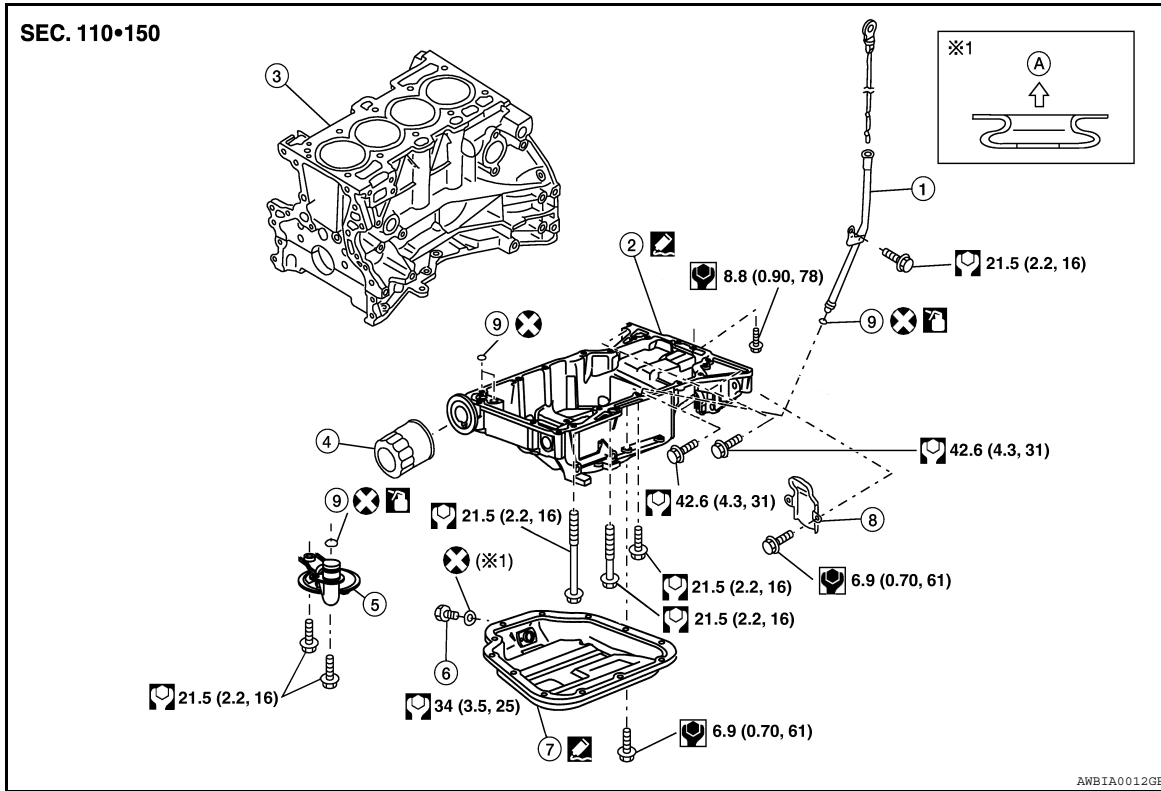
< ON-VEHICLE REPAIR >

[QR25DE]

## OIL PAN AND OIL STRAINER

### Exploded View

INFOID:000000005809639



- |                          |                     |                   |
|--------------------------|---------------------|-------------------|
| 1. Oil level gauge guide | 2. Oil pan, upper   | 3. Cylinder block |
| 4. Oil filter            | 5. Oil strainer     | 6. Drain plug     |
| 7. Oil pan, lower        | 8. Rear plate cover | 9. O-ring         |
| A. To oil pan, lower     |                     |                   |

### Removal and Installation (Lower Oil Pan)

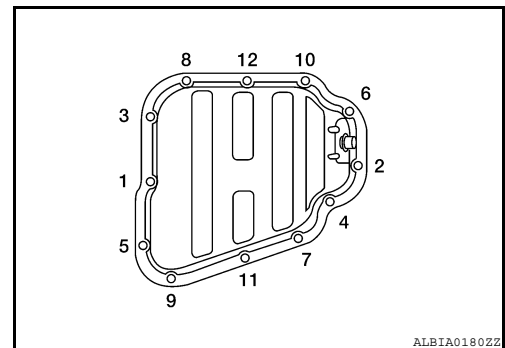
INFOID:000000005809640

#### REMOVAL

#### **WARNING:**

To avoid the danger of being scalded, never drain the engine oil when the engine is hot.

1. Drain engine oil. Refer to [LU-9, "Changing Engine Oil"](#).
2. Remove the lower oil pan bolts in the order as shown, using power tool.



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# OIL PAN AND OIL STRAINER

[QR25DE]

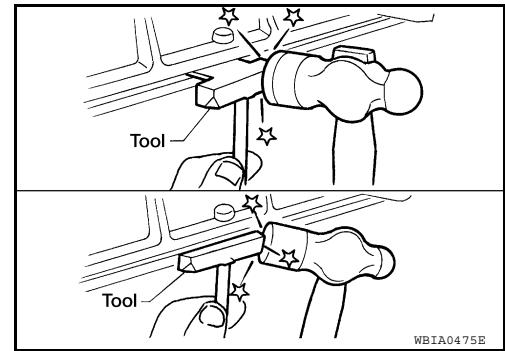
## < ON-VEHICLE REPAIR >

3. Remove the lower oil pan using Tool.

**NOTE:**

Tap gently to cut sealant around the pan; do not damage the mating surface using Tool.

**Tool number** : KV10111100 (J-37228)



## INSPECTION AFTER REMOVAL

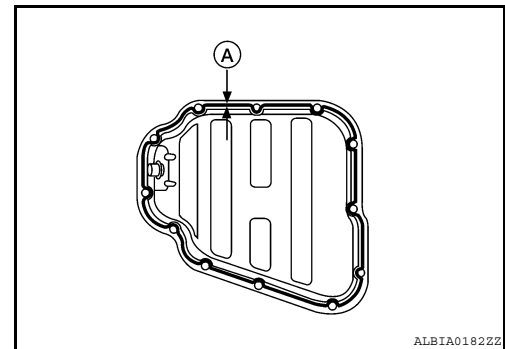
- Clean the oil strainer screen to remove all foreign material.

## INSTALLATION

Installation is in the reverse order of removal.

- Apply Genuine Silicone RTV Sealant, or equivalent to the lower oil pan as shown. Refer to [GI-15, "Recommended Chemical Products and Sealants"](#).

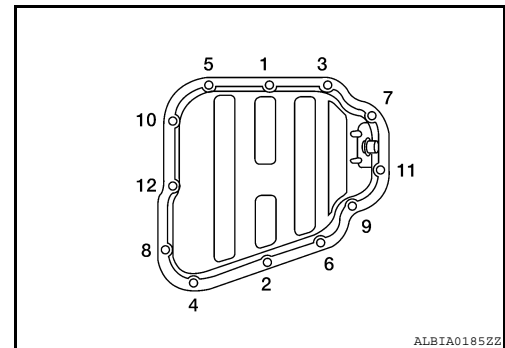
**Sealant bead diameter (A)** : 4.0 - 5.0 mm  
(0.157 - 0.197 in)



- Tighten the lower oil pan bolts in the numerical order as shown.

**CAUTION:**

**Wait at least 30 minutes after the oil pan is installed before filling the engine with oil.**



## INSPECTION AFTER INSTALLATION

- Check for any engine oil leaks with the engine and inverter at operating temperature and running at idle.

## Removal and Installation (Upper Oil Pan)

INFOID:000000005441575

### REMOVAL

**WARNING:**

**To avoid the danger of being scalded, never drain the engine oil when the engine is hot.**

1. Remove the engine from the vehicle. Refer to [EM-71, "Removal and Installation"](#).
2. Mount the engine on a suitable engine stand.
3. Drain engine oil. Refer to [LU-9, "Changing Engine Oil"](#).
4. Remove the oil level gauge and oil level gauge guide.
5. Remove the rear engine mount torque rod bracket.
6. Remove the driveshaft support bearing bracket.
7. Remove the lower oil pan. Refer to [EM-31, "Removal and Installation \(Lower Oil Pan\)"](#).
8. Remove the oil strainer.

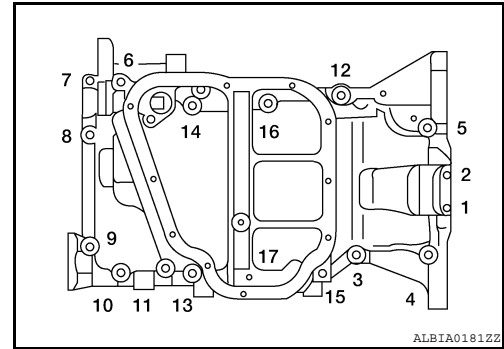


# OIL PAN AND OIL STRAINER

[QR25DE]

## < ON-VEHICLE REPAIR >

9. Loosen the upper oil pan bolts in the order shown to remove upper oil pan, using power tool.

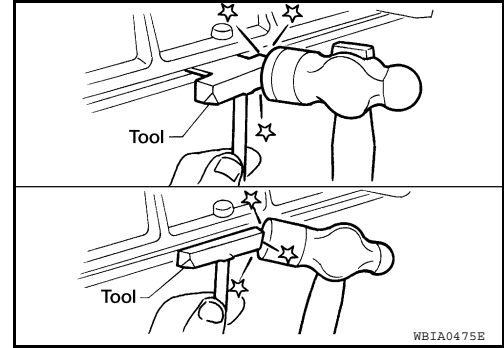


10. Remove upper oil pan using Tool.

**NOTE:**

Tap gently to cut sealant around the pan; do not damage the mating surface using Tool.

**Tool number** : KV10111100 (J-37228)



## INSPECTION AFTER REMOVAL

- Clean the oil strainer screen to remove all foreign material.

## INSTALLATION

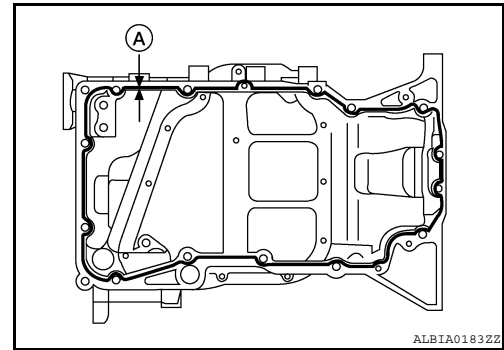
Installation is in the reverse order of removal.

- Apply Genuine Silicone RTV Sealant or equivalent to the upper oil pan at the specified sealant bead diameter (A) as shown. Refer to [GI-15. "Recommended Chemical Products and Sealants"](#).

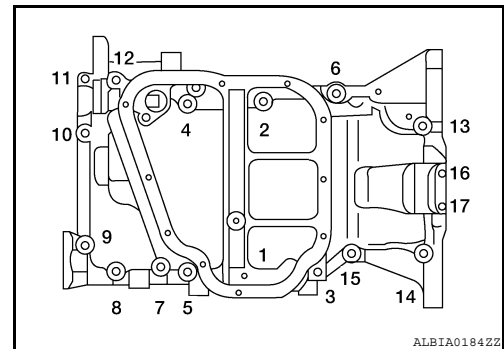
**Sealant bead diameter (A)** : 4.0 - 5.0 mm  
(0.157 - 0.197 in)

**CAUTION:**

Install two new O-rings in the upper oil pan.



- Tighten the upper oil pan bolts in the order as shown.



## INSPECTION AFTER INSTALLATION

- Check for any engine oil leaks with the engine and inverter at operating temperature and running at idle.

A  
EM  
C  
D  
E  
F  
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H  
I  
J  
K  
L  
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N  
O  
P

# IGNITION COIL

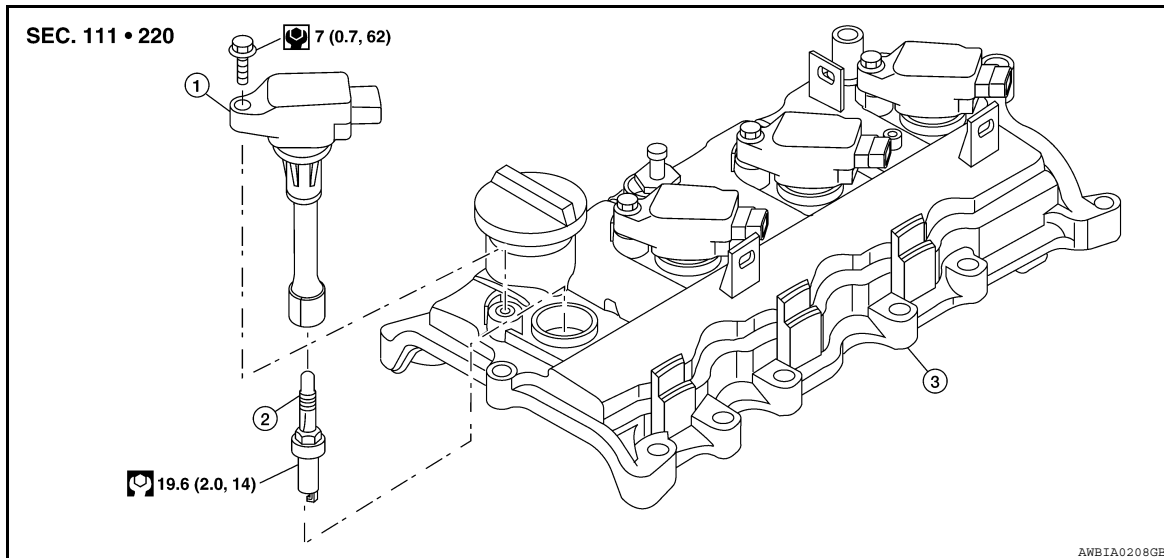
< ON-VEHICLE REPAIR >

[QR25DE]

## IGNITION COIL

### Removal and Installation

INFOID:000000005441576



1. Ignition coil

2. Spark plug

3. Rocker cover

### REMOVAL

1. Remove the engine room cover.
2. Disconnect the harness connector from the ignition coil.
3. Remove the ignition coil.

#### **CAUTION:**

**Do not drop or shock it.**

### INSTALLATION

Installation is in the reverse order of removal.

# FUEL INJECTOR AND FUEL TUBE

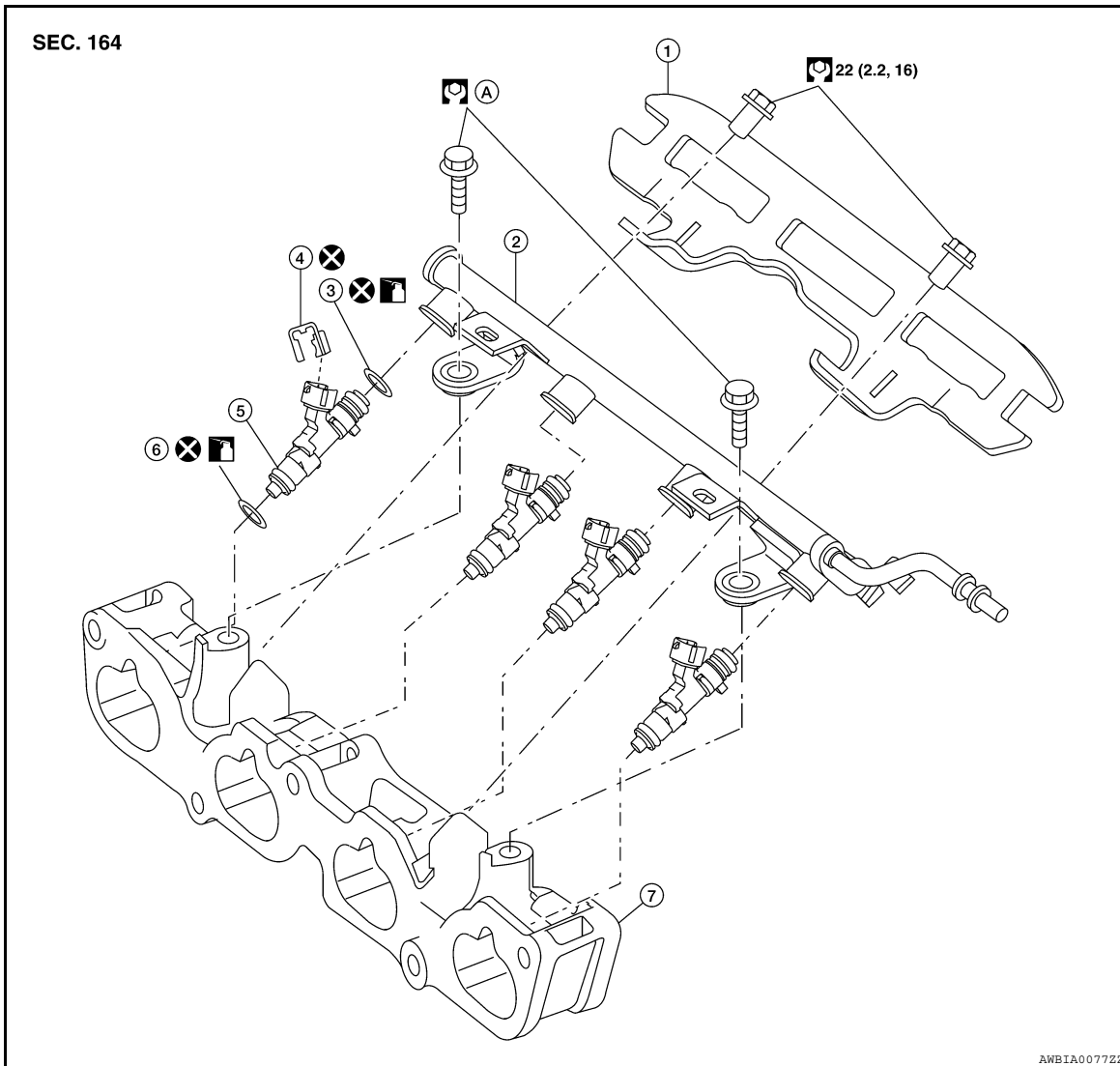
< ON-VEHICLE REPAIR >

[QR25DE]

## FUEL INJECTOR AND FUEL TUBE

### Removal and Installation

INFOID:000000005441577



- |                            |                                  |                         |
|----------------------------|----------------------------------|-------------------------|
| 1. Fuel tube protector     | 2. Fuel tube                     | 3. Upper O-ring (black) |
| 4. Clip                    | 5. Fuel injector                 | 6. Lower O-ring (green) |
| 7. Intake manifold adapter | A. Follow the installation steps |                         |

#### CAUTION:

- Apply new engine oil to parts before installation, as shown above.
- Do not remove or disassemble parts unless instructed as shown.

#### REMOVAL

1. Remove the engine room cover.
2. Remove the intake manifold. Refer to [EM-25, "Removal and Installation"](#).
3. Remove the air cleaner assembly. Refer to [EM-24, "Removal and Installation"](#).
4. Disconnect sub-harness for injector at engine front side, and remove it from bracket.

# FUEL INJECTOR AND FUEL TUBE

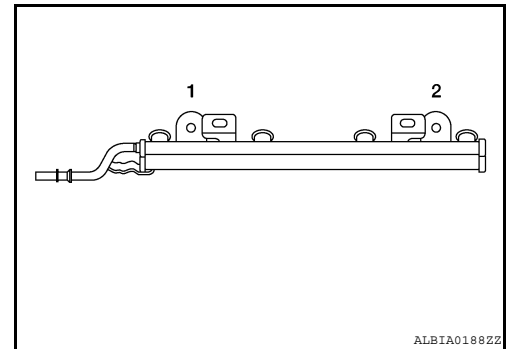
[QR25DE]

## < ON-VEHICLE REPAIR >

5. Remove the fuel tube assembly bolts in the reverse order as shown, then remove the fuel tube and fuel injectors as an assembly.
6. Remove the fuel injectors from the fuel tube.
  - Release the clip and remove the fuel injector.
  - Pull fuel injector straight out of the fuel tube.

**CAUTION:**

  - Be careful not to damage the nozzle.
  - Avoid any impact, such as dropping the fuel injector.
  - Do not disassemble or adjust the fuel injector.



## INSTALLATION

1. Install new O-rings on the fuel injector, the fuel side black O-ring and the nozzle side green O-ring.

**CAUTION:**

- Upper and lower O-rings are different. Be careful not to confuse them.

- Fuel tube side: black O-ring

- Nozzle side: green O-ring

- Lubricate the O-rings lightly with new engine oil.

- Handle O-rings with bare hands only. Do not wear gloves.

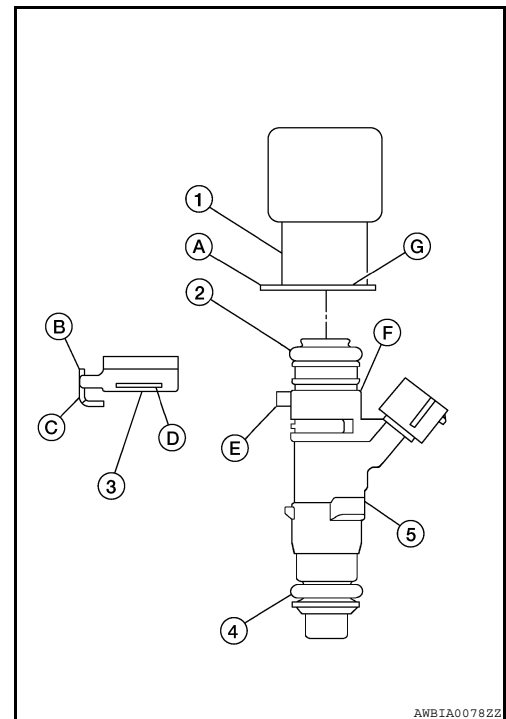
- Do not clean O-rings with solvent.

- Make sure that O-ring and its mating part is free of foreign material.

- Be careful not to scratch O-rings during installation.

- Do not twist or stretch the O-ring. If the O-ring was stretched while it is attached, do not insert it into the fuel tube immediately.

2. Install the fuel injector (5) into the fuel tube (1) with the following procedure:
  - Do not reuse the clip (3), replace it with a new one.
  - Insert the new clip (3) into the clip mounting groove (F) on fuel injector (5).
  - Insert the clip (3) so that projection (E) of fuel injector (5) matches notch (C) of the clip (3).
  - Fuel tube side: black O-ring (2)
  - Nozzle side: green O-ring (4)
3. Insert fuel injector (5) into fuel tube (1) with clip (3) attached.
  - Insert it while matching it to the axial center.
  - Insert fuel injector (5) so that projection (A) of fuel tube (1) matches notch (B) of the clip (3).
  - Make sure that fuel tube flange (G) is securely fixed in flange fixing groove (D) on the clip (3).
  - Make sure that installation is complete by checking that fuel injector (5) does not rotate or come off.



4. Install the fuel tube assembly.
  - a. Insert the tip of each fuel injector into the intake manifold adapter.

# FUEL INJECTOR AND FUEL TUBE

[QR25DE]

< ON-VEHICLE REPAIR >

- b. Tighten the fuel tube assembly bolts in two steps in the numerical order as shown.

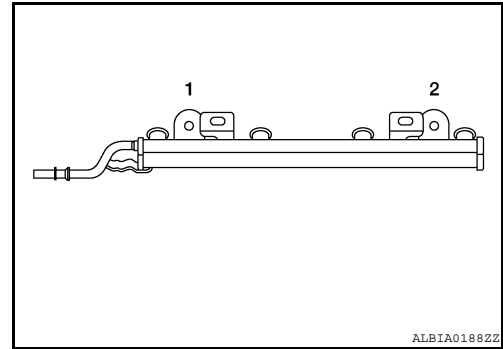
### Fuel tube assembly bolts

Step 1 : 10 N·m (1.0 kg-m, 7 ft-lb)

Step 2 : 22 N·m (2.2 kg-m, 16 ft-lb)

### CAUTION:

- After properly connecting fuel tube assembly to injector and fuel hose, check connection for fuel leakage.



5. Install the intake manifold. Refer to [EM-25, "Removal and Installation"](#).
6. Connect the fuel hose quick connector.
7. Installation of the remaining components is in the reverse order of removal.

### INSPECTION AFTER INSTALLATION

Make sure there is no fuel leakage at connections as follows:

1. Apply fuel pressure to fuel lines using CONSULT III. Then check for fuel leaks at connections.
2. Start the Hybrid System and rev it up using CONSULT III and check for fuel leaks at connections.
  - Perform procedures for "Throttle Valve Closed Position Learning" after finishing repairs. Refer to [EC-15, "THROTTLE VALVE CLOSED POSITION LEARNING : Special Repair Requirement"](#).
  - If electric throttle control actuator is replaced, perform procedures for "Idle Air Volume Learning" after finishing repairs. Refer to [EC-16, "IDLE AIR VOLUME LEARNING : Special Repair Requirement"](#).

### WARNING:

**Do not touch engine immediately after stopping as engine is extremely hot.**

### NOTE:

Use mirrors for checking on connections out of the direct line of sight.

# ROCKER COVER

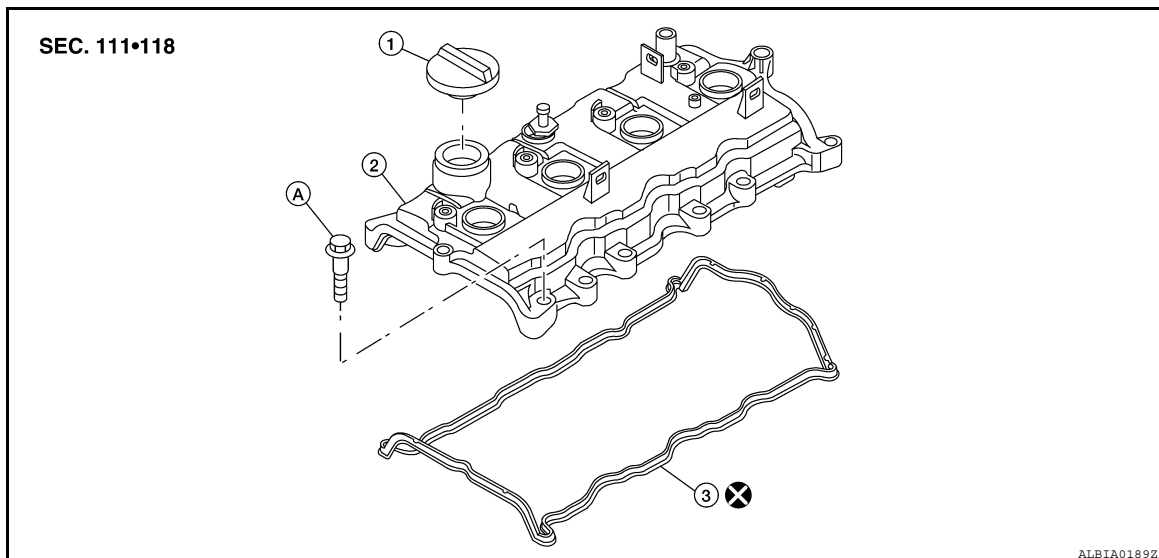
< ON-VEHICLE REPAIR >

[QR25DE]

## ROCKER COVER

### Removal and Installation

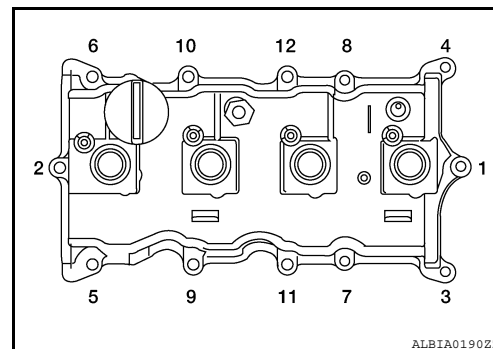
INFOID:000000005441578



1. Oil filler cap
  2. Rocker cover
  3. Rocker cover gasket
- A. Follow installation for tightening steps

### REMOVAL

1. Disconnect the 12-volt battery negative terminal. Refer to [PG-71, "Removal and Installation"](#).
2. Remove the engine room cover.
3. Remove the front air duct. Refer to [EM-24, "Removal and Installation"](#).
4. Remove the blow-by hose.
5. Remove the two brake ECU nuts and set the brake ECU aside. Refer to [BRC-193, "Removal and Installation"](#).
6. Remove the RH engine mount torque rod. Refer to [EM-71, "Removal and Installation"](#).
7. Use a suitable tool to support the engine assembly.
8. Remove the RH engine support bracket. Refer to [EM-71, "Removal and Installation"](#).
9. Remove the RH engine mounting bracket. Refer to [EM-71, "Removal and Installation"](#).
10. Disconnect the PCV hose.
11. Remove the ignition coils. Refer to [EM-34, "Removal and Installation"](#).
12. Disconnect the fuel injectors and position the fuel injector harness aside.
13. Loosen the bolts in the numerical order as shown using power tool.
14. Remove the rocker cover and the rocker cover gasket. Discard the rocker cover gasket.  
**CAUTION:**  
**Do not reuse the rocker cover gasket.**
15. Remove the oil filler cap if necessary, to transfer to the new rocker cover.



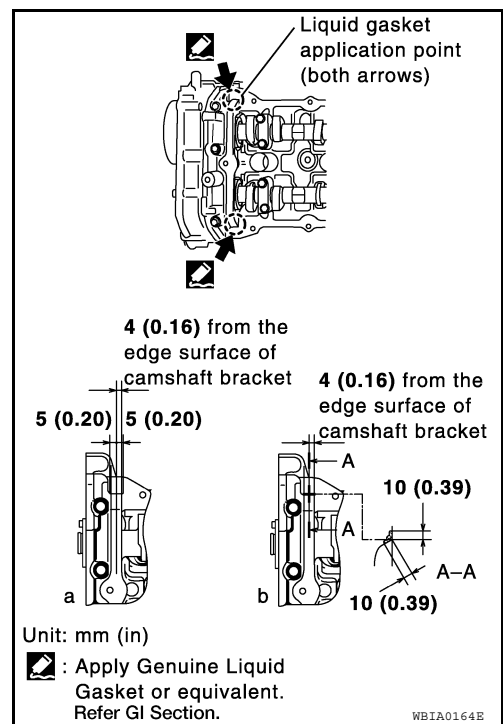
### INSTALLATION

# ROCKER COVER

[QR25DE]

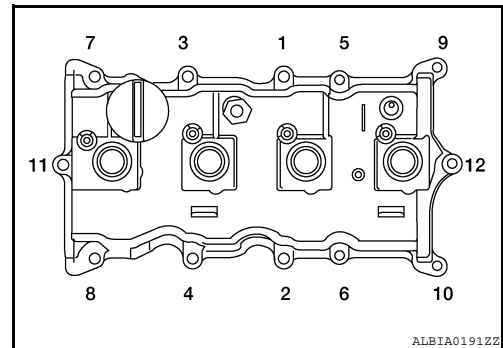
## < ON-VEHICLE REPAIR >

1. Apply RTV Silicone Sealant to the joint part of the cylinder head and camshaft bracket using the following the steps:
  - Use Genuine Silicone RTV Sealant, or equivalent. Refer to [GI-15. "Recommended Chemical Products and Sealants"](#).
- a. Follow illustration (a) to apply sealant to joint part of No.1 camshaft bracket and cylinder head.
- b. Follow illustration (b) to apply sealant in a 90° degree angle to the illustration (a).



2. Install the rocker cover and the new rocker cover gasket.
  - The rocker cover gasket must be securely installed in the groove in the rocker cover.
3. Tighten the rocker cover bolts in two steps, in the numerical order as shown.

- Step 1 : 1.96 N·m (0.20 kg-m, 17 in-lb)**
- Step 2 : 8.33 N·m (0.85 kg-m, 74 in-lb)**



4. Installation of the remaining components is in the reverse order of removal.

# CAMSHAFT

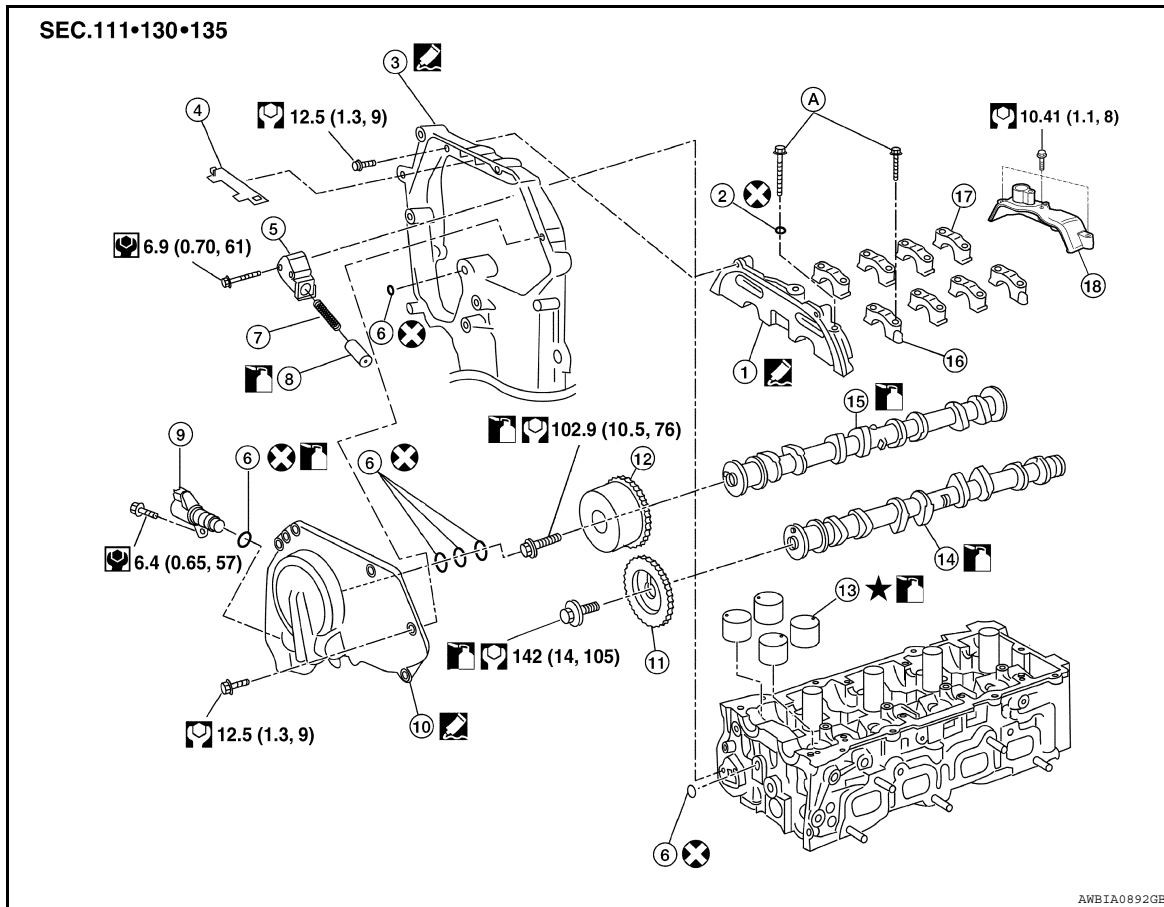
< ON-VEHICLE REPAIR >

[QR25DE]

## CAMSHAFT

### Removal and Installation

INFOID:000000005441579



- |                             |                             |                               |
|-----------------------------|-----------------------------|-------------------------------|
| 1. Camshaft bracket (No.1)  | 2. Washer                   | 3. Front cover (partial view) |
| 4. Chain guide              | 5. Chain tensioner          | 6. O-ring(s)                  |
| 7. Chain tensioner spring   | 8. Chain tensioner plunger  | 9. IVT control solenoid valve |
| 10. IVT control cover       | 11. Camshaft sprocket (EXH) | 12. Camshaft sprocket (INT)   |
| 13. Valve lifter            | 14. Camshaft (EXH)          | 15. Camshaft (INT)            |
| 16. Camshaft brackets (EXH) | 17. Camshaft brackets (INT) | 18. Camshaft sensor bracket   |
- A. Follow installation for tightening steps

### REMOVAL

1. Remove the rocker cover. Refer to [EM-38, "Removal and Installation"](#).
2. Disconnect variable timing control solenoid and camshaft sensor harness connectors.
3. Remove camshaft sensor.
4. Remove camshaft sensor bracket.

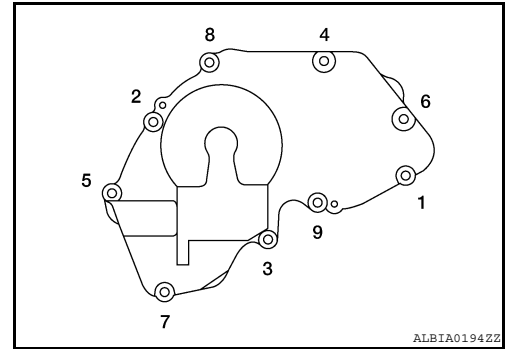


# CAMSHAFT

[QR25DE]

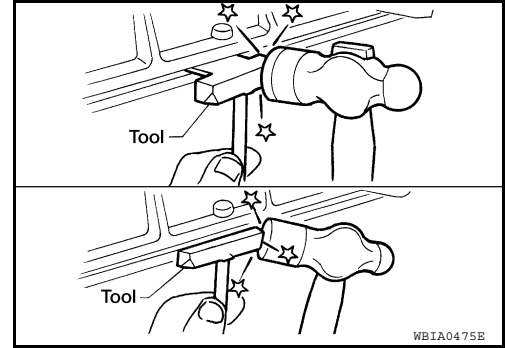
< ON-VEHICLE REPAIR >

5. Loosen the IVT control cover bolts in the order as shown.



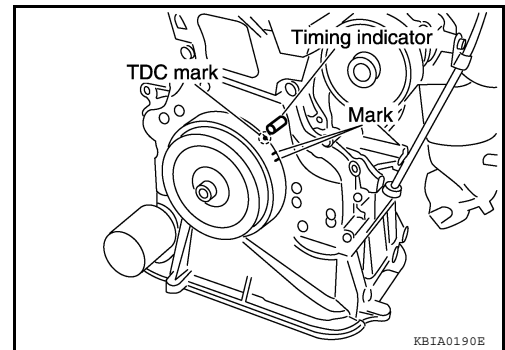
- Remove the IVT control cover by cutting the sealant using Tool.

**Tool number : KV10111100 (J-37228)**



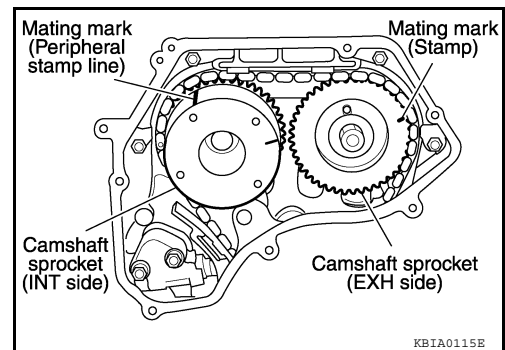
6. Set the No.1 cylinder at TDC on its compression stroke with the following procedure:

- Open the fender protector side cover (RH). Refer to [EXT-19, "Removal and Installation"](#).
- Rotate crankshaft pulley clockwise, and align mating marks for TDC with timing indicator on front cover, as shown.



c. At the same time, make sure that the mating marks on camshaft sprockets are lined up with the yellow links in the timing chain, as shown.

- If not, rotate crankshaft pulley one more turn to line up the mating marks to the yellow links, as shown.



# CAMSHAFT

[QR25DE]

## < ON-VEHICLE REPAIR >

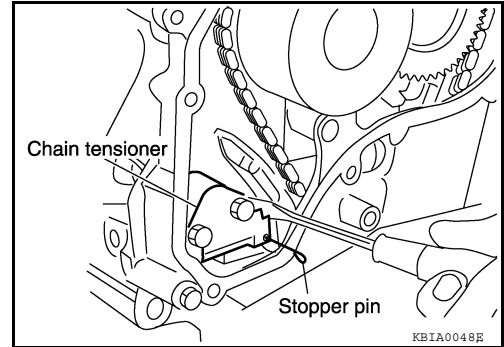
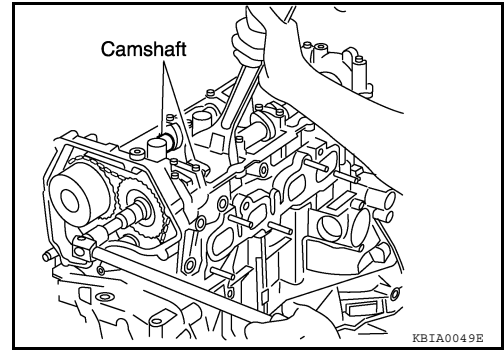
7. Remove camshaft sprockets with the following procedure.

**CAUTION:**

- Do not rotate the crankshaft or camshaft while the timing chain is removed. It causes interference between valve and piston.

**NOTE:**

- Chain tension holding work is not necessary. Crankshaft sprocket and timing chain do not disconnect structurally while front cover is attached.
- Line up the mating marks on camshaft sprockets with the yellow links in the timing chain, and paint an indelible mating mark on the sprocket and timing chain link plate.
  - Push in the tensioner plunger and hold. Insert a stopper pin into the hole on tensioner body to hold the chain tensioner. Remove the timing chain tensioner.
    - Use a wire with 0.5 mm (0.02 in) diameter for a stopper pin.
  - Secure the hexagonal part of camshaft with a suitable tool. Loosen the camshaft sprocket mounting bolts and remove the camshaft sprockets.



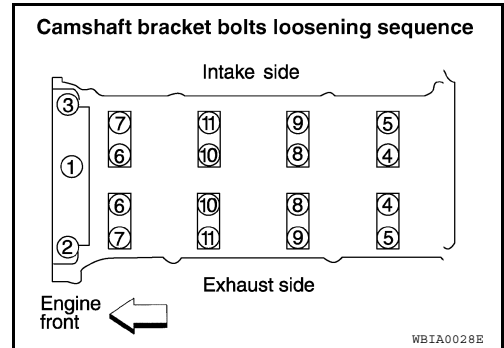
8. Pull the timing chain guide out between the camshaft sprockets through front cover.

9. Loosen the camshaft bracket bolts in the order as shown, and remove the camshaft brackets and camshafts.

- Remove No.1 camshaft bracket by slightly tapping it with a rubber mallet.

10. Remove the valve lifters, if necessary.

- Check mounting positions, and set them aside in the order removed.

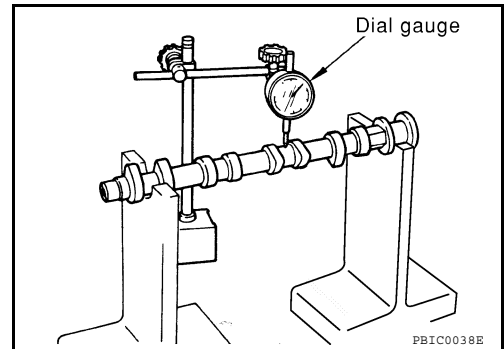


## INSPECTION AFTER REMOVAL

### Camshaft Runout

- Put the camshaft on a V-block supporting the No.2 and No.5 journals.
- Set the dial gauge vertically on the No.3 journal.
- Turn camshaft in one direction by hand, and measure the camshaft runout on the dial gauge total indicator reading.

**Standard : Less than 0.04 mm (0.0016 in)**



### Camshaft Cam Height

# CAMSHAFT

< ON-VEHICLE REPAIR >

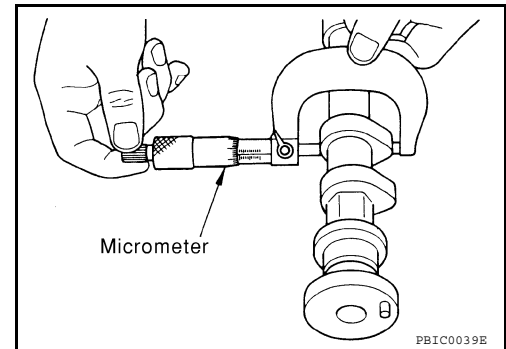
[QR25DE]

1. Measure the camshaft cam height.

**Standard intake cam height** : 44.815 - 45.005 mm  
(1.7644 - 1.7718 in)

**Standard exhaust cam height** : 43.975 - 44.165 mm  
(1.7313 - 1.7388 in)

2. If wear is beyond the limit, replace the camshaft.



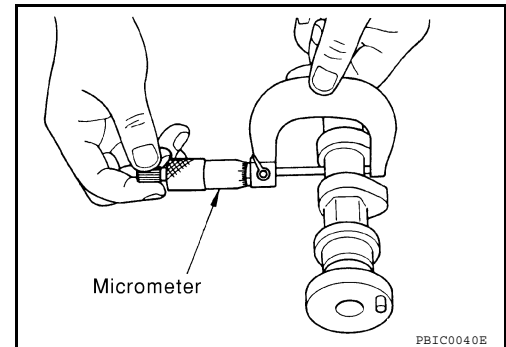
Camshaft Journal Clearance

## Outer Diameter of Camshaft Journal

- Measure the outer diameter of the camshaft journal.

**Standard No.1 outer diameter** : 27.935 - 27.955 mm  
(1.0998 - 1.1006 in)

**Standard No.2, 3, 4, 5, outer diameter** : 23.435 - 23.455 mm  
(0.9226 - 0.9234 in)



## Inner Diameter of Camshaft Bracket

- Tighten the camshaft bracket bolts to the specified torque following the tightening pattern as shown.

**Step 1 (bolts 9 - 11)** : 1.96 N·m (0.2 kg·m, 17 in·lb)

**Step 2 (bolts 1 - 8)** : 1.96 N·m (0.2 kg·m, 17 in·lb)

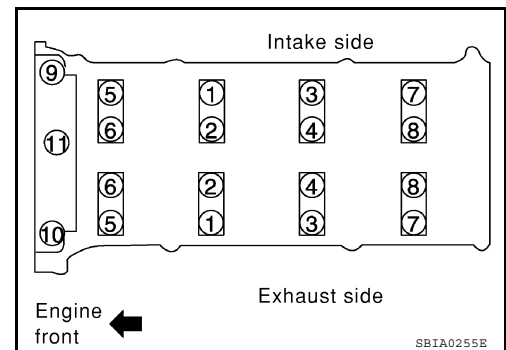
**Step 3 (bolts 1 - 11)** : 5.88 N·m (0.6 kg·m, 52 in·lb)

**Step 4 (bolts 1 - 11)** : 10.4 N·m (1.02 kg·m, 92 in·lb)

### CAUTION:

After tightening camshaft bracket bolts, be sure to wipe off excessive sealant from the parts listed below.

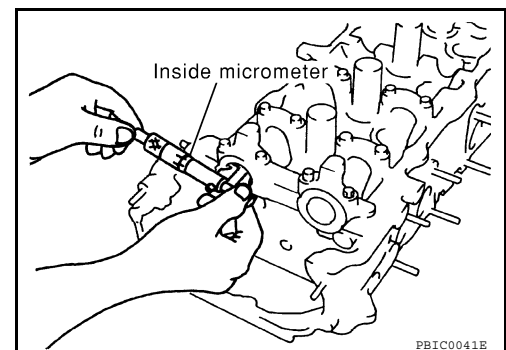
- Mating surface of rocker cover.
- Mating surface of front cover, when installed without the front cover.



- Using inside micrometer, measure inner diameter of camshaft bracket.

**Standard No.1** : 28.000 - 28.021 mm (1.1024 - 1.1032 in)

**Standard No.2, 3, 4, 5** : 23.500 - 23.521 mm (0.9252 - 0.9260 in)



## Calculation of Camshaft Journal Clearance

- (Journal clearance) = (inner diameter of camshaft bracket) – (outer diameter of camshaft journal)

**Standard** : 0.045 - 0.086 mm (0.0018 - 0.0034 in)

- When out of the specified range above, replace either or both the camshaft and the cylinder head assembly.

# CAMSHAFT

[QR25DE]

< ON-VEHICLE REPAIR >

## NOTE:

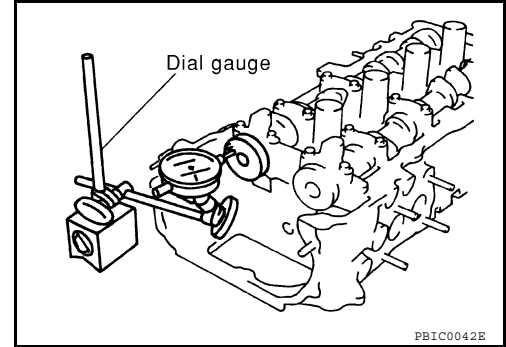
Inner diameter of the camshaft bracket is manufactured together with the cylinder head. If the camshaft bracket is out of specification, replace the whole cylinder head assembly.

### Camshaft End Play

1. Install a dial gauge in the thrust direction on the front end of the camshaft. Measure the end play with the dial gauge while moving the camshaft forward and backward (in direction to axis).

**Standard end play** : 0.115 - 0.188 mm (0.0045 - 0.0074 in)

2. If out of the specified range, replace with new camshaft and measure again.
3. If out of the specified range again, replace with new cylinder head assembly.

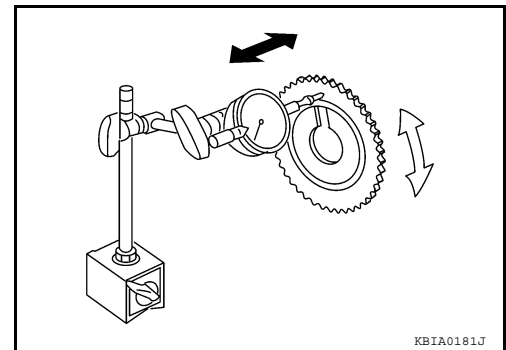


### Camshaft Sprocket Runout

1. Install the camshaft in the cylinder head.
2. Install the camshaft sprocket on the camshaft.
3. Measure camshaft sprocket runout while turning the camshaft by hand.

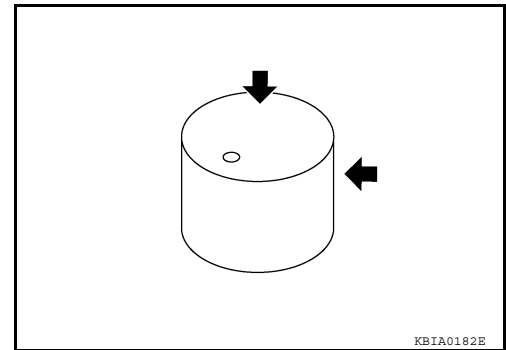
**Runout** : Less than 0.15 mm (0.0059 in)

4. If it exceeds the specification, replace camshaft sprocket.



### Valve Lifter

- Check if the surface of the valve lifter has any excessive wear or cracks, replace as necessary.



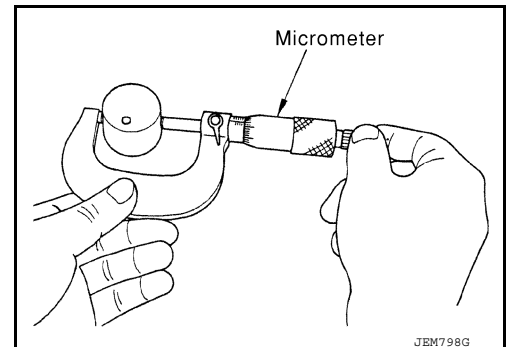
### Valve Lifter Clearance

#### Outer Diameter of Valve Lifter

- Measure the outer diameter of the valve lifter.

**Valve lifter outer diameter** : 33.977 - 33.987 mm (1.3377 - 1.3381 in)

- If out of the specified range, replace the valve lifter.



# CAMSHAFT

< ON-VEHICLE REPAIR >

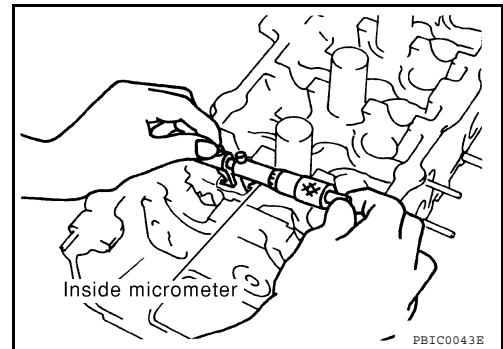
[QR25DE]

## Valve Lifter Bore Inner Diameter

- Using inside micrometer, measure diameter of valve lifter bore of cylinder head.

**Standard : 34.000 - 34.021 mm (1.3386 - 1.3394 in)**

- If out of the specified range, replace the cylinder head assembly.



## Calculation of Valve Lifter Clearance

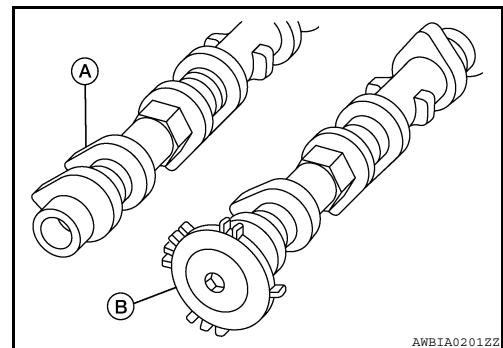
- (Valve lifter clearance) = (hole diameter for valve lifter) – (outer diameter of valve lifter)

**Standard : 0.013 - 0.044 mm (0.0005 - 0.0017 in)**

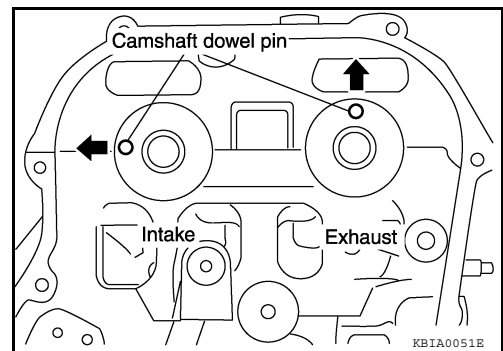
- If out of specified range, replace either or both valve lifter and cylinder head assembly.

## INSTALLATION

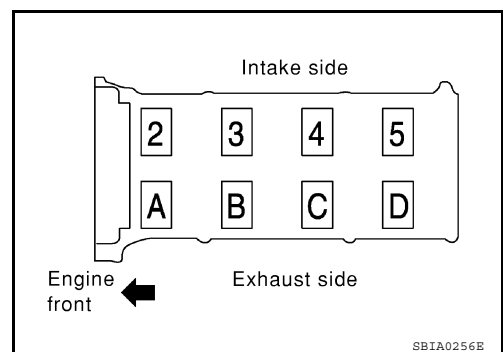
- Install the valve lifter.
  - Install them in the same position from which they were removed.
- Install the camshafts.
  - The distinction between the intake and exhaust camshafts is in a difference of shapes of the back end:
  - A: Exhaust
  - B: Intake Signal plate for the camshaft position sensor (PHASE)



- Install camshafts so that the dowel pins on the front side are positioned as shown.



- Install camshaft brackets.
  - Install by referring to identification mark on upper surface mark.
  - Install so that identification mark can be correctly read when viewed from the exhaust side.



# CAMSHAFT

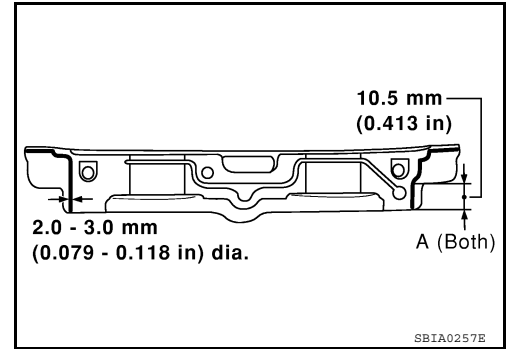
[QR25DE]

## < ON-VEHICLE REPAIR >

- Install No. 1 camshaft bracket as follows.
- Apply sealant to No.1 camshaft bracket as shown.
- Use Genuine Silicone RTV Sealant, or equivalent. Refer to [GI-15, "Recommended Chemical Products and Sealants"](#).

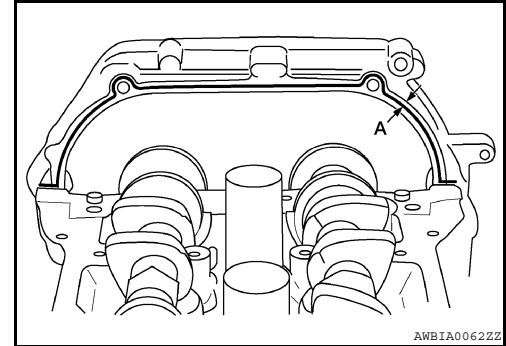
**CAUTION:**

- After installation, be sure to wipe off any excessive sealant leaking from part (A) (both on right and left sides).

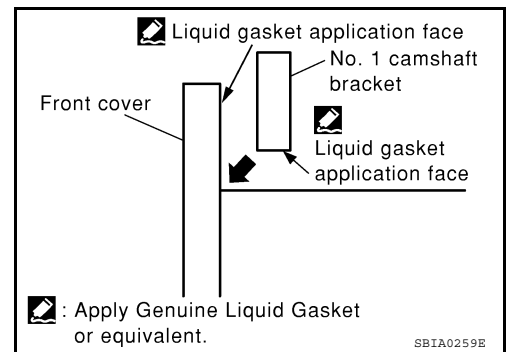


- Apply sealant to camshaft bracket contact surface on the front cover backside.
- Apply sealant to the outside of bolt hole on front cover.

**Dimension (A) : 3.9 mm (0.154 in)**



- Position the No.1 camshaft bracket near the mounting position, and install it without disturbing the sealant applied to the surfaces.



4. Tighten camshaft bracket bolts in four steps in the order as shown.

**Step 1 (bolts 9 - 11) : 1.96 N·m (0.2 kg·m, 17 in-lb)**

**Step 2 (bolts 1 - 8) : 1.96 N·m (0.2 kg·m, 17 in-lb)**

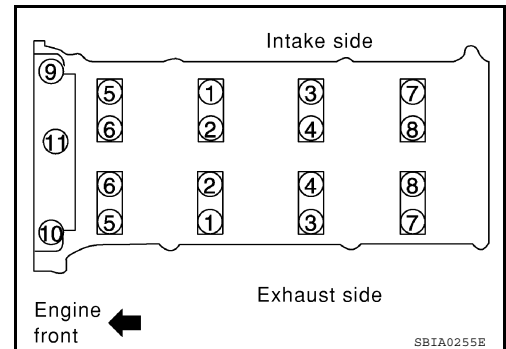
**Step 3 (bolts 1 - 11) : 5.88 N·m (0.6 kg·m, 52 in-lb)**

**Step 4 (bolts 1 - 11) : 10.4 N·m (1.02 kg·m, 92 in-lb)**

**CAUTION:**

After tightening camshaft bracket bolts, be sure to wipe off excessive sealant from the parts listed below.

- Mating surface of rocker cover.
- Mating surface of front cover, when installed without the front cover.



# CAMSHAFT

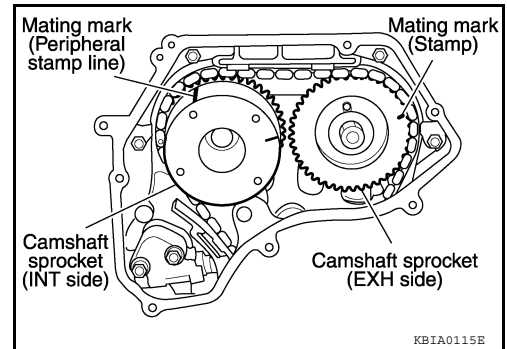
[QR25DE]

## < ON-VEHICLE REPAIR >

5. Install camshaft sprockets.
  - Install them by lining up the mating marks on each camshaft sprocket with the ones painted on the timing chain during removal.
  - Before installation of chain tensioner, it is possible to re-match the marks on timing chain with the ones on each sprocket.

**CAUTION:**

- **Aligned mating marks could slip. Therefore, after matching them, hold the timing chain in place by hand.**
- **Before and after installing chain tensioner, check again to make sure that mating marks have not slipped.**



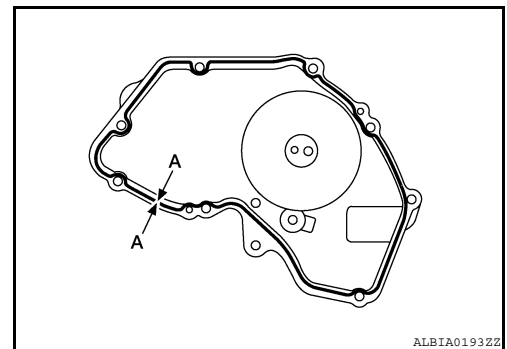
6. Install chain tensioner.

**CAUTION:**

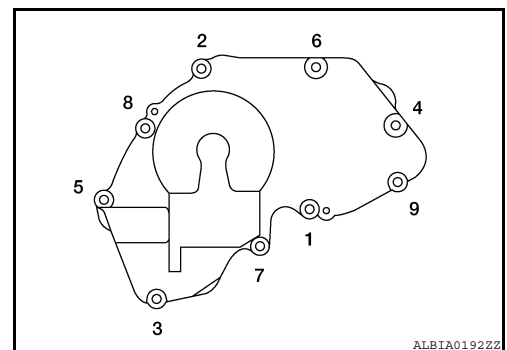
- **After installation, pull the stopper pin off completely, and make sure that the tensioner is fully released.**

7. Install chain guide.
8. Install IVT control cover with the following procedure.
  - a. Install IVT control solenoid valve to intake valve timing control cover.
  - b. Install O-ring to front cover side.
  - c. Apply Genuine Silicone RTV Sealant to the positions as shown. Refer to [GI-15. "Recommended Chemical Products and Sealants"](#).

**Diameter (A) : 3.0 - 4.0 mm (0.118 - 0.157 in)**



- d. Install IVT control cover.
  - Tighten the bolts in the numerical order as shown.
9. Check and adjust valve clearances. Refer to [EM-48. "Valve Clearance"](#).
10. Installation of the remaining components is in the reverse order of removal.



## Inspection After Installation

INFOID:000000005441580

### Inspection of Camshaft Sprocket (INT) Oil Groove

**WARNING:**

- **Check when engine is cold so as to prevent burns from any splashing engine oil.**

**CAUTION:**

- **Perform this inspection only when DTC P0011 is detected in self-diagnostic results of CONSULT III and it is directed according to inspection procedure of EC section. Refer to [EC-127. "Diagnosis Procedure"](#).**

1. Check engine oil level. Refer to [LU-9. "Changing Engine Oil"](#).
2. Perform the following procedure so as to prevent the engine from being unintentionally started while checking.
  - a. Release fuel pressure. Refer to [EC-465. "Inspection"](#).
  - b. Disconnect ignition coil and injector harness connectors if practical.
3. Support engine using a suitable hoist or jack.
4. Remove the RH engine mounting bracket, mounting insulator and support bracket. Refer to [EM-71. "Removal and Installation"](#).
5. Remove IVT control solenoid valve. Refer to [EM-51. "Removal and Installation"](#).

# CAMSHAFT

[QR25DE]

## < ON-VEHICLE REPAIR >

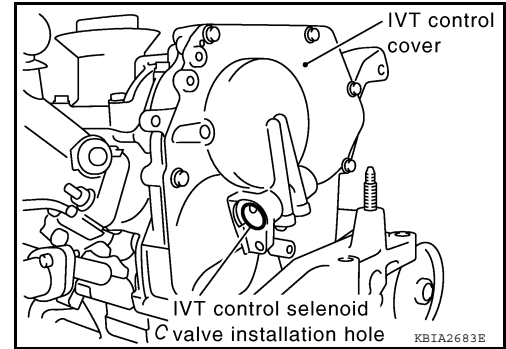
6. Crank engine, and then make sure that engine oil comes out from IVT control cover oil hole. End cranking after checking.

**WARNING:**

Be careful not to touch rotating parts (drive belts, idler pulley, and crankshaft pulley, etc.).

**CAUTION:**

- Engine oil may squirt from IVT control solenoid valve installation hole during cranking. Use a shop cloth to prevent engine oil from splashing on worker, engine components and vehicle.
  - Do not allow engine oil to get on rubber components such as drive belts or engine mount insulators. Immediately wipe off any splashed engine oil.
7. Clean oil groove between oil strainer and IVT control solenoid valve if engine oil does not come out from IVT control cover oil hole. Refer to [LU-6, "Lubrication Circuit"](#).
  8. Remove components between IVT control solenoid valve and camshaft sprocket (INT), and then check each oil groove for clogging.
    - Clean oil groove if necessary. Refer to [LU-6, "Lubrication Circuit"](#).
  9. After inspection, installation of the remaining components is in the reverse order of removal.

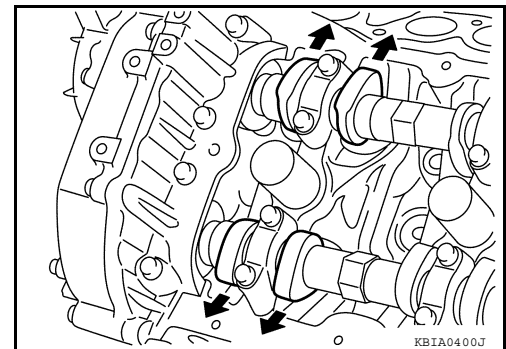
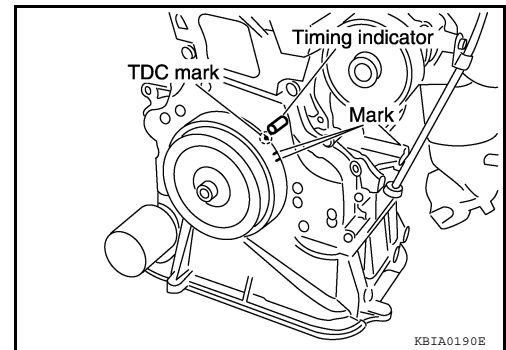


## Valve Clearance

INFOID:000000005441581

### Inspection

- Perform this inspection as follows after removal, installation, or replacement of the camshaft or any valve-related parts, or if there are any unusual engine conditions due to changes in valve clearance over time (starting, idling, and/or noise).
1. Warm up the engine, then stop it.
  2. Remove fender protector side cover (RH). Refer to [EXT-19, "Removal and Installation"](#).
  3. Remove the rocker cover using power tool. Refer to [EM-38, "Removal and Installation"](#).
  4. Turn crankshaft pulley in normal direction (clockwise when viewed from front) to align TDC identification mark (without paint mark) with timing indicator.
- 
- A technical line drawing of the timing belt area. Labels include 'Timing indicator', 'TDC mark', and 'Mark'. The drawing is identified by the code KBIA0190E.
5. At this time, check that the both intake and exhaust cam lobes of No. 1 cylinder face outside.
    - If they do not face outside, turn crankshaft pulley once more.





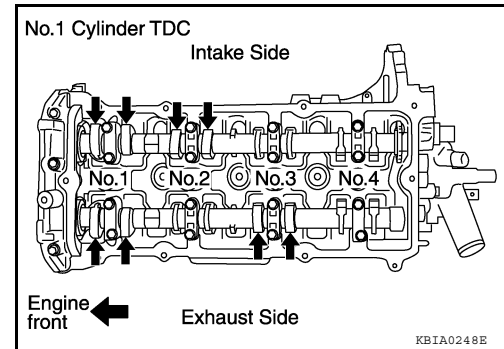
# CAMSHAFT

[QR25DE]

## < ON-VEHICLE REPAIR >

6. Measure valve clearances with a feeler gauge at locations marked X as shown in the table below.
- No.1 cylinder compression TDC.

Cylinder	No.1		No.2		No.3		No.4	
	INT	EXH	INT	EXH	INT	EXH	INT	EXH
Measurable	X	X	X			X		



- Use a feeler gauge to measure the clearance between valve and camshaft.

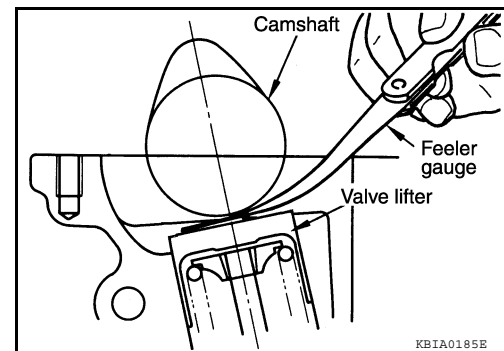
### Valve clearance standard:

<b>Cold</b>	<b>Intake</b>	: 0.24 - 0.32 mm (0.009 - 0.013 in)
	<b>Exhaust</b>	: 0.26 - 0.34 mm (0.010 - 0.013 in)
<b>Hot*</b>	<b>Intake</b>	: 0.304 - 0.416 mm (0.012 - 0.016 in)
	<b>Exhaust</b>	: 0.308 - 0.432 mm (0.012 - 0.017 in)

\*Reference data at approximately 80°C (176°F)

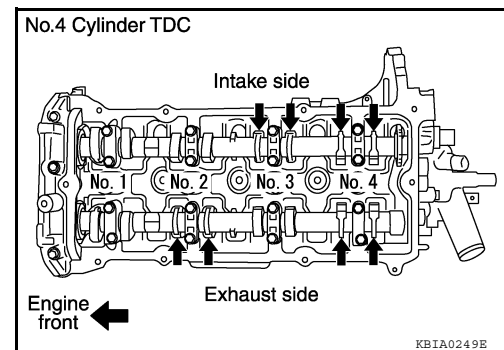
### CAUTION:

If inspection was carried out with cold engine, check that values with fully warmed up engine are still within specifications.



7. Turn crankshaft one complete revolution (360°) and align mark on crankshaft pulley with pointer.
8. Measure valve clearances with a feeler gauge at locations marked X as shown in the table below.
- No.4 cylinder compression TDC.

Cylinder	No.1		No.2		No.3		No.4	
	INT	EXH	INT	EXH	INT	EXH	INT	EXH
Measurable				X	X		X	X



9. If out of specifications, adjust as follows.

## ADJUSTMENT

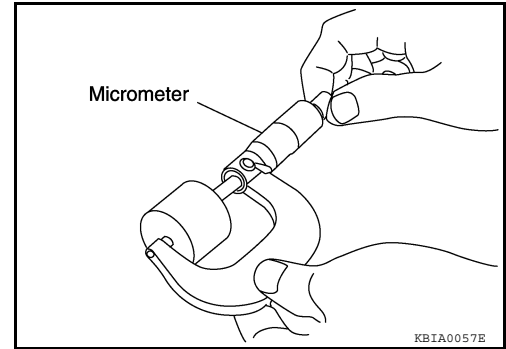
- Perform adjustment depending on selected head thickness of valve lifter.
  - The specified valve lifter thickness is the dimension at normal temperatures. Ignore dimensional differences caused by temperature. Use the specifications for hot engine condition to adjust.
- Remove camshaft. Refer to [EM-40. "Removal and Installation"](#).
  - Remove the valve lifters at the locations that are outside the standard.

# CAMSHAFT

[QR25DE]

## < ON-VEHICLE REPAIR >

3. Measure the center thickness of the removed valve lifters with a micrometer.



4. Use the equation below to calculate valve lifter thickness for replacement.

- Valve lifter thickness calculation.

$$t = t1 + (C1 - C2)$$

t = Thickness of replacement valve lifter.

t1 = Thickness of removed valve lifter.

C1 = Measured valve clearance.

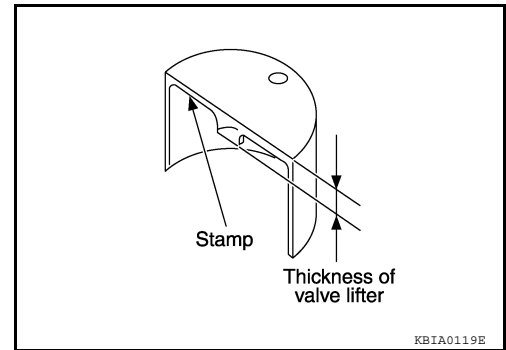
C2 = Standard valve clearance.

- Thickness of a new valve lifter can be identified by stamp marks on the reverse side (inside the cylinder).

Stamp mark 696 indicates a thickness of 6.96 mm (0.2740 in)

**Available thickness of valve lifter: 26 sizes with a range of 7.88 to 8.38 mm (0.3102 to 0.3299 in), in steps of 0.02 mm (0.0008 in), when assembled at the factory.**

5. Install the selected valve lifter.
6. Install camshaft.
7. Manually turn crankshaft pulley a few turns.
8. Check that valve clearances for cold engine are within specifications, by referring to the specified values.
9. After completing the repair, check valve clearances again with the specifications for warmed engine. Use a feeler gauge to measure the clearance between the valve and camshaft. Make sure the values are within specifications.



### Valve clearance standard:

Cold	Intake	: 0.24 - 0.32 mm (0.009 - 0.013 in)
	Exhaust	: 0.26 - 0.34 mm (0.010 - 0.013 in)
Hot*	Intake	: 0.304 - 0.416 mm (0.012 - 0.016 in)
	Exhaust	: 0.308 - 0.432 mm (0.012 - 0.017 in)

\*: Reference data at approximately 80°C (176°F)

# TIMING CHAIN

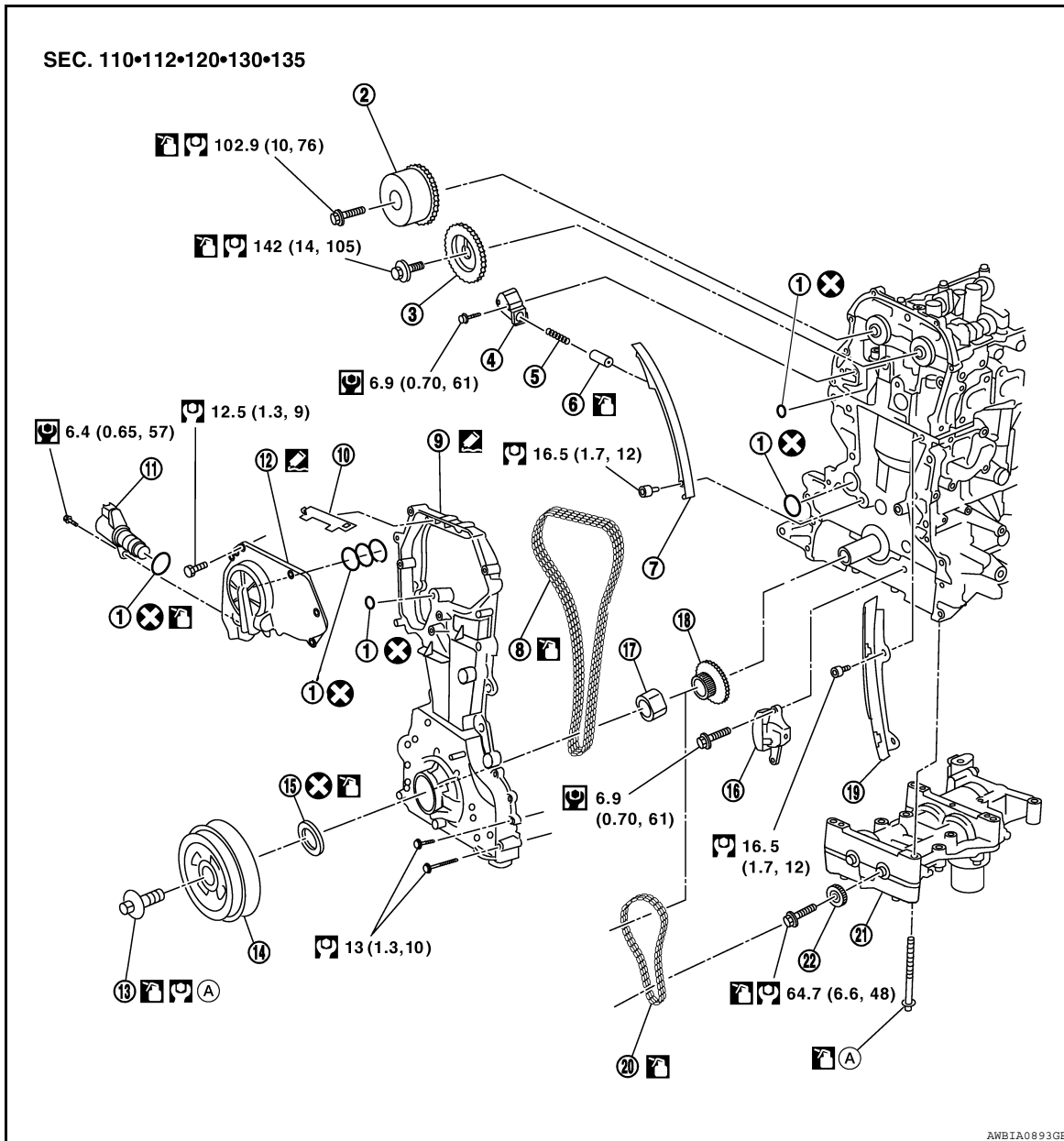
< ON-VEHICLE REPAIR >

[QR25DE]

## TIMING CHAIN

### Removal and Installation

INFOID:000000005441582



- |  |                                      |                            |
|--|--------------------------------------|----------------------------|
| 1. O-rings                               | 2. Camshaft sprocket (INT)           | 3. Camshaft sprocket (EXH) |
| 4. Chain tensioner                       | 5. Spring                            | 6. Chain tensioner plunger |
| 7. Timing chain slack guide              | 8. Timing chain                      | 9. Front cover             |
| 10. Chain guide                          | 11. IVT solenoid valve               | 12. IVT cover              |
| 13. Crankshaft pulley bolt               | 14. Crankshaft pulley                | 15. Front oil seal         |
| 16. Balancer unit timing chain tensioner | 17. Oil pump drive spacer            | 18. Crankshaft sprocket    |
| 19. Timing chain tension guide           | 20. Balancer unit timing chain       | 21. Balancer unit          |
| 22. Balancer unit sprocket               | A. Follow the installation procedure |                            |

#### CAUTION:

Apply new engine oil to parts as indicated in the illustration before installation.

#### REMOVAL

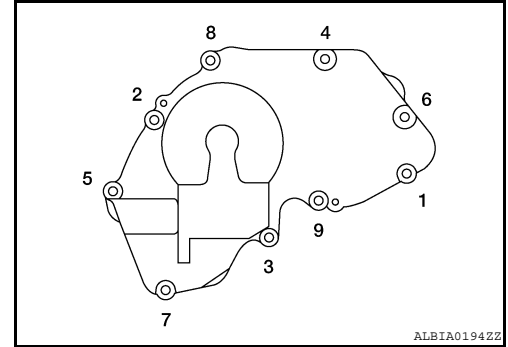
1. Remove the engine and transaxle assembly. Refer to [EM-71. "Removal and Installation"](#).

# TIMING CHAIN

[QR25DE]

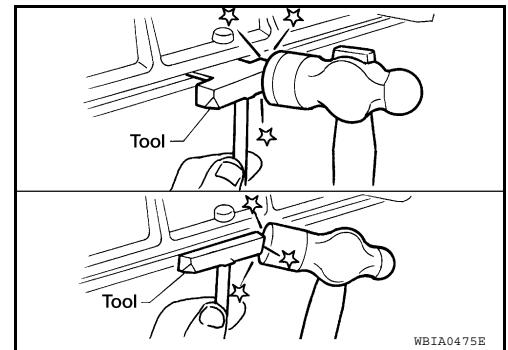
## < ON-VEHICLE REPAIR >

2. Remove the upper and lower oil pan, and oil strainer. Refer to [EM-32. "Removal and Installation \(Upper Oil Pan\)"](#).
3. Disconnect variable timing control solenoid harness connector.
4. Loosen IVT (intake valve timing) control cover bolts in the numerical order as shown.

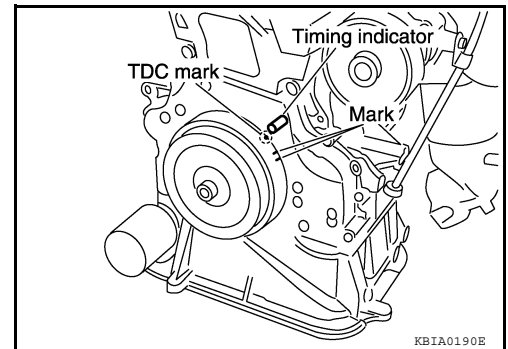


Remove the IVT control cover using Tool.

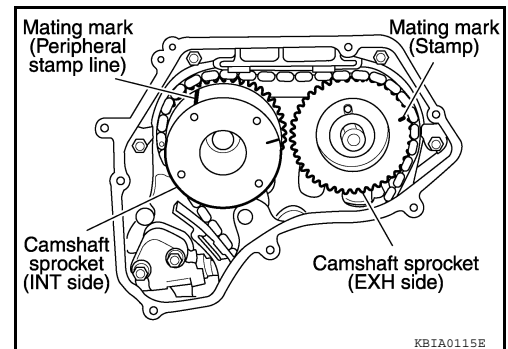
**Tool number : KV10111100 (J-37228)**



5. Pull chain guide between camshaft sprockets out through front cover.
6. Set the No.1 cylinder at TDC on the compression stroke with the following procedure:
  - a. Rotate the crankshaft pulley clockwise and align the mating marks to the timing indicator on the front cover.



- b. At the same time, make sure that the mating marks on the camshaft sprockets are lined up as shown.
    - If not lined up, rotate the crankshaft pulley one more turn to line up the mating marks to the positions as shown.

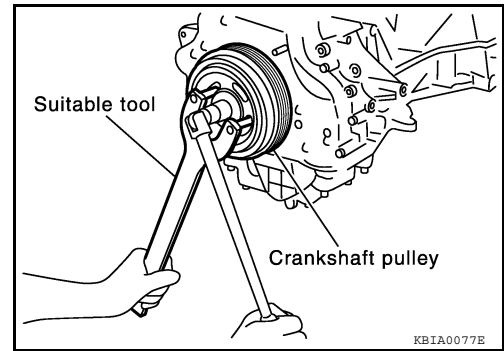


# TIMING CHAIN

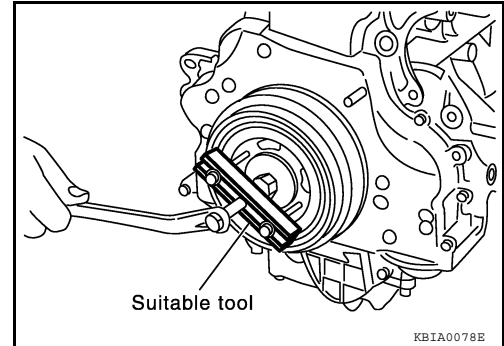
[QR25DE]

## < ON-VEHICLE REPAIR >

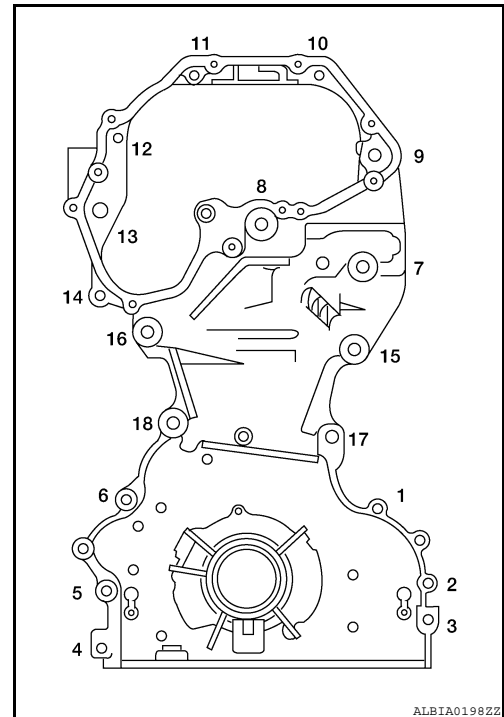
7. Remove crankshaft pulley with the following procedure:
  - a. Hold the crankshaft pulley using suitable tool, then loosen the crankshaft pulley bolt, and pull the pulley out about 10 mm (0.39 in).



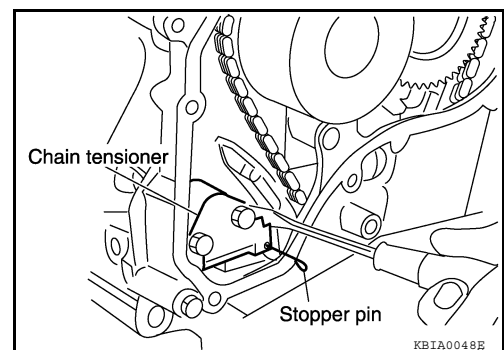
- b. Attach suitable pulley puller in the M 6 (0.24 in diameter) thread hole on crankshaft pulley, and remove crankshaft pulley using a suitable puller.



8. Remove the front cover with the following procedure:
  - a. Loosen the bolts in the numerical order as shown, and remove them.
  - b. Remove the front cover.  
**CAUTION:**
    - Be careful not to damage the mounting surface.
9. Remove front oil seal using suitable tool, if necessary.



10. Remove timing chain with the following procedure:
  - a. Push in the tensioner plunger. Insert a stopper pin into the hole on the tensioner body to secure the chain tensioner plunger and remove chain tensioner.
    - Use a wire of 0.5 mm (0.02 in) diameter as a stopper pin.
  - b. Remove the timing chain.



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# TIMING CHAIN

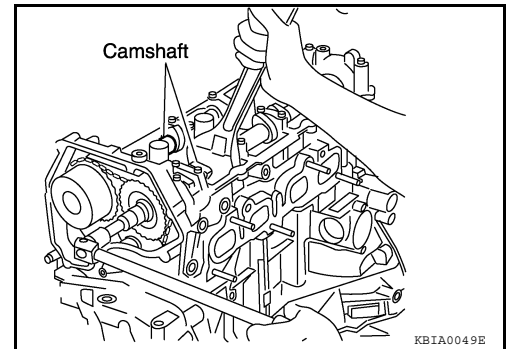
[QR25DE]

## < ON-VEHICLE REPAIR >

- c. Secure hexagonal part of the camshaft with a wrench and loosen the camshaft sprocket bolt and remove the camshaft sprocket for both camshafts.

**CAUTION:**

- Do not rotate the crankshaft or camshafts while the timing chain is removed. It can cause damage to the valve and piston.



11. Remove the chain slack guide, tension guide, timing chain, and oil pump drive spacer.

12. Press stopper tab (A) in the direction shown to push the timing chain slack guide (B) toward timing chain tensioner (for balancer unit) (1).

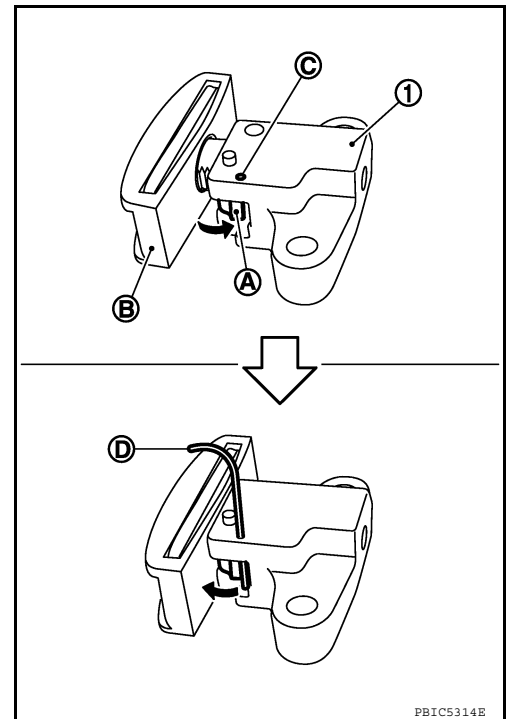
- The slack guide (B) is released by pressing the stopper tab (A). As a result, the slack guide (B) can be moved.

13. Insert stopper pin (D) into tensioner body hole (C) to secure timing chain slack guide (B).

**NOTE:**

Use a hard metal pin with a diameter of approximately 1.2 mm (0.047 in) as a stopper pin.

14. Remove timing chain tensioner (for balancer unit) (1).
15. Secure width across flats of the balancer LH side shaft using a suitable tool. Loosen the balancer sprocket bolt.
16. Remove balancer unit timing chain, balancer unit sprocket and crankshaft sprocket.

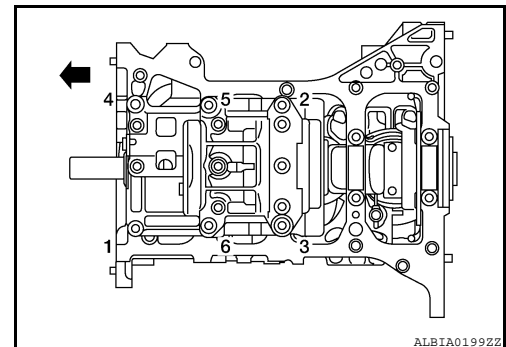


17. Loosen bolts in order as shown, and remove balancer unit.

- Use Torx socket (size E14)

**CAUTION:**

- Do not disassemble balancer unit.



## INSPECTION AFTER REMOVAL

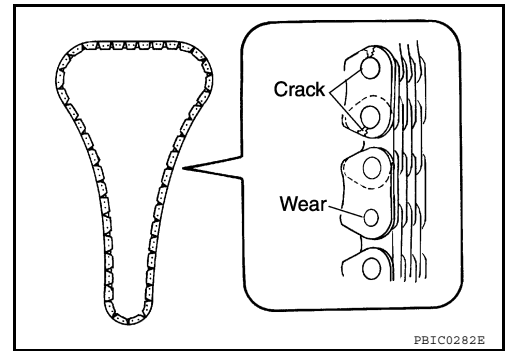
Timing Chain

# TIMING CHAIN

[QR25DE]

## < ON-VEHICLE REPAIR >

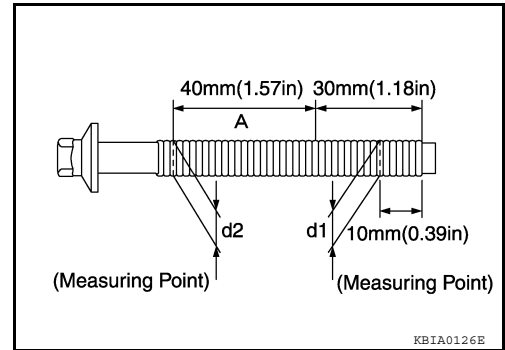
Check the timing chain for cracks or excessive wear. If a defect is detected, replace it.



### Balancer Unit Bolt Outer Diameter

- Measure outer diameters (d1, d2) at the two positions as shown.
- Measure d2 within the range A.
- If the value difference (d1 - d2) exceeds the limit, replace it with a new one.

**Limit : 0.15 mm (0.0059 in) or more**



## INSTALLATION

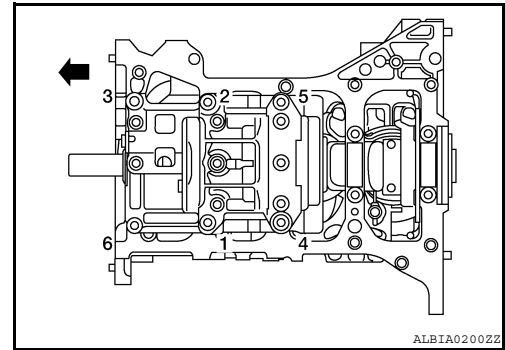
### NOTE:

- There may be two color variations of the link marks (link colors) on the timing chain.
- There are 26 links between the gold/yellow mating marks on the timing chain; and 64 links between the camshaft sprocket gold/yellow link and the crankshaft sprocket orange/blue link, on the timing chain side without the tensioner.

1. Make sure the crankshaft key points straight up.
2. Install the balancer unit and tighten the bolts in the numerical order as shown:

### CAUTION:

- **When reusing a bolt, check its outer diameter before installation. Follow the Balancer Unit Bolt Outer Diameter procedure.**
- **Apply new engine oil to threads and seating surfaces of bolts.**



- **Check tightening angle with an angle wrench (A) or a protractor. Do not make judgment by visual check alone.**

**Tool number : KV10112100 (BT-8653-A)**

### Balancer unit bolts

#### Step 1

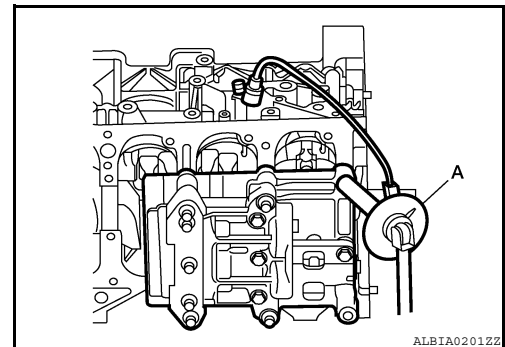
**Bolts 1-5 : 42 N·m (4.3 kg·m, 31 ft·lb)**

**Bolt 6 : 36 N·m (3.7 kg·m, 27 ft·lb)**

#### Step 2

**Bolts 1-5 : 120° + 5°**

**Bolt 6 : 90° + 5°**



# TIMING CHAIN

< ON-VEHICLE REPAIR >

[QR25DE]

**Step 3 (Loosen in reverse order or tightening) : 0 N·m (0 kg-m, 0 ft-lb)**

**Step 4**

**Bolts 1-5 : 42 N·m (4.3 kg-m, 31 ft-lb)**

**Bolt 6 : 36 N·m (3.7 kg-m, 27 ft-lb)**

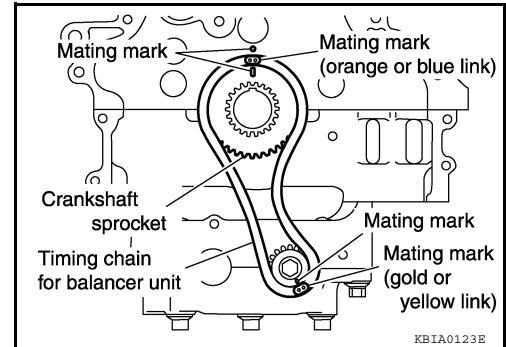
**Step 5**

**Bolts 1-5 : 120° + 5°**

**Bolt 6 : 90° + 5°**

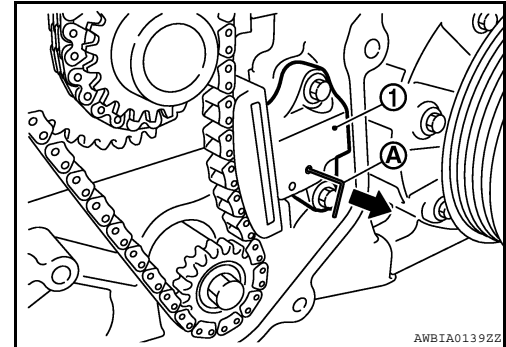
3. Install the crankshaft sprocket and timing chain for the balancer unit.

- Make sure that the crankshaft sprocket is positioned with mating marks on the block and sprocket meeting at the top.
- Install it by lining up mating marks on each sprocket and timing chain.



4. Install timing chain tensioner (for balancer unit) (1).

- Fix the plunger at the most compressed position using a stopper pin (A), and then install it.
- Securely pull out (←) the stopper pin after installing the timing chain tensioner (for balancer unit).
- Check matching mark position of balancer unit drive chain and each sprocket again.



5. Install timing chain and related parts.

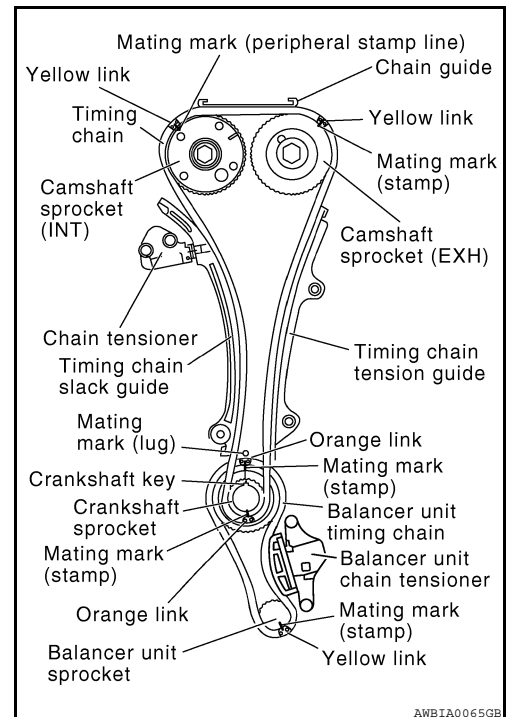
- Install by lining up mating marks on each sprocket and timing chain as shown.
- Before and after installing timing chain tensioner, check again to make sure the mating marks have not slipped.
- After installing timing chain tensioner, remove the stopper pin, and make sure that the tensioner moves freely.

**CAUTION:**

- For the following note, after the mating marks are aligned, keep them aligned by holding them by hand.
- To avoid skipped teeth, do not move crankshaft and camshaft until front cover is installed.

**NOTE:**

Before installing chain tensioner, it is possible to change the position of mating mark on timing chain for that of each sprocket for alignment.





# TIMING CHAIN

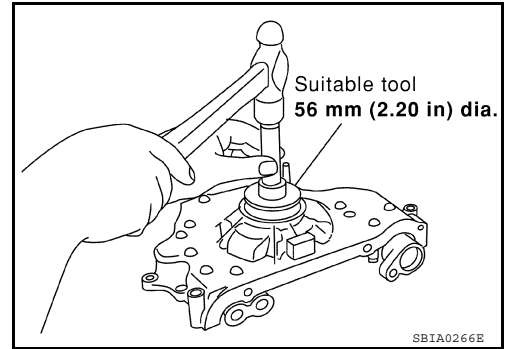
[QR25DE]

## < ON-VEHICLE REPAIR >

6. Install new front oil seal to front cover, using suitable tool
  - Install new oil seal in until it is flush with front end surface of front cover.

**CAUTION:**

- Do not reuse oil seal.
- Be careful not to cause damage to circumference of oil seal.

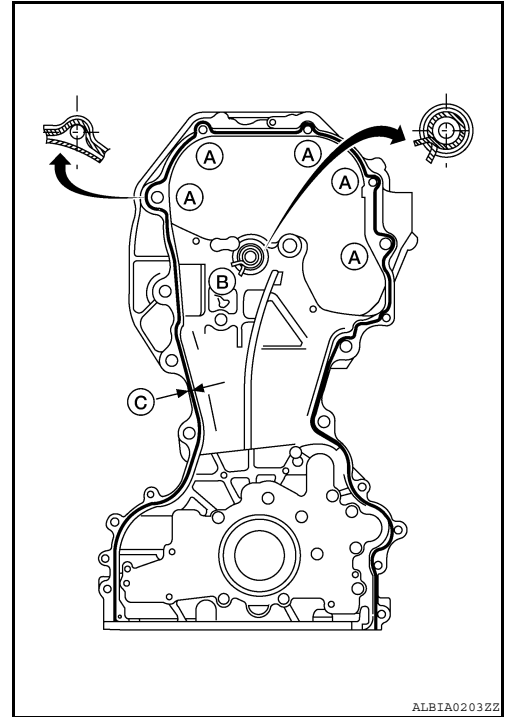


7. Install front cover with the following procedure:
  - a. Install O-rings (B) to cylinder head and cylinder block.
  - b. Apply Genuine Silicone RTV Sealant or equivalent, to positions (A) specified as shown. Refer to [GI-15. "Recommended Chemical Products and Sealants"](#).
  - c. Make sure the mating marks on the timing chain and each sprocket are still aligned. Then install the front cover.

**Sealant diameter (C) : 3.9 mm (0.154 in)**

**CAUTION:**

- Be careful not to damage the front oil seal during installation with the front end of the crankshaft.



- d. Tighten front cover bolts in the numerical order as shown.
- e. After all bolts are tightened, retighten them to the specified torque.

**Front cover bolts**

**Bolts (A) : 49 N·m (5.0 kg-m, 36 ft-lb)**

**Bolts (B) : 12.7 N·m (1.3 kg-m, 9 ft-lb)**

**Bolts (C) : 12.7 N·m (1.3 kg-m, 9 ft-lb)**

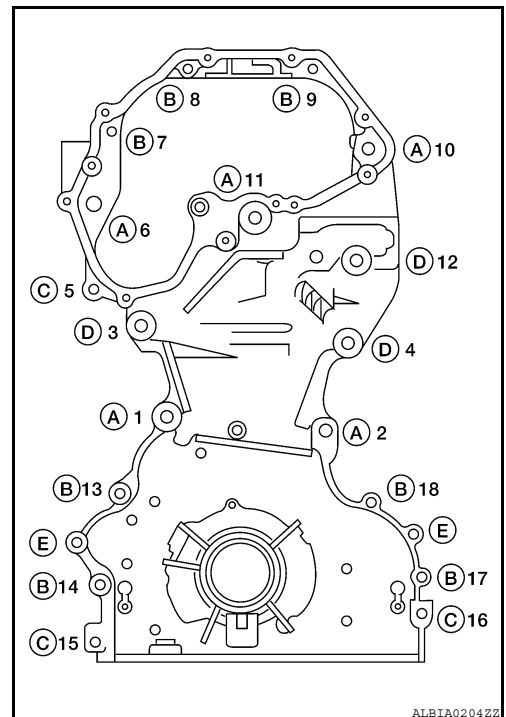
**Bolts (D) : 49 N·m (5.0 kg-m, 36 ft-lb)**

**(E) Dowel pins**

**CAUTION:**

**Wipe off any excess sealant leaking at the surface for installing the oil pan.**

8. Install the chain guide between the camshaft sprockets.



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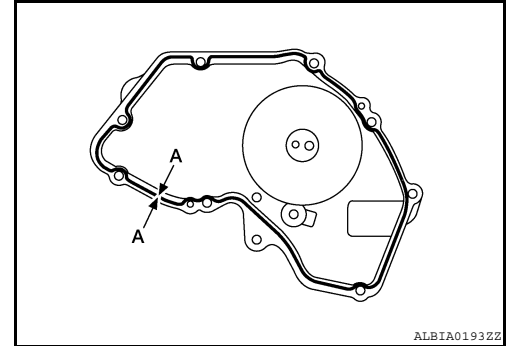
# TIMING CHAIN

[QR25DE]

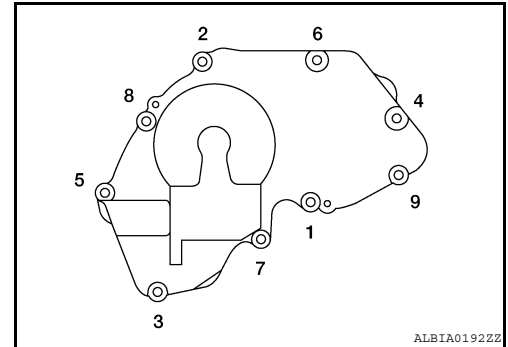
## < ON-VEHICLE REPAIR >

9. Install IVT cover with the following procedure:
  - a. Install IVT solenoid valve to IVT cover.
  - b. Install new O-ring to front cover.
  - c. Apply Silicone RTV Sealant to the IVT cover as shown.
    - Apply Genuine Silicone RTV Sealant or equivalent, to positions specified as shown. Refer to [GI-15, "Recommended Chemical Products and Sealants"](#).

**Diameter (A) : 3.0 - 4.0 mm (0.118 - 0.157 in)**



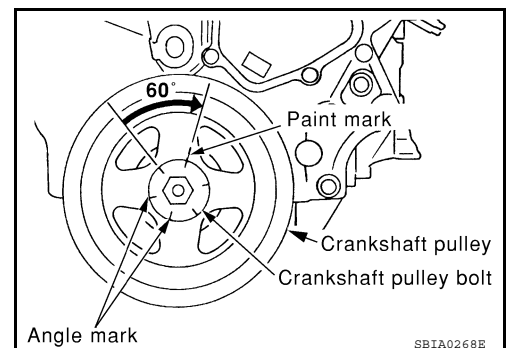
- d. Tighten the IVT cover bolts in the numerical order as shown.



10. Insert crankshaft pulley by aligning with crankshaft key.
  - Tap its center with a plastic hammer to insert.
  - Do not tap the belt hook.
11. Tighten crankshaft pulley bolts.
  - Secure crankshaft pulley with tool to tighten the bolt.
  - Perform angle tightening with the following procedure:
- a. Apply new engine oil to threads and seat surfaces of bolts.
- b. Tighten to initial specifications:·

**Crankshaft bolt : 42.1 N·m (4.3 kg·m, 31 ft·lb)**

- c. Apply a paint mark on the front cover, mating with any one of six easy to recognize stamp marks on bolt flange.
- d. Turn crankshaft pulley bolt another 60° to 66° degrees [Target: 60° degrees].
  - Check vertical mounting angle with movement of one stamp mark.
12. Installation of the remaining components is in the reverse order of removal.



## OIL SEAL

## Removal and Installation of Valve Oil Seal

INFOID:000000005441583

## REMOVAL

1. Remove camshaft. Refer to [EM-40, "Removal and Installation"](#).
2. Remove valve lifter. Refer to [EM-40, "Removal and Installation"](#).
3. Rotate crankshaft, and set piston whose oil seal is to be removed to top dead center. This prevents valve from dropping inside cylinder.

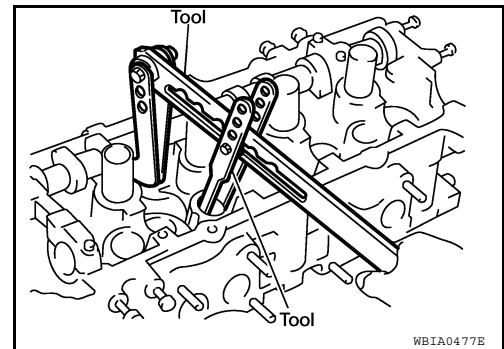
**CAUTION:**

**When rotating crankshaft, be careful to avoid scarring the front cover with the timing chain.**

4. Remove valve collet, valve spring retainer and valve spring using Tool.

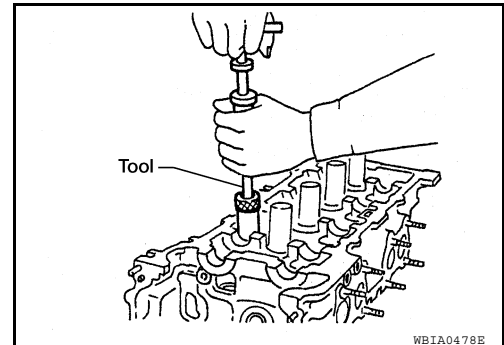
**Tool number**

- : KV10116200 (J-26336-B)
- : KV10115900 (J-26336-20)



5. Remove valve oil seal using Tool.

**Tool number : KV10107902 (J-38959)**

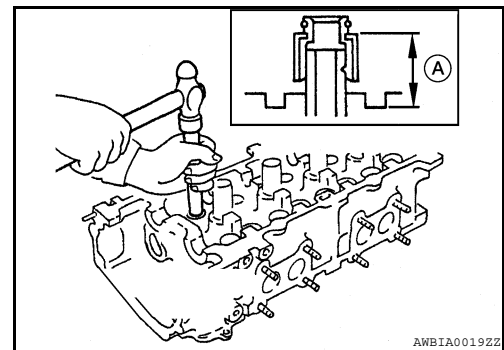


## INSTALLATION

1. Apply new engine oil to new valve oil seal joint surface and seal lip.
2. Press in valve oil seal to the position shown using Tool.

**Oil seal installed height (A) : 12.1 mm (0.476 in)**

**Tool number : KV10115600 (J-38958)**



3. Installation of the remaining components in the reverse order of removal.

## Removal and Installation of Front Oil Seal

INFOID:000000005441584

## REMOVAL

1. Remove the following parts:
  - RH front wheel. Refer to [WT-60, "Adjustment"](#).

# OIL SEAL

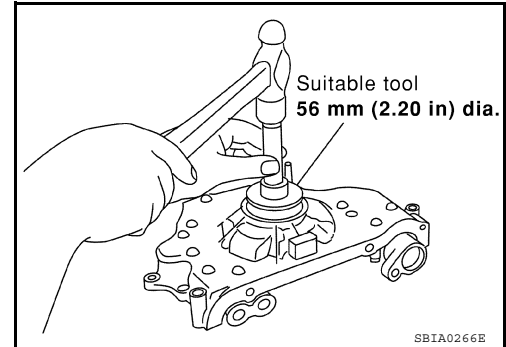
[QR25DE]

## < ON-VEHICLE REPAIR >

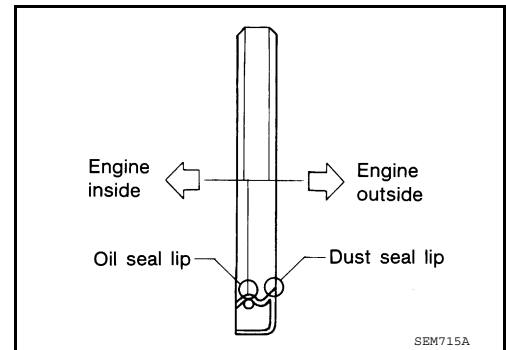
- Fender protector side cover RH. Refer to [EXT-19. "Removal and Installation"](#).
  - Drive belt. Refer to [EM-14](#).
  - Crankshaft pulley. Refer to [EM-51](#).
2. Remove front oil seal from front cover.  
**CAUTION:**  
**Be careful not to scratch front cover.**

## INSTALLATION

1. Install new front oil seal to front cover using suitable tool.
- Install new oil seal in until it is flush with front end surface of front cover.
- CAUTION:**
- **Do not reuse oil seal.**
  - **Be careful not to cause damage to circumference of oil seal.**



- Install new oil seal in the direction shown.



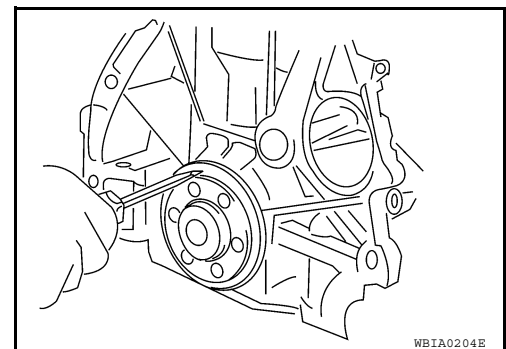
2. Installation of the remaining components is in reverse order of removal.

## Removal and Installation of Rear Oil Seal

INFOID:000000005441585

## REMOVAL

1. Remove the transaxle. Refer to [TM-35. "Removal and Installation"](#).
2. Remove flywheel.
3. Remove rear oil seal using suitable tool.
- CAUTION:**  
**Be careful not to scratch rear oil seal retainer.**



## INSTALLATION

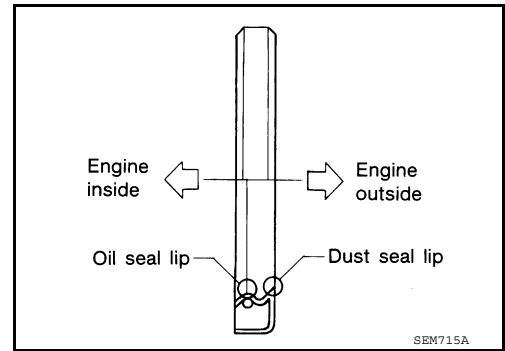
1. Apply new engine oil to new oil seal and install it using a suitable tool.

# OIL SEAL

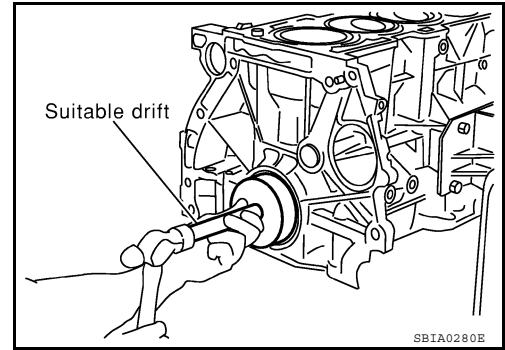
< ON-VEHICLE REPAIR >

[QR25DE]

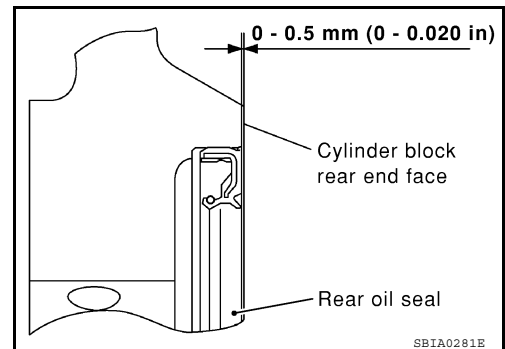
- Install new oil seal in the direction shown.



- Press fit new oil seal straight using a suitable drift, to avoid causing burrs or tilting.



- Press in the new oil seal to the specified depth as shown.



2. Installation of the remaining components is in the reverse order of removal.

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# CYLINDER HEAD

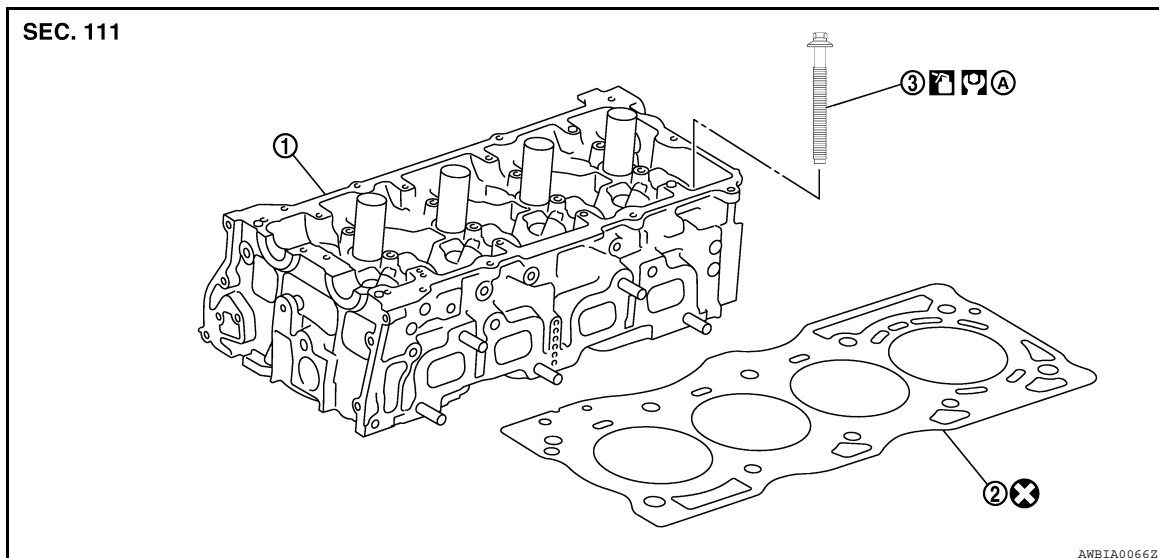
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[QR25DE]

## CYLINDER HEAD

### Removal and Installation

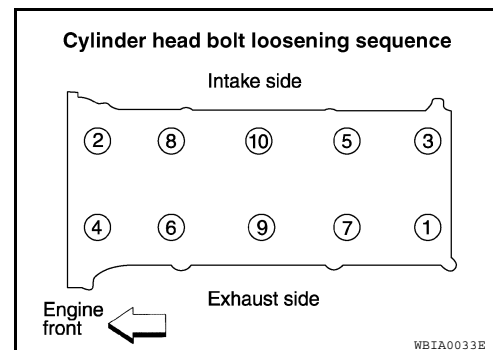
INFOID:00000005441586



1. Cylinder head
  2. Cylinder head gasket
  3. Cylinder head bolt
- A. Follow installation procedure

### REMOVAL

1. Remove the timing chain. Refer to [EM-51, "Removal and Installation"](#).
2. Remove the camshafts. Refer to [EM-40, "Removal and Installation"](#).
3. Remove spark plugs. Refer to [EM-12, "Removal and Installation"](#).
4. Remove the exhaust manifold and three way catalyst. Refer to [EM-29, "Removal and Installation"](#).
5. Remove cylinder head loosening bolts in the order as shown, using power tool.
6. Remove cylinder head.
7. Remove cylinder head gasket.
8. If necessary to transfer to new cylinder head or remove for reconditioning, remove the intake manifold collector, intake manifold, and fuel tube assembly. Refer to [EM-35, "Removal and Installation"](#).



### INSPECTION AFTER REMOVAL

#### Outer Diameter of Cylinder Head Bolts

- Cylinder head bolts are tightened by plastic zone tightening method. Whenever the size difference between d1 and d2 exceeds the limit, replace the bolts with new ones.

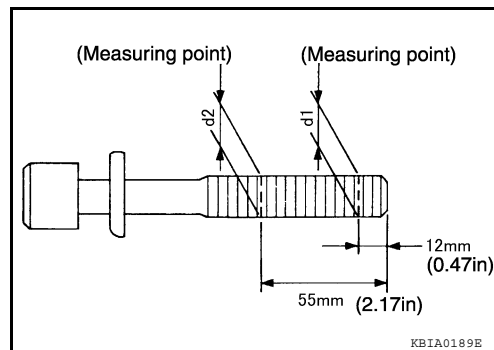
# CYLINDER HEAD

< ON-VEHICLE REPAIR >

[QR25DE]

**Limit (d1 - d2) : 0.23 mm (0.0091 in) or less**

- If reduction of outer diameter appears in a position other than d2, use it as d2 point.



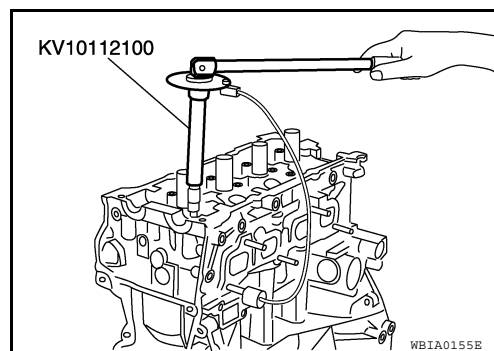
## INSTALLATION

1. Install a new cylinder head gasket.
2. Install the cylinder head.
3. Follow the steps below to tighten the cylinder head bolts in the numerical order as shown.
  - Apply new engine oil to the threads and the seating surfaces of bolts.

**CAUTION:**

- If cylinder head bolts are re-used, check their outer diameters before installation. Follow the **Outer Diameter of Cylinder Head Bolts** procedure.
- Check and confirm the tightening angle by using angle wrench or protractor. Avoid judgment by visual inspection without the tool.

**Tool number : KV10112100 (BT-8653-A)**



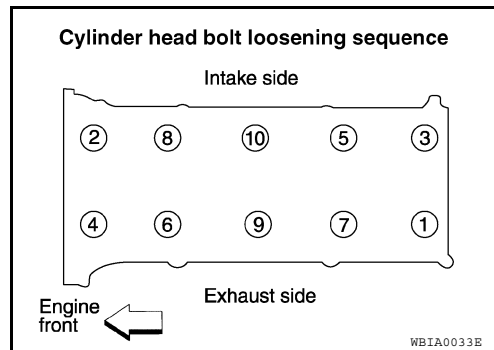
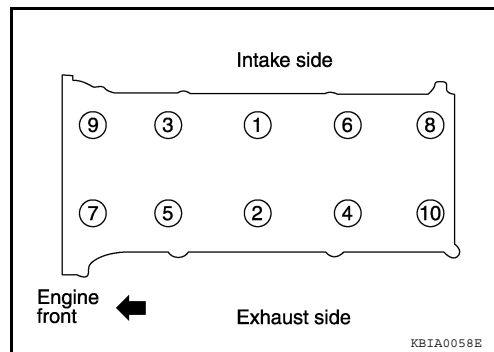
**Step a : 98.1 N·m (10 kg·m, 72 ft·lb)**

**Step b : Loosen to 0 N·m in the reverse order of tightening.**

**Step c : 39.2 N·m (4.0 kg·m, 29 ft·lb)**

**Step d : 75° clockwise**

**Step e : 75° clockwise**



4. Installation of the remaining components is in the reverse order of removal.

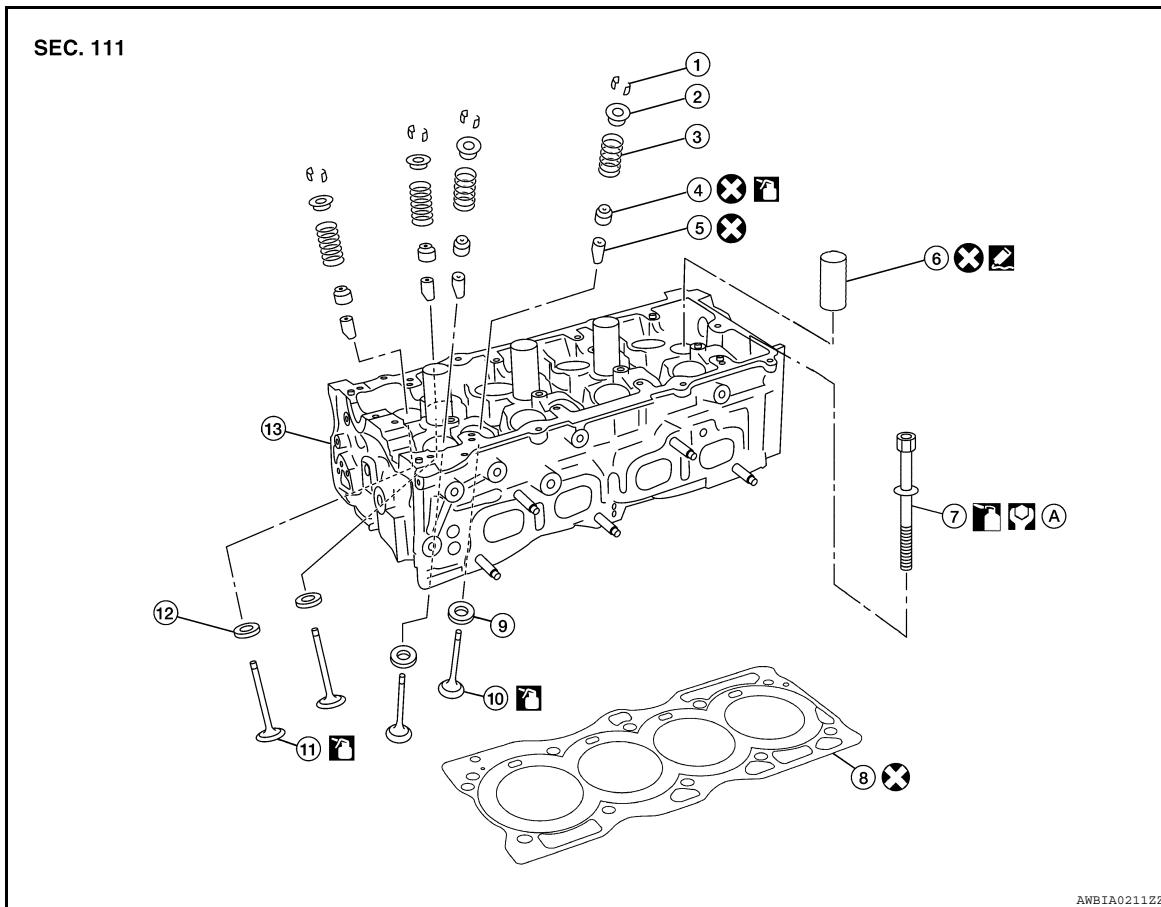
# CYLINDER HEAD

< ON-VEHICLE REPAIR >

[QR25DE]

## Disassembly and Assembly

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- |                       |                                  |                      |
|-----------------------|----------------------------------|----------------------|
| 1. Valve collet       | 2. Valve spring retainer         | 3. Valve spring      |
| 4. Valve oil seal     | 5. Valve guide                   | 6. Spark plug tube   |
| 7. Cylinder head bolt | 8. Cylinder head gasket          | 9. Valve seat (EXH)  |
| 10. Valve (EXH)       | 11. Valve (INT)                  | 12. Valve seat (INT) |
| 13. Cylinder head     | A. Follow installation procedure |                      |

### CAUTION:

- When installing camshafts, chain tensioners, oil seals or other sliding parts, lubricate contacting surfaces with new engine oil.
- Apply new engine oil to threads and seat surfaces when installing the cylinder head, camshaft sprocket, crankshaft pulley and camshaft bracket.
- Attach tags to valve lifters so all parts are assembled in their original position.

### DISASSEMBLY

1. Remove the valve lifter.
  - Confirm installation point.



# CYLINDER HEAD

[QR25DE]

## < ON-VEHICLE REPAIR >

2. Remove the valve collet, valve spring retainer and valve spring using Tool.

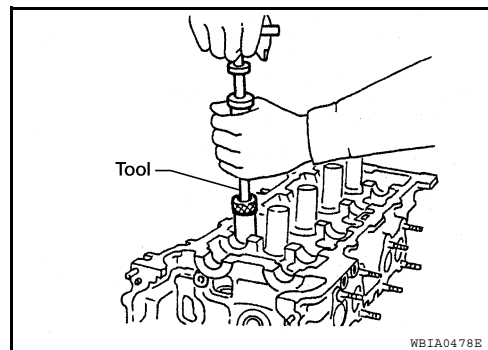
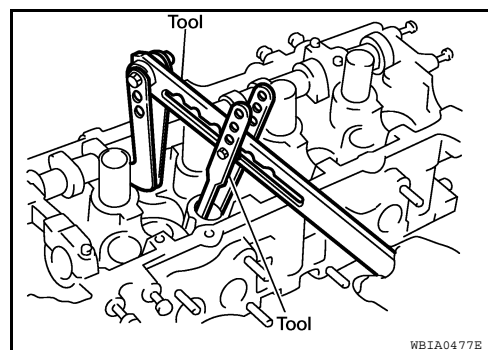
**Tool number** : KV10116200 (J-26336-B)  
: KV10115900 (J-26336-20)

### CAUTION:

**Do not remove valve spring seat from valve spring.**

3. Push valve stem to combustion chamber side, and remove valve.
  - Inspect valve guide clearance before removal. Refer to [EM-66. "Inspection After Disassembly"](#).
  - Confirm installation point.
4. Remove valve oil seal using Tool.

**Tool number** : KV10107902 (J-38959)



5. When valve seat must be replaced, refer to [EM-66. "Inspection After Disassembly"](#).
6. When valve guide must be replaced, refer to [EM-66. "Inspection After Disassembly"](#).

7. Remove spark plug using suitable tool.
8. Remove spark plug tubes, if necessary using suitable tool.

### CAUTION:

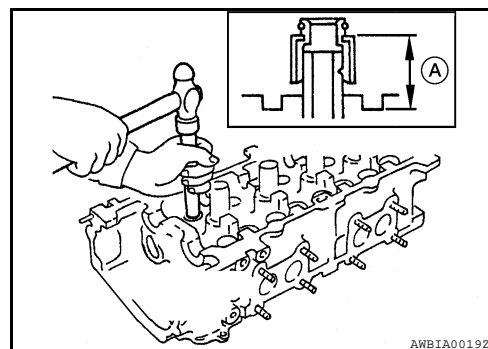
- Be careful not to damage cylinder head.
- Do not remove spark plug tube if not necessary. Once removed, the spark plug tube cannot be reused because of deformation during removal.

## ASSEMBLY

1. Install valve guide. Refer to [EM-66. "Inspection After Disassembly"](#).
2. Install valve seat. Refer to [EM-66. "Inspection After Disassembly"](#).
3. Install new valve oil seal using Tool as shown.

**Oil seal installed height (A)** : 12.1 mm (0.476 in)

**Tool number** : KV10115600 (J-38958)



4. Install valve.
  - Install larger diameter on the intake side.
5. Install valve spring.
  - Install valve spring so that the identification color faces upwards.
  - Confirm the identification color of the valve spring.
  - Intake: pink
  - Exhaust: green
6. Install valve spring retainer.

# CYLINDER HEAD

< ON-VEHICLE REPAIR >

[QR25DE]

7. Install valve collet using Tool.
  - Compress valve spring with valve spring compressor. Install valve collet with magnet hand.
  - Tap stem edge lightly with plastic hammer after installation to check its installed condition.

**Tool number** : KV10116200 (J-26336-B)  
: KV10115900 (J-26336-20)

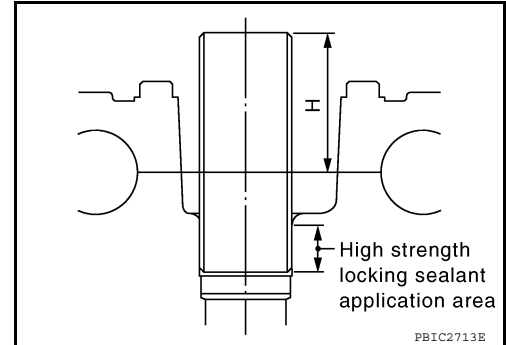
8. Install valve lifter.
9. Install spark plug tube.
  - a. Remove old liquid gasket from cylinder head side mounting hole.
  - b. Apply liquid gasket all around on spark plug tube with a 12 mm (0.47 in) width from edge of spark plug tube on the press fit side.
    - Use Three Bond or equivalent. Refer to [GI-15, "Recommended Chemical Products and Sealants"](#).
  - c. Press fit spark plug tube so that height is to (H) as shown.

**Press fit height (H) standard value** : 41.7 mm (1.642 in)

**CAUTION:**

- When press fitting be careful not to deform spark plug tube.
- After press fitting, wipe off any protruding liquid gasket on top surface of cylinder head.

10. Install spark plug using suitable tool.



## Inspection After Disassembly

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## CYLINDER HEAD DISTORTION

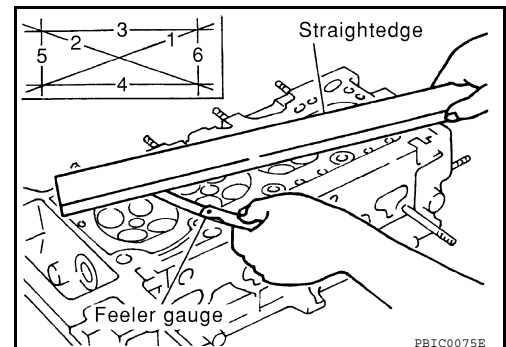
1. Wipe off oil and remove water scale deposits, old gasket, old sealer, and carbon with a scraper.

**CAUTION:**

**Use care not to allow gasket debris to enter passages for oil or water.**

2. At each of several locations on bottom surface of cylinder head, measure distortion in six directions.

**Limit** : 0.1 mm (0.004 in)



## VALVE DIMENSIONS

Check dimensions of each valve. Refer to [EM-98, "Standard and Limit"](#).

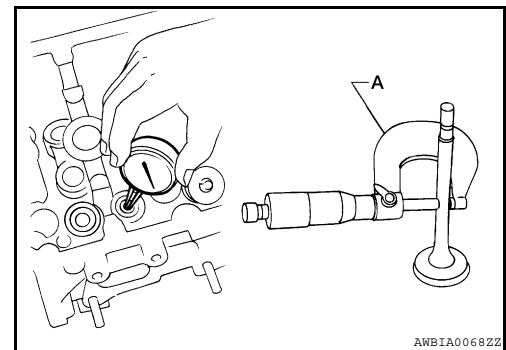
## VALVE GUIDE CLEARANCE

- Measure diameter of valve stem using suitable tool (A) as shown.

**Standard**

**Intake** : 5.965 - 5.980 mm (0.2348 - 0.2354 in)

**Exhaust** : 5.955 - 5.970 mm (0.2344 - 0.2350 in)



- Measure inner diameter of valve guide with a bore gauge as shown.

# CYLINDER HEAD

< ON-VEHICLE REPAIR >

[QR25DE]

## Standard

**Intake and Exhaust : 6.000 - 6.018 mm (0.2362 - 0.2369 in)**

- Valve guide clearance = (Valve guide inner diameter) - (Valve stem diameter)

## Valve guide clearance

### Standard

**Intake : 0.020 - 0.053 mm (0.0008 - 0.0021 in)**

**Exhaust : 0.030 - 0.063 mm (0.0012 - 0.0025 in)**

### Limit

**Intake : 0.08 mm (0.003 in)**

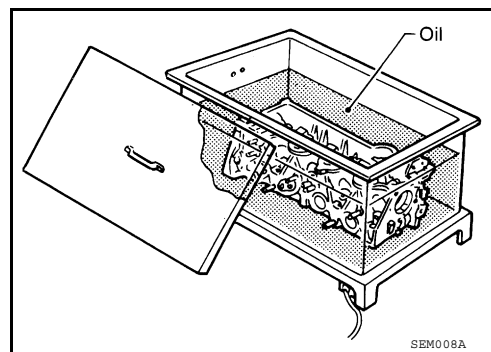
**Exhaust : 0.09 mm (0.004 in)**

- If it exceeds the limit, replace valve guide and/or valve. When valve guide must be replaced, follow the "VALVE GUIDE REPLACEMENT" procedure.

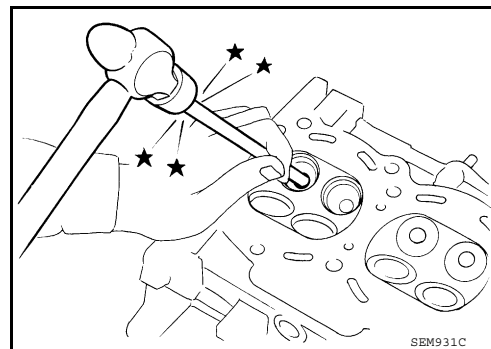
## VALVE GUIDE REPLACEMENT

When valve guide is removed, replace with oversized (0.2 mm, 0.008 in) valve guide.

1. To remove valve guide, heat cylinder head to 110° to 130°C (230° to 266°F) by soaking in heated oil.



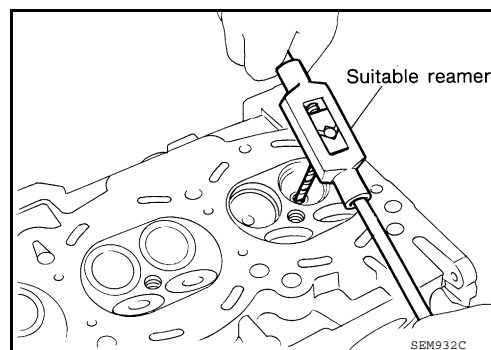
2. Drive out valve guide with a press [under a 20 kN (2.2 ton-force) pressure] or hammer and suitable tool.



3. Ream cylinder head valve guide hole using suitable reamer.

**Intake and exhaust valve guide hole diameter (Service) : 10.175 - 10.196 mm (0.4006 - 0.4014 in)**

4. Heat cylinder head to 110° to 130°C (230° to 266°F) by soaking in heated oil.



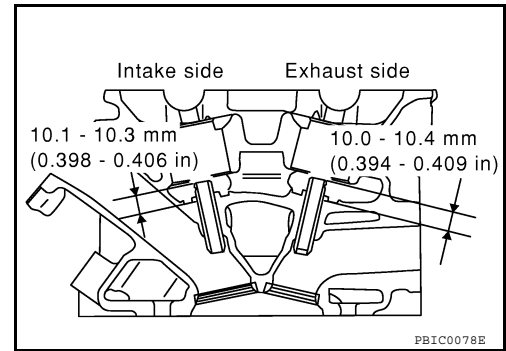
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# CYLINDER HEAD

< ON-VEHICLE REPAIR >

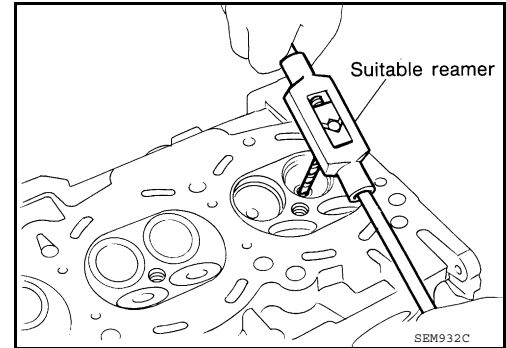
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5. Press valve guide from camshaft side to dimensions as shown.



6. Apply finish to valve guide using suitable reamer.

**Intake and exhaust : 6.000 - 6.018 mm (0.2362 - 0.2369 in)**

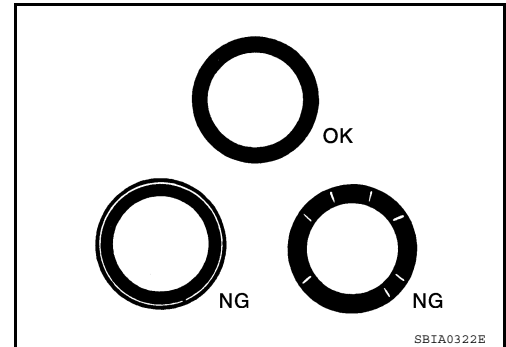


## VALVE SEAT CONTACT

### NOTE:

After confirming that the dimensions of valve guides and valves are within specifications, perform this procedure:

- Apply prussian blue (or white lead) onto contacting surface of valve seat to check the condition of the valve contact on the seat surface.
- Check if the contact area band is continuous all around the circumference.
- If not, grind to adjust valve fitting and check again. If the contacting surface still has NG conditions even after the re-check, replace the valve seat.



## VALVE SEAT REPLACEMENT

### NOTE:

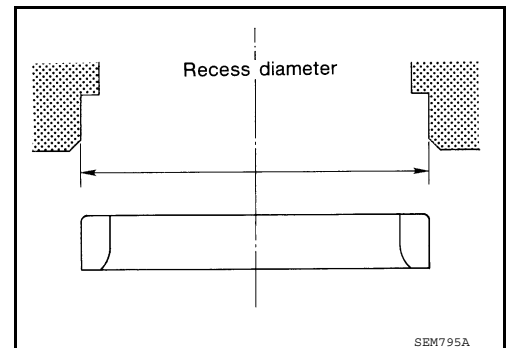
When valve seat is removed, replace with an oversized [0.5 mm (0.020 in)] valve seat.

1. Bore out old seat until it collapses. Boring should not continue beyond the bottom face of the seat recess in the cylinder head. Set the machine depth stop to ensure this.
2. Ream cylinder head recess diameter for service valve seat.

**Intake : 37.000 - 37.016 mm (1.4567 - 1.4573 in)**

**Exhaust : 32.000 - 32.016 mm (1.2598 - 1.2605 in)**

- Be sure to ream in circles concentric to the valve guide center. This will enable the valve seat to fit correctly.

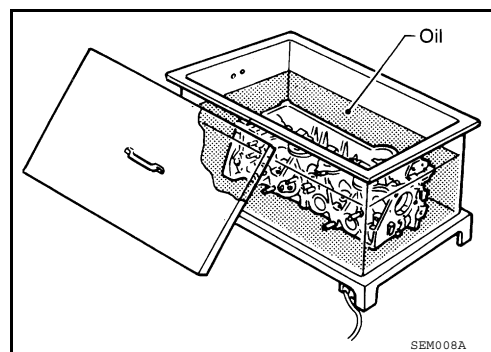


# CYLINDER HEAD

[QR25DE]

## < ON-VEHICLE REPAIR >

- Heat cylinder head to 110° to 130°C (230° to 266°F) by soaking in heated oil.



- Use valve seats cooled well with dry ice. Force fit valve seat into cylinder head.

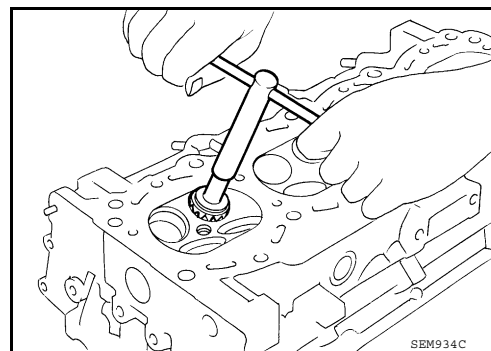
**CAUTION:**

**Avoid directly touching the cold valve seats.**

- Finish the seat to the specified dimensions using suitable tool. Refer to [EM-98. "Standard and Limit"](#).

**CAUTION:**

**When using valve seat cutter, firmly grip the cutter handle with both hands. Then, press on the contacting surface all around the circumference to cut in a single drive. Improper pressure on the cutter or cutting many different times may result in a defective valve seat.**



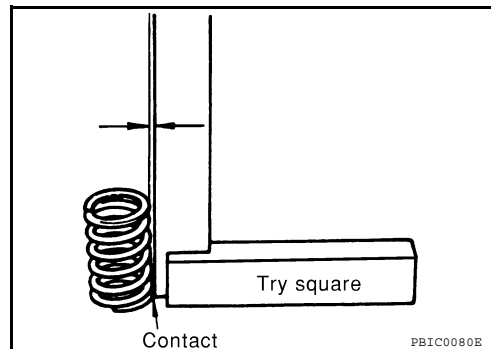
- Using compound, grind to adjust valve fitting.

- Check again for normal contact.

### VALVE SPRING SQUARENESS

Set try square along the side of the valve spring and rotate the spring. Measure the maximum clearance between the top face of the spring and the try square.

**Limit : 1.9 mm (0.0748 in)**

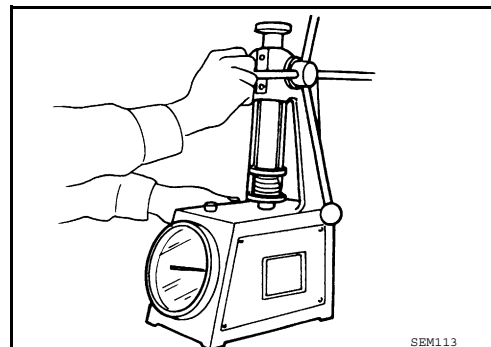


### VALVE SPRING DIMENSIONS AND VALVE SPRING PRESSURE LOAD

Check valve spring pressure with valve spring seat installed at specified spring height. Replace if not within specifications.

**CAUTION:**

**Do not remove the valve spring seat.**



# CYLINDER HEAD

< ON-VEHICLE REPAIR >

[QR25DE]

STANDARD	INTAKE (identification color: pink)	EXHAUST (identification color: green)
Free height	43.72 - 43.92 mm (1.7213 - 1.7291 in)	45.29 - 45.49 mm (1.7831 - 1.7909 in)
Installation height	35.30 mm (1.390 in)	35.30 mm (1.390 in)
Installation load	151 - 175 N (15.4 - 17.8 kg-f, 34 - 39 lb-f)	151 - 175 N (15.4 - 17.8 kg-f, 34 - 39 lb-f)
Height during valve open	25.30 mm (0.9961 in)	26.76 mm (1.0535 in)
Load with valve open	351 - 394 N (35.8 - 40.2 kg-f, 79 - 89 lb-f)	318 - 362 N (32.4 - 37.8 kg-f, 72 - 81 lb-f)

# ENGINE ASSEMBLY

< REMOVAL AND INSTALLATION >

[QR25DE]

## REMOVAL AND INSTALLATION

### ENGINE ASSEMBLY

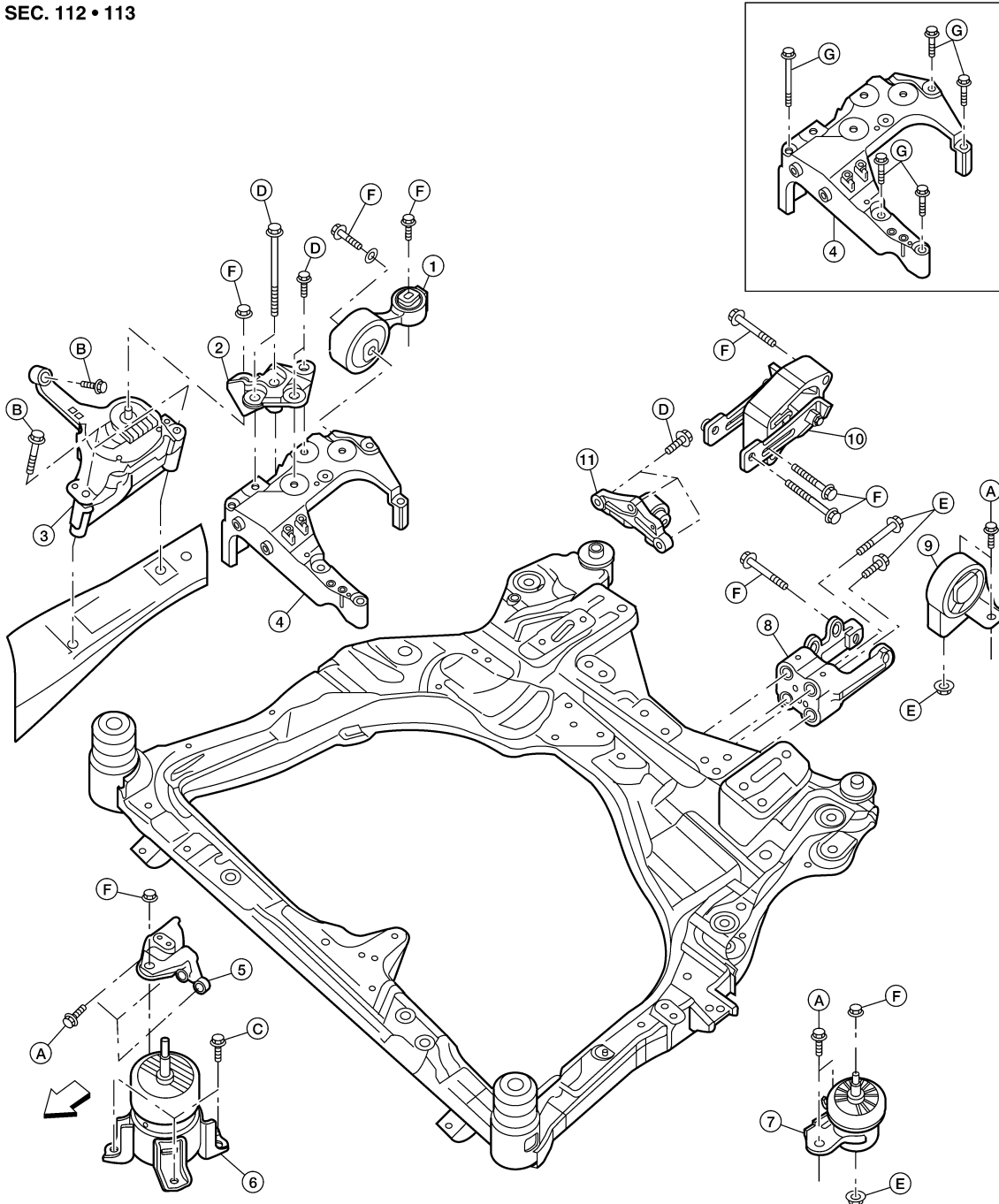
#### Removal and Installation

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# ENGINE ASSEMBLY

< REMOVAL AND INSTALLATION >

[QR25DE]

- |                                  |   |                                    |
|----------------------------------|---|------------------------------------|
| 1. RH engine mount torque rod    | 2. RH engine support bracket              | 3. RH engine mounting insulator    |
| 4. RH engine mounting bracket    | 5. Front engine mounting bracket          | 6. Front engine mounting insulator |
| 7. LH engine mounting insulator  | 8. Rear engine mounting insulator bracket | 9. Rear engine mounting insulator  |
| 10. Rear engine mount torque rod | 11. Rear engine mount torque rod bracket  | A. 40 N·m (4.1 kg-m, 30 ft-lb)     |
| B. 41 N·m (4.2 kg-m, 30 ft-lb)   | C. 47 N·m (4.8 kg-m, 35 ft-lb)            | D. 50 N·m (5.1 kg-m, 37 ft-lb)     |
| E. 70 N·m (7.1 kg-m, 52 ft-lb)   | F. 103 N·m (11 kg-m, 76 ft-lb)            | G. Follow installation procedure   |

⇐ Front

## WARNING:

- Place chocks at the front and back of the rear wheels.
- For engines not equipped with slingers, attach proper slingers and bolts as described in the Parts Catalog.
- Wear electrically insulated gloves and pull out the service plug grip before inspection procedures may require disconnecting high voltage connectors. Be sure to carry the removed service plug grip because other workers install it by mistake.
- Never touch the high voltage connectors or terminals for 10 minutes after the service plug grip is removed.

## CAUTION:

- Do not start working until the exhaust system and coolant are cool.
- If items or work required are not covered by the engine main body section, refer to the applicable sections.
- Use the correct supporting points for lifting and jacking. Refer to [GI-33, "Garage Jack and Safety Stand"](#).
- In removing the drive shaft, be careful not to damage the grease seals on the transaxle.

## REMOVAL

1. Remove the inverter upper LH bracket.
2. Release fuel pressure. Refer to [EC-465, "Inspection"](#).
3. Disconnect the 12-volt negative battery terminal. Refer to [PG-71, "Removal and Installation"](#).
4. Disconnect the fuel rail at the fuel hose quick connector (engine side).
5. Drain the engine and inverter coolant. Refer to [CO-11, "Changing Engine Coolant"](#), [HBC-634, "Replacement"](#).
6. Remove the engine under cover. Refer to [EXT-13, "Removal and Installation"](#).
7. Partially drain transaxle fluid. Refer to [TM-23, "Replacement"](#).
8. Remove engine room cover.
9. Remove the air duct and air cleaner case assembly. Refer to [EM-24, "Removal and Installation"](#).
10. Disconnect and remove the ECM with ECM bracket.
11. Remove cowl top. Refer to [EXT-18, "Removal and Installation"](#).
12. Remove strut brace. Refer to [FSU-12, "Exploded View"](#).
13. Disconnect and set aside the IPDM/ER and remove the IPDM/ER bracket. Refer to [PCS-36, "Removal and Installation"](#).
14. Remove upper and lower radiator hoses (engine side).
15. Remove the inverter with converter assembly. Refer to [HBC-636, "Removal and Installation"](#).
16. Disconnect EVAP hose.
17. Disconnect the heater hoses.
18. Disconnect main harness connector and harness ground wire.
19. Disconnect remaining sensors and harness connectors from engine and transaxle.
20. Disconnect and set aside the brake ECU. Refer to [BRC-193, "Removal and Installation"](#).
21. Remove front LH and RH wheels and tires. Refer to [WT-60, "Adjustment"](#).



# ENGINE ASSEMBLY

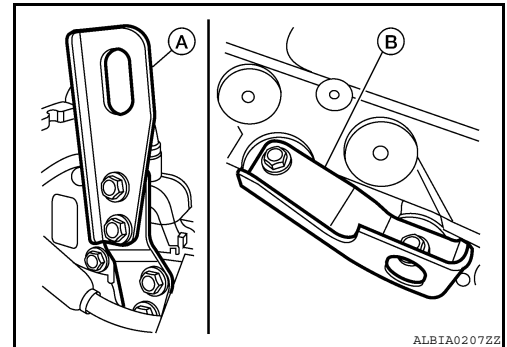
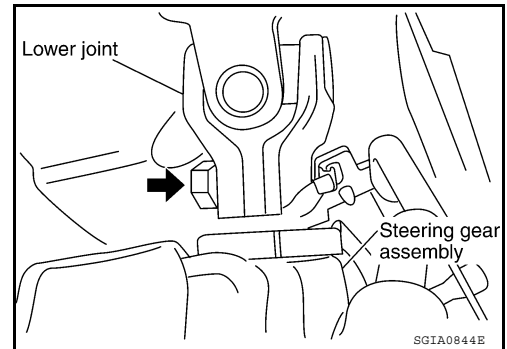
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## < REMOVAL AND INSTALLATION >

22. Remove the lower side bolt of the lower shaft assembly.
23. Remove the fender protector side covers (RH) and (LH). Refer to [EXT-19. "Removal and Installation"](#).
24. Remove front exhaust tube. Refer to [EX-5. "Exploded View"](#).
25. Remove the left and right drive shafts. Refer to [FAX-10. "Removal and Installation \(Left Side\)"](#), [FAX-11. "Removal and Installation \(Right Side\)"](#).
26. Remove rear engine mount torque rod and bracket.
27. Remove rear engine mounting insulator and bracket.
28. Disconnect the electric compressor pipes and connectors. Refer to [HA-27. "Removal and Installation"](#).
29. Disconnect the transaxle shift controls.
30. Install engine slingers into front left cylinder head and rear right cylinder head.
  - Use the proper slingers and bolts as described in the Parts Catalog.

**Slinger bolts - front** : 48 N·m (4.9 kg-m, 35 ft-lb)

**Slinger bolts - rear** : 28 N·m (2.8 kg-m, 21 ft-lb)



31. Support engine and transaxle assembly with engine lifting equipment from the top with the vehicle raised on a hoist.
32. Remove the RH engine mount torque rod, RH engine support bracket, RH engine mounting insulator and RH engine mounting bracket.
33. Remove the front suspension member bolts. Refer to [FSU-12. "Exploded View"](#).
34. Lower the engine and transaxle assembly on the front suspension member from the engine compartment using Tool.

### CAUTION:

- Before and during this procedure, always check if any harnesses are left connected.
- Avoid any damage to, or any oil/grease smearing or spills onto the engine mounting insulators.

**Tool number** : — (J-47242)

35. Remove the engine and transaxle assembly from the front suspension member.
  - Remove front engine mounting insulator nut.
  - Remove LH engine mounting insulator nut.
36. Separate the engine from the transaxle. Refer to [TM-35. "Removal and Installation"](#).

## INSTALLATION

Installation is in the reverse order of removal.

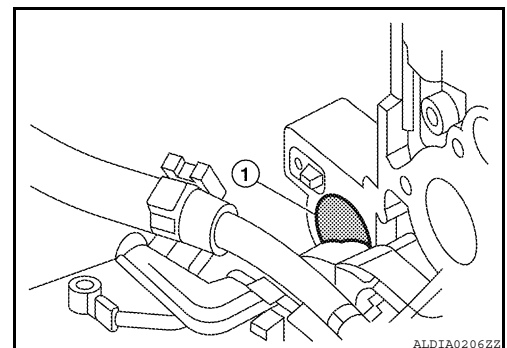
- Be sure the grommet (1) is installed flush with the flange plane as shown prior to mating the engine and transaxle.

### CAUTION:

**Do not use lubricating oil for lubricant.**

### NOTE:

Be careful that the edge does not protrude from the socket.



- Do not allow oil to get on mounting insulators. Be careful not to damage mounting insulators.

# ENGINE ASSEMBLY

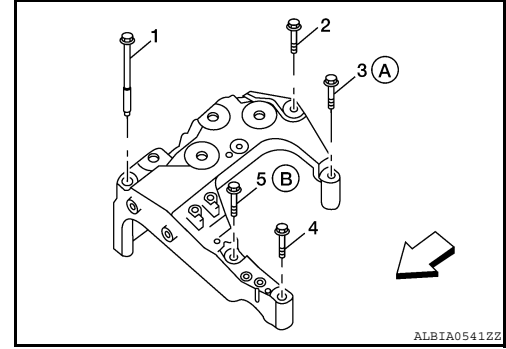
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## < REMOVAL AND INSTALLATION >

- If parts have a direction mark (arrow) this indicates front of the vehicle, and the parts must be installed according to the identification mark.
- Install the RH engine mounting bracket bolts in the following steps:
  - First install bolts (A) and (B) loosely.
  - Install and tighten the five RH engine mounting bracket bolts to specification in the order as shown.

**RH engine mounting bracket bolt : 48.2 N·m (4.9 kg·m, 36 ft-lb)**

- ⇐: Front



## INSPECTION AFTER INSTALLATION

- Before starting the hybrid system, check oil/fluid levels including hybrid system coolant and hybrid system oil. If less than required quantity, fill to the specified level. Refer to [MA-11, "Fluids and Lubricants"](#).
- Use procedure below to check for fuel leakage.
  - Turn ignition switch ON (with hybrid system stopped). With fuel pressure applied to fuel piping, check for fuel leakage at connection points.
  - Start the hybrid system. With engine speed increased, check again for fuel leakage at connection points.
  - Run hybrid system to check for unusual noise and vibration.
  - Warm up hybrid system thoroughly to make sure there is no leakage of fuel, exhaust gas, or any oils/fluids including hybrid system oil and hybrid system coolant.
- Bleed air from passages in lines and hoses, such as in cooling system.
- After cooling down hybrid system, again check oils/fluids including hybrid system oil and hybrid system coolant. Refill to specified level, if necessary.
- Summary of the inspection items:

Item	Before starting engine	Engine running	After engine stopped
Hybrid system coolant	Level	Leakage	Level
Hybrid system oil	Level	Leakage	Level
Other oils and fluids*	Level	Leakage	Level
Fuel	Leakage	Leakage	Leakage
Exhaust gas	—	Leakage	—

\*Transaxle/CVT fluid, brake fluid, etc.

# CYLINDER BLOCK

< DISASSEMBLY AND ASSEMBLY >

[QR25DE]

## DISASSEMBLY AND ASSEMBLY

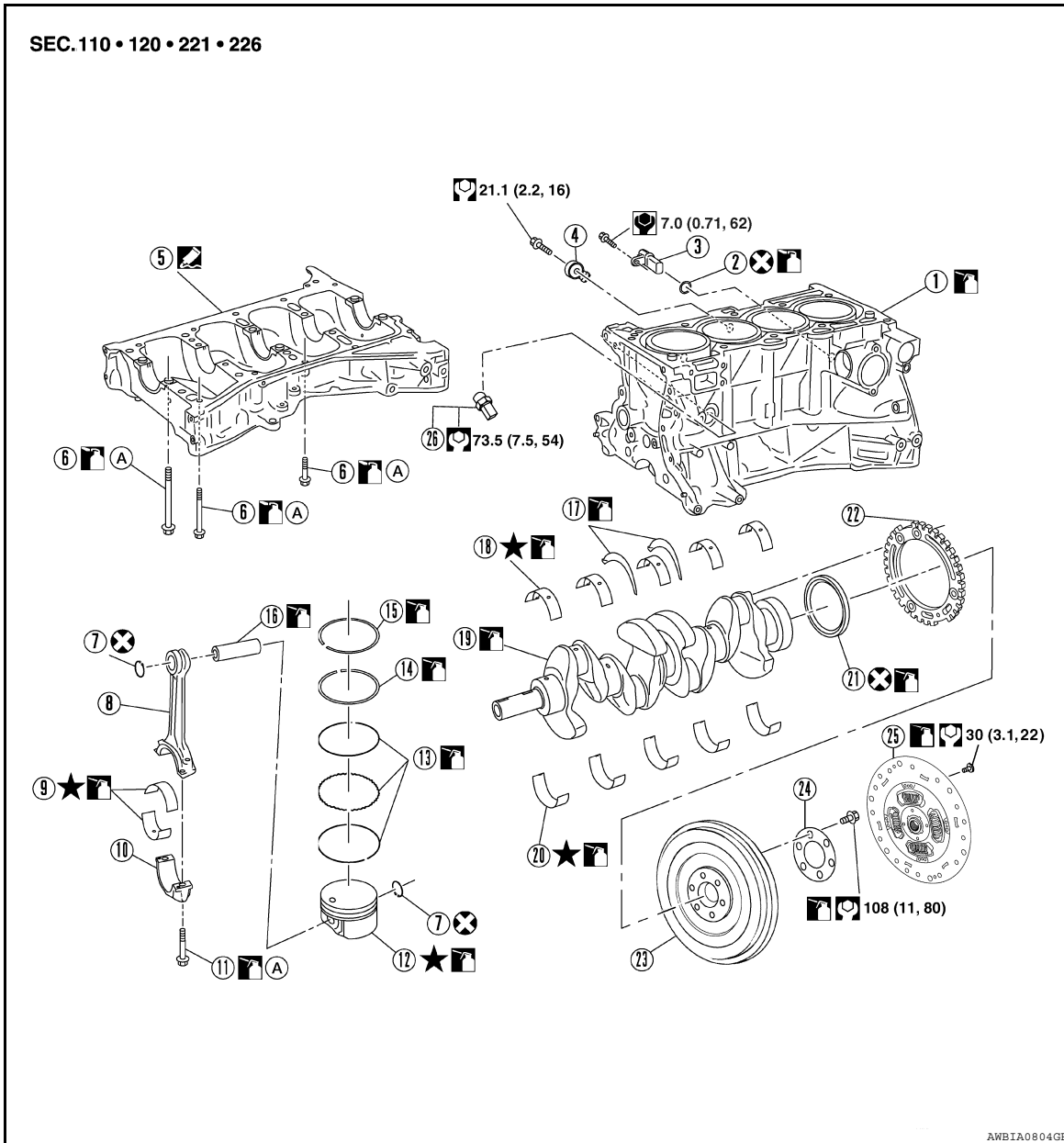
### CYLINDER BLOCK

#### Disassembly and Assembly

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- |                                |   |                                     |
|--------------------------------|---|-------------------------------------|
| 1. Cylinder block              | 2. O-ring                               | 3. Crankshaft position sensor (POS) |
| 4. Knock sensor                | 5. Lower cylinder block                 | 6. Lower cylinder block bolt        |
| 7. Snap ring                   | 8. Connecting rod                       | 9. Connecting rod bearing           |
| 10. Connecting rod bearing cap | 11. Connecting rod bearing cap bolt     | 12. Piston                          |
| 13. Oil ring                   | 14. Second ring                         | 15. Top ring                        |
| 16. Piston pin                 | 17. Main thrust bearing                 | 18. Main bearing upper              |
| 19. Crankshaft                 | 20. Main bearing lower                  | 21. Crankshaft rear oil seal        |
| 22. Crankshaft signal plate    | 23. Flywheel                            | 24. Reinforcement plate             |
| 25. Flywheel damper            | 26. Cylinder block heater (if equipped) | A. Follow installation procedure    |

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# CYLINDER BLOCK

< DISASSEMBLY AND ASSEMBLY >

[QR25DE]

## CAUTION:

Apply new engine oil to parts marked in illustration before installation.

## DISASSEMBLY

1. Remove the engine and transaxle as an assembly from the vehicle, and separate the transaxle from the engine. Refer to [EM-71, "Removal and Installation"](#).
2. Mount the engine on a suitable engine stand.
3. Drain any remaining engine oil and coolant from the engine.
4. Remove the following components and associated parts.
  - Exhaust manifold and three way catalyst assembly. Refer to [EM-29, "Removal and Installation"](#).
  - Intake manifold collector. Refer to [EM-25, "Removal and Installation"](#).
  - Intake manifold and fuel tube assembly. Refer to [EM-25, "Removal and Installation"](#).
  - Ignition coils. Refer to [EM-34, "Removal and Installation"](#).
  - Rocker cover. Refer to [EM-38, "Removal and Installation"](#).
  - Front cover, timing chain, and balancer unit. Refer to [EM-51, "Removal and Installation"](#).
  - Cylinder head. Refer to [EM-62, "Removal and Installation"](#).

5. Remove the knock sensor.

## CAUTION:

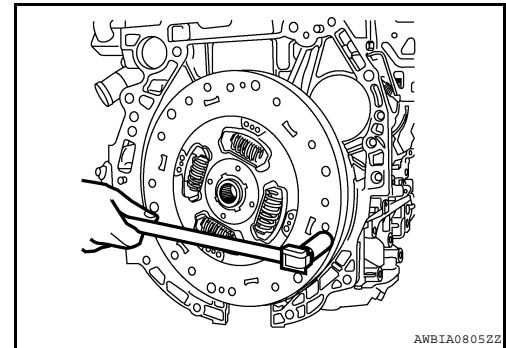
Carefully handle the sensor and do not drop the sensor.

6. Remove crankshaft position sensor (POS).

## CAUTION:

- Avoid impacts such as a dropping.
- Do not disassemble.
- Keep it away from metal particles.
- Do not place sensor close to magnetic materials.

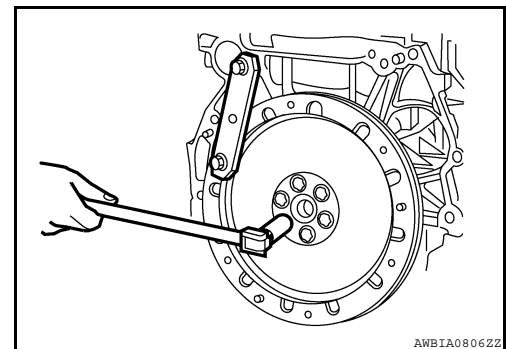
7. Remove the flywheel damper bolts using suitable tool and remove flywheel damper.



8. Remove the flywheel. Hold the crankshaft with a stopper plate and use a suitable tool to remove the bolts.

## CAUTION:

- Be careful not to damage the flywheel contact surface for the clutch disc.

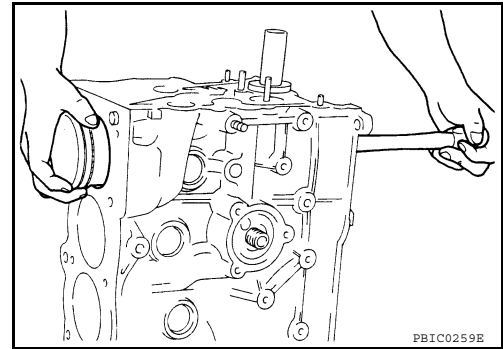


# CYLINDER BLOCK

## < DISASSEMBLY AND ASSEMBLY >

[QR25DE]

9. Remove the piston and connecting rod assemblies.
  - a. Position the crankshaft and corresponding connecting rod, to be removed, to the bottom dead center stroke.
  - b. Remove the connecting rod cap. Number the cap so it can be assembled in the same position.
  - c. Using a hammer handle or similar tool, push the piston and connecting rod assembly out of the top of the cylinder block. Number the piston and rod so it can be assembled in the same position.
    - Before removing the piston and connecting rod assembly, check the connecting rod side clearance. Refer to [EM-84, "Inspection After Disassembly"](#).



10. Remove the connecting rod bearings. If reusing, number them so they can be assembled in the same position and direction.

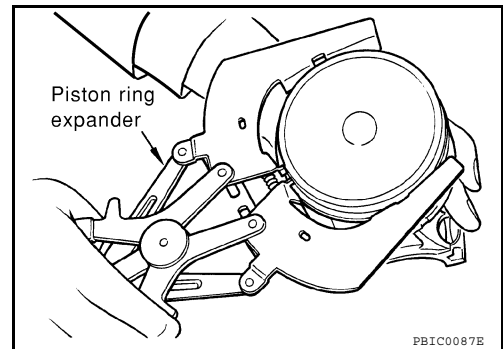
**CAUTION:**

- When removing them, note the installation position. Keep them in the correct order.

11. Remove the piston rings from the piston.
  - Use a piston ring expander.
  - Before removing the piston rings, check the piston ring side clearance. Refer to [EM-84, "Inspection After Disassembly"](#).

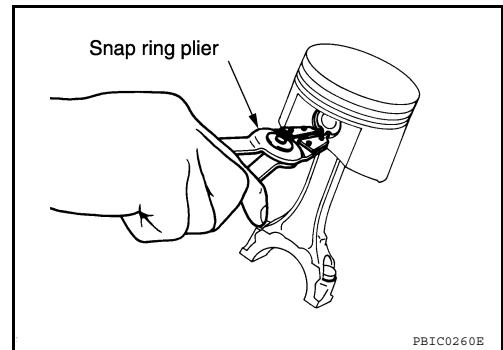
**CAUTION:**

- When removing the piston rings, be careful not to damage the piston.
- Be careful not to damage piston rings by expanding them excessively, if reusing them.

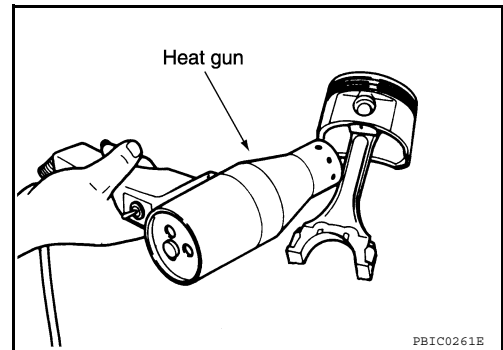


12. Remove the piston from the connecting rod as follows.

- a. Using a snap ring pliers, remove the two snap rings.



- b. Heat the piston to 60° - 70°C (140° - 158°F) with a heat gun, or equivalent.

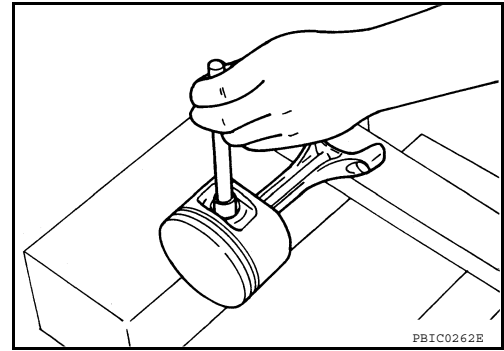


# CYLINDER BLOCK

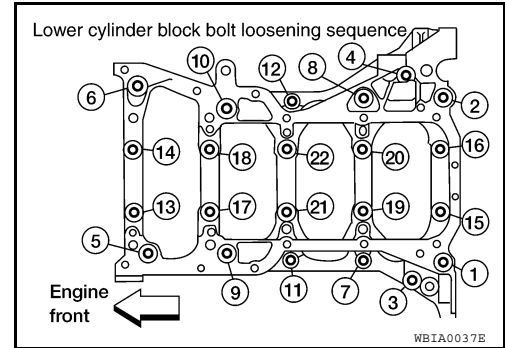
## < DISASSEMBLY AND ASSEMBLY >

[QR25DE]

- c. Push out piston pin with a punch of an outer diameter of approximately 19 mm (0.75 in).



13. Remove the lower cylinder block bolts.
- Before loosening the lower cylinder block bolts, measure the crankshaft side clearance. Refer to [EM-84, "Inspection After Disassembly"](#).
  - Loosen them in the order as shown to remove them.

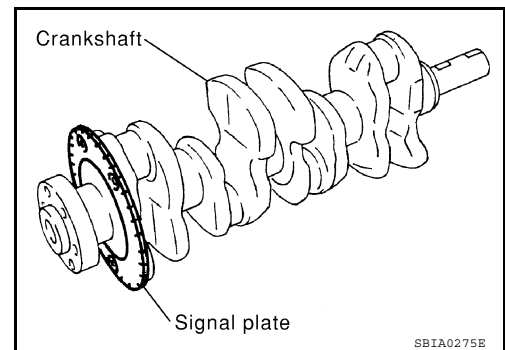


14. Remove the lower cylinder block.
- Cut the Silicone RTV Sealant and remove the lower cylinder block from the cylinder block, using Tool.

**Seal cutter**    **KV10111100 (J-37228)**

**CAUTION:**  
Be careful not to damage the mating surface.

15. Remove the crankshaft.
- CAUTION:**
- Do not damage or deform the signal plate while mounted on the crankshaft.
  - When setting the crankshaft on a flat surface, use a block of wood to avoid interference between the signal plate and the surface.
  - Do not remove signal plate unless it is necessary.



16. Pull the rear oil seal out of the rear end of the crankshaft.
- CAUTION:**  
Do not to damage the crankshaft or cylinder block when removing the rear oil seal.
- NOTE:**  
When replacing the rear oil seal without removing the cylinder block, use a screwdriver to pull it out from between crankshaft and block.
17. Remove the main bearings and thrust bearings from the cylinder block and lower cylinder block.
- CAUTION:**  
Identify and number the bearings, if reusing them, so that they are assembled in the same position and direction.

## ASSEMBLY

1. Using compressed air, clean out the coolant and oil passages in the cylinder block, the cylinder bore and the crankcase to remove any foreign material.

**WARNING:**

# CYLINDER BLOCK

< DISASSEMBLY AND ASSEMBLY >

[QR25DE]

**Use approved safety glasses to protect your eyes.**

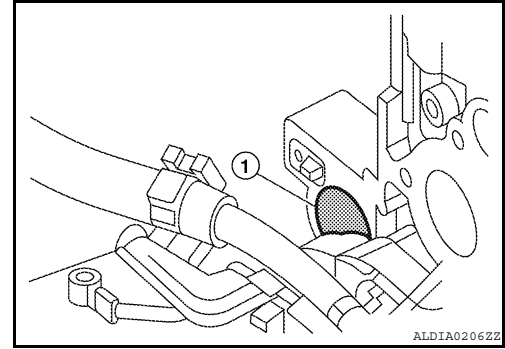
- Be sure the grommet (1) is installed flush with the flange plane as shown prior to mating the engine and transaxle.

**CAUTION:**

**Do not use lubricating oil for lubricant.**

**NOTE:**

Be careful that the edge does not protrude from the socket.



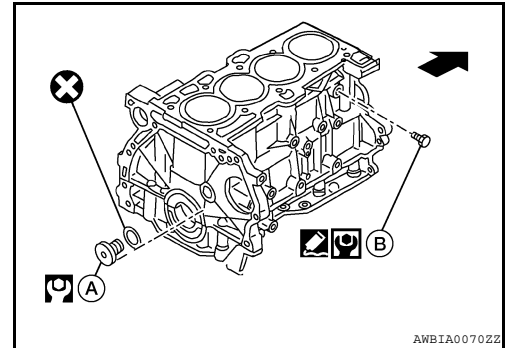
- Install the drain plugs on the cylinder block.

**Drain plug torque**

**Drain plug A : 53.9 N·m (5.5 kg·m, 40.0 ft·lb)**

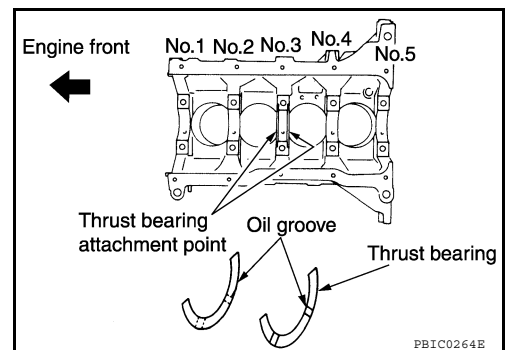
**Drain plug B : 9.8 N·m (1.0 mm, 87 in·lb)**

- Apply Silicone RTV Sealant.
- Use Genuine Silicone RTV Sealant, or equivalent. Refer to [GI-15. "Recommended Chemical Products and Sealants"](#).**
- Replace the copper washers with new ones.
- ↔: Front



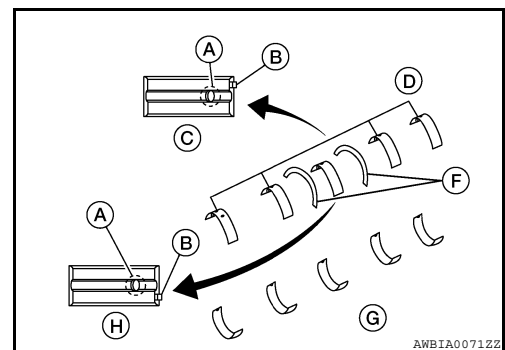
- Install the main bearings and the thrust bearings.

- Remove dust, dirt, and oil from the bearing mating surfaces of the cylinder block and lower cylinder block.
- Install the thrust bearings to both sides of the No. 3 main bearing journal on the cylinder block.
  - Install the thrust bearings with the oil groove facing the crankshaft arm (outside).



- Install the main bearings (D, G) paying attention to their position and direction.

- The main bearing (C) with an oil hole and groove goes on the cylinder block. The main bearing (H) without them goes on the lower cylinder block.
- Only the main bearing (D) (on the cylinder block) for No. 3 journal has different specifications.
- Before installing the bearings, apply engine oil to the bearing friction surface (inside). Do not apply oil to the back surface, but thoroughly clean it.
- When installing, align the bearing stopper (B) to the notch.
- Make sure that the oil holes on the cylinder block and those on the corresponding bearing (A) are aligned.



# CYLINDER BLOCK

[QR25DE]

## < DISASSEMBLY AND ASSEMBLY >

5. Install the signal plate to the crankshaft.
  - a. Position the crankshaft and signal plate using a positioning dowel pin, and tighten the bolts to specification.
  - b. Remove the dowel pin.

**CAUTION:**

**Be sure to remove dowel pin before installing the crankshaft.**

**NOTE:**

Dowel pins for the crankshaft and signal plate are supplied as a set for each.

6. Install the crankshaft onto the cylinder block.
  - While turning the crankshaft by hand, check that it turns smoothly.
7. Install the lower cylinder block.

**Dimension A** : 3.5 - 4.0 mm (0.138 - 1.157 in)

**Dimension B** : Apply to end

- Apply Silicone RTV Sealant to positions as shown.
- Use Genuine Silicone RTV Sealant, or equivalent. Refer to [GL-15. "Recommended Chemical Products and Sealants"](#).

**CAUTION:**

**After the Silicone RTV Sealant is applied, the lower cylinder block installation must be finished within 5 minutes.**

**NOTE:**

Cylinder block and lower cylinder block are machined together. Neither of them can be replaced separately.

8. Tighten lower cylinder block bolts in the numerical order as shown and according to the following steps:
  - a. Apply new engine oil to threads and seat surfaces of the bolts.
  - b. Tighten bolts No. 11 - 22 only in the order as shown, to specification below.

**Step 1, bolts 11 - 22 only** : 25.1 N·m (2.6 kg·m, 19 ft·lb)

- c. Tighten bolts No. 1 - 10 only in the order as shown, to specification below.

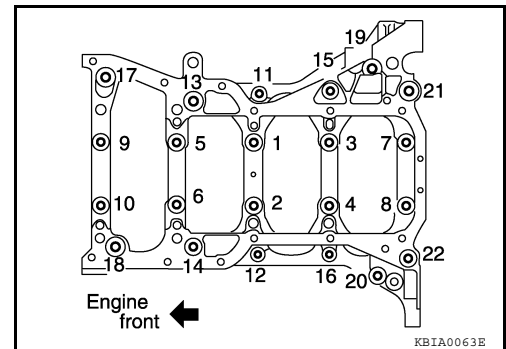
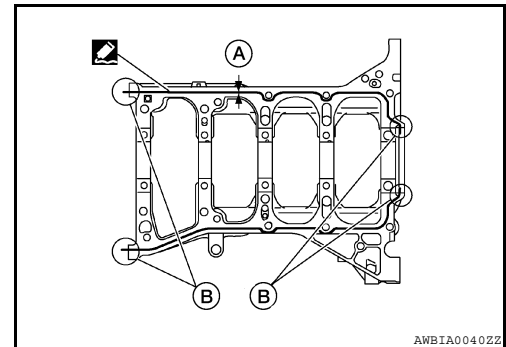
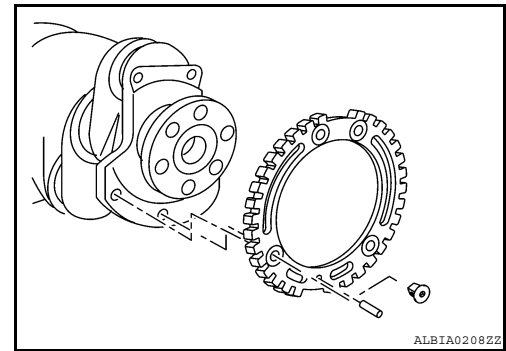
**Step 2, bolts 1 - 10 only** : 39.2 N·m (4.0 kg·m, 29 ft·lb)

- d. Tighten bolts No. 1 - 10 only in the order as shown, to specification below.

**Step 3, bolts 1 - 10 only** : 60° degrees rotation

**Tool number** : KV 10112100 (BT-8653-A)

**CAUTION:**





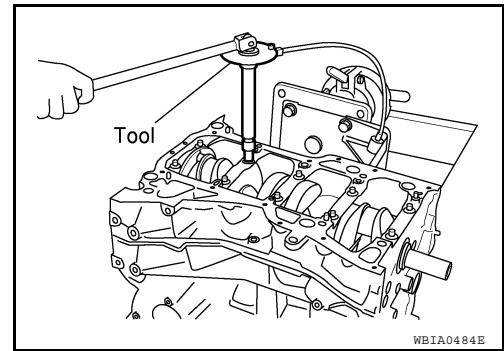
# CYLINDER BLOCK

< DISASSEMBLY AND ASSEMBLY >

[QR25DE]

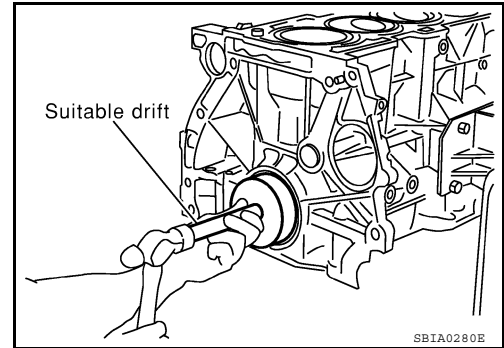
**Check tightening angle. Do not make judgment by visual inspection.**

- Wipe off completely any protruding Silicone RTV Sealant on rear oil seal installation surface and the exterior of engine.
- Check crankshaft side clearance. Refer to [EM-84, "Inspection After Disassembly"](#).
- After installing the bolts, make sure that the crankshaft can be rotated smoothly by hand.

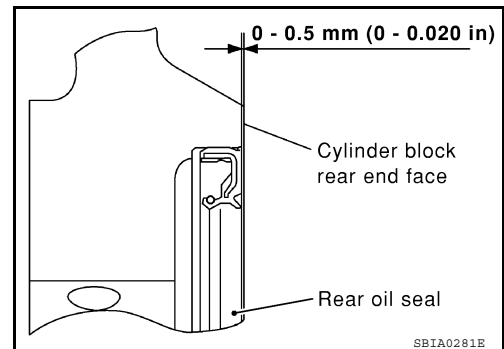


9. Install the rear oil seal.

- Press the oil seal between cylinder block and crankshaft with a suitable drift.
- Be careful not to touch the grease on the oil seal lip.
- Be careful not to cause scratches or burrs when pressing in the rear oil seal.

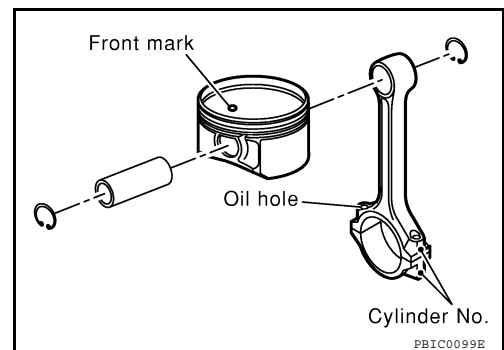


- Press in rear oil seal to the position as shown.



10. Install the piston to the connecting rod. Assemble the components in their original positions.

- Using a snap ring pliers, install the snap ring to the grooves of the piston's rear side.
  - Insert the piston pin snap ring fully into groove.
- Install the piston to the connecting rod.
  - Using a heat gun, heat the piston [approximately 60° - 70 C° (140° - 158 °F)] until the piston pin can be pushed in by hand without excessive force. From the front to the rear, insert the piston pin into the piston and the connecting rod.
  - Assemble so that the front mark on the piston crown and the oil holes and the cylinder No. on the connecting rod are positioned as shown.
- Install the piston pin snap ring into the front of the piston.
  - Check that the connecting rod moves smoothly.



# CYLINDER BLOCK

[QR25DE]

## < DISASSEMBLY AND ASSEMBLY >

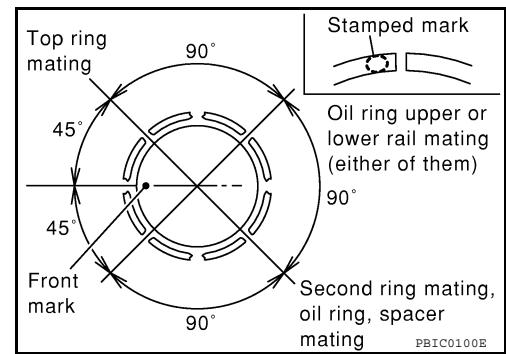
11. Using a piston ring expander, install the piston rings. Assemble the components in their original positions.

**CAUTION:**

**Be careful not to damage the piston.**

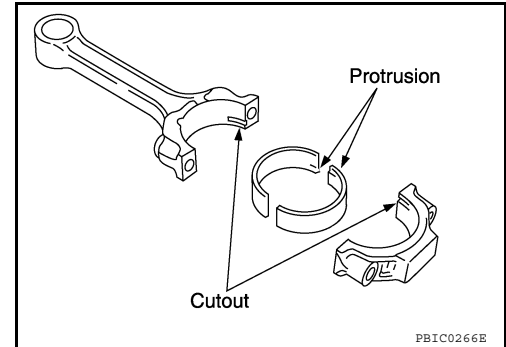
- Position each ring with the gap as shown, referencing the piston front mark as the starting point.
- Install the top ring and the second ring with the stamped surface facing upward.

**Stamped mark** : 1K (top ring)  
: 2K (second ring)



12. Install the connecting rod bearings to the connecting rod and the connecting rod cap. Assemble the components in their original positions.

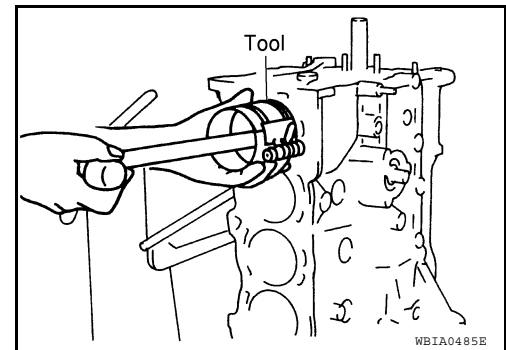
- When installing the connecting rod bearings, apply engine oil to the bearing friction surface (inside). Do not apply oil to the back surface, but thoroughly clean the back.
- When installing, align the connecting rod bearing stopper protrusion with the notch of the connecting rod to install.
- Check the oil holes on the connecting rod and those on the corresponding bearing are aligned.



13. Install the piston and connecting rod assembly to the crankshaft. Assemble the components in their original positions.

**Tool number** : EM03470000 (J-8037)

- Rotate the crankshaft so the pin corresponding to the connecting rod to be installed is at the bottom dead center position.
- Apply engine oil sufficiently to the cylinder bore, piston, and crankshaft pin.
- Match the cylinder position number with the cylinder No. on the connecting rod for installation.
- Install the piston with the front mark on the piston crown facing the front of the engine using Tool.

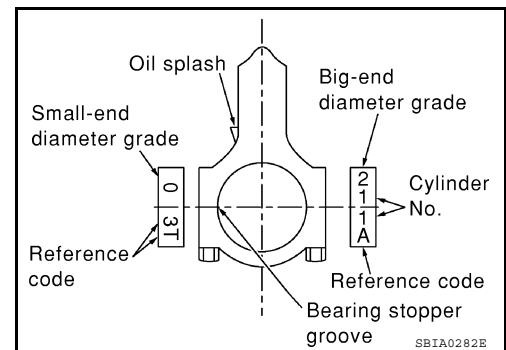


**CAUTION:**

**Be careful not to damage the crankshaft pin, resulting from an interference of the connecting rod big end.**

14. Install the connecting rod caps. Assemble the components in their original positions.

- Match the stamped cylinder number marks on the connecting rod with those on the cap to install.



# CYLINDER BLOCK

< DISASSEMBLY AND ASSEMBLY >

[QR25DE]

15. Tighten the connecting rod bolt using Tool as follows:  
Apply engine oil to the threads and seats of the connecting rod bolts.

**CAUTION:**

Check tightening angle. Do not make judgment by visual inspection.

Tool number : KV10112100 (BT-8653-A)

Step 1 : 29.4 N·m (3.0 kg-m, 22 ft-lb)

Step 2 : 0 N·m

Step 3 : 19.6 N·m (2.0 kg-m, 14 ft-lb)

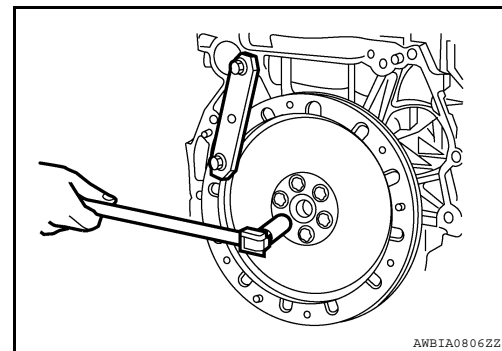
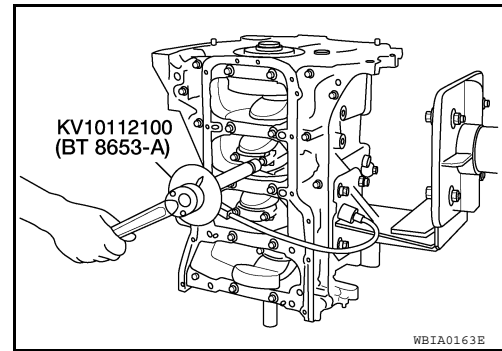
Step 4 : Rotate bolts  $90^\circ + 0.5^\circ$

- Check the connecting rod side clearance. Refer to [EM-84. "Inspection After Disassembly"](#).
- After tightening the bolts, make sure that the crankshaft rotates smoothly.

16. Install the flywheel. Hold the crankshaft with a stopper plate and use a suitable tool to install the flywheel bolts. Tighten to specification.

**CAUTION:**

- Be careful not to damage the flywheel contact surface for the clutch disc.

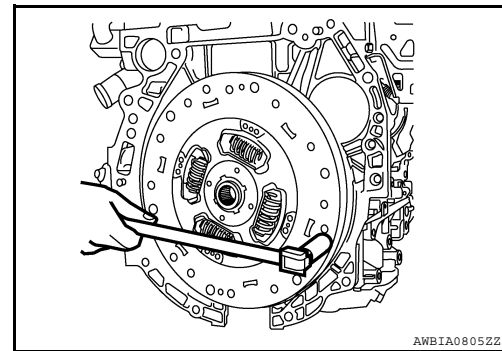


17. Install the reinforcement plate.

**NOTE:**

Be sure to install the reinforcement plate with the rounded side facing the flywheel damper.

18. Install the flywheel damper and the flywheel damper bolts using suitable tool. Tighten to specification.



19. Install the knock sensor.

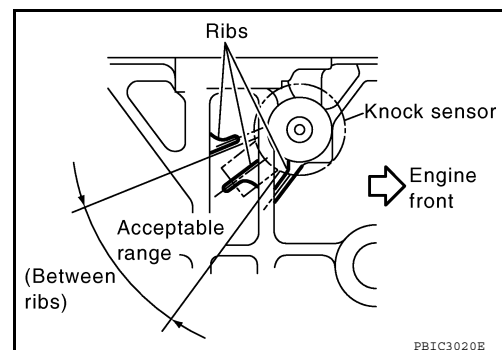
- Make sure that there is no foreign material on the cylinder block mating surface and the back surface of the knock sensor.
- Install the knock sensor with the connector facing lower left by  $45^\circ$  as shown.
- Do not tighten the bolts while holding the connector.
- Make sure that the knock sensor does not interfere with other parts.

**CAUTION:**

If the knock sensor is dropped, replace it with new one.

20. Install the crankshaft position sensor (POS).

21. Installation of remaining components is in the reverse order of removal.



# CYLINDER BLOCK

< DISASSEMBLY AND ASSEMBLY >

[QR25DE]

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## Inspection After Disassembly

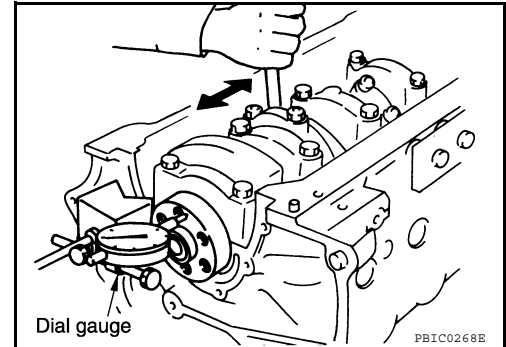
### CRANKSHAFT SIDE CLEARANCE

- Using a dial gauge, measure the clearance between the thrust bearings and the crankshaft arm when the crankshaft is moved fully forward or backward.

**Standard : 0.10 - 0.26 mm (0.0039 - 0.0102 in)**

**Limit : 0.30 mm (0.0118 in)**

- If the measured value exceeds the limit, replace the thrust bearings, and measure again. If it still exceeds the limit, replace the crankshaft.



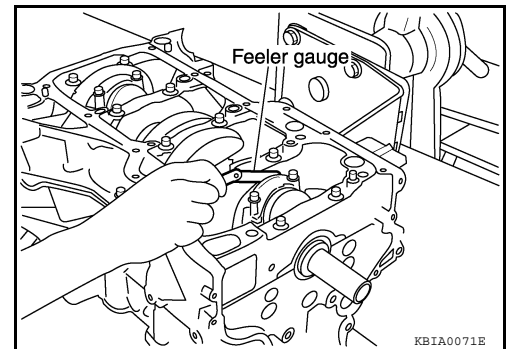
### CONNECTING ROD SIDE CLEARANCE

- Measure side clearance between connecting rod and crankshaft arm using a feeler gauge.

**Standard : 0.20 - 0.35 mm (0.0079 - 0.0138 in)**

**Limit : 0.50 mm (0.0197 in)**

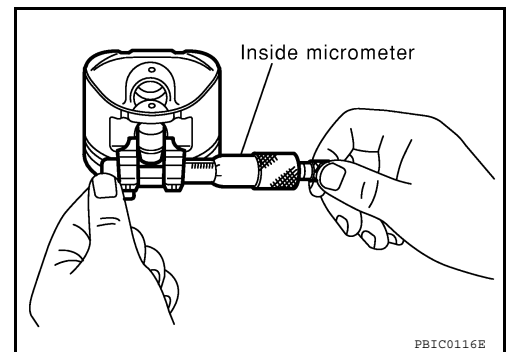
- If the measured value exceeds the limit, replace the connecting rod bearings, and measure again. If it still exceeds the limit, replace the crankshaft also.



### PISTON AND PISTON PIN CLEARANCE

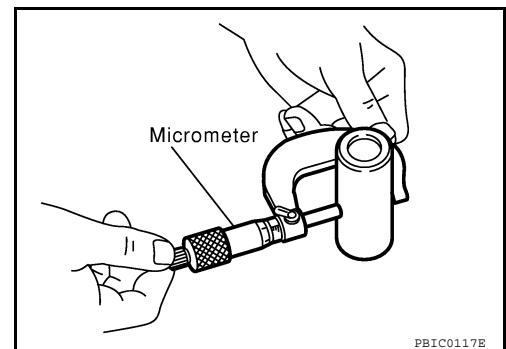
#### Diameter of Piston Pin Bore

- Measure the diameter of piston pin bore using an inside micrometer. Refer to [EM-98, "Standard and Limit"](#).



#### Outer Diameter of Piston Pin

- Measure outer diameter of piston pin using a micrometer. Refer to [EM-98, "Standard and Limit"](#).



#### Piston to Piston Pin Clearance

(Piston pin clearance) = (Piston pin bore diameter) – (Outer diameter of piston pin)

# CYLINDER BLOCK

[QR25DE]

## < DISASSEMBLY AND ASSEMBLY >

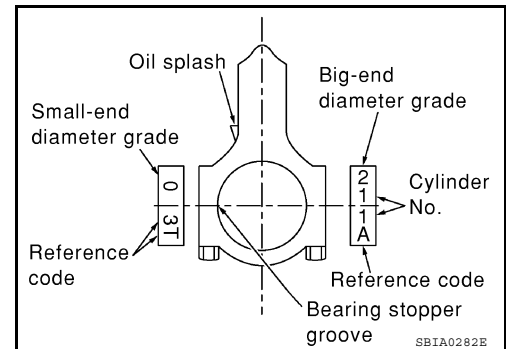
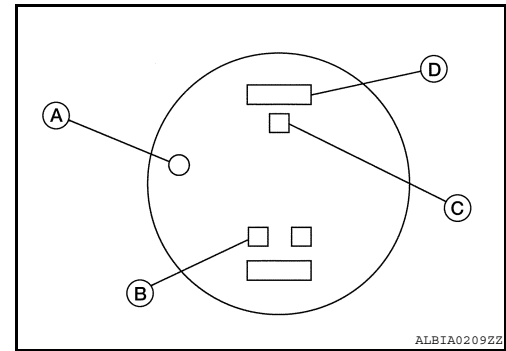
- A: Front mark
- B: Piston pin bore grade
- C: Piston grade I.D. stamp
- D: Piston crown I.D. code stamp

**Standard : 0.002 - 0.006 mm (0.0001 - 0.0002 in)**

- If clearance exceeds specification, replace either or both of piston/piston pin assembly and connecting rod assembly with reference to specification of each parts.
- Use the piston selection table to replace piston/piston pin assembly. Refer to [EM-92, "How to Select Piston and Bearing"](#).
- Use the connecting rod bearing selection table to replace connecting rod. Refer to [EM-92, "How to Select Piston and Bearing"](#).

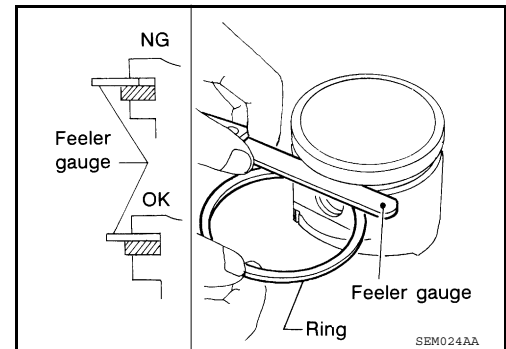
### NOTE:

- The connecting rod small end grade and piston pin hole (piston pin) grade are provided only for the parts installed at the plant. For service parts, no grades can be selected. Only 0 grade is available.
- Follow the "CONNECTING ROD BUSHING OIL CLEARANCE (SMALL END)" procedure for the values for each grade at the plant.



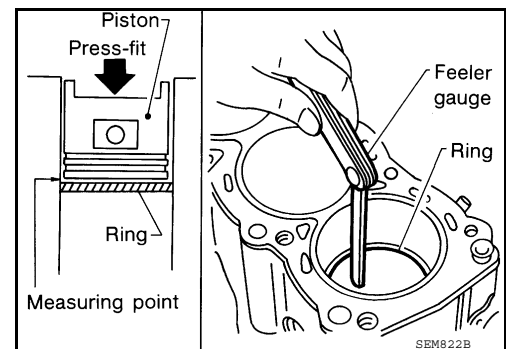
## PISTON RING SIDE CLEARANCE

- Measure side clearance of piston ring and piston ring groove using a feeler gauge. Refer to [EM-98, "Standard and Limit"](#).
- If out of specification, replace piston and/or piston ring assembly.



## PISTON RING END GAP

- Check if inner diameter of cylinder bore is within specification. Follow the "PISTON TO CYLINDER BORE CLEARANCE".
- Insert piston ring until middle of cylinder with piston, and measure gap using a feeler gauge. Refer to [EM-98, "Standard and Limit"](#).
- If out of specification, replace piston ring.



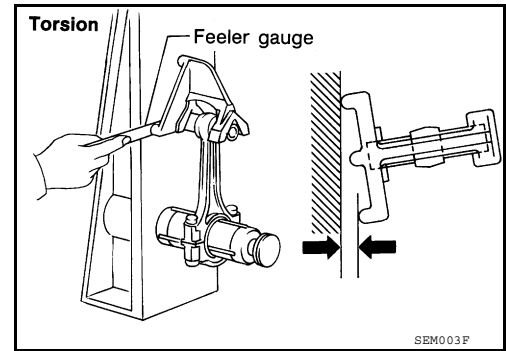
## CONNECTING ROD BEND AND TORSION

# CYLINDER BLOCK

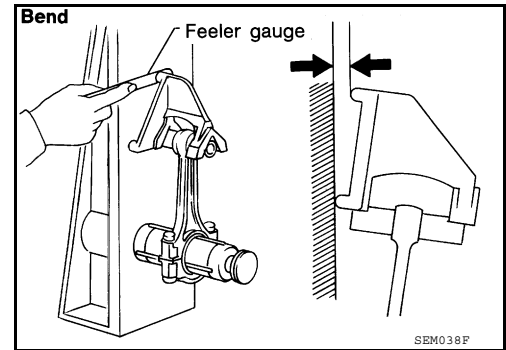
[QR25DE]

## < DISASSEMBLY AND ASSEMBLY >

- Check with connecting rod aligner. Refer to [EM-98. "Standard and Limit"](#).

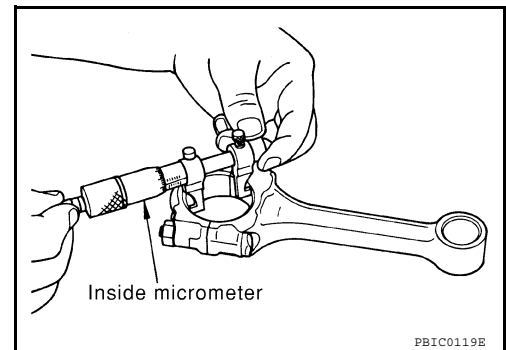


- If it exceeds the limit, replace connecting rod assembly.



## CONNECTING ROD BEARING (BIG END)

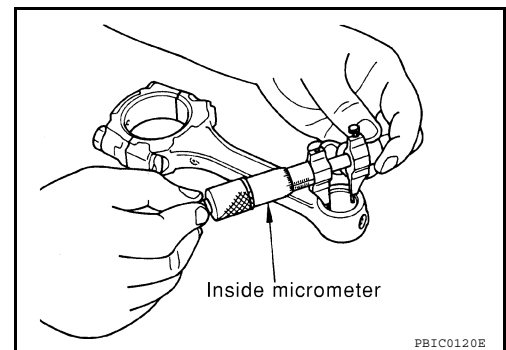
- Install the connecting rod cap without the connecting rod bearing installed. After tightening the connecting rod bolt to the specified torque, measure the connecting rod big end inner diameter using an inside micrometer. Refer to [EM-98. "Standard and Limit"](#).



## CONNECTING ROD BUSHING OIL CLEARANCE (SMALL END)

### Inner Diameter of Connecting Rod (Small End)

- Measure inner diameter of bushing. Refer to [EM-98. "Standard and Limit"](#)



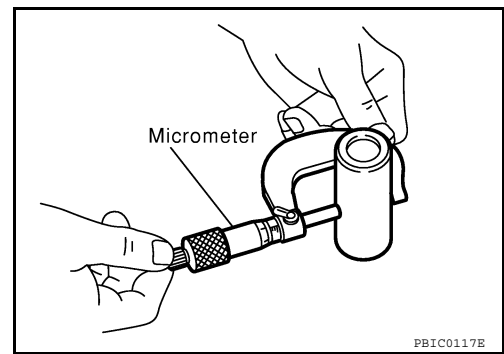
### Outer Diameter of Piston Pin

# CYLINDER BLOCK

< DISASSEMBLY AND ASSEMBLY >

[QR25DE]

- Measure outer diameter of piston pin. Refer to [EM-98. "Standard and Limit"](#).



Connecting Rod Bushing Oil Clearance (Small End)  
 (Connecting rod small end oil clearance) = (Inner diameter of connecting rod small end) – (Outer diameter of piston pin)

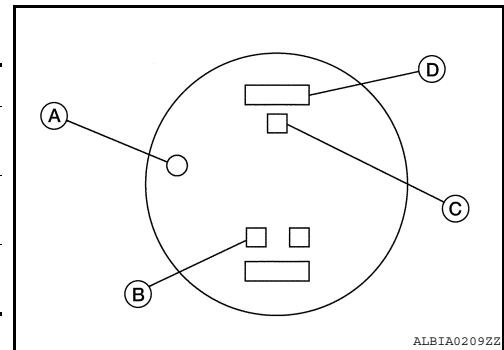
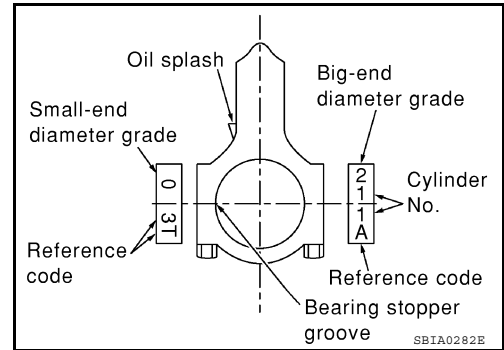
**Standard : 0.005 - 0.017 mm (0.0002 - 0.0007 in)**

- If the measured value exceeds the standard, replace the connecting rod assembly and/or piston and piston pin assembly.
- If replacing the piston and piston pin assembly, use the "Piston Selection Table" to select the piston corresponding to the applicable bore grade of the cylinder block to be used. Refer to [EM-92. "How to Select Piston and Bearing"](#).

### Factory Installed Parts Grading:

- Service parts apply only to piston pin grade 0 (B).

Piston Pin Grade (B)	Unit: mm (in)	
	0	1
Connecting rod small end inner diameter	20.000 - 20.006 (0.7874 - 0.7876)	20.006 - 20.012 (0.7876 - 0.7879)
Piston pin outer diameter	19.989 - 19.995 (0.7870 - 0.7872)	19.995 - 20.001 (0.7872 - 0.7874)
Piston pin bore diameter	19.993 - 19.999 (0.7871 - 0.7874)	19.999 - 20.005 (0.7874 - 0.7876)



- A: Front mark
- C: Piston grade I.D. stamp
- D: Piston crown I.D. code stamp

### CYLINDER BLOCK DISTORTION

- Using a scraper, remove gasket on the cylinder block surface, and also remove oil, scale, carbon, or other contamination.

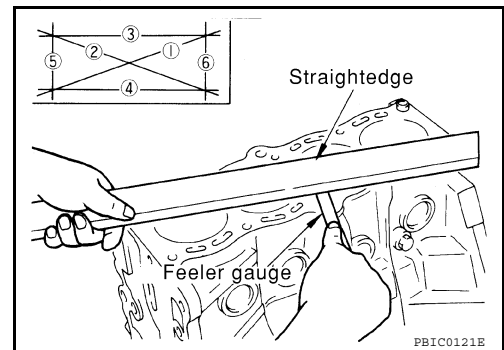
#### CAUTION:

**Be careful not to allow gasket debris to enter the oil or coolant passages.**

- Measure the distortion on the block upper face at some different points in 6 directions.

**Limit : 0.1 mm (0.004 in)**

- If out of the distortion limit, replace the cylinder block and lower block they are machined together as an assembly.



### INNER DIAMETER OF MAIN BEARING HOUSING

- Install the main bearing caps with the main bearings removed and tighten the bolts to the specified torque. Refer to [EM-75. "Disassembly and Assembly"](#).

# CYLINDER BLOCK

[QR25DE]

## < DISASSEMBLY AND ASSEMBLY >

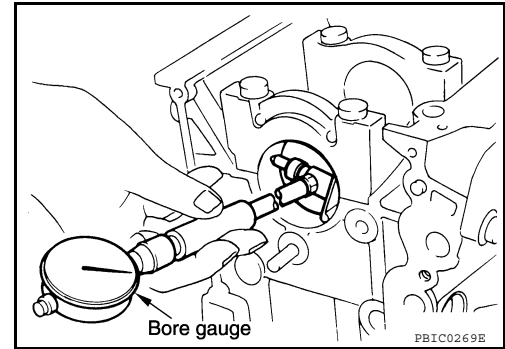
- Using a bore gauge, measure the inner diameter of the main bearing housing.

**Standard** : 58.944 - 58.967 mm (2.3206 - 2.3215 in)

- If out of the standard, replace the cylinder block and lower cylinder block assembly.

**NOTE:**

These components cannot be replaced as a single unit because they were processed together.



## PISTON TO CYLINDER BORE CLEARANCE

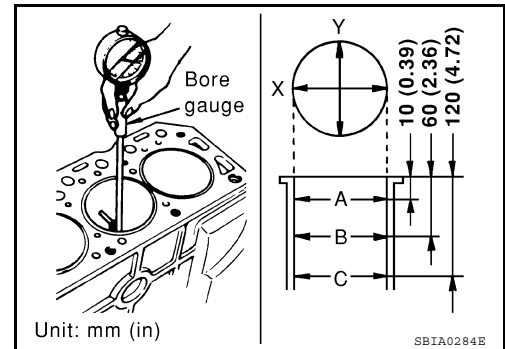
### Inner Diameter of Cylinder Bore

- Using a bore gauge, measure cylinder bore for wear, out-of-round and taper at 6 different points on each cylinder. (X and Y directions at A, B and C). The Y axis is in the longitudinal direction of the engine.

**NOTE:**

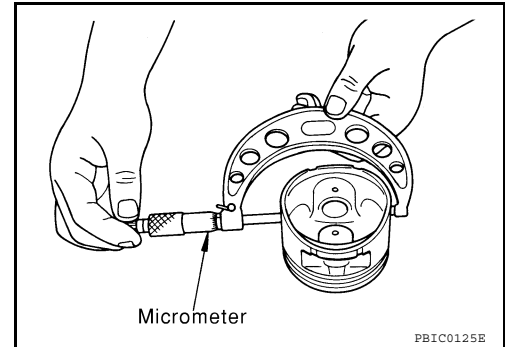
When determining cylinder bore grade, measure cylinder bore at B position. Refer to [EM-98, "Standard and Limit"](#).

- If there are scratches and/or seizure on the cylinder inner wall, hone the inner wall.



### Outer Diameter of Piston

- Measure piston skirt diameter using a micrometer. Refer to [EM-98, "Standard and Limit"](#).
- Measuring point (distance from the top): 37.5 mm (1.476 in)



### Piston to Cylinder Bore Clearance

- Calculate by outer diameter of piston skirt and inner diameter of cylinder (direction X, position B).  
(Clearance) = (Inner diameter of cylinder) – (Outer diameter of piston skirt).

**Standard** : 0.010 - 0.030 mm (0.0004 - 0.0012 in)

**Limit** : 0.08 mm (0.0031 in)

- If it exceeds the limit, replace piston/piston pin assembly.

### Reboring Cylinder Bore

- Cylinder bore size is determined by adding piston-to-bore clearance to piston diameter "A".

**Rebored size calculation:  $D = A + B - C$**

**D: Bored diameter**

**A: Piston diameter as measured**

**B: Piston-to-bore clearance (standard value)**

**C: Honing allowance 0.02 mm (0.0008 in)**



# CYLINDER BLOCK

< DISASSEMBLY AND ASSEMBLY >

[QR25DE]

2. Install lower cylinder block, and tighten to the specified torque. Otherwise, cylinder bores may be distorted in final assembly.
3. Cut cylinder bores.
  - **When any cylinder needs boring, all other cylinders must also be bored.**
  - **Do not cut too much out of cylinder bore at a time. Cut only 0.05 mm (0.0020 in) or so in diameter at a time.**
- 4.hone cylinders to obtain specified piston-to-bore clearance.
5. Measure finished cylinder bore for out-of-round and taper.
  - **Measurement should be done after cylinder bore cools down.**

## OUTER DIAMETER OF CRANKSHAFT JOURNAL

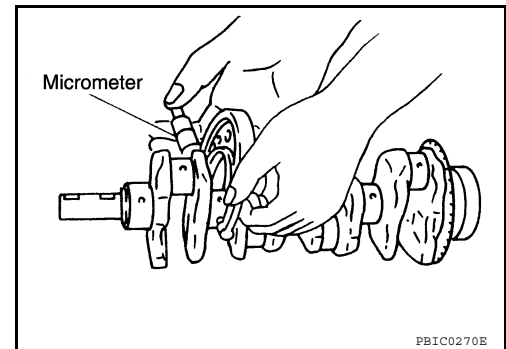
- Measure outer diameter of crankshaft journals.

**Standard : 54.955 - 54.979 mm (2.1636 - 2.1645 in)**

## OUTER DIAMETER OF CRANKSHAFT PIN

- Measure outer diameter of crankshaft pin.

**Standard : 44.956 - 44.974 mm (1.7699 - 1.7706 in)**



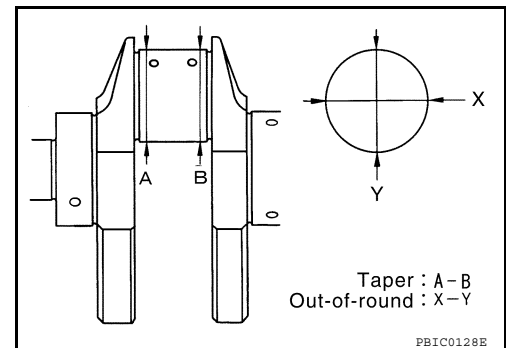
## OUT-OF-ROUND AND TAPER OF CRANKSHAFT

- Measure the dimensions at four different points as shown on each journal and pin using a micrometer.
- Out-of-round is indicated by the difference in dimensions between (X) and (Y) at (A) and (B).
- Taper is indicated by the difference in dimension between (A) and (B) at (X) and (Y).

### Limit

**Out-of-round (X - Y) : 0.005 mm (0.0002 in)**

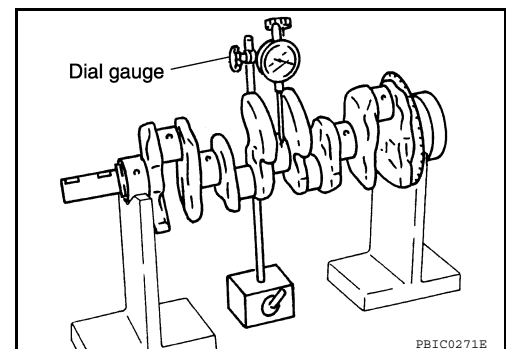
**Taper (A - B) : 0.005 mm (0.0002 in)**



## CRANKSHAFT RUNOUT

- Place a V-block on a precise flat table to support the journals on both ends of the crankshaft.
- Place a dial gauge straight up on the No. 3 journal.
- While rotating the crankshaft, read the movement of the pointer on the dial gauge, the total indicator reading.

**Limit : Less than 0.05 mm (0.002 in)**



## OIL CLEARANCE OF CONNECTING ROD BEARING

Method of Measurement

# CYLINDER BLOCK

[QR25DE]

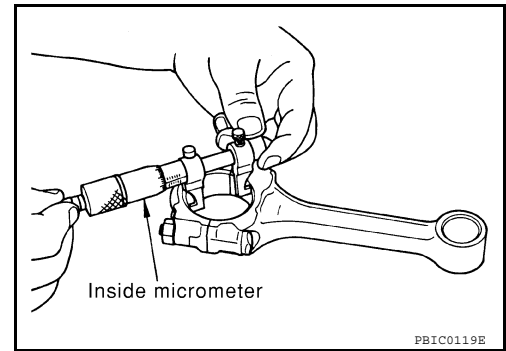
## < DISASSEMBLY AND ASSEMBLY >

- Install the connecting rod bearings to the connecting rod and the cap, and tighten the connecting rod bolts to the specified torque. Using an inside micrometer measure the inner diameter of connecting rod bearing.  
(Oil clearance) = (Inner diameter of connecting rod bearing) – (Outer diameter of crankshaft pin)

**Standard** : 0.035 - 0.045 mm (0.0014 - 0.0018 in)

**Limit** : 0.10 mm (0.0039 in)

- If clearance cannot be adjusted within the standard, grind crankshaft pin and use undersized bearing. Refer to [EM-92, "How to Select Piston and Bearing"](#).



### Method of Using Plastigage

- Remove oil and dust on the crankshaft pin and the surfaces of each bearing completely.
- Cut the Plastigage slightly shorter than the bearing width, and place it in crankshaft axial direction, avoiding oil holes.
- Install the connecting rod bearings to the connecting rod cap, and tighten the connecting rod bolts to the specified torque.

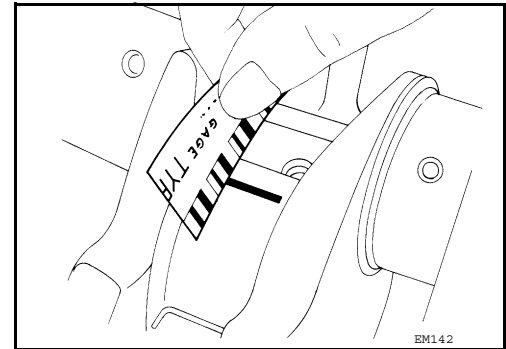
#### **CAUTION:**

**Never rotate the crankshaft.**

- Remove the connecting rod cap and bearings, and using the scale on the Plastigage bag, measure the Plastigage width.

#### **NOTE:**

The procedure when the measured value exceeds the limit is same as that described in the method by calculation.



## OIL CLEARANCE OF MAIN BEARING

### Method of Measurement

- Install the main bearings to the cylinder block and bearing cap. Measure the main bearing inner diameter with the bearing cap bolt tightened to the specified torque.  
(Oil clearance) = (Inner diameter of main bearing) – (Outer diameter of crankshaft journal)

#### **Standard:**

**No. 1, 3, and 5 journals** : 0.012 - 0.022 mm (0.0005 - 0.0009 in)

**No. 2 and 4 journals** : 0.018 - 0.028 mm (0.0007 - 0.0011 in)

**Limit** : 0.1 mm (0.004 in)

- If the measured value exceeds the limit, select main bearings referring to the main bearing inner diameter and crankshaft journal outer diameter, so that the oil clearance satisfies the standard. Refer to [EM-92, "How to Select Piston and Bearing"](#).

### Method of Using Plastigage

- Remove oil and dust on the crankshaft journal and the surfaces of each bearing completely.
- Cut the Plastigage slightly shorter than the bearing width, and place it in crankshaft axial direction, avoiding oil holes.
- Tighten the main bearing bolts to the specified torque.

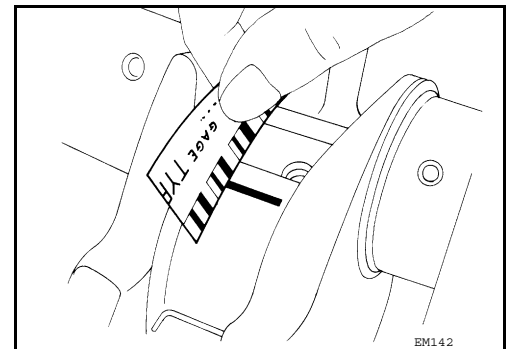
#### **CAUTION:**

**Never rotate the crankshaft.**

- Remove the bearing cap and bearings, and using the scale on the plastigage bag, measure the plastigage width.

#### **NOTE:**

The procedure when the measured value exceeds the limit is same as that described in the "Method by Calculation".



## CRUSH HEIGHT OF MAIN BEARING

# CYLINDER BLOCK

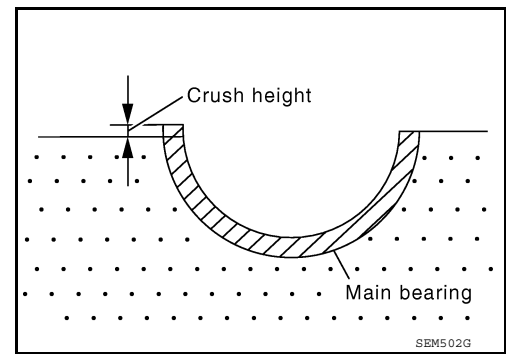
[QR25DE]

## < DISASSEMBLY AND ASSEMBLY >

- When the bearing cap is removed after being tightened to the specified torque with main bearings installed, the tip end of bearing must protrude.

**Standard** : There must be crush height.

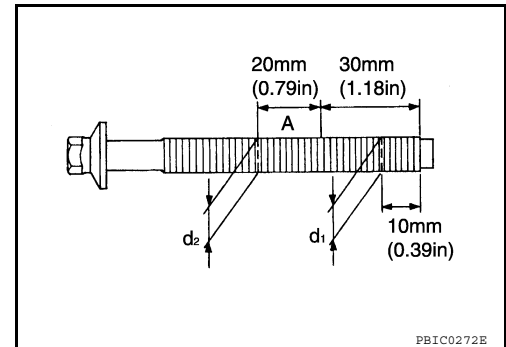
- If the standard is not met, replace main bearings.



## OUTER DIAMETER OF LOWER CYLINDER BLOCK BOLT

- Perform only with M10 (0.39 in) bolts.
- Measure outer diameters ( $d_1$ ,  $d_2$ ) at two positions as shown.
- Measure  $d_2$  at a point within area A as shown.
- When the value of  $d_1 - d_2$  exceeds the limit (a large difference in dimensions), replace the bolt with a new one.

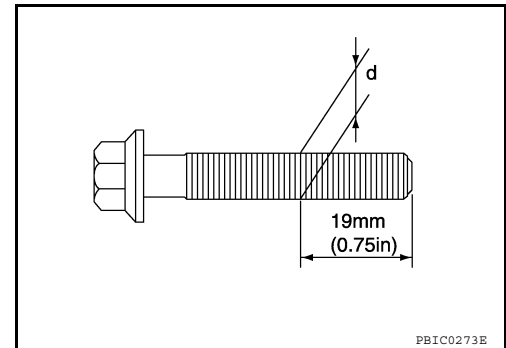
**Limit** : 0.13 mm (0.0051 in)



## OUTER DIAMETER OF CONNECTING ROD BOLT

- Measure outer diameter ( $d$ ) at position as shown.
- When ( $d$ ) exceeds the limit (when it becomes thinner), replace the bolt with a new one.

**Limit** : 7.75 mm (0.3051 in) or less



# HOW TO SELECT PISTON AND BEARING

< DISASSEMBLY AND ASSEMBLY >

[QR25DE]

## HOW TO SELECT PISTON AND BEARING

### How to Select Piston and Bearing

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#### DESCRIPTION

Selection points	Selection parts	Selection items	Selection methods
Between cylinder block to crankshaft	Main bearing	Main bearing grade (bearing thickness)	Determined by match of cylinder block bearing housing grade (inner diameter of housing) and crankshaft journal grade (outer diameter of journal)
Between crankshaft to connecting rod	Connecting rod bearing	Connecting rod bearing grade (bearing thickness)	Combining service grades for connecting rod big end inner diameter and crankshaft pin outer diameter determine connecting rod bearing selection
Between cylinder block to piston	Piston and piston pin assembly (The piston is available together with piston pin as an assembly)	Piston grade (piston outer diameter)	Piston grade = cylinder bore grade (inner diameter of bore)
*Between piston to connecting rod	—	—	—

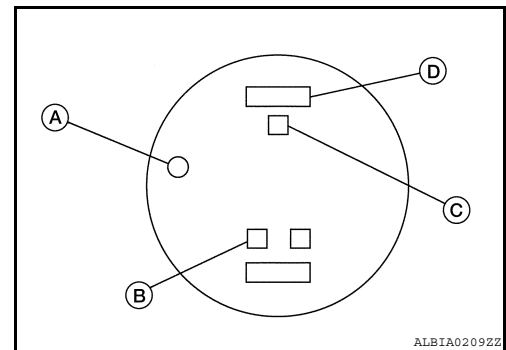
\*For the service parts, the grade for fitting cannot be selected between a piston pin and a connecting rod. (Only 0 grade is available.) The information at the shipment from the plant is described as a reference.

- The identification grade stamped on each part is the grade for the dimension measured in new condition. This grade cannot apply to reused parts.
- For reused or repaired parts, measure the dimension accurately. Determine the grade by comparing the measurement with the values of each selection table.
- For details of the measurement method of each part, the reuse standards, and the selection method of the selective fitting parts, follow the applicable procedure.

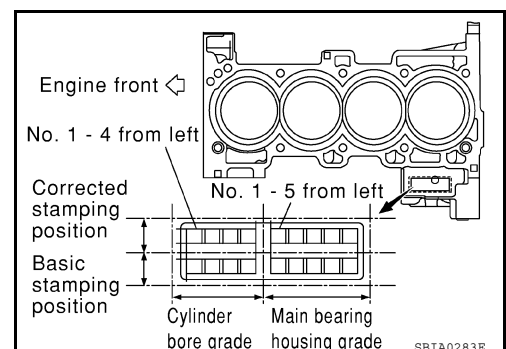
#### HOW TO SELECT A PISTON

##### When New Cylinder Block is Used:

- Check the cylinder bore grade on rear left side of cylinder block, and select a piston of the same grade (C).
- A: Front mark
- B: Piston pin bore grade
- D: Piston crown I. D. code stamp



- If there is a corrected stamp mark on the cylinder block, use it as a correct reference.



##### When a Cylinder Block is Reused:

# HOW TO SELECT PISTON AND BEARING

< DISASSEMBLY AND ASSEMBLY >

[QR25DE]

1. Measure the cylinder block bore inner diameter.
2. Determine the bore grade by comparing the measurement with the values under the cylinder bore inner diameter of the "Piston Selection Table", refer to [EM-98. "Standard and Limit"](#). Select the piston of the same grade.

## Piston Selection Table

- For the piston selection table, refer to [EM-98. "Standard and Limit"](#).

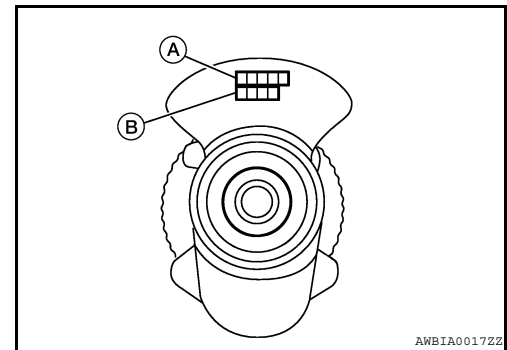
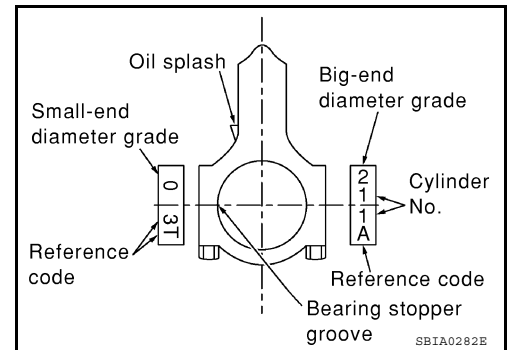
### NOTE:

- The piston is available together with piston pin as an assembly.
- The piston pin (piston pin bore) grade is provided only for the parts installed at the plant. For service parts, no piston pin grades can be selected. Only piston pin grade 0 is available.

## HOW TO SELECT A CONNECTING ROD BEARING

### When New Connecting Rod and Crankshaft are Used:

1. Apply big end inside diameter grade stamped on connecting rod side face to the row in the "Connecting Rod Bearing Selection Table".
2. Apply pin diameter grade (B) stamped on crankshaft front side to the column in the "Connecting Rod Bearing Selection Table".
  - Journal diameter grade (A)
3. Read the symbol at the cross point of selected row and column in the "Connecting Rod Bearing Selection Table".
4. Apply the symbol obtained to connecting rod bearing grade table to select.



### When Crankshaft and Connecting Rod are Reused:

1. Measure dimensions of the big end inner diameter of connecting rod and outer diameter of crankshaft pin individually.
2. Apply the dimension measured to the "Connecting Rod Bearing Selection Table" below.

# HOW TO SELECT PISTON AND BEARING

< DISASSEMBLY AND ASSEMBLY >

[QR25DE]

**Connecting Rod Bearing Selection Table**

Connecting rod big end. inner diameter		Mark	Mark													
			0	1	2	3	4	5	6	7	8	9	A	B	C	
Crankshaft pin outer diameter		Inner diameter Unit: mm (in)	48.000 - 48.001 (1.8898 - 1.8898)	48.001 - 48.002 (1.8898 - 1.8898)	48.002 - 48.003 (1.8898 - 1.8899)	48.003 - 48.004 (1.8899 - 1.8899)	48.004 - 48.005 (1.8900 - 1.8900)	48.005 - 48.006 (1.8900 - 1.8900)	48.006 - 48.007 (1.8900 - 1.8900)	48.007 - 48.008 (1.8900 - 1.8901)	48.008 - 48.009 (1.8901 - 1.8901)	48.009 - 48.010 (1.8901 - 1.8902)	48.010 - 48.011 (1.8902 - 1.8902)	48.011 - 48.012 (1.8902 - 1.8902)	48.012 - 48.013 (1.8902 - 1.8903)	
			Mark	Outer diameter Unit: mm (in)												
A	44.974 - 44.973 (1.7706 - 1.7706)	0	0	0	0	0	01	01	01	1	1	1	1	12	12	12
B	44.973 - 44.972 (1.7706 - 1.7705)	0	0	0	01	01	01	01	1	1	1	1	12	12	12	2
C	44.972 - 44.971 (1.7705 - 1.7705)	0	0	01	01	01	01	1	1	1	1	12	12	12	2	2
D	44.971 - 44.970 (1.7705 - 1.7705)	0	01	01	01	1	1	1	1	12	12	12	2	2	2	2
E	44.970 - 44.969 (1.7705 - 1.7704)	01	01	01	1	1	1	1	12	12	12	2	2	2	2	23
F	44.969 - 44.968 (1.7704 - 1.7704)	01	01	1	1	1	1	12	12	12	2	2	2	2	23	23
G	44.968 - 44.967 (1.7704 - 1.7704)	01	1	1	1	1	12	12	12	2	2	2	2	23	23	23
H	44.967 - 44.966 (1.7704 - 1.7703)	1	1	1	12	12	12	2	2	2	2	23	23	23	3	3
J	44.966 - 44.965 (1.7703 - 1.7703)	1	1	12	12	12	2	2	2	2	23	23	23	3	3	3
K	44.965 - 44.964 (1.7703 - 1.7702)	1	12	12	12	2	2	2	2	23	23	23	3	3	3	3
L	44.964 - 44.963 (1.7702 - 1.7702)	12	12	12	2	2	2	2	23	23	23	3	3	3	3	34
M	44.963 - 44.962 (1.7702 - 1.7702)	12	12	2	2	2	2	23	23	23	3	3	3	3	34	34
N	44.962 - 44.961 (1.7702 - 1.7701)	12	2	2	2	2	23	23	23	3	3	3	3	34	34	34
P	44.961 - 44.960 (1.7701 - 1.7701)	2	2	2	23	23	23	3	3	3	3	34	34	34	4	4
R	44.960 - 44.959 (1.7701 - 1.7700)	2	2	23	23	23	3	3	3	3	34	34	34	4	4	4
S	44.959 - 44.958 (1.7700 - 1.7700)	2	23	23	23	3	3	3	3	34	34	34	4	4	4	4
T	44.958 - 44.957 (1.7700 - 1.7700)	23	23	23	3	3	3	3	34	34	34	4	4	4	4	4
U	44.957 - 44.956 (1.7700 - 1.7699)	23	23	3	3	3	3	34	34	34	4	4	4	4	4	4

Connecting Rod Bearing Grade Table. Refer to [EM-98. "Standard and Limit"](#).

**Undersize Bearing Usage Guide**

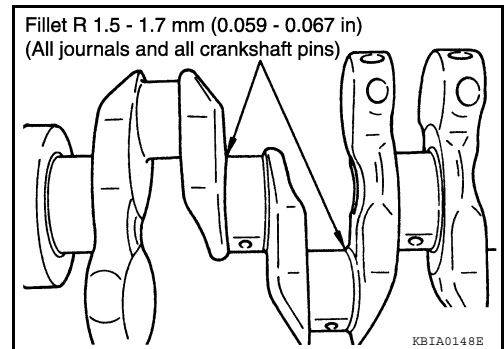
- When the specified oil clearance is not obtained with standard size connecting rod bearing, use undersize (US) bearing.
- When using undersize bearing, measure the bearing inner diameter with bearing installed, and grind the crankshaft pin so that the oil clearance satisfies the standard.

**Bearing Undersize Table**

Unit: mm (in)	
Size U.S.	Thickness
0.25 (0.0098)	1.622 - 1.630 (0.0639 - 0.0642)

**CAUTION:**

In grinding the crankshaft pin to use undersize bearings, do not damage the fillet R (All crankshaft pins).



**HOW TO SELECT A MAIN BEARING**

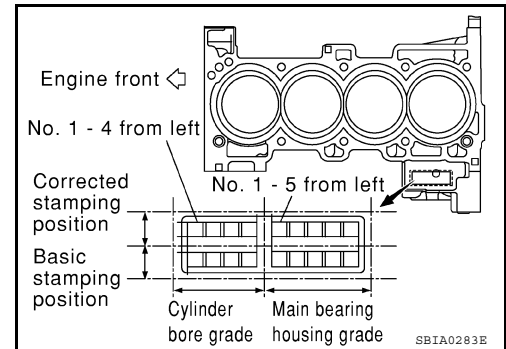
**When New Cylinder Block and Crankshaft are Used:**

# HOW TO SELECT PISTON AND BEARING

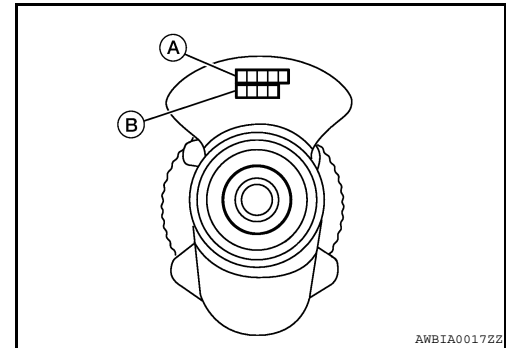
< DISASSEMBLY AND ASSEMBLY >

[QR25DE]

1. "Main Bearing Selection Table" rows correspond to bearing housing grade on rear left side of cylinder block.
  - If there is a corrected stamp mark on the cylinder block, use it as a correct reference.



2. Apply journal diameter grade (A) stamped on crankshaft front side to column in "Main Bearing Selection Table".
  - Pin diameter grade (B)



3. Find value at crossing of row and column in "Main Bearing Selection Table".

**CAUTION:**

- There are two main bearing selection tables. One is for odd-numbered journals (1, 3, and 5) and the other is for even-numbered journals (2 and 4). Make certain to use the appropriate table. This is due to differences in the specified clearances.

4. Apply the symbol obtained to "Main Bearing Grade Table" to select.

**NOTE:**

- Service parts are available as a set of both upper and lower.

**When Cylinder Block and Crankshaft are Reused:**

1. Measure inner diameter of cylinder block main bearing housing and outer diameter of crankshaft journal.
2. Apply measurement in above step 1 to the "Main Bearing Selection Table".
3. Follow steps 3 and 4 in "When New Cylinder Block and Crankshaft are Used".

A  
EM  
C  
D  
E  
F  
G  
H  
I  
J  
K  
L  
M  
N  
O  
P

# HOW TO SELECT PISTON AND BEARING

< DISASSEMBLY AND ASSEMBLY >

[QR25DE]

**Main Bearing Selection Table (No.1, 3, and No.5 journals)**

Cylinder block main bearing hausing inner diameter		Crankshaft journal outer diameter		Mark																														
				A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	V	W	X	Y	4	7							
Outer diameter Unit: mm (in)		Inner diameter Unit: mm (in)																																
A	54.979 - 54.978 (2.1645 - 2.1645)	0	0	01	01	01	01	01	1	1	1	12	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	34	4	4	4	4		
B	54.978 - 54.977 (2.1645 - 2.1644)	0	01	01	01	01	1	1	1	1	12	12	12	12	2	2	2	23	23	23	3	3	3	3	34	34	34	34	4	4	4	4		
C	54.977 - 54.976 (2.1644 - 2.1644)	01	01	01	1	1	1	1	12	12	12	12	2	2	2	2	23	23	23	3	3	3	3	3	34	34	34	34	4	4	4	4		
D	54.976 - 54.975 (2.1644 - 2.1644)	01	01	1	1	1	12	12	12	12	2	2	2	2	23	23	23	3	3	3	3	3	3	34	34	34	34	4	4	4	4	45		
E	54.975 - 54.974 (2.1644 - 2.1643)	01	1	1	1	12	12	12	2	2	2	2	2	23	23	23	3	3	3	3	3	3	3	34	34	34	34	4	4	4	4	45		
F	54.974 - 54.973 (2.1643 - 2.1643)	1	1	1	12	12	12	2	2	2	2	2	23	23	23	3	3	3	3	34	34	34	4	4	4	4	4	4	4	4	45	45		
G	54.973 - 54.972 (2.1643 - 2.1642)	1	1	12	12	12	2	2	2	2	2	23	23	23	3	3	3	3	34	34	34	4	4	4	4	4	4	4	4	45	45	45	5	
H	54.972 - 54.971 (2.1642 - 2.1642)	1	12	12	12	2	2	2	2	2	23	23	23	3	3	3	3	34	34	34	4	4	4	4	4	4	4	4	45	45	45	5	5	
J	54.971 - 54.970 (2.1642 - 2.1642)	12	12	12	2	2	2	2	23	23	23	3	3	3	3	34	34	34	4	4	4	4	4	4	4	4	4	4	45	45	45	5	5	
K	54.970 - 54.969 (2.1642 - 2.1641)	12	12	2	2	2	23	23	23	3	3	3	3	34	34	34	4	4	4	4	4	4	4	4	4	4	4	4	45	45	45	5	5	56
L	54.969 - 54.968 (2.1641 - 2.1641)	12	2	2	2	23	23	23	3	3	3	3	34	34	34	4	4	4	4	4	4	4	4	4	4	4	4	4	45	45	45	5	5	56
M	54.968 - 54.967 (2.1641 - 2.1641)	2	2	2	23	23	23	3	3	3	3	34	34	34	4	4	4	4	4	4	4	4	4	4	4	4	4	4	45	45	45	5	5	56
N	54.967 - 54.966 (2.1641 - 2.1640)	2	2	23	23	23	3	3	3	3	34	34	34	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	45	45	45	5	5	56
P	54.966 - 54.965 (2.1640 - 2.1640)	2	23	23	23	3	3	3	3	34	34	34	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	45	45	45	5	5	56
R	54.965 - 54.964 (2.1640 - 2.1639)	23	23	23	3	3	3	34	34	34	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	45	45	45	5	5	56
S	54.964 - 54.963 (2.1639 - 2.1639)	23	23	3	3	3	34	34	34	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	45	45	45	5	5	56
T	54.963 - 54.962 (2.1639 - 2.1639)	23	3	3	3	34	34	34	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	45	45	45	5	5	56
U	54.962 - 54.961 (2.1639 - 2.1638)	3	3	3	34	34	34	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	45	45	45	5	5	56
V	54.961 - 54.960 (2.1638 - 2.1638)	3	3	34	34	34	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	45	45	45	5	5	56
W	54.960 - 54.959 (2.1638 - 2.1637)	3	34	34	34	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	45	45	45	5	5	56
X	54.959 - 54.958 (2.1637 - 2.1637)	34	34	34	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	45	45	45	5	5	56
Y	54.958 - 54.957 (2.1637 - 2.1637)	34	34	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	45	45	45	5	5	56
4	54.957 - 54.956 (2.1637 - 2.1636)	34	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	45	45	45	5	5	56
7	54.956 - 54.955 (2.1636 - 2.1636)	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	45	45	45	5	5	56

KB1A0149E





# SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[QR25DE]

## SERVICE DATA AND SPECIFICATIONS (SDS)

### SERVICE DATA AND SPECIFICATIONS (SDS)

#### Standard and Limit

INFOID:000000005441593

#### GENERAL SPECIFICATIONS

Cylinder arrangement		In-line 4
Displacement cm <sup>3</sup> (in <sup>3</sup> )		2,488 (151.82)
Bore and stroke mm (in)		89.0 x 100 (3.50 x 3.94)
Valve arrangement		DOHC
Firing order		1-3-4-2
Number of piston rings	Compression	2
	Oil	1
Compression ratio		9.5:1
Compression pressure kPa (kg/cm <sup>2</sup> , psi) / 250 rpm	Standard	900 (9.2, 130.5)
	Minimum	710 (7.3, 103)
	Differential limit between cylinders	100 (1.0, 14)

Valve timing	<p style="text-align: right;">PBIC0187E</p>				
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Unit: degree

a	b	c	d	e	f
220°	232°	-41°	93°	10°	30°

#### DRIVE BELTS

Tension of drive belts	Auto adjustment by auto tensioner
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#### INTAKE MANIFOLD AND EXHAUST MANIFOLD

Unit: mm (in)

Description	Component	Limit
Surface distortion	Intake manifold adaptor	0.1 (0.004)
	Intake manifold	0.1 (0.004)
	Exhaust manifold	0.3 (0.012)

#### SPARK PLUG

Unit: mm (in)

Make	NGK	
Type*	Standard	DILKAR6A-11
Gap (nominal)	1.1 (0.043)	

\*: Always check with the Parts Department for the latest parts information

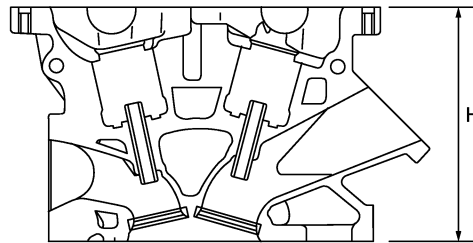
# SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[QR25DE]

## CYLINDER HEAD

Unit: mm (in)



Nominal cylinder head height:  
H = 129.4 mm (5.09 in)

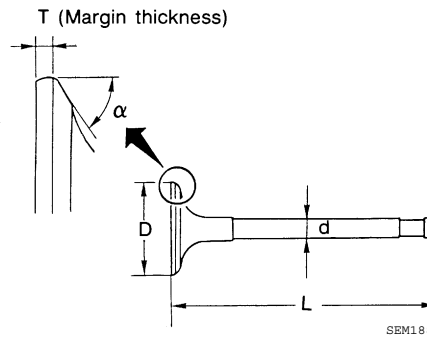
PBIC0283E

Description	Limit
Head surface distortion	0.1 (0.004)
Description	Standard
Spark plug tube installation height	41.7 (1.642)

## VALVE

### Valve Dimensions

Unit: mm (in)



SEM188

Valve head diameter (D)	Intake	35.5 - 35.8 (1.398 - 1.409)
	Exhaust	30.3 - 30.6 (1.193 - 1.205)
Valve length (L)	Intake	96.84 (3.8136)
	Exhaust	97.9 (3.8543)
Valve stem diameter (d)	Intake	5.965 - 5.980 (0.2348 - 0.2354)
	Exhaust	5.955 - 5.970 (0.2344 - 0.2350)
Valve seat angle $\alpha$	Intake	45°15' - 45°45'
	Exhaust	
Valve margin (T)	Intake	1.08 (0.0425)
	Exhaust	1.38 (0.0543)

### Valve Clearance

Unit: mm (in)

	Cold	Hot*
Intake	0.24 - 0.32 (0.009 - 0.013)	0.304 - 0.416 (0.012 - 0.016)
Exhaust	0.26 - 0.34 (0.010 - 0.013)	0.308 - 0.432 (0.012 - 0.017)

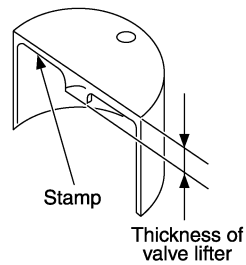
\*: Approximately 80°C (176 °F)

### Available Valve Lifter

# SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[QR25DE]



KBTA0119E

Thickness mm (in)	Identification mark (Stamp)*
7.88	788U
7.90	790U
7.92	792U
7.94	794U
7.96	796U
7.98	798U
8.00	800U
8.02	802U
8.04	804U
8.06	806U
8.08	808U
8.10	810U
8.12	812U
8.14	814U
8.16	816U
8.18	818U
8.20	820U
8.22	822U
8.24	824U
8.26	826U
8.28	828U
8.30	830U
8.32	832U
8.34	834U
8.36	836U
8.38	838U

\*: Always check with the Parts Department for the latest parts information

## Valve Spring

Free height standard mm (in)	Intake	43.72 - 43.92 (1.7213 - 1.7291)
	Exhaust	45.29 - 45.49 (1.7831 - 1.7909)
Pressure standard N (kg, lb) at height mm (in)	Intake and Exhaust	151 - 175 (15.4 - 17.8, 34 - 39) at 35.30 (1.390)
Out-of-square mm (in)		1.9 (0.0748)

# SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[QR25DE]

Installation height mm (in)	Intake	35.30 (1.390)
	Exhaust	35.30 (1.390)
Installation load N (kg - force, lb - force)	Intake	151 - 175 (15.4 - 17.8, 34 - 39)
	Exhaust	151 - 175 (15.4 - 17.8, 34 - 39)
Height during valve open mm (in)	Intake	25.30 (0.9961)
	Exhaust	26.76 (1.0535)
Load with valve open N (kg - force, lb - force)	Intake	351 - 394 (35.8 - 40.2, 79 - 89)
	Exhaust	318 - 362 (32.4 - 36.9, 71 - 81)

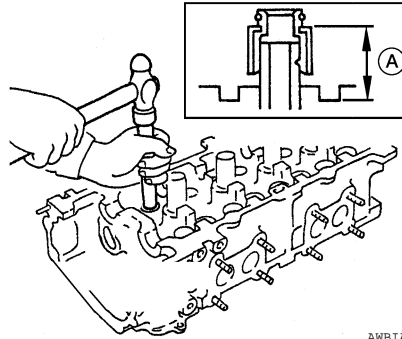
## Valve Lifter

Unit: mm (in)

Description	Standard
Valve lifter outer diameter	33.977 - 33.987 (1.3377 - 1.3381)
Lifter lifter bore inner diameter	34.000 - 34.021 (1.3386 - 1.3394)
Clearance between lifter and lifter guide	0.013 - 0.044 (0.0005 - 0.0017)

## Valve Oil Seal

Unit: mm. (in)

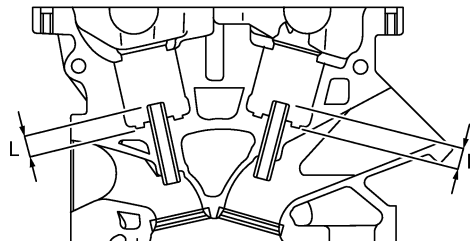


AWBIA0019ZZ

Description	Standard
Valve oil seal installation height (A)	12.1 (0.476)

## Valve Guide

Unit: mm (in)



PBIC0184E

Description		Standard	Service
Valve guide	Outer diameter	10.023 - 10.034 (0.3946 - 0.3950)	10.223 - 10.234 (0.4025 - 0.4029)
	Inner diameter (Finished size)	6.000 - 6.018 (0.2362 - 0.2369)	
Cylinder head valve guide hole diameter		9.975 - 9.996 (0.3927 - 0.3935)	10.175 - 10.196 (0.4006 - 0.4014)
Interference fit of valve guide		0.027 - 0.059 (0.0011 - 0.0023)	

# SERVICE DATA AND SPECIFICATIONS (SDS)

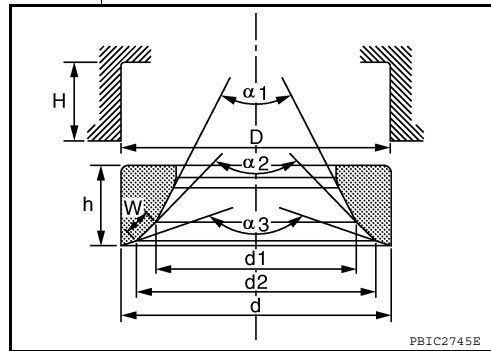
< SERVICE DATA AND SPECIFICATIONS (SDS)

[QR25DE]

		Standard	Limit
Valve guide clearance	Intake	0.020 - 0.053 (0.0008 - 0.0021)	0.08 (0.003)
	Exhaust	0.030 - 0.063 (0.0012 - 0.0025)	0.09 (0.004)
Projection length (L)	Intake	10.1 - 10.3 (0.398 - 0.406)	
	Exhaust	10.0 - 10.4 (0.394 - 0.409)	

## Valve Seat

Unit: mm (in)



Description		Standard	Service
Cylinder head seat recess diameter (D)	Intake	36.500 - 36.516 (1.4370 - 1.4376)	37.000 - 37.016 (1.4567 - 1.4573)
	Exhaust	31.500 - 31.516 (1.2402 - 1.2408)	32.000 - 32.016 (1.2598 - 1.2605)
Valve seat interference fit	Intake	0.081 - 0.113 (0.0032 - 0.0044)	
	Exhaust	0.084 - 0.116 (0.0033 - 0.0046)	
Valve seat outer diameter (d)	Intake	36.597 - 36.613 (1.4408 - 1.4415)	37.097 - 37.113 (1.4605 - 1.4611)
	Exhaust	31.600 - 31.616 (1.2441 - 1.2447)	32.100 - 32.116 (1.2638 - 1.2644)
Diameter (d1)	Intake	33.5 (1.319)	
	Exhaust	28.0 (1.102)	
Diameter (d2)	Intake	34.8 - 35.3 (1.370 - 1.390)	
	Exhaust	29.6 - 30.1 (1.165 - 1.185)	
Angle ( $\alpha 1$ )	Intake	60°	
	Exhaust	60°	
Angle ( $\alpha 2$ )	Intake	88° 46' - 90° 14'	
	Exhaust	88° 46' - 90° 14'	
Angle ( $\alpha 3$ )	Intake	120°	
	Exhaust	120°	
Contacting width (W)*1	Intake	0.99 - 1.35 (0.0390 - 1.1531)	
	Exhaust	1.19 - 1.55 (0.0469 - 0.0610)	

\*1 Machining data

## CAMSHAFT AND CAMSHAFT BEARING

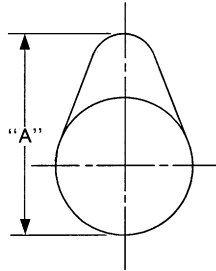
# SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[QR25DE]

Unit: mm (in)

	Standard
Camshaft runout [TIR*]	Less than 0.04 (0.0016)

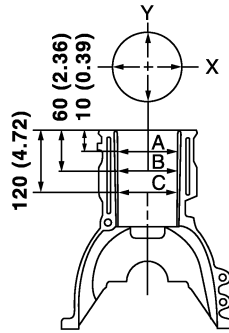


Cam height (A)	Intake	44.815 - 45.005 (1.7644 - 1.7718)
	Exhaust	43.975 - 44.165 (1.7313 - 1.7388)
Outer diameter of camshaft journal	No. 1	27.935 - 27.955 (1.0998 - 1.1006)
	No. 2, 3, 4, 5	23.435 - 23.455 (0.9226 - 0.9234)
Inner diameter of camshaft bracket	No.1	28.000 - 28.021 (1.1024 - 1.1032)
	No.2, 3, 4, 5	23.500 - 23.521 (0.9252 - 0.9260)
Camshaft journal clearance		0.045 - 0.086 (0.0018 - 0.0034)
Camshaft end play		0.115 - 0.188 (0.0045 - 0.0074)
Camshaft sprocket runout [TIR*]		Less than 0.15 (0.0059)

\*: Total indicator reading

## CYLINDER BLOCK

Unit: mm (in)



Surface distortion	Limit			0.1 (0.004)
Cylinder bore	Inner diameter	Standard	Grade No. 2	89.010 - 89.020 (3.5043 - 3.5047)
			Grade No. 3	89.020 - 89.030 (3.5047 - 3.5051)
		Wear limit		
Out-of-round (X - Y)			Less than 0.015 (0.0006)	
Taper (C - A)			Less than 0.01 (0.0004)	

# SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

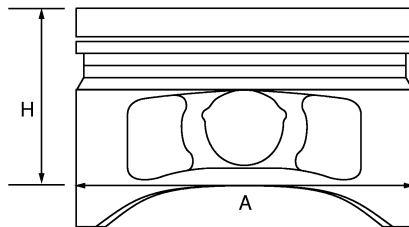
[QR25DE]

Main journal inner diameter grade (Without bearing)	Grade No. A	58.944 - 58.945 (2.3206 - 2.3207)
	Grade No. B	58.945 - 58.946 (2.3207 - 2.3207)
	Grade No. C	58.946 - 58.947 (2.3207 - 2.3207)
	Grade No. D	58.947 - 58.948 (2.3207 - 2.3208)
	Grade No. E	58.948 - 58.949 (2.3208 - 2.3208)
	Grade No. F	58.949 - 58.950 (2.3208 - 2.3209)
	Grade No. G	58.950 - 58.951 (2.3209 - 2.3209)
	Grade No. H	58.951 - 58.952 (2.3209 - 2.3209)
	Grade No. J	58.952 - 58.953 (2.3209 - 2.3210)
	Grade No. K	58.953 - 58.954 (2.3210 - 2.3210)
	Grade No. L	58.954 - 58.955 (2.3210 - 2.3211)
	Grade No. M	58.955 - 58.956 (2.3211 - 2.3211)
	Grade No. N	58.956 - 58.957 (2.3211 - 2.3211)
	Grade No. P	58.957 - 58.958 (2.3211 - 2.3212)
	Grade No. R	58.958 - 58.959 (2.3212 - 2.3212)
	Grade No. S	58.959 - 58.960 (2.3212 - 2.3213)
	Grade No. T	58.960 - 58.961 (2.3213 - 2.3213)
	Grade No. U	58.961 - 58.962 (2.3213 - 2.3213)
	Grade No. V	58.962 - 58.963 (2.3213 - 2.3214)
	Grade No. W	58.963 - 58.964 (2.3214 - 2.3214)
Grade No. X	58.964 - 58.965 (2.3214 - 2.3215)	
Grade No. Y	58.965 - 58.966 (2.3215 - 2.3215)	
Grade No. 4	58.966 - 58.967 (2.3215 - 2.3215)	
Grade No. 7	58.967 - 58.968 (2.3215 - 2.3216)	
Difference in inner diameter between cylinders	Standard	Less than 0.03 (0.0012)

## PISTON, PISTON RING, AND PISTON PIN

Available Piston

Unit: mm (in)



PBIC0188E

		Grade*	Dimension
Piston skirt diameter (A)	Standard	Grade No. 1	88.990 - 88.995 (3.5035 - 3.5037)
		Grade No. 2	88.995 - 89.000 (3.5037 - 3.5039)
		Grade No. 3	89.000 - 89.005 (3.5039 - 3.5041)
		Grade No. 4	89.005 - 89.010 (3.5041 - 3.5043)
(H) dimension			37.5 (1.476)
Piston pin bore diameter		Grade No. 0	19.993 - 19.999 (0.7871 - 0.7874)
		Grade No. 1	19.999 - 20.005 (0.7874 - 0.7876)
Piston clearance to cylinder block		Standard	0.010 - 0.030 (0.0004 - 0.0012)
		Limit	0.08 (0.0031)

\*: Always check with the Parts Department for the latest parts information

Piston Ring



# SERVICE DATA AND SPECIFICATIONS (SDS)

## < SERVICE DATA AND SPECIFICATIONS (SDS)

**[QR25DE]**

Unit: mm (in)

		Standard	Limit
Side clearance	Top	0.040 - 0.080 (0.0016 - 0.0031)	0.11 (0.0043)
	2nd	0.030 - 0.070 (0.0012 - 0.0028)	0.10 (0.0039)
	Oil ring	0.045 - 0.125 (0.0018 - 0.0049)	—
End gap	Top	0.21 - 0.31 (0.0083 - 0.0122)	0.54 (0.0213)
	2nd	0.37 - 0.52 (0.0146 - 0.0205)	0.67 (0.0264)
	Oil (rail ring)	0.20 - 0.45 (0.0079 - 0.0177)	0.95 (0.0374)

### Piston Pin

Unit: mm (in)

Piston pin outer diameter	Grade No.0	19.989 - 19.995 (0.7870 - 0.7872)
	Grade No.1	19.995 - 20.001 (0.7872 - 0.7874)
Piston to piston pin clearance (Standard)		0.002 - 0.006 (0.0001 - 0.0002)
Piston pin to connecting rod bushing clearance	Standard	0.005 - 0.017 (0.0002 - 0.0007)

### CONNECTING ROD

Unit: mm (in)

Center distance		143.00 - 143.10 (5.63 - 5.63)
Bend [per 100 (3.94)]	Limit	0.15 (0.0059)
Torsion [per 100 (3.94)]	Limit	0.30 (0.0118)
Connecting rod small end inner diameter		22.000 - 22.012 (0.7874 - 0.7879)
Connecting rod small end inner diameter <sup>1</sup>	Grade <sup>2</sup>	Dimension
	Grade No. 0	20.000 - 20.006 (0.7874 - 0.7876)
	Grade No. 1	20.006 - 20.012 (0.7876 - 0.7879)
Connecting rod big end inner diameter		48.000 - 48.013 (1.8898 - 1.8903)
Side clearance	Standard	0.20 - 0.35 (0.0079 - 0.0138)
	Limit	0.50 (0.0197)
Connecting rod bearing housing	Grade No. 0	48.000 - 48.001 (1.8898 - 1.8898)
	Grade No. 1	48.001 - 48.002 (1.8898 - 1.8898)
	Grade No. 2	48.002 - 48.003 (1.8898 - 1.8899)
	Grade No. 3	48.003 - 48.004 (1.8899 - 1.8899)
	Grade No. 4	48.004 - 48.005 (1.8899 - 1.8899)
	Grade No. 5	48.005 - 48.006 (1.8899 - 1.8900)
	Grade No. 6	48.006 - 48.007 (1.8900 - 1.8900)
	Grade No. 7	48.007 - 48.008 (1.8900 - 1.8901)
	Grade No. 8	48.008 - 48.009 (1.8901 - 1.8901)
	Grade No. 9	48.009 - 48.010 (1.8901 - 1.8902)
	Grade No. A	48.010 - 48.011 (1.8902 - 1.8902)
Grade No. B	48.011 - 48.012 (1.8902 - 1.8902)	
Grade No. C	48.012 - 48.013 (1.8902 - 1.8903)	

<sup>1</sup>: After installing in connecting rod

<sup>2</sup>: Always check with the Parts Department for the latest parts information

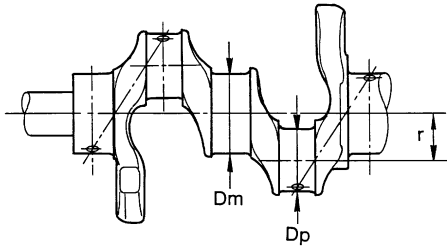
### CRANKSHAFT

# SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

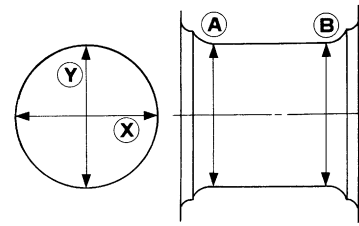
[QR25DE]

Unit: mm (in)



SEM645

Out-of-round (X - Y)  
Taper (A - B)



SEM715

Pin journal dia. (DP)	Grade No. A	44.974 - 44.973 (1.7706 - 1.7706)
	Grade No. B	44.973 - 44.972 (1.7706 - 1.7705)
	Grade No. C	44.972 - 44.971 (1.7705 - 1.7705)
	Grade No. D	44.971 - 44.970 (1.7705 - 1.7705)
	Grade No. E	44.970 - 44.969 (1.7705 - 1.7704)
	Grade No. F	44.969 - 44.968 (1.7704 - 1.7704)
	Grade No. G	44.968 - 44.967 (1.7704 - 1.7704)
	Grade No. H	44.967 - 44.966 (1.7704 - 1.7703)
	Grade No. J	44.966 - 44.965 (1.7703 - 1.7703)
	Grade No. K	44.965 - 44.964 (1.7703 - 1.7702)
	Grade No. L	44.964 - 44.963 (1.7702 - 1.7702)
	Grade No. M	44.963 - 44.962 (1.7702 - 1.7702)
	Grade No. N	44.962 - 44.961 (1.7702 - 1.7701)
	Grade No. P	44.961 - 44.960 (1.7701 - 1.7701)
	Grade No. R	44.960 - 44.959 (1.7701 - 1.7700)
	Grade No. S	44.959 - 44.958 (1.7700 - 1.7700)
	Grade No. T	44.958 - 44.957 (1.7700 - 1.7700)
Grade No. U	44.957 - 44.956 (1.7700 - 1.7699)	
Main journal dia. (Dm) grade	Grade No. A	54.979 - 54.978 (2.1645 - 2.1645)
	Grade No. B	54.978 - 54.977 (2.1645 - 2.1644)
	Grade No. C	54.977 - 54.976 (2.1644 - 2.1644)
	Grade No. D	54.976 - 54.975 (2.1644 - 2.1644)
	Grade No. E	54.975 - 54.974 (2.1644 - 2.1643)
	Grade No. F	54.974 - 54.973 (2.1643 - 2.1643)
	Grade No. G	54.973 - 54.972 (2.1643 - 2.1642)
	Grade No. H	54.972 - 54.971 (2.1642 - 2.1642)
	Grade No. J	54.971 - 54.970 (2.1642 - 2.1642)
	Grade No. K	54.970 - 54.969 (2.1642 - 2.1641)
	Grade No. L	54.969 - 54.968 (2.1641 - 2.1641)
	Grade No. M	54.968 - 54.967 (2.1641 - 2.1641)
	Grade No. N	54.967 - 54.966 (2.1641 - 2.1640)
	Grade No. P	54.966 - 54.965 (2.1640 - 2.1640)
	Grade No. R	54.965 - 54.964 (2.1640 - 2.1639)
	Grade No. S	54.964 - 54.963 (2.1639 - 2.1639)
	Grade No. T	54.963 - 54.962 (2.1639 - 2.1639)
	Grade No. U	54.962 - 54.961 (2.1639 - 2.1638)
	Grade No. V	54.961 - 54.960 (2.1638 - 2.1638)
	Grade No. W	54.960 - 54.959 (2.1638 - 2.1637)
Grade No. X	54.959 - 54.958 (2.1637 - 2.1637)	
Grade No. Y	54.958 - 54.957 (2.1637 - 2.1637)	
Grade No. 4	54.957 - 54.956 (2.1637 - 2.1636)	
Grade No. 7	54.956 - 54.955 (2.1636 - 2.1636)	
Center distance (r)		49.60 - 50.04 (1.9528 - 1.9701)
Out-of-round (X - Y)	Standard	Less than 0.005 (0.0002)
Taper (A - B)	Standard	Less than 0.005 (0.0002)
Runout [TIR*]	Limit	Less than 0.05 (0.002)
Free end play	Standard	0.10 - 0.26 (0.0039 - 0.0102)
	Limit	0.30 (0.0118)

# SERVICE DATA AND SPECIFICATIONS (SDS)

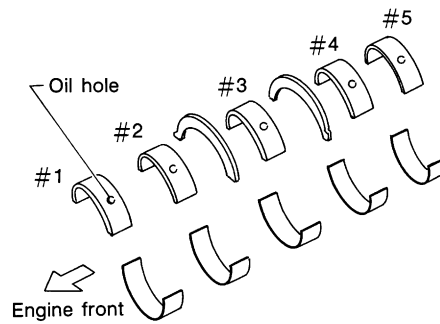
< SERVICE DATA AND SPECIFICATIONS (SDS)

[QR25DE]

\*: Total indicator reading

## MAIN BEARING

Unit: mm (in)



SEM665D

Grade number*	Thickness	Identification color (UPR / LWR)	Remarks
0	1.973 - 1.976 (0.0777 - 0.0778)	Black	Grade and color are the same for upper and lower bearings.
1	1.976 - 1.979 (0.0778 - 0.0779)	Brown	
2	1.979 - 1.982 (0.0779 - 0.0780)	Green	
3	1.982 - 1.985 (0.0780 - 0.0781)	Yellow	
4	1.985 - 1.988 (0.0781 - 0.0783)	Blue	
5	1.988 - 1.991 (0.0783 - 0.0784)	Pink	
6	1.991 - 1.994 (0.0784 - 0.0785)	Purple	
7	1.994 - 1.997 (0.0785 - 0.0786)	White	
01	UPR	1.973 - 1.976 (0.0777 - 0.0778)	Black / Brown
	LWR	1.976 - 1.979 (0.0778 - 0.0779)	
12	UPR	1.976 - 1.979 (0.0778 - 0.0779)	Brown / Green
	LWR	1.979 - 1.982 (0.0779 - 0.0780)	
23	UPR	1.979 - 1.982 (0.0779 - 0.0780)	Green / Yellow
	LWR	1.982 - 1.985 (0.0780 - 0.0781)	
34	UPR	1.982 - 1.985 (0.0780 - 0.0781)	Yellow / Blue
	LWR	1.985 - 1.988 (0.0781 - 0.0783)	
45	UPR	1.985 - 1.988 (0.0781 - 0.0783)	Blue / Pink
	LWR	1.988 - 1.991 (0.0783 - 0.0784)	
56	UPR	1.988 - 1.991 (0.0783 - 0.0784)	Pink / Purple
	LWR	1.991 - 1.994 (0.0784 - 0.0785)	
67	UPR	1.991 - 1.994 (0.0784 - 0.0785)	Purple / White
	LWR	1.994 - 1.997 (0.0785 - 0.0786)	

\*: Always check with the Parts Department for the latest parts information

## Undersize

Unit: mm (in)

Size U.S.	Thickness	Main journal diameter
0.25 (0.0098)	2.106 - 2.114 (0.0829 - 0.0832)	Grind so that bearing clearance is the specified value.

## Bearing Clearance

# SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

**[QR25DE]**

Unit: mm (in)

Main bearing oil clearance	Standard	No.1, 3, and 5	0.012 - 0.022 (0.0005 - 0.0009)
		No.2 and 4	0.018 - 0.028 (0.0007 - 0.0011)
	Limit		0.1 (0.004)

## CONNECTING ROD BEARING

Grade number*		Thickness	Identification color (UPR / LWR)	Remarks
0		1.496 - 1.493 (0.0589 - 0.0588)	Black	Grade and color are the same for upper and lower bearings.
1		1.499 - 1.496 (0.0590 - 0.0589)	Brown	
2		1.502 - 1.499 (0.0591 - 0.0590)	Green	
3		1.505 - 1.502 (0.0593 - 0.0591)	Yellow	
4		1.508 - 1.505 (0.0594 - 0.0593)	Blue	
01	UPR	1.496 - 1.493 (0.0589 - 0.0588)	Black / Brown	Grade and color are different for upper and lower bearings.
	LWR	1.499 - 1.496 (0.0590 - 0.0589)		
12	UPR	1.499 - 1.496 (0.0590 - 0.0589)	Brown / Green	
	LWR	1.502 - 1.499 (0.0591 - 0.0590)		
23	UPR	1.502 - 1.499 (0.0591 - 0.0590)	Green / Yellow	
	LWR	1.505 - 1.502 (0.0593 - 0.0591)		
24	UPR	1.505 - 1.502 (0.0593 - 0.0591)	Yellow / Blue	
	LWR	1.508 - 1.505 (0.0594 - 0.0593)		

\*: Always check with the Parts Department for the latest parts information

### Undersize

Unit: mm (in)

Size U.S.	Thickness	Crank pin journal diameter
0.25 (0.0098)	1.622 - 1.630 (0.0639 - 0.0642)	Grind so that bearing clearance is the specified value.

### Bearing Clearance

Unit: mm (in)

Connecting rod bearing clearance	Standard	0.035 - 0.045 (0.0014 - 0.0018)
	Limit	0.10 (0.0039)