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SECTION **EM**

ENGINE MECHANICAL

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PRECAUTIONS

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Precautions for Draining Coolant

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- Drain coolant when engine is cooled.

Precautions for Disconnecting Fuel Piping

EBS00DTR

- 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.

Precautions for Removal and Disassembly

EBS00DTS

- 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.

Precautions for Inspection, Repair and Replacement

EBS00DTT

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

Precautions for Assembly and Installation

EBS00DTU

- 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

EBS00DTV

- 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.

PRECAUTIONS

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Precautions for Liquid Gasket REMOVAL OF LIQUID GASKET SEALING

- After removing the mounting bolts and nuts, separate the mating surface using a seal cutter and remove the liquid gasket sealing.

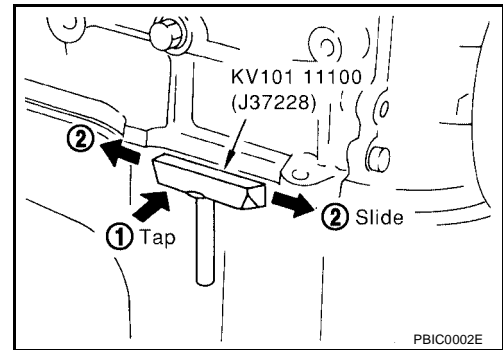
CAUTION:

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.

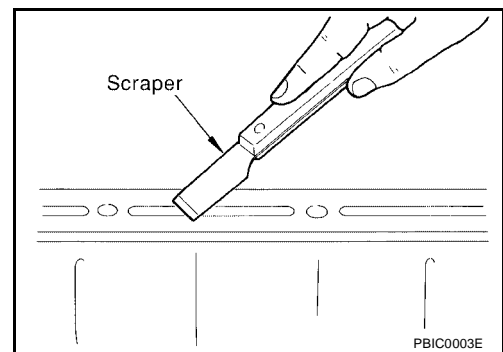
CAUTION:

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

- 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.
- Thoroughly clean the gasket application surface and the mating surface and remove adhering moisture, grease and foreign materials.



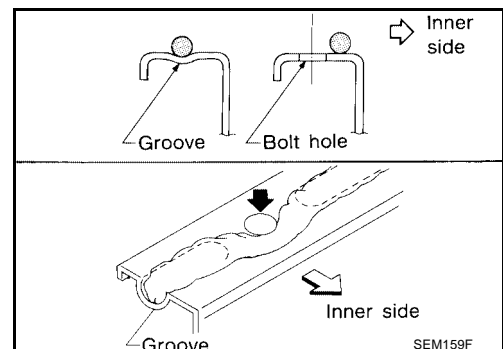
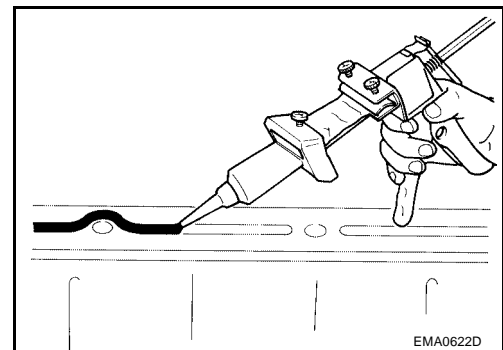
- Attach the sealant tube to the tube presser.
Use Genuine Silicone RTV Sealant or equivalent. Refer to [GI-43, "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS"](#).

- 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-13, "RECOMMENDED FLUIDS AND LUBRICANTS"](#).



CAUTION:

Follow all specific instructions in this manual.

PREPARATION

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PREPARATION

Special Service Tools

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
ST0501S000 Engine stand assembly 1. ST05011000 (—) Engine stand 2. ST05012000 (—) Base	Disassembling and assembling
KV10106500 (—) Engine stand shaft	
KV10115300 (—) Engine sub-attachment	
KV10116200 (J-26336-B) Valve spring compressor 1. KV10115900 (J-26336-20) Attachment	Disassembling valve mechanism
KV10112100 (BT-8653-A) Angle wrench	Tightening bolts for bearing cap, cylinder head, etc.
KV10117100 (J-36471-A) Heated oxygen sensor wrench	Loosening or tightening heated oxygen sensors with 22 mm 80.87 in) hexagon nut

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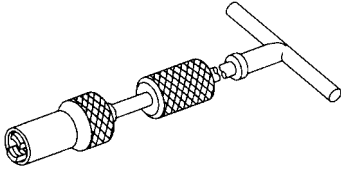
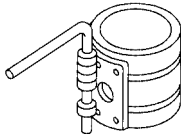
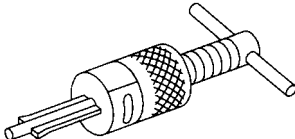
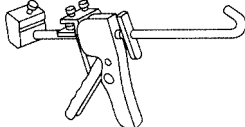
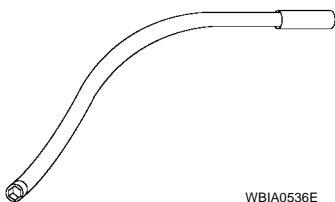
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PREPARATION

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Tool number (Kent-Moore No.) Tool name	Description
KV10107902 (J-38959) Valve oil seal puller	Removing valve oil seal  <p style="text-align: center;">S-NT011</p>
KV10115600 (J-38958) Valve oil seal drift	Installing valve oil seal Use side A. a: 20 (0.79) dia. d: 8 (0.31) dia. b: 13 (0.51) dia. e: 10.7 (0.421) dia. c: 10.3 (0.406) dia. f: 5 (0.20) dia. Unit: mm (in)
EM03470000 (J-8037) Piston ring compressor	Installing piston assembly into cylinder bore  <p style="text-align: center;">S-NT044</p>
ST16610001 (J-23907) Pilot bushing puller	Removing crankshaft pilot bushing  <p style="text-align: center;">S-NT045</p>
WS39930000 (—) Tube presser	Pressing the tube of liquid gasket  <p style="text-align: center;">S-NT052</p>
— (J-45488) Quick connector release	Removing fuel tube quick connectors in engine room (Available in SEC. 164 of PARTS CATALOG: Part No. 16441 6N210)
— (J-46535) Drive belt tension releaser	Releasing drive belt tension  <p style="text-align: center;">WBIA0536E</p>

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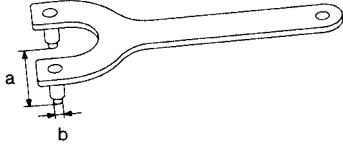
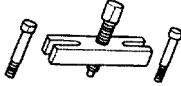
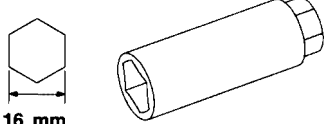
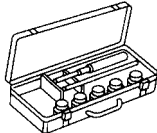
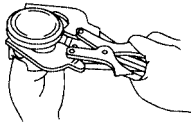
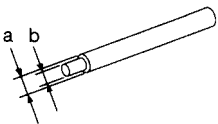
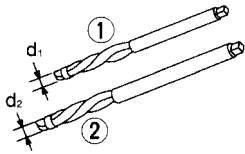
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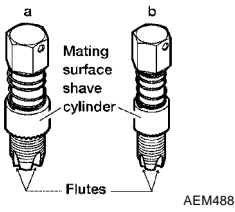

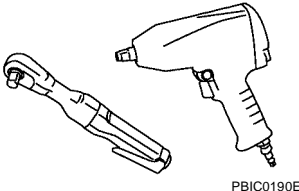
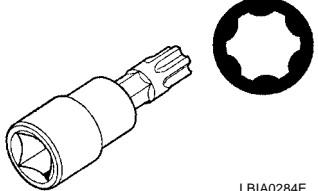
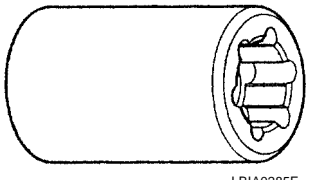
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Commercial Service Tools

Tool number (Kent-Moore No.) Tool name	Description
Pulley holder  NT628	Crankshaft pulley removing and installing a: 68 mm (2.68 in) dia. b: 8 mm (0.31 in) dia.
Crank puller  ZZA0010D	Crankshaft pulley removing
Spark plug wrench  S-NT047	Removing and installing spark plug
Valve seat cutter set  S-NT048	Finishing valve seat dimensions
Piston ring expander  S-NT030	Removing and installing piston ring
Valve guide drift  S-NT015	Removing and installing valve guide Intake & Exhaust: a: 9.5 mm (0.374 in) dia. b: 5.5 mm (0.217 in) dia.
Valve guide reamer  S-NT016	1: Reaming valve guide inner hole 2: Reaming hole for oversize valve guide Intake & Exhaust: d1 : 6.0 mm (0.236 in) dia. d2 : 10.2 mm (0.402 in) dia.

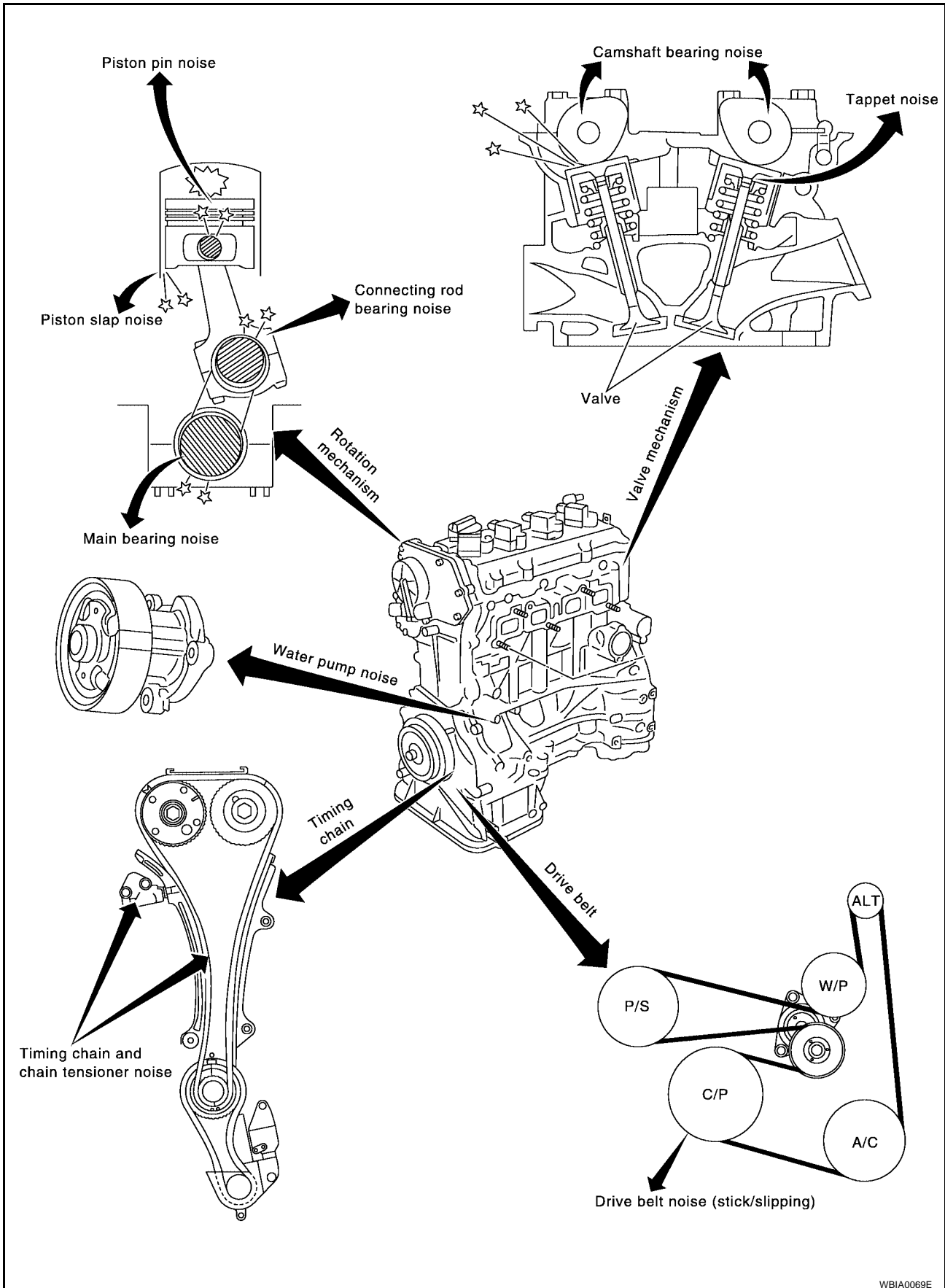
PREPARATION

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Tool number (Kent-Moore No.) Tool name	Description	
Oxygen sensor thread cleaner a: (J-43897-18) b: (J-43897-12)	 <p>Reconditioning the exhaust system threads before installing a new oxygen sensor (Use with anti-seize lubricant shown below.) a: (18 mm 0.71in) for zirconia oxygen sensor b: (12 mm 0.47 in) for titania oxygen sensor</p>	A EM C
Anti-seize lubricant (Permatex 133AR or equivalent meeting MIL specification MIL-A-907)	 <p>Lubricating oxygen sensor thread cleaning tool when reconditioning exhaust system threads</p>	D E
Power tool	 <p>Loosening bolts and nuts</p>	F G
TP50 Torx® plus Bit (J-45737)	 <p>Removing and installing M/T flywheel bolts</p>	H I J
E20 Torx® Socket (J-45816)	 <p>Removing and installing A/T drive plate bolts</p>	K L M

NVH Troubleshooting —Engine Noise

EBS00DTZ



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NOISE, VIBRATION, AND HARSHNESS (NVH) TROUBLESHOOTING

[QR25DE]

EBS00DU0

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

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 engine						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	EM-45
	Rattle	C	A	—	A	B	C	Camshaft bearing noise	Camshaft journal clearance Camshaft runout	EM-40 EM-40
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	EM-94 EM-94
	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	EM-93 EM-93 EM-93 EM-93
	Knock	A	B	C	B	B	B	Connecting rod bearing noise	Connecting rod bushing clearance (Small end) Connecting rod bearing clearance (Big end)	EM-94 EM-94
	Knock	A	B	—	A	B	C	Main bearing noise	Main bearing oil clearance Crankshaft runout	EM-98 EM-97
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	EM-49
Front of engine	Squeaking or fizzing	A	B	—	B	—	B	Drive belts (Sticking or slipping)	Drive belts deflection	EM-14
	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	CO-8

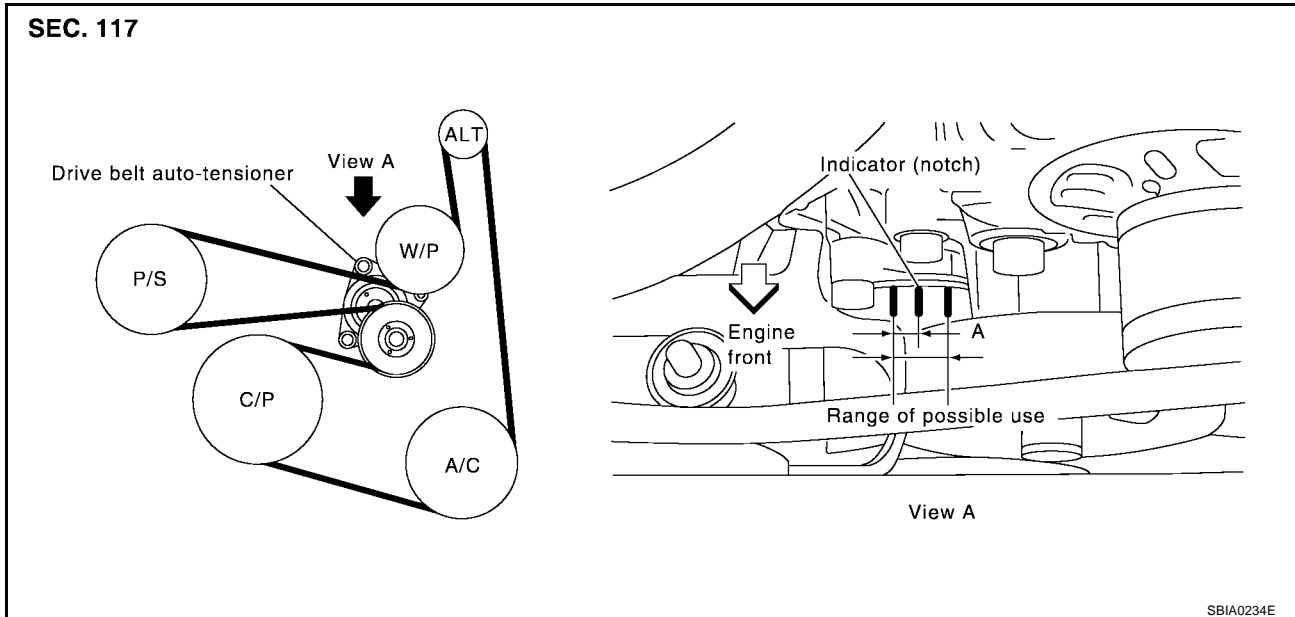
A: Closely related B: Related C: Sometimes related —: Not related

DRIVE BELTS

PF0:02117

Checking Drive Belts

EBS00DU1



SBIA0234E

NOTE:

On vehicles not equipped with A/C, there is an idler pulley in the position for the drive belt routing.

WARNING:

Inspect the drive belt only when the engine is stopped.

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

NOTE:

- Check the drive belt auto-tensioner indication when the engine is cold.
- When the new drive belt is installed, the range should be A.
- 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

EBS00DU2

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

Removal and Installation

EBS00DU3

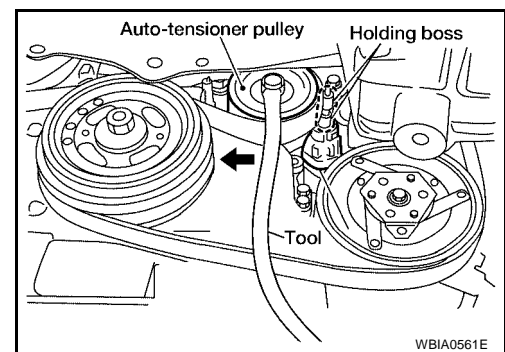
REMOVAL

1. Remove front RH engine side cover.
2. While securely holding the hexagonal part in pulley center of drive belt auto-tensioner, move in the direction of arrow (loosening direction of tensioner) using Tool.

Tool number : — J-46535

CAUTION:

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



WBIA0561E

3. Insert a rod approximately 6 mm (0.24 in) in diameter through the rear of tensioner into retaining boss to lock tensioner pulley.

NOTE:

Leave tensioner pulley arm locked until belt is installed again.

4. Loosen auxiliary drive belt from water pump pulley in sequence, and remove it.

INSTALLATION

Installation is in the reverse order of removal.

CAUTION:

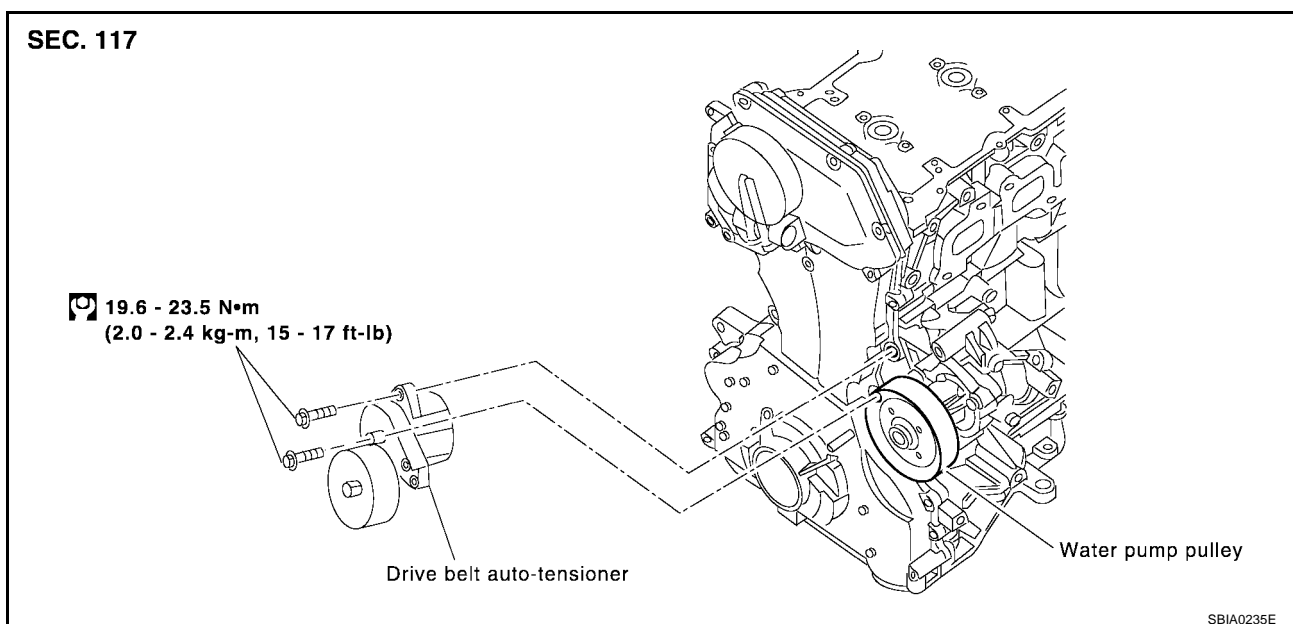
- Do not loosen the auto-tensioner pulley bolt. (Do not turn it counterclockwise.) If turned counterclockwise, the complete auto-tensioner must be replaced as a unit, including pulley.
- Avoid placing hand in a location where pinching may occur if the holding tool accidentally comes off.
- Confirm belts are completely set on the pulleys.

NOTE:

- Turn crankshaft pulley clockwise several times to equalize tension between each pulley.
- Confirm tension of drive belt at indicator (notch on fixed side) is within the possible use range. Refer to [EM-14, "Checking Drive Belts"](#).

Removal and Installation of Drive Belt Auto-tensioner

EBS00DU4

**CAUTION:**

The complete auto-tensioner must be replaced as a unit, including the pulley.

REMOVAL

1. Remove the front RH engine side cover.
2. Remove the drive belt. Refer to [EM-14](#).
3. Remove the alternator. Refer to [SC-29, "Removal and Installation"](#).
4. Remove the drive belt auto-tensioner, using power tool.

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.

INSTALLATION

1. Install drive belt auto-tensioner.
2. While securely holding the hexagonal part in pulley center of drive belt auto-tensioner, move in the direction of arrow (loosening direction of tensioner) using Tool.

Tool number : — J-46535

CAUTION:

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

-
- **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.

NOTE:

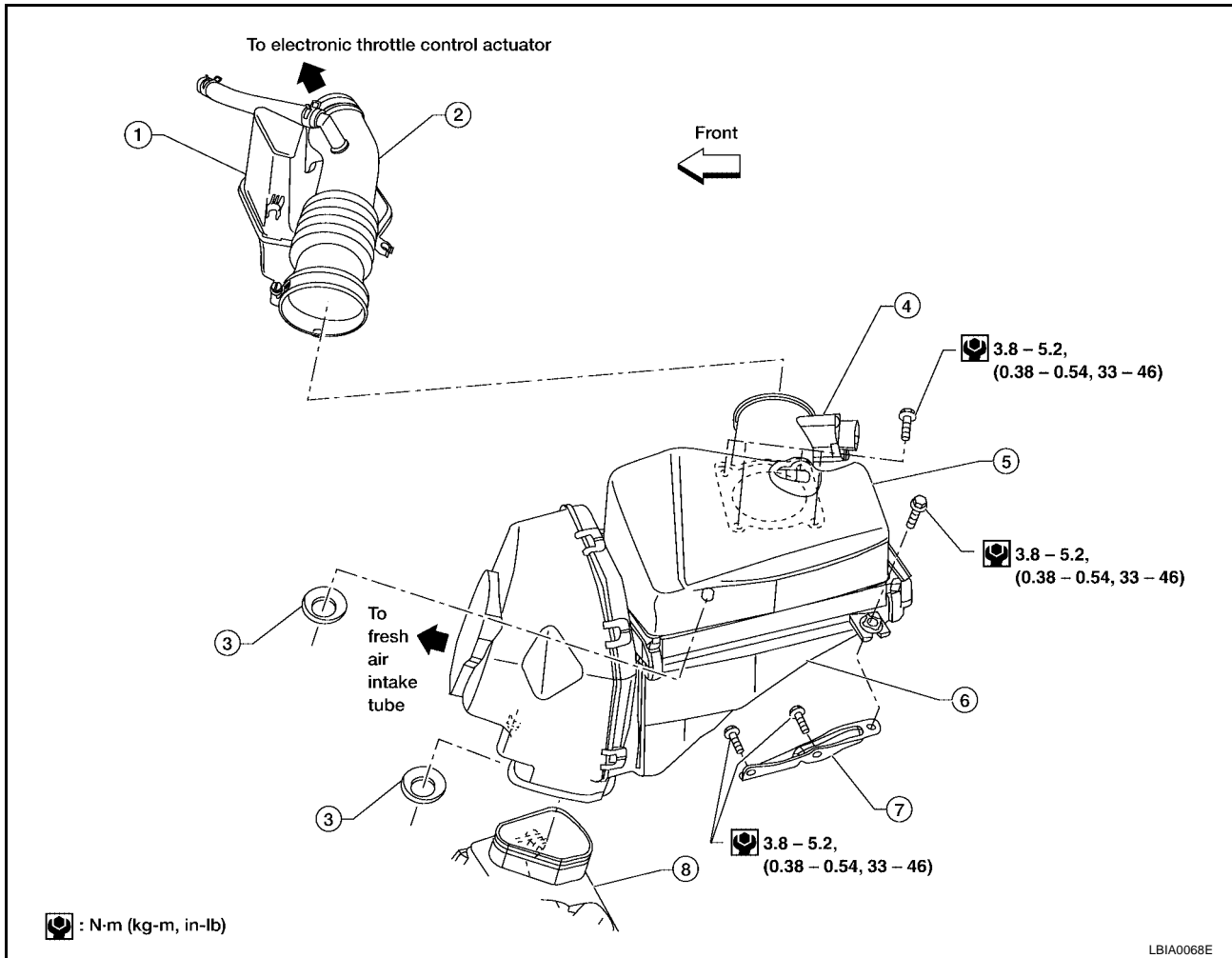
Leave tensioner pulley arm locked until belt is installed.

CAUTION:

- **Install the drive belt auto-tensioner carefully so not to damage the water pump pulley.**
- **If there is damage greater than peeled paint, replace the drive belt auto-tensioner.**
- **Do not swap the pulley between the new and old auto-tensioner unit.**
- 4. Installation of the remaining components is in the reverse order of removal.

AIR CLEANER AND AIR DUCT

Removal and Installation



- | | | |
|--------------------------------------|---|-----------------------------|
| 1. Resonator | 2. Air cleaner to electronic throttle control actuator tube | 3. Grommet |
| 4. Mass air flow sensor | 5. Air cleaner case (upper) | 6. Air cleaner case (lower) |
| 7. Air cleaner case mounting bracket | 8. Resonator in fender | |

REMOVAL

1. Disconnect the mass air flow sensor electrical connector.
2. Disconnect the tube clamp at the electronic throttle control actuator and the fresh air intake tube.
3. Remove air cleaner to electronic throttle control actuator tube, air cleaner case (upper), with mass air flow sensor attached.
4. Remove mass air flow sensor from air cleaner case (upper), 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.

5. Remove the resonator in the fender, as necessary.

INSTALLATION

Installation is in the reverse order of removal.

- Attach each joint according to the alignment marks made during removal. Screw all clamps firmly.

CHANGING THE AIR CLEANER ELEMENT

1. Unhook the air cleaner case side clips and raise the air cleaner case (upper).
2. Remove the air cleaner element.
3. Install a new air cleaner element.
4. Installation is in the reverse order of removal.

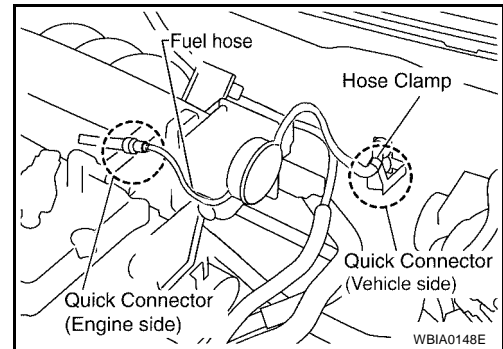
INTAKE MANIFOLD

[QR25DE]

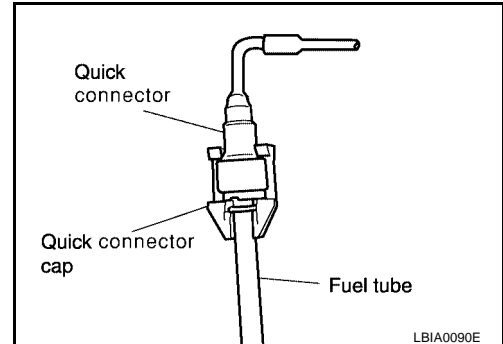
7. Disconnect the fuel quick connector on the engine side.

- Using Tool perform the following steps to disconnect the quick connector.

Tool number : — (J-45488)



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.

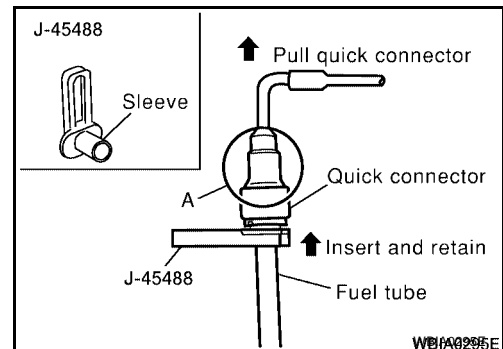
CAUTION:

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.

8. 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:

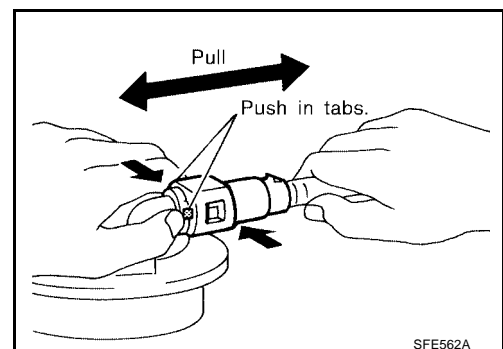
- The tube can be removed when the tabs are completely depressed. Do not twist it more than necessary.

- Do not use any tools to remove the quick connector.

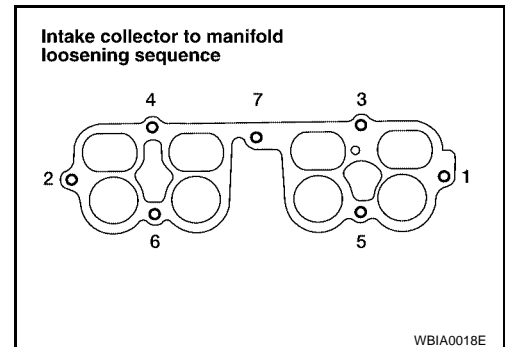
- Keep the resin tube away from heat. Be especially careful when welding near the tube.

- Prevent acid liquid such as battery electrolyte etc. from getting on the resin tube.

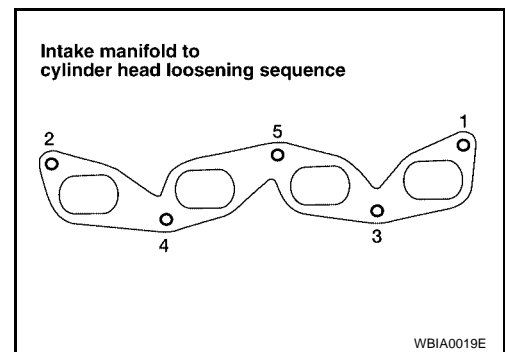
- Do not bend or twist the tube during installation and removal.



- 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.
9. Loosen mounting bolts diagonally, and remove the electric throttle control actuator.
CAUTION:
Handle carefully to avoid any damage.
 10. Disconnect intake manifold collector harness, and vacuum hose.
CAUTION:
Cover engine openings to avoid entry of foreign materials.
 11. Remove intake manifold collector mounting bolts on the support, using power tools.
 12. Loosen the mounting bolts and nuts in the order shown to remove the intake manifold collector, using power tools.



13. Loosen the bolts in the order shown to remove the intake manifold assembly, using power tools.

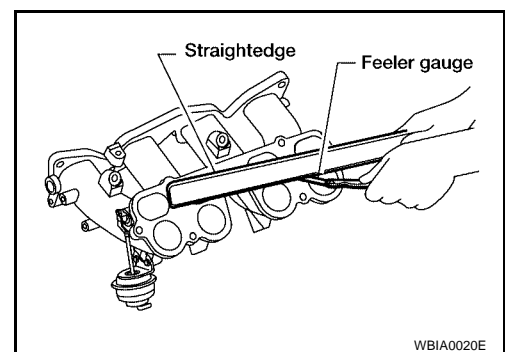


INSPECTION AFTER REMOVAL

Surface Distortion

- Using straightedge and feeler gauge, inspect surface distortion of intake manifold collector and intake manifold surface.

Standard : 0.1 mm (0.004 in)



INSTALLATION

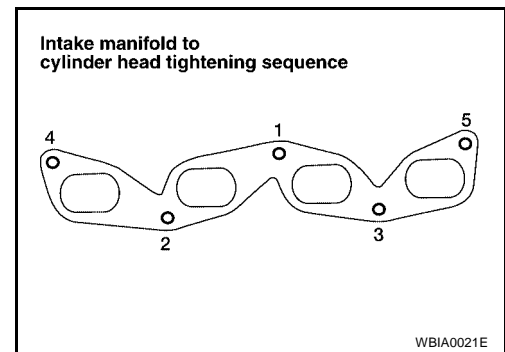
- Install the intake manifold bolts and nuts in the reverse order of removal, following the tightening sequences below.

Tightening Intake Manifold Bolts and Nuts

- Tighten in numerical order as shown.

CAUTION:

After tightening No.5, retighten the No.1 mounting bolt to specification.

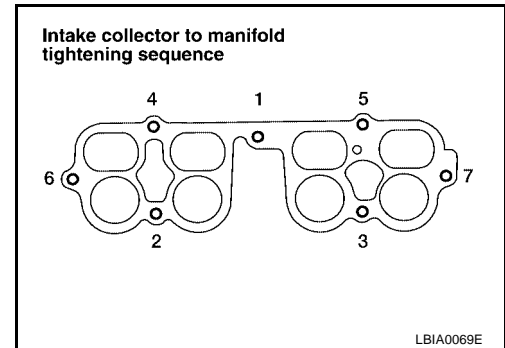


Tightening Intake Manifold Collector Bolts and Nuts

- Tighten in numerical order as shown.

CAUTION:

After tightening No.7, retighten the No.1 mounting bolt to specification.



Installation of Electric Throttle Control Actuator:

- Tighten the mounting bolts of electric throttle control actuator equally and diagonally in several steps.

Electric throttle control actuator mounting bolts : 7.2 - 9.6 N·m (0.74 - 0.98 kg·m, 64 - 84 in·lb)

- After installation perform procedure in [EM-23, "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.

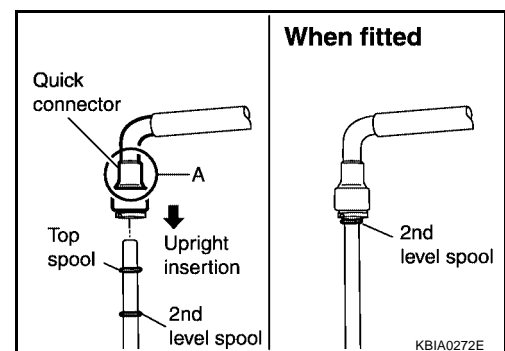
- Insert the fuel tube until you hear a "click" sound and actually feel the engagement.

- 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:

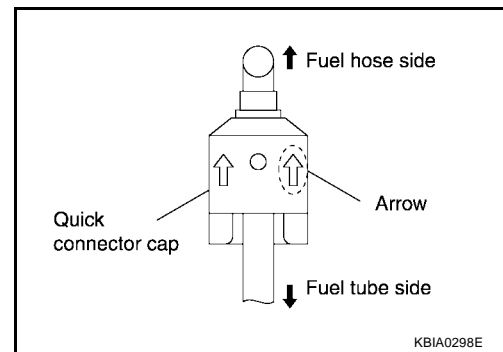
Recommended pulling force is 50 N (5.1 kg, 11.2 lb).



INTAKE MANIFOLD

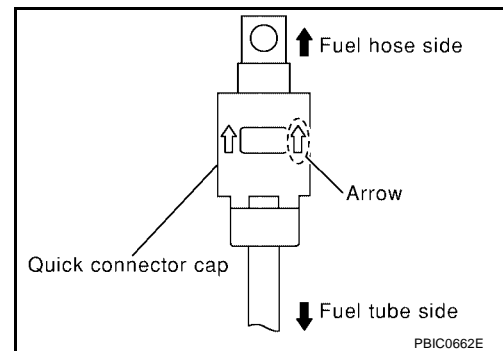
[QR25DE]

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 by turning ignition switch ON (with engine stopped). Then check for fuel leaks at connections.
2. Start the engine and rev it up and check for fuel leaks at connections.

NOTE:

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

CAUTION:

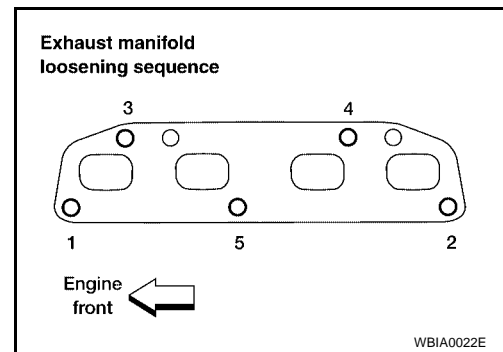
Do not touch engine immediately after stopping as engine is extremely hot.

- Perform procedures for "Throttle Valve Closed Position Learning" after finishing repairs. Refer to [EC-47, "Throttle Valve Closed Position Learning"](#).
- If electric throttle control actuator is replaced, perform procedures for "Idle Air Volume Learning" after finishing repairs. Refer to [EC-48, "Idle Air Volume Learning"](#).

EXHAUST MANIFOLD AND THREE WAY CATALYST

[QR25DE]

- Loosen the nuts in the sequence shown, on the exhaust manifold and three way catalyst.
- Remove the exhaust manifold and three way catalyst assembly and gasket. Discard the gasket.

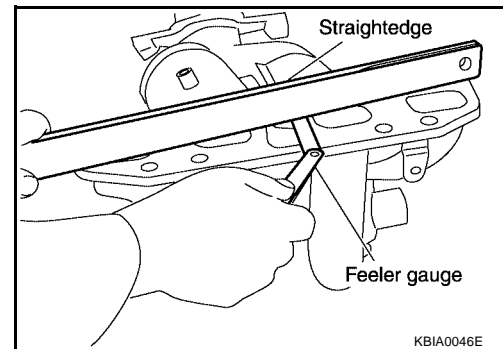


INSPECTION AFTER REMOVAL

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)

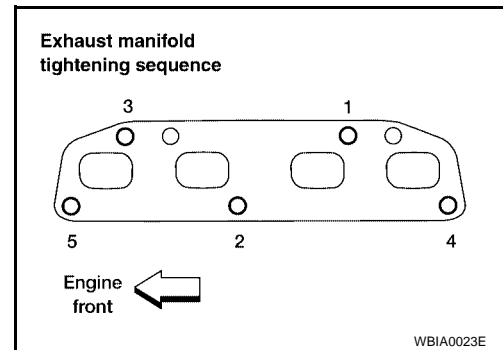


INSTALLATION

Installation is in the reverse order of removal. Pay attention to the following.

Tightening Exhaust Manifold Nuts

- Tighten the nuts in the numerical order shown, to specification. After tightening No.5, retighten No.1 and then No.3 to specification.



Installation of Air Fuel A/F Ratio Sensors and Heated Oxygen Sensors

Clean the A/F sensors and heated oxygen sensor threads with the Tool, then apply the anti-seize lubricant to the threads before installing the A/F sensors or heated oxygen sensors.

Oxygen sensor thread cleaner J43897 - 18
J43897 - 12

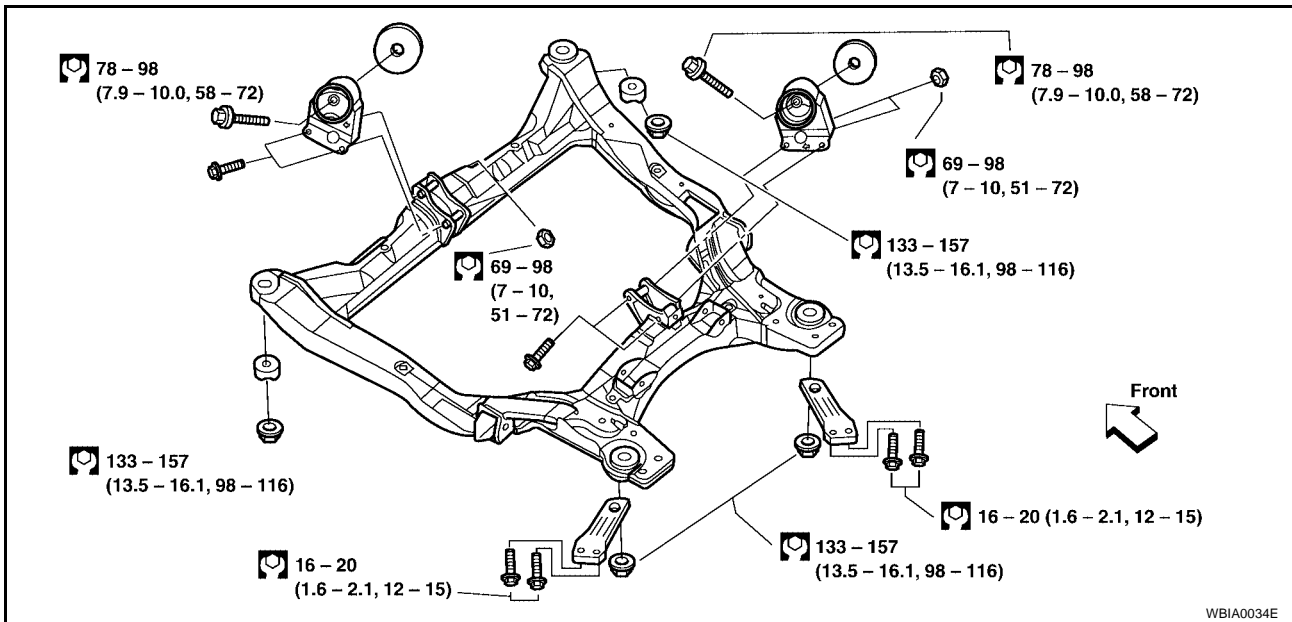
CAUTION:

Do not over-tighten the A/F sensors or heated oxygen sensors. Doing so may cause damage to the A/F sensors or heated oxygen sensors, resulting in a malfunction and the MIL coming on.

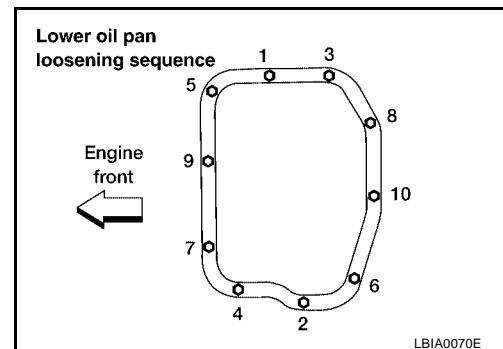
OIL PAN AND OIL STRAINER

[QR25DE]

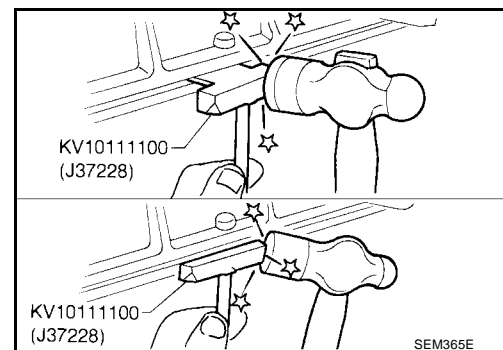
6. Remove the front suspension member for clearance to remove the oil pan by disconnecting the following:



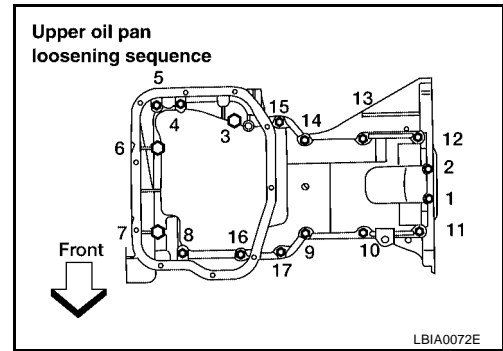
- Position the power steering pump and reservoir aside.
 - Remove auxiliary drive belts. Refer to [EM-14, "Removal and Installation"](#).
 - Dismount the A/C compressor and position it out of the way with wire.
 - Disconnect the upper swaybar links. Refer to [FSU-11, "Removal and Installation"](#).
 - Remove the through bolts from the front and rear engine mounts.
 - Disconnect the lower ball joints. Refer to [FSU-5, "Components"](#).
 - Remove the two steering gear housing mounting bolts. Refer to [PS-13, "Removal and Installation"](#).
 - Remove crossmember bolts and remove crossmember.
7. Remove the lower oil pan bolts. Loosen the bolts in the order shown, using power tool.



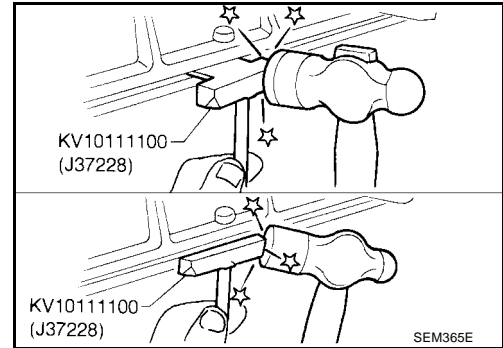
- 8. Insert the Tool between lower oil pan and the upper oil pan to separate them. Tap gently on the side to move the Tool around the pan; do not damage the mating surface.
- 9. Remove the lower oil pan.
- 10. Remove the oil pickup screen.
- 11. Remove rear plate cover, and four engine-to transaxle bolts, using power tool.



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



13. Insert the Tool between the upper oil pan and the cylinder block to separate them. Tap gently on the side to move the Tool around the pan; do not damage the mating surface.



14. Remove the upper oil pan.

INSPECTION AFTER REMOVAL

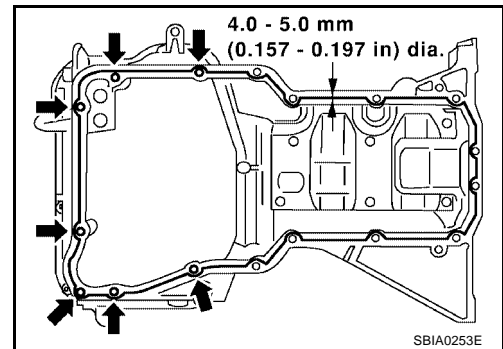
- Clean the oil pickup screen to remove any foreign material.

INSTALLATION

1. Installation is in the reverse order of removal. Paying attention to the following.

- a. Apply Genuine Silicone RTV Sealant, or equivalent, to the upper oil pan. Refer to [GI-43, "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS"](#) , and [EM-6, "Precautions for Liquid Gasket"](#) .

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



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

- Bolt No.10,11,18 indicate a double tightening in the sequence of bolt No.s 1, 2, 3.

NOTE:

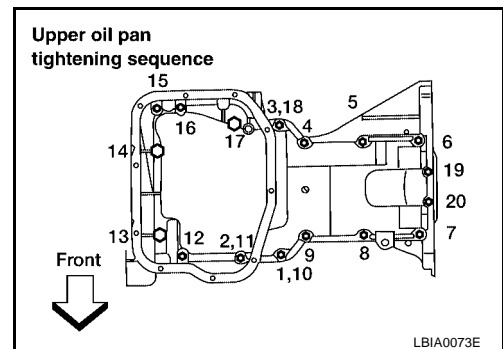
Refer below for specified bolt sizes:

M6 × 20 mm (0.79 in): No.19, 20

M8 × 25 mm (0.98 in): No.1, 3, 4, 9

M8 x 45 mm (1.77 in): No.2, 5, 6, 7, 8, 17

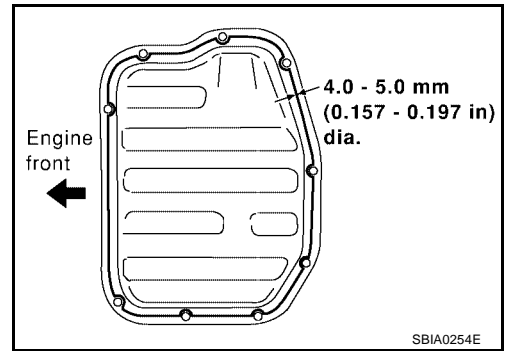
M8 x100 mm (3.97 in): No.12, 13, 14, 15, 16



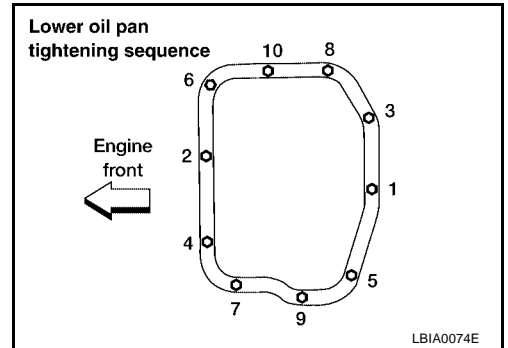
OIL PAN AND OIL STRAINER

[QR25DE]

- c. Apply Genuine Silicone RTV Sealant, or equivalent to the lower oil pan. Refer to [GI-43, "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS"](#), and [EM-6, "Precautions for Liquid Gasket"](#)



- d. Tighten the lower oil pan bolts in the numerical order shown.
- Wait at least 30 minutes after the oil pans are installed before filling the engine with oil.



INSPECTION AFTER INSTALLATION

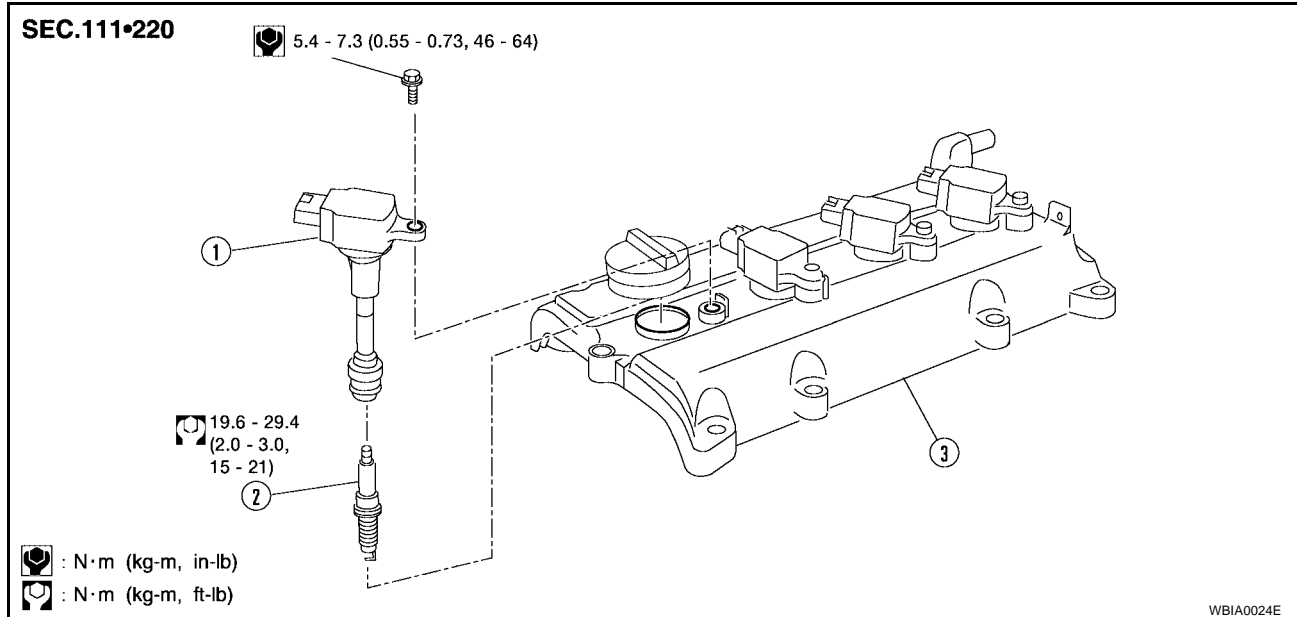
- Check for any engine oil leaks with the engine at operating temperature and running at idle.

IGNITION COIL

PFP:22448

Removal and Installation

EBS00DU9



1. Ignition coil

2. Spark plug

3. Rocker cover

REMOVAL

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

CAUTION:

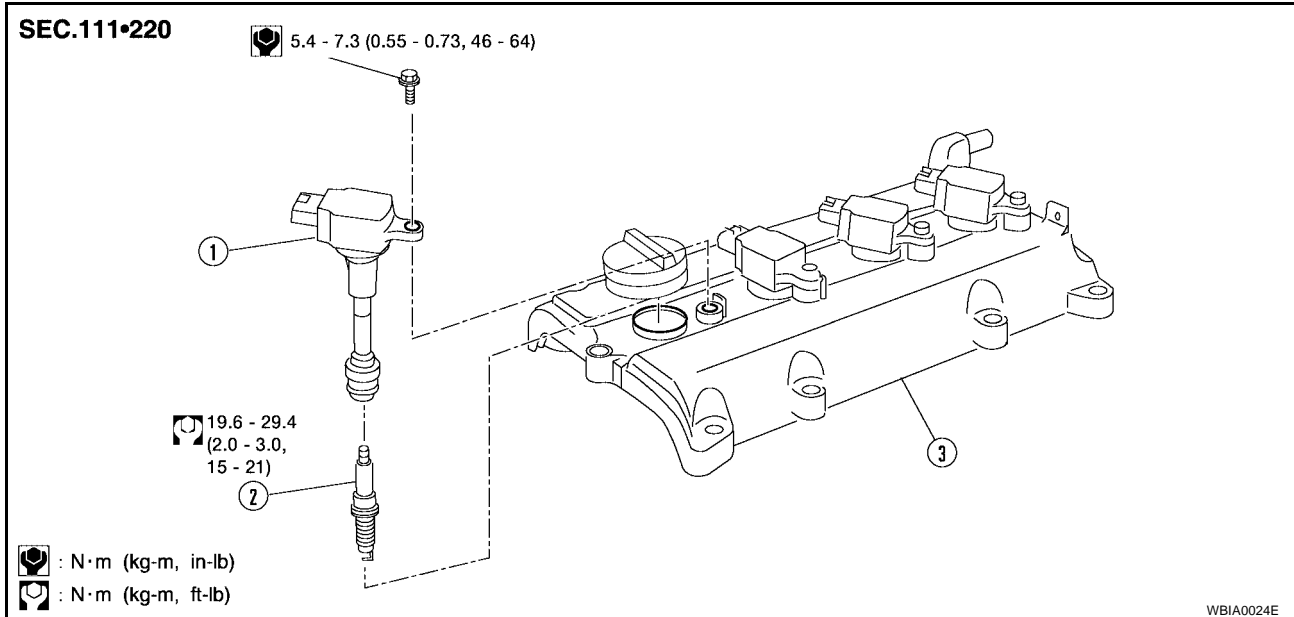
Do not drop or shock it.

INSTALLATION

Installation is in the reverse order of removal.

SPARK PLUG

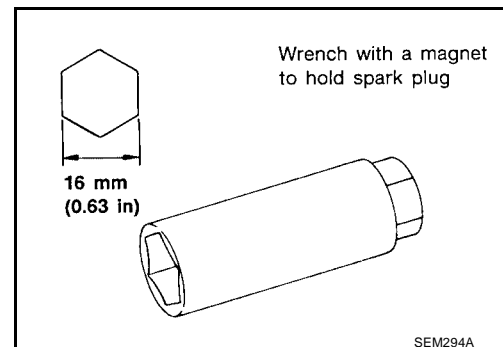
Removal and Installation



REMOVAL

1. Remove the ignition coil. Refer to [EM-30, "Removal and Installation"](#).
2. Remove the spark plug with a suitable spark plug wrench.

Temperature range	NGK
Standard type	PLFR5A-11
Hot type	PLFR4A-11
Cold type	PLFR6A-11



INSPECTION AFTER REMOVAL

- Use standard type spark plug for normal conditions.

The hot type spark plug is suitable when fouling occurs with the standard type spark plug under conditions such as:

- Frequent engine starts.
- Low ambient temperatures.

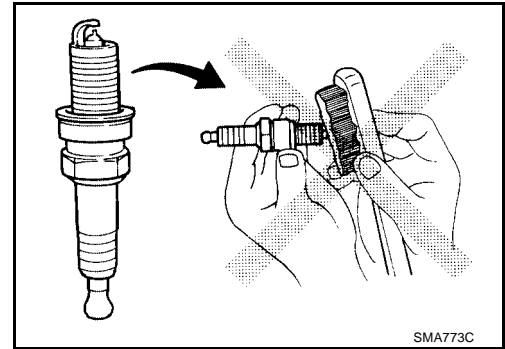
The cold type spark plug is suitable when spark plug knock occurs with the standard type spark plug under conditions such as:

- Extended highway driving.
- Frequent high engine revolution.

SPARK PLUG

[QR25DE]

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



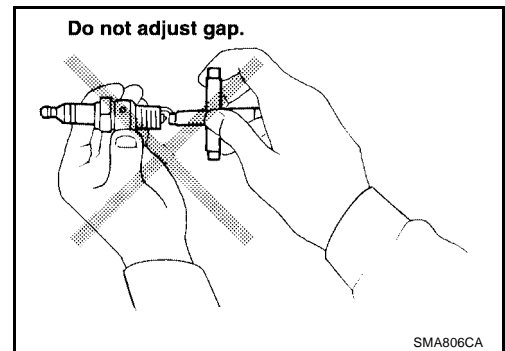
If plug is covered with carbon, a spark plug cleaner may be used.

Cleaner air pressure : less than 588 kPa (6 kg/cm² , 85 psi)

Cleaning time : less than 20 seconds

Checking and adjusting plug gap is not required between change intervals.

Gap : 1.1 mm (0.043 in)

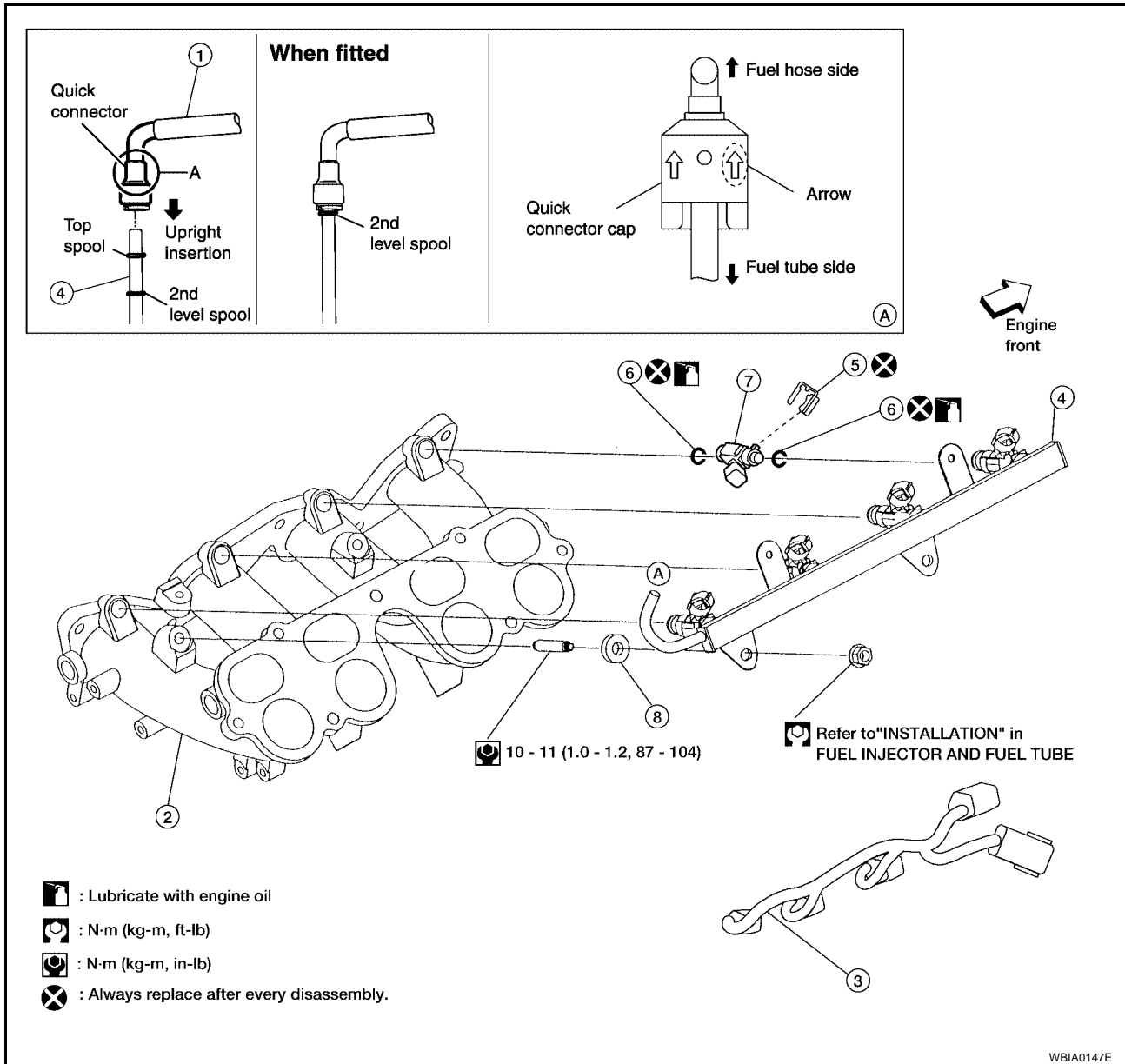


INSTALLATION

- Installation is in the reverse order of removal.

FUEL INJECTOR AND FUEL TUBE

Removal and Installation



- | | | |
|------------------|--------------------|----------------|
| 1. Fuel hose | 2. Intake manifold | 3. Sub-harness |
| 4. Fuel tube | 5. Clip | 6. O-ring |
| 7. Fuel injector | 8. Insulator | |

CAUTION:

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

REMOVAL

1. Release the fuel pressure. Refer to [EC-50, "FUEL PRESSURE RELEASE"](#).
2. Remove the intake air duct. Refer to [EM-17, "Removal and Installation"](#).
3. Disconnect the fuel hose quick connector at the fuel tube side. Refer to [EM-19, "INTAKE MANIFOLD"](#).

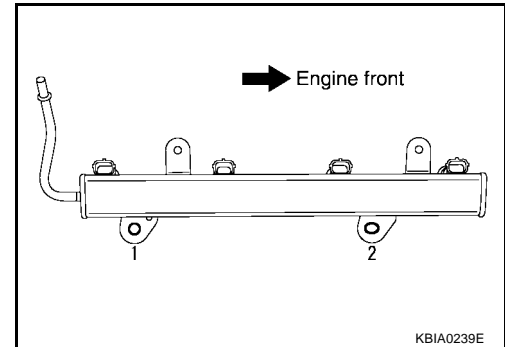
CAUTION:

- Prepare a container and cloth for catching any spilled fuel.
- This operation should be performed in a place that is free from any open flames.

FUEL INJECTOR AND FUEL TUBE

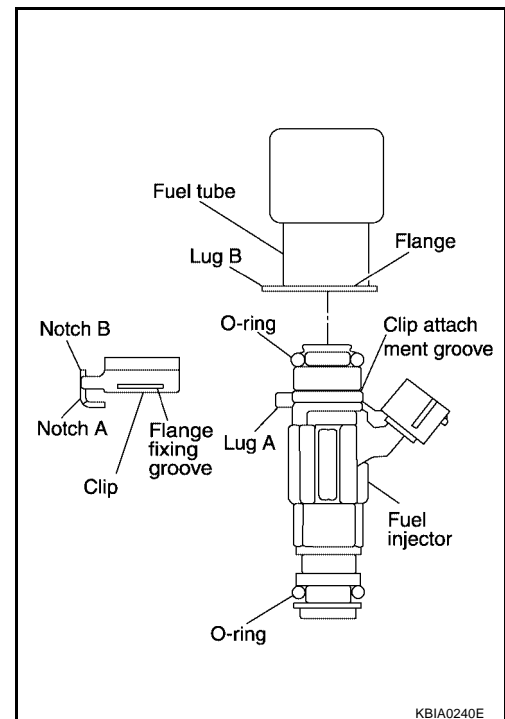
[QR25DE]

- While hoses are disconnected seal their openings with vinyl bag or similar material to prevent foreign material from entering them.
4. Remove the intake collector. Refer to [EM-19, "INTAKE MANIFOLD"](#) .
 5. Disconnect sub-harness for injector at engine front side, and remove it from bracket.
 6. Loosen the mounting bolts in the order as shown, then remove fuel tube and fuel injectors as an assembly.
 7. 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.
 - Be careful not to damage the nozzle.
 - Avoid any impact, such as dropping the fuel injector.
 - Do not disassemble or adjust the fuel injector.

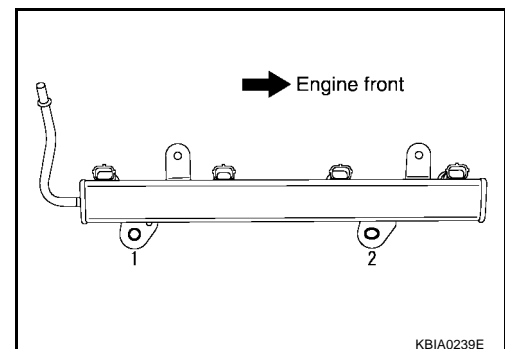


INSTALLATION

1. Install new O-rings on the fuel injector.
 - Lubricate the O-rings lightly with new engine oil.
 - Be careful not to scratch it during installation. Also be careful not to 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 into the fuel tube with the following procedure:
 - Do not reuse the clip, replace it with a new one.
 - Insert the new clip into the clip mounting groove on fuel injector.
 - Insert the clip so that projection "A" of fuel injector matches notch "A" of the clip.
3. Insert fuel injector into fuel tube with clip attached.
 - Insert it while matching it to the axial center.
 - Insert fuel injector so that projection "B" of fuel injector matches notch "B" of the clip.
 - Make sure that fuel tube flange is securely fixed in flange fixing groove on the clip.
 - Make sure that installation is complete by checking that fuel injector does not rotate or come off.
4. Install fuel tube assembly.
 - a. Insert the tip of each fuel injector into intake manifold.



- b. Tighten the mounting bolts in two steps in the numerical order shown.



FUEL INJECTOR AND FUEL TUBE

[QR25DE]

Fuel tube bolt tightening 1st step : 9.3 - 10.8 N·m (0.95 - 1.1 kg·m, 83 - 95 in·lb)

Fuel tube bolt tightening 2nd step : 20.6 - 26.5 N·m (2.1 - 2.7 kg·m, 16 - 19 ft·lb)

A

CAUTION:

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

EM

5. Install the intake collector. Refer to [EM-19, "INTAKE MANIFOLD"](#) .

6. Connect the fuel hose quick connector. Refer to [EM-19, "INTAKE MANIFOLD"](#) .

C

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

INSPECTION AFTER INSTALLATION

D

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

1. Apply fuel pressure to fuel lines by turning ignition switch ON (with engine stopped). Then check for fuel leaks at connections.

E

2. Start the engine and rev it up and check for fuel leaks at connections.

NOTE:

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

F

CAUTION:

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

- Perform procedures for "Throttle Valve Closed Position Learning" after finishing repairs. Refer to [EC-47, "Throttle Valve Closed Position Learning"](#) .

G

- If electric throttle control actuator is replaced, perform procedures for "Idle Air Volume Learning" after finishing repairs. Refer to [EC-48, "Idle Air Volume Learning"](#) .

H

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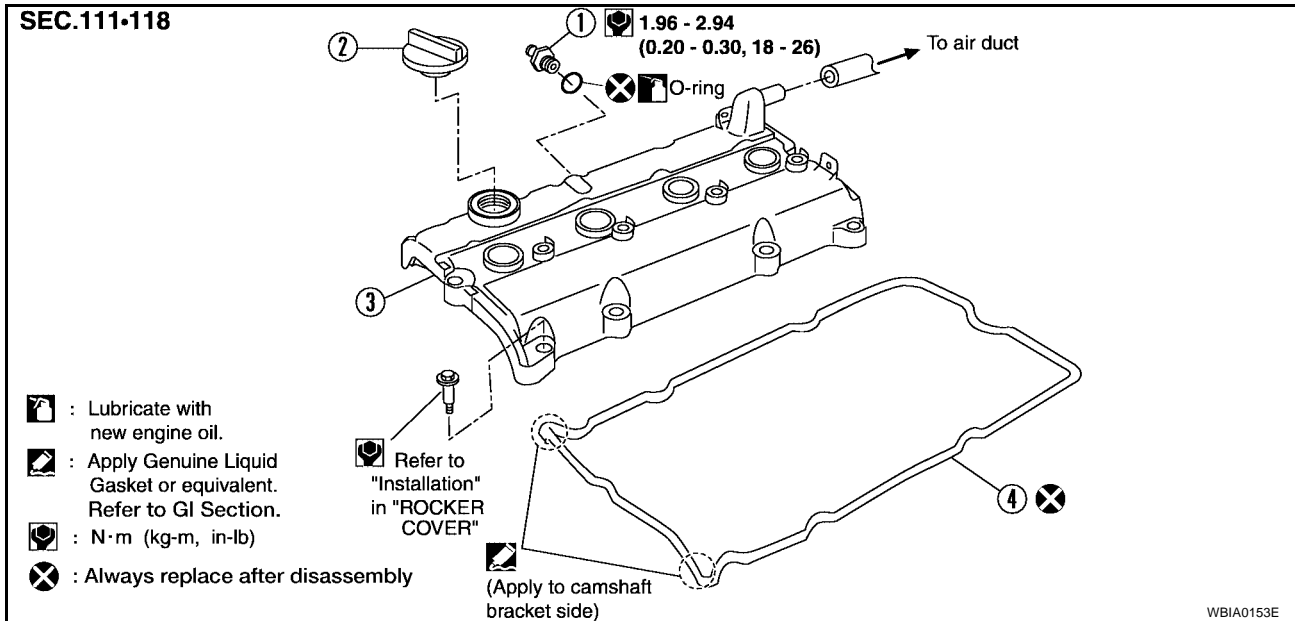
K

L

M

ROCKER COVER

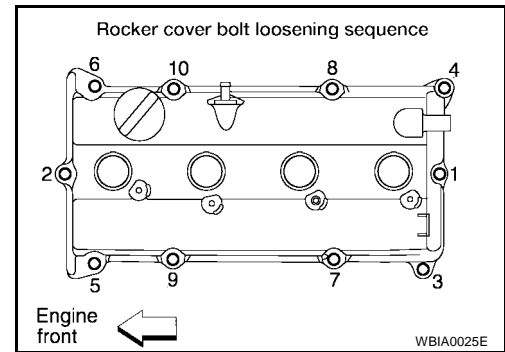
Removal and Installation



1. PCV valve
2. Oil filler cap
3. Rocker cover
4. Rocker cover gasket

REMOVAL

1. Remove the ignition coils. Refer to [EM-30, "Removal and Installation"](#).
2. Disconnect the PCV hose and breather hose from the rocker cover.
3. Loosen the bolts in the numerical order as shown using power tool.
4. Remove the rocker cover. Remove the oil filler cap and PCV valve if necessary, to transfer to the new rocker cover.



INSTALLATION

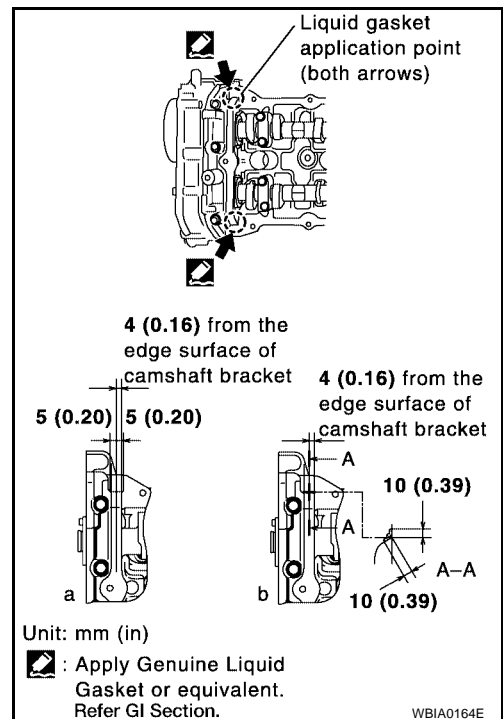
1. Apply RTV Silicone Sealant to the joint part of the cylinder head and camshaft bracket following the steps below:

ROCKER COVER

[QR25DE]

- Use Genuine Silicone RTV Sealant, or equivalent. Refer to [GI-43, "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS"](#).

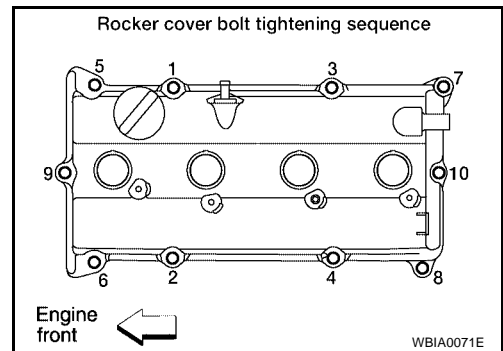
- Refer to illustration "a" to apply sealant to joint part of No.1 camshaft bracket and cylinder head.
 - Refer to illustration "b" to apply sealant in a 90° degree angle to the illustration "a".
- Install the rocker cover.
 - The rocker cover gasket must be securely installed in the groove in the rocker cover.



- Tighten the rocker cover bolts in two steps, in the numerical order as shown.

Rocker cover bolt tightening 1st step : 1.0 - 2.9 N·m (0.1 - 0.3 kg-m, 9 - 26 in-lb)

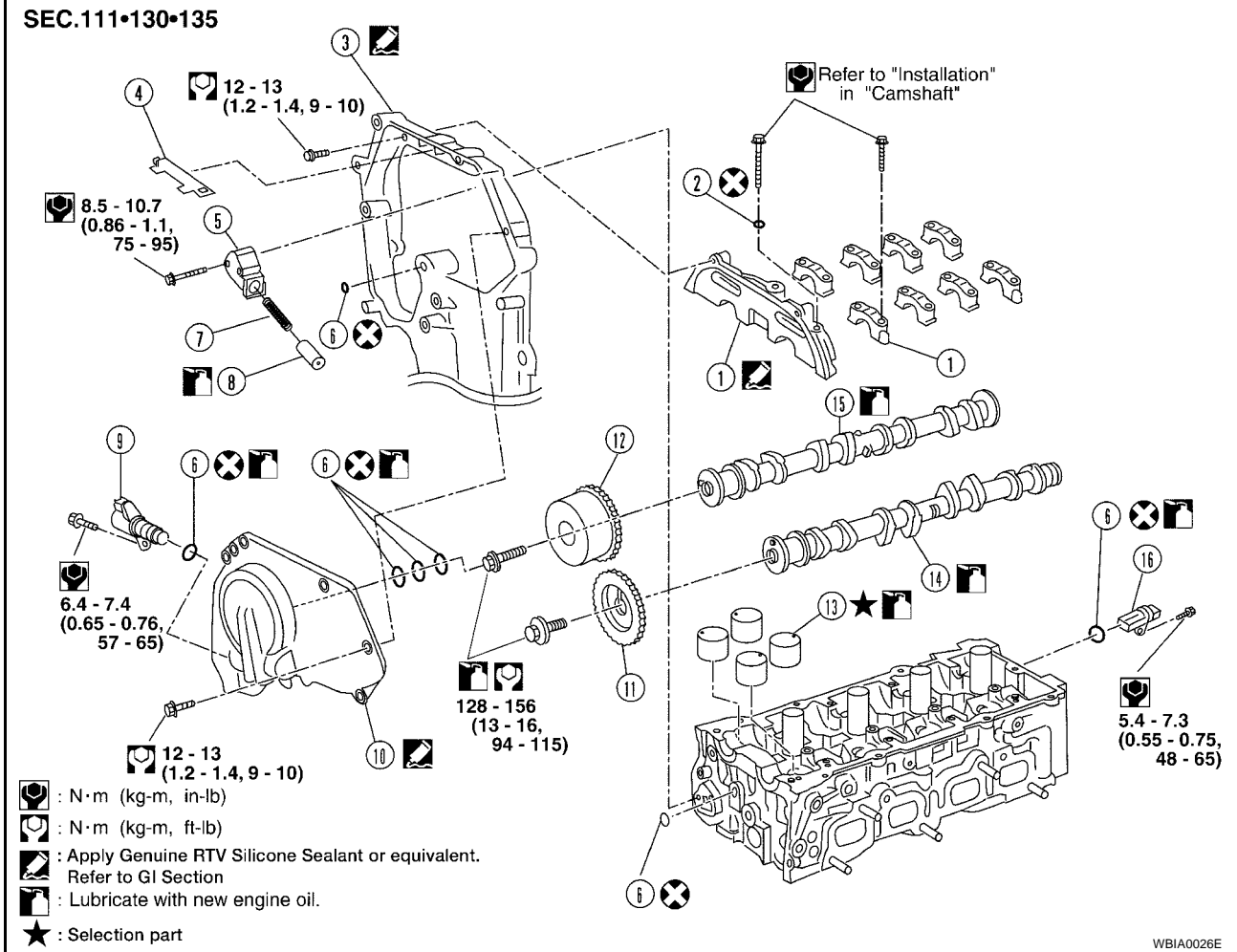
Rocker cover bolt tightening 2nd step : 7.4 - 9.3 N·m (0.75 - 0.95 kg-m, 65 - 82 in-lb)



- Connect the PCV hose and breather hose to the rocker cover. If necessary, install the oil filler cap and PCV valve and lubricate the PCV valve O-ring with new engine oil.
- Install the ignition coils. Refer to [EM-30, "Removal and Installation"](#).

CAMSHAFT

Removal and Installation



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- | | | |
|--------------------------------------|-----------------------------|-------------------------------|
| 1. Camshaft brackets (1 - 5) | 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 position sensor (PHASE) | | |

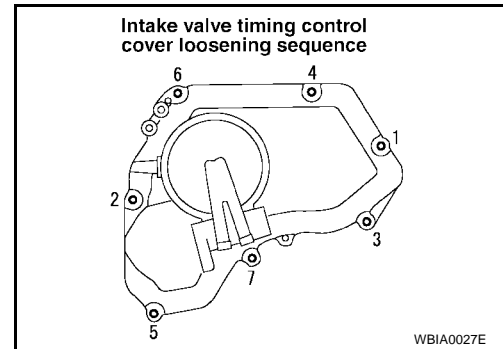
REMOVAL

1. Remove the rocker cover. Refer to [EM-36, "Removal and Installation"](#) .
2. Remove the front right side tire and wheel using power tool.
3. Remove the RH splash shield using power tool.
4. Remove the drive belt.
5. Remove the coolant overflow reservoir tank.
6. Disconnect variable timing control solenoid harness connector.

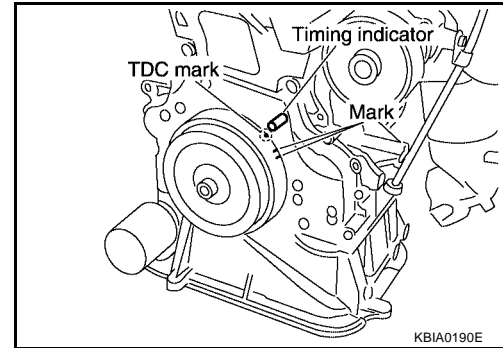
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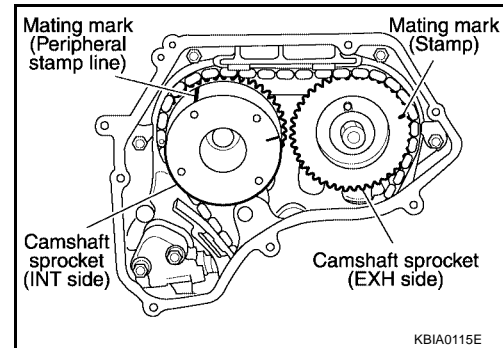
7. Remove the IVT control cover by cutting the sealant using the Tool.
- Loosen the bolts in the order shown.



8. Set the No.1 cylinder at TDC on its compression stroke with the following procedure:
- Open the splash cover on RH under cover.
 - Rotate crankshaft pulley clockwise, and align mating marks for TDC with timing indicator on front cover, as shown.



- 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.



9. Pull the timing chain guide out between the camshaft sprockets through front cover.
10. Remove camshaft sprockets with the following procedure.

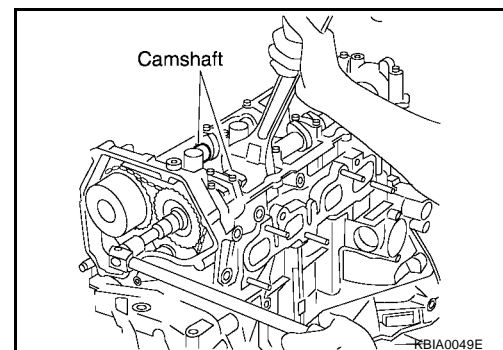
CAUTION:

- 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.

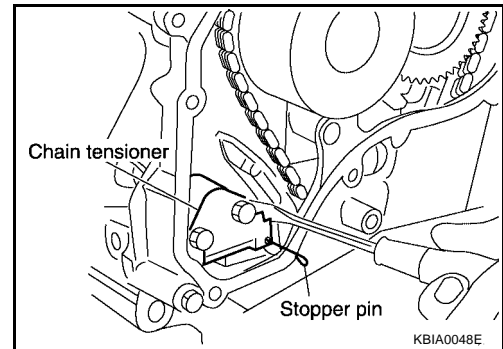


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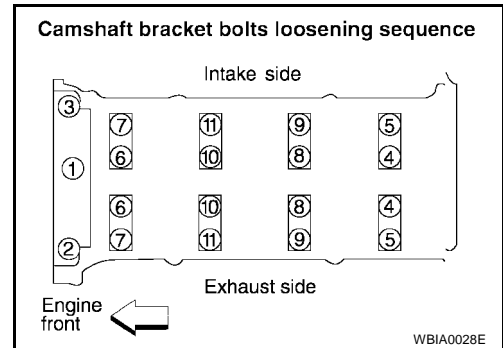
CAMSHAFT

[QR25DE]

- b. 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.
- c. Secure the hexagonal part of camshaft with a suitable tool. Loosen the camshaft sprocket mounting bolts and remove the camshaft sprockets.



11. Loosen the camshaft bracket bolts in the order shown, and remove the camshaft brackets and camshafts.
 - Remove No.1 camshaft bracket by slightly tapping it with a rubber mallet.
12. Remove the valve lifters.
 - Check mounting positions, and set them aside in the order removed.

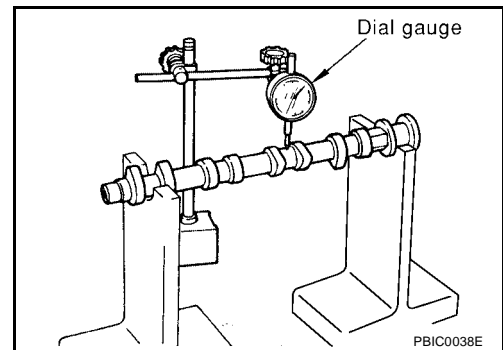


INSPECTION AFTER REMOVAL

Camshaft Runout

1. Put the camshaft on a V-block supporting the No.2 and No.5 journals.
2. Set the dial gauge vertically on the No.3 journal.
3. 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)



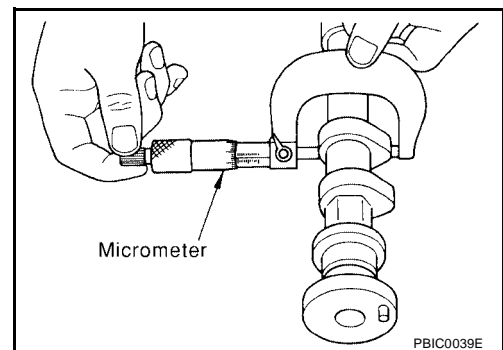
Camshaft Cam Height

1. Measure the camshaft cam height.

Standard intake cam height : 45.665 - 45.855 mm (1.7978 - 1.8053 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

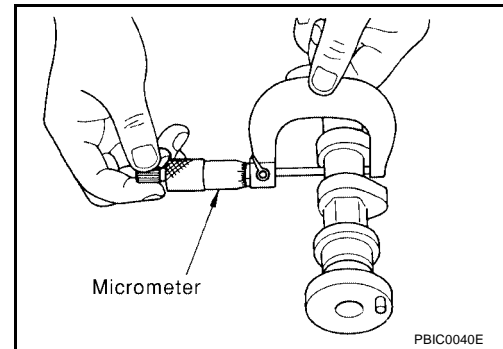
CAMSHAFT

[QR25DE]

- Measure the outer diameter of the camshaft journal.

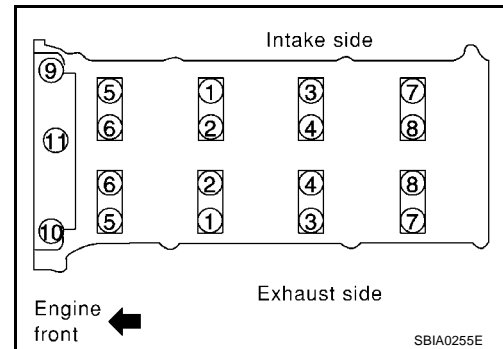
Standard No.1 outer diameter : 27.935 - 27.955 mm (1.0998 - 1.1006 in)

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



Inner Diameter of Camshaft Bracket

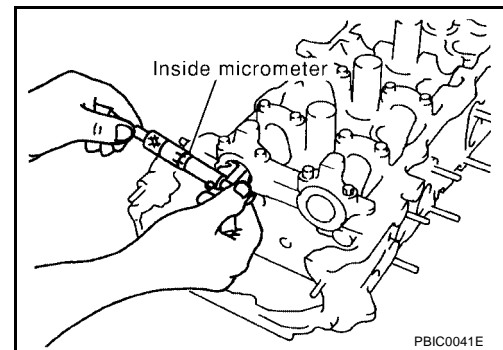
- Tighten the camshaft bracket bolts to the specified torque following the tightening pattern as shown. Refer to Step 4 of [EM-43, "INSTALLATION"](#), of "CAMSHAFT" for the specified torque sequence.



- 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.

NOTE:

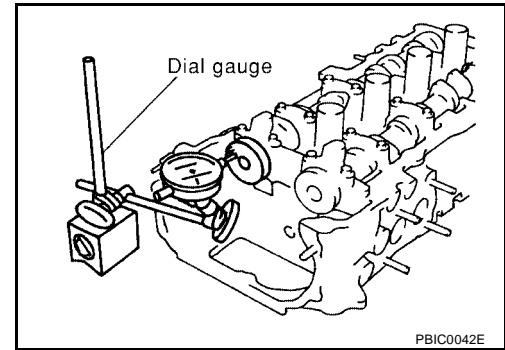
Inner diameter of the camshaft bracket is manufactured together with the cylinder head. If the camshaft bracket is out of specification, replace the whole cylinder head assembly.

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.

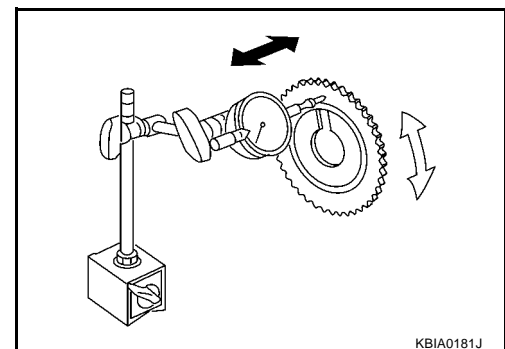


Camshaft Sprocket Runout

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.

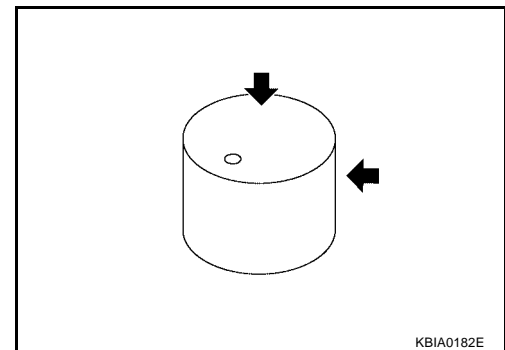
Runout : Less than 0.15 mm (0.0059 in)

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.



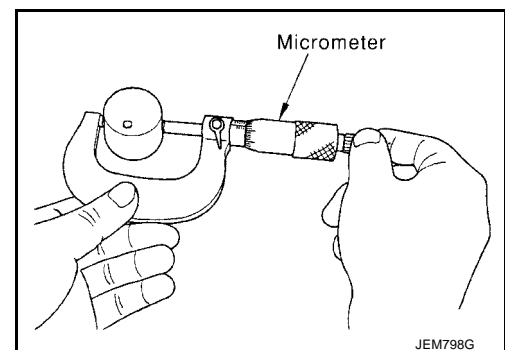
Valve Lifter Clearance

Outer Diameter of Valve Lifter

- Measure the outer diameter of the valve lifter.

Valve lifter outer diameter : 33.965 - 33.980 mm (1.3372 - 1.3378 in)

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

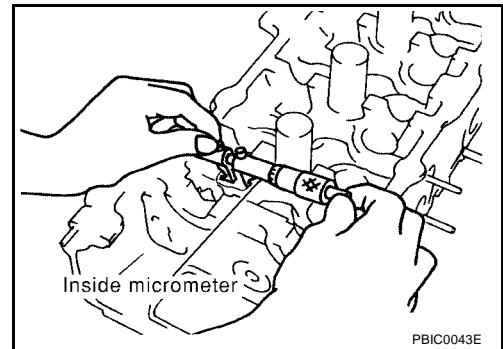


CAMSHAFT

[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.



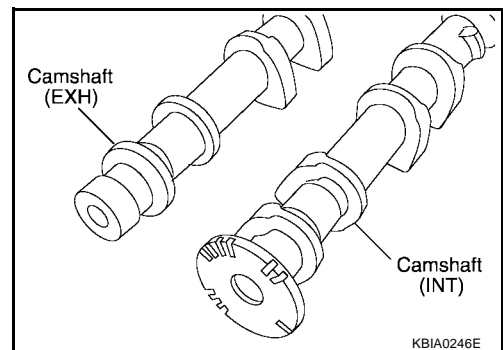
Calculation of Valve Lifter Clearance

- (Valve lifter clearance) = (hole diameter for valve lifter) – (outer diameter of valve lifter)
- Standard : 0.020 - 0.056 mm (0.0008 - 0.0022 in)**
- If out of specified range, replace either or both valve lifter and cylinder head assembly.

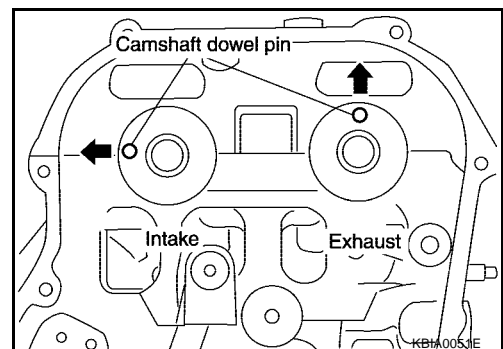
INSTALLATION

- 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:

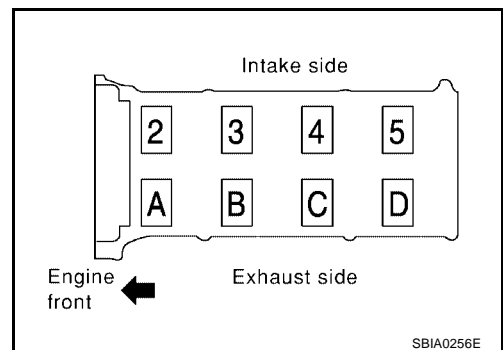
Intake: Signal plate for the camshaft position sensor (PHASE)
Exhaust: Cone end shape



- 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.



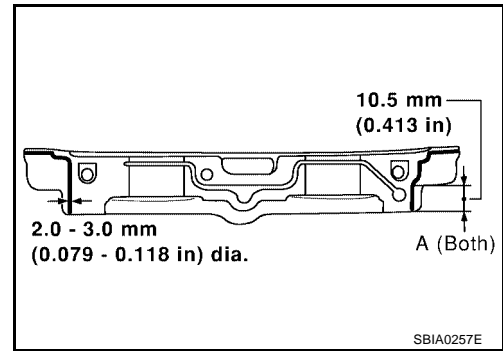
CAMSHAFT

[QR25DE]

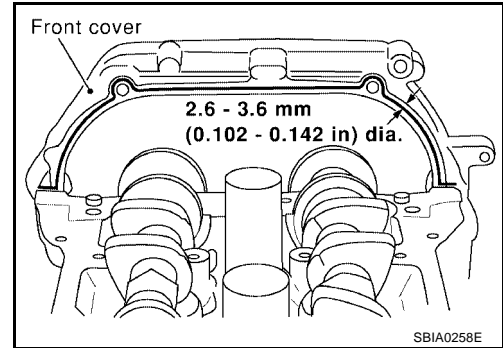
- Install No. 1 camshaft bracket as follows.
 - Apply sealant to No.1 camshaft bracket as shown.
- Use **Genuine Silicone RTV Sealant, or equivalent. Refer to GI-43, "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS"**.

CAUTION:

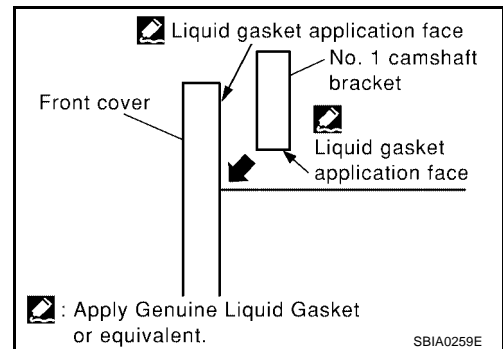
- **After installation, be sure to wipe off any excessive sealant leaking from part "A" (both on right and left sides).**



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



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



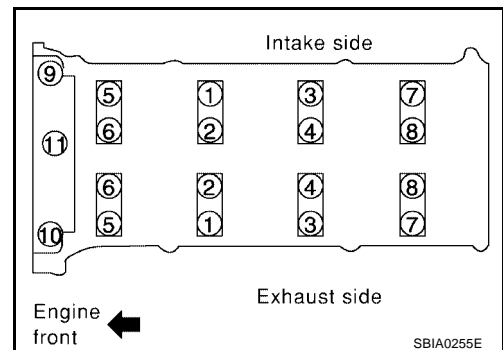
4. Tighten camshaft bracket bolts in four steps in the order shown.

- Step 1 (bolts 9 - 11) : 2.0 N·m (0.2 kg-m, 17 in-lb)**
- Step 2 (bolts 1 - 8) : 2.0 N·m (0.2 kg-m, 17 in-lb)**
- Step 3 (bolts 1 - 11) : 5.9 N·m (0.6 kg-m, 52 in-lb)**
- Step 4 (bolts 1 - 11) : 9.0 - 11.8 N·m (0.92 - 1.2 kg-m, 80 - 104 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]

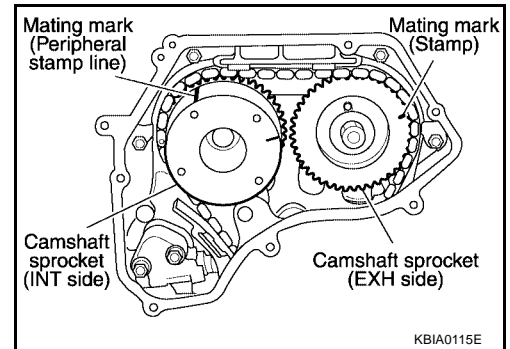
5. Install camshaft sprockets.

- 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.**

Camshaft sprocket mounting bolts : 128 - 156 N·m (13 - 16 kg·m, 94 - 115 ft·lb)



6. Install chain tensioner.

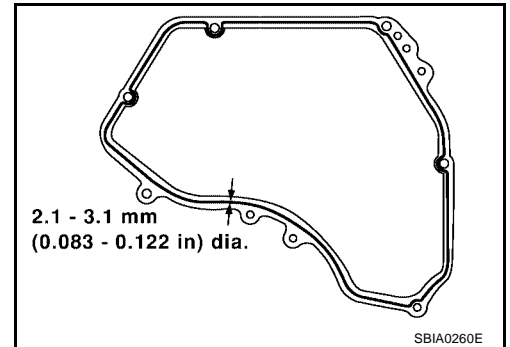
CAUTION:

- **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.

- Install IVT control solenoid valve to intake valve timing control cover.
- Install O-ring to front cover side.
- Apply Genuine Silicone RTV Sealant to the positions shown in the figure. Refer to [GI-43, "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS"](#).

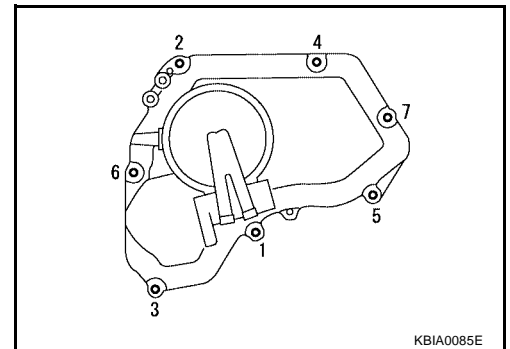


d. Install IVT control cover.

- Tighten the bolts in the numerical order as shown.

9. Check and adjust valve clearances. Refer to [EM-45, "Valve Clearance"](#).

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



EBS00DUE

Valve Clearance INSPECTION

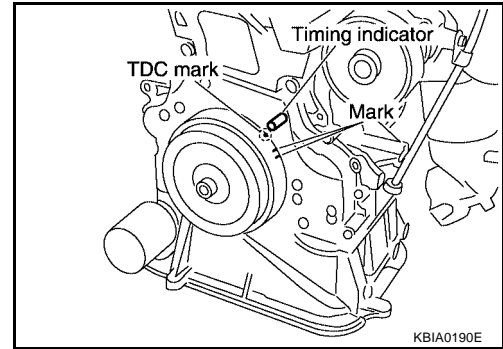
- Perform this inspection as follows after removal, installation, or replacement of the camshaft or any valve-related parts, or if there are any unusual engine conditions due to changes in valve clearance over time (starting, idling, and/or noise).

1. Warm up the engine, then stop it.

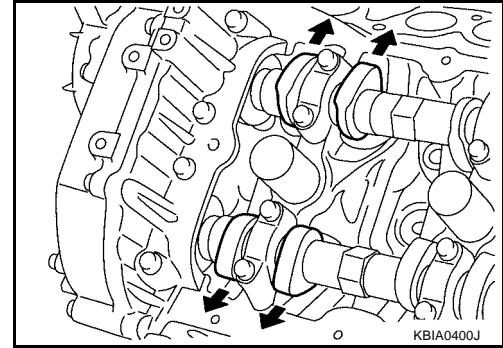
CAMSHAFT

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2. Remove front RH engine under cover using power tool.
3. Remove the rocker cover using power tool.
Refer to [EM-36, "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.

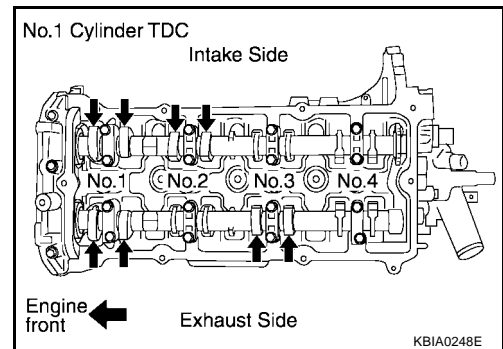


5. At this time, check that the both intake and exhaust cam lobes of No. 1 cylinder face outside.
 - If they do not face outside, turn crankshaft pulley once more.



6. By referring to the figure (locations indicated with black arrow), 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
Valve								
Measurable	x	x	x			x		



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

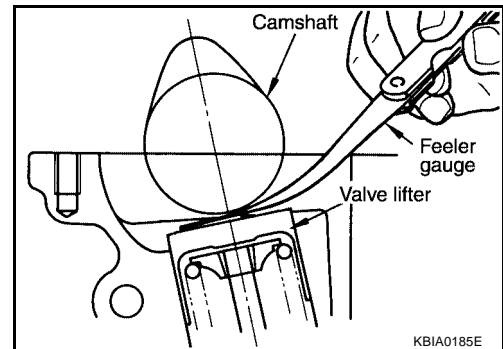
Valve clearance standard:

Hot	Intake	: 0.32 - 0.40 mm (0.013 - 0.016 in)
	Exhaust	: 0.33 - 0.41 mm (0.013 - 0.016 in)
Cold*	Intake	: 0.24 - 0.32 mm (0.009 - 0.013 in)
	Exhaust	: 0.26 - 0.34 mm (0.010 - 0.013 in)

*Reference data at approximately 20°C (68°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.

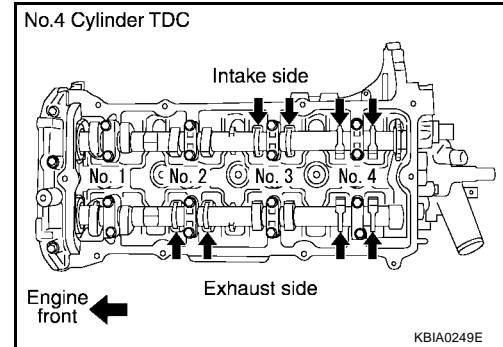
CAMSHAFT

[QR25DE]

8. By referring to the figure (locations indicated with black arrow), 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	
Valve	INT	EXH	INT	EXH	INT	EXH	INT	EXH
Measurable				X	X		X	X

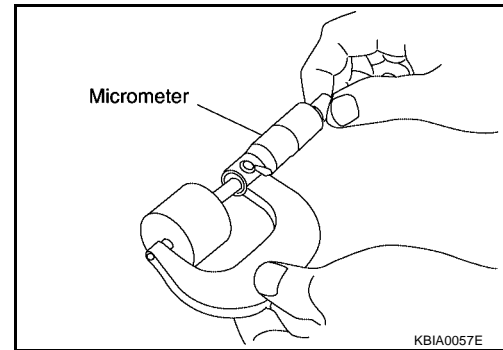


9. If out of specifications, adjust as follows.

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.

1. Remove camshaft. Refer to [EM-38, "Removal and Installation"](#) .
2. Remove the valve lifters at the locations that are outside the standard.
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.

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

t = Thickness of replacement valve lifter.

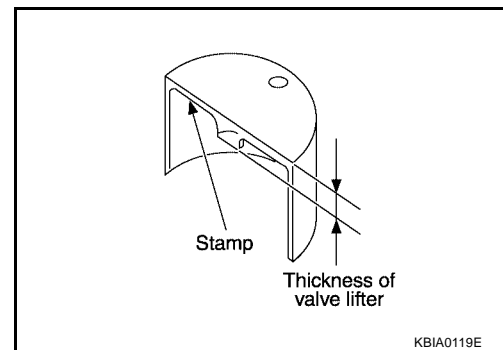
t₁ = Thickness of removed valve lifter.

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 6.96 to 7.46 mm (0.2740 to 0.2937 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:

Hot Intake : 0.32 - 0.40 mm (0.013 - 0.016 in)

Exhaust : 0.33 - 0.41 mm (0.013 - 0.016 in)

CAMSHAFT

[QR25DE]

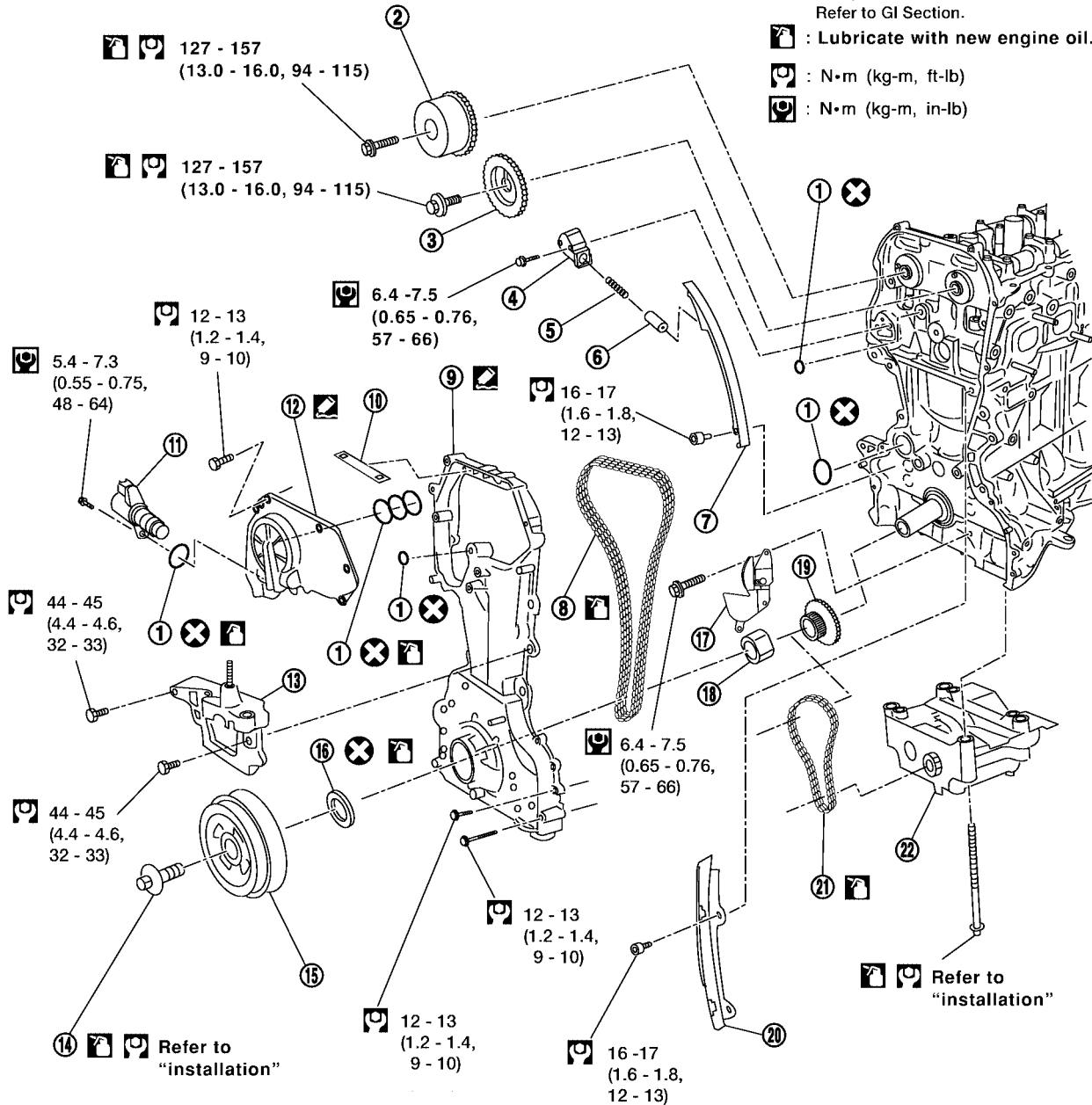
Cold* Intake : 0.24 - 0.32 mm (0.009 - 0.013 in)
Exhaust : 0.26 - 0.34 mm (0.010 - 0.013 in)

*: Reference data at approximately 20°C (68°F)

TIMING CHAIN

Removal and Installation

SEC.110•112•120•130•135



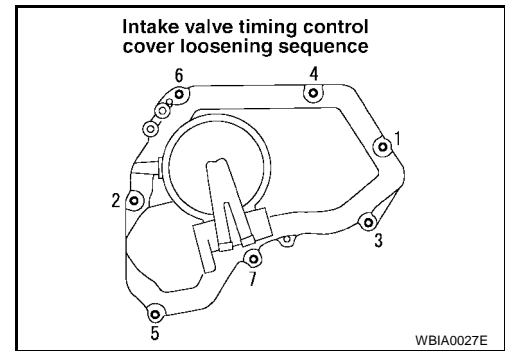
- | | | |
|-----------------------------|--|--------------------------------|
| 1. Oil rings | 2. Camshaft sprocket (INT) | 3. Camshaft sprocket (EXH) |
| 4. Chain tensioner | 5. Spring | 6. Chain tensioner plunger |
| 7. Timing chain slack guide | 8. Timing chain | 9. Front cover |
| 10. Chain guide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

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

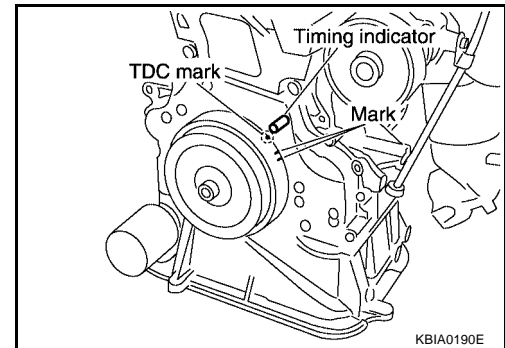
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REMOVAL

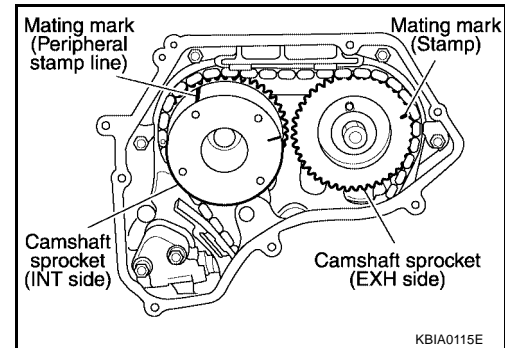
1. Support the engine and transaxle assembly with suitable tools.
2. Remove RH splash shield.
3. Remove the upper and lower oil pan, and oil strainer. Refer to [EM-26, "Removal and Installation"](#) .
4. Remove generator. Refer to [SC-29, "Removal"](#) .
5. Remove engine cover.
6. Disconnect variable timing control solenoid harness connector.
7. Remove engine ground.
8. Remove the coolant overflow reservoir tank.
9. Position the RH engine compartment fuse and relay box aside.
10. Remove the RH engine mount and bracket. Refer to [EM-73, "Removal and Installation"](#) .
11. Remove the IVT (intake valve timing) control cover.
 - a. Loosen bolts in the numerical order as shown.
 - b. Remove the cover with suitable tool to cut the sealant.
12. Pull chain guide between camshaft sprockets out through front cover.



13. 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.

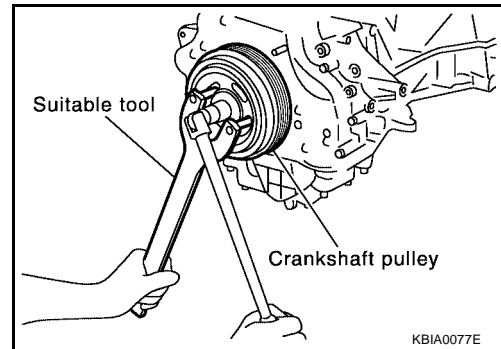


TIMING CHAIN

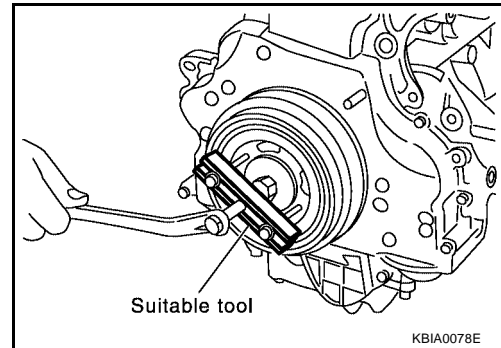
[QR25DE]

14. Remove crankshaft pulley with the following procedure:

- a. Hold the crankshaft pulley with a suitable tool, then loosen the crankshaft pulley mounting bolt, and pull the pulley out about 10 mm (0.39 in).



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



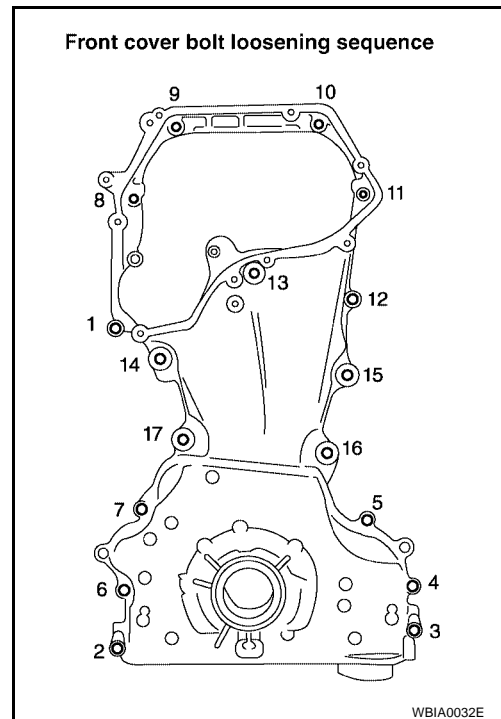
15. Remove the front cover with the following procedure:

- a. Loosen the mounting bolts in the reverse order shown in the figure, and remove them.
- b. Remove the front cover.

CAUTION:

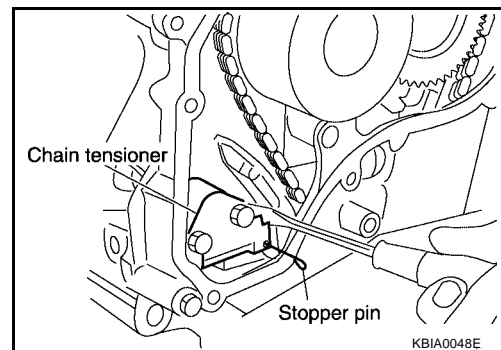
- Be careful not to damage the mounting surface.

16. If the front oil seal needs to be replaced, lift it out with a screwdriver to remove it.



17. 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 hold the chain tensioner.
 - Use a wire of 0.5 mm (0.02 in) diameter as a stopper pin.
- b. Remove the chain tensioner.



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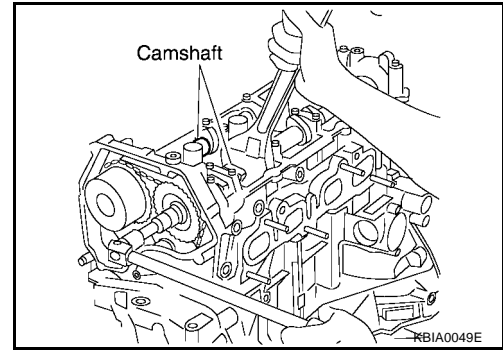
TIMING CHAIN

[QR25DE]

- c. Secure hexagonal part of the camshaft with a wrench and loosen the camshaft sprocket mounting 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.

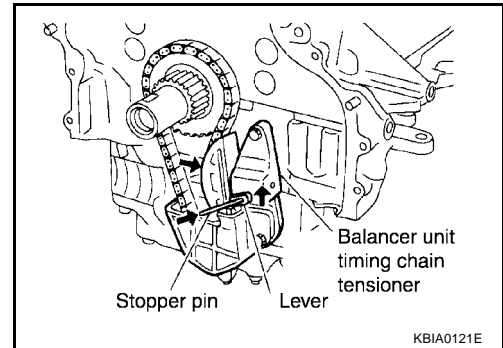


18. Remove the chain slack guide, tension guide, timing chain, and oil pump drive spacer.

19. Remove the timing chain tensioner for the balancer unit with the following procedure:

- Lift the tensioner lever up, and release the ratchet claw for installation.
- Push tensioner sleeve in, and hold it.
- Matching the hole on lever with the one on body, insert a stopper pin to secure tensioner sleeve.
- Remove the timing chain tensioner for the balancer unit.

20. Remove timing chain for balancer unit and crankshaft sprocket.

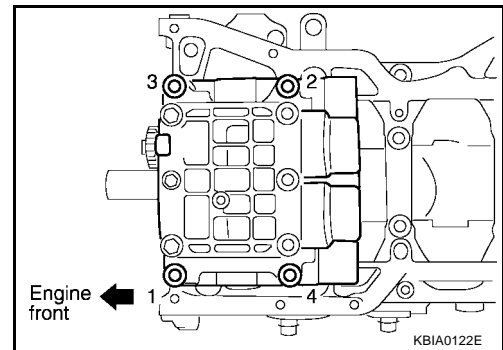


21. Loosen mounting bolts in reverse order shown in the figure, and remove balancer unit.

- Use Torx socket (size E14)

CAUTION:

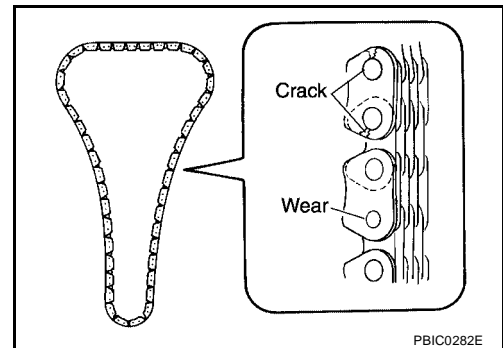
- Do not disassemble balancer unit.



INSPECTION AFTER REMOVAL

Timing Chain

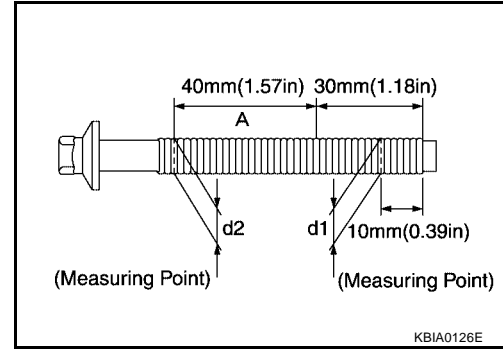
Check the timing chain for cracks or serious wear. If a defect is detected, replace it.



Balancer Unit Mounting Bolt Outer Diameter

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

Limit : 0.15 mm (0.0059 in) or more



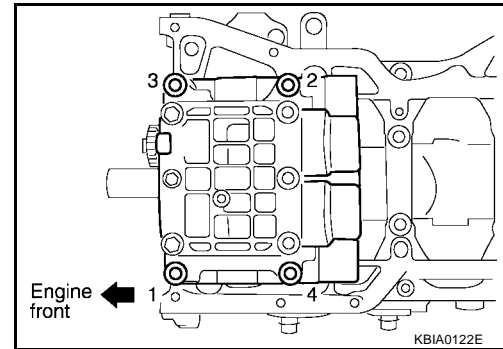
INSTALLATION

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 mounting bolts in the numerical order shown with the following procedure:

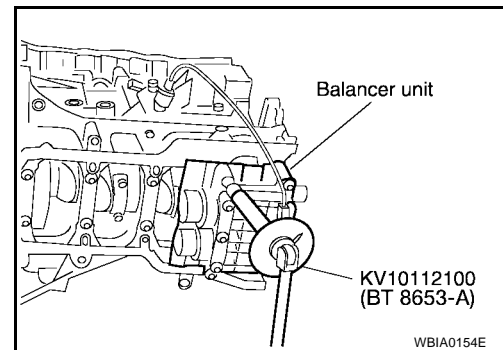
CAUTION:

- When reusing a mounting bolt, check its outer diameter before installation. Refer to [EM-53, "Balancer Unit Mounting Bolt Outer Diameter"](#).



Balancer unit mounting bolts

- | | |
|---|---|
| Step 1 | : 45.2 - 51.0 N·m (4.6 - 5.2 kg-m, 34 - 37 ft-lb) |
| Step 2 | : 90° - 95° degrees rotation (Target: 90° degrees) |
| Step 3 (Loosen in reverse order or tightening) | : 0 N·m (0 kg-m, 0 ft-lb) |
| Step 4 | : 45.2 - 51.0 N·m (4.6 - 5.2 kg-m, 34 - 37 ft-lb) |
| Step 5 | : 90° - 95° degrees rotation (Target: 90° degrees) |



- Apply new engine oil to threads and seating surfaces of mounting bolts.

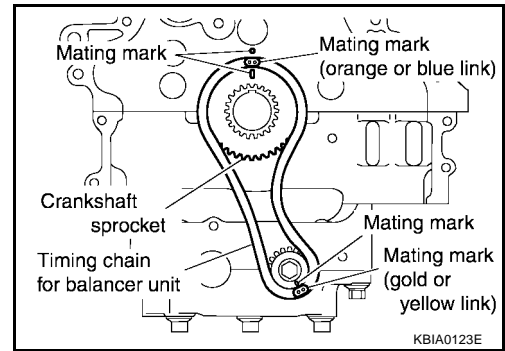
CAUTION:

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

TIMING CHAIN

[QR25DE]

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.

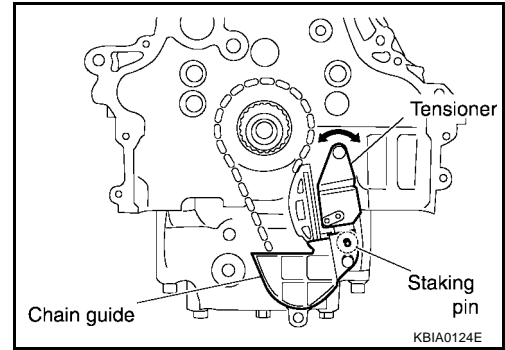


4. Install timing chain tensioner for balancer unit.

NOTE:

Chain guide and tensioner move freely with the caulking pin as the axle. Therefore, bolt hole position of the three points could be changed during removal. If points change, temporarily fix the two mounting bolts on the chain guide and move the tensioner to match the bolt holes.

- Be careful not to let mating marks of each sprocket and timing chain slip.
- After installation, make sure the mating marks have not slipped, then remove stopper pin and release tensioner.



5. Install timing chain and related parts.

- Install by lining up mating marks on each sprocket and timing chain as shown.

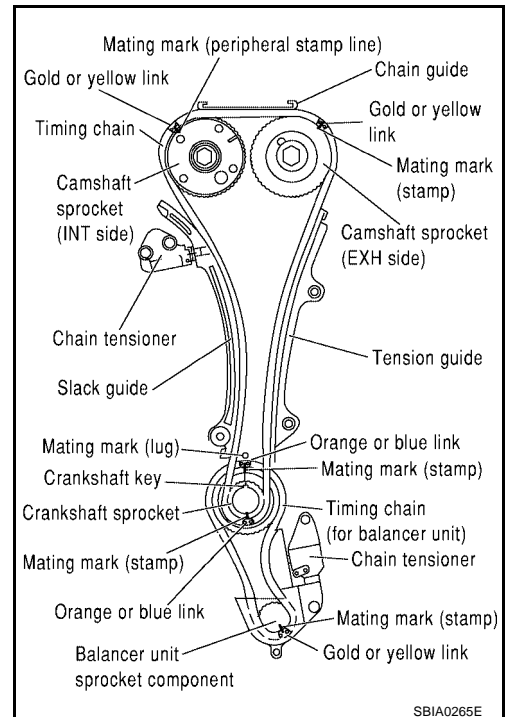
NOTE:

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

CAUTION:

For the above reason, after the mating marks are aligned, keep them aligned by holding them with a hand.

- Before and after installing chain tensioner, check again to make sure that mating marks have not slipped.
- After installing chain tensioner, remove stopper pin, and make sure the tensioner moves freely.
- To avoid skipped teeth, do not move crankshaft and camshaft until front cover is installed.



TIMING CHAIN

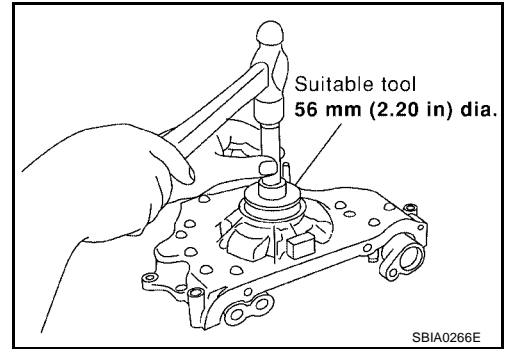
[QR25DE]

6. Install front oil seal to front cover.

- Using a drift of 56 mm (2.20 in) diameter, press oil seal in until it is flush with front end surface of front cover.

CAUTION:

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

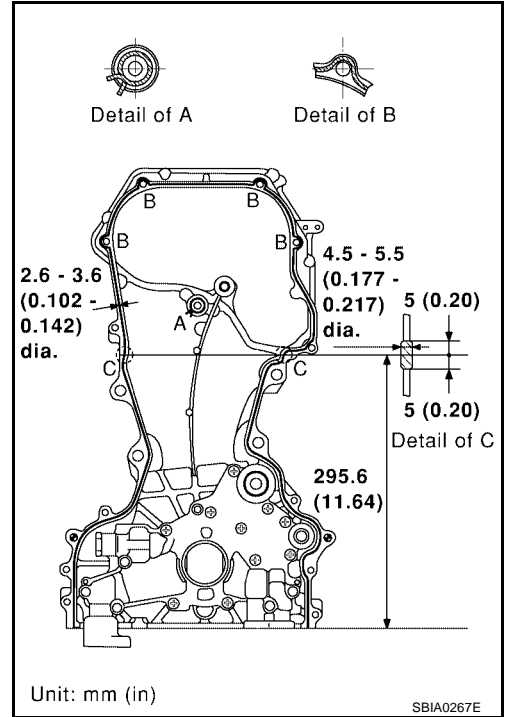


7. Install front cover with the following procedure:

- Install O-rings to cylinder head and cylinder block.
- Apply Genuine Silicone RTV Sealant or equivalent, to positions specified in the figure. Refer to [GI-43, "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS"](#).
- Make sure the mating marks on the timing chain and each sprocket are still aligned. Then install the front cover.

CAUTION:

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



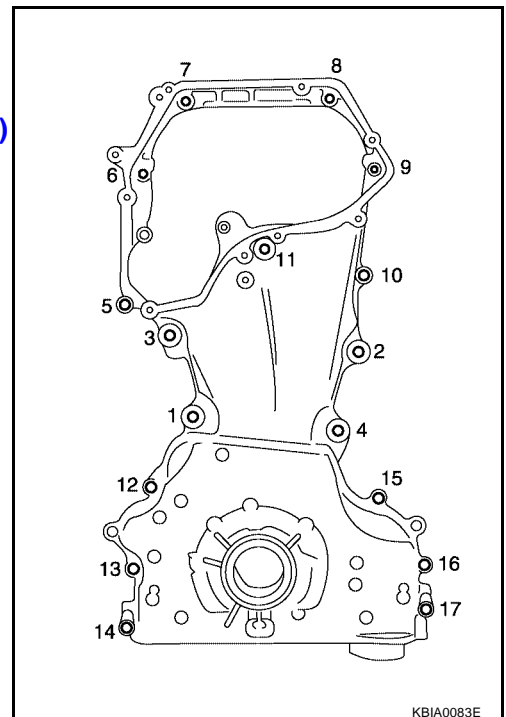
- Tighten mounting bolts in the numerical order shown.
- After all bolts are tightened, retighten them to the specified torque.

Front cover bolts : 12 - 13 N·m (1.2 - 1.4 kg·m, 9 - 10 ft·lb)

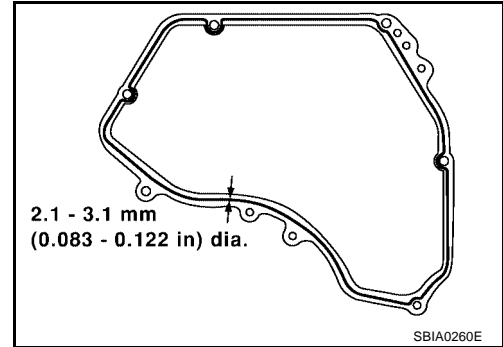
CAUTION:

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

8. Install the chain guide between the camshaft sprockets.

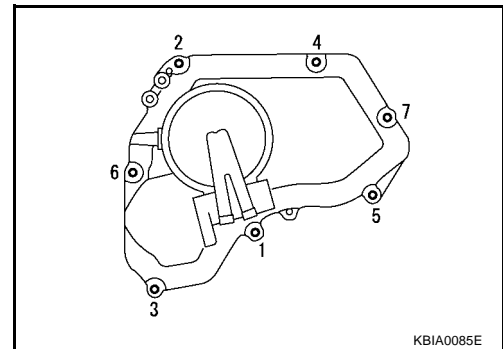


9. Install IVT cover with the following procedure:
 - a. Install IVT solenoid valves to IVT cover.
 - b. Install oil rings to the intake camshaft sprocket insertion points on IVT control cover backside.
 - c. Install O-ring to front cover.
 - d. Apply Silicone RTV Sealant to the IVT cover as shown.
 - Apply Genuine Silicone RTV Sealant or equivalent, to positions specified in the figure. Refer to [GI-43, "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS"](#).



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

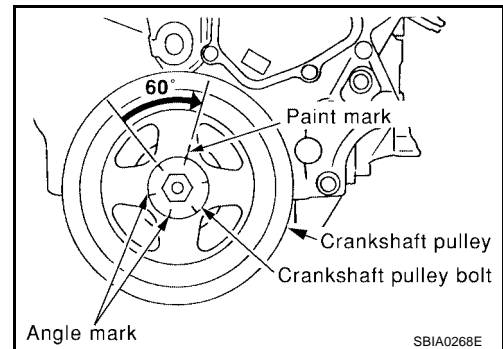
IVT cover mounting bolts : 12 - 13 N-m (1.2 - 1.4 kg-m, 9-10 in-lb)



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 mounting bolts.
 - Secure crankshaft pulley with a pulley holder to tighten the bolt.
 - Perform angle tightening with the following procedure:
 - a. Apply new engine oil to threads and seat surfaces of mounting bolts.
 - b. Tighten to initial specifications:-

Crankshaft pulley bolt initial tightening : 37.3 - 47.1 N-m (3.8 - 4.8 kg-m, 28 - 34 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 parts is in reverse order of removal.



OIL SEAL

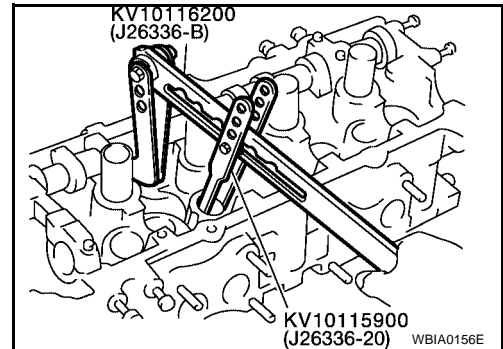
Removal and installation of Valve Oil Seal
REMOVAL

1. Remove camshaft. Refer to [EM-38, "REMOVAL"](#).
2. Remove valve lifter. Refer to [EM-38, "REMOVAL"](#).
3. Rotate crankshaft, and set piston whose oil seal is to be removed to top dead center. This prevents valve from dropping inside cylinder.

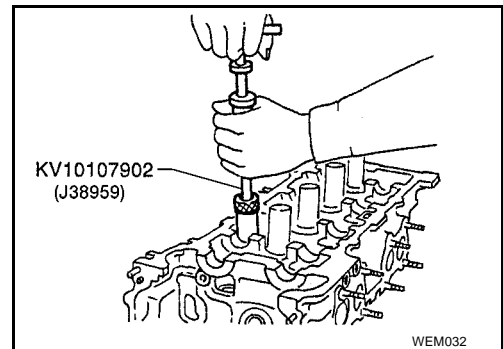
CAUTION:

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 with Tool.

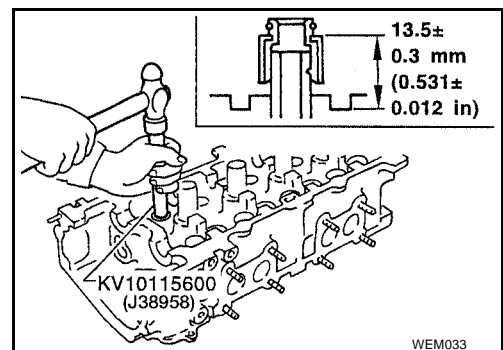


5. Remove valve oil seal with Tool.



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 with Tool.



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

Removal and Installation of Front Oil Seal

REMOVAL

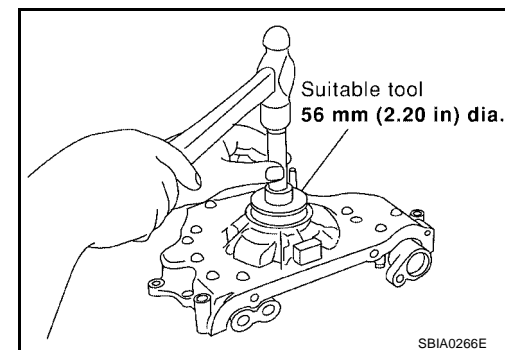
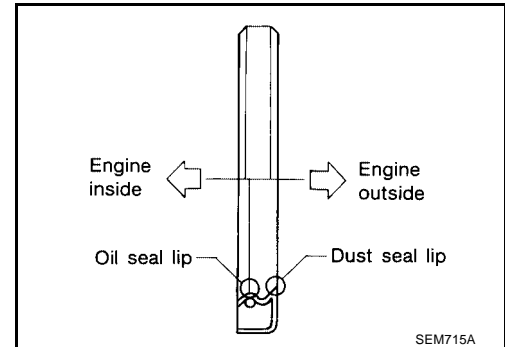
1. Remove the following parts:
 - Engine under cover
 - Drive belts. Refer to [EM-14, "DRIVE BELTS"](#) .
 - Crankshaft pulley. Refer to [EM-49, "TIMING CHAIN"](#) .
2. Remove front oil seal from front cover.

CAUTION:

Be careful not to scratch front cover.

INSTALLATION

1. Apply new engine oil to new oil seal and install it using a suitable tool.
 - Install new oil seal in the direction shown.



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

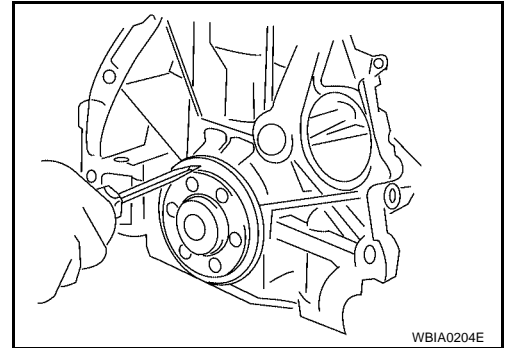
Removal and Installation of Rear Oil Seal

REMOVAL

1. Remove the transaxle. Refer to [MT-16, "Removal and Installation"](#) (M/T), [AT-270, "REMOVAL AND INSTALLATION"](#) (A/T).
2. Remove flywheel (MT) or drive plate (AT).
3. Remove rear oil seal.

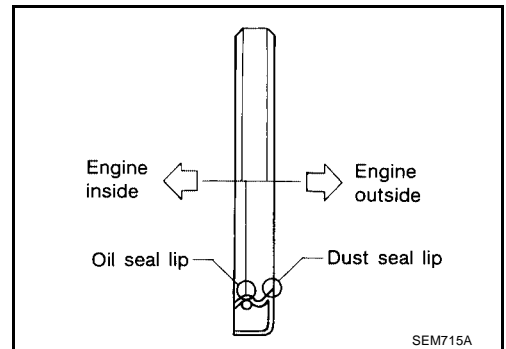
CAUTION:

Be careful not to scratch rear oil seal retainer.

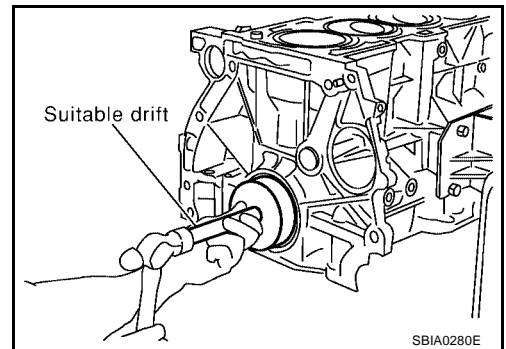


INSTALLATION

1. Apply new engine oil to new oil seal and install it using a suitable tool.
 - Install new oil seal in the direction shown.

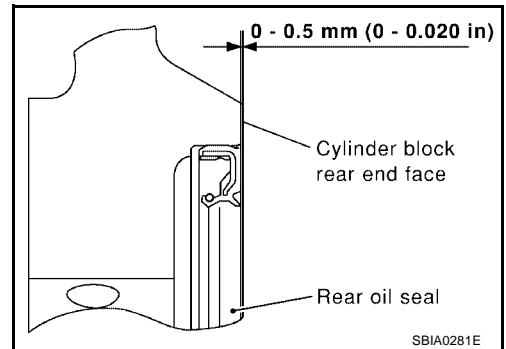


- Press fit oil seal straight using a suitable tool, to avoid causing burrs or tilting.



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

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

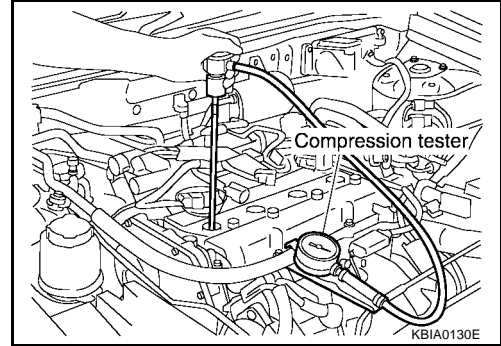


CYLINDER HEAD

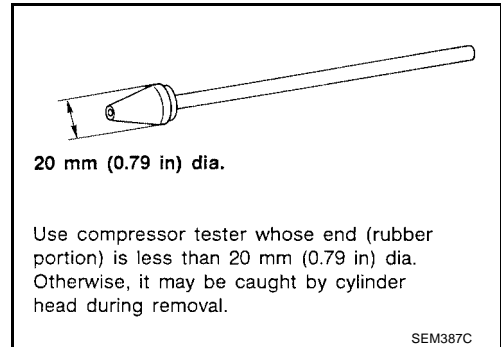
On-Vehicle Service

CHECKING COMPRESSION PRESSURE

1. Warm up the engine to full operating temperature.
2. Release the fuel pressure. Refer to [EC-50, "FUEL PRESSURE RELEASE"](#).
3. Remove the ignition coil and spark plug from each cylinder. Refer to [EM-31, "Removal and Installation"](#).
4. Connect engine tachometer (not required in use of CONSULT-II).
5. Disconnect the fuel injector harness connector to avoid any residual fuel injection during the measurement.
6. Install the compression tester with the adapter into the spark plug hole.



- Use compression gauge whose picking up end inserted to spark plug hole is smaller than 20 mm (0.79 in) in diameter. Otherwise, it may be caught by cylinder head during removal.



7. With the accelerator pedal fully depressed, turn the ignition switch to the "START" position to crank over the engine. When the gauge pointer stabilizes, read the compression pressure and engine rpm. Perform these steps to check each cylinder.

Unit: kPa (kg/cm², psi) / rpm

Standard	Minimum	Difference limit between cylinders
1,250 (12.8, 181.3) / 250	1,060 (10.8, 153.7) / 250	100 (1.0, 14) / 250

CAUTION:

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

- 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.

CYLINDER HEAD

[QR25DE]

- 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.
- 8. Install spark plug, ignition coil and harness connectors.

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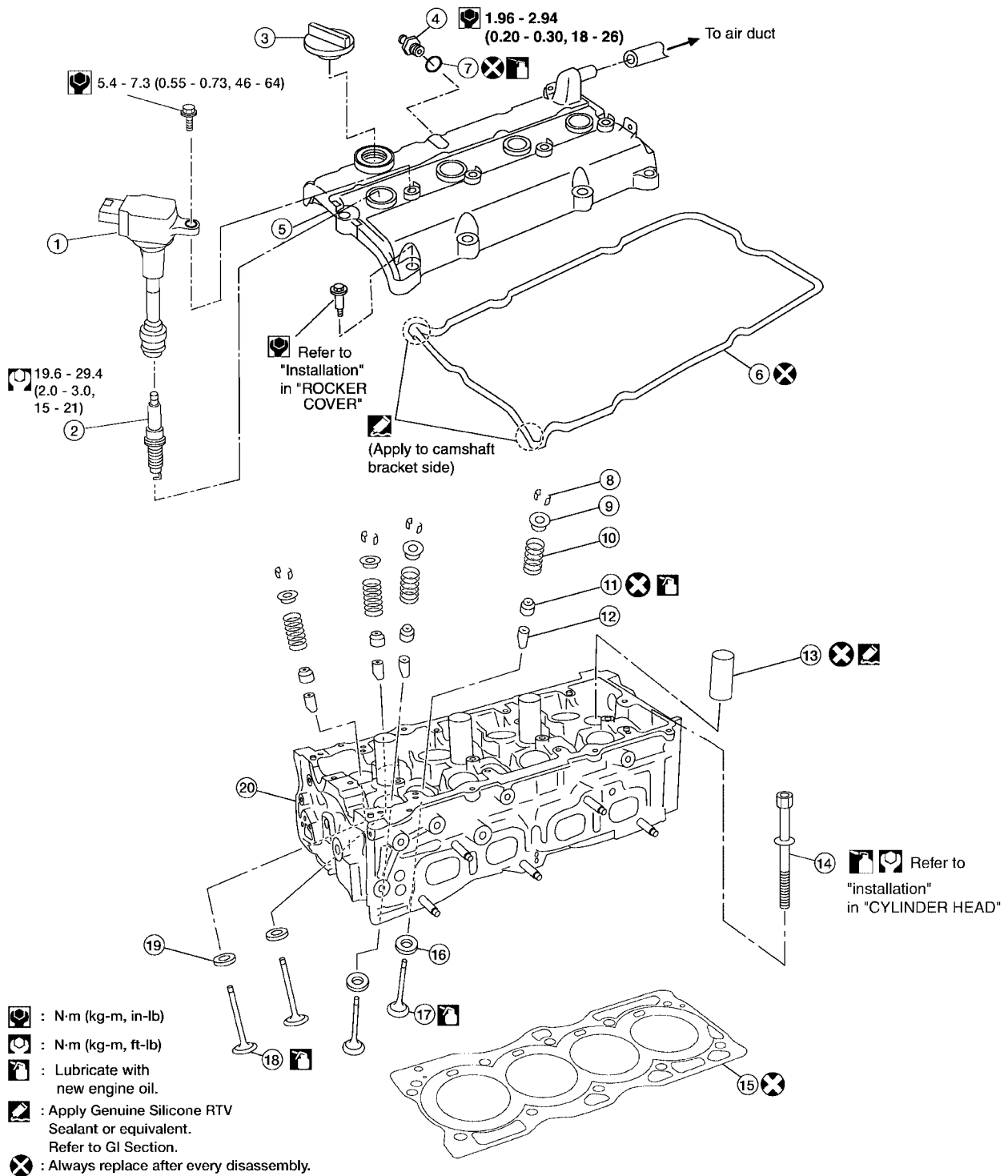
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CYLINDER HEAD

[QR25DE]

Removal and Installation

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- | | | |
|---------------------|------------------------|--------------------------|
| 1. Ignition coil | 2. Spark plug | 3. Oil filler cap |
| 4. PCV valve | 5. Rocker cover | 6. Rocker cover gasket |
| 7. O-ring | 8. Valve collet | 9. Valve spring retainer |
| 10. Valve spring | 11. Valve oil seal | 12. Valve guide |
| 13. Spark plug tube | 14. Cylinder head bolt | 15. Cylinder head gasket |

- | | | | |
|----------------------|-------------------|-----------------|---|
| 16. Valve seat (EXH) | 17. Valve (EXH) | 18. Valve (INT) | |
| 19. Valve seat (INT) | 20. Cylinder head | | A |

REMOVAL

1. Release fuel pressure. Refer to [EC-50, "FUEL PRESSURE RELEASE"](#) .
2. Drain engine coolant. Refer to [MA-16, "DRAINING ENGINE COOLANT"](#) .
3. Drain engine oil. Refer to [MA-19, "Changing Engine Oil"](#) .
4. Disconnect upper radiator hose and heater hose.
5. Position the RH engine compartment fuse and relay box aside.
6. Remove the engine undercovers using power tool.
7. Remove the resonator, air cleaner to electronic throttle control actuator tube and air cleaner case (upper). Refer to [EM-17, "Removal and Installation"](#) .
8. Remove engine cover.
9. Disconnect the following harness connectors:
 - Engine coolant temperature sensor
 - Camshaft position sensor
 - EVAP canister purge volume control solenoid
 - Throttle control actuator
 - Swirl control valve solenoid
 - Variable timing control solenoid
10. Disconnect the brake booster vacuum hose.
11. Disconnect the fuel hose quick connector at the fuel tube side.
 - For how to disconnect and connect the quick connector, refer to [EM-19, "INTAKE MANIFOLD"](#) .

CAUTION:

 - **Prepare a container and cloth for catching any spilled fuel.**
 - **This operation should be performed in a place that is free from any open flames.**
 - **While hoses are disconnected seal their openings with vinyl bag or similar material to prevent foreign material from entering them.**
12. Remove the engine harness bracket and power steering hose bracket (collector side).
13. Remove the timing chain. Refer to [EM-49, "Removal and Installation"](#) .
14. Remove drive belt auto-tensioner. Refer to [EM-15, "REMOVAL"](#) .
15. Remove the camshafts. Refer to [EM-38, "CAMSHAFT"](#) .
16. Remove spark plugs. Refer to [EM-31, "Removal and Installation"](#) .
17. Remove the exhaust manifold. Refer to [EX-4, "Removal and Installation"](#) .
18. Support the engine from above and underneath with suitable hoist and floor jack.

EM

C

D

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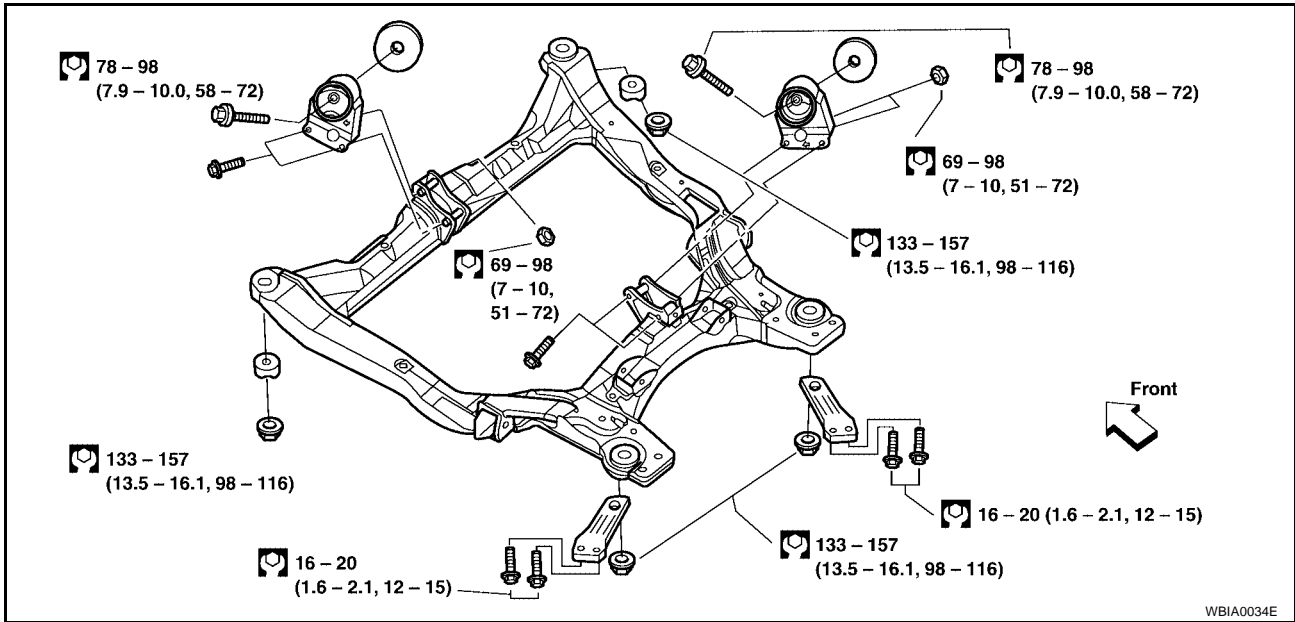
L

M

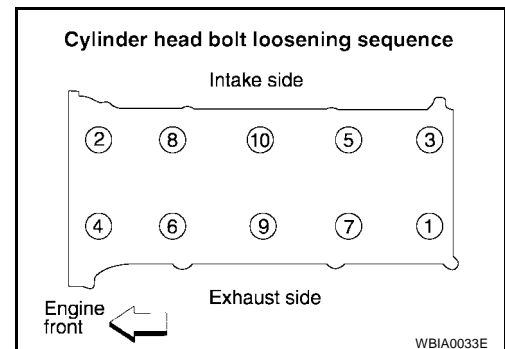
CYLINDER HEAD

[QR25DE]

19. Remove the front suspension member for clearance to remove the oil pan by disconnecting the following:



- Position the power steering pump and reservoir aside.
 - Remove auxiliary drive belts. Refer to [EM-14, "Removal and Installation"](#).
 - Dismount the A/C compressor and position it out of the way with wire.
 - Disconnect the upper swaybar links. Refer to [FSU-11, "Removal and Installation"](#).
 - Remove the through bolts from the front and rear engine mounts.
 - Disconnect the lower ball joints. Refer to [FSU-5, "Components"](#).
 - Remove the two steering gear housing mounting bolts. Refer to [PS-13, "Removal and Installation"](#).
 - Remove crossmember bolts and remove crossmember.
20. Remove cylinder head loosening bolts in the order shown, using power tool.
21. 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-19, "Removal and Installation"](#).



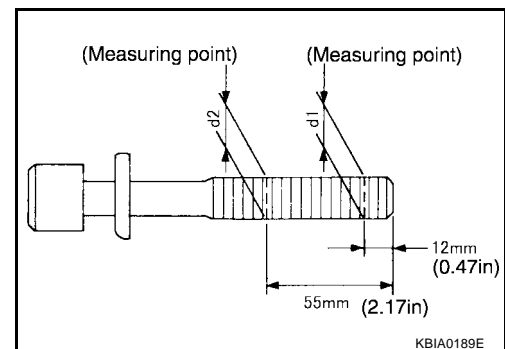
INSPECTION AFTER REMOVAL

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.

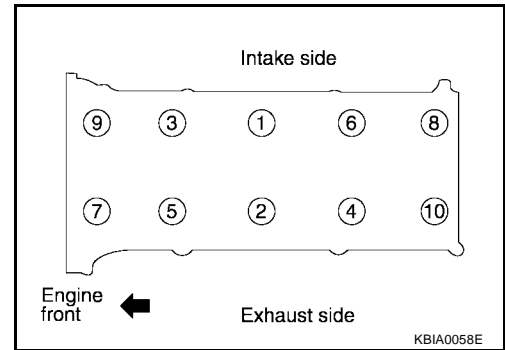
Limit (d1 - d2) : 0.23 mm (0.0091 in) or less

- 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. Follow the steps below to tighten the cylinder head bolts in the numerical order as shown.



CAUTION:

- If cylinder head bolts are re-used, check their outer diameters before installation. Refer to [EM-64, "Outer Diameter of Cylinder Head Bolts"](#).

Cylinder head bolts

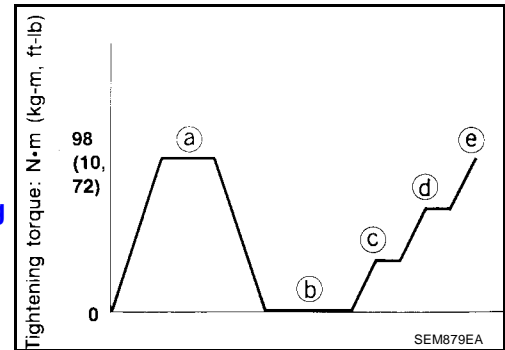
Step a : 98.1 N·m (10 kg-m, 72 ft-lb)

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

Step c : 32.9 N·m (4.0 kg-m, 29 ft-lb)

Step d : 90° degrees rotation clockwise

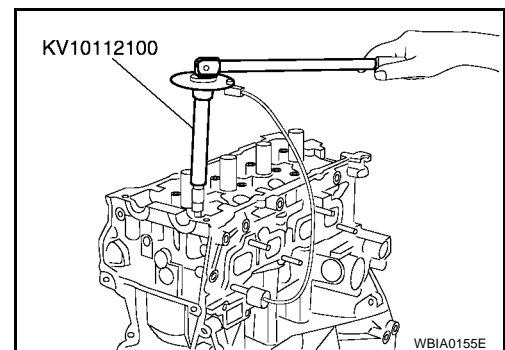
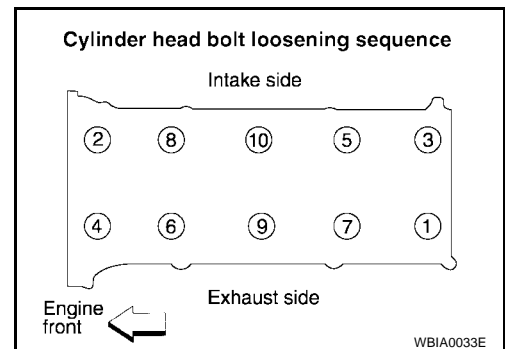
Step e : 90° degrees rotation clockwise



- Apply new engine oil to the threads and the seating surfaces of mounting bolts.

CAUTION:

Check and confirm the tightening angle by using angle wrench or protractor. Avoid judgment by visual inspection without the tool.



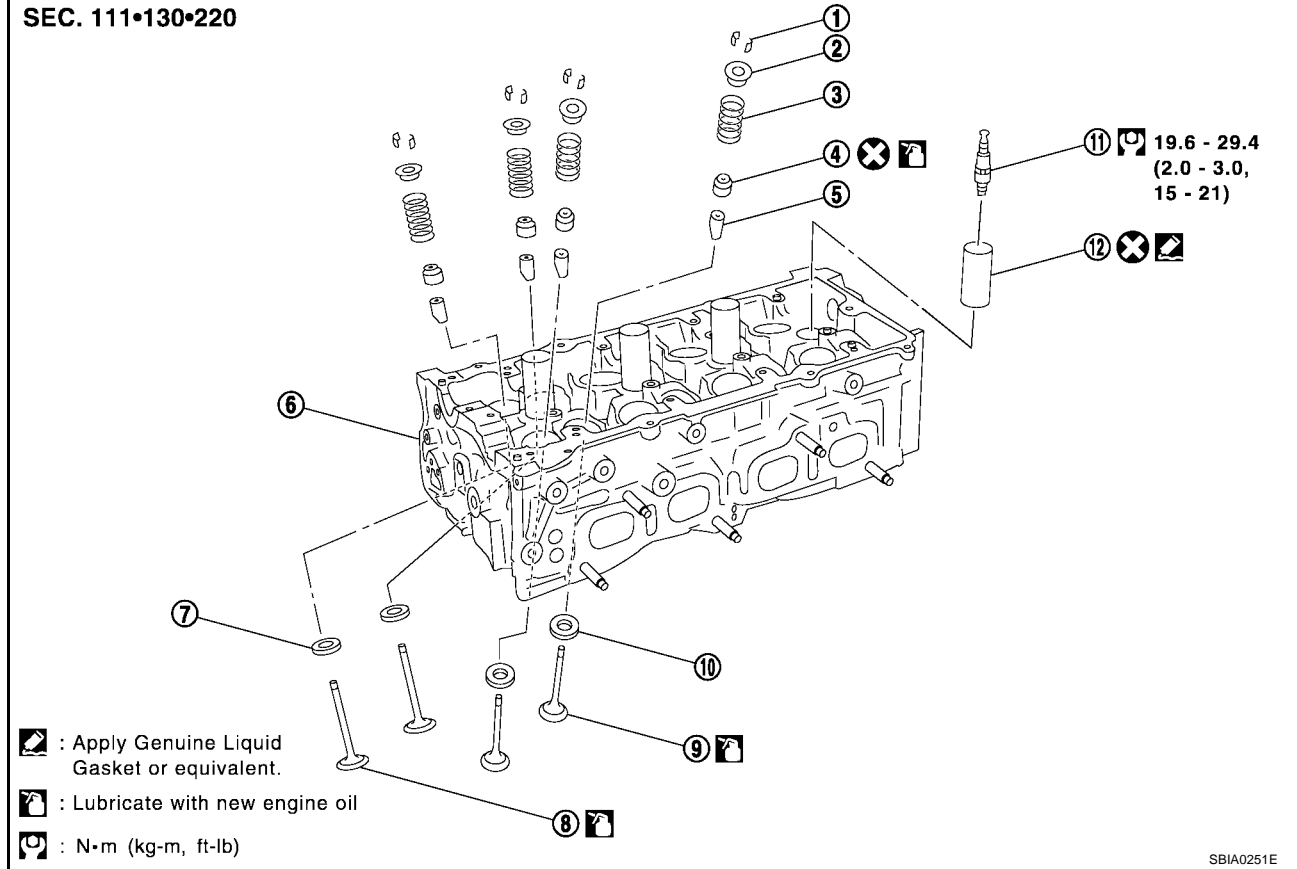
3. Installation of the remaining components is in reverse order of removal.

CYLINDER HEAD

[QR25DE]

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Disassembly and Assembly



- | | | |
|----------------------|--------------------------|--|
| 1. Valve collet | 2. Valve spring retainer | 3. Valve spring (with valve spring seat) |
| 4. Valve oil seal | 5. Valve guide | 6. Cylinder head |
| 7. Valve seat (INT) | 8. valve (INT) | 9. Valve (EXH) |
| 10. Valve seat (EXH) | 11. Spark plug | 12. Spark plug tube |

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.

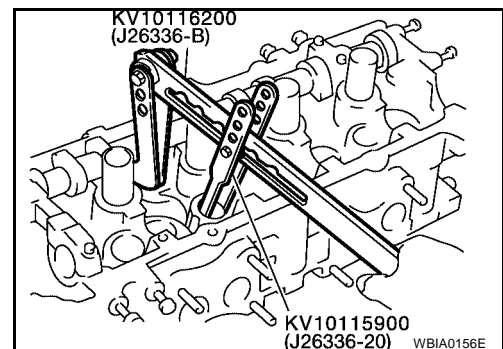
DISASSEMBLY

1. Remove the valve lifter.
 - Confirm installation point.
2. Remove the valve collet.
 - Compress valve spring with valve spring compressor. Remove valve collet with magnet driver.
3. Remove valve spring retainer and valve spring.

CAUTION:

Do not remove valve spring seat from valve spring.

4. Push valve stem to combustion chamber side, and remove valve.
 - Inspect valve guide clearance before removal. Refer to [EM-68, "VALVE GUIDE CLEARANCE"](#).
 - Confirm installation point.



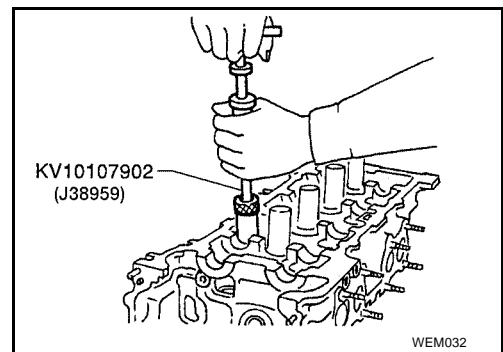
CYLINDER HEAD

[QR25DE]

5. Remove valve oil seal with valve oil seal puller.
6. When valve seat must be replaced, refer to [EM-70, "VALVE SEAT REPLACEMENT"](#).
7. When valve guide must be replaced, refer to [EM-68, "VALVE GUIDE REPLACEMENT"](#).
8. Remove spark plug with spark plug wrench.
9. Remove spark plug tubes, if necessary using pliers.

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.



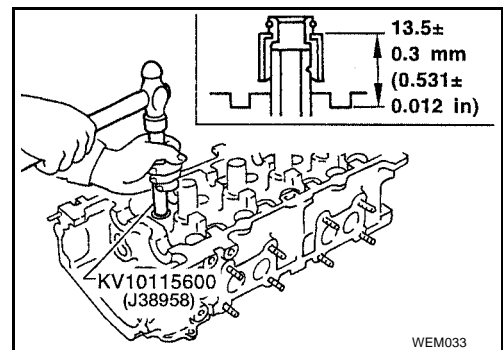
ASSEMBLY

1. Install valve guide. Refer to [EM-68, "VALVE GUIDE REPLACEMENT"](#).
2. Install valve seat. Refer to [EM-70, "VALVE SEAT REPLACEMENT"](#).
3. Install valve oil seal.

- Install with valve oil seal drift to match dimension in illustration.

4. Install valve.

- Install larger diameter to intake side.



5. Install valve spring.

- Install smaller pitch (valve spring seat side) to cylinder head side.
- Confirm the identification color of the valve spring:
Intake: blue
Exhaust: yellow

6. Install valve spring retainer.

7. Install valve collet.

- 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.

8. Install valve lifter.

9. Install spark plug tube.

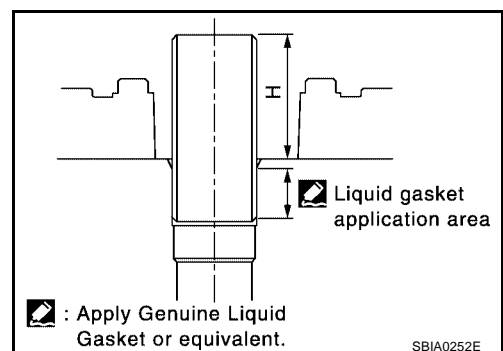
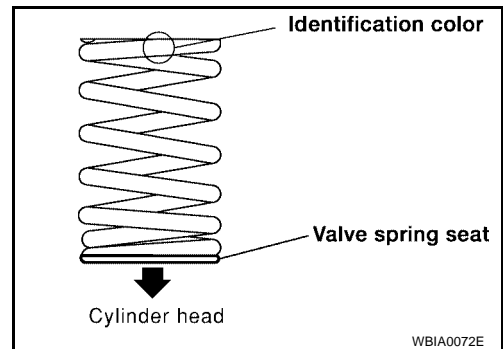
- a. Remove old liquid gasket from cylinder head side mounting hole.

- 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 Genuine Anaerobic Liquid Gasket or equivalent. Refer to [MA-13, "RECOMMENDED FLUIDS AND LUBRICANTS"](#).

- c. Press fit spark plug tube so that height is to "H" as shown.

Press fit height "H" standard value : 38.55 - 38.65 mm (1.518 - 1.522 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.

Inspection After Disassembly CYLINDER HEAD DISTORTION

EBS00DUJ

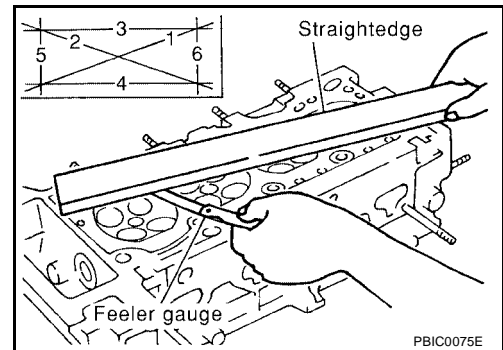
1. Wipe off oil and remove water scale deposits, old gasket, old sealer, and carbon with a scraper.

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.

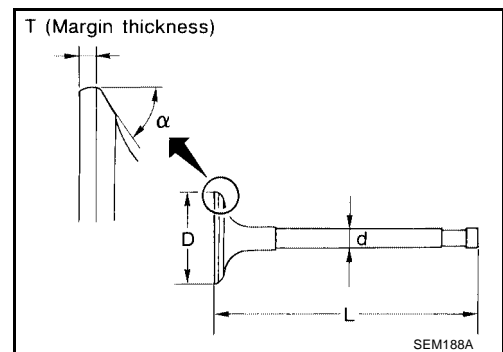
Limit : 0.1 mm (0.004 in) or less



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VALVE DIMENSIONS

Check dimensions of each valve. Refer to [EM-102, "VALVE"](#).



SEM188A

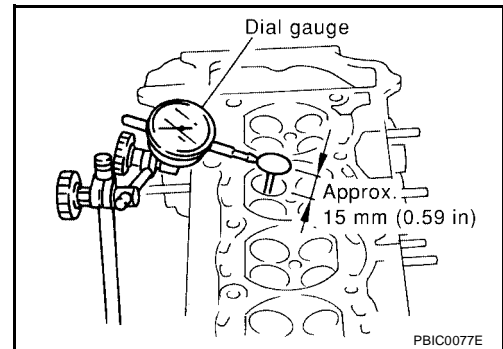
VALVE GUIDE CLEARANCE

Perform this inspection before removing the valve guide.

1. Make sure that the valve stem diameter is within the specification.
2. Push the valve out by approximately 15 mm (0.59 in) toward the combustion chamber side to measure the valve's run-out volume (in the direction of dial gauge) with dial gauge.
3. Half of the run-out volume accounts for the valve guide clearance.

Intake valve clearance : 0.020 - 0.053 mm (0.0008 - 0.0021 in) or less

Exhaust valve clearance : 0.030 - 0.063 mm (0.0012 - 0.0025 in) or less



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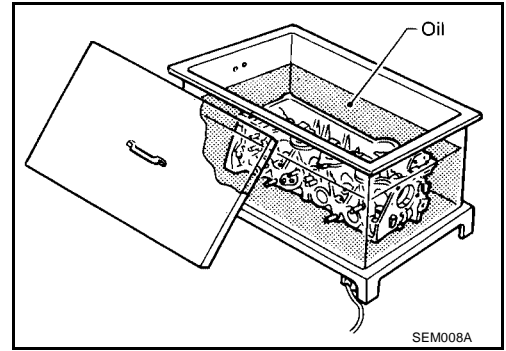
VALVE GUIDE REPLACEMENT

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

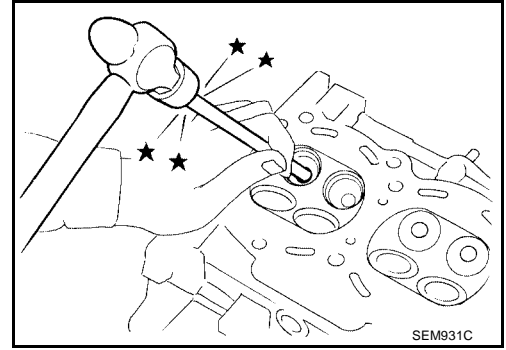
CYLINDER HEAD

[QR25DE]

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



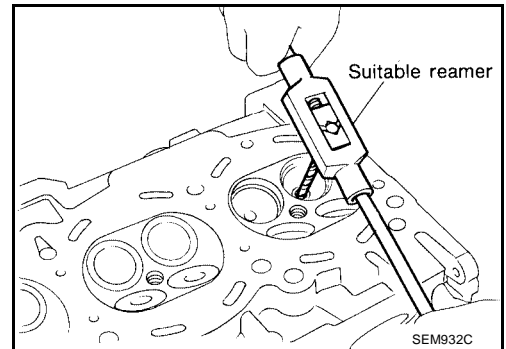
2. Drive out valve guide with a press [under a 20 kN (2.2 ton-force) pressure] or hammer and suitable tool.



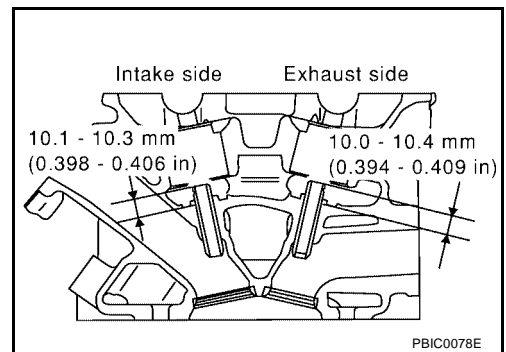
3. Ream cylinder head valve guide hole.

**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.



5. Press valve guide from camshaft side to dimensions as in illustration.

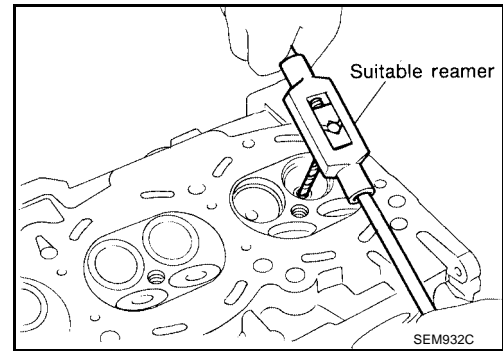


CYLINDER HEAD

[QR25DE]

6. Using valve guide reamer, apply reamer finish to valve guide.

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

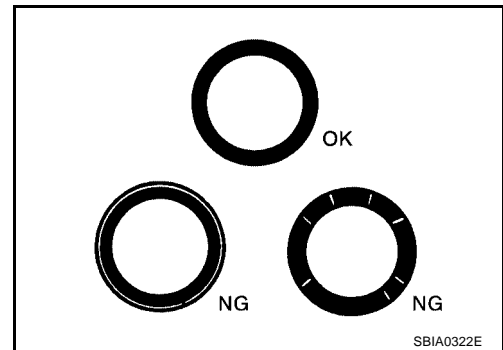


VALVE SEAT CONTACT

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:

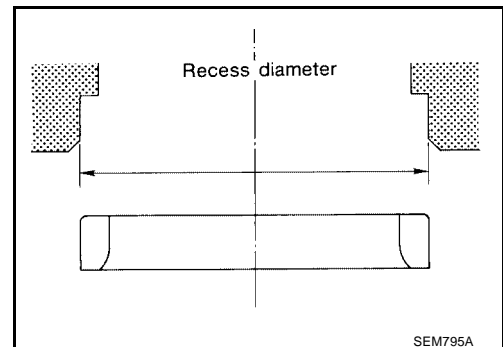
When valve seat is removed, replace with an oversized [0.5 mm (0.020 in)] valve seat.

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)

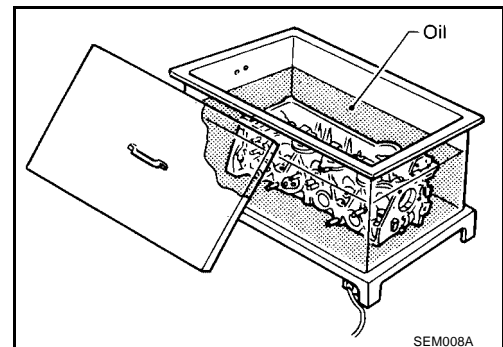
- Be sure to ream in circles concentric to the valve guide center. This will enable the valve seat to fit correctly.



3. Heat cylinder head to 110° to 130°C (230° to 266°F) by soaking in heated oil.
4. Use valve seats cooled well with dry ice. Force fit valve seat into cylinder head.

CAUTION:

Avoid directly touching the cold valve seats.



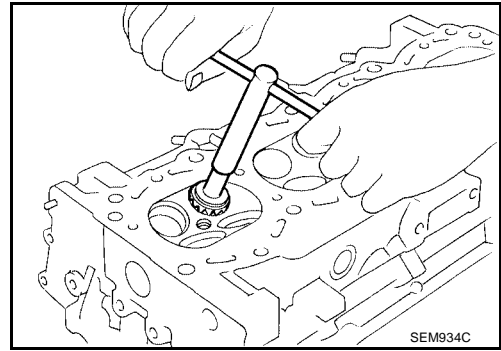
CYLINDER HEAD

[QR25DE]

- Using a valve seat cutter set or a valve seat grinder, finish the seat to the specified dimensions.

CAUTION:

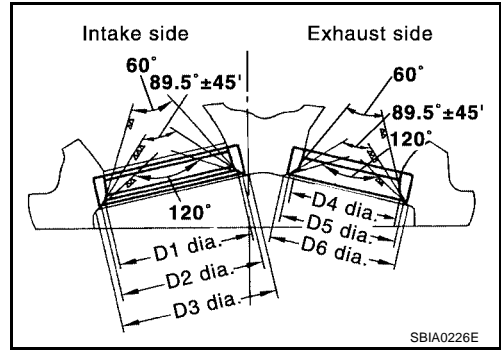
When using valve seat cutter, firmly grip the cutter handle with both hands. Then, press on the contacting surface all around the circumference to cut in a single drive. Improper pressure on the cutter or cutting many different times may result in a defective valve seat.



Grind to obtain the dimensions indicated as shown.

Standard

- D1 dia.** : 33.5 mm (1.3189 in)
- D2 dia.** : 35.1 - 35.3 mm (1.382 - 1.390 in)
- D3 dia.** : 39.0 - 39.2 mm (1.535 - 1.543 in)
- D4 dia.** : 28 mm (1.10 in)
- D5 dia.** : 29.9 - 30.1 mm (1.177 - 1.185 in)
- D6 dia.** : 33.5 - 33.7 mm (1.319 - 1.327 in)

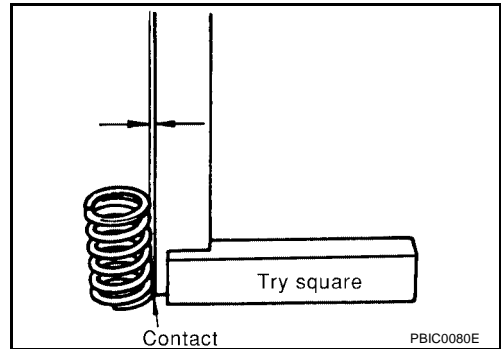


- Using compound, grind to adjust valve fitting.
- Check again for normal contact.

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)

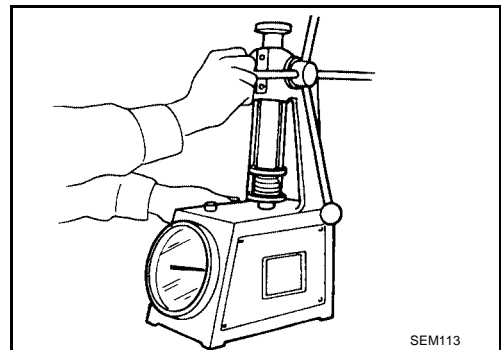


VALVE SPRING DIMENSIONS AND VALVE SPRING PRESSURE LOAD

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.



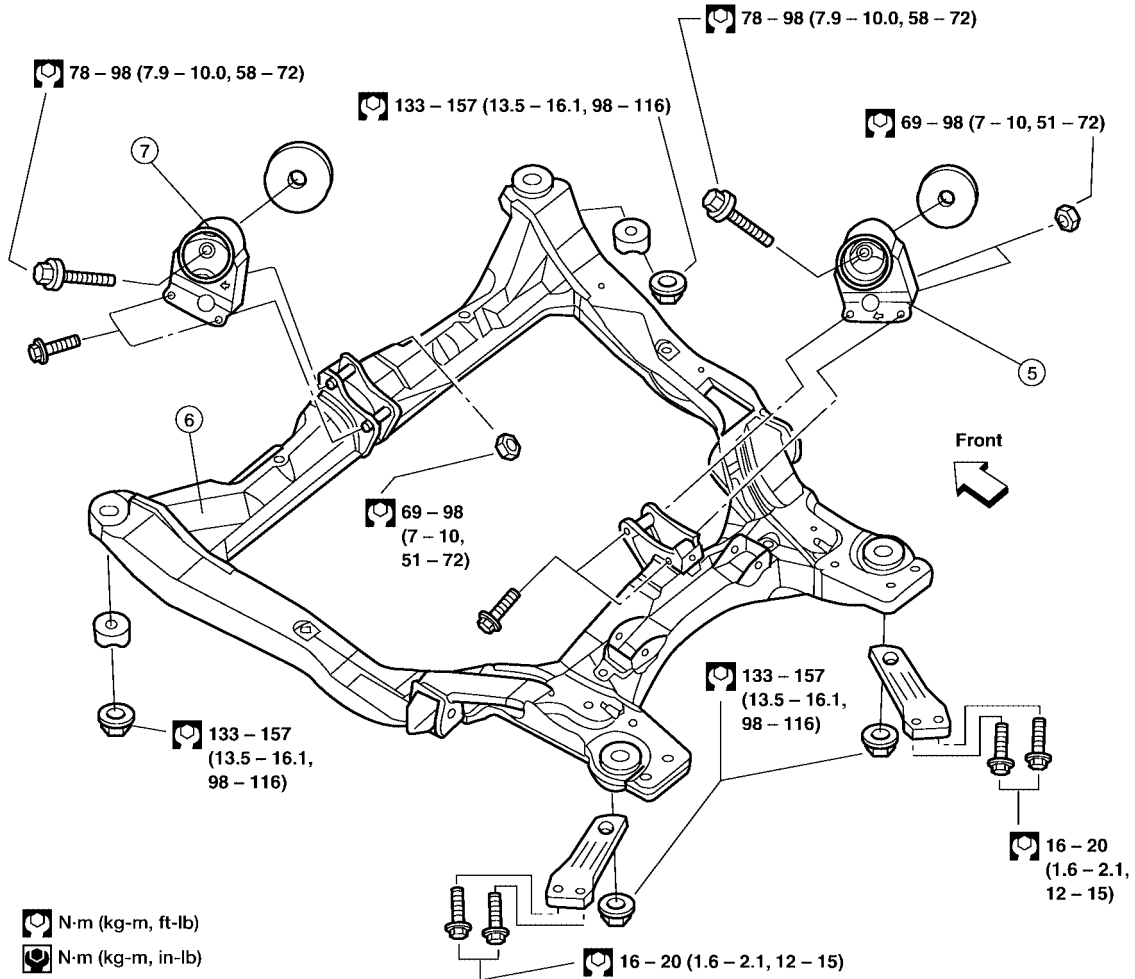
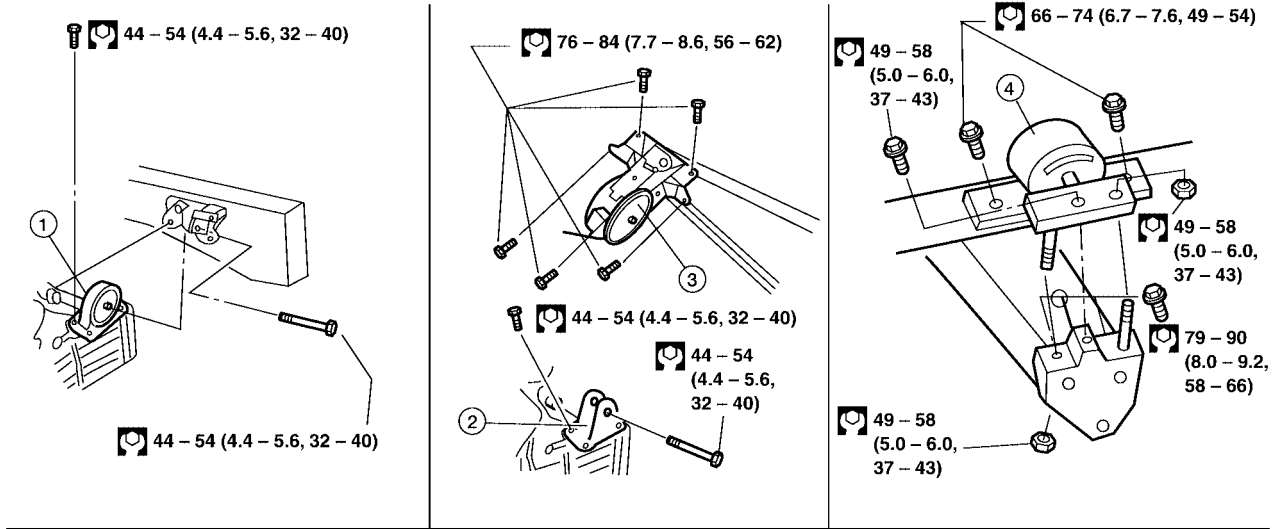
STANDARD	INTAKE (identification color: blue)	EXHAUST (identification color: yellow)
Free height	44.84 - 45.34 mm (1.7654 - 1.7850 in)	45.28 - 45.78 mm (1.7827 - 1.8024 in)

CYLINDER HEAD

[QR25DE]

Installation height	35.30 mm (1.390 in)	35.30 mm (1.390 in)
Installation load	151 - 175 N (15.4 - 17.8 kg-force, 34 - 39 lb-force)	151 - 175 N (15.4 - 17.8 kg-force, 34 - 39 lb-force)
Height during valve open	24.94 mm (0.9819 in)	26.39 mm (1.0390 in)
Load with valve open	358 - 408 N (36.5 - 41.6 kg-force, 80 - 92 lb-force)	325 - 371 N (33.1 - 37.8 kg-force, 73-83 lb-force)

ENGINE ASSEMBLY Removal and Installation



1. LH transaxle mounting insulator (A/T)
2. LH transaxle mounting bracket (M/T)
3. LH transaxle mounting insulator (M/T)
4. RH engine mounting insulator
5. Rear engine mounting insulator (orient by direction mark)
6. Front suspension member
7. Front engine mounting insulator (orient by direction mark)

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WARNING:

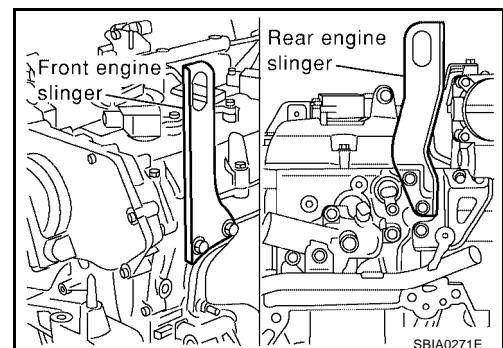
- Place chocks at the front and back of the rear wheels.
- For engines not equipped with slingers, attach proper slingers and bolts as described in the parts catalog.

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-38, "LIFTING POINT"](#) .
- In removing the drive shaft, be careful not to damage the grease seals on the transaxle.
- Before separating the engine and transaxle, remove the crankshaft position sensor (POS) from the assembly.
- Be sure not to damage the edge of the crankshaft position sensor (POS) or the ring gear teeth.

REMOVAL

1. Release fuel pressure. Refer to [EC-50, "FUEL PRESSURE RELEASE"](#) .
2. Disconnect the fuel rail at the fuel hose quick connector (engine side). Refer to [EM-19, "INTAKE MANIFOLD"](#) .
3. Drain the engine oil. Refer to [MA-19, "Changing Engine Oil"](#) .
4. Drain the engine coolant. Refer to [MA-16, "DRAINING ENGINE COOLANT"](#) .
5. Remove the engine hood assembly. Refer to [BL-13, "Removal and Installation of Hood Assembly"](#) .
6. Remove the battery, battery hold downs, and battery tray.
7. Disconnect the engine room harness from the engine side and position it aside. Disconnect the engine harness ground connections. Access the connector through the glove box opening.
8. Disconnect the MAF sensor electrical connector.
9. Remove the air duct and air cleaner case assembly. Refer to [EM-17, "Removal and Installation"](#) .
10. Disconnect the heater hoses.
11. Remove engine cover using power tool.
12. Remove the engine coolant reservoir tank, radiator and radiator fan assembly. Refer to [CO-11, "Removal and Installation"](#) .
13. Disconnect and set aside the IPDM/ER and remove the IPDM/ER bracket. Refer to [PG-27, "Removal and Installation of IPDM E/R"](#) .
14. Remove the generator. Refer to [SC-29, "Removal"](#) .
15. Remove the engine under covers and splash shield using power tool.
16. Dismount the A/C compressor with piping connected and secure with wire to the radiator support.
17. Disconnect the engine wiring harness retainers and ground strap.
18. Remove clutch operating cylinder from transaxle, and move it aside (M/T models).
19. Disconnect the transaxle shift controls.
20. Remove front exhaust tube. Refer to [EX-4, "Removal and Installation"](#) .
21. Remove the left and right drive shafts. Refer to [FAX-11, "Removal and Installation"](#) .
22. Remove the front suspension member. Refer to [FSU-14, "Removal and Installation"](#) .
23. Dismount the power steering pump with piping connected and position it aside with wire.
24. Install engine slingers into front left cylinder head and rear right cylinder head.
 - Use alternator bracket mounting bolt holes for the front slinger.
 - Use the proper slingers and bolts as described in the Parts Catalog.

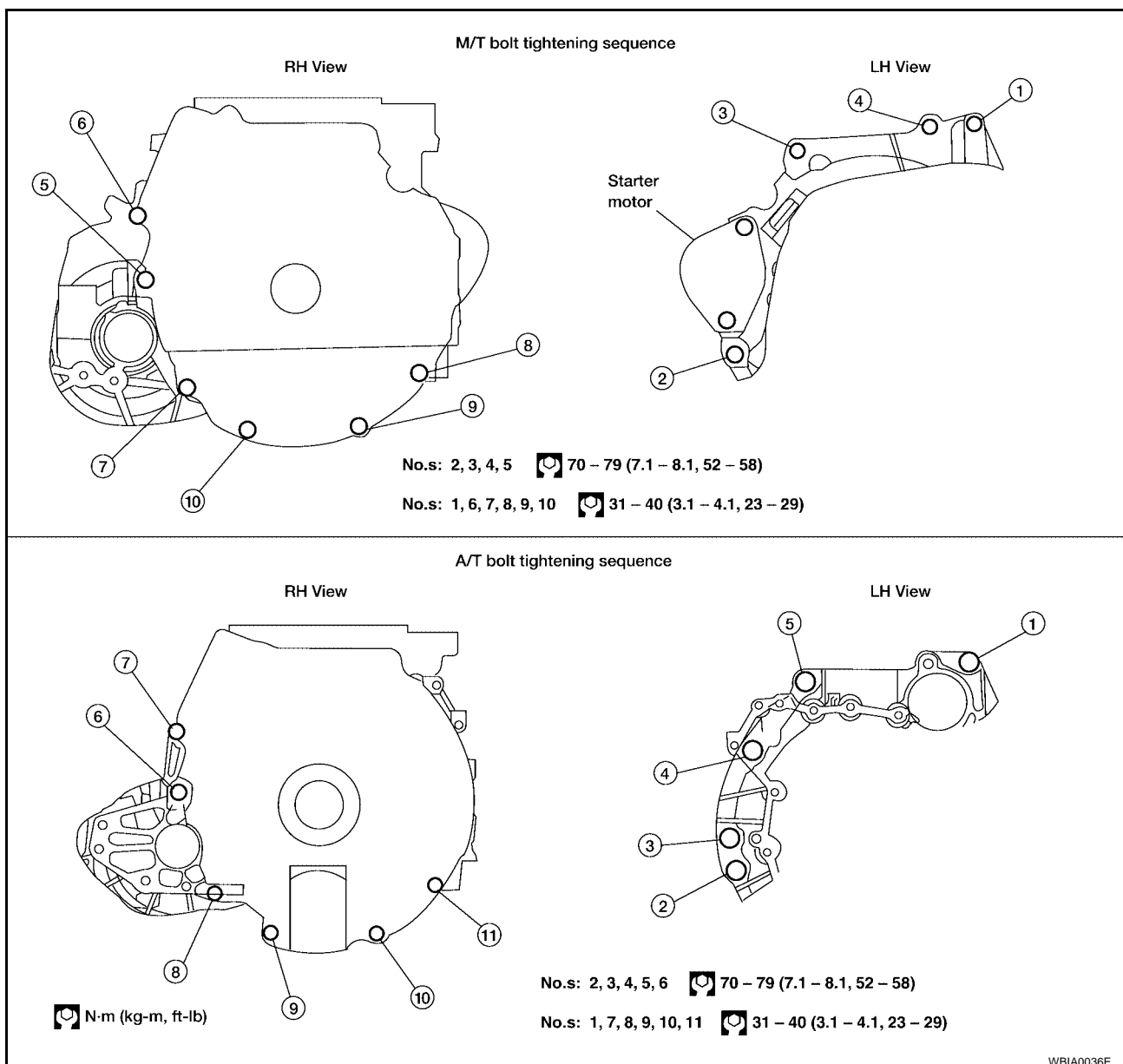


- Slinger bolts - front** : 51.0 - 64.7 N-m (5.2 - 6.5 kg-m, 38 - 47 ft-lb)
- Slinger bolts - rear** : 24.5 - 31.4 N-m (2.5 - 3.2 kg-m, 18 - 23 ft-lb)

25. Support engine and transaxle assembly with engine lifting equipment from the top with the vehicle raised on a hoist.
26. Remove RH engine mounting insulator and bracket.
27. Remove LH transaxle mounting insulator through-bolts.
28. Lower the engine and transaxle assembly from the engine compartment.
29. Remove the starter motor. Refer to [SC-19, "Removal and Installation"](#).
30. Separate engine and transaxle.

INSTALLATION

Installation is in the reverse order of removal.



- Do not allow oil to get on mounting insulators. Be careful not to damage mounting insulators.
- If parts have a direction mark (arrow) this indicates front of the vehicle, and the parts must be installed according to the identification mark.

INSPECTION AFTER INSTALLATION

- Before starting engine, check the levels of engine coolant, lubricants, engine oil. If less than required quantity, fill to the specified level.
- Run engine to check for unusual noise and vibration.
- Warm up engine thoroughly to make sure there is no leakage of coolant, lubricants, oil, fuel, and exhaust gas.
- Bleed air from passages in pipes and tubes of applicable lines.

CYLINDER BLOCK

[QR25DE]

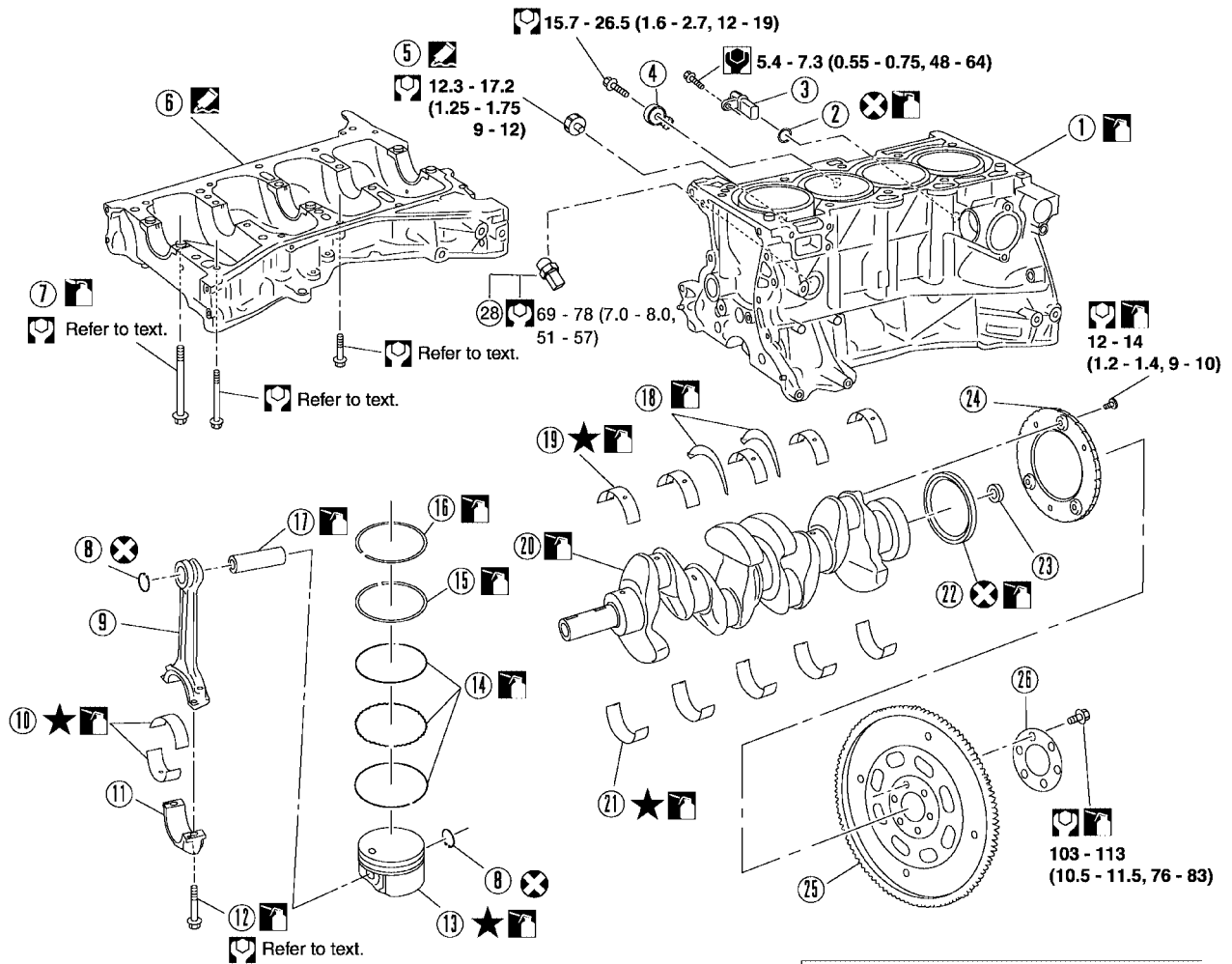
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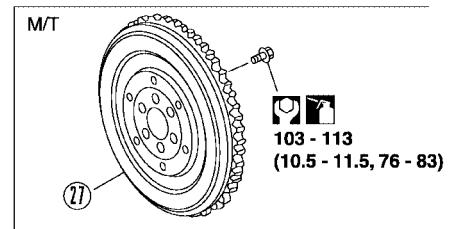
CYLINDER BLOCK

Disassembly and Assembly

SEC.110 • 120 • 221 • 226



- ★ : Select with proper clearance.
- ☑ : Apply engine oil.
- ☑ : Apply Genuine RTV Silicone Sealant or equivalent. Refer to GI Section.
- ⊗ : N·m (kg-m, ft-lb)
- ⊗ : N·m (kg-m, in-lb)



- | | | |
|---|--------------------------------|-------------------------------------|
| 1. Cylinder block | 2. O-ring | 3. Crankshaft position sensor (POS) |
| 4. Knock sensor | 5. Oil pressure switch | 6. Lower cylinder block |
| 7. Lower cylinder block bolt | 8. Snap ring | 9. Connecting rod |
| 10. Connecting rod bearing | 11. Connecting rod bearing cap | 12. Connecting rod bearing cap bolt |
| 13. Piston | 14. Oil ring | 15. Second ring |
| 16. Top ring | 17. Piston pin | 18. Main thrust bearing |
| 19. Main bearing upper | 20. Crankshaft | 21. Main bearing lower |
| 22. Crankshaft rear oil seal | 23. Pilot converter (A/T only) | 24. Crankshaft signal plate |
| 25. Drive plate | 26. Reinforcement plate | 27. Flywheel |
| 28. Cylinder block heater (if equipped) | | |

WBIA0073E

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-73, "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-24, "Removal and Installation"](#) .
 - Intake manifold collector. Refer to [EM-19, "Removal and Installation"](#) .
 - Intake manifold and fuel tube assembly. Refer to [EM-19, "Removal and Installation"](#) .
 - Ignition coils. Refer to [EM-30, "Removal and Installation"](#) .
 - Rocker cover. Refer to [EM-36, "Removal and Installation"](#) .
 - Front cover, timing chain, and balancer unit. Refer to [EM-49, "Removal and Installation"](#) .
 - Cylinder head. Refer to [EM-62, "Removal and Installation"](#) .
5. Remove the knock sensor.

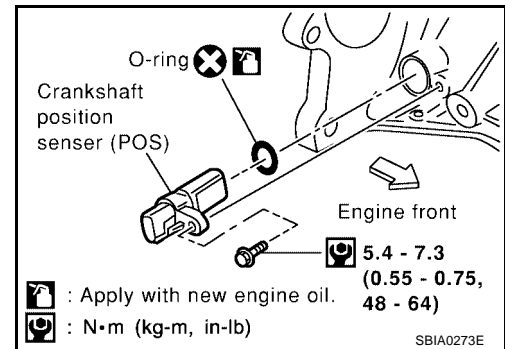
CAUTION:

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.



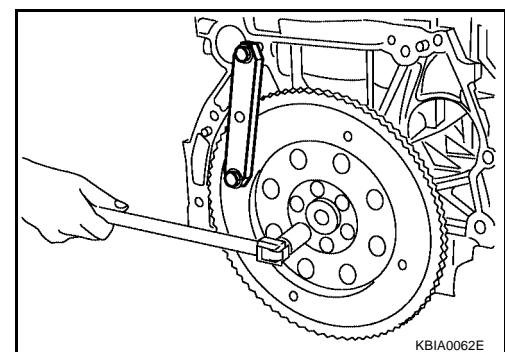
7. Remove the flywheel (M/T models) or drive plate (A/T models). Hold the crankshaft with a stopper plate and use a suitable tool to remove the mounting bolts.

CAUTION:

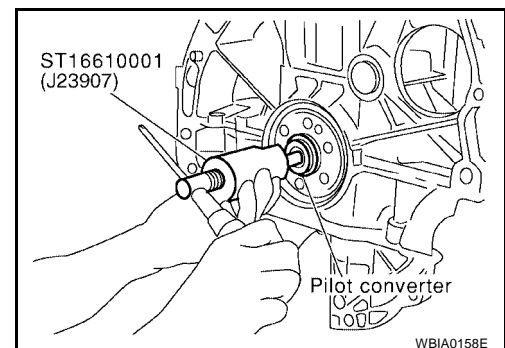
- Be careful not to damage the flywheel contact surface for the clutch disc.

NOTE:

- The flywheel two-block construction allows movement in response to transmission side pressure, or when twisted in its rotational direction, therefore, some amount of noise is normal.



8. Remove pilot converter using Tool (A/T models).



CYLINDER BLOCK

[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-92](#), "[CONNECTING ROD SIDE CLEARANCE](#)".

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

CAUTION:

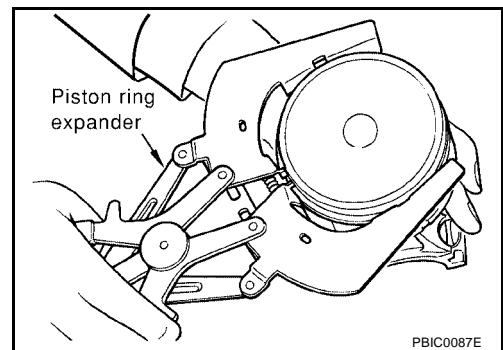
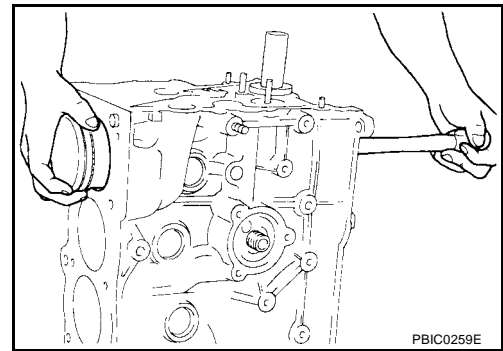
- When removing them, note the installation position. Keep them in the correct order.

11. Remove the piston rings from the piston.

- Use a piston ring expander.

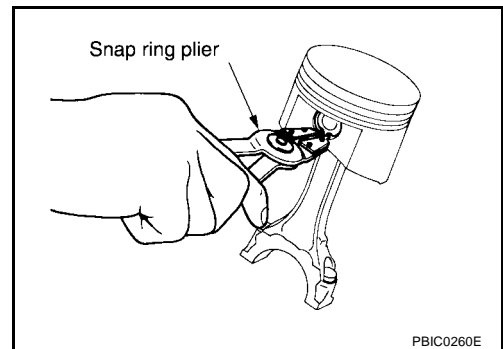
CAUTION:

- 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.
- Before removing the piston rings, check the piston ring side clearance. Refer to [EM-93](#), "[PISTON RING SIDE CLEARANCE](#)".

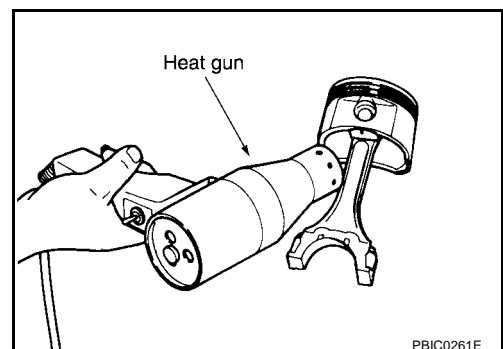


12. Remove the piston from the connecting rod as follows.

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



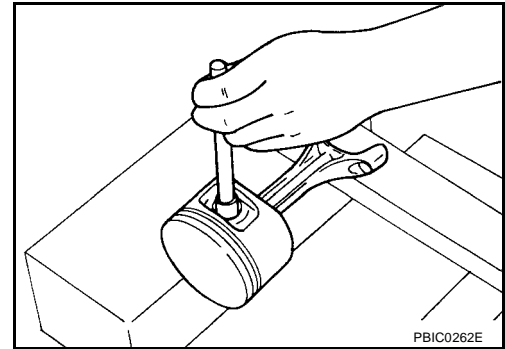
- b. Heat the piston to 60° - 70°C (140° - 158°F) with a heat gun, or equivalent.



CYLINDER BLOCK

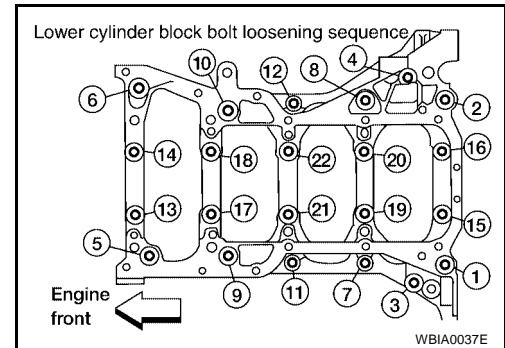
[QR25DE]

- 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 mounting bolts.

- Before loosening the lower cylinder block mounting bolts, measure the crankshaft side clearance. Refer to [EM-91](#), "[CRANKSHAFT SIDE CLEARANCE](#)".
- Loosen them in the order shown to remove them.



14. Remove the lower cylinder block.

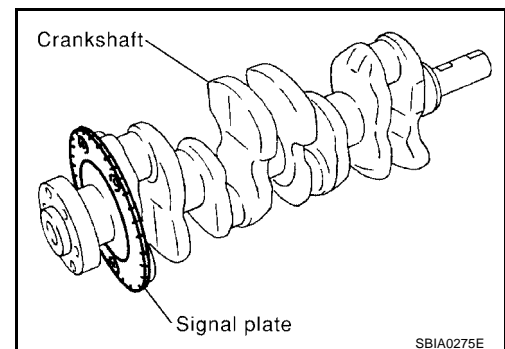
- Using Tool to cut the Silicone RTV Sealant and remove the lower cylinder block from the cylinder block.

Seal cutter

KV10111100 (J37228)

CAUTION:

Be careful not to damage the mounting 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 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.

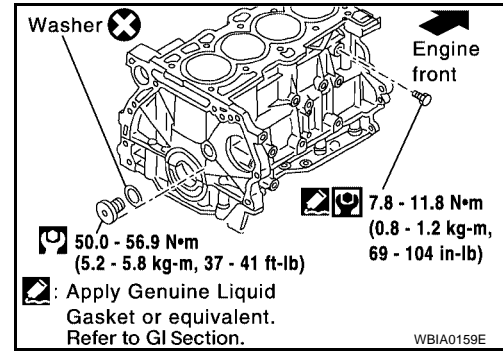
ASSEMBLY

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.

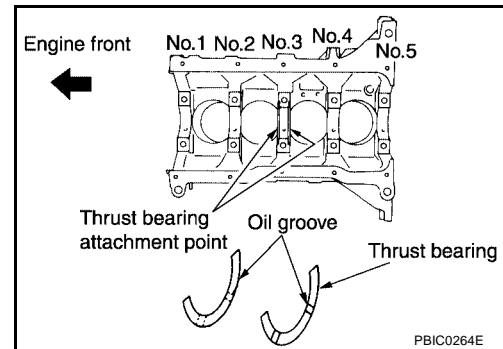
CAUTION:

Use approved safety glasses to protect your eyes.

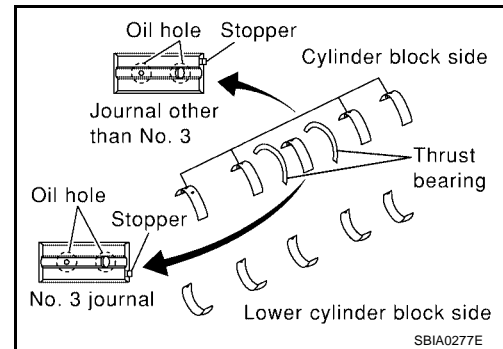
2. Install the drain plugs on the cylinder block.
 - Apply Silicone RTV Sealant.
Use Genuine Silicone RTV Sealant, or equivalent. Refer to GI-43, "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS" .
 - Replace the copper washers with new ones.



3. Install the main bearings and the thrust bearings.
 - a. Remove dust, dirt, and oil from the bearing mating surfaces of the cylinder block and lower cylinder block.
 - b. 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).



- c. Install the main bearings paying attention to their position and direction.
 - The main bearing with an oil hole and groove goes on the cylinder block. The one without them goes on the lower cylinder block.
 - Only the main bearing (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 to the notch.
 - Make sure that the oil holes on the cylinder block and those on the corresponding bearing are aligned.



4. Install the signal plate to the crankshaft.

Signal plate bolts : 12 - 14 N·m (1.22 - 1.43 kg-m, 9 - 10 ft-lb)

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

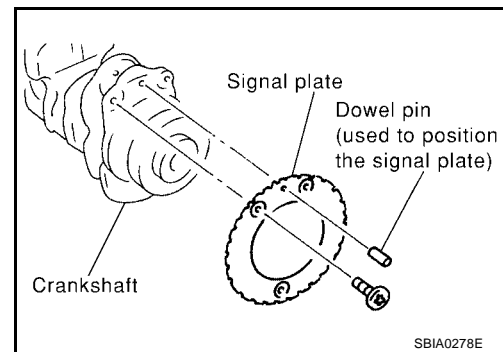
CAUTION:

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.

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



CYLINDER BLOCK

[QR25DE]

6. Install the lower cylinder block.

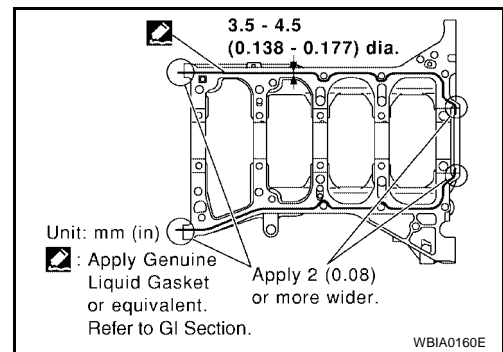
- Apply Silicone RTV Sealant to positions shown in the figure.
- Use Genuine Silicone RTV Sealant, or equivalent. Refer to [GI-43, "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS"](#).

NOTE:

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

CAUTION:

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



7. Tighten lower cylinder block mounting bolts in the numerical order shown and according to the following steps:

- Apply new engine oil to threads and seat surfaces of the mounting bolts.
- Tighten bolts No. 1 - 10 only in the order shown, to specification below.

First tightening, bolts 1 - 10 only : 36.3 - 42.2 N-m (3.7 - 4.3 kg-m, 27 - 31 ft-lb)

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

CAUTION:

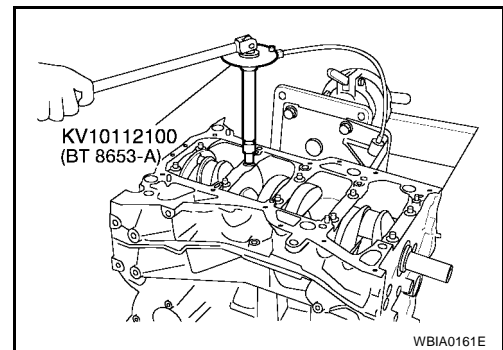
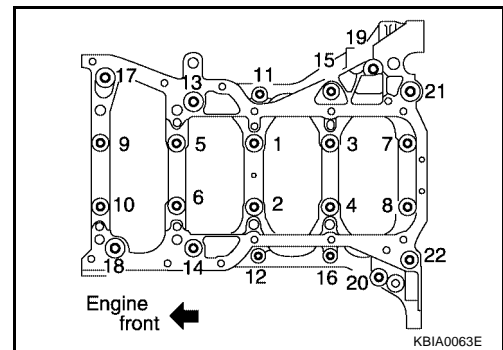
Use an angle wrench (special service tool) or protractor to check tightening angle. Do not make judgment by visual inspection.

Second tightening, bolts 1 - 10 only : 60° - 65° degrees rotation (target: 60° degrees)

- Tighten bolts No. 11 - 22 only in the order shown, to specification below.

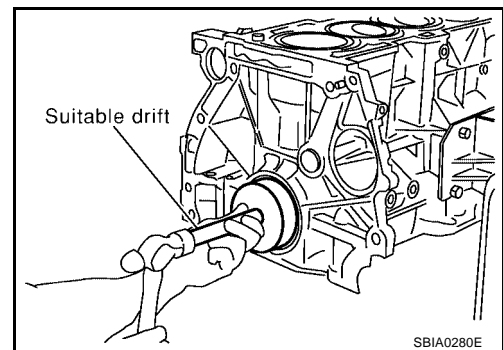
Third tightening, bolts 11 - 22 only : 19.6 - 24.5 N-m (2.0 - 2.5 kg-m, 15 - 18 ft-lb)

- Wipe off completely any protruding Silicone RTV Sealant on the exterior of engine.
- Check crankshaft side clearance. Refer to [EM-91, "CRANK-SHAFT SIDE CLEARANCE"](#).
- After installing the mounting bolts, make sure that the crankshaft can be rotated smoothly by hand.



8. Install the rear oil seal.

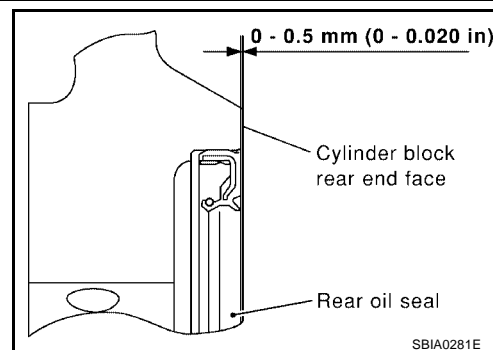
- Press the oil seal between cylinder block and crankshaft with a suitable drift.
- Be careful not to touch the grease on the oil seal lip.
- Be careful not to cause scratches or burrs when pressing in the rear oil seal.



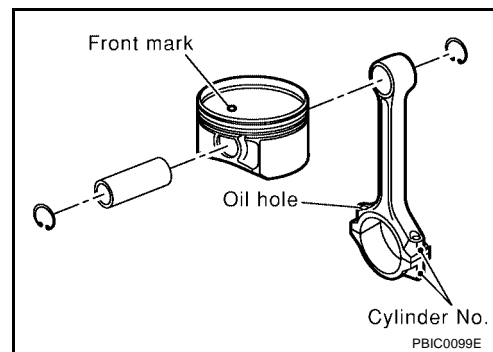
CYLINDER BLOCK

[QR25DE]

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



9. Install the piston to the connecting rod. Assemble the components in their original positions.
 - a. 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.
 - b. 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 in the figure.
 - c. Install the piston pin snap ring into the front of the piston.
 - Check that the connecting rod moves smoothly.



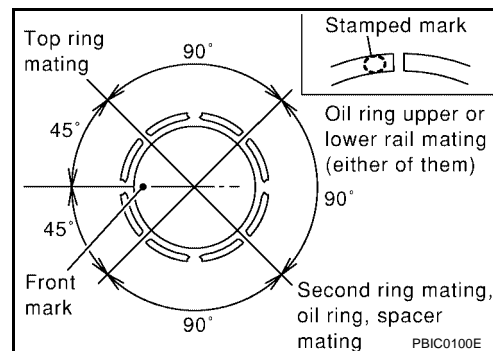
10. Using a piston ring expander, install the piston rings. Assemble the components in their original positions.

CAUTION:

Be careful not to damage the piston.

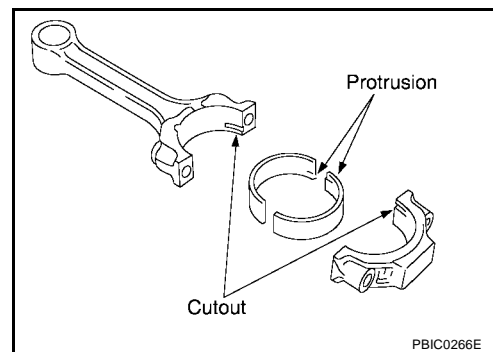
- Position each ring with the gap as shown in the figure, referencing the piston front mark as the starting point.
- Install the top ring and the second ring with the stamped surface facing upward.

Stamped mark : A (top ring)
 : 2A (second ring)



11. 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.

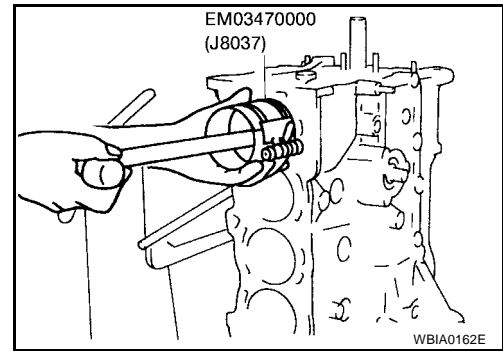


CYLINDER BLOCK

[QR25DE]

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

- 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.
- Using a piston ring compressor, install the piston with the front mark on the piston crown facing the front of the engine.

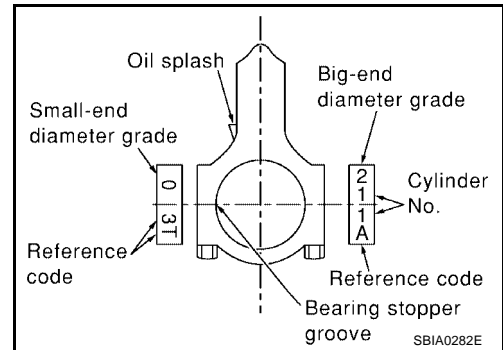


CAUTION:

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

13. 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.



14. Tighten the connecting rod bolt as follows:

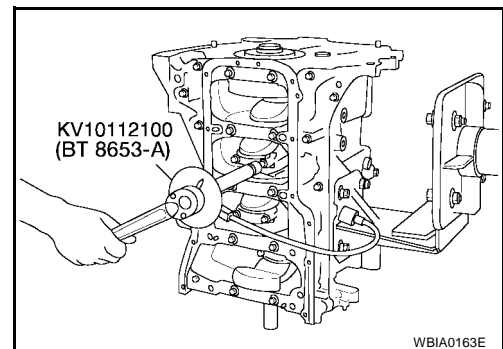
Apply engine oil to the threads and seats of the connecting rod bolts.

CAUTION:

Always use either an angle wrench or protractor. Avoid tightening based on visual check alone.

Stage 1 : 18.6 - 20.6 N·m (1.9 - 2.1 kg·m, 14 - 15 ft·lb)

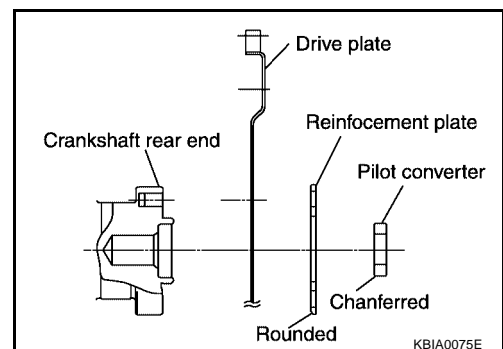
Stage 2 : Rotate bolts 85° - 95° degrees (target 90° degrees)



- Check the connecting rod side clearance. Refer to [EM-92](#), "[CONNECTING ROD SIDE CLEARANCE](#)".
- After tightening the bolts, make sure that the crankshaft rotates smoothly.

15. Install flywheel (M/T Models), or drive plate (A/T Models).

- Install drive plate, reinforcement plate and pilot converter as shown in figure.
- Using a drift with 33 mm (1.30 in) diameter, push pilot converter into the end of the crankshaft.



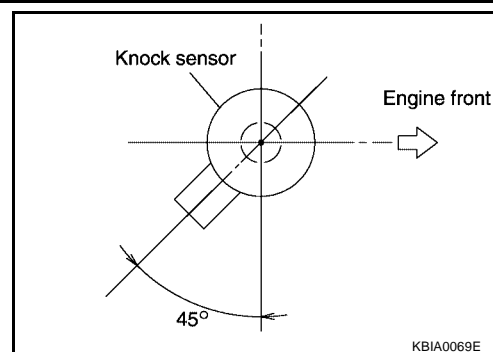
CYLINDER BLOCK

[QR25DE]

16. 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° as shown.
- Do not tighten the mounting bolts while holding the connector.
- Make sure that the knock sensor does not interfere with other parts.

Knock sensor bolt : 15.7 - 26.5 N·m (1.6 - 2.7 kg-m, 12 - 19 ft-lb)



CAUTION:

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

17. Install the crankshaft position sensor (POS).

Crankshaft position sensor bolt : 5.4 - 7.3 N·m (0.55 - 0.75 kg-m, 48 - 65 in-lb)

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

How to Select Piston and Bearing DESCRIPTION

EBS00DUM

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, refer to the text.

HOW TO SELECT A PISTON

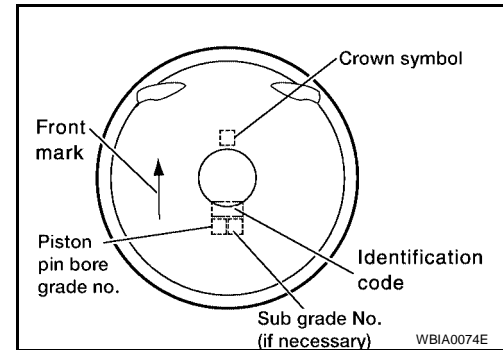
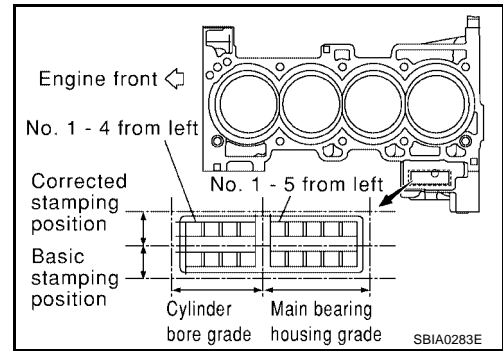
When New Cylinder Block is Used:

- Check the cylinder bore grade on rear left side of cylinder block, and select a piston of the same grade.

CYLINDER BLOCK

[QR25DE]

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



When a Cylinder Block is Reused:

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". Select the piston of the same grade.

Piston Selection Table

Unit: mm (in)

Grade number (Mark)	1	2 (or no mark)	3
Inner diameter of cylinder bore	89.000-89.010 (3.5039-3.5043)	89.010-89.020 (3.5043-3.5047)	89.020-89.030 (3.5047-3.5051)
Outer diameter of piston	88.980-88.990 (3.5031-3.5035)	88.990-89.000 (3.5035-3.5039)	89.000-89.010 (3.5039-3.5043)

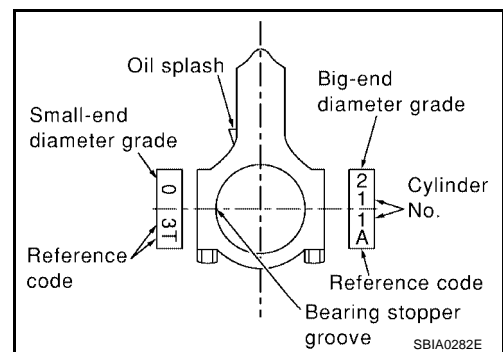
NOTE:

- 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 grades can be selected. Only 0 grade is available.

HOW TO SELECT A CONNECTING ROD BEARING

When New Connecting Rod and Crankshaft are Used:

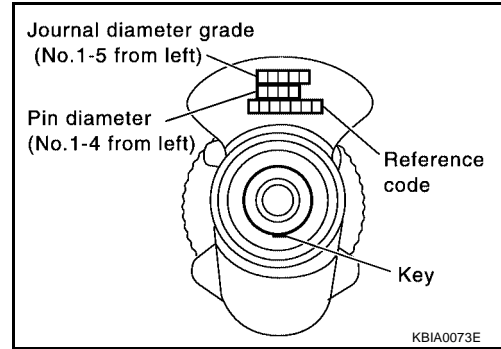
1. Apply big end inside diameter grade stamped on connecting rod side face to the row in the "Connecting Rod Bearing Selection Table".



CYLINDER BLOCK

[QR25DE]

- Apply pin diameter grade stamped on crankshaft front side to the column in the "Connecting Rod Bearing Selection Table".
- Read the symbol at the cross point of selected row and column in the "Connecting Rod Bearing Selection Table".
- Apply the symbol obtained to connecting rod bearing grade table to select.



When Crankshaft and Connecting Rod are Reused:

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

Connecting Rod Bearing Selection Table

Mark	Outer diameter Unit: mm (in)	Connecting rod big end. inner diameter	Crankshaft pin outer diameter	Mark												
				0	1	2	3	4	5	6	7	8	9	A	B	C
				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 (1.8899 - 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)
A	44.974 - 44.973 (1.7706 - 1.7706)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
B	44.973 - 44.972 (1.7706 - 1.7705)	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
C	44.972 - 44.971 (1.7705 - 1.7705)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
D	44.971 - 44.970 (1.7705 - 1.7705)	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
E	44.970 - 44.969 (1.7705 - 1.7704)	0	0	0	0	0	1	1	1	1	1	1	1	1	1	2
F	44.969 - 44.968 (1.7704 - 1.7704)	0	0	0	1	1	1	1	1	1	1	1	1	1	2	2
G	44.968 - 44.967 (1.7704 - 1.7704)	0	0	1	1	1	1	1	1	1	1	1	1	2	2	2
H	44.967 - 44.966 (1.7704 - 1.7703)	0	1	1	1	1	1	1	1	1	1	1	2	2	2	2
J	44.966 - 44.965 (1.7703 - 1.7703)	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2
K	44.965 - 44.964 (1.7703 - 1.7702)	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
L	44.964 - 44.963 (1.7702 - 1.7702)	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2
M	44.963 - 44.962 (1.7702 - 1.7702)	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2
N	44.962 - 44.961 (1.7702 - 1.7701)	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3
P	44.961 - 44.960 (1.7701 - 1.7701)	1	1	1	2	2	2	2	2	2	2	2	2	2	3	3
R	44.960 - 44.959 (1.7701 - 1.7700)	1	1	2	2	2	2	2	2	2	2	2	2	3	3	3
S	44.959 - 44.958 (1.7700 - 1.7700)	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3
T	44.958 - 44.957 (1.7700 - 1.7700)	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3
U	44.957 - 44.956 (1.7700 - 1.7699)	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3

CYLINDER BLOCK

[QR25DE]

Connecting Rod Bearing Grade Table

Grade	0	1	2	3
Upper / Lower thickness mm (in)	1.499 / 1.495 (0.0590/0.0589)	1.503 / 1.499 (0.0592 / 0.0590)	1.507 / 1.503 (0.0593 / 0.0592)	1.511 / 1.507 (0.0595 / 0.0593)
Identification color	Black	Brown	Green	Yellow

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.

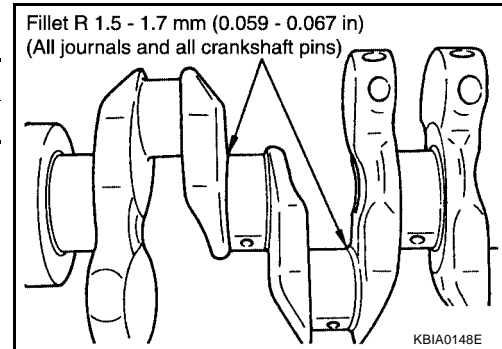
Bearing Undersize Table

Unit: mm (in)

Size U.S.	Thickness
0.25 (0.0098)	1.624 - 1.632 (0.0639 - 0.0643)

CAUTION:

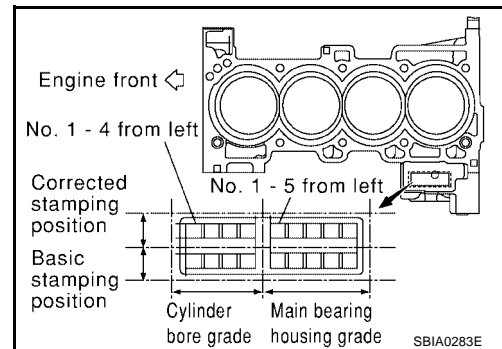
In grinding the crankshaft pin to use undersize bearings, do not damage the fillet R (All crankshaft pins).



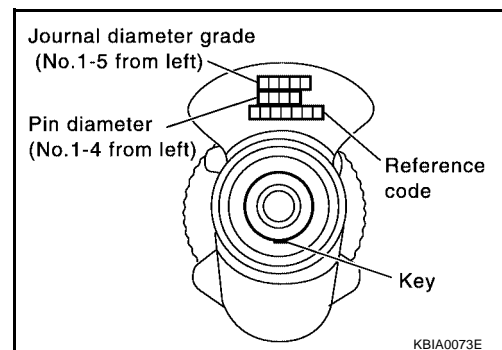
HOW TO SELECT A MAIN BEARING

When New Cylinder Block and Crankshaft are Used:

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 stamped on crankshaft front side to column in "Main Bearing Selection Table".



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.

CYLINDER BLOCK

[QR25DE]

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".

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

Crankshaft journal outer diameter	Cylinder block main bearing housing inner diameter	Mark	Inner diameter Unit: mm (in)		A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	V	W	X	Y	4	7	
			Mark	Outer diameter Unit: mm (in)	58.944 - 58.945 (2.3206 - 2.3207)	58.945 - 58.946 (2.3207 - 2.3207)	58.946 - 58.947 (2.3207 - 2.3207)	58.947 - 58.948 (2.3207 - 2.3208)	58.948 - 58.949 (2.3208 - 2.3208)	58.949 - 58.950 (2.3209 - 2.3209)	58.950 - 58.951 (2.3209 - 2.3209)	58.951 - 58.952 (2.3209 - 2.3209)	58.952 - 58.953 (2.3209 - 2.3210)	58.953 - 58.954 (2.3210 - 2.3210)	58.954 - 58.955 (2.3210 - 2.3211)	58.955 - 58.956 (2.3211 - 2.3211)	58.956 - 58.957 (2.3211 - 2.3211)	58.957 - 58.958 (2.3211 - 2.3212)	58.958 - 58.959 (2.3212 - 2.3212)	58.959 - 58.960 (2.3212 - 2.3213)	58.960 - 58.961 (2.3213 - 2.3213)	58.961 - 58.962 (2.3213 - 2.3213)	58.962 - 58.963 (2.3213 - 2.3214)	58.963 - 58.964 (2.3214 - 2.3214)	58.964 - 58.965 (2.3214 - 2.3215)	58.965 - 58.966 (2.3215 - 2.3215)	58.966 - 58.967 (2.3215 - 2.3215)	58.967 - 58.968 (2.3215 - 2.3216)	
A	54.979 - 54.978 (2.1645 - 2.1645)	0	0	01	01	01	1	1	1	1	1	12	12	12	2	2	2	23	23	23	23	3	3	3	34	34	34	4	4
B	54.978 - 54.977 (2.1645 - 2.1644)	0	01	01	01	1	1	1	1	1	12	12	12	2	2	2	23	23	23	23	3	3	3	34	34	34	4	4	
C	54.977 - 54.976 (2.1644 - 2.1644)	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	23	23	23	3	3	3	34	34	34	4	4	4	
D	54.976 - 54.975 (2.1644 - 2.1644)	01	01	1	1	1	12	12	12	2	2	2	23	23	23	23	23	23	23	3	3	3	34	34	34	4	4	4	
E	54.975 - 54.974 (2.1644 - 2.1643)	01	1	1	1	12	12	12	2	2	2	23	23	23	23	23	23	23	23	3	3	3	34	34	34	4	4	4	
F	54.974 - 54.973 (2.1643 - 2.1643)	1	1	1	12	12	12	2	2	2	2	23	23	23	23	23	23	23	23	3	3	3	34	34	34	4	4	4	
G	54.973 - 54.972 (2.1643 - 2.1642)	1	1	12	12	12	2	2	2	2	23	23	23	23	23	23	23	23	23	3	3	3	34	34	34	4	4	4	
H	54.972 - 54.971 (2.1642 - 2.1642)	1	12	12	12	2	2	2	2	23	23	23	23	23	23	23	23	23	23	3	3	3	34	34	34	4	4	4	
J	54.971 - 54.970 (2.1642 - 2.1642)	12	12	12	2	2	2	23	23	23	23	23	23	23	23	23	23	23	23	3	3	3	34	34	34	4	4	4	
K	54.970 - 54.969 (2.1642 - 2.1641)	12	12	2	2	2	23	23	23	23	23	23	23	23	23	23	23	23	23	3	3	3	34	34	34	4	4	4	
L	54.969 - 54.968 (2.1641 - 2.1641)	12	2	2	2	23	23	23	23	23	23	23	23	23	23	23	23	23	23	3	3	3	34	34	34	4	4	4	
M	54.968 - 54.967 (2.1641 - 2.1641)	2	2	2	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	3	3	3	34	34	34	4	4	4	
N	54.967 - 54.966 (2.1641 - 2.1640)	2	2	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	3	3	3	34	34	34	4	4	4	
P	54.966 - 54.965 (2.1640 - 2.1640)	2	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	3	3	3	34	34	34	4	4	4	
R	54.965 - 54.964 (2.1640 - 2.1639)	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	3	3	3	34	34	34	4	4	4	
S	54.964 - 54.963 (2.1639 - 2.1639)	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	3	3	3	34	34	34	4	4	4	
T	54.963 - 54.962 (2.1639 - 2.1639)	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	3	3	3	34	34	34	4	4	4	
U	54.962 - 54.961 (2.1639 - 2.1638)	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	3	3	3	34	34	34	4	4	4	
V	54.961 - 54.960 (2.1638 - 2.1638)	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	3	3	3	34	34	34	4	4	4	
W	54.960 - 54.959 (2.1638 - 2.1637)	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	3	3	3	34	34	34	4	4	4	
X	54.959 - 54.958 (2.1637 - 2.1637)	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	3	3	3	34	34	34	4	4	4	
Y	54.958 - 54.957 (2.1637 - 2.1637)	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	3	3	3	34	34	34	4	4	4	
4	54.957 - 54.956 (2.1637 - 2.1636)	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	3	3	3	34	34	34	4	4	4	
7	54.956 - 54.955 (2.1636 - 2.1636)	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	3	3	3	34	34	34	4	4	4	

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CYLINDER BLOCK

[QR25DE]

01	UPR	1.973 - 1.976 (0.0777 - 0.0778)	Black / Brown	Grade and color are different for upper and lower bearings.
	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 / Orange	
	LWR	1.994 - 1.997 (0.0785 - 0.0786)		

Use Undersize Bearing Usage Guide

- Use undersize (U.S.) bearing when oil clearance with standard size main bearing is not within specification.
- When using undersize (U.S.) bearing, measure the bearing inner diameter with the bearing installed and grind journal until oil clearance falls within specification.

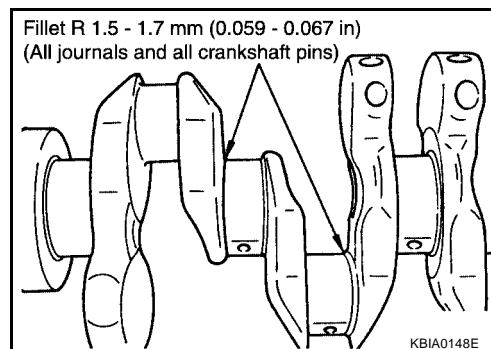
Bearing Undersize Table

Unit: mm (in)

Size U.S.	Thickness
0.25 (0.0098)	2.106 - 2.114 (0.0829 - 0.0832)

CAUTION:

Do not damage fillet R when grinding crankshaft journal in order to use an undersize bearing (all journals).



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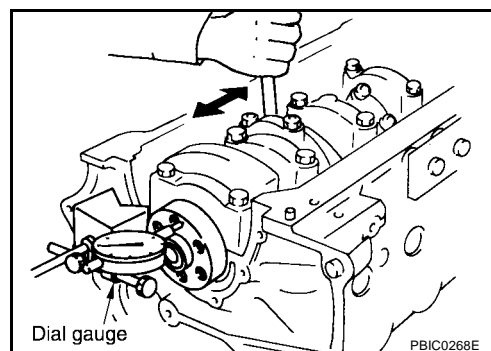
Inspection After Disassembly CRANKSHAFT SIDE CLEARANCE

- 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.



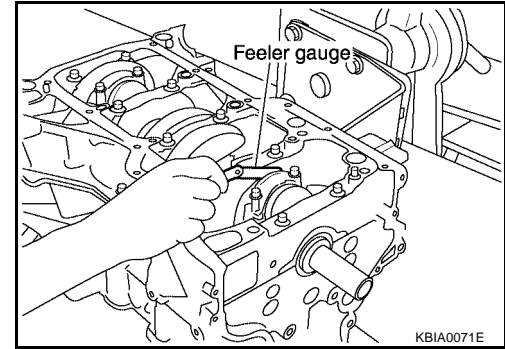
CONNECTING ROD SIDE CLEARANCE

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

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

Limit : 0.50 mm (0.0197 in)

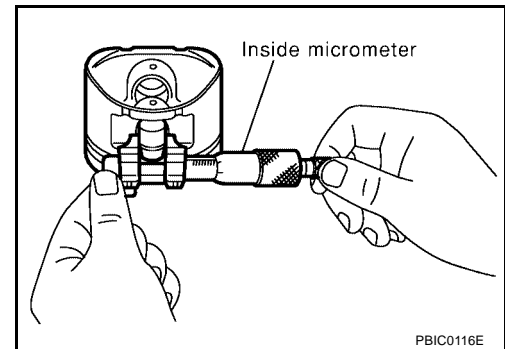
- If the measured value exceeds the limit, replace the connecting rod bearings, and measure again. If it still exceeds the limit, replace the crankshaft also.



PISTON AND PISTON PIN CLEARANCE

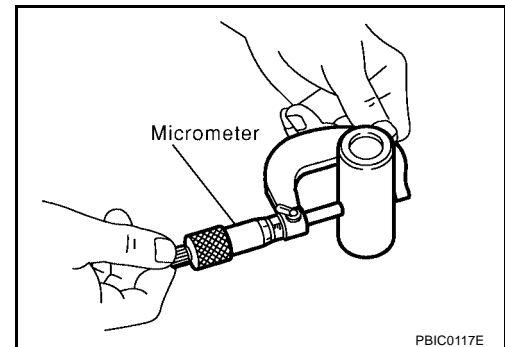
Diameter of Piston Pin Bore

- Measure the diameter of piston pin bore with an inside micrometer. Refer to [EM-107, "Available Piston"](#) .



Outer Diameter of Piston Pin

- Measure outer diameter of piston pin with a micrometer. Refer to [EM-107, "Piston Pin"](#) .

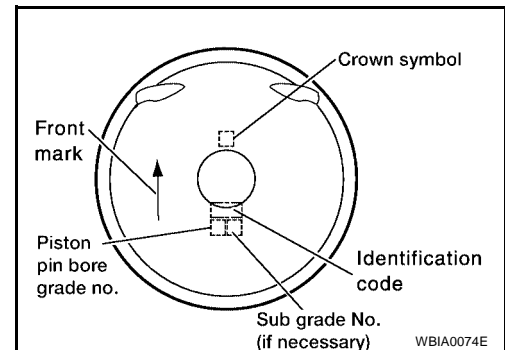


Piston to Piston Pin Clearance

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

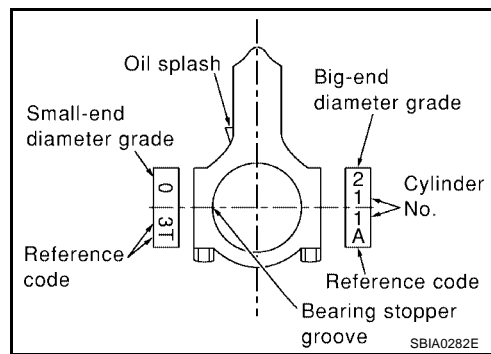
Standard : 0.002 - 0.006 mm (0.0001 - 0.0002 in)

- If clearance exceeds specification, replace either or both of piston/piston pin assembly and connecting rod assembly with reference to specification of each parts.
- Refer to piston selection table to replace piston/piston pin assembly. Refer to [EM-85, "HOW TO SELECT A PISTON"](#) .
- Refer to connecting rod bearing selection table to replace connecting rod. Refer to [EM-86, "HOW TO SELECT A CONNECTING ROD BEARING"](#) .



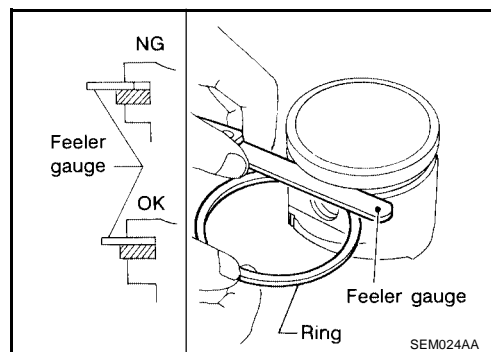
NOTE:

- 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.
- Refer to [EM-94, "CONNECTING ROD BUSHING OIL CLEARANCE \(SMALL END\)"](#) for the values for each grade at the plant.
- Regarding marks on piston head, Refer to [EM-85, "HOW TO SELECT A PISTON"](#) .



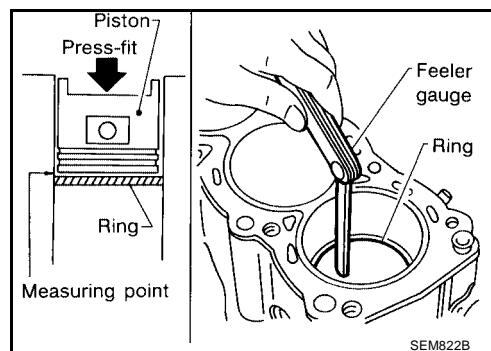
PISTON RING SIDE CLEARANCE

- Measure side clearance of piston ring and piston ring groove with feeler gauge. Refer to [EM-107, "Available Piston"](#) .
- If out of specification, replace piston and/or piston ring assembly.



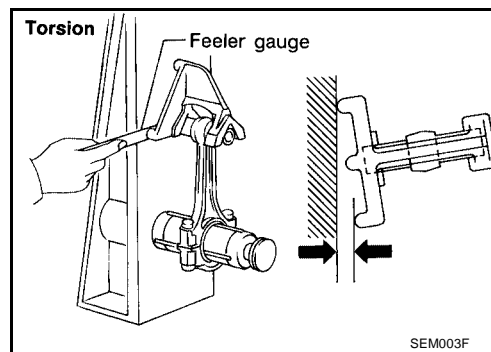
PISTON RING END GAP

- Check if inner diameter of cylinder bore is within specification. Refer to [EM-96, "PISTON TO CYLINDER BORE CLEARANCE"](#) .
- Insert piston ring until middle of cylinder with piston, and measure gap. Refer to [EM-107, "Available Piston"](#) .
- If out of specification, replace piston ring. If gap still exceeds the limit even with a new ring, re-bore cylinder and use oversized piston and piston ring.



CONNECTING ROD BEND AND TORSION

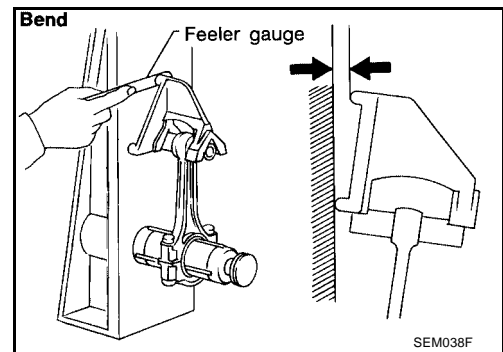
- Check with connecting rod aligner. Refer to [EM-107, "CONNECTING ROD"](#) .



CYLINDER BLOCK

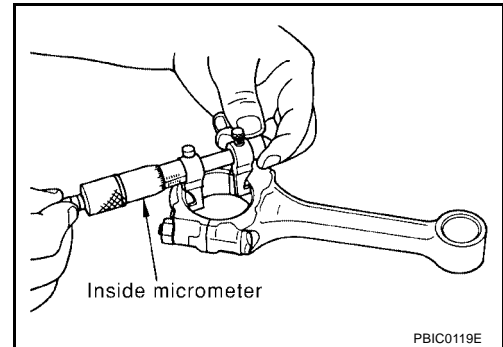
[QR25DE]

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



CONNECTING ROD BEARING (BIG END)

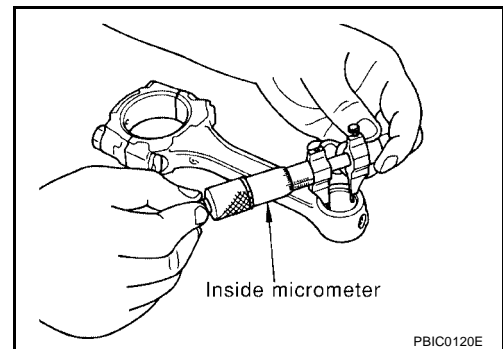
- Install the connecting rod cap without the connecting rod bearing installed. After tightening the connecting rod bolt to the specified torque, measure the connecting rod big end inner diameter using an inside micrometer. Refer to [EM-107, "CONNECTING ROD"](#).



CONNECTING ROD BUSHING OIL CLEARANCE (SMALL END)

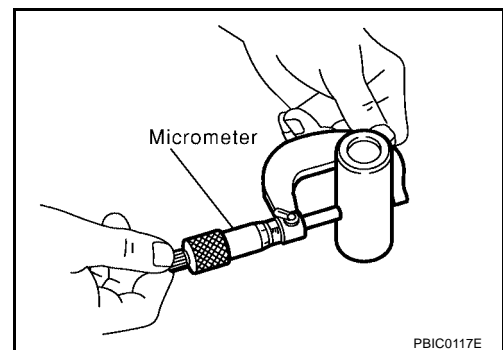
Inner Diameter of Connecting Rod (Small End)

- Measure inner diameter of bushing. Refer to [EM-107, "CONNECTING ROD"](#)



Outer Diameter of Piston Pin

- Measure outer diameter of piston pin. Refer to [EM-107, "Piston Pin"](#).

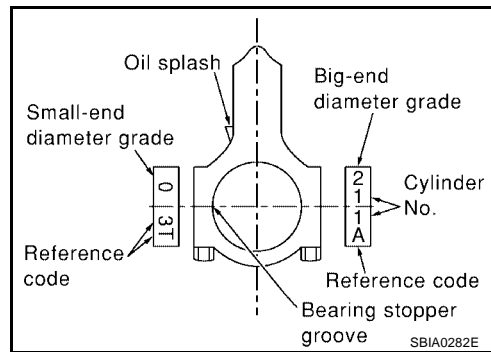


Connecting Rod Bushing Oil Clearance (Small End)

(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)

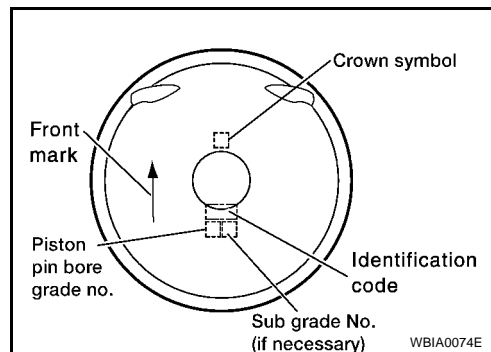
- If the measured value exceeds the standard, replace the connecting rod assembly and/or piston and piston pin assembly.
- If replacing the piston and piston pin assembly, refer to the "Piston Selection Table" to select the piston corresponding to the applicable bore grade of the cylinder block to be used. Refer to [EM-85, "HOW TO SELECT A PISTON"](#).



Factory Installed Parts Grading:

- Service parts apply only to grade 0.

Grade	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)



CYLINDER BLOCK DISTORTION

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

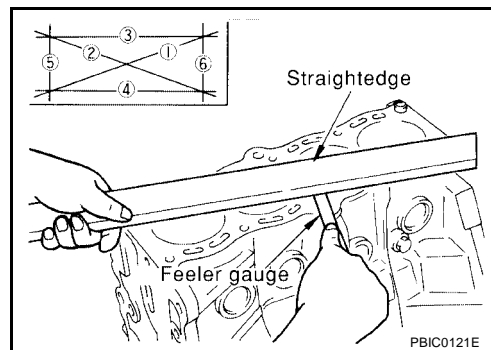
CAUTION:

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.



INNER DIAMETER OF MAIN BEARING HOUSING

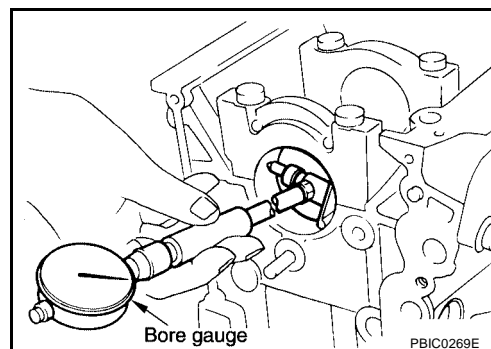
- Install the main bearing caps with the main bearings removed and tighten the mounting bolts to the specified torque. Refer to [EM-80, "ASSEMBLY"](#).
- Using a bore gauge, measure the inner diameter of the main bearing housing.

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

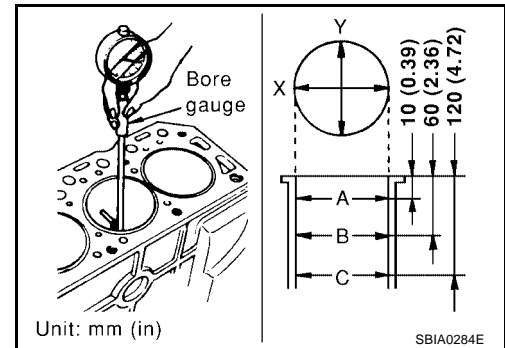
- Using a bore gauge, measure cylinder bore for wear, out-of-round and taper at 6 different points on each cylinder. (X and Y directions at A, B and C). The Y axis is in the longitudinal direction of the engine.

NOTE:

When determining cylinder bore grade, measure cylinder bore at B position. Refer to [EM-106, "CYLINDER BLOCK"](#).

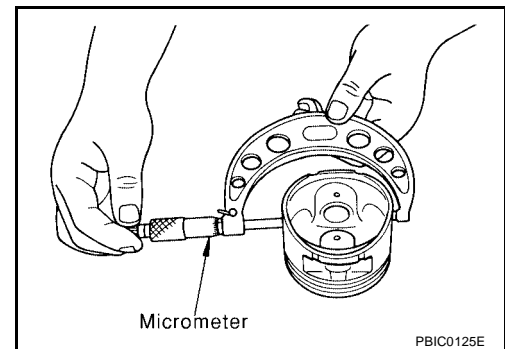
- If the measured value rebore exceeds the limit, or if there are scratches and/or seizure on the cylinder inner wall, hone the inner wall.
- An oversize piston is provided. When using an oversize piston, rebore the cylinder so that the clearance of the piston cylinder satisfies the standard.

Over size (OS) : 0.2 mm (0.008 in)



Outer Diameter of Piston

- Measure piston skirt diameter. Refer to [EM-107, "Available Piston"](#).



- Measure point (distance from the top): 42 mm (1.65 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)

- Install main bearing caps, and tighten to the specified torque. Otherwise, cylinder bores may be distorted in final assembly.
- 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

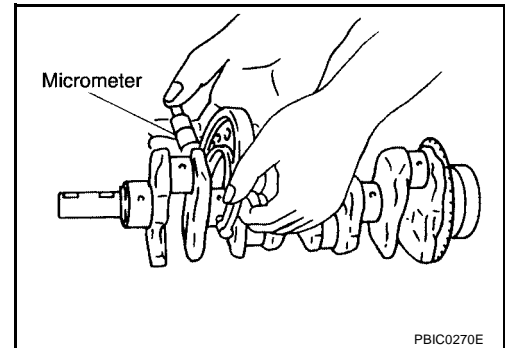
- Measure outer diameter of crankshaft journals.

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)



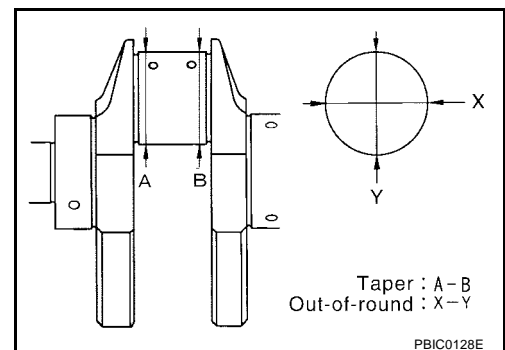
OUT-OF-ROUND AND TAPER OF CRANKSHAFT

- Using a micrometer, measure the dimensions at four different points shown in the figure on each journal and pin.
- 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)

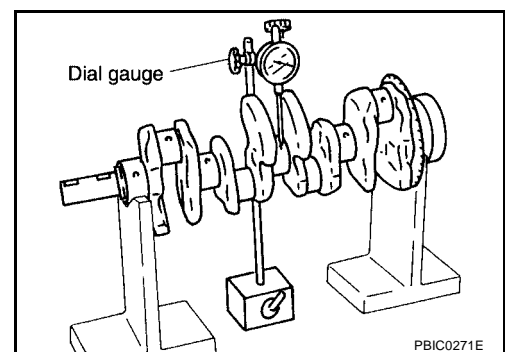
Taper (A - B) : 0.005 mm (0.0002 in)



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

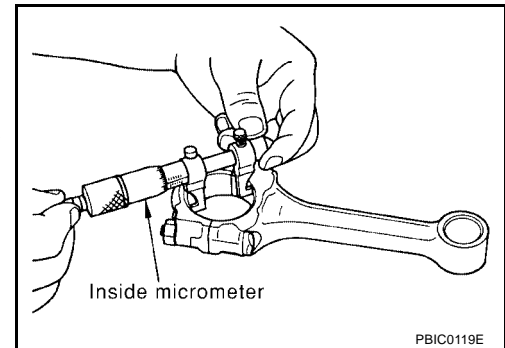
- Install the connecting rod bearings to the connecting rod and the cap, and tighten the connecting rod bolts to the specified torque. Using an inside micrometer measure the inner diameter of connecting rod bearing.

(Oil clearance) = (Inner diameter of connecting rod bearing) – (Outer diameter of crankshaft pin)

Standard : 0.028 - 0.045 mm (0.0011 - 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-86, "HOW TO SELECT A CONNECTING ROD 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.

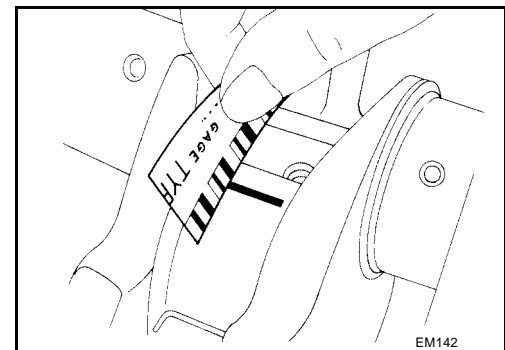
CAUTION:

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-88, "HOW TO SELECT A MAIN BEARING"](#).

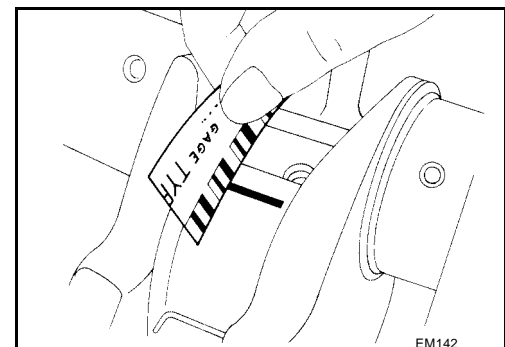
Method of Using Plastigage

- 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:

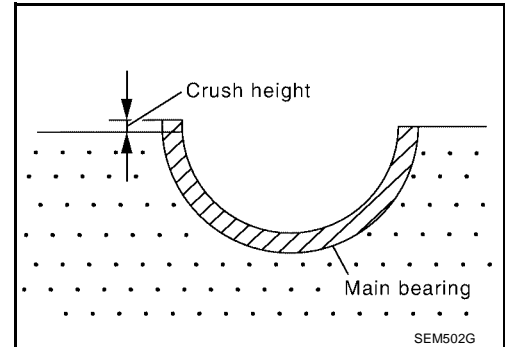
The procedure when the measured value exceeds the limit is same as that described in the "Method by Calculation".

CRUSH HEIGHT OF MAIN BEARING

- 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.

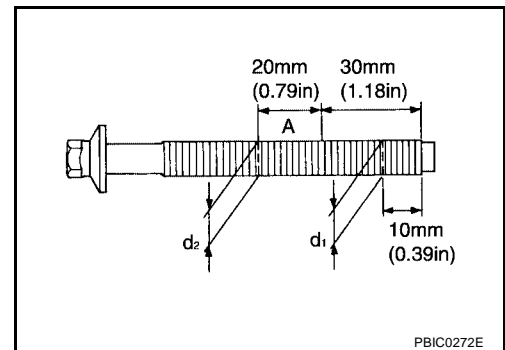
- If the standard is not met, replace main bearings.



OUTER DIAMETER OF LOWER CYLINDER BLOCK MOUNTING BOLT

- Perform only with M10 (0.39 in) bolts.
- Measure outer diameters (d1, d2) at two positions as shown.
- Measure d2 at a point within area A as shown.
- When the value of d1- d2 exceeds the limit (a large difference in dimensions), replace the bolt with a new one.

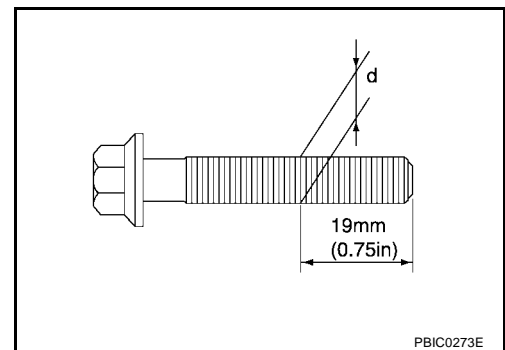
Limit : 0.13 mm (0.0051 in)



OUTER DIAMETER OF CONNECTING ROD BOLT

- Measure outer diameter (d) at position shown in the figure.
- 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



MOVEMENT AMOUNT OF FLYWHEEL (M/T MODEL)

NOTE:

- Inspection for double mass flywheel only.
- Do not disassemble double mass flywheel.

Flywheel Deflection

- Measure deflection of flywheel contact surface to the clutch with a dial gauge.

CYLINDER BLOCK

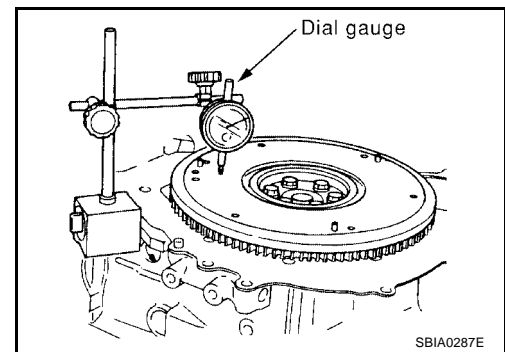
[QR25DE]

- Measure deflection at 210 mm (8.27 in) dia.

Standard : 0.45 mm (0.0177 in) or less

Limit : 1.3 mm (0.051 in) or less

- When measured value exceeds the limit, replace the flywheel with a new one.

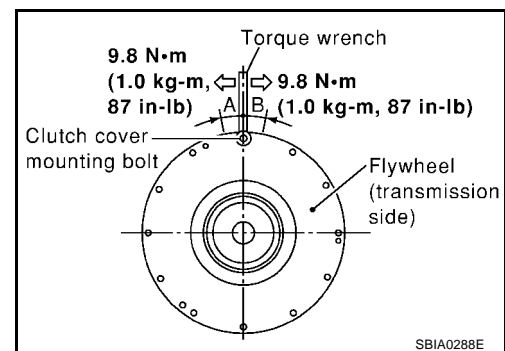


Movement Amount in Rotation Direction

- Check the movement amount in the following procedure.
 1. Install a bolt to clutch cover mounting hole, and place a torque wrench on the extended line of the flywheel center line.
 2. Tighten bolt to keep it from loosening at a force of 9.8 N·m (1 kg·m, 87 in·lb).
 3. Put a mating mark on circumferences of the two flywheel masses without applying any load (measurement standard points).
 4. Apply a force of 9.8 N·m (1 kg·m, 87 in·lb) in each direction, and mark the movement amount on the mass on the transmission side.
 5. Measure dimensions of movement amounts A and B on circumference of the flywheel on the transmission side.

Standard : 28.3 mm (1.114 in) or less

- When measured value is outside the standard, replace flywheel.



SERVICE DATA AND SPECIFICATIONS (SDS)

[QR25DE]

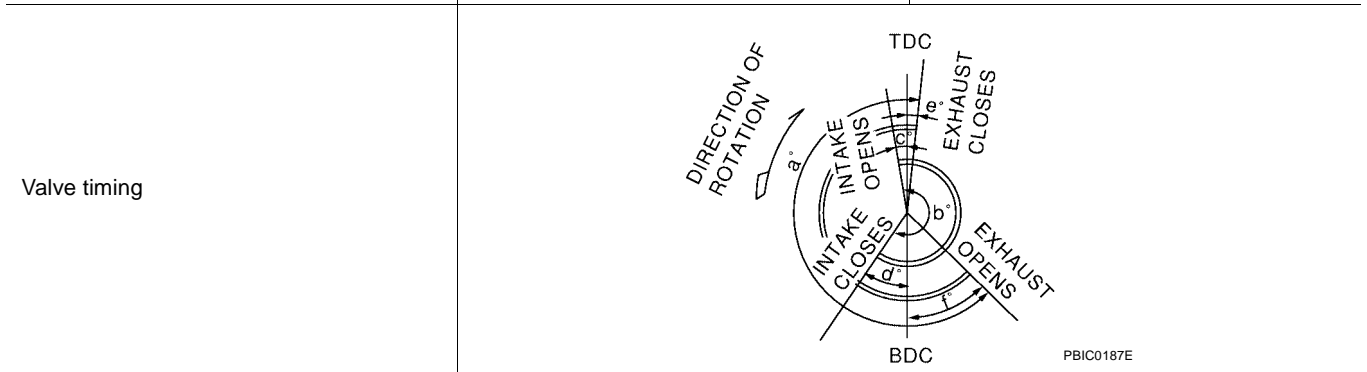
PF0:00030

EBS00DU0

SERVICE DATA AND SPECIFICATIONS (SDS)

Standard and Limit GENERAL SPECIFICATIONS

Cylinder arrangement		In-line 4
Displacement cm^3 (cu in)		2,488 (151.82)
Bore and stroke mm (in)		89.0 x 100 (3.50 - 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 ² , psi) / 250 rpm	Standard	1,250 (12.8, 181.3)
	Minimum	1,060 (10.8, 153.7)
	Differential limit between cylinders	100 (1.0, 14)



Unit: degree					
a	b	c	d	e	f
224°	244°	0°	64°	3°	41°

DRIVE BELTS

Tension of drive belts	Auto adjustment by auto tensioner
------------------------	-----------------------------------

INTAKE MANIFOLD AND EXHAUST MANIFOLD

Unit: mm (in)		
		Limit
Surface distortion	Intake manifold collector	0.1 (0.004)
	Intake manifold	0.1 (0.004)
	Exhaust manifold	0.3 (0.012)

SPARK PLUG

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

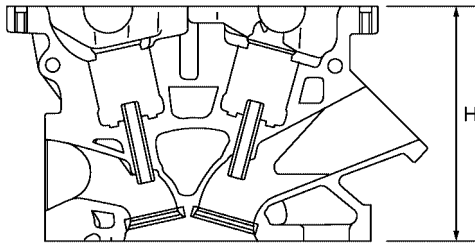
SERVICE DATA AND SPECIFICATIONS (SDS)

[QR25DE]

CYLINDER HEAD

Unit: mm (in)

	Limit
Head surface distortion	0.1 (0.004)



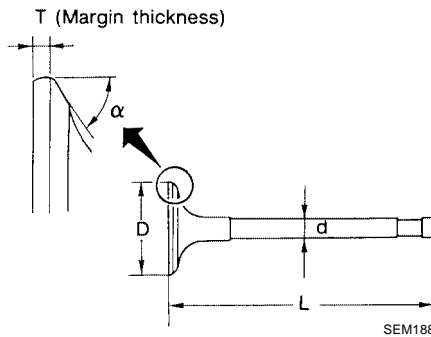
Nominal cylinder head height:
H = 129.4 mm (5.09 in)

PBIC0283E

VALVE

Valve Dimensions

Unit: mm (in)



Valve head diameter "D"	Intake	35.5 - 35.8 (1.398 - 1.409)
	Exhaust	30.5 - 30.8 (1.201 - 1.213)
Valve length "L"	Intake	97.16 (3.8252)
	Exhaust	98.82 (3.8905)
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 "α"	Intake	45°15' - 45°45'
	Exhaust	
Valve margin "T"	Intake	1.1 (0.043)
	Exhaust	1.3 (0.051)

Valve Clearance

Unit: mm (in)

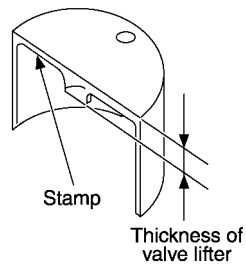
	Cold* (reference data)	Hot
Intake	0.24 - 0.32 (0.009 - 0.013)	0.32 - 0.40 (0.013 - 0.016)
Exhaust	0.26 - 0.34 (0.010 - 0.013)	0.33 - 0.41 (0.013 - 0.016)

*: Approximately 20°C (68 °F)

SERVICE DATA AND SPECIFICATIONS (SDS)

[QR25DE]

Available Valve Lifter



KBIA0119E

Thickness mm (in)	Identification mark (Stamp)
6.96 (0.2740)	696
6.98 (0.2748)	698
7.00 (0.2756)	700
7.02 (0.2764)	702
7.04 (0.2772)	704
7.06 (0.2780)	706
7.08 (0.2787)	708
7.10 (0.2795)	710
7.12 (0.2803)	712
7.14 (0.2811)	714
7.16 (0.2819)	716
7.18 (0.2827)	718
7.20 (0.2835)	720
7.22 (0.2843)	722
7.24 (0.2850)	724
7.26 (0.2858)	726
7.28 (0.2866)	728
7.30 (0.2874)	730
7.32 (0.2882)	732
7.34 (0.2890)	734
7.36 (0.2898)	736
7.38 (0.2906)	738
7.40 (0.2913)	740
7.42 (0.2921)	742
7.44 (0.2929)	744
7.46 (0.2937)	746

Valve Spring

Free height standard mm (in)	Intake	44.84 - 45.34 (1.7654 - 1.7850)
	Exhaust	45.28 - 45.78 (1.7827 - 1.8024)
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)
Installation height mm (in)	Intake	35.30 (1.390)
	Exhaust	35.30 (1.390)

SERVICE DATA AND SPECIFICATIONS (SDS)

[QR25DE]

Installation load N (kg - force, lb - force)	Intake	151 (15.4 - 17.8, 34 - 39)
	Exhaust	151 (15.4 - 17.8, 34 - 39)
Height during valve open mm (in)	Intake	24.94 (0.9819)
	Exhaust	26.39 (1.0390)
Load with valve open N (kg - force, lb - force)	Intake	358 - 408 (36.5 - 41.6, 80 - 92)
	Exhaust	325 - 371 (33.1 - 37.8, 73 - 83)

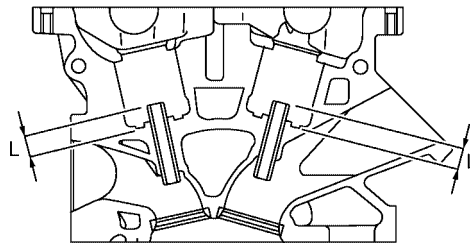
Valve Lifter

Unit: mm (in)

	Standard
Valve lifter outer diameter	33.965 - 33.980 (1.3372 - 1.3378)
Lifter bore inner diameter	34.000 - 34.021 (1.3386 - 1.3394)
Clearance between lifter and lifter guide	0.020 - 0.056 (0.0008 - 0.0022)

Valve Guide

Unit: mm (in)



PBIC0184E

		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)	
Standard			
Valve guide clearance	Intake	0.020 - 0.053 (0.0008 - 0.0021) or less	
	Exhaust	0.030 - 0.063 (0.0012 - 0.0025) or less	
Projection length "L"	Intake	10.1 - 10.3 (0.398 - 0.406)	
	Exhaust	10.0 - 10.4 (0.394 - 0.409)	

SERVICE DATA AND SPECIFICATIONS (SDS)

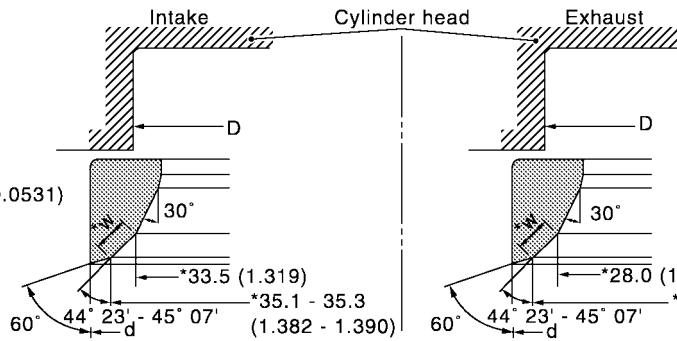
[QR25DE]

Valve Seat

Unit: mm (in)

*: Machining data

Contacting width (W)
; 1.05 - 1.35 (0.0413 - 0.0531)



Contacting width (W)
; 1.25 - 1.55 (0.0492 - 0.0610)

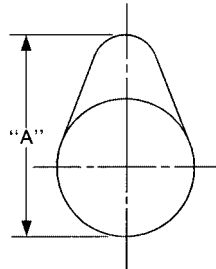
PBIC0284E

		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)

CAMSHAFT AND CAMSHAFT BEARING

Unit: mm (in)

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



SEM671

Cam height "A"	Intake	45.665 - 45.855 (1.7978 - 1.8053)
	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)

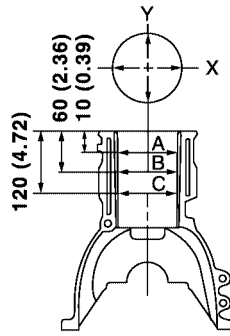
*: Total indicator reading

SERVICE DATA AND SPECIFICATIONS (SDS)

[QR25DE]

CYLINDER BLOCK

Unit: mm (in)



Surface distortion	Limit			0.1 (0.004)
Cylinder bore	Inner diameter	Standard	Grade No. 1	89.000 - 89.010 (3.5039 - 3.5043)
			Grade No. 2	89.010 - 89.020 (3.5043 - 3.5047)
			Grade No. 3	89.020 - 89.030 (3.5047 - 3.5051)
		Wear limit	0.2 (0.008)	
Out-of-round (X - Y)				Less than 0.015 (0.0006)
Taper (C - A)				Less than 0.01 (0.0004)
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)

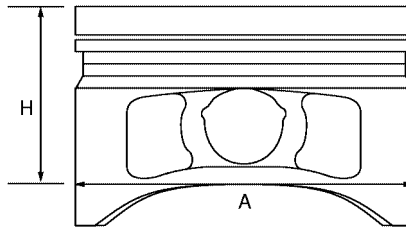
SERVICE DATA AND SPECIFICATIONS (SDS)

[QR25DE]

PISTON, PISTON RING, AND PISTON PIN

Available Piston

Unit: mm (in)



PBIC0188E

Piston skirt diameter "A"	Standard	Grade No. 1	88.980 - 88.990 (3.5031 - 3.5035)
		Grade No. 2	88.990 - 89.000 (3.5035 - 3.5039)
		Grade No. 3	89.000 - 89.010 (3.5039 - 3.5043)
		0.20 (0.0079) oversize (service)	89.180 - 89.210 (3.5110 - 3.5122)
"H" dimension			42 (1.65)
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)

Piston Ring

Unit: mm (in)

		Standard	Limit
Side clearance	Top	0.045 - 0.080 (0.0018 - 0.0031)	0.11 (0.0043)
	2nd	0.030 - 0.070 (0.0012 - 0.0028)	0.10 (0.0039)
	Oil ring	0.065 - 0.135 (0.0026 - 0.0053)	—
End gap	Top	0.21 - 0.31 (0.0083 - 0.0122)	0.54 (0.0213)
	2nd	0.32 - 0.47 (0.0126 - 0.0185)	0.67 (0.0264)
	Oil (rail ring)	0.20 - 0.60 (0.0079 - 0.0236)	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)

SERVICE DATA AND SPECIFICATIONS (SDS)

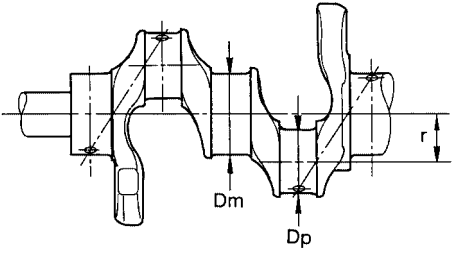
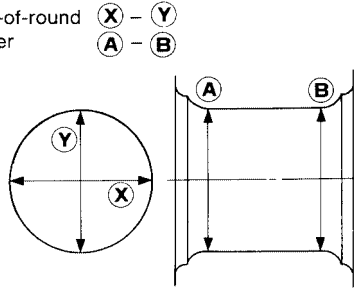
[QR25DE]

Connecting rod small end inner diameter*	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)	

*: After installing in connecting rod

CRANKSHAFT

Unit: mm (in)

 <p>SEM645</p>	<p>Out-of-round (X - Y) Taper (A - B)</p>  <p>SEM715</p>																																				
Pin journal dia. "DP"	<table border="1"> <tr><td>Grade No. A</td><td>44.974 - 44.973 (1.7706 - 1.7706)</td></tr> <tr><td>Grade No. B</td><td>44.973 - 44.972 (1.7706 - 1.7705)</td></tr> <tr><td>Grade No. C</td><td>44.972 - 44.971 (1.7705 - 1.7705)</td></tr> <tr><td>Grade No. D</td><td>44.971 - 44.970 (1.7705 - 1.7705)</td></tr> <tr><td>Grade No. E</td><td>44.970 - 44.969 (1.7705 - 1.7704)</td></tr> <tr><td>Grade No. F</td><td>44.969 - 44.968 (1.7704 - 1.7704)</td></tr> <tr><td>Grade No. G</td><td>44.968 - 44.967 (1.7704 - 1.7704)</td></tr> <tr><td>Grade No. H</td><td>44.967 - 44.966 (1.7704 - 1.7703)</td></tr> <tr><td>Grade No. J</td><td>44.966 - 44.965 (1.7703 - 1.7703)</td></tr> <tr><td>Grade No. K</td><td>44.965 - 44.964 (1.7703 - 1.7702)</td></tr> <tr><td>Grade No. L</td><td>44.964 - 44.963 (1.7702 - 1.7702)</td></tr> <tr><td>Grade No. M</td><td>44.963 - 44.962 (1.7702 - 1.7702)</td></tr> <tr><td>Grade No. N</td><td>44.962 - 44.961 (1.7702 - 1.7701)</td></tr> <tr><td>Grade No. P</td><td>44.961 - 44.960 (1.7701 - 1.7701)</td></tr> <tr><td>Grade No. R</td><td>44.960 - 44.959 (1.7701 - 1.7700)</td></tr> <tr><td>Grade No. S</td><td>44.959 - 44.958 (1.7700 - 1.7700)</td></tr> <tr><td>Grade No. T</td><td>44.958 - 44.957 (1.7700 - 1.7700)</td></tr> <tr><td>Grade No. U</td><td>44.957 - 44.956 (1.7700 - 1.7699)</td></tr> </table>	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)
Grade No. A	44.974 - 44.973 (1.7706 - 1.7706)																																				
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SERVICE DATA AND SPECIFICATIONS (SDS)

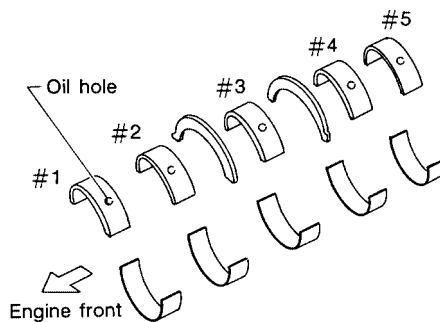
[QR25DE]

Main journal dia. "Dm" grade	Grade No. A	54.979 - 54.978 (2.1645 - 2.1645)	A
	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)	EM
	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)	C
	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)	D
	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)	E
	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)	F	
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)	G	
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)	H
Runout [TIR*]	Limit	Less than 0.05 (0.002)	
Free end play	Standard	0.10 - 0.26 (0.0039 - 0.0102)	I
	Limit	0.30 (0.0118)	

*: Total indicator reading

MAIN BEARING

Unit: mm (in)



SEM685D

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	

SERVICE DATA AND SPECIFICATIONS (SDS)

[QR25DE]

01	UPR	1.973 - 1.976 (0.0777 - 0.0778)	Black / Red	Grade and color are different for upper and lower bearings.
	LWR	1.976 - 1.979 (0.0778 - 0.0779)		
12	UPR	1.976 - 1.979 (0.0778 - 0.0779)	Red / 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 / Orange	
	LWR	1.994 - 1.997 (0.0785 - 0.0786)		

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

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 mm (in)	Identification color (mark)
0	1.499 - 1.495 (0.0590 - 0.0589)	Black
1	1.503 - 1.499 (0.0592 - 0.0590)	Brown
2	1.507 - 1.503 (0.0593 - 0.0592)	Green
3	1.511 - 1.507 (0.0595 - 0.0593)	Yellow

Undersize

Unit: mm (in)

Size U.S.	Thickness	Crank pin journal diameter
0.25 (0.0098)	1.624 - 1.632 (0.0639 - 0.0643)	Grind so that bearing clearance is the specified value.

Bearing Clearance

Unit: mm (in)

Connecting rod bearing clearance	Standard	0.028 - 0.045 (0.0011 - 0.0018)
	Limit	0.10 (0.0039)

PRECAUTIONS

PFP:00001

Precautions for Drain Coolant

EBS00DUP

- Drain coolant when engine is cooled.

Precautions for Disconnecting Fuel Piping

EBS00DUQ

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

Precautions for Removal and Disassembly

EBS00DUR

- When instructed to use special service tools, use the specified tools. Always be careful to work safely, avoid forceful or uninstructed operations.
- Exercise maximum care to avoid damage to mating or sliding surfaces.
- Cover openings of engine system with tape or the 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, do exactly as specified. Power tools may be used where noted in the step.

Precautions for Inspection, Repair and Replacement

EBS00DUS

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

Precautions for Assembly and Installation

EBS00DUT

- Use torque wrench to tighten bolts or nuts to specification.
- 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, do exactly as specified.
- Replace with 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.
- Release air within route after draining 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.

Parts Requiring Angular Tightening

EBS00DUU

- Use an angle wrench for the final tightening of the following engine parts:
 - Cylinder head bolts
 - Main bearing cap bolts
 - Connecting rod cap nuts
 - 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.

PRECAUTIONS

[VQ35DE]

EBS00EZ3

Precautions for Liquid Gasket REMOVAL OF LIQUID GASKET SEALING

- After removing the mounting bolts and nuts, separate the mating surface using a seal cutter and remove the liquid gasket sealing.

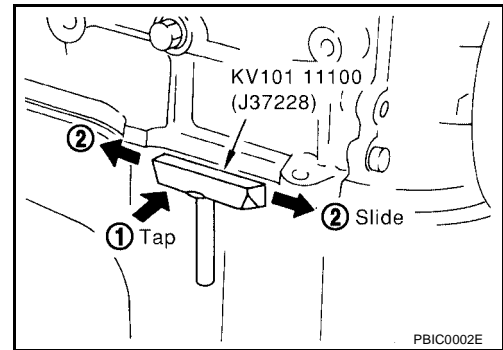
CAUTION:

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.

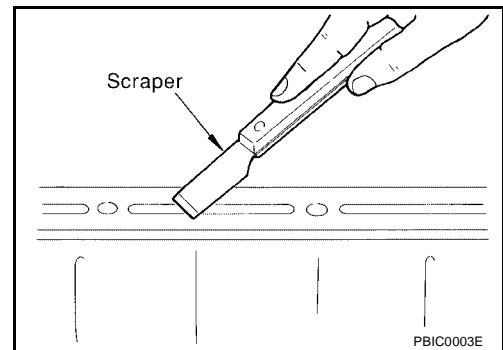
CAUTION:

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

- 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.
- Thoroughly clean the gasket application surface and the mating surface and remove adhering moisture, grease and foreign materials.



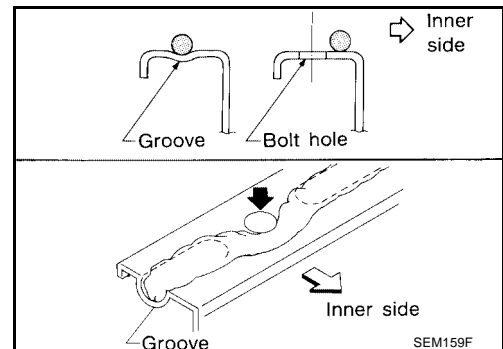
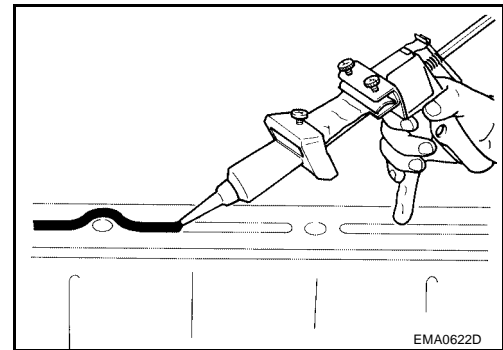
- Attach the sealant tube to the tube presser.
Use Genuine Silicone RTV Sealant or equivalent. Refer to [GI-43, "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS"](#).

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

Tube presser

WS 3993 0000 (-)

- 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-13, "RECOMMENDED FLUIDS AND LUBRICANTS"](#).



CAUTION:

Follow all specific instructions in this manual.

PREPARATION

[VQ35DE]

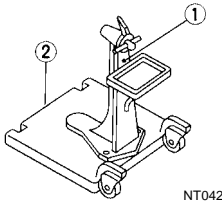
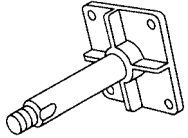
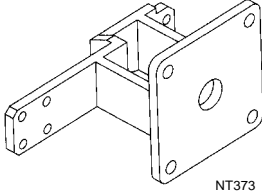
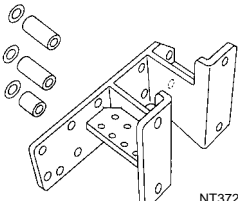
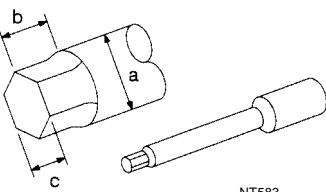
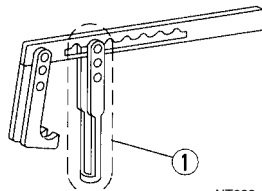
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EBS00DUW

PREPARATION

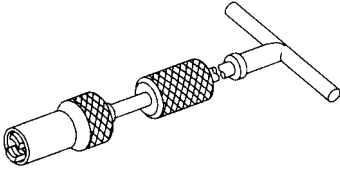
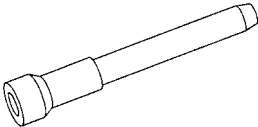
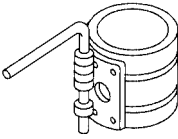
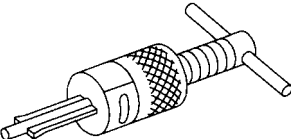
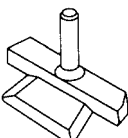
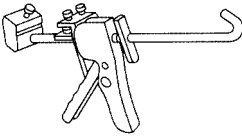
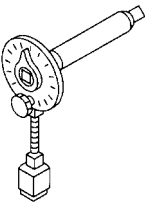
Special Service Tools

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

Tool number (Kent-Moore No.) Tool name	Description	EM
ST0501S000 (—) Engine stand assembly 1 ST05011000 (—) Engine stand 2 ST05012000 (—) Base	 Disassembling and assembling NT042	A C D E
KV10106500 (—) Engine stand shaft	 NT028	F G
KV10117000 (J41262) Engine sub-attachment	 NT373	H I
KV10117001 (—) Engine sub-attachment	 NT372	J K
ST10120000 (J24239-01) Cylinder head bolt wrench	 NT583	L M
KV10116200 (J26336-A) Valve spring compressor 1 KV10115900 (J26336-20) Attachment	 NT022	

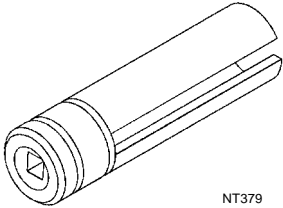
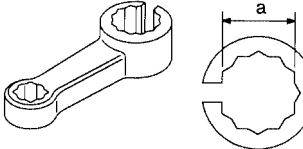
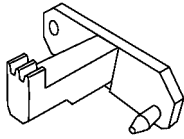
PREPARATION

[VQ35DE]

Tool number (Kent-Moore No.) Tool name	Description
KV10107902 (J38959) Valve oil seal puller  <p style="text-align: center;">S-NT011</p>	Removing valve oil seal
(J39386) Valve oil seal drift  <p style="text-align: center;">NT024</p>	Installing valve oil seal
EM03470000 (J8037) Piston ring compressor  <p style="text-align: center;">NT044</p>	Installing piston assembly into cylinder bore
ST16610001 (J23907) Pilot bushing puller  <p style="text-align: center;">NT045</p>	Removing crankshaft pilot bushing
KV10111100 (J37228) Seal cutter  <p style="text-align: center;">NT046</p>	Removing steel oil pan and rear timing chain case
WS39930000 (—) Tube presser  <p style="text-align: center;">NT052</p>	Pressing the tube of liquid gasket
KV10112100 (BT8653-A) Angle wrench  <p style="text-align: center;">NT014</p>	Tightening bolts for bearing cap, cylinder head, etc.

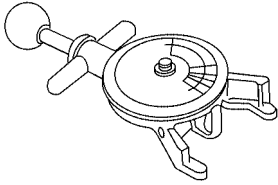
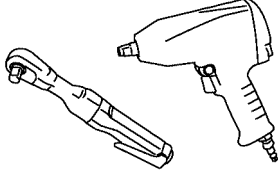
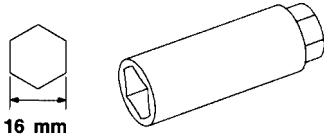
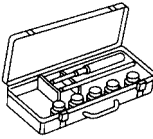
PREPARATION

[VQ35DE]

Tool number (Kent-Moore No.) Tool name	Description	
KV10117100 (J3647-A) Heated oxygen sensor wrench  NT379	Loosening or tightening heated oxygen sensor For 22 mm (0.87 in) hexagon nut	A EM C
KV10114400 (J38365) Heated oxygen sensor wrench  NT636	Loosening or tightening rear heated oxygen sensor a: 22 mm (0.87 in)	D E
KV10117700 (J44716) Ring gear stopper  NT822	Removing and installing crankshaft pulley	F G H

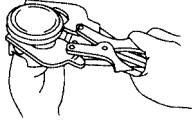
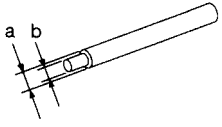
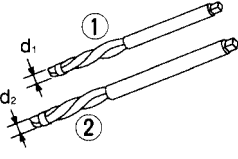
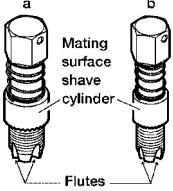
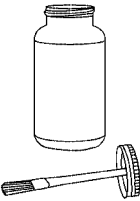
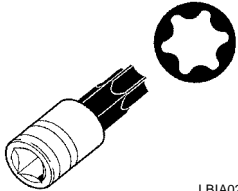
Commercial Service Tools

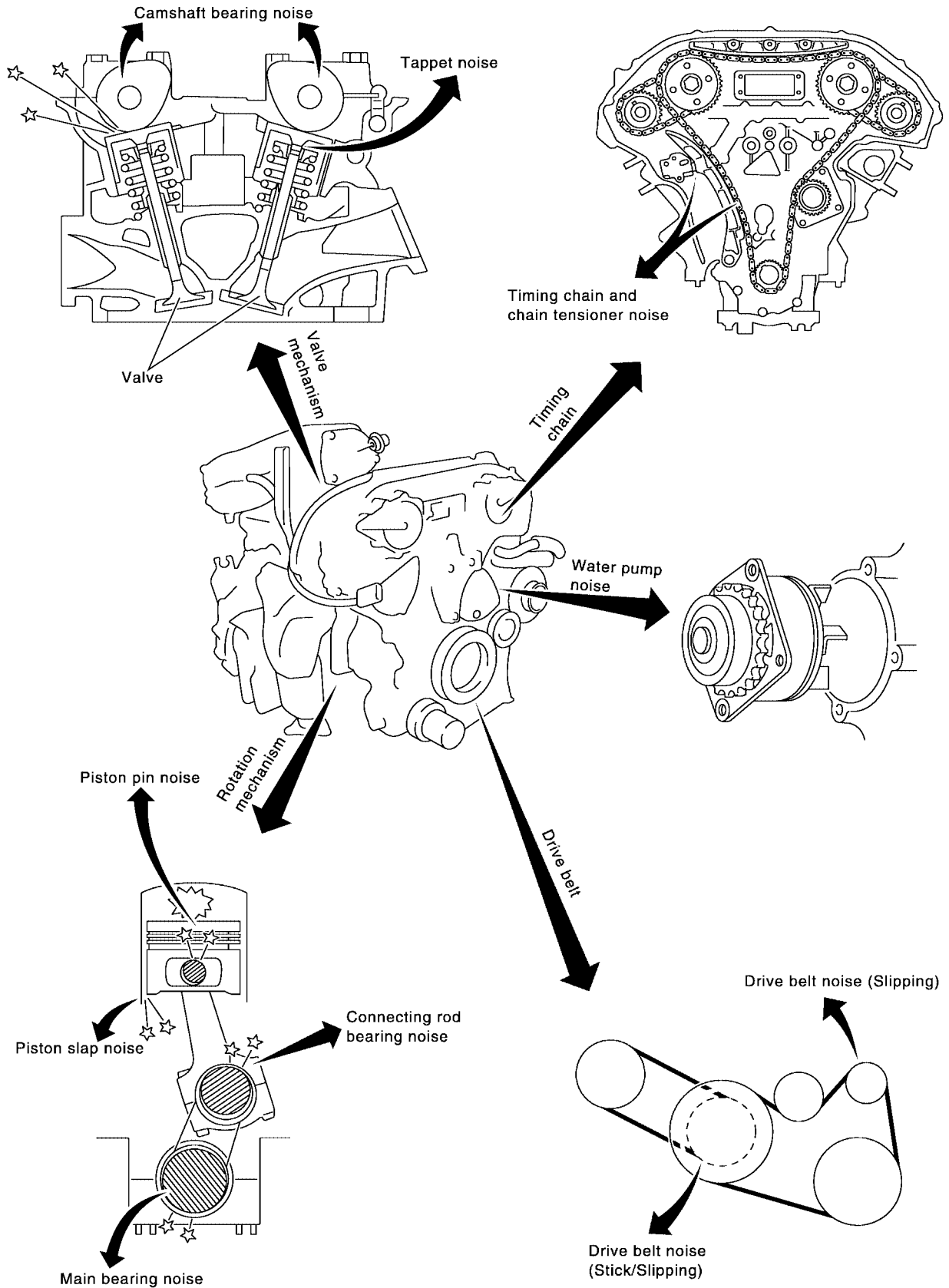
EBS00DUX

(Kent-Moore No.) Tool name	Description	
(BT3373-F) Belt tension gauge  AMA126	Checking drive belt tension	I J K
Power tool  PBIC0190E	Loosening bolts and nuts	L M
Spark plug wrench  NT047	Removing and installing spark plug	
Valve seat cutter set  NT048	Finishing valve seat dimensions	

PREPARATION

[VQ35DE]

(Kent-Moore No.) Tool name	Description
Piston ring expander  NT030	Removing and installing piston ring
Valve guide drift  NT015	Removing and installing valve guide Intake & Exhaust: a = 9.5 mm (0.374 in) dia. b = 5.5 mm (0.217 in) dia.
Valve guide reamer  NT016	Reaming valve guide 1 or hole for oversize valve guide 2 Intake & Exhaust: d1 = 6.0 mm (0.236 in) dia. d2 = 10.2 mm (0.402 in) dia.
(J-43897-18) (J-43897-12) Oxygen sensor thread cleaner  AEM488	Reconditioning the exhaust system threads before installing a new oxygen sensor (Use with anti-seize lubricant shown below.) a = J-43897-18 (18 mm dia.) for zirconia oxygen sensor b = J-43897-12 (12 mm dia.) for titania oxygen sensor
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
T55 Torx® Bit  LBIA0286E	Removing and installing A/T drive plate and M/T flywheel bolts



NOISE, VIBRATION, AND HARSHNESS (NVH) TROUBLESHOOTING

[VQ35DE]

EBS00DUZ

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

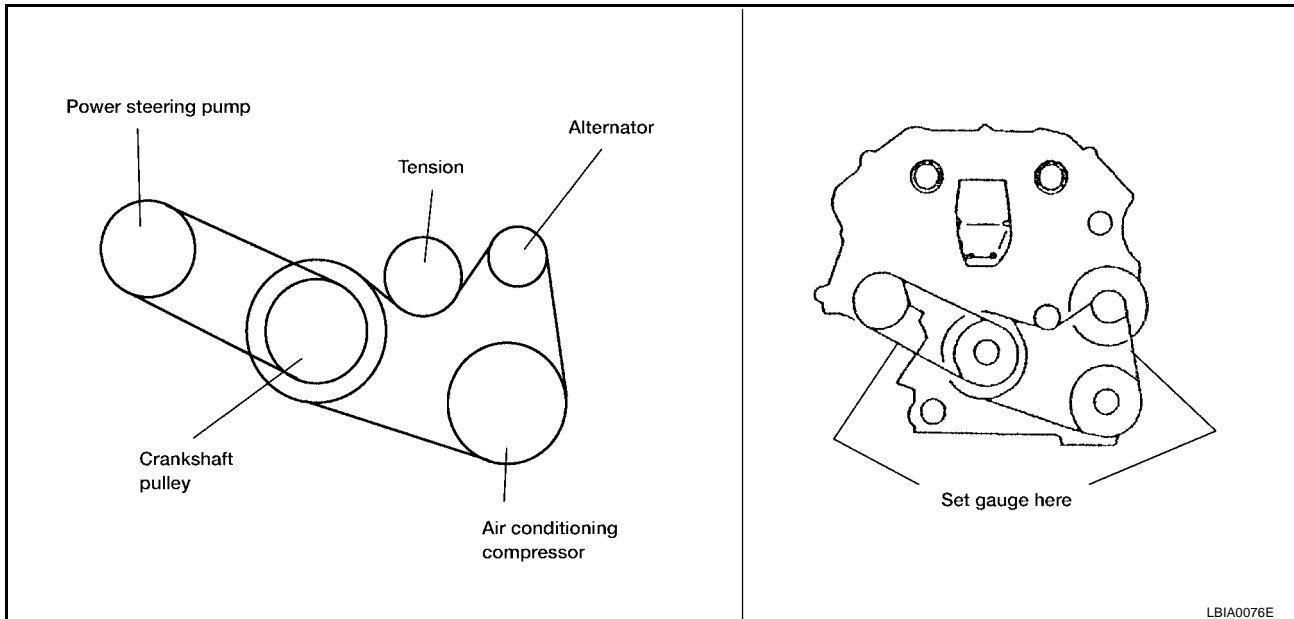
1. Locate the area where noise occurs.
2. Confirm the type of noise.
3. Specify the operating condition of engine.
4. Check specified noise source. Repair or replace the identified part as necessary.

Location of noise	Type of noise	Operating condition of engine						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	EM-154
	Rattle	C	A	—	A	B	C	Camshaft bearing noise	Camshaft journal clearance Camshaft runout	EM-145
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	EM-184
	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	EM-207
	Knock	A	B	C	B	B	B	Connecting rod bearing noise	Connecting rod bushing clearance (Small end) Connecting rod bearing clearance (Big end)	EM-207
	Knock	A	B	—	A	B	C	Main bearing noise	Main bearing oil clearance Crankshaft runout	EM-207
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	EM-158
Front of engine	Squeaking or fizzing	A	B	—	B	—	C	Drive belts (Sticking or slipping)	Drive belts deflection	EM-119
	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	CO-38

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

DRIVE BELTS

Checking Drive Belts



1. Inspect belt for cracks, fraying, wear or oil adhesion. If necessary, replace with a new one.
2. Inspect drive belt deflections by pushing on the belt midway between pulleys as shown.
3. Rotate the crankshaft pulley two times then check the belt tension using Belt Tension Gauge (BT3373-F or equivalent).

NOTE:

Inspect drive belt deflection or tension when engine is cold.

Adjust if belt deflections exceed the limit or if belt tension is not within specifications.

Belt Deflection and Tension

	Deflection adjustment		Unit: mm (in)	Tension adjustment*		Unit: N (kg, lb)
	Used belt		New belt	Used belt		New belt
	Limit	After adjustment		Limit	After adjustment	
Alternator and air conditioning compressor	7 (0.28)	4.2 - 4.6 (0.17 - 0.18)	3.7 - 4.1 (0.15 - 0.16)	294 (30, 66)	730 - 818 (74.5 - 83.5, 164 - 184)	838 - 926 (85.5 - 94.5, 188 - 208)
Power steering pump	11 (0.43)	7.3 - 8 (0.29 - 0.30)	6.5 - 7.2 (0.26 - 0.28)	196 (20, 44)	495 - 583 (50.5 - 59.5, 111 - 131)	603 - 691 (61.5 - 70.5, 135.6 - 155.4)
Applied pushing force	98 (10, 22)			—		

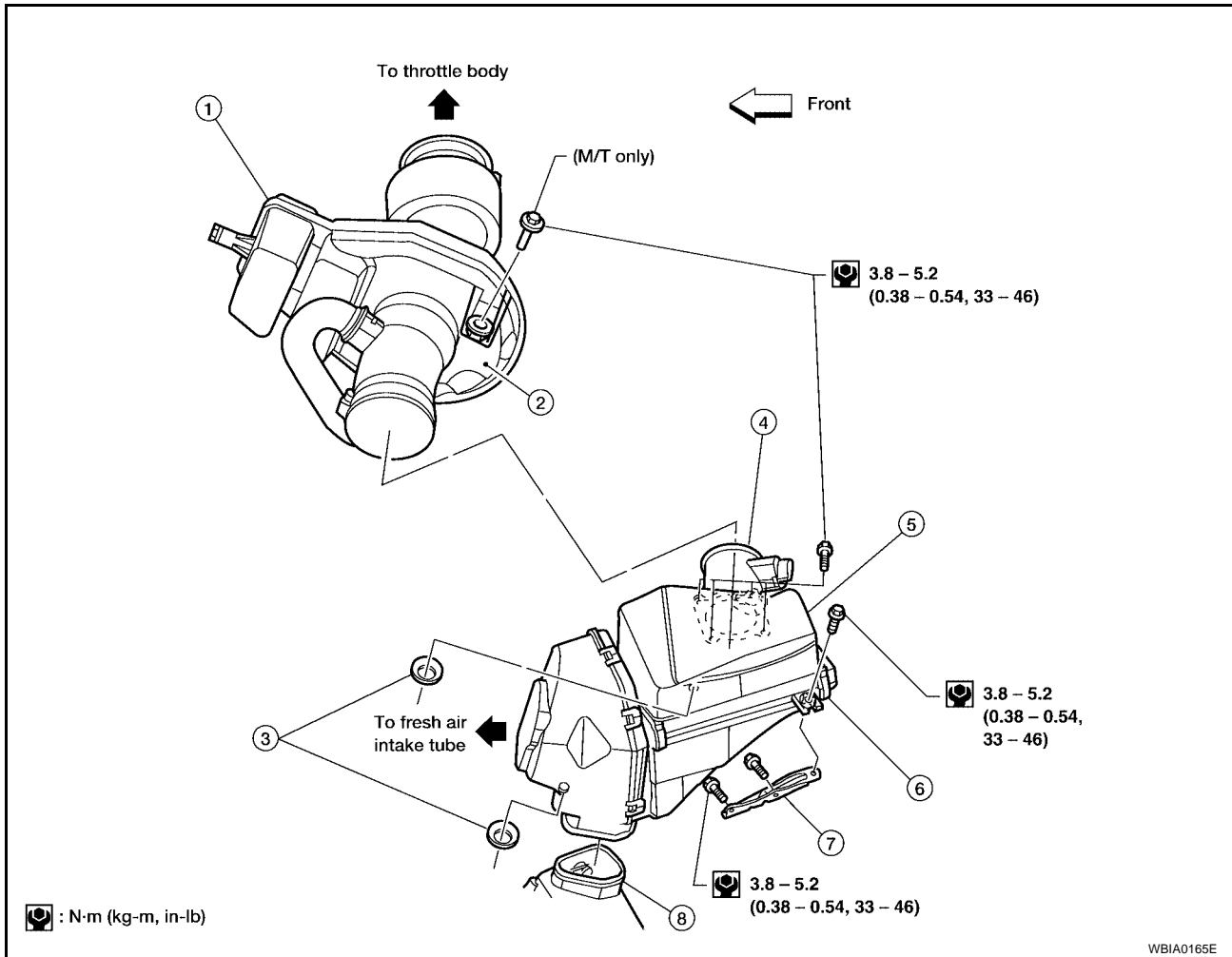
*: If belt tension gauge cannot be installed at check points shown, check drive belt tension at different location on the belt.

AIR CLEANER AND AIR DUCT

PFP:16500

Removal and Installation

EBS00DV1



- | | | |
|--------------------------------------|---|-----------------------------|
| 1. Resonator | 2. Air cleaner to electric throttle control actuator tube | 3. Grommet |
| 4. Mass air flow sensor | 5. Air cleaner case (upper) | 6. Air cleaner case (lower) |
| 7. Air cleaner case mounting bracket | 8. Resonator in fender | |

REMOVAL

1. Disconnect the harness connector from the mass air flow sensor.
2. Disconnect the tube clamp at the electric throttle control actuator and at the fresh air intake tube.
3. Remove air cleaner to electric throttle control actuator tube, air cleaner case (upper) with the mass air flow sensor attached.
4. Remove mass air flow sensor from air cleaner case (upper), as necessary.

CAUTION:

Handle mass air flow sensor with care.

- Do not shock it.
- Do not disassemble it.
- Do not touch its sensor.

5. Remove resonator in the fender, lifting left fender protector, as necessary.

INSTALLATION

Installation is in the reverse order of removal.

CHANGING AIR CLEANER ELEMENT

1. Unhook the air cleaner case side clips and lift up the air cleaner case (upper).

AIR CLEANER AND AIR DUCT

[VQ35DE]

-
2. Remove the air cleaner element.
 3. Install a new air cleaner element.
 4. Installation is in the reverse order of removal.

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| 10. Intake manifold | 11. Service port | 12. Gasket |
| 13. O-ring | 14. Fuel damper | |

REMOVAL

WARNING:

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

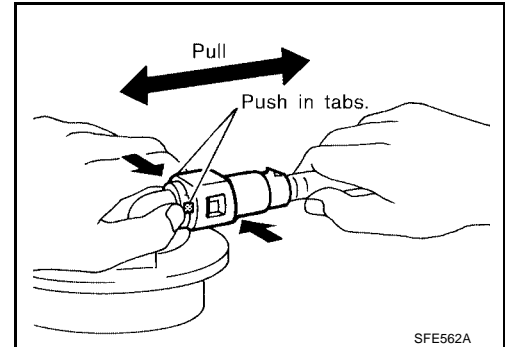
1. Remove the engine cover with power tool.
2. Release the fuel pressure. Refer to [EC-50, "FUEL PRESSURE RELEASE"](#).
3. Remove air cleaner case lid and mass air flow sensor, and air intake tube as an assembly. Refer to [EM-120, "Removal and Installation"](#).
4. Partially drain the coolant when the engine is cool. Refer to [EC-1065, "Description"](#).
5. Disconnect fuel tube quick connector at vehicle piping side.
6. To remove the quick connector cap, hold the sides of the connector, push in the tabs and pull out the tube.

NOTE:

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 liquids such as battery electrolyte, etc. from getting on the resin tube.
- Do not bend or twist the tube during removal or installation.
- Do not remove the remaining retainer on the tube
- When the tube is replaced, also replace the retainer with a new one.
- To keep the connecting portion clean and to avoid damage and foreign materials entering, cover the ends of the fuel tubes with plastic bags or something similar.

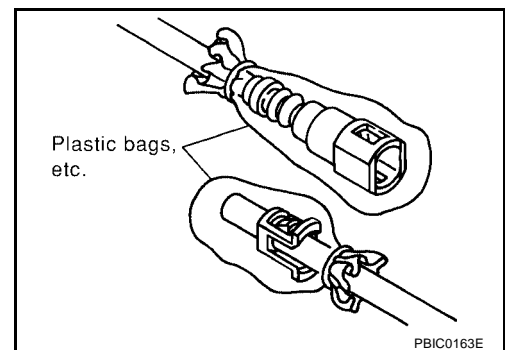


7. Disconnect the power brake booster vacuum hose, the coolant hoses from the electric throttle control actuator, the swirl control vacuum lines, the fuel injectors electrical connectors, and the PCV hose.

CAUTION:

- Cover any engine openings to avoid the entry of any foreign material.

8. Disconnect the electric throttle control actuator electrical connectors.



9. Remove the cowl top grille and the windshield wiper assembly. Refer to [EI-18, "Removal and Installation"](#).
10. Disconnect the power steering hose bracket.
11. Remove the vacuum tank from the back of the intake manifold collector.
12. Remove the intake manifold collector pipe and electric throttle control actuator by loosening the four bolts in a diagonal pattern.

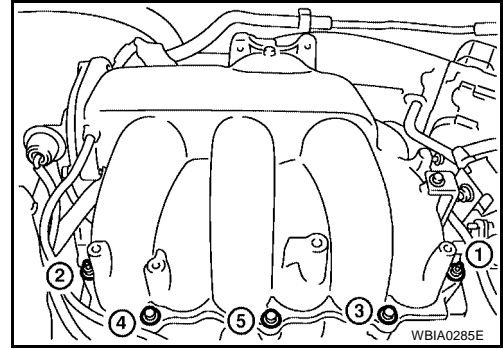
CAUTION:

Handle carefully to avoid any shock to the electric throttle control actuator.

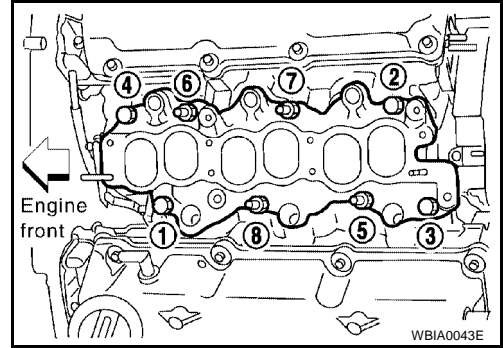
INTAKE MANIFOLD

[VQ35DE]

13. Loosen the bolts in the order shown, and remove the intake manifold collector with power tool.
14. Remove the fuel rail with the fuel injectors attached, from the intake manifold. Remove the fuel injector O-rings and use new O-rings for installation.



15. Loosen the bolts in the order shown, and remove the intake manifold with power tool.

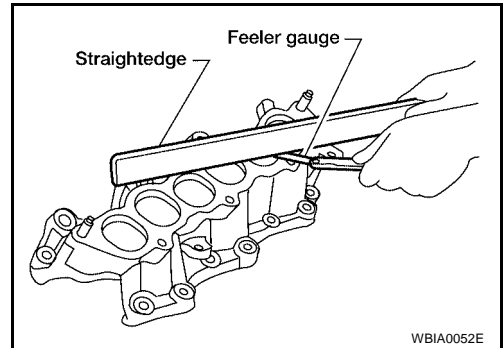


INSPECTION AFTER REMOVAL

Surface Distortion

- Using straightedge and feeler gauge, inspect the surface distortion of both the intake manifold and the intake manifold collector.

Standard : 0.1 mm (0.004 in)



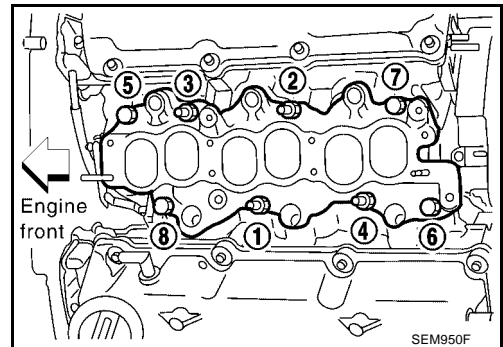
INSTALLATION

Installation is in the reverse order of removal. Follow the procedures below for specific tightening sequences and procedures.

- Install intake manifold bolts in two stages in the numerical order as shown.

Stage 1 : 5- 10 N·m (0.5 - 1.0 kg·m, 44 - 86 in-lb)

Stage 2 : 26 - 31 N·m (2.7 - 3.2 kg·m, 20 - 23 ft-lb)



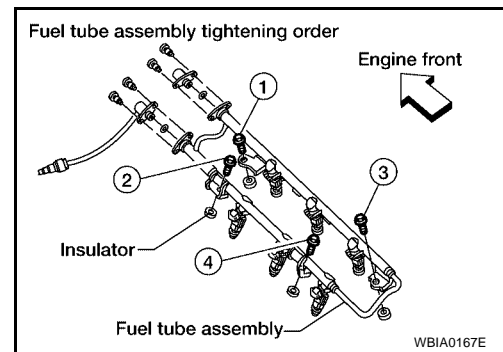
INTAKE MANIFOLD

[VQ35DE]

- Seat the fuel injectors into the intake manifold with new O-rings. Tighten the fuel rail bolts as shown, in two stages:

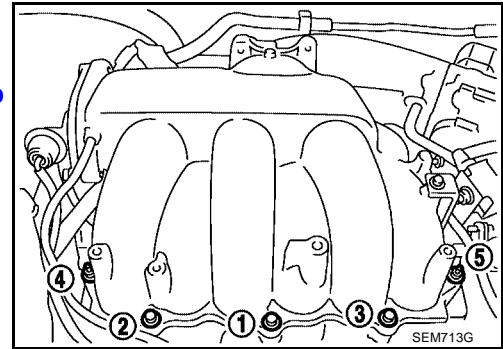
Stage 1 : 9.3 - 10.8 N·m (0.95 - 1.1 kg·m, 83 - 95 in·lb)

Stage 2 : 20.6 - 26.5 N·m (2.1 - 2.7 kg·m, 16 - 19 ft·lb)



- Install the intake manifold collector bolts in the numerical order as shown.

Intake manifold collector bolts : 18 - 21 N·m (1.8 - 2.2 kg·m, 13 - 15 ft·lb)



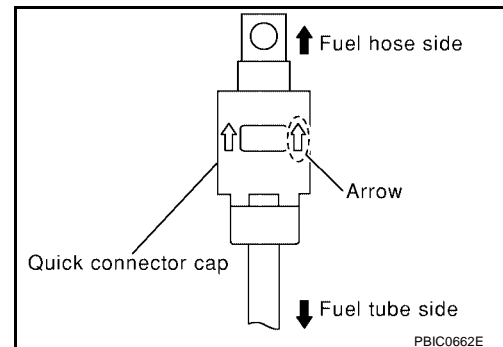
- Tighten the mounting bolts of the intake manifold collector pipe and electric throttle control actuator assembly equally and diagonally to specification.

Intake manifold collector pipe bolts : 18 - 21 N·m (1.8 - 2.2 kg·m, 13 - 15 ft·lb)

NOTE:

After installation, it is necessary to re-calibrate the electric throttle control actuator as follows:

1. Perform the "Throttle Valve Closed Position Learning" when harness connector of the electric throttle control actuator is disconnected. Refer to [EC-644, "Throttle Valve Closed Position Learning"](#).
 2. Perform the "Idle Air Volume Learning" when the electric throttle control actuator is replaced. Refer to [EC-644, "Idle Air Volume Learning"](#).
- Install the quick connector as follows:
 - Make sure no foreign substances are deposited in and around the fuel tube and quick connector and that there is no damage.
 - Align the center to insert the quick connector straight onto the fuel tube.
 - Insert the fuel tube until a click is heard.
 - Install the quick connector cap on the quick connector joint. Align the arrow mark on the quick connector cap to the upper side.
 - Install the fuel hose into the hose clamp.



INSPECTION AFTER INSTALLATION

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

1. Apply fuel pressure to fuel lines by turning ignition switch ON (with engine stopped). Then check for fuel leaks at connections.
2. Start the engine and rev it up and check for fuel leaks at connections.

NOTE:

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

CAUTION:

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

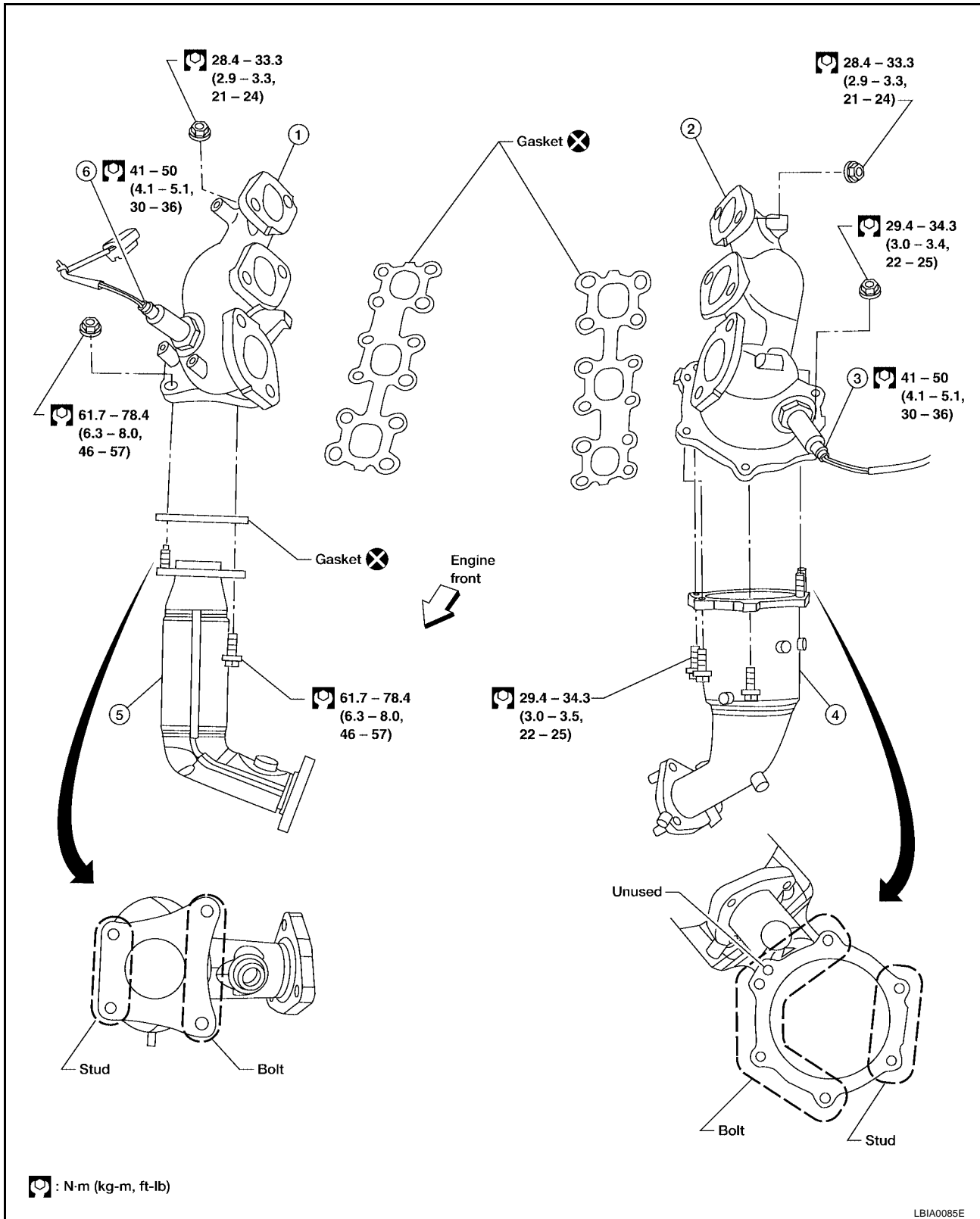
- Perform procedures for “Throttle Valve Closed Position Learning” after finishing repairs. Refer to [EC-644, "Throttle Valve Closed Position Learning"](#) .
- If electric throttle control actuator is replaced, perform procedures for “Idle Air Volume Learning” after finishing repairs. Refer to [EC-644, "Idle Air Volume Learning"](#) .

EXHAUST MANIFOLD AND THREE WAY CATALYST

PF14004

Removal and Installation

EBS00DV3



- | | | |
|---|---|--|
| 1. Exhaust manifold (bank 1) | 2. Exhaust manifold (bank 2) | 3. Heated oxygen sensor 1 (front) (bank 2) |
| 4. Three way catalyst (manifold) (bank 2) | 5. Three way catalyst (manifold) (bank 1) | 6. Heated oxygen sensor 1 (front) (bank 1) |

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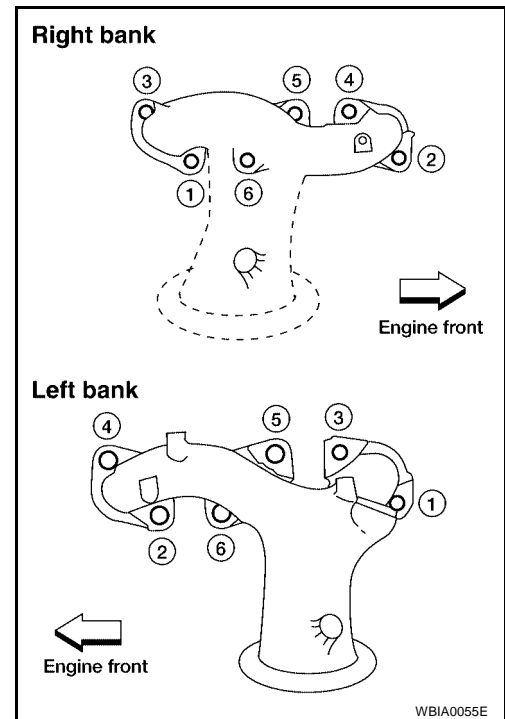
REMOVAL

WARNING:

- Perform the work when the exhaust and cooling system have completely cooled down.
 - When removing the front and rear engine mounting through bolts and nuts, lift the engine up slightly for safety. For engine slingers, refer to step 17 in [EM-204, "REMOVAL"](#).
1. Remove the front wheel and tires with power tool.
 2. Remove the engine undercovers with power tool.
 3. Remove the inner wheel well splash shields with power tool.
 4. Remove the radiator and cooling fan assembly. Refer to [EC-1040, "Component Description"](#).
 5. Remove the front exhaust tube. Refer to [EX-7, "Removal and Installation"](#).
 6. Remove the front suspension member. Refer to [FSU-14, "Removal and Installation"](#).
 7. Remove heated oxygen sensor 1 (front) (bank 1) and heated oxygen sensor 2 (front) (bank 2).
 - a. Remove harness connector of each heated oxygen sensor, and disconnect the harness from the bracket and middle clamp.
 - b. Remove both heated oxygen sensors with the Tool.

CAUTION:

- Be careful not to damage heated oxygen sensor.
 - Discard any heated oxygen 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 sensor.
8. Remove exhaust manifolds and the three way catalyst heat shields with power tool.
 9. Remove the three way catalyst (manifold) (bank 1) and three way catalyst (manifold) (bank 2) by loosening the bolts first and then removing the nuts and through bolts.
 10. Remove the exhaust manifolds. Loosen the nuts in the numerical order as shown.



INSPECTION AFTER REMOVAL

Surface Distortion

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

Distortion limit : 0.3 mm (0.012 in)

EXHAUST MANIFOLD AND THREE WAY CATALYST

[VQ35DE]

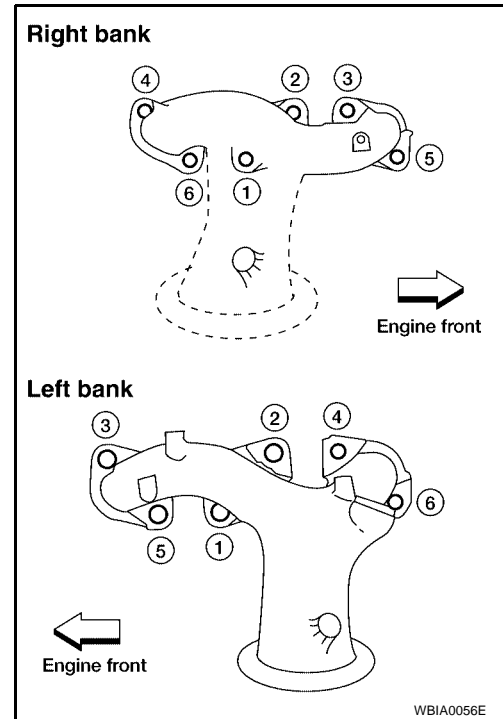
INSTALLATION

Installation is in the reverse order of removal.

- Install the exhaust manifold nuts in the numerical order as shown.

CAUTION:

- When using the heated oxygen sensor wrench, tighten to the middle of specified torque range, because the length of the Tool may increase the actual tightness. Do not tighten to the maximum specified torque range.
- Before installing a heated oxygen sensor, clean the exhaust manifold threads using the oxygen sensor thread cleaner tool, and apply anti-seize lubricant.
- Do not over-torque the heated oxygen sensors. Doing so may cause damage to the heated oxygen sensors.



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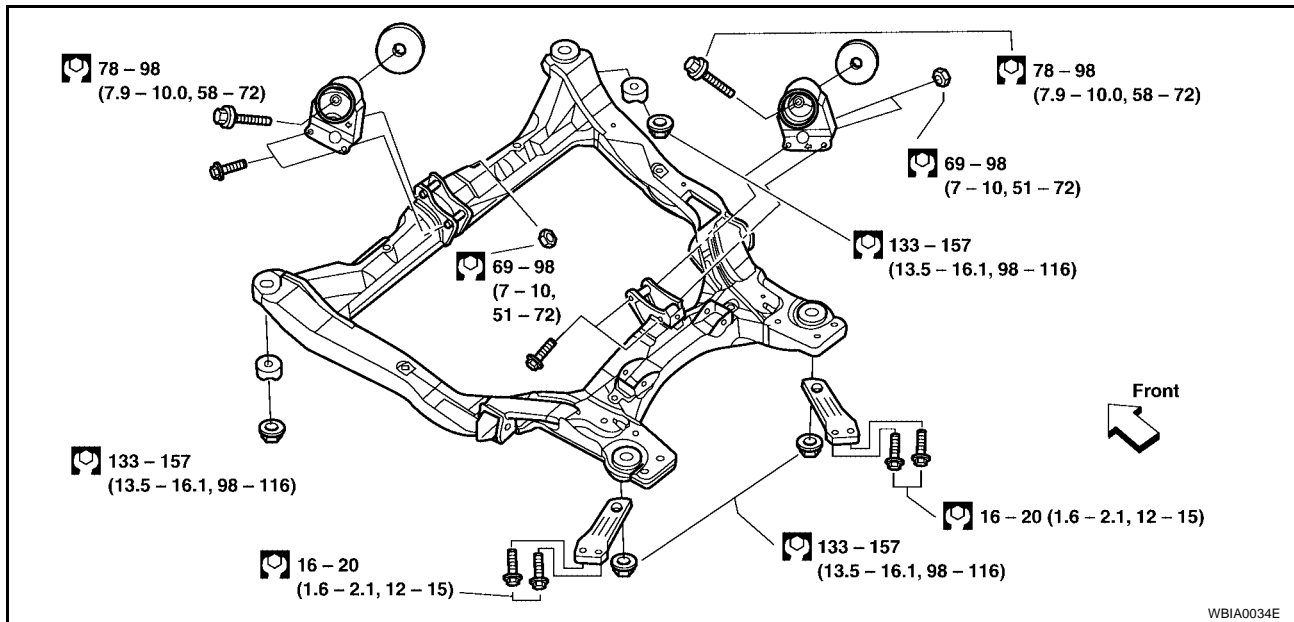
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13. Remove the front suspension member, as follows:



CAUTION:

Before disconnecting, support the front suspension member with a suitable power lift. Use the lift to lower the front suspension member to remove it.

- Disconnect the lower ball joints
Refer to [FSU-5, "FRONT SUSPENSION ASSEMBLY"](#).
- Disconnect the power steering line bracket.
- Disconnect the steering gear mounting bolts.
Refer to [PS-13, "Removal and Installation"](#).
- Disconnect the upper sway bar links.
Refer to [FSU-5, "FRONT SUSPENSION ASSEMBLY"](#).
- Remove the LH and RH drive axles.
Refer to [FAX-11, "Removal and Installation"](#).
- Disconnect the front engine mounts electrical connectors, if equipped. Remove the front and rear engine mounts through bolts and nuts using power tool.

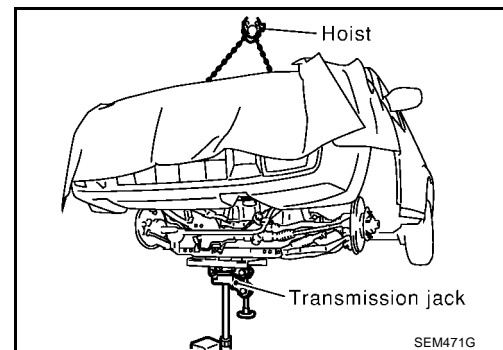
WARNING:

For additional safety, support the engine from above with a suitable hoist.

CAUTION:

For vehicles equipped with an automatic transaxle, the front and rear engine mounts are electrically controlled. Disconnect the engine mount electrical connector before removing the through bolt.

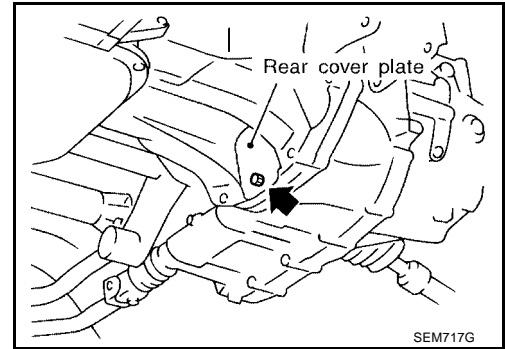
- Remove the front suspension member mounting nuts and lower the member out of the engine compartment.
14. Disconnect the heated oxygen sensors and remove the two catalytic converters from the exhaust manifolds using power tool.



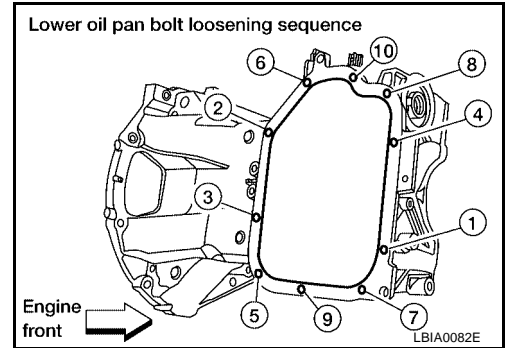
OIL PAN

[VQ35DE]

15. Remove the rear plate cover from the upper oil pan.



16. Remove the bottom oil pan. Loosen the bolts in the numerical sequence as shown with power tool.



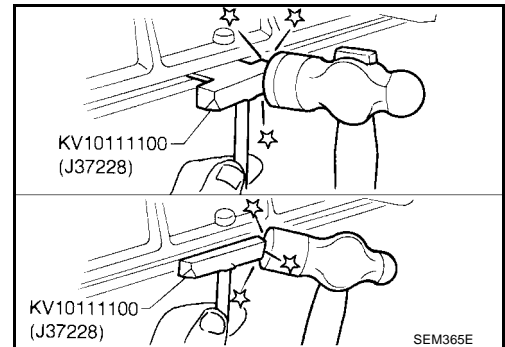
a. Insert Tool between the lower oil pan and the upper oil pan.

Seal cutter

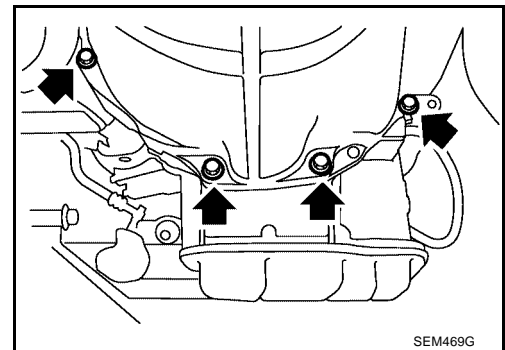
KV10111100 (J37228)

- Be careful not to damage the mating surface.
- Do not insert a screwdriver, this will damage the mating surfaces.

b. Slide the Tool by tapping its side with a hammer to remove the lower oil pan from the upper oil pan.



17. Remove the four engine-to-transaxle bolts.

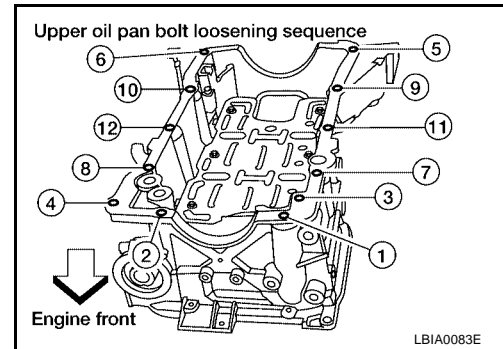


OIL PAN

[VQ35DE]

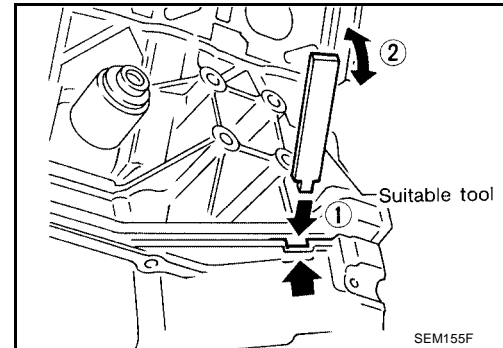
18. Remove the upper oil pan.

a. Loosen the bolts in the numerical order as shown, using power tool.

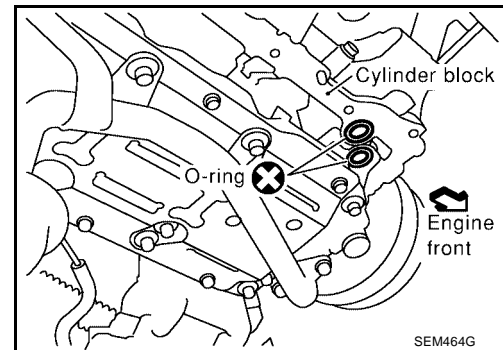


b. Insert an appropriate size tool into the notch (1) of the upper oil pan as shown.

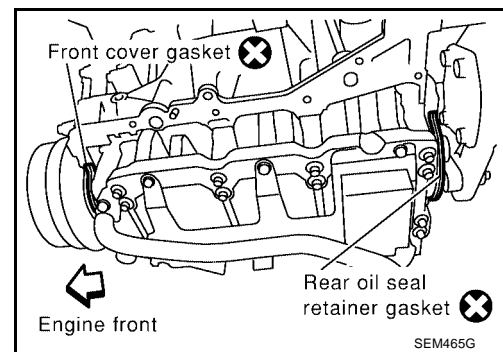
c. Pry off the upper oil pan by moving the tool up and down (2) as shown.



19. Remove the O-ring seals from the bottom of the cylinder block and oil pump housing, use new O-rings for installation.



20. Remove front cover gasket and rear oil seal retainer gasket.



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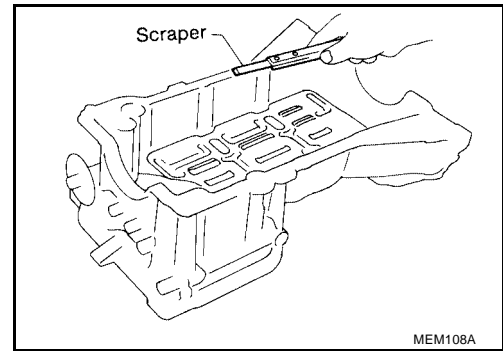
OIL PAN

[VQ35DE]

21. If re-installing the original oil pan, remove the old sealant from the mating surfaces using a scraper.
- Also remove the old sealant from mating surface of the cylinder block.
 - Remove the old sealant from the bolt holes and threads.

CAUTION:

Do not scratch or damage the mating surfaces when cleaning off the old sealant.

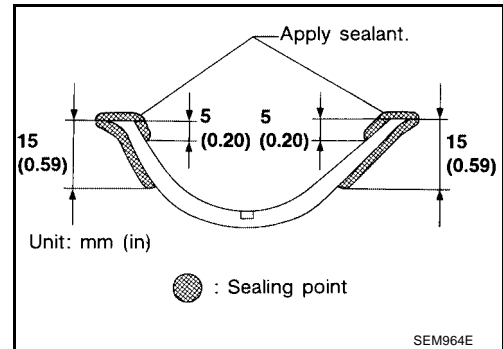


INSTALLATION

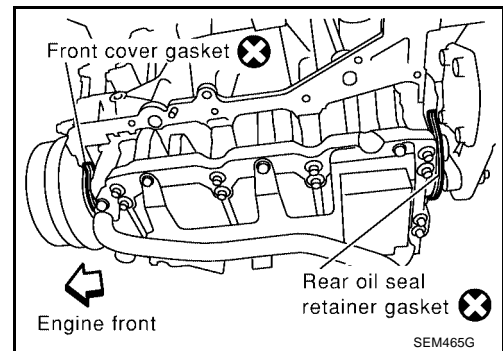
CAUTION:

Wait at least 30 minutes before refilling the engine with oil.

1. Apply Genuine Silicone RTV Sealant or equivalent, to the front cover gasket and the rear oil seal retainer gasket as shown. Refer to [GI-43, "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS"](#).

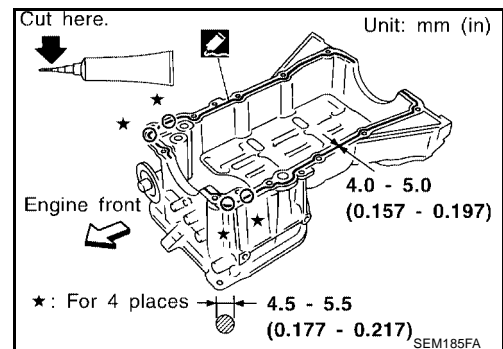


2. Install the front cover gasket and rear oil seal retainer gasket as shown.

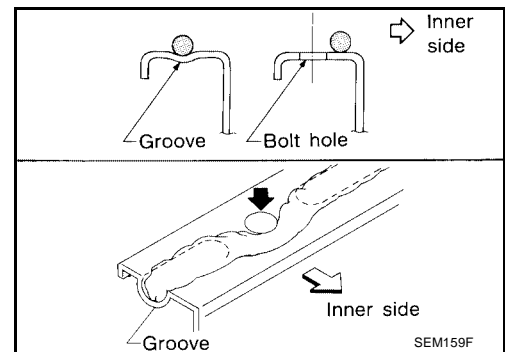


3. Apply a bead of sealant to the cylinder block mating surface of the upper oil pan to a limited portion as shown.

- Use Genuine Silicone RTV Sealant, or equivalent. Refer to [GI-43, "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS"](#).
- Be sure the sealant is applied to a limited portion as shown, and the sealant is 4.0 - 5.0 mm (0.157 - 0.197 in) or 4.5 - 5.5 mm (0.177 - 0.217 in) wide.
- Attaching should be done within 5 minutes after coating.

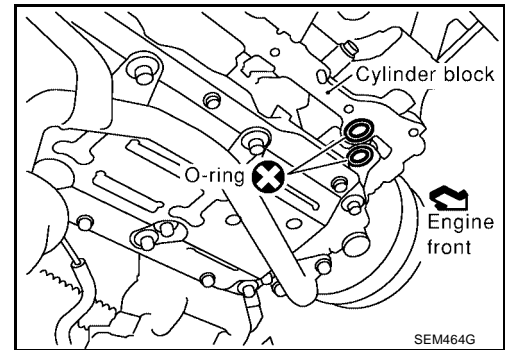


4. Install new O-rings on the cylinder block and oil pump body.

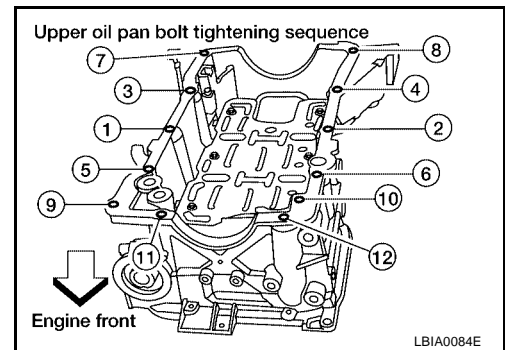


5. Install the upper oil pan.

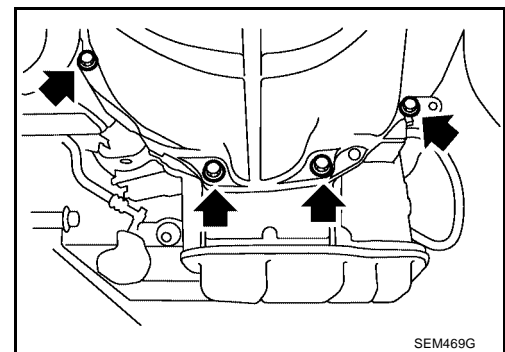
- Tighten bolts in numerical order.
- **Wait at least 30 minutes before refilling the engine with oil.**



5. Install the upper oil pan.
- Tighten bolts in numerical order.
 - **Wait at least 30 minutes before refilling the engine with oil.**

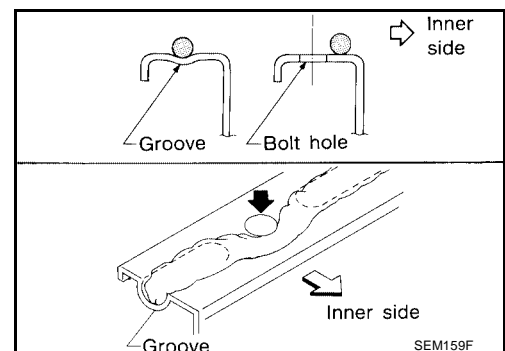


6. Install the four engine-to-transmission bolts. Refer to [EM-203, "Removal and Installation"](#).



7. Apply a continuous bead of sealant to the lower oil pan.

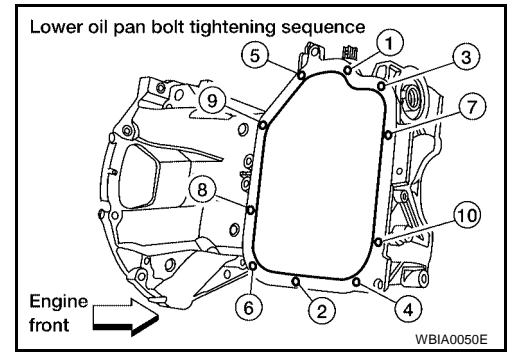
- **Use Genuine Silicone RTV Sealant, or equivalent. Refer to [GI-43, "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS"](#).**
- **Be sure the sealant is 4.5 - 5.5 mm (0.177 - 0.217 in) wide.**
- **Attaching should be done within 5 minutes after coating.**



OIL PAN

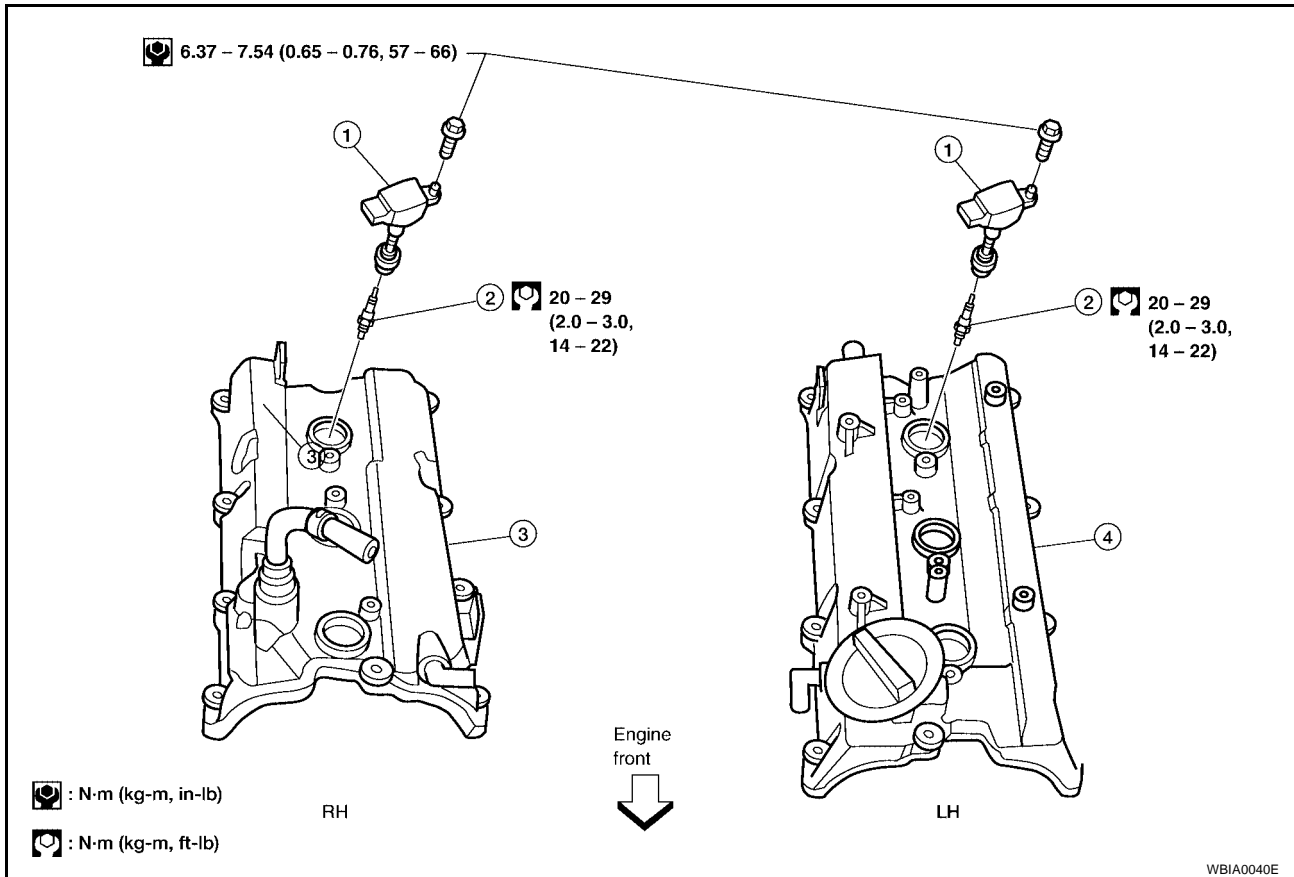
[VQ35DE]

8. Install the lower oil pan. Tighten the bolts in the numerical order as shown.
 - **Wait at least 30 minutes before refilling the engine with oil.**
9. Install the remaining components in the reverse order of removal.



IGNITION COIL

Removal and Installation



1. Ignition coil
2. Spark plug
3. Rocker cover (right bank)
4. Rocker cover (left bank)

REMOVAL

1. Remove the engine cover with power tool.
2. Drain engine coolant. Refer to [MA-24, "DRAINING ENGINE COOLANT"](#).
3. Disconnect the mass air flow sensor electrical connector and remove the air cleaner assembly and air intake tubes. Refer to [EM-120, "Removal and Installation"](#).
4. Remove the windshield wiper arms and motor assembly and the front cowl panel. Refer to [EI-18, "Removal and Installation"](#).
5. Remove the intake manifold collector, gasket, and throttle body. Refer to [EM-122, "Removal and Installation"](#).
6. Remove the six ignition coils.

CAUTION:
Do not shock it.

INSTALLATION

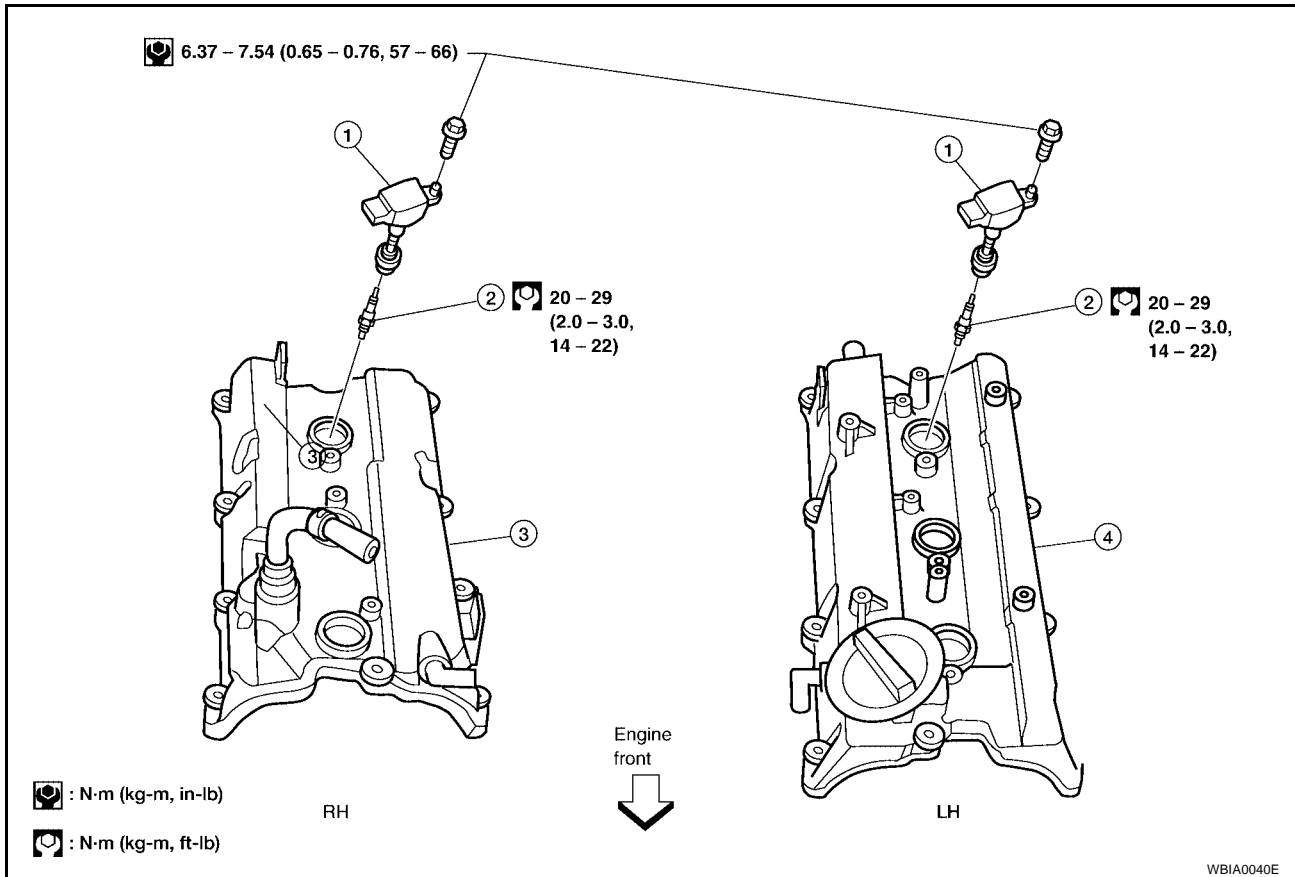
Installation is in the reverse order of removal.

SPARK PLUG (PLATINUM-TIPPED TYPE)

PF22401

Removal and Installation

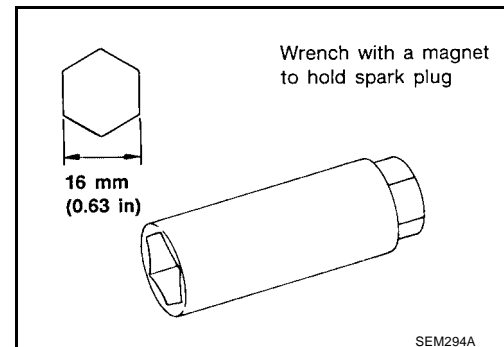
EBS00DV6



1. Ignition coil
2. Spark plug
3. Rocker cover (right bank)
4. Rocker cover (left bank)

REMOVAL

1. Remove the engine cover, with power tool.
2. Drain engine coolant. Refer to [MA-24, "DRAINING ENGINE COOLANT"](#).
3. Disconnect the mass air flow sensor electrical connector and remove the air cleaner assembly and air intake tubes. Refer to [EM-120, "Removal and Installation"](#).
4. Remove the windshield wiper arms and motor assembly and the front cowl panel. Refer to [EI-18, "Removal and Installation"](#).
5. Remove the intake manifold collector, gasket, and throttle body. Refer to [EM-122, "Removal and Installation"](#).
6. Remove the six ignition coils.
7. Remove the six spark plugs with a suitable tool.
 - If replacing the spark plugs use the correct spark plug for maximum performance. Refer to [MA-28, "Changing Spark Plugs \(Platinum - Tipped Type\)"](#).



INSPECTION AFTER REMOVAL

CAUTION:

Use standard type spark plug for normal driving conditions.

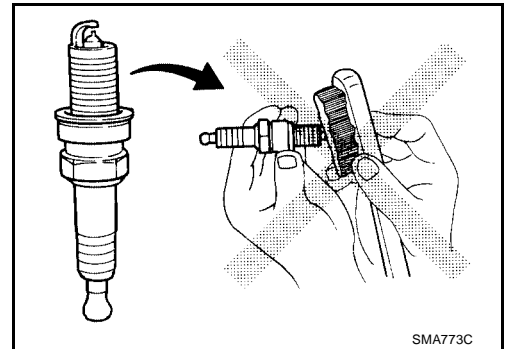
The hot type spark plug is suitable when fouling occurs with the standard type spark plug under conditions such as:

- Frequent engine starts
- Low ambient temperatures

The cold type spark plug is suitable when engine spark knock occurs with the standard type spark plug under conditions such as:

- Extended highway driving
- Frequent high engine revolution

Do not use a wire brush for cleaning.



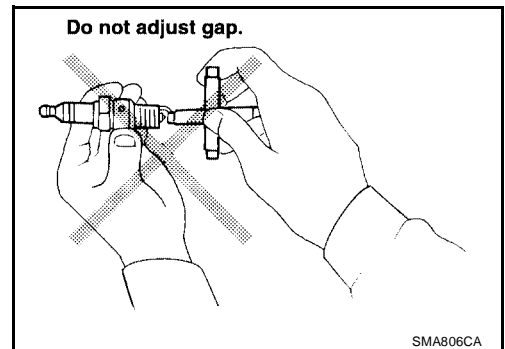
If plug tip is covered with carbon, a spark plug cleaner may be used.

Cleaner air pressure : less than 588 kPa (6 kg/cm² , 85 psi)

Cleaning time : less than 20 seconds

Checking and adjusting plug gap is not required between change intervals.

Gap (nominal) : 1.1 mm (0.043 in)



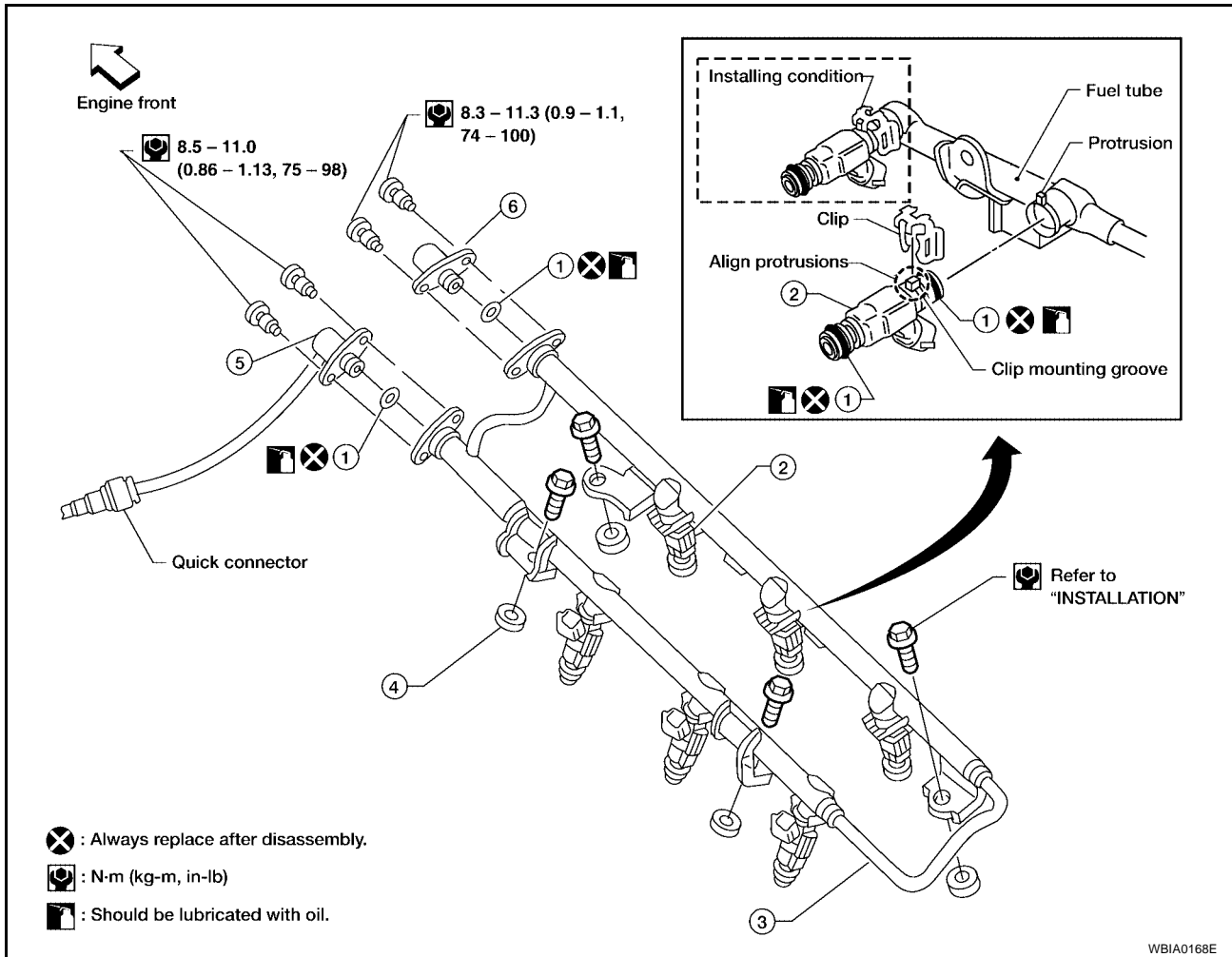
INSTALLATION

Installation is in the reverse order of removal.

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

FUEL INJECTOR AND FUEL TUBE

Removal and Installation



- | | | |
|--------------|------------------|-----------------------|
| 1. O-ring | 2. Fuel injector | 3. Fuel tube assembly |
| 4. Insulator | 5. Fuel damper | 6. Fuel damper |

CAUTION:

- Apply new engine oil when installing the parts as specified to do so.
- Do not remove or disassemble parts unless instructed as shown.

REMOVAL

1. Remove the engine cover using power tool.
2. Release the fuel pressure.
Refer to [EC-646, "FUEL PRESSURE RELEASE"](#).
3. Remove air cleaner case lid and mass air flow sensor, and air intake tube as an assembly.
Refer to [EM-120, "Removal and Installation"](#).
4. Partially drain the coolant when the engine is cool. Refer to [EC-1065, "Description"](#).

WARNING:

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

5. Disconnect fuel tube quick connector at vehicle piping side.
Refer to step 5 of [EM-123, "REMOVAL"](#).
6. Disconnect the power brake booster vacuum hose, the coolant hoses from the electric throttle control actuator, the swirl control vacuum lines, the fuel injectors electrical connectors, and the PCV hose.

CAUTION:

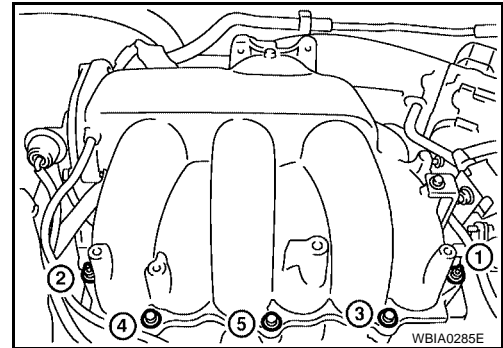
- Cover any engine openings to avoid the entry of any foreign material.
7. Disconnect the electric throttle control actuator electrical connector and coolant hoses.

8. Remove the cowl top grille and the windshield wiper assembly. Refer to [EI-18, "Removal and Installation"](#).
9. Disconnect the power steering hose bracket.
10. Remove the vacuum tank from the back of the intake manifold collector.
11. Remove the intake manifold collector pipe and electric throttle control actuator, by loosening the four bolts in a diagonal pattern.

CAUTION:

Handle carefully to avoid any shock to the electric throttle control actuator.

12. Loosen the bolts in the order shown, and remove the intake manifold collector using power tool.
13. Remove the fuel rail with the fuel injectors attached, from the intake manifold. Remove the fuel injector O-rings and use new O-rings for installation.

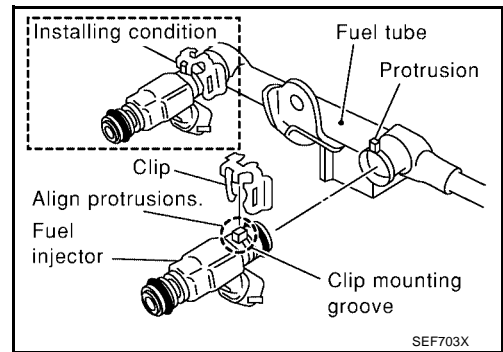


INSTALLATION

1. Install the fuel rails with fuel injectors attached.

NOTE:

- Carefully install new O-rings, including the one used with the fuel damper.
- Lubricate O-rings by lightly coating with new engine oil.
- Be careful not to damage the O-rings and surfaces for O-ring sealing surfaces. Do not expand or twist O-rings.
- Discard old clips; replace with new ones.
- Make sure that protrusions of fuel injectors are aligned with cutouts of clips after installation.
- Position clips in grooves on the fuel injectors.
- Align the protrusions of the fuel tube assembly with those of the fuel injectors.
- After properly inserting the fuel injectors onto the fuel tube assembly, check that the fuel tube protrusions are engaged with those of fuel injectors, and the flanges of the fuel tube assembly are fully engaged with the clips.



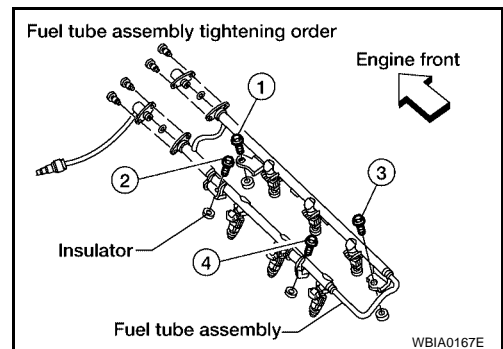
2. Tighten fuel tube assembly mounting bolts as shown, in two steps:

1st step : 9.3 - 10.8 N·m (0.95 - 1.1 kg-m,
6.2 - 7.9 ft-lb)

2nd step : 20.6 - 26.5 N·m (2.1 - 2.7 kg-m,
16 - 19 ft-lb)

CAUTION:

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

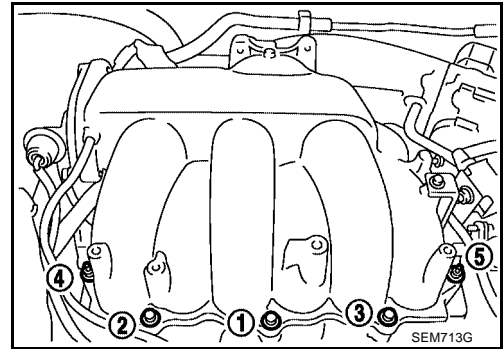


FUEL INJECTOR AND FUEL TUBE

[VQ35DE]

3. Install the intake manifold collector bolts in the numerical order as shown.

Intake manifold collector bolts : 18 - 21 N·m (1.8 - 2.2 kg-m, 13 - 15 ft-lb)



4. Tighten the mounting bolts of the intake manifold collector pipe and electric throttle control actuator assembly diagonally to specification.

Intake manifold collector pipe bolts : 18 - 21 N·m (1.8 - 2.2 kg-m, 13 - 15 ft-lb)

5. After installation, it is necessary to re-calibrate the electric throttle control actuator.
- Perform "Throttle Control Closed Position Learning" when the harness connector of the electric throttle control actuator is disconnected. Refer to [EC-644, "Throttle Valve Closed Position Learning"](#).
 - Perform "Idle Air Volume Learning" when the electric throttle control actuator is replaced. Refer to [EC-644, "Idle Air Volume Learning"](#).
6. Attach the quick connector. Refer to [EM-124, "INSTALLATION"](#).
7. Installation of remaining components is in the reverse of removal.

INSPECTION AFTER INSTALLATION

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

1. Apply fuel pressure to fuel lines by turning ignition switch ON (with engine stopped). Then check for fuel leaks at connections.
2. Start the engine and rev it up and check for fuel leaks at connections.

NOTE:

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

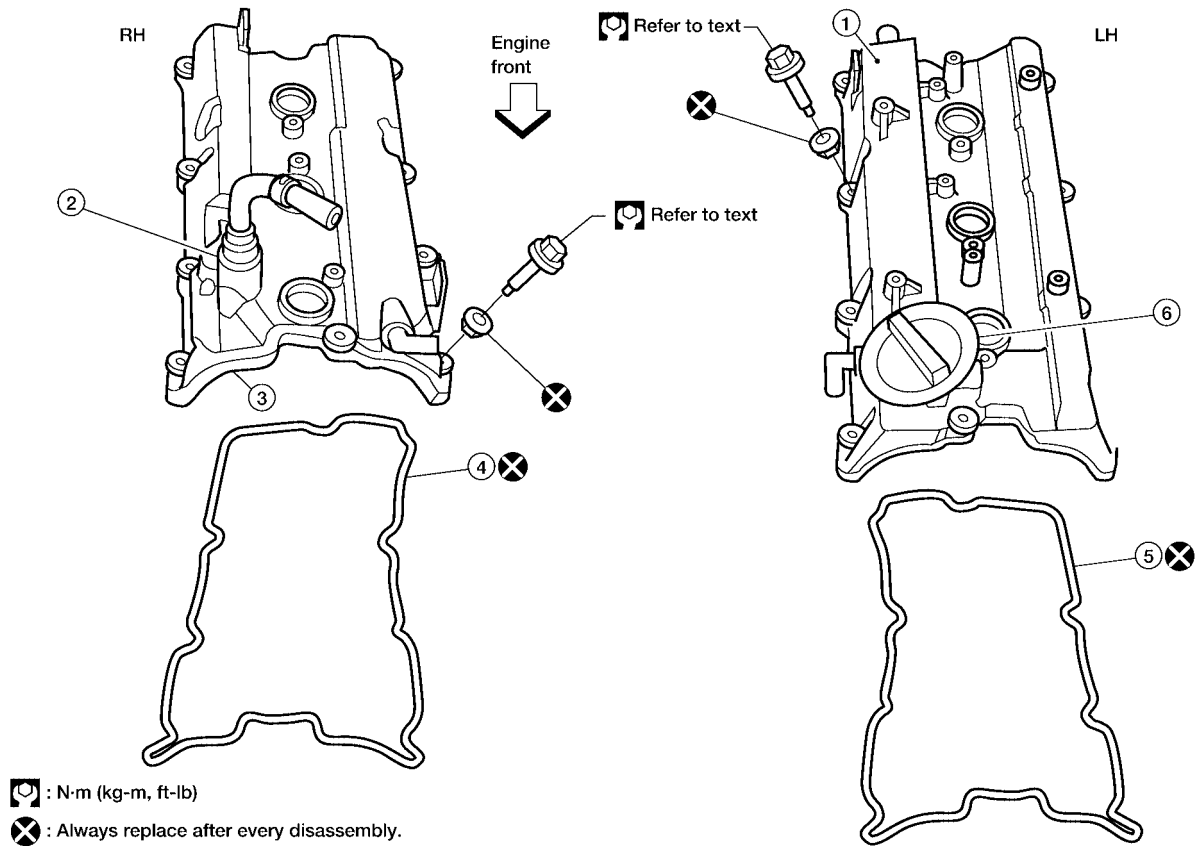
CAUTION:

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

- Perform procedures for "Throttle Valve Closed Position Learning" after finishing repairs. Refer to [EC-644, "Throttle Valve Closed Position Learning"](#).
- If electric throttle control actuator is replaced, perform procedures for "Idle Air Volume Learning" after finishing repairs. Refer to [EC-644, "Idle Air Volume Learning"](#).

ROCKER COVER

Removal and Installation



- | | | |
|-------------------------------------|-----------------------------|------------------------------|
| 1. Rocker cover (left bank) | 2. PCV valve | 3. Rocker cover (right bank) |
| 4. Rocker cover gasket (right bank) | 5. Rocker cover (left bank) | 6. Oil filler cap |

WBIA0222E

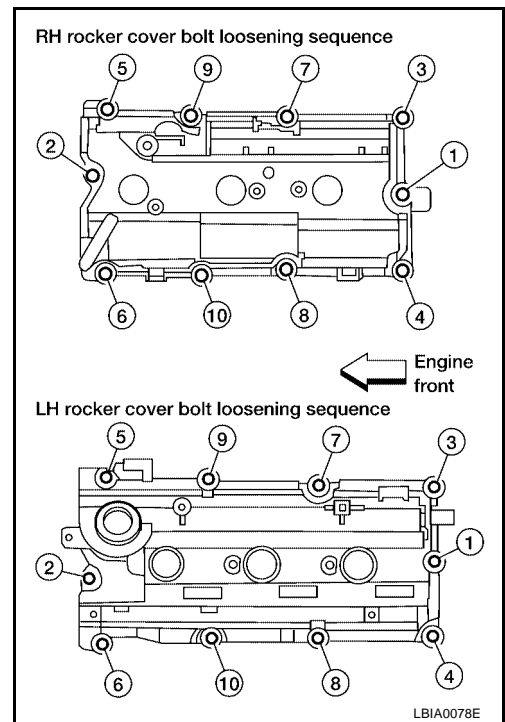
REMOVAL

- Remove the engine cover, using power tool.
- Disconnect the mass air flow sensor electrical connector and remove the air cleaner assembly and air intake tubes. Refer to [EM-120, "Removal and Installation"](#).
- Remove the windshield wiper arms and motor assembly and the front cowl panel. Refer to [WW-30, "Removal and Installation for Wiper Motor and Linkage"](#).
- Remove the intake manifold collector using power tool. Remove gasket and the electric throttle control actuator. Refer to [EM-122, "Removal and Installation"](#).
- Remove the six ignition coils. Refer to [EM-137, "Removal and Installation"](#).
- Remove the two intake valve timing control solenoid valves and gaskets. Refer to [EC-752, "INTAKE VALVE TIMING CONTROL SOLENOID VALVE"](#).

ROCKER COVER

[VQ35DE]

7. Remove RH and LH rocker covers from cylinder head.
 - Follow the loosening sequence for each side rocker cover bolts as shown.



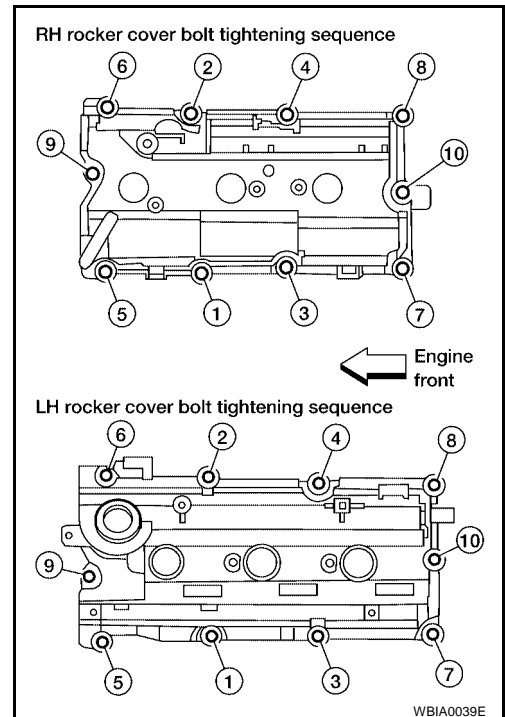
INSTALLATION

1. Installation is in the reverse order of removal.
 - Apply sealant to the areas on the front corners. Refer to [EM-160, "POSITION FOR APPLYING LIQUID GASKET"](#).
 - Use Genuine Silicone RTV Sealant or equivalent. Refer to [GI-43, "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS"](#).
 - **Tighten the rocker cover bolts in two stages and in the numerical order as shown.**

Rocker cover bolts

Stage 1 : 0.96 - 2.96 N·m (0.10 - 0.30 kg·m, 9 - 26 in·lb)

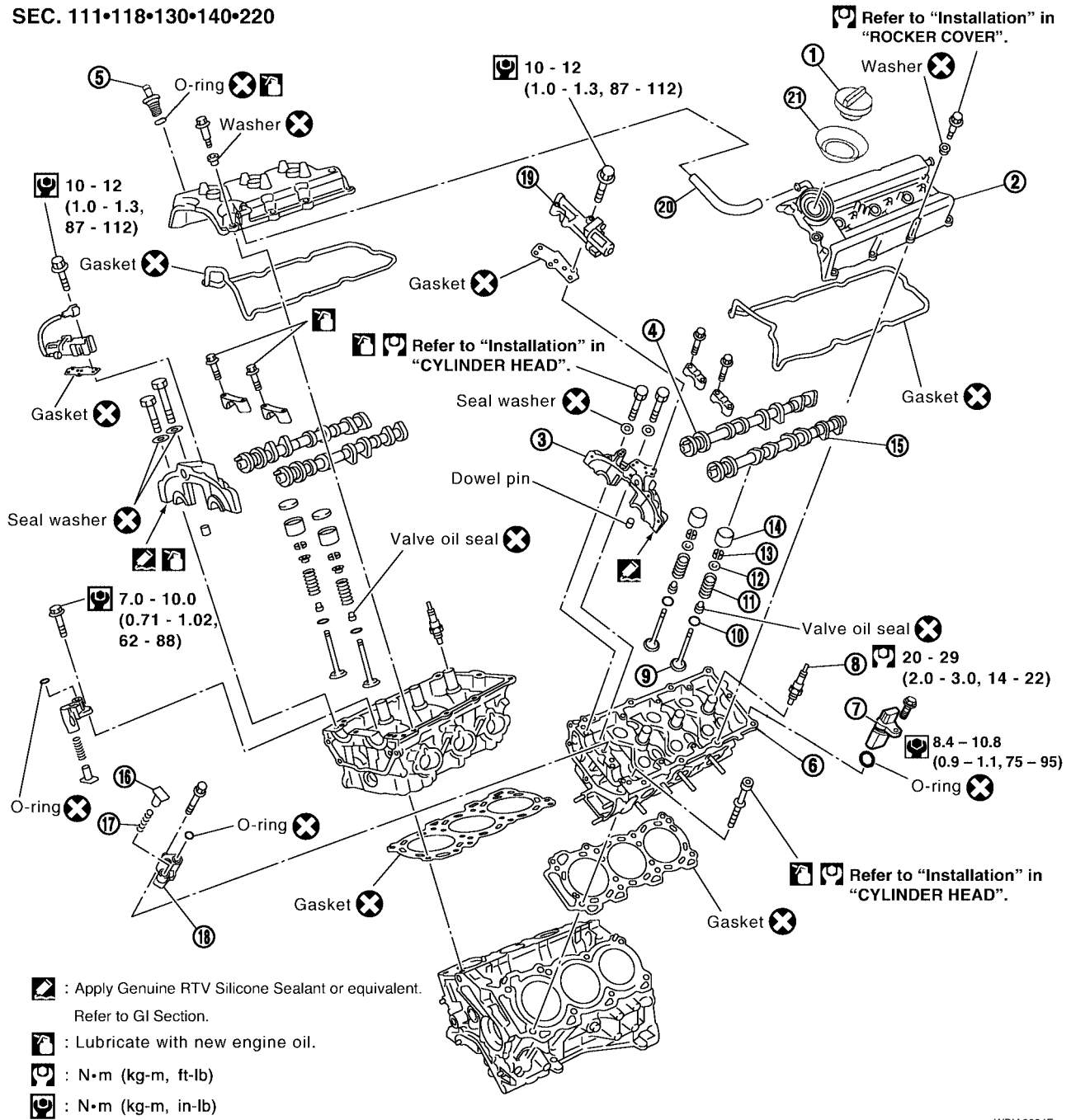
Stage 2 : 7.33 - 9.33 N·m (0.75 - 0.95 kg·m, 65 - 82 in·lb)



CAMSHAFT

Removal and Installation

SEC. 111•118•130•140•220



- | | | |
|-------------------------------------|----------------------|---------------------------|
| 1. Oil filler cap | 2. Rocker cover (LH) | 3. Camshaft bracket (LH) |
| 4. Camshaft (INT) | 5. PCV valve | 6. Cylinder head |
| 7. Camshaft position sensor (PHASE) | 8. Spark plug | 9. Valve |
| 10. Valve spring seat | 11. Valve spring | 12. Valve spring retainer |
| 13. Valve collet | 14. Valve lifter | 15. Camshaft (EXH) |
| 16. Tensioner sleeve | 17. Tensioner spring | 18. Chain tensioner |
| 19. IVT control solenoid valve | 20. PCV hose | 21. Oil catcher |

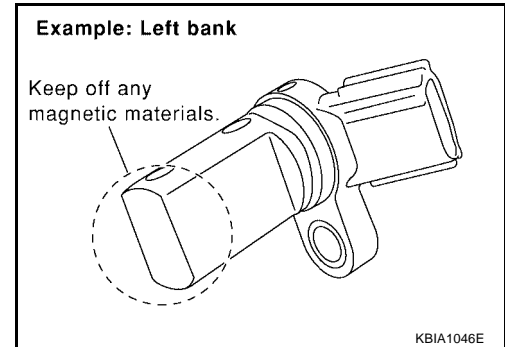
CAUTION:
Apply new engine oil to parts marked in illustration before installation.

REMOVAL

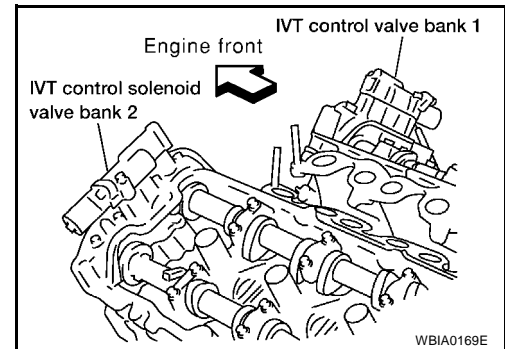
1. Remove the timing chains. Refer to [EM-161, "Removal"](#) .
2. Remove the fuel rail and injectors. Refer to [EM-140, "Removal and Installation"](#) .
3. If necessary, remove camshaft position sensor (PHASE) (RH and LH bank) from cylinder head back side.

CAUTION:

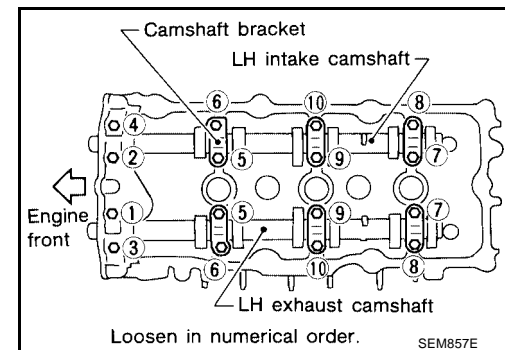
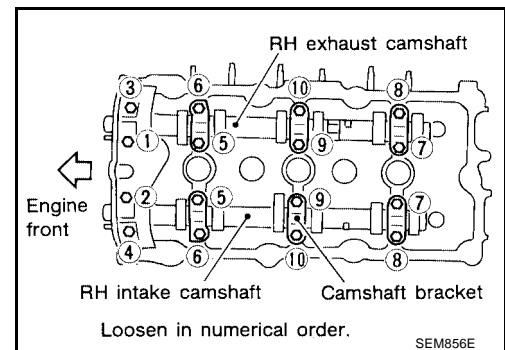
- Handle carefully to avoid dropping an shocks.
- Do not disassemble.
- Do not allow metal powder to adhere to magnetic part at sensor tip.
- Do not place sensors in a location where they are exposed to magnetism.



4. Remove the IVT control solenoid valves.
 - Discard the IVT control solenoid valve gaskets and use new gaskets for installation.



5. Remove the intake and exhaust camshaft brackets and the camshafts.
 - Mark the camshafts, camshaft brackets, and bolts so they are placed in the same position and direction for installation.
 - Equally loosen the camshaft bracket bolts in several steps in the numerical order shown.



6. Remove valve lifters.

NOTE:
Identify installation positions to ensure proper installation.

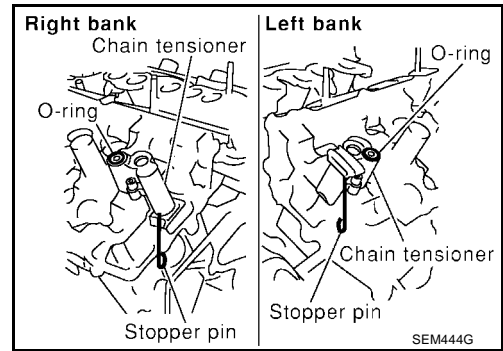
CAMSHAFT

[VQ35DE]

- Remove secondary timing chain tensioner from cylinder head
 - Remove secondary tensioner with its stopper pin attached.

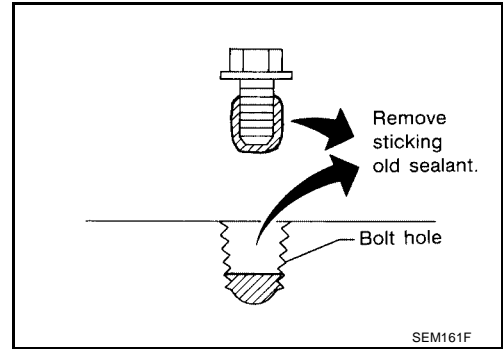
NOTE:

Stopper pin was attached when secondary timing chain was removed.

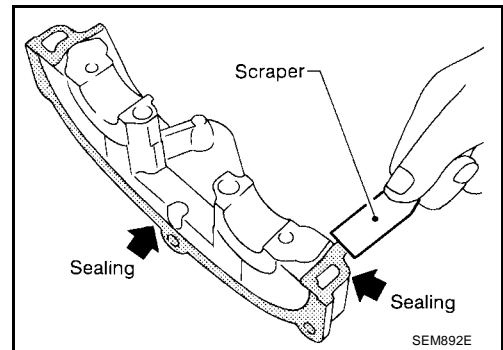


INSTALLATION

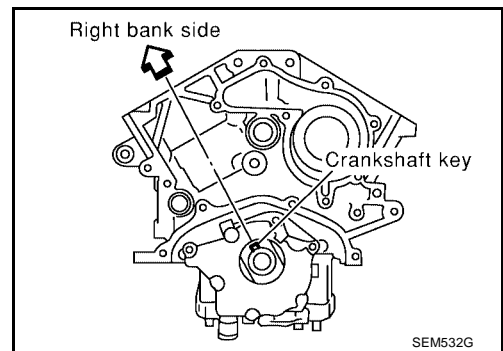
- Before installation, remove any old Silicone RTV Sealant from component mating surfaces using a scraper.
 - Remove the old Silicone RTV Sealant from the bolt holes and threads.
 - Do not scratch or damage the mating surfaces.



- Before installing the front cam bracket, remove the old Silicone RTV Sealant from the mating surface using a scraper.
 - Do not scratch or damage the mating surface.



- Turn the crankshaft until No. 1 piston is set at TDC on the compression stroke.
 - The crankshaft key should line up with the right bank cylinder center line as shown.

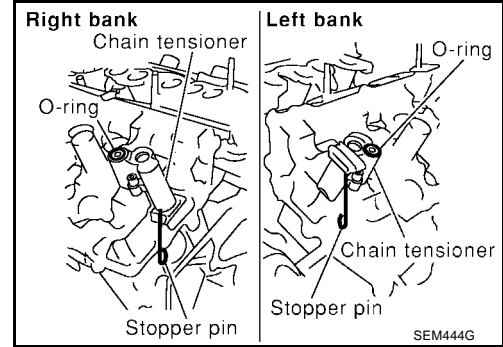


CAMSHAFT

[VQ35DE]

4. Install camshaft chain tensioners on both sides of cylinder head.

Camshaft chain tensioner bolts : 7 - 10 N·m (0.7 - 1.0 kg-m, 62 - 89 in-lb)



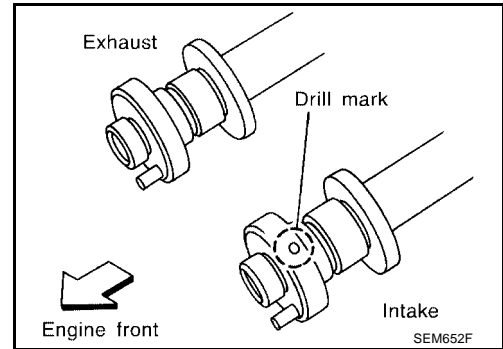
5. Install valve lifters.

NOTE:

Install them in original positions.

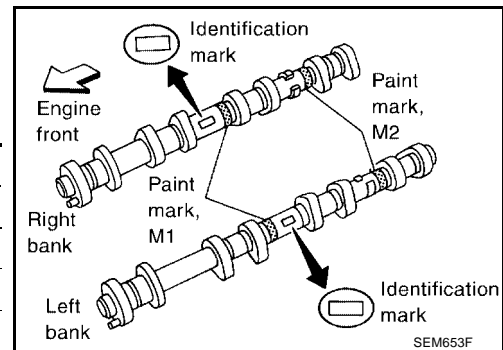
6. Install exhaust and intake camshafts and camshaft brackets.

- Intake camshaft has a drill mark on camshaft sprocket mounting flange.

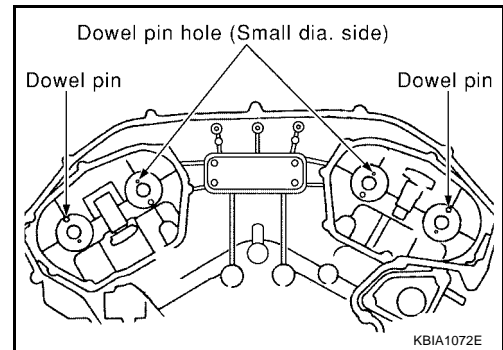


- Follow your identification marks made during removal, or follow the identification marks that are present on the new camshafts components for proper placement and direction of the components.

Bank	INT/EXH	ID mark	Drill mark	Paint marks	
				M1	M2
RH	INT	RE	Yes	Yes	No
	EXH	RE	No	No	Yes
LH	INT	LH	Yes	Yes	No
	EXH	LH	No	No	Yes



- Position the camshafts:
RH exhaust camshaft dowel pin at about 10 o'clock.
LH exhaust camshaft dowel pin at about 2 o'clock.

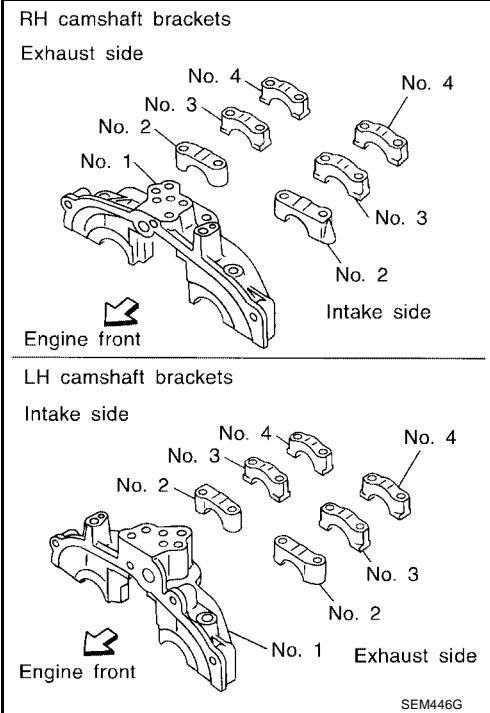


CAMSHAFT

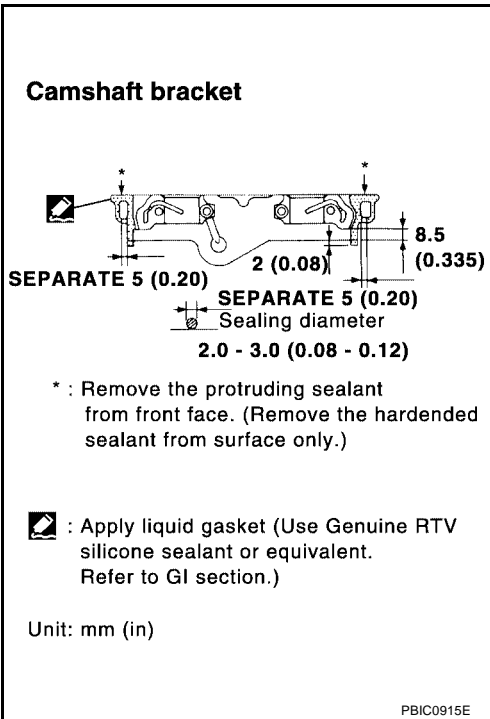
[VQ35DE]

7. Before installing camshaft brackets, apply sealant to mating surface of No. 1 camshaft bracket.

- Use **Genuine Silicone RTV Sealant, or equivalent. Refer to [GI-43, "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS"](#)**.



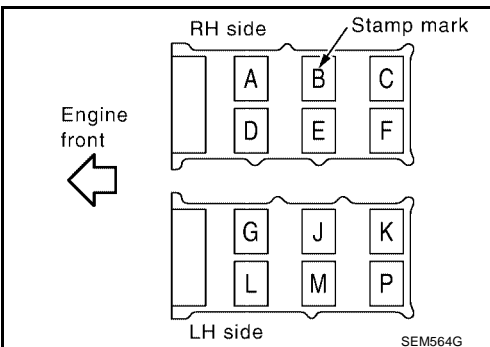
- Before installation, wipe off any protruding sealant.
- Refer to [EM-112, "Precautions for Liquid Gasket"](#).



- Install camshaft brackets in their original positions and direction. Align the stamp marks as shown.
- If checking and adjusting any part of valve assembly or camshaft, check valve clearance according to the reference data. Refer to [EM-154, "Valve Clearance"](#).

Valve clearance (cold) Intake : 0.26 - 0.34 mm (0.010 - 0.013 in)

Valve clearance (cold) Exhaust : 0.29 - 0.37 mm (0.011 - 0.015 in)

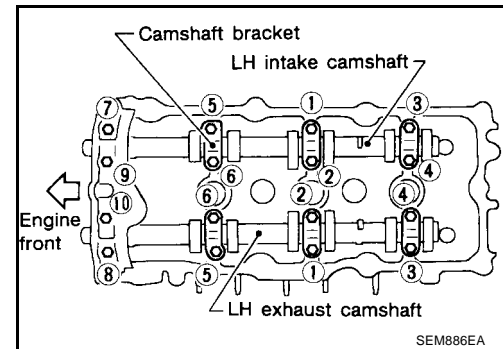
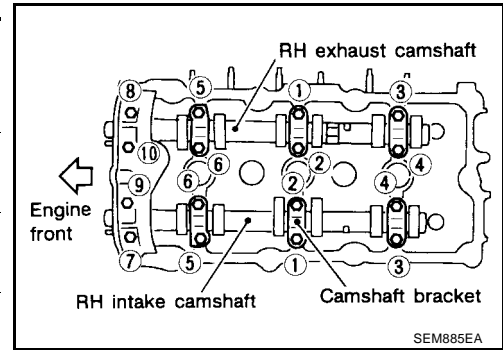


CAMSHAFT

[VQ35DE]

- Tighten the camshaft brackets in the four steps, in numerical order as shown.

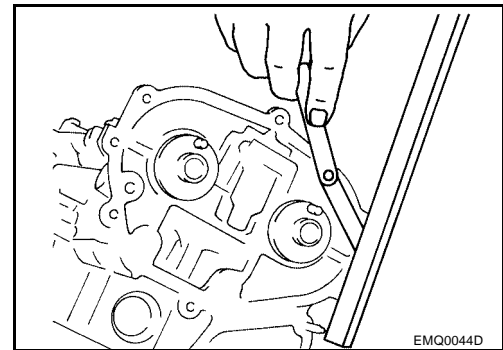
1	1.96 N·m (0.2 kg·m, 17 in·lb)	Tighten No.s 7 to 10, then tighten 1 to 6 in order as shown.
2	6 N·m (0.6 kg·m, 52 in·lb)	Tighten in numerical order as shown.
3	9.02 - 11.8 N·m (0.92 - 1.20 kg·m, 79.9 - 104.2 in·lb)	Tighten No. 1 - 6 in the numerical order as shown.
4	8.30 - 10.3 N·m (0.90 - 1.00 kg·m, 74 - 91 in·lb)	Tighten No. 7 - 10 in the numerical order as shown.



8. Measure difference in levels between front end faces of No. 1 camshaft bracket and cylinder head.

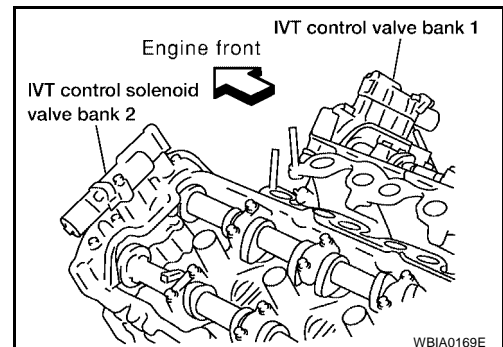
Standard : - 0.14 (- 0.0055 in)

- If measurement is outside the specified range, re-install camshaft and camshaft bracket.



9. Install the IVT control solenoid valves with new gaskets.

IVT control solenoid valve bolts : 10 - 12 N·m (1.0 - 1.3 kg·m, 87 - 112 in·lb)



10. If necessary, install camshaft position sensor (PHASE) (RH and LH bank.)
 11. Install the fuel rail and injectors. Refer to [EM-140, "Removal and Installation"](#) .
 12. Install the timing chains. Refer to [EM-169, "Installation"](#) .

INSPECTION AFTER REMOVAL

Camshaft Visual Check

Check camshaft for scratches, seizure and wear. Replace if necessary.

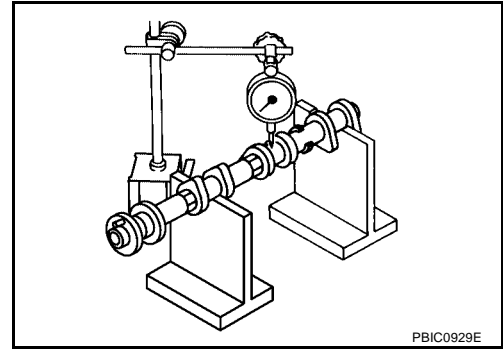
Camshaft Runout

- Put V-block on precise flat bed and support No. 2 and No. 4 journal of camshaft as shown.
- Set dial gauges vertically to No. 3 journal as shown.
- Turn camshaft in one direction slowly by hand, measure the camshaft runout on the dial gauges.
 - Runout is the largest indicator reading after one full revolution.

Camshaft Runout

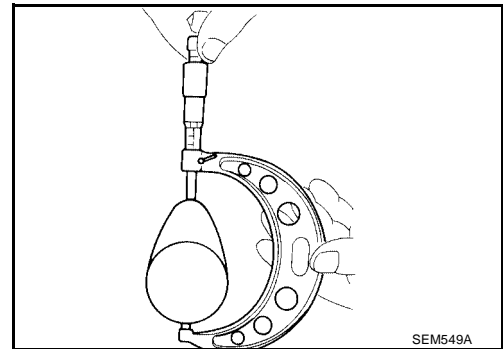
Standard	: Less than 0.02 mm (0.0008 in)
Limit	: 0.05 mm (0.0020 in)

- If actual runout exceeds the limit, replace the camshaft.



Camshaft Cam Lobe Height

- Measure camshaft cam lobe height as shown. Refer to [EM-234, "CAMSHAFT AND CAMSHAFT BEARING"](#).
- If wear has reduced the lobe height below specifications, replace the camshaft.

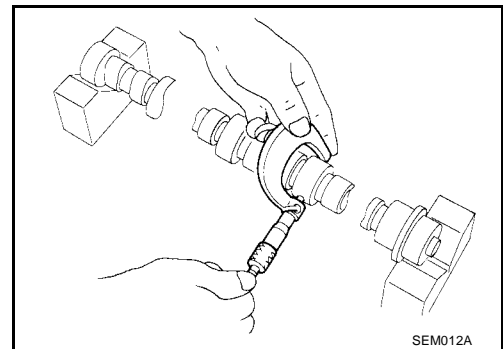


Camshaft Journal Clearance

Outer Diameter of Camshaft Journal

- Measure outer diameter of camshaft journal as shown.

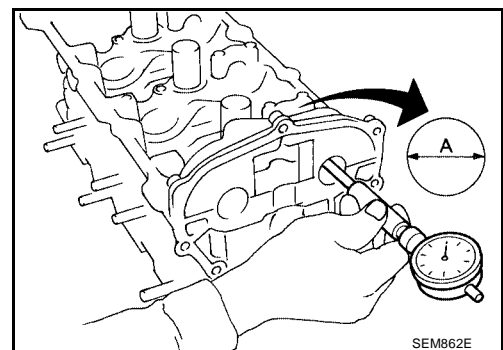
Standard outer diameter, No.1	: 25.935 - 25.955 mm (1.0211 - 1.0218 in)
Standard outer diameter, No.2, 3, 4	: 23.445 - 23.465 mm (0.9230 - 0.9238 in)



Inner Diameter of Camshaft Bracket

- Tighten camshaft bracket bolt with specified torque.
- Using inside micrometer, measure inner diameter "A" of camshaft bearing.

Standard inner diameter No.1	: 26.000 - 26.021 mm (1.0236 - 1.0244 in)
Standard inner diameter No.2, 3, 4	: 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)

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- Standard No.1** : 0.045 - 0.086 mm (0.0018 - 0.0034 in)
- Standard No.2, 3, 4** : 0.035 - 0.076 mm (0.0014 - 0.0030 in)
- Limit** : 0.15 mm (0.0059 in)

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

NOTICE:

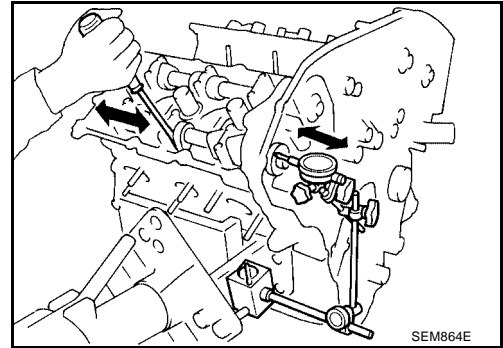
Inner diameter of camshaft bracket is manufactured together with cylinder head. Replace the whole cylinder head assembly.

Camshaft End Play

1. Install the camshaft in the cylinder head.
2. Install dial gauge in thrust direction on front end of camshaft. Measure end play when camshaft is moved forward/backward (in direction to axis) as shown.

- Standard** : 0.115 - 0.188 mm (0.0045 - 0.0074 in)
- Limit** : 0.24 mm (0.0094 in)

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

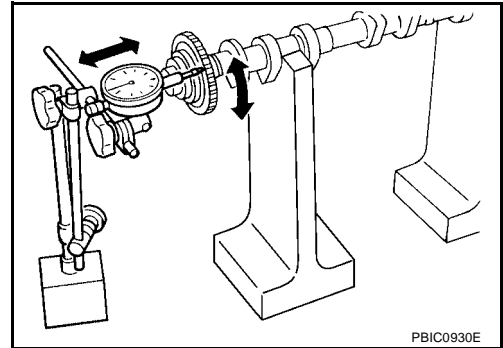


Camshaft Sprocket Runout

1. Put V-block on precise flat bed and support No. 2 and No. 4 journal of camshaft as shown.
2. Install camshaft sprocket on camshaft.
3. Measure camshaft sprocket runout.

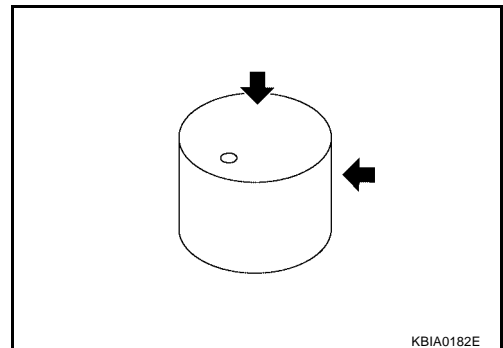
- Runout** : Less than 0.15 mm (0.0059 in)

4. If sprocket runout exceeds the limit, replace camshaft sprocket.



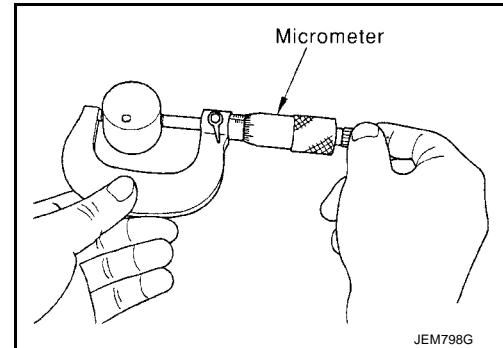
Valve Lifter

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

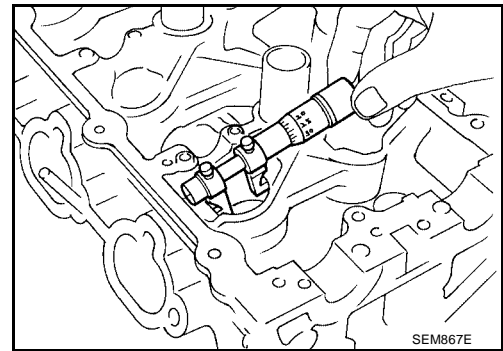


Valve Lifter Clearance**Outer Diameter of Valve Lifter**

- Measure the outer diameter of the valve lifter. Refer to [EM-231, "Valve Lifter"](#).
- If out of the specified range, replace the valve lifter.

**Valve Lifter Bore Diameter**

- Using inside micrometer, measure diameter of valve lifter bore of cylinder head. Refer to [EM-231, "Valve Lifter"](#).
- If out of the specified range, replace the cylinder head assembly.

**Calculation of Valve Lifter Clearance**

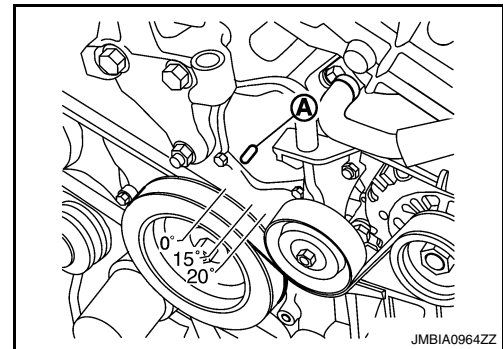
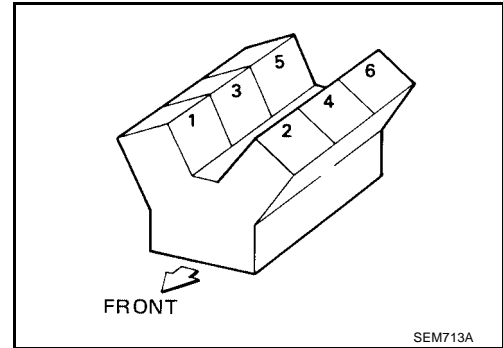
- (Valve lifter clearance) = (hole diameter for valve lifter) – (outer diameter of valve lifter) Refer to [EM-231, "Valve Lifter"](#).
- If out of specified range, replace either or both valve lifter and cylinder head assembly.

Valve Clearance CHECKING

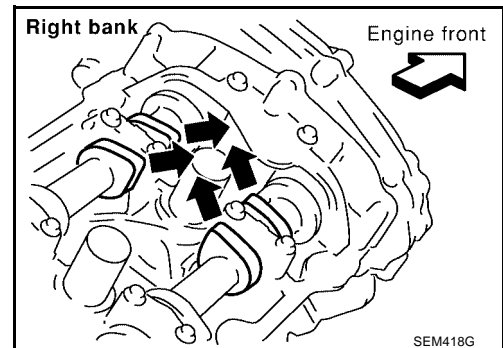
- Perform inspection as follows after removal, installation or replacement of camshaft or valve related parts, or if there is unusual engine conditions regarding valve clearance.

Check valve clearance while engine is cold and not running.

1. Remove the air duct with air cleaner case, collectors, hoses, wires, harnesses, and connectors.
 2. Remove the intake manifold collectors.
 3. Remove the ignition coils and spark plugs.
 4. Remove the rocker covers.
5. Set No.1 cylinder at TDC on its compression stroke.
 - Align pointer (A) with TDC mark on crankshaft pulley.



- Check that the valve lifters on No.1 cylinder are loose and valve lifters on No.4 are tight. If not, turn the crankshaft one full revolution (360°) and align as shown.



CAMSHAFT

[VQ35DE]

6. Check only the valves as shown.

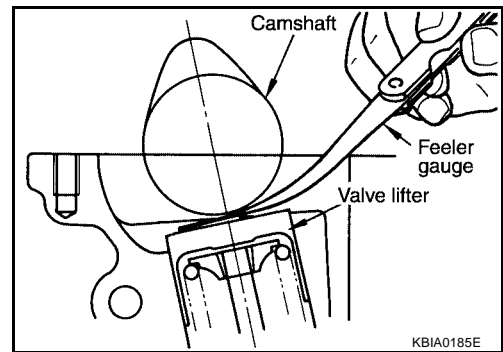
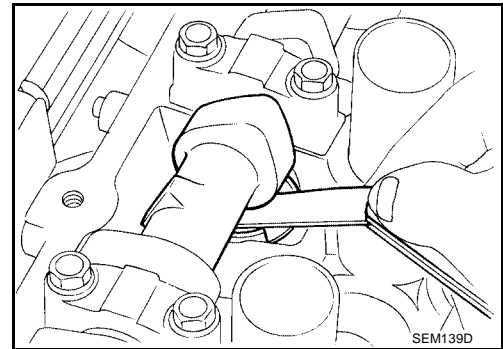
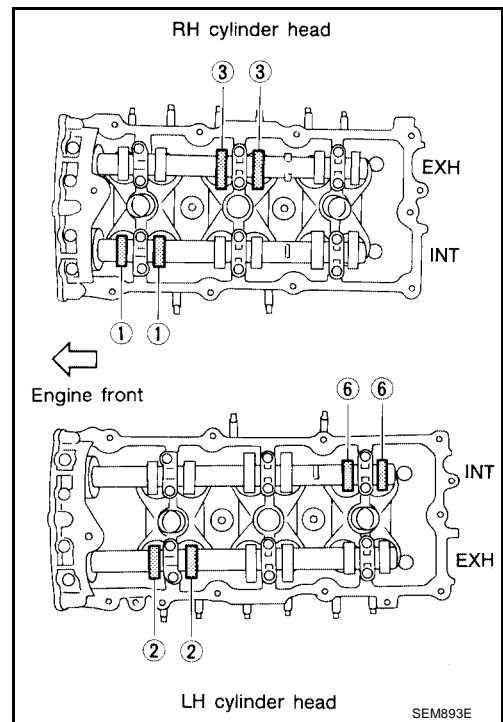
Crank Position	Valve No. 1	Valve No. 2	Valve No. 3	Valve No. 6
No. 1 TDC	Intake	Exhaust	Exhaust	Intake

- Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
- Record any valve clearance measurements which are out of specification. They will be used later to determine the required replacement lifter size.

Valve Clearance for Checking (cold)

Intake : 0.26 - 0.34 mm (0.010 - 0.013 in)

Exhaust : 0.29 - 0.37 mm (0.011 - 0.015 in)



7. Turn crankshaft 240°.
8. Set No.3 cylinder at TDC on its compression stroke.

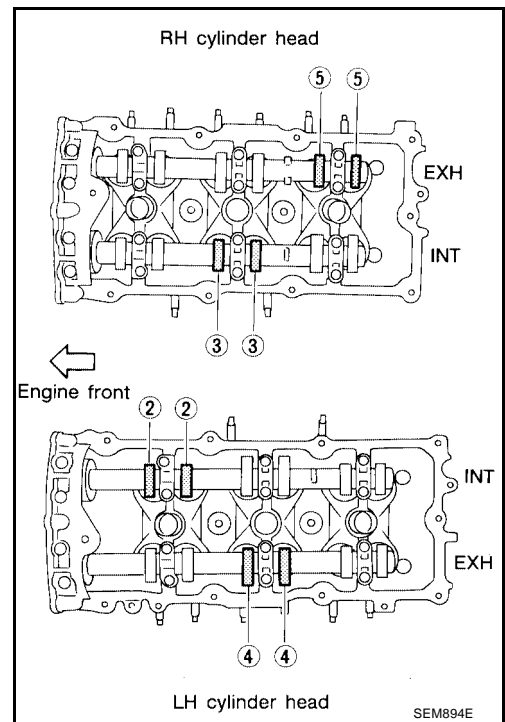
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CAMSHAFT

[VQ35DE]

9. Check only those valves as shown.

Crank Position	Valve No. 2	Valve No. 3	Valve No. 4	Valve No. 5
No. 3 TDC	Intake	Intake	Exhaust	Exhaust

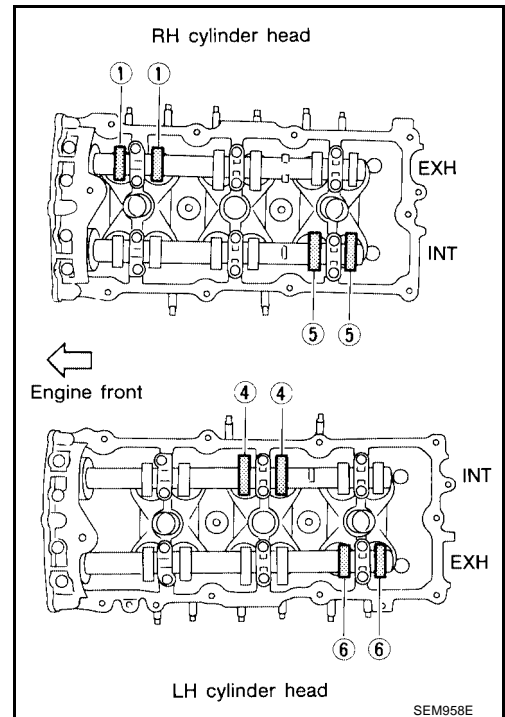


10. Turn the crankshaft 240° and align as above.

11. Set No.5 cylinder at TDC on its compression stroke.

12. Check only those valves as shown.

Crank Position	Valve No. 1	Valve No. 4	Valve No. 5	Valve No. 6
No. 5 TDC	Exhaust	Intake	Intake	Exhaust



13. If all valve clearances are within specification, install the following components. If the valve clearances are out of specification, adjust the valve clearances.

- Intake manifold collectors
- Rocker covers
- All spark plugs
- All ignition coils

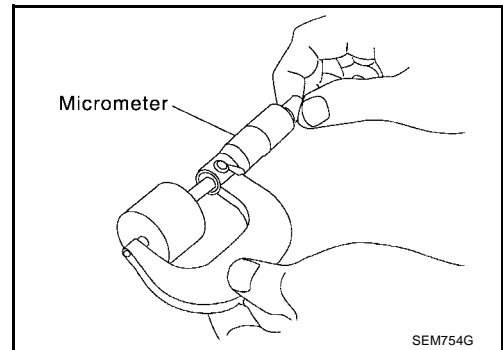
VALVE ADJUSTING

CAUTION:

Adjust valve clearance while engine is cold.

NOTE:

- Perform adjustment by selecting the correct head thickness of the valve lifter (adjusting shims are not used).
 - The specified valve lifter thickness is the dimension at normal temperatures. Ignore dimensional differences caused by temperature. Use specifications for hot engine condition to confirm valve clearances.
1. Remove the camshaft.
 2. Remove the valve lifter that was measured as being outside the standard specifications.
 3. Measure the center thickness of the removed lifter with a micrometer, as shown.



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

Valve lifter thickness calculation equation: $t = t1 + (C1 - C2)$

t = thickness of the replacement lifter

t1 = thickness of the removed lifter

C1 = measured valve clearance

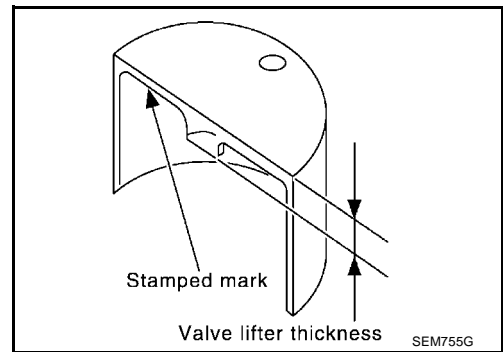
C2 = standard valve clearance

- The thickness of the new valve lifter can be identified by the stamp mark on the reverse side (inside the lifter).
- Available thickness of the valve lifter (factory setting): 7.88 - 8.36 mm (0.3102 - 0.3291 in), in 0.02 mm (0.0008 in) increments, in 25 sizes (intake / exhaust). Refer to [EM-231, "Valve Lifter"](#).

Value lifter thickness:

Intake: 0.30 mm (0.012 in)

Exhaust: 0.33 mm (0.013 in)



5. Install the selected replacement valve lifter.
6. Install the camshaft.
7. Rotate the crankshaft a few turns by hand.
8. Confirm that the valve clearances are within specification.
9. After the engine has been run to full operating temperature, confirm that the valve clearances are within specification.

Valve Clearance	Cold	Hot* (reference data)
Intake	0.26 - 0.34 mm (0.010 - 0.013 in)	0.304 - 0.416 mm (0.012 - 0.016 in)
Exhaust	0.29 - 0.37 mm (0.011 - 0.015 in)	0.308 - 0.432 mm (0.012 - 0.017 in)

* Approximately 80°C (176°F)

TIMING CHAIN

[VQ35DE]

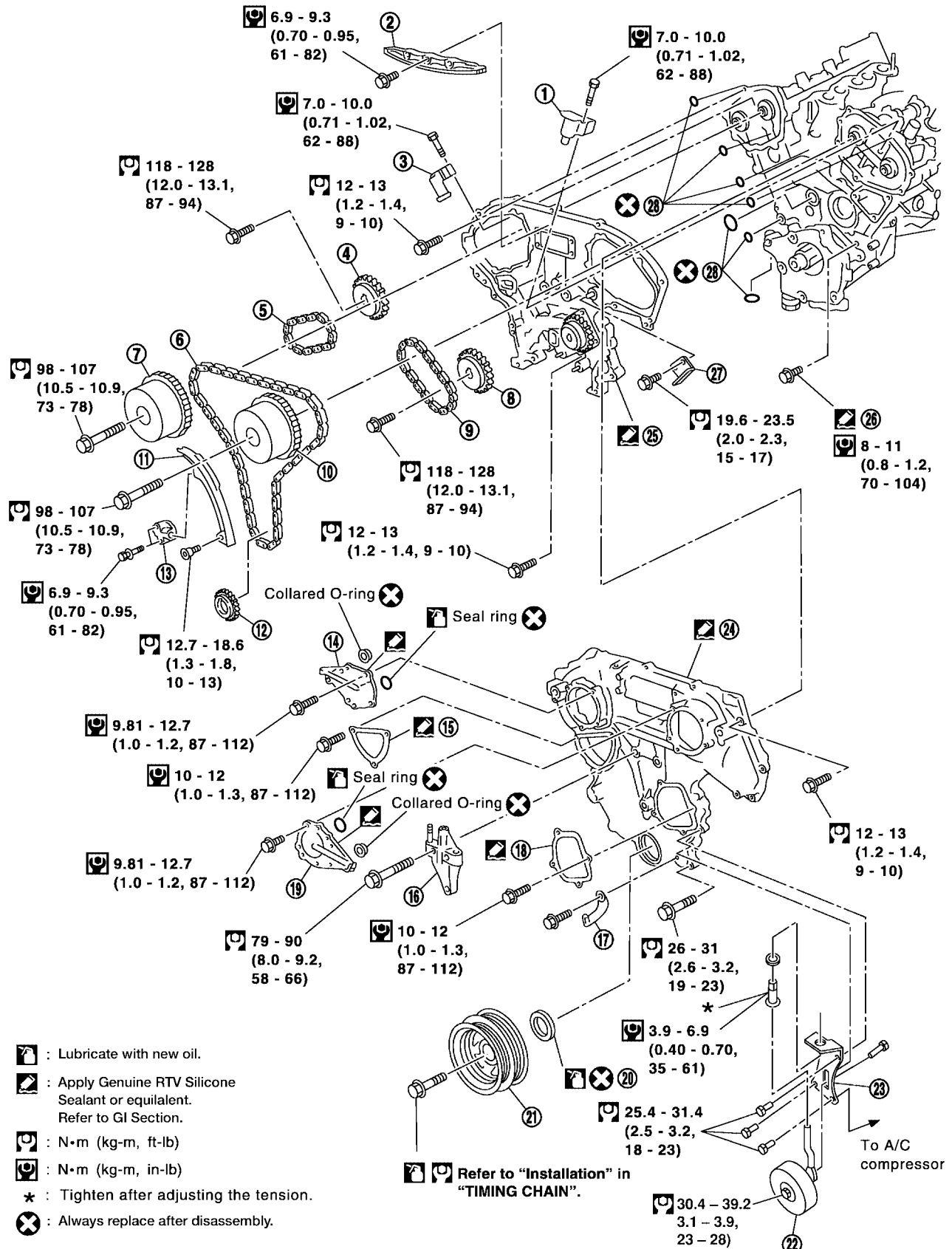
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TIMING CHAIN

Components

SEC. 120•130•150•210•275



: Lubricate with new oil.

: Apply Genuine RTV Silicone Sealant or equivalent. Refer to GI Section.

: N·m (kg-m, ft-lb)

: N·m (kg-m, in-lb)

* : Tighten after adjusting the tension.

: Always replace after disassembly.

WBIA0170E

TIMING CHAIN

[VQ35DE]

- | | | |
|------------------------------------|-------------------------------------|-----------------------------|
| 1. Timing chain tensioner | 2. Internal chain guide | 3. Timing chain tensioner |
| 4. Camshaft sprocket (EXH) | 5. Timing chain (secondary) | 6. Timing chain (primary) |
| 7. Camshaft sprocket (INT) | 8. Camshaft sprocket (EXH) | 9. Timing chain (secondary) |
| 10. Camshaft sprocket (INT) | 11. Slack guide | 12. Crankshaft sprocket |
| 13. Timing chain tensioner | 14. IVT control valve cover - right | 15. Chain tensioner cover |
| 16. RH engine mounting bracket | 17. Water hose clamp | 18. Water pump cover |
| 19. IVT control valve cover - left | 20. Front oil seal | 21. Crankshaft pulley |
| 22. Idler pulley | 23. Idler pulley bracket | 24. Front timing chain case |
| 25. Rear timing chain case | 26. Water drain plug | 27. Tension guide |
| 28. O-ring | | |

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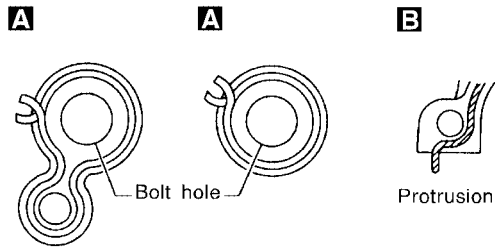
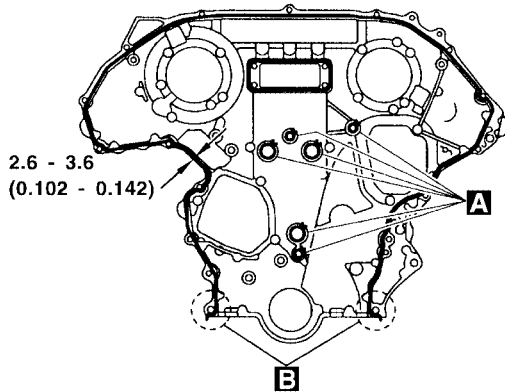
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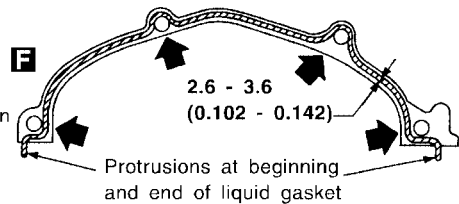
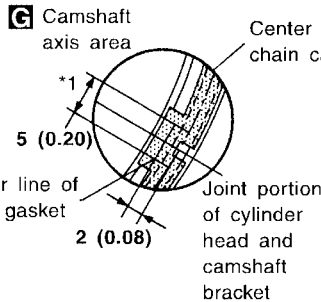
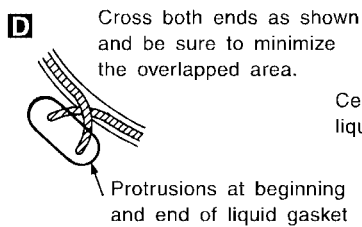
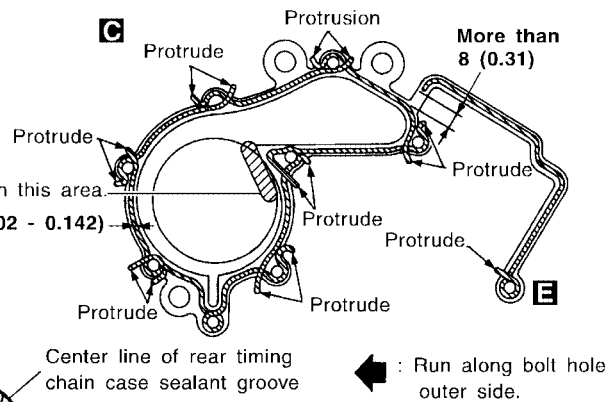
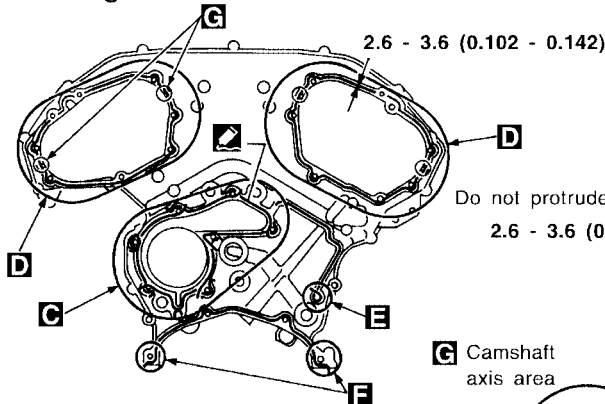
POSITION FOR APPLYING LIQUID GASKET

- Refer to [EM-112, "Precautions for Liquid Gasket"](#) .
- Before installation, wipe off any protruding sealant.

Front timing chain case

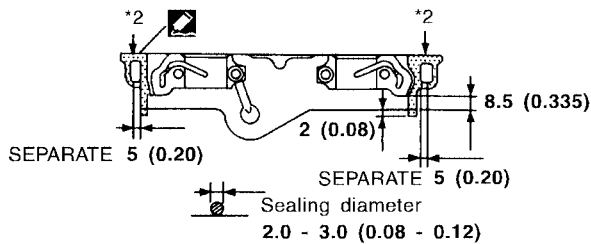


Rear timing chain case



*1: Apply liquid gasket to the chamfered surface between camshaft bracket and cylinder head.

Camshaft bracket

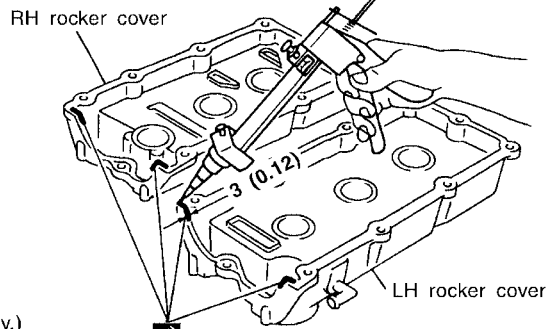


*2: Remove the protruding sealant from front face. (Remove the hardened sealant from surface only.)

Unit: mm (in)

: Apply Genuine Anaerobic Liquid Gasket or equivalent. Refer to GI Section.

Rocker cover



WBIA0171E

CAUTION:

- After removing timing chain, do not turn the crankshaft and camshaft separately, or the valves will strike the pistons.

TIMING CHAIN

[VQ35DE]

- When installing camshafts, chain tensioners, oil seals, or other sliding parts, lubricate contacting surfaces with new engine oil.
- Apply new engine oil to bolt threads and seat surfaces when installing camshaft sprockets, camshaft brackets, and crankshaft pulley.
- Before disconnecting fuel hose, release fuel pressure. Refer to [EC-646, "FUEL PRESSURE RELEASE"](#).
- Before removing the upper oil pan, remove the crankshaft position sensor (POS).
- Be careful not to damage sensor edges.
- Do not spill engine oil or coolant on drive belts.

Removal

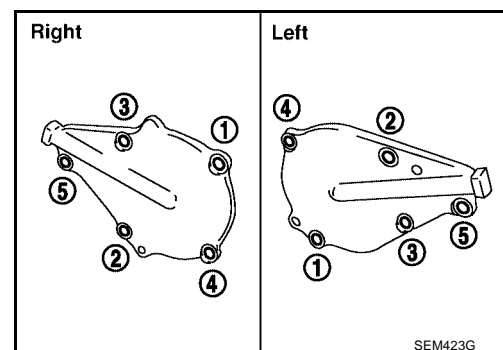
EBS00DVC

1. Release the fuel pressure. Refer to [EC-646, "FUEL PRESSURE RELEASE"](#).
2. Remove the battery.
3. Drain the engine cooling system. Refer to [EC-1065, "Description"](#).
4. Drain engine oil. Refer to [MA-26, "Changing Engine Oil"](#).
5. Remove engine cover with power tool.
6. Remove the intake air duct with the air cleaner case lid and mass air flow sensor.
7. Remove the engine coolant reservoir.
8. Disconnect the fuel rail quick connector at the vehicle piping side. Refer to [EM-140, "Removal and Installation"](#).
9. Remove the cowl top grille and the windshield wiper assembly. Refer to [EI-18, "Removal and Installation"](#).
10. Remove the front RH wheel and tire with power tool.
11. Remove the engine undercovers with power tool.
12. Remove the inner fender splash shield with power tool.
13. Remove the drive belts and idler pulley.
14. Recover the A/C system R134a and remove the A/C compressor. Refer to [MTC-17, "REFRIGERATION SYSTEM"](#).
15. Dismount the power steering oil pump and reservoir tank. Tie them down with wire to reposition them out of the way.
16. Remove the lower and upper oil pans. Refer to [EM-130, "Removal and Installation"](#).
17. Remove the A/C high pressure line. Refer to [MTC-78, "REFRIGERANT LINES"](#).
18. Remove the alternator. Refer to [SC-29, "Removal and Installation"](#).
19. Disconnect the engine harness and set aside.
20. Support the engine and remove the RH engine mount and bracket.
21. Remove the IVT control covers, right and left. Loosen the bolts in the numerical order as shown.

NOTE:

The shaft in the cover is inserted into the center hole of the intake camshaft sprocket. Remove the cover by pulling straight out until the cover disengages from the camshaft sprocket.

22. Remove the starter motor. Refer to [SC-19, "Removal and Installation"](#).

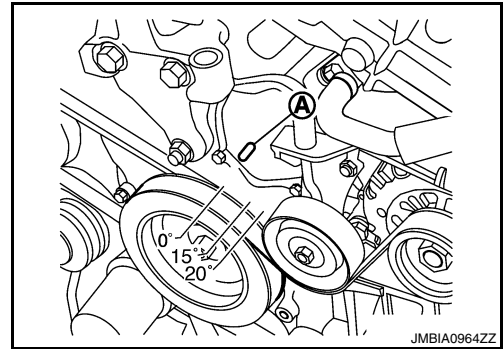


23. Obtain compression TDC of No. 1 cylinder as follows:

TIMING CHAIN

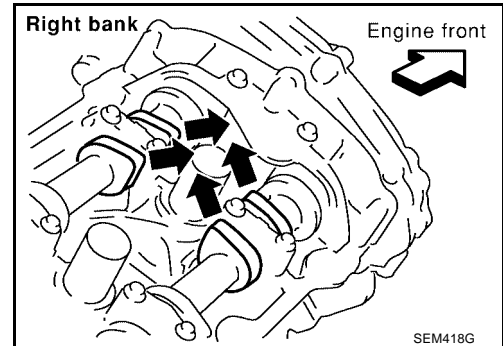
[VQ35DE]

- a. Rotate crankshaft pulley clockwise to align pointer (A) with TDC mark on crankshaft pulley.



- b. Check that intake and exhaust cam nose on No. 1 cylinder (engine front side of right) are located as shown.

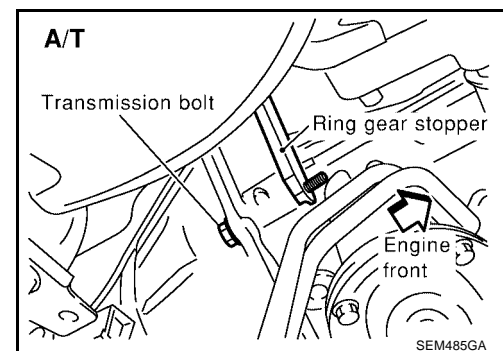
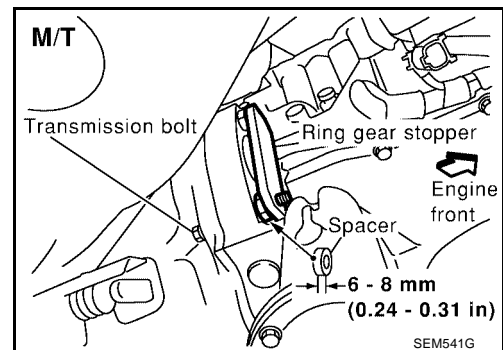
- If not, turn the crankshaft one revolution (360°) and align as shown.



24. Set the ring gear stopper using the mounting bolt hole.

CAUTION:

Do not damage the ring gear teeth, or the signal plate teeth behind the ring gear, when setting the stopper.

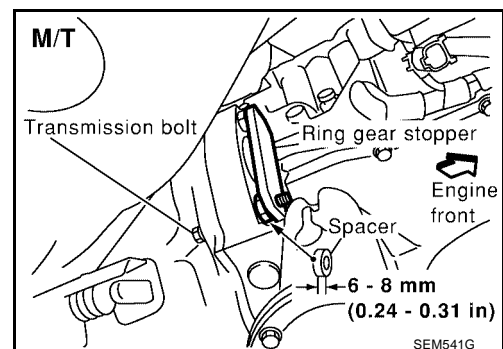


25. Remove the crankshaft pulley as follows:

- a. Set the ring gear stopper using the mounting bolt hole.

CAUTION:

Do not damage the ring gear teeth, or the signal plate teeth behind the ring gear when setting the stopper.

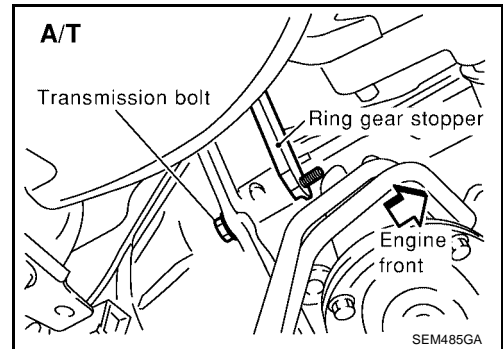


TIMING CHAIN

[VQ35DE]

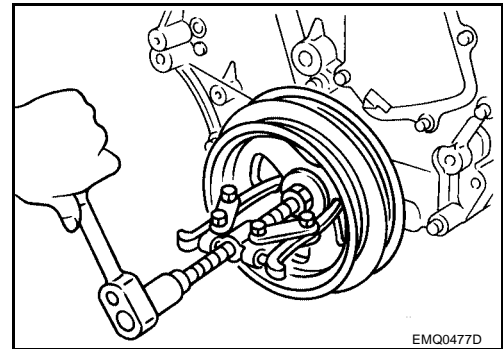
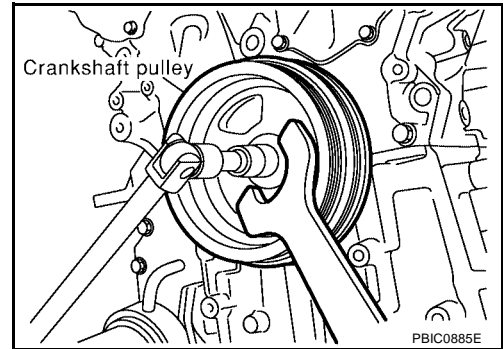
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- b. Loosen crankshaft pulley mounting bolt using pulley holder and locate bolt seating surface at 10 mm (0.39 in) from its original position.

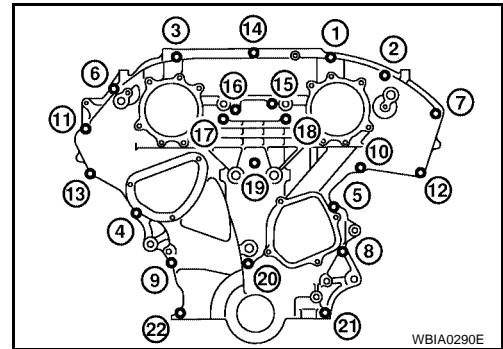


- c. Position a pulley puller at recess hole of crankshaft pulley to remove crankshaft pulley.

CAUTION:
Do not use a puller claw on crankshaft pulley periphery.

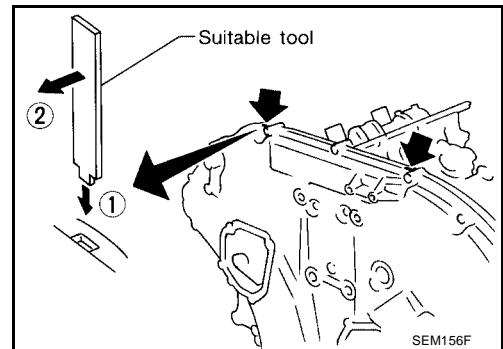


26. Remove the front timing chain case.
a. Loosen the bolts in the numerical order as shown.



- b. Insert the appropriate size tool into the notch (1) at the top of the front timing chain case as shown.
c. Pry off the case by moving the suitable tool (2) as shown.
● Use seal cutter or an equivalent tool to cut liquid gasket for removal.

CAUTION:
● Do not use a screwdriver or similar tool.
● After removal, handle carefully so it does not bend, or warp under a load.

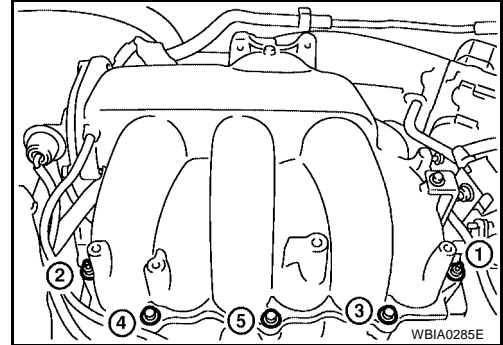


TIMING CHAIN

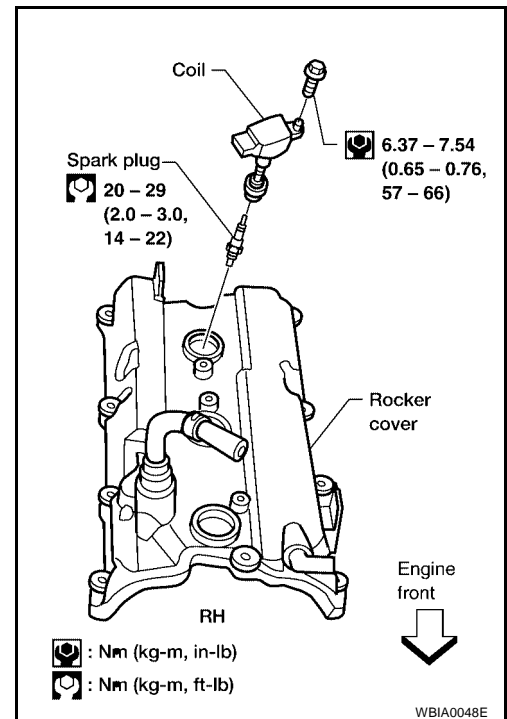
[VQ35DE]

27. Disconnect the power brake booster vacuum hose.
28. Disconnect the electric throttle control actuator.
29. Disconnect the coolant hoses at the electric throttle control actuator.
30. Disconnect the PCV hose.
31. Disconnect the EVAP canister purge volume control solenoid vacuum hose.

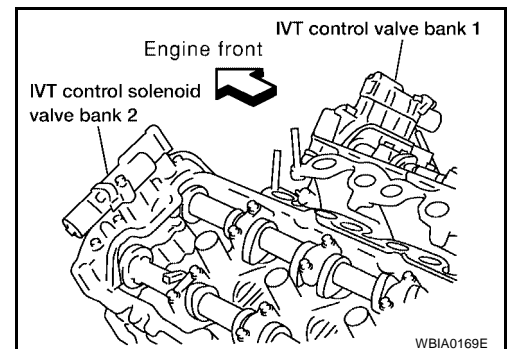
32. Remove the intake manifold collector. Loosen the bolts and nuts in the numerical order as shown.



33. Remove the six ignition coils.
34. Remove the six spark plugs.
35. Remove the engine oil dipstick.



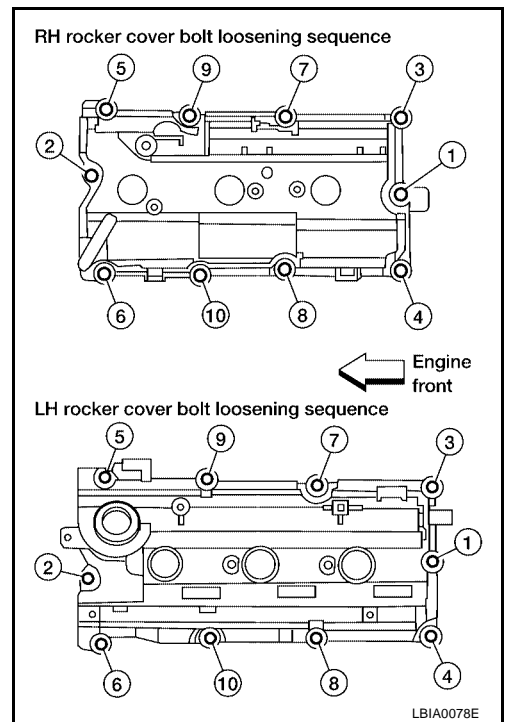
36. Remove the IVT control solenoid valves.
 - Discard the gaskets and use new gaskets for installation.



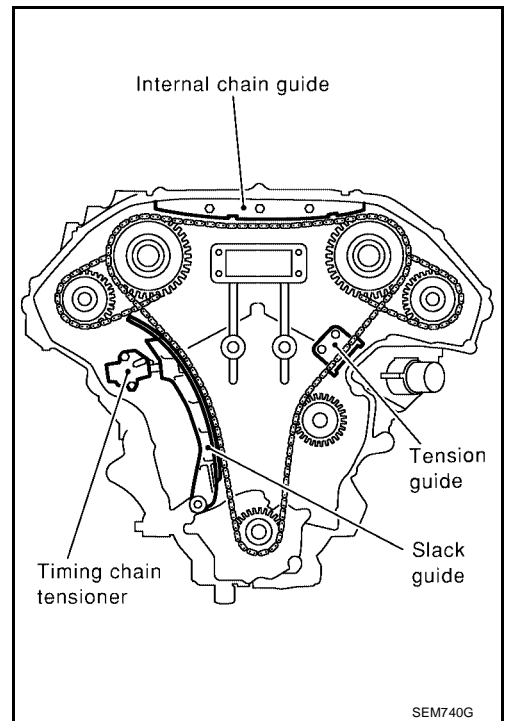
TIMING CHAIN

[VQ35DE]

37. Remove the rocker covers. Loosen the bolts in the numerical order as shown.



38. Remove the internal chain guide.



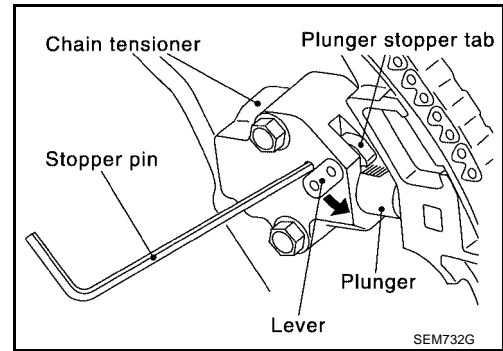
39. Remove the timing chain tensioner and slack side chain guide.

- Place paint marks on the timing chain and sprockets to indicate the correct position of the components for installation.

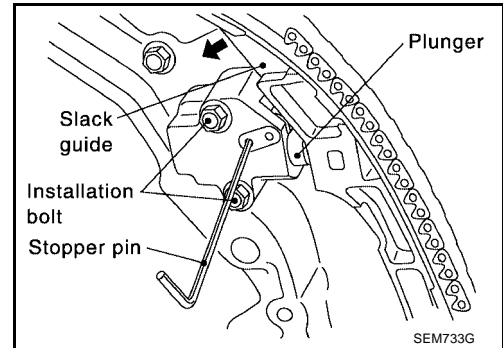
TIMING CHAIN

[VQ35DE]

- a. Pull lever down and release plunger stopper tab. Plunger stopper tab can be pushed up to release (coaxial structure with lever).



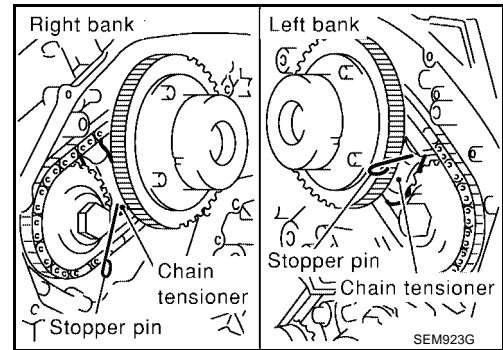
- b. Insert stopper pin into tensioner body hole to hold lever, and keep the tab released. An Allen wrench [2.5 mm (0.098 in)] is used for a stopper pin as an example.
- c. Insert plunger into tensioner body by pressing the slack side chain guide.
- d. Keep the slack side chain guide pressed and hold it by pushing the stopper pin through the lever hole and body hole.
- e. Remove the mounting bolts and remove the timing chain tensioner.
40. Remove primary timing chain and crankshaft sprocket.



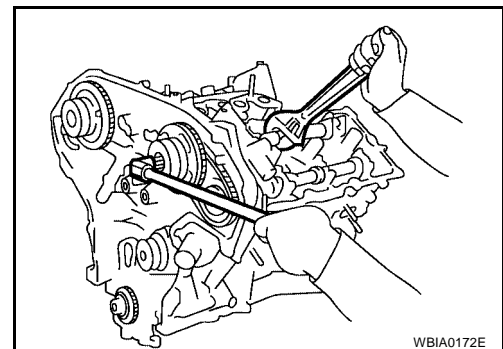
CAUTION:

After removing timing chain, do not turn the crankshaft and camshaft separately, or the valves will strike the pistons.

41. Attach a suitable stopper pin to the right and left camshaft chain tensioners (for secondary timing chains).



42. Remove the intake and exhaust camshaft sprocket bolts.
- Apply paint to the timing chain and camshaft sprockets for alignment during installation.
 - Secure the hexagonal portion of the camshaft using a wrench to loosen the bolts.



TIMING CHAIN

[VQ35DE]

43. Remove the secondary timing chains with camshaft sprockets.
 - a. Rotate camshaft slightly, and slacken timing chain of timing chain tensioner -side.
 - b. Insert metal or resin plate [0.5 mm (0.020 in)] into guide between timing chain and chain tensioner plunger. Remove cam sprocket and secondary timing chain with timing chain removed from guide groove.

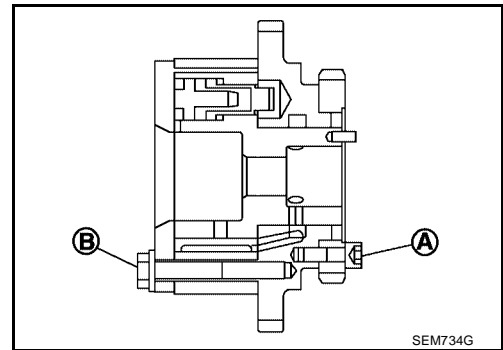
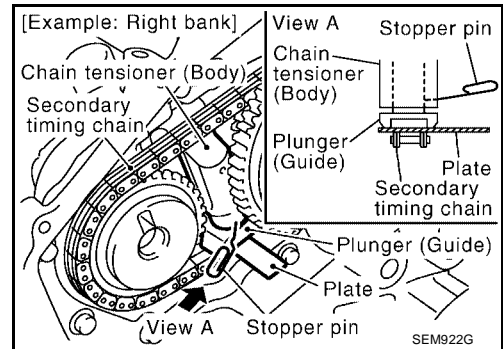
CAUTION:

Chain tensioner plunger can move, while stopper pin is inserted in tensioner. Plunger can come out of tensioner when timing chain is removed. Use caution during removal.

- Intake camshaft sprocket is two-for-one structure of primary and secondary sprockets.
- Handle the intake sprockets as an assembly.

CAUTION:

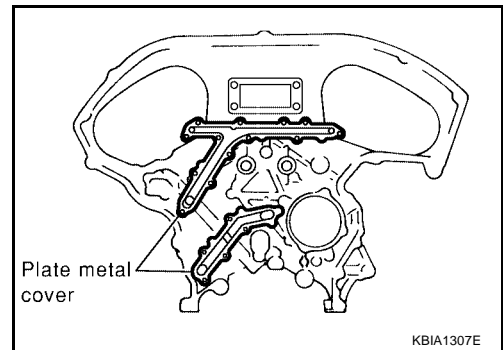
- Avoid impact or dropping the intake sprockets.
- Do not disassemble the intake sprockets (never loosen bolts A and B as shown).



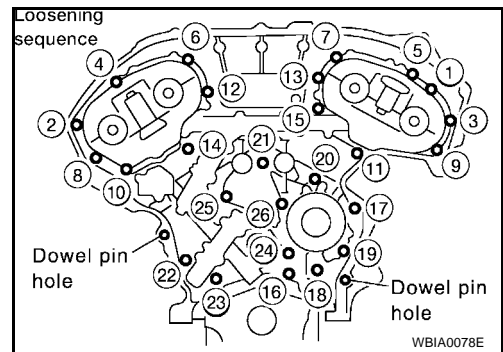
44. Remove the chain tension guide.
45. Remove the rear timing chain case.

CAUTION:

- Do not remove the plate metal cover for the oil passage.
- After removing the chain case, do not apply any load to the case that might bend it.



- a. Loosen and remove the rear timing chain case bolts in the order shown.
- b. Cut the sealant with an appropriate tool and remove the rear timing chain case.



46. Remove O-rings to cylinder head and cylinder block.

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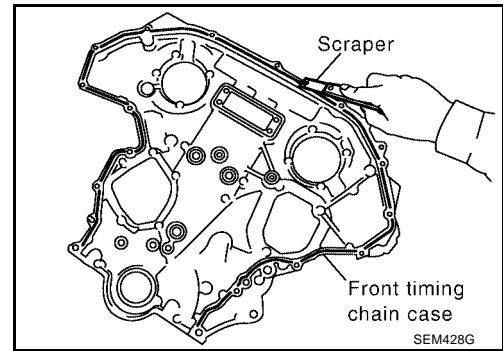
TIMING CHAIN

[VQ35DE]

47. Use a scraper to remove all of the old Silicone RTV Sealant from the front and rear timing chain case and opposite mating surfaces.

CAUTION:

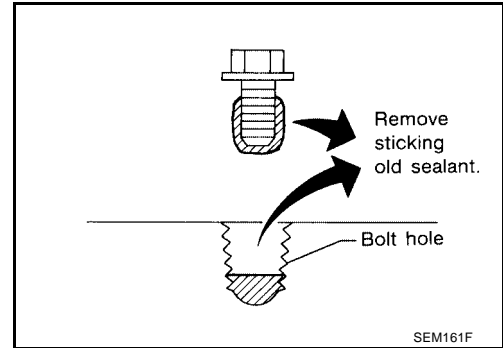
Do not damage the mating surfaces.



48. Remove all old Silicone RTV Sealant from all the bolt holes and bolts.

CAUTION:

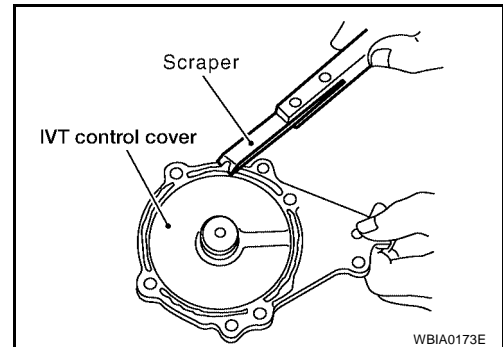
Do not damage the threads or mating surfaces.



49. Use a scraper to remove all the old Silicone RTV Sealant from the water pump cover, chain tensioner cover and IVT control covers.

CAUTION:

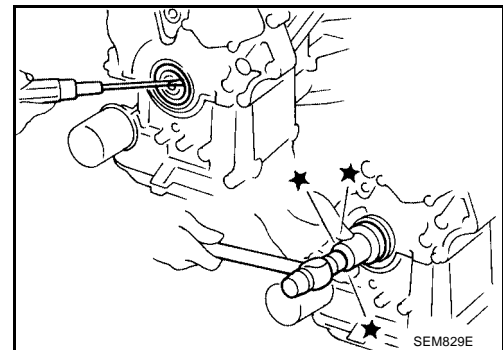
Do not damage the mating surfaces.



50. Remove the front oil seal from the front timing chain case using a suitable tool.

CAUTION:

Do not damage the front cover.



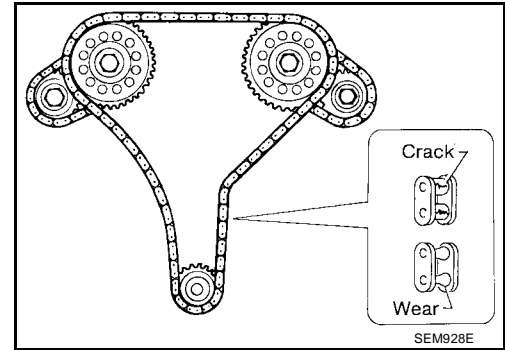
TIMING CHAIN

[VQ35DE]

Inspection

EBS00DVD

Check for cracks and any excessive wear at the roller links of the timing chain. Replace the timing chain as necessary.

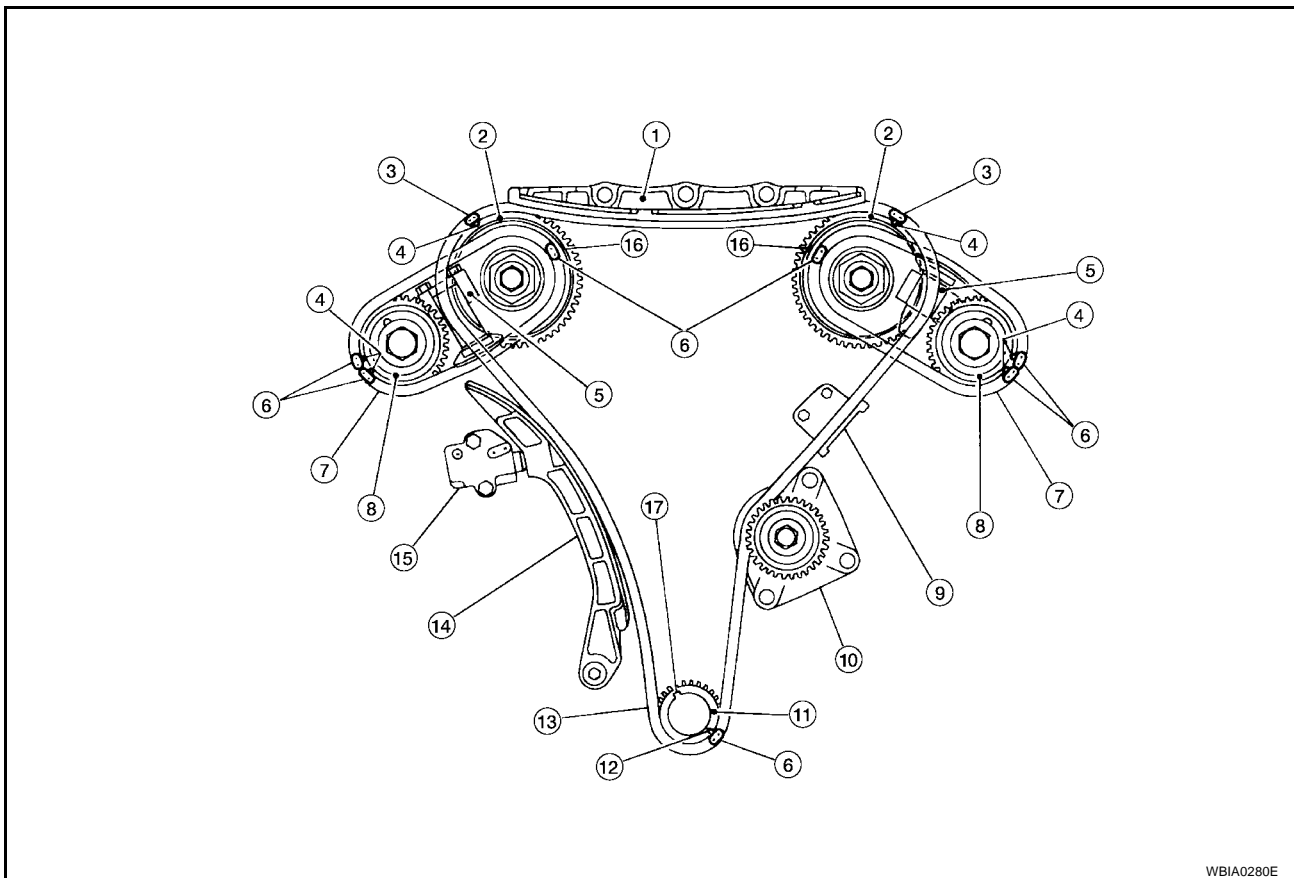


Installation

EBS00DVE

NOTE:

The figure shows the relationship between the mating mark on each timing chain and that on the corresponding sprocket, the components installed.

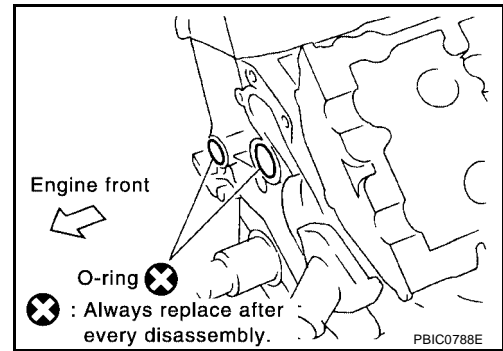


- | | | |
|-----------------------------|-------------------------------------|------------------------------------|
| 1. Internal chain guide | 2. Camshaft sprocket (intake) | 3. Mating mark (copper link) |
| 4. Mating mark (punched) | 5. Secondary timing chain tensioner | 6. Mating mark (gold link) |
| 7. Secondary timing chain | 8. Camshaft sprocket (exhaust) | 9. Tensioner guide |
| 10. Water pump | 11. Crankshaft sprocket | 12. Mating mark (notched) |
| 13. Primary timing chain | 14. Slack guide | 15. Primary timing chain tensioner |
| 16. Mating mark (back side) | 17. Crankshaft key | |

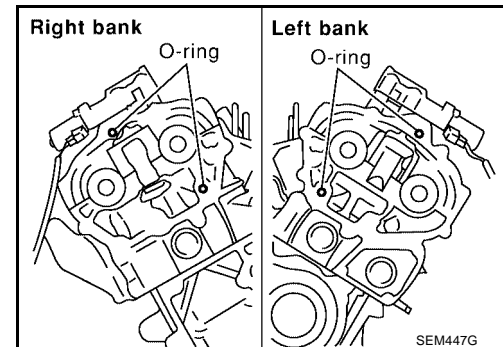
TIMING CHAIN

[VQ35DE]

1. Install rear timing chain case as follows:
 - a. Install O-rings on cylinder block.

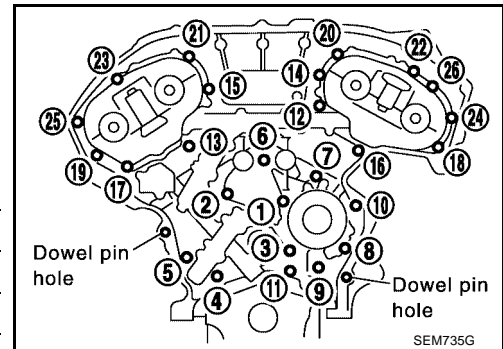


- b. Install O-rings on cylinder head.



2. Apply Genuine Silicone RTV Sealant or equivalent, to the rear timing chain case. Refer to [EM-160, "POSITION FOR APPLYING LIQUID GASKET"](#).
3. Align the rear timing chain case and water pump assembly with the dowel pins (RH and LH) on the cylinder block and install the case. Make sure the O-rings stay in place during installation.
- a. Tighten the mounting bolts in the numerical order as shown. There are two bolt lengths used. Follow the chart below for proper bolt length specifications.

Bolt position	Bolt length
1, 2, 3, 6, 7, 8, 9, 10	20 mm (0.79 in)
4, 5, 11 - 26	16 mm (0.63 in)



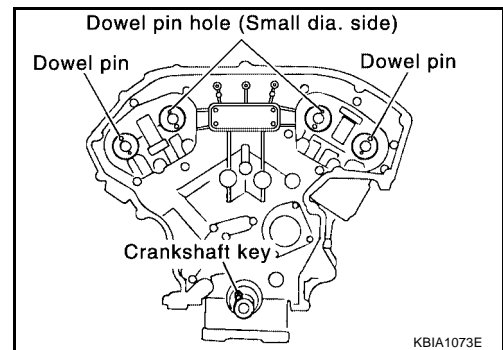
- b. After all bolts are initially tightened, retighten them to the specification in the numerical order as shown.

Rear timing chain case bolts : 12 - 13 N-m (1.2 - 1.4 kg-m, 9 -10 ft-lb)

4. Install the timing chain tension guide.
5. Position the crankshaft so No. 1 piston is set at TDC on the compression stroke.
 - Make sure that the dowel pin hole, dowel pin and crankshaft key are located as shown.
 - Camshaft dowel pin hole (intake side): at cylinder head upper face side in each bank.
 - Camshaft dowel pin (exhaust side): at cylinder head upper face side in each bank.
 - Crankshaft key: at cylinder head side of RH bank.

CAUTION:

Hole on small diameter side must be used for intake camshaft sprocket dowel pin. Do not misidentify (ignore big diameter side).



TIMING CHAIN

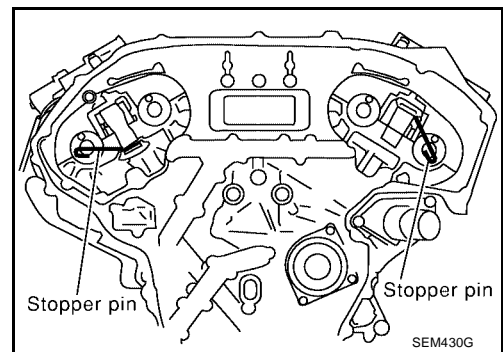
[VQ35DE]

6. Install the secondary timing chains and camshaft sprockets.

CAUTION:

Matching marks between the timing chain and sprockets slip easily. Confirm all matching mark positions repeatedly during the installation process.

- Push the sleeve of the secondary chain tensioner and keep it pressed in with a stopper pin.

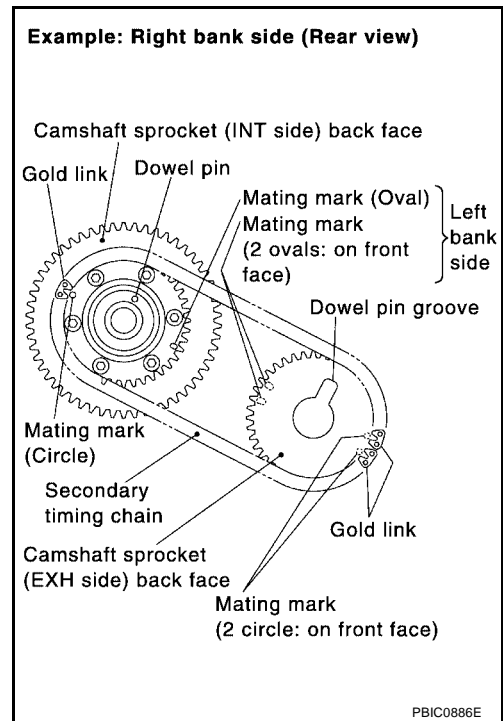


- a. Align the matching marks on the secondary timing chain (gold link) with the ones on the intake and exhaust sprockets (stamped), and install them.

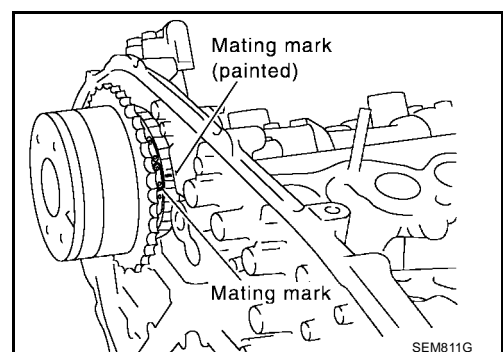
- Matching marks for the intake sprocket are on the back side of the secondary sprocket.
- There are two types of matching marks, round and oval types. They should be used for the RH and LH banks, respectively.
RH bank: use round type.
LH bank: use oval type.

- b. Align the dowel pin and pin hole on the camshaft with the groove and dowel pin on the sprocket, and install them.

- On the intake side, align the pin hole on the small diameter side of the camshaft front end with the dowel pin on the back side of the camshaft sprocket, and install them.
- On the exhaust side, align the dowel pin on the camshaft front end with the pin groove on the camshaft sprocket, and install them.
- Mounting bolts for the camshaft sprockets must be tightened in the next step. Tightening them by hand is enough to prevent the dislocation of the dowel pins.

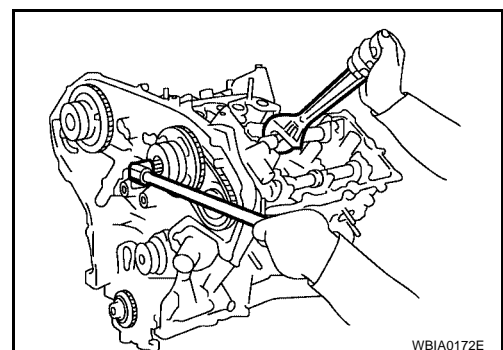


- It may be difficult to visually check the dislocation of mating marks during and after installation. To make the matching easier, make a mating mark on the sprocket teeth in advance with paint.



7. After confirming the mating marks are aligned, tighten the camshaft sprocket mounting bolts.

- Secure the camshaft using a wrench at the hexagonal portion to tighten the mounting bolts.

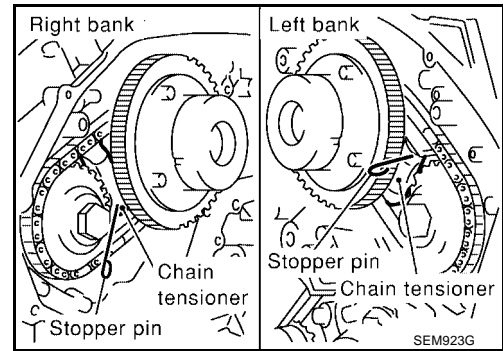


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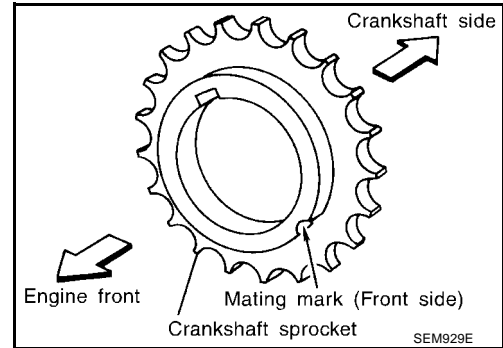
TIMING CHAIN

[VQ35DE]

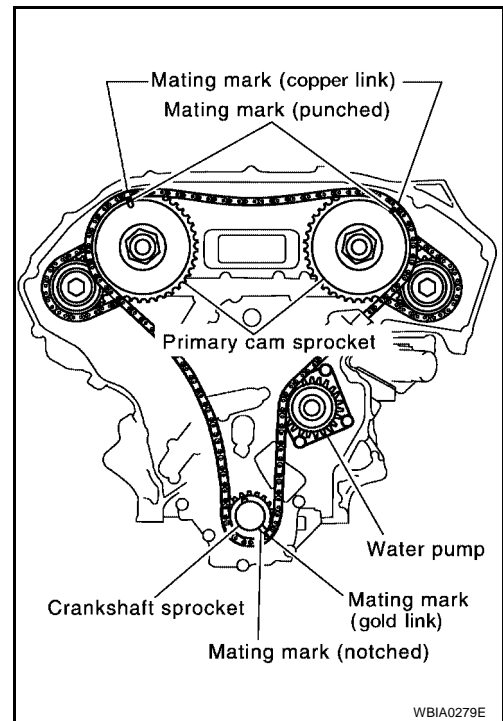
8. Pull the stopper pins out from the secondary timing chain tensioners.



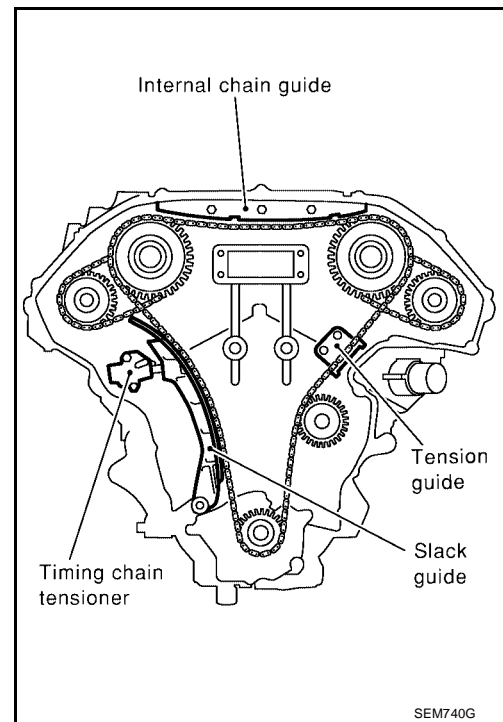
9. Install the crankshaft sprocket on the crankshaft.
- Make sure the mating marks on the crankshaft sprocket face the front of the engine.



10. Install the primary timing chain.
- Install primary timing chain so the mating mark (punched) on camshaft sprocket is aligned with the copper link on the timing chain, while the mating mark (notched) on the crankshaft sprocket is aligned with the orange one on the timing chain, as shown.
 - When it is difficult to align mating marks of the primary timing chain with each sprocket, gradually turn the camshaft using a wrench on the hexagonal portion to align it with the mating marks.
 - During alignment, be careful to prevent dislocation of mating mark alignments of the secondary timing chains.

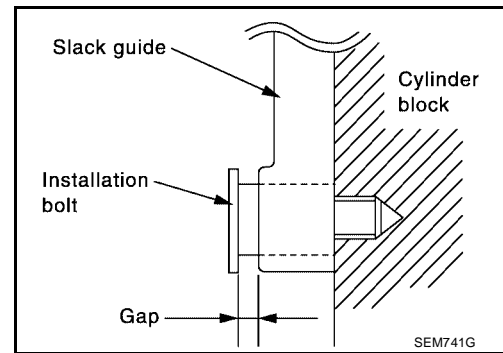


11. Install the internal chain guide.



12. Install the slack guide.

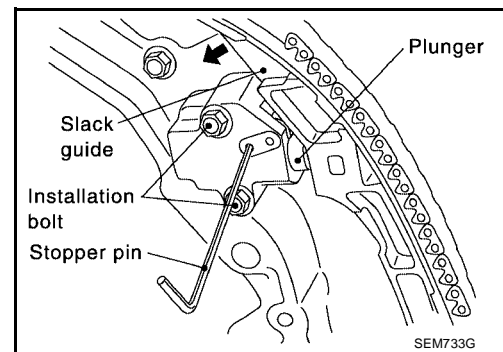
- Do not overtighten the slack guide mounting bolts. It is normal for a gap to exist under the bolt seats when the mounting bolts are tightened to specification.



13. Install the timing chain tensioner for the slack guide.

- When installing the chain tensioner, push in the sleeve and keep it pressed in with the stopper pin.
- Remove any dirt and foreign materials completely from the back and the mounting surfaces of the chain tensioner.
- After installation, pull out the stopper pin by pressing the slack guide.

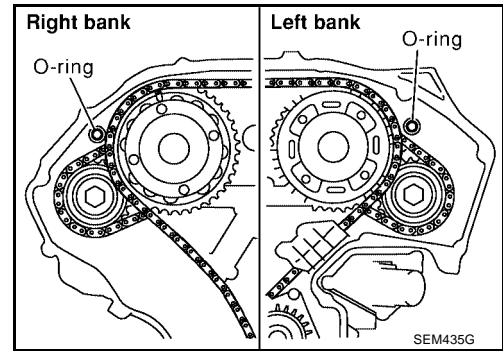
14. Reconfirm that the matching marks on the sprockets and the timing chain have not slipped out of alignment.



TIMING CHAIN

[VQ35DE]

15. Install new O-rings on the rear timing chain case.



16. Install the front oil seal on the front timing chain case using a suitable tool. Apply clean engine oil to the oil seal edges.

- Install it so that each seal lip is oriented as shown.

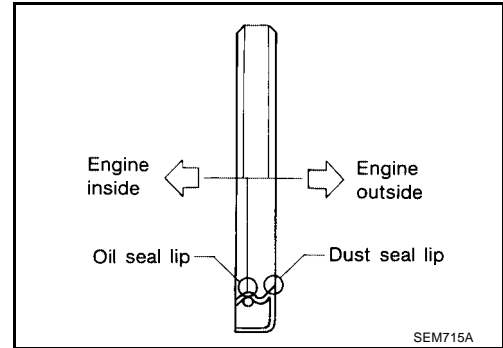
Suitable drift

Outer diameter : 59 mm (2.32 in)

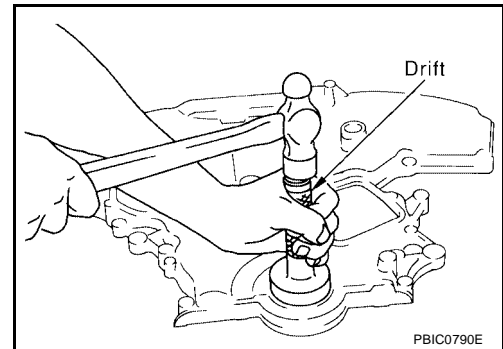
Inner diameter : 49 mm (1.93 in)

CAUTION:

Press fit straight and avoid causing burrs or tilting the oil seal.



- Using a suitable drift, press-fit oil seal until it becomes flush with timing chain case end face.
- Make sure the garter spring in the oil seal is in position and seal lip is not inverted.



17. Apply Silicone RTV Sealant to front timing chain case.

Refer to [EM-160, "POSITION FOR APPLYING LIQUID GASKET"](#) .

- Use Genuine Silicone RTV Sealant, or equivalent. Refer to [MA-13, "RECOMMENDED FLUIDS AND LUBRICANTS"](#) .
- **Before installation, wipe off the protruding sealant.**

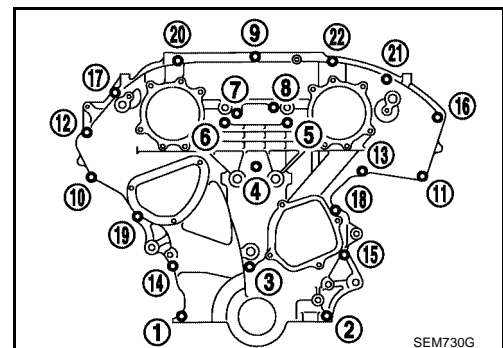
18. Install the rear case pin into dowel pin hole on front timing chain case.

19. Tighten bolts to the specified torque in order shown in the figure.

Bolt position

1, 2 : 25.5 - 31.4 N-m (2.6 - 3.2 kg-m, 18.8 - 23.1 ft-lb)

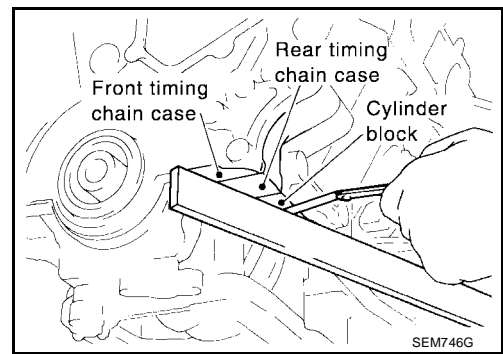
3 - 22 : 11.8 - 13.7 N-m (1.2 - 1.4 kg-m, 8.7 - 10.1 ft-lb)



TIMING CHAIN

[VQ35DE]

20. After installing the front timing chain case, check the surface height difference between the following parts on the oil pan mounting surface.
- If not within specification, repeat the installation procedure.



Front timing chain case to rear timing chain case

: (-0.14) - 0.14 mm [(-0.0055) - 0.0055 in]

Oil pump to cylinder block

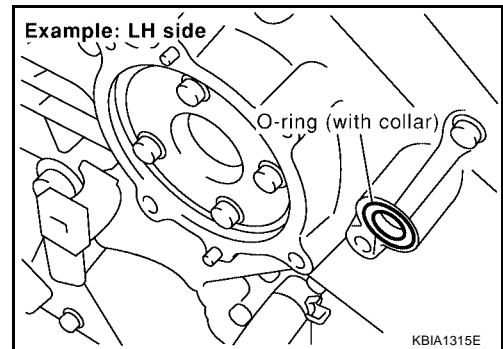
: (-0.36) - (-0.10) mm [(-0.0142) - (-0.0039) in]

Rear timing chain case to cylinder block

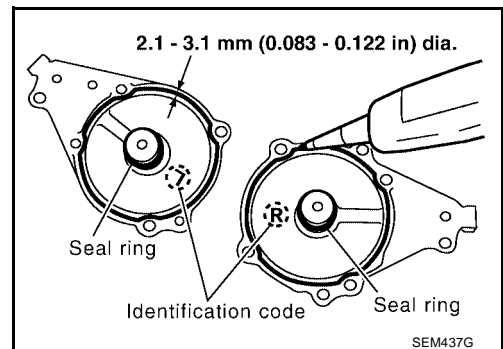
: (-0.24) - 0.14 mm [(-0.0094) - 0.0055 in]

21. Install IVT control valve covers as follows:

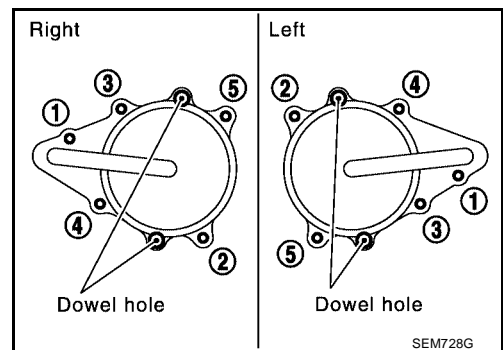
- a. Install new collared O-rings in front cover oil hole (LH and RH sides).



- b. Install new seal rings on the IVT control covers.
 c. Apply Silicone RTV Sealant to the IVT control covers. Use Silicone RTV Sealant, or equivalent. Refer to [GI-43, "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS"](#).



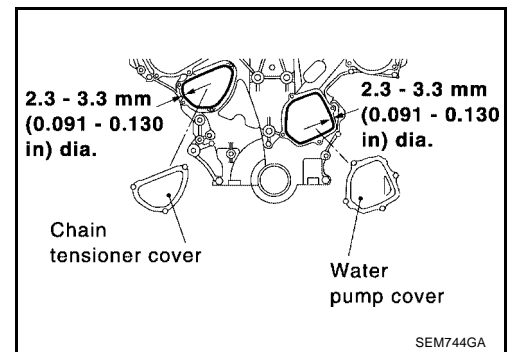
- Being careful not to move the seal ring from the installation groove, align the dowel pins on the chain case with the holes to install the IVT control covers.
- Tighten in the numerical order as shown.



TIMING CHAIN

[VQ35DE]

22. Install the water pump cover and the chain tensioner cover. Apply Silicone RTV Sealant or equivalent. Refer to [GI-43, "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS"](#).

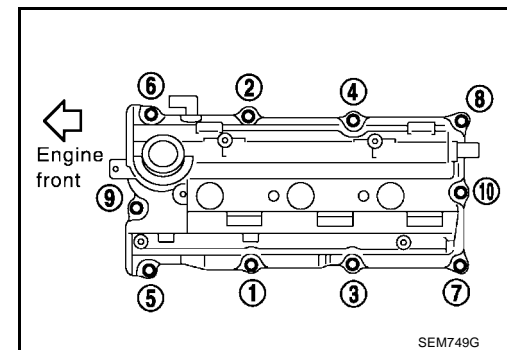
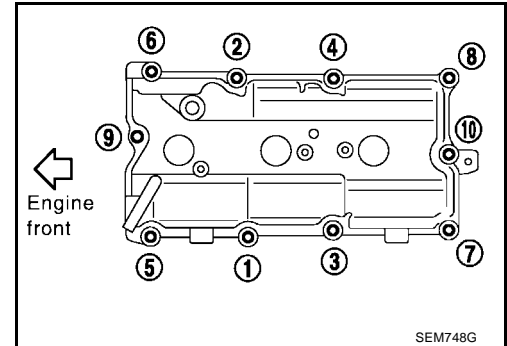


23. Install the RH and LH rocker covers.
Rocker cover tightening procedure:

- Tighten the rocker cover bolts in two stages in the numerical order as shown.

Stage 1 : 0.96 - 2.96 N·m (0.1 - 0.3 kg·m, 9 - 26 in·lb)

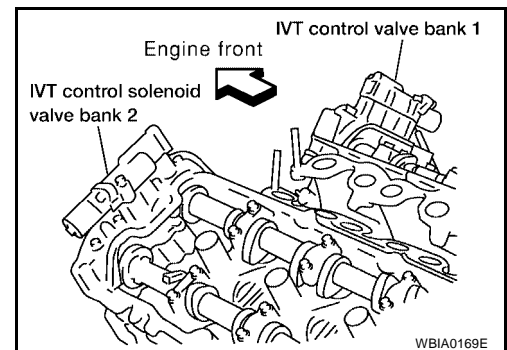
Stage 2 : 7.33 - 9.33 N·m (0.75 - 0.95 kg·m, 65 - 82 in·lb)



24. Install the IVT control solenoid valve bank 1 and bank 2.

IVT control solenoid valve bolts : 10 - 12 N·m (1.0 - 1.3 kg·m, 87 - 112 in·lb)

25. Install the engine oil dipstick.



TIMING CHAIN

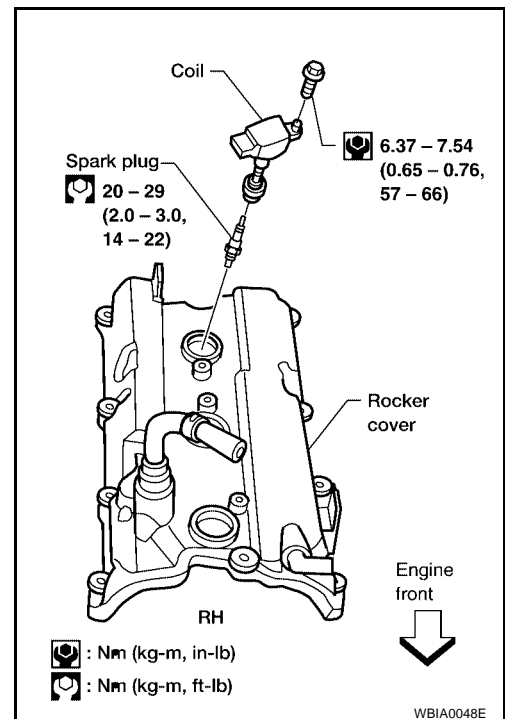
[VQ35DE]

26. Install the six spark plugs to their original positions.

Spark plugs (6) : 20 - 29 N·m (2.0 - 3.0 kg-m, 14 - 22 ft-lb)

27. Install the six ignition coils to their original positions.

Ignition coils (6) : 6.37 - 7.54 N·m (0.65 - 0.76 kg-m, 57 - 66 in-lb)



28. Install the intake manifold collector. Tighten the bolts and nuts in numerical order as shown.

Intake manifold collector bolts : 18 - 21 N·m (1.8 - 2.2 kg-lb, 13 - 15 ft-lb)

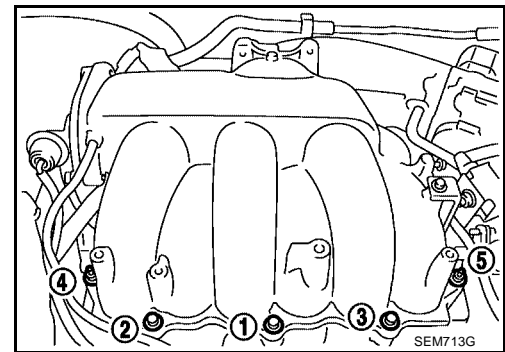
29. Connect the EVAP purge volume control solenoid hose.

30. Connect the PCV hose.

31. Connect the coolant hoses to the electric throttle control actuator.

32. Connect the power brake booster vacuum hose.

33. Connect the electric throttle control actuator harness electrical connector.

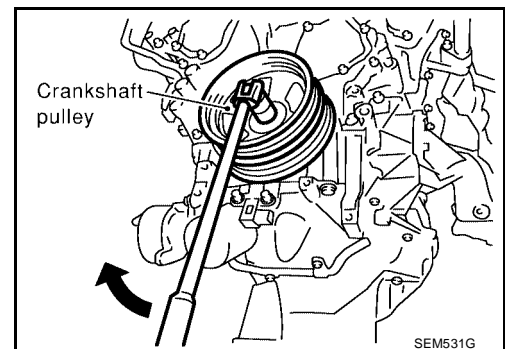


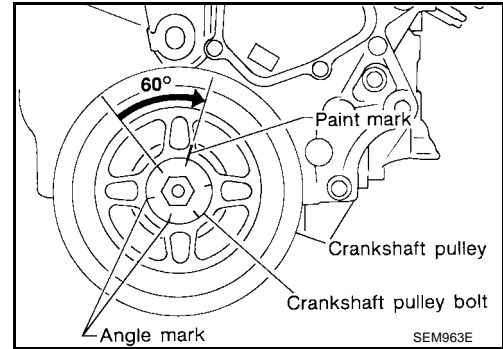
34. Install crankshaft pulley and tighten the bolt in two stages.

- Lubricate thread and seat surface of the bolt with new engine oil.
- Apply a paint mark for the second stage of angle tightening.

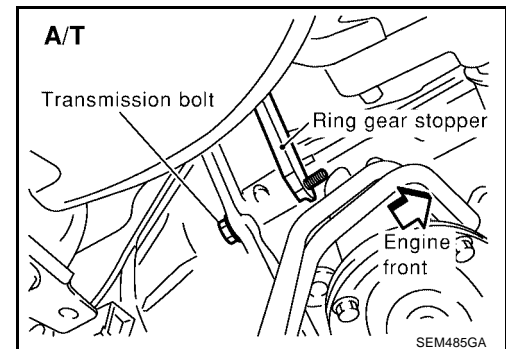
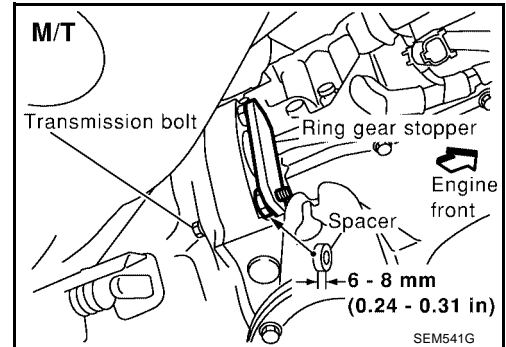
Stage 1 : 39 - 49 N·m (4.0 - 5.0 kg-m, 29 - 36 ft-lb)

Stage 2 : 60° - 65° degrees clockwise





35. Remove the ring gear stopper.



36. Install the starter motor.
Refer to [SC-19, "Removal and Installation"](#) .

37. Install the RH engine mount and bracket.

Engine mount to frame bolts (2)	: 66 - 74 N·m (6.7 - 7.6 kg·m, 49 - 54 ft·lb)
Engine mount bracket to front cover bolts (2)	: 79 - 90 N·m (8.0 - 9.2 kg·m, 58 - 66 ft·lb)
Engine mount bracket to front cover nut (1)	: 10 - 15 N·m (1.0 - 1.6 kg·m, 87 - 138 in·lb)
Engine mount to bracket nuts (2)	: 49 - 58 N·m (5.0 - 6.0 kg·m, 37 - 43 ft·lb)

38. Reposition and reconnect the engine harness.

39. Install the alternator.
Refer to [SC-29, "Removal and Installation"](#) .

40. Install the upper and lower oil pans.
Refer to [EM-130, "Removal and Installation"](#) .

41. Install the power steering pump.
Refer to [PS-20, "Removal and Installation"](#) .

42. Install the A/C compressor and recharge the system.
Refer to [ATC-121, "Removal and Installation for Compressor"](#) .

43. Install the idler pulley and the drive belts.
Refer to [EM-119, "Checking Drive Belts"](#) .

44. Install the inner fender splash shield and the engine undercovers.

45. Install the RH wheel and tire.
Refer to [WT-4, "WHEEL AND TIRE ASSEMBLY"](#) .

TIMING CHAIN

[VQ35DE]

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46. Install the windshield wiper assembly and the cowl top grille.
Refer to [EI-18, "Removal and Installation"](#) .
47. Install the fuel hose quick connector to the fuel tube at the vehicle piping side.
Refer to [EM-140, "Removal and Installation"](#) .
48. Install the engine coolant reservoir.
49. Install the intake air duct with the air cleaner case lid and mass air flow sensor.
50. Install engine cover.
51. Refill the engine with oil and coolant.
Refer to [MA-13, "Fluids and Lubricants"](#) .
- CAUTION:**
Wait at least 30 minutes for the Silicone RTV Sealant to set before filling the engine with fluids to avoid leaks.
52. Install the battery.
53. Activate the fuel system. Check for any leaks when the system is repressurized and correct as necessary.
54. Start the engine and check all systems for leaks or improper operation. Correct as necessary.
- **After starting engine, keep idling for three minutes. Then rev engine up to 3,000 rpm under no load to purge air from the high-pressure oil chamber of the chain tensioners. The engine may produce a rattling noise. This indicates that air still remains in the chamber and is not a matter of concern.**

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OIL SEAL

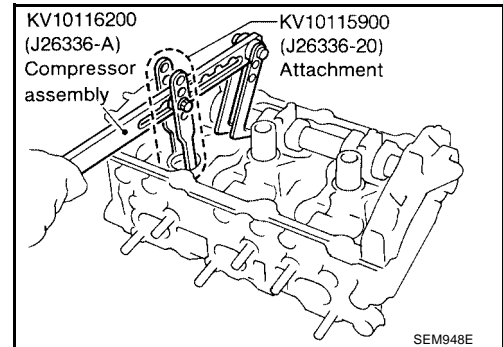
Removal and installation of Valve Oil Seal
REMOVAL

1. Remove camshaft relating to valve oil seal to be removed. Refer to [EM-145, "CAMSHAFT"](#) .
2. Remove valve lifter. Refer to [EM-145, "CAMSHAFT"](#) .
3. Rotate crankshaft, and set piston whose oil seal is to be removed to top dead center. This prevents valve from dropping inside cylinder.

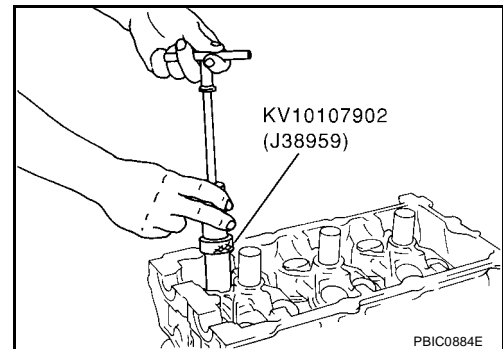
CAUTION:

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 with Tool.



5. Remove valve oil seal with Tool.



INSTALLATION

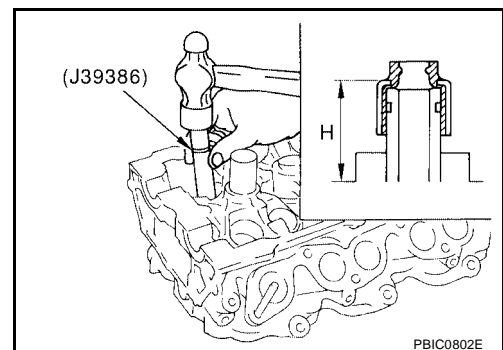
1. Apply new engine oil to new valve oil seal joint surface and seal lip.
2. Press in valve oil seal to height "H" with Tool to specified height.

NOTE:

Dimension "H": height measured before valve spring seat installation.

Intake and exhaust : 14.3 - 14.9 mm (0.563 - 0.587 in)

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

Removal and Installation of Front Oil Seal
REMOVAL

1. Remove the following parts:
 - Engine under cover
 - Drive belts. Refer to [EM-119, "DRIVE BELTS"](#) .
 - Radiator fan. Refer to [CO-32, "RADIATOR"](#) .
2. Remove the crankshaft pulley as follows:
 - a. Remove the starter motor. Refer to [SC-19, "Removal and Installation"](#) .

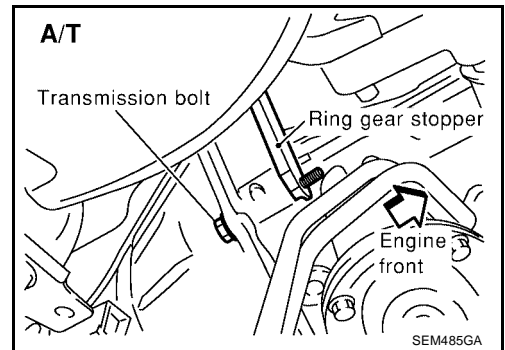
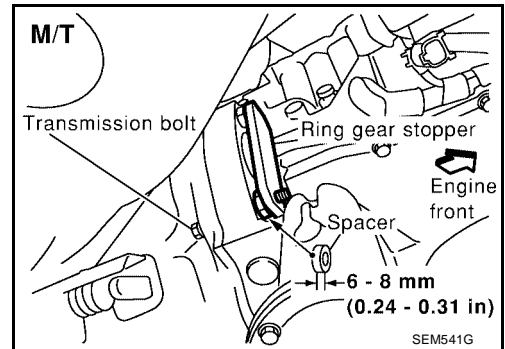
OIL SEAL

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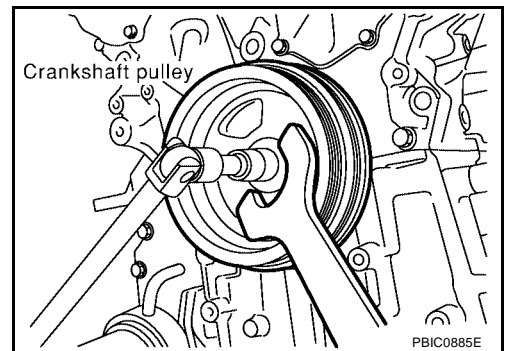
- b. Set the ring gear stopper using the mounting bolt hole.

CAUTION:

Do not damage the ring gear teeth, or the signal plate teeth behind the ring gear when setting the stopper.



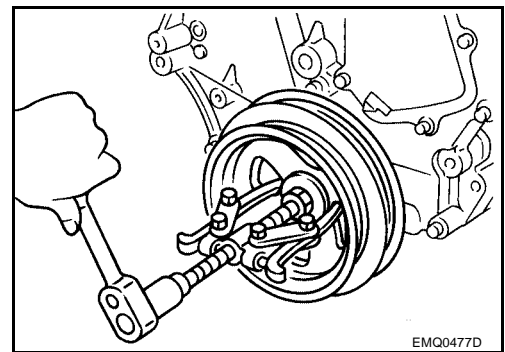
- c. Loosen crankshaft pulley mounting bolt using pulley holder and locate bolt seating surface at 10 mm (0.39 in) from its original position.



- d. Position a pulley puller at recess hole of crankshaft pulley to remove crankshaft pulley.

CAUTION:

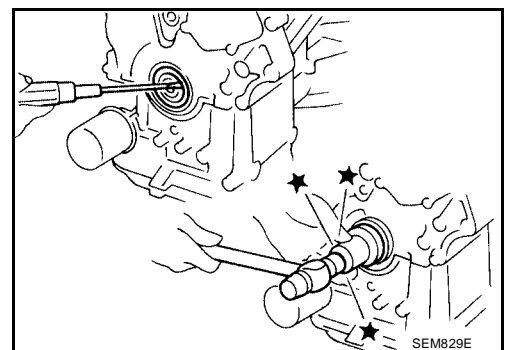
Do not use a puller claw on crankshaft pulley periphery.



3. Remove front oil seal from front cover.

CAUTION:

Be careful not to damage front cover or crankshaft.



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INSTALLATION

1. Apply new engine oil to new oil seal and install it flush with front of mounting surface using a suitable tool.
 - Install new oil seal in the direction shown.

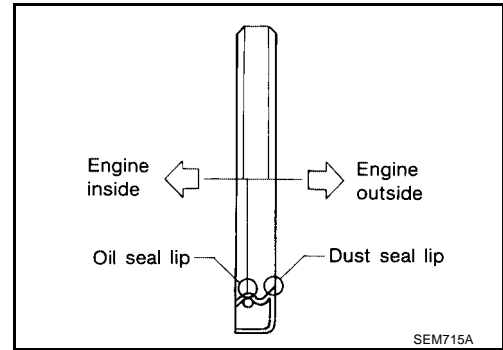
Suitable drift

Outer diameter : 59 mm (2.32 in)

Inner diameter : 49 mm (1.93 in)

CAUTION:

Press fit straight and avoid causing burrs or tilting the oil seal.



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

Removal and Installation of Rear Oil Seal

REMOVAL

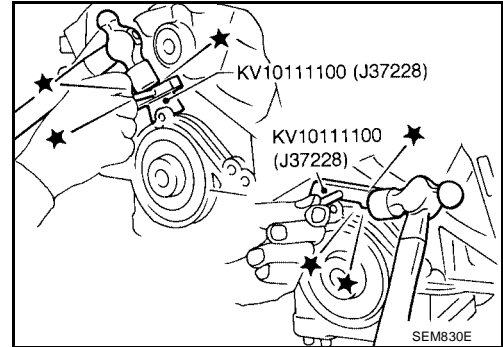
1. Remove oil pan (upper). Refer to [EM-130, "Removal and Installation"](#) .
2. Remove the transaxle. Refer to [MT-16, "Removal and Installation"](#) (M/T), [AT-270, "REMOVAL AND INSTALLATION"](#) (A/T).
3. Remove flywheel (MT) or drive plate (AT).
4. Use a seal cutter to cut away liquid gasket and remove rear oil seal retainer. Refer to [EM-112, "REMOVAL OF LIQUID GASKET SEALING"](#) .

CAUTION:

- Be careful not to damage mounting surface.
- If rear oil seal retainer is removed, replace it with a new one.

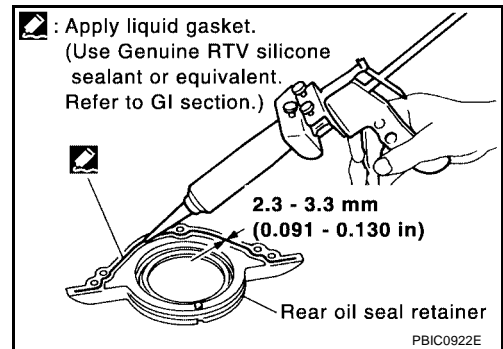
NOTE:

Rear oil seal and retainer form a single part and are handled as an assembly.



INSTALLATION

1. Remove oil liquid gasket on mating surface of cylinder block and oil pan using a scraper.
2. Apply liquid gasket to rear oil seal retainer using tube presser as shown.
 - Use Genuine Silicone RTV Sealant or equivalent. Refer to [MA-13, "RECOMMENDED FLUIDS AND LUBRICANTS"](#) .
 - Assembly should be completed within 5 minutes after coating.



3. Install rear oil seal retainer to cylinder block.

Rear oil seal retainer mounting bolts : 8.2 - 9.3 N-m (0.83 - 0.95 kg-m, 72 - 82 in-lb)

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

CYLINDER HEAD

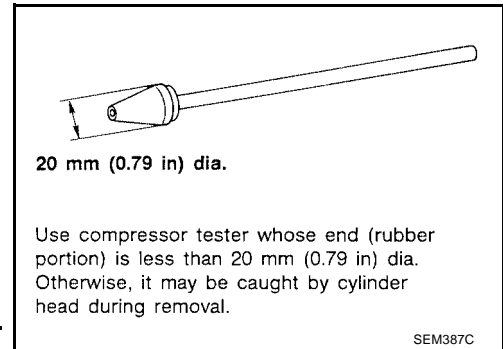
On-Vehicle Service

CHECKING COMPRESSION PRESSURE

1. Run the engine until it reaches normal operating temperature.
2. Turn the ignition switch to OFF.
3. Release fuel pressure and leave the fuel pump electrically disconnected.
Refer to [EC-646, "FUEL PRESSURE RELEASE"](#) .
4. Remove all six spark plugs.
Refer to [EM-138, "Removal and Installation"](#) .
5. Attach a compression tester to No. 1 cylinder.
6. Depress accelerator pedal fully to keep the electric throttle control actuator butterfly-valve wide open to maximize air intake flow.
7. Crank the engine and record the highest gauge indication.
8. Repeat the measurement on each cylinder (steps 5 - 7).
 - **Always use a fully-charged battery to obtain specified engine speed.**

Unit: kPa (kg/cm² , psi)/rpm

Standard	Minimum	Difference limit between cylinders
1,275 (13.0, 185)/300	981 (10.0, 142)/300	98 (1.0, 14)/300

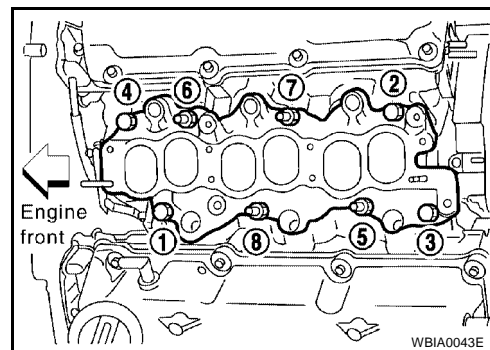


9. If compression in one or more cylinders is low:
 - a. Pour a small amount of engine oil into cylinders through the spark plug holes.
 - b. Retest compression (steps 5 - 8).
 - **If adding oil helps raise compression pressure, then the piston rings may be worn or damaged. If so, replace piston rings after checking piston.**
 - **If the pressure stays low, a valve may be sticking or is seating improperly. Inspect and repair the valve and/or valve seat. Refer to [EM-230, "VALVE"](#) . If the valve and/or valve seat is damaged excessively, replace as necessary.**
 - **If compression stays low in two or more cylinders that are next to each other:**
 - The cylinder head gasket may be leaking.
 - Both cylinders may have valve component damage. Inspect and repair as necessary.

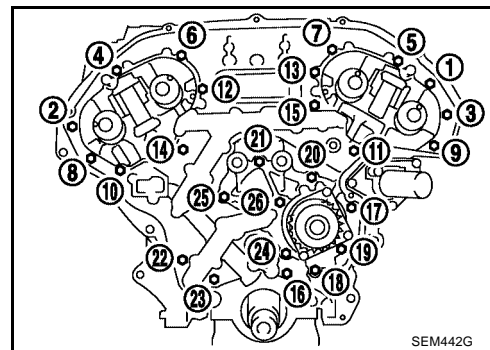
CYLINDER HEAD

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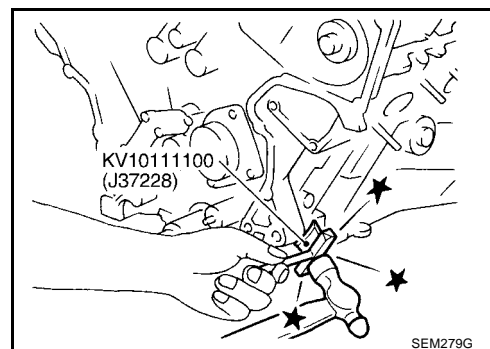
3. Remove the intake manifold using power tool.
 - Loosen the bolts in the numerical order as shown.
4. Remove the coolant outlet housing.



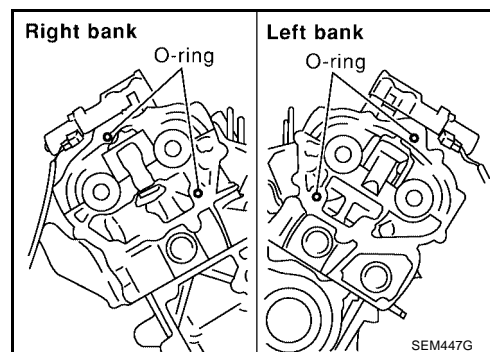
5. Remove rear timing chain case bolts using power tool.
 - Loosen the bolts in the numerical order as shown.



6. Remove rear timing chain case using Tool.



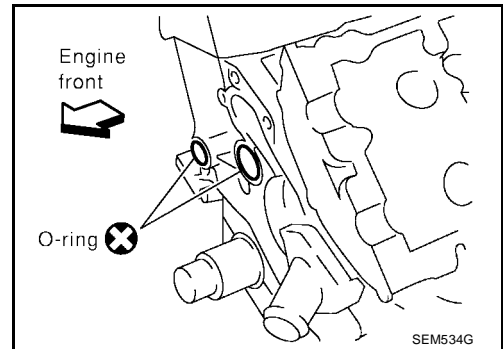
7. Remove the O-rings from the front of the cylinder heads.
 - Discard the O-rings and use new O-rings for installation.



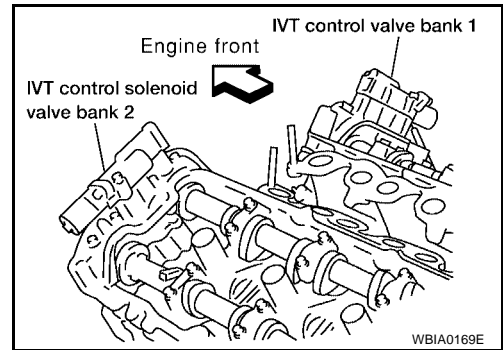
CYLINDER HEAD

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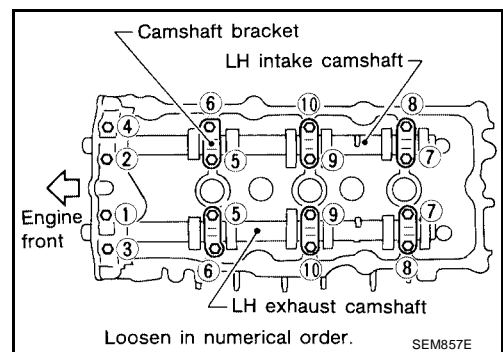
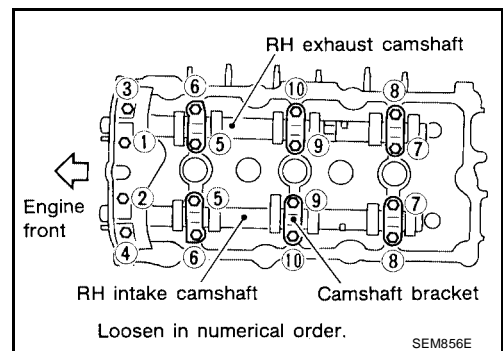
8. Remove the O-rings from the cylinder block.
- Discard the O-rings and use new O-rings for installation.



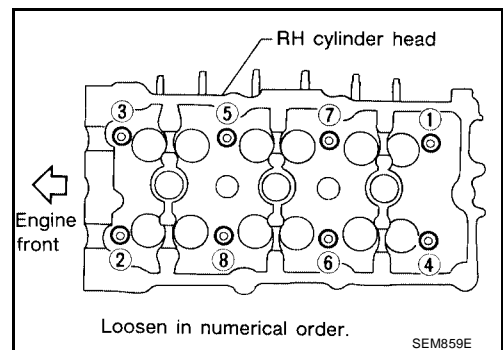
9. Remove the IVT control valves.
- Discard the IVT control valve gaskets and use new gaskets for installation.



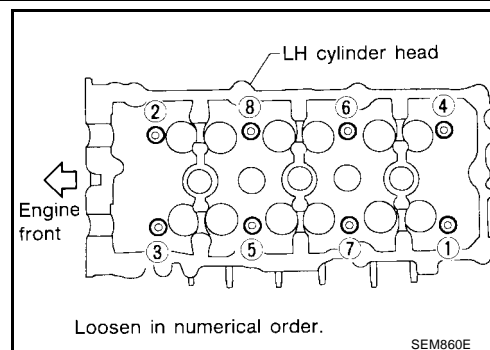
10. Remove the intake and exhaust camshafts and the camshaft brackets.
- Mark the camshaft brackets so they are placed in the same position and direction for installation.
 - Equally loosen the camshaft bracket bolts in several steps in the numerical order shown.



11. Remove the RH and LH cylinder head bolts, with power tool.
- The bolts should be loosened gradually in three stages.
 - Loosen the bolts in the numerical order as shown.

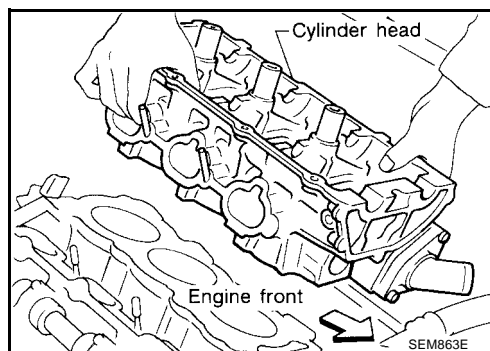


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12. Remove cylinder heads and gaskets.

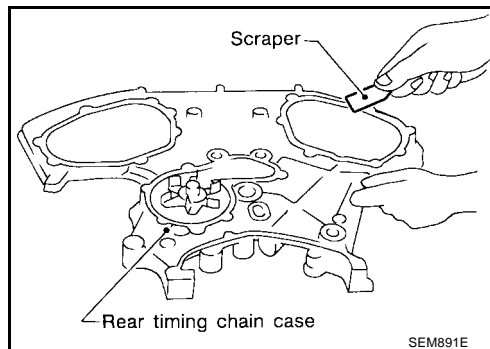
- Discard the cylinder head gaskets and use new gaskets for installation.



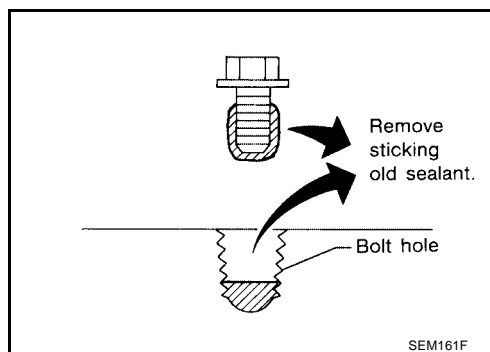
INSTALLATION

1. Before installing the rear timing chain case, remove the old Silicone RTV Sealant from mating surface using a scraper.

- Also remove old sealant from mating surface of cylinder block.



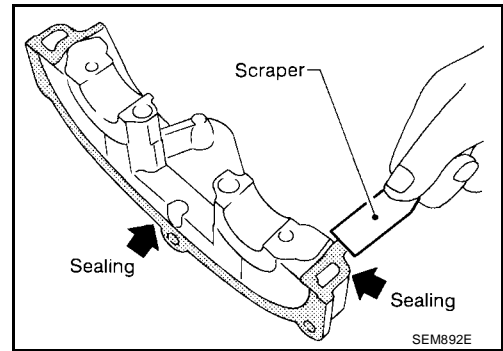
- Remove the old Silicone RTV Sealant from the bolt hole and thread.



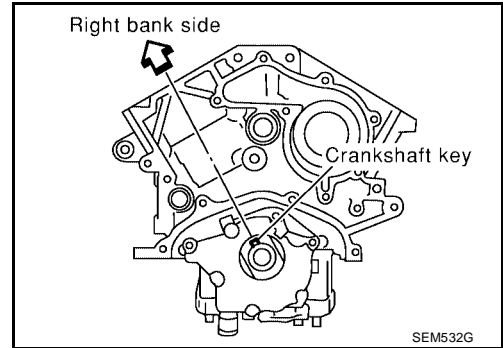
CYLINDER HEAD

[VQ35DE]

2. Before installing the front cam bracket, remove the old RTV Silicone Sealant from the mating surface using a scraper.
 - Do not scratch the mating surface.



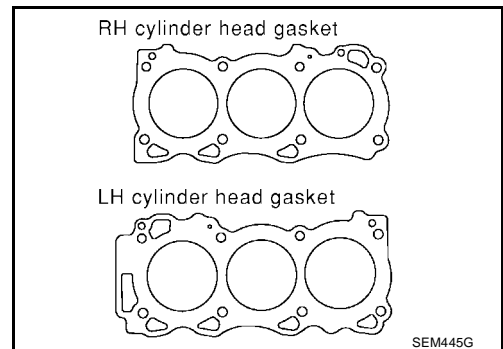
3. Turn the crankshaft until No. 1 piston is set at TDC on the compression stroke.
 - The crankshaft key should line up with the right bank cylinder center line as shown.



4. Install new gaskets on the cylinder heads.

CAUTION:

Do not rotate crankshaft and camshaft separately or valves will strike piston heads.



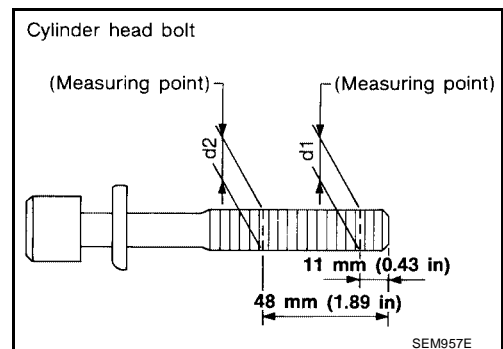
5. Inspect the cylinder head bolts before installing the cylinder heads.

CAUTION:

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

Limit (d1 - d2) : 0.11 mm (0.0043 in)

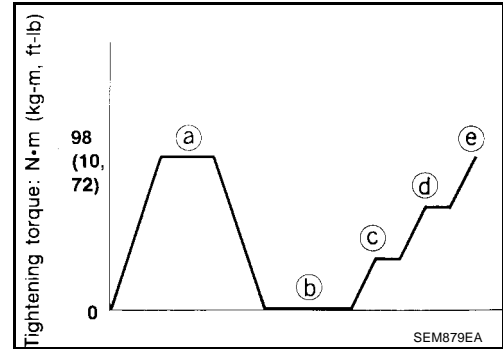
- Lubricate threads and seat surfaces of the bolts with new engine oil.



CYLINDER HEAD

[VQ35DE]

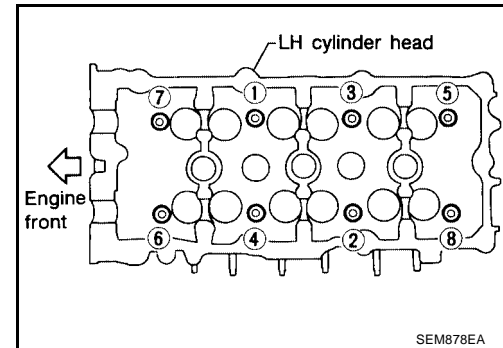
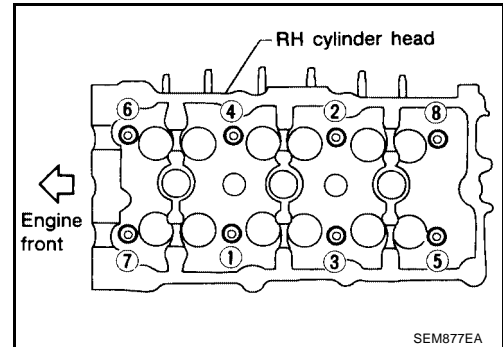
6. Install the cylinder heads on the cylinder block. Tighten the cylinder head bolts in the five stages in the numerical order as shown.



● **Tightening procedure:**

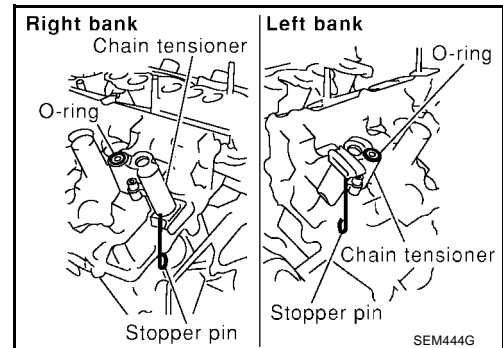
Cylinder head bolts

- Step a** : 98.1 N·m (10 kg-m, 72 ft-lb)
- Step b** : Loosen in the reverse order of tightening
- Step c** : 32.9 N·m (4.0 kg-m, 29 ft-lb)
- Step d** : 90° degrees rotation clockwise
- Step e** : 90° degrees rotation clockwise



7. Install camshaft chain tensioners on both sides of cylinder head.

Camshaft chain tensioner bolts : 7 - 10 N·m (0.7 - 1.0 kg-m, 62 - 89 in-lb)

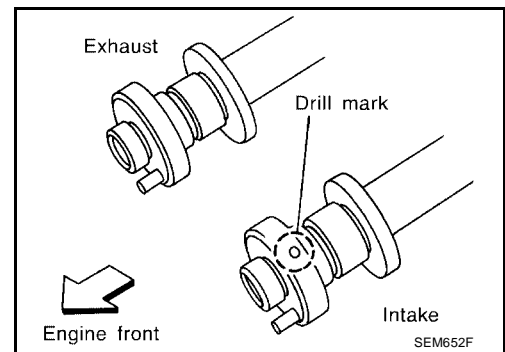


CYLINDER HEAD

[VQ35DE]

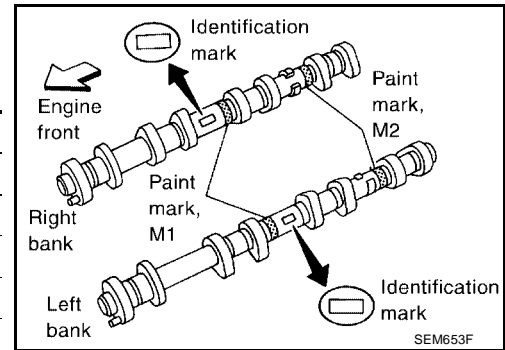
8. Install exhaust and intake camshafts and camshaft brackets.

- Intake camshaft has a drill mark on camshaft sprocket mounting flange.

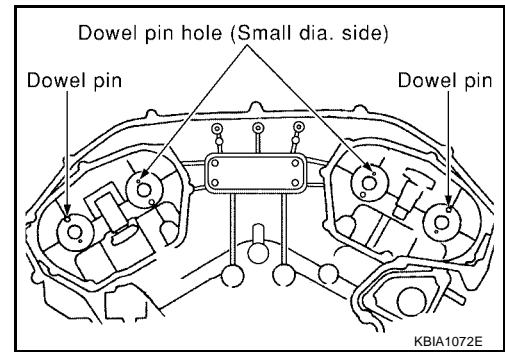


- Follow your identification marks made during removal, or follow the identification marks that are present on the new camshaft components for proper placement.

Bank	INT/EXH	ID mark	Drill mark	Paint marks	
				M1	M2
RH	INT	RE	Yes	Yes	No
	EXH	RE	No	No	Yes
LH	INT	LH	Yes	Yes	No
	EXH	LH	No	No	Yes

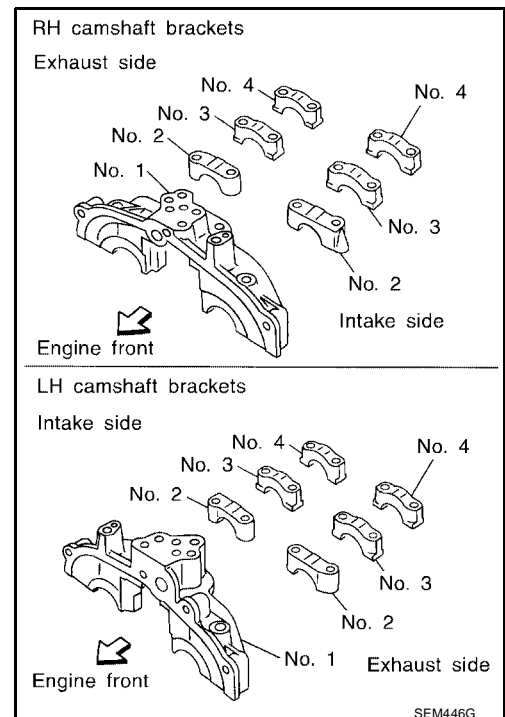


- Position the camshafts:
RH exhaust camshaft dowel pin at about 10 o'clock
LH exhaust camshaft dowel pin at about 2 o'clock.



9. Before installing camshaft brackets, apply sealant to mating surface of No. 1 journal head.

- Use Genuine RTV Silicone Sealant, or equivalent. Refer to [GI-43, "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS"](#).
- Refer to [EM-160, "POSITION FOR APPLYING LIQUID GASKET"](#).



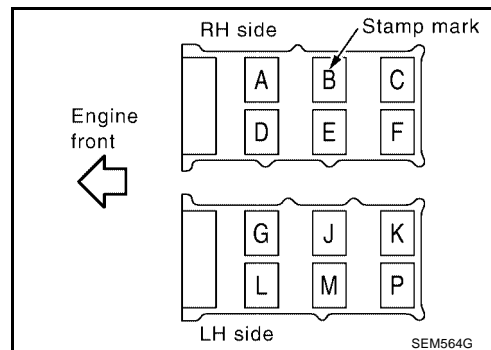
CYLINDER HEAD

[VQ35DE]

- Install camshaft brackets in their original positions and direction. Align the stamp marks as shown.
- If any part of valve assembly or camshaft is replaced, check and adjust the valve clearance. Refer to [EM-154, "Valve Clearance"](#).

Valve clearance (cold) : 0.26 - 0.34 mm
Intake (0.010 - 0.013 in)
Valve clearance (cold) : 0.29 - 0.37 mm
Exhaust (0.011 - 0.015 in)

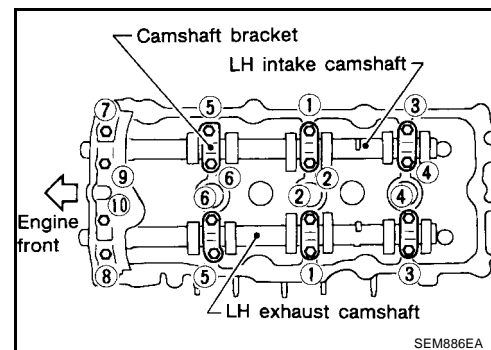
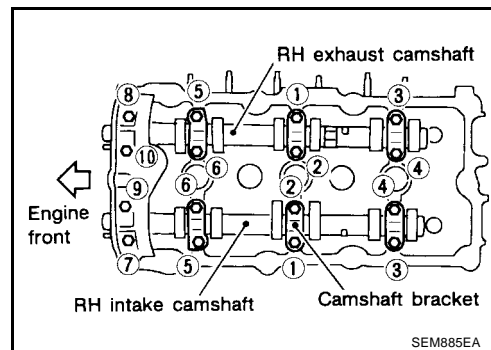
- Lubricate the threads and seat surfaces of the camshaft bracket bolts with new engine oil before installation.



10. Tighten the camshaft brackets in the following five steps in the numerical order shown.

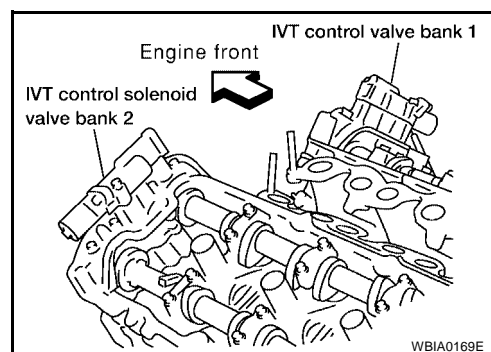
Camshaft bracket bolts

Step 1 (bolts 7 - 10) : 1.96 N·m (0.2 kg-m, 17 in-lb)
Step 2 (bolts 1 - 6) : 1.96 N·m (0.2 kg-m, 17 in-lb)
Step 3 : 5.88 N·m (0.6 kg-m, 52 in-lb)
Step 4 (bolts 1 - 6) : 10.4 N·m (1.1 kg-m, 92 in-lb)



11. Install the IVT control solenoid valves with new gaskets.

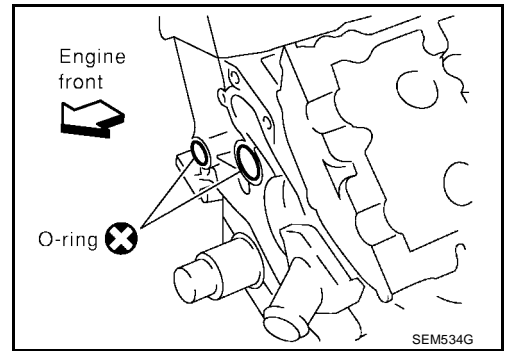
IVT control solenoid valve bolts : 10 - 12 N·m (1.0 - 1.3 kg-m, 87 - 112 in-lb)



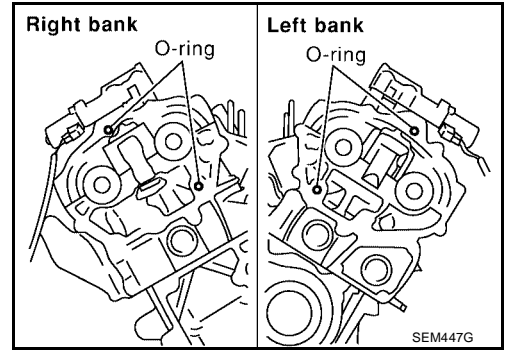
CYLINDER HEAD

[VQ35DE]

12. Install the new O-rings on the cylinder block.



13. Install the new O-rings on the cylinder head.



14. Apply sealant to the specified portion of the rear timing chain case. Refer to [EM-112, "Precautions for Liquid Gasket"](#).

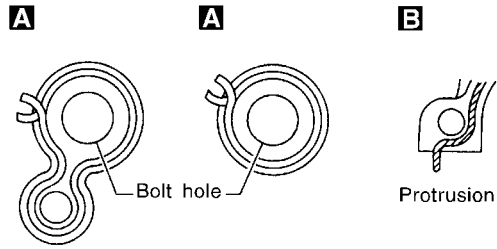
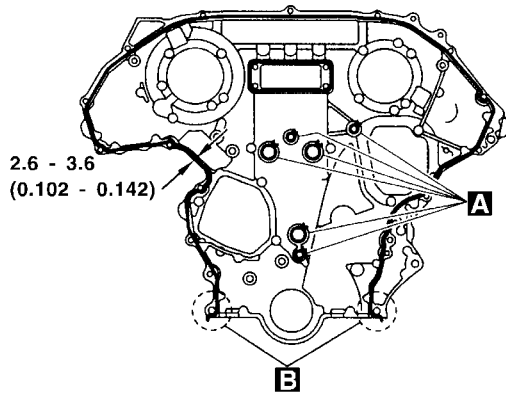
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CYLINDER HEAD

[VQ35DE]

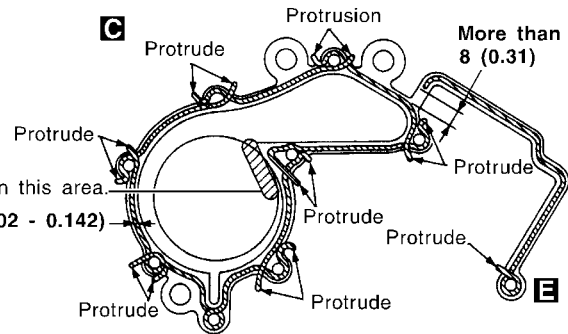
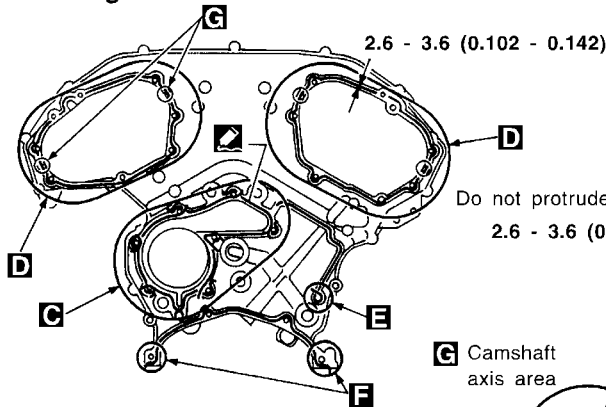
- Use Genuine Silicone RTV Sealant, or equivalent. Refer to [MA-13. "RECOMMENDED FLUIDS AND LUBRICANTS"](#).

Front timing chain case



Sealant protrusion away from bolt hole

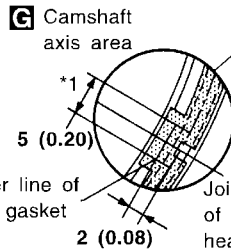
Rear timing chain case



D Cross both ends as shown and be sure to minimize the overlapped area.



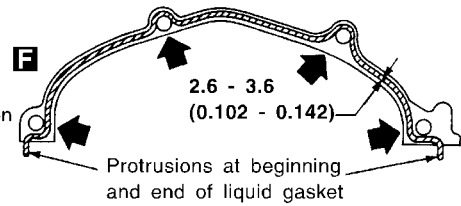
Protrusions at beginning and end of liquid gasket



Center line of rear timing chain case sealant groove

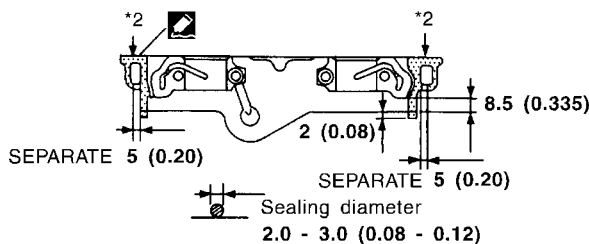
Center line of rear timing chain case sealant groove

← : Run along bolt hole outer side.



*1: Apply liquid gasket to the chamfered surface between camshaft bracket and cylinder head.

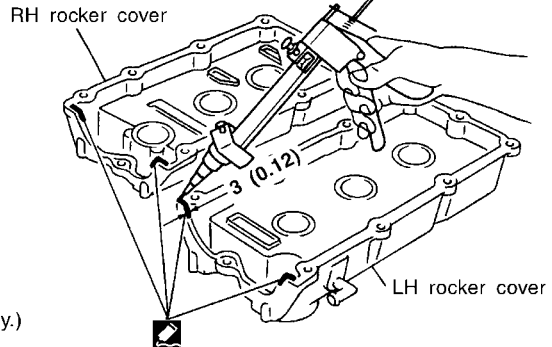
Camshaft bracket



*2: Remove the protruding sealant from front face. (Remove the hardened sealant from surface only.)

Unit: mm (in)

Rocker cover



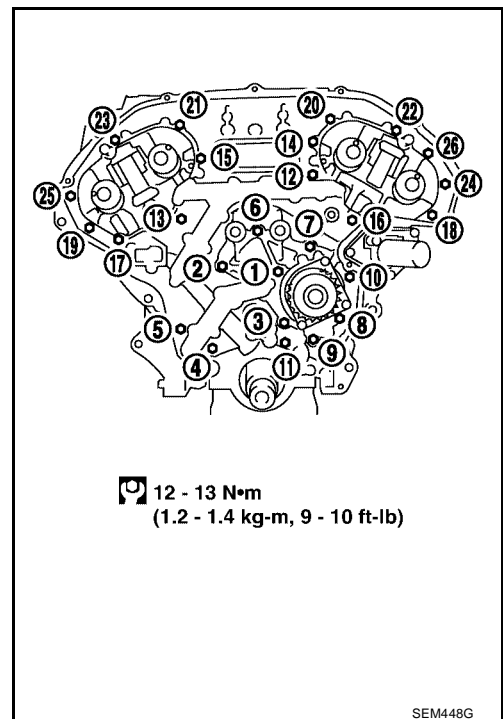
- Before installation, wipe off the protruding sealant.

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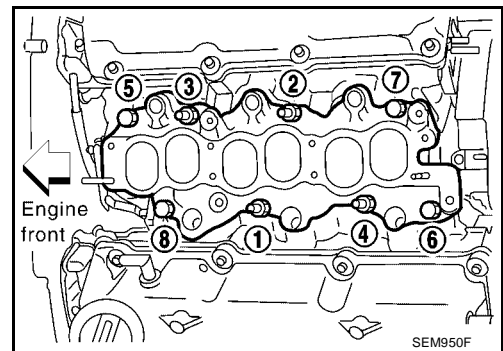
CYLINDER HEAD

[VQ35DE]

15. Align rear timing chain case with dowel pins, then install on cylinder head and block.
16. Tighten rear chain case bolts in two stages.
 - a. Tighten bolts in numerical order shown.
 - b. Retighten bolts in numerical order shown.
17. Install the coolant outlet housing.



18. Install the intake manifold with a new gasket.
 - Tighten the bolts in the numerical order as shown.
Step 1 : 5 - 10 N·m (0.5 - 1.0 kg-m, 44 - 86 in-lb)
Step 2 : 26 - 31 N·m (2.7 - 3.2 kg-m, 20 - 23 ft-lb)



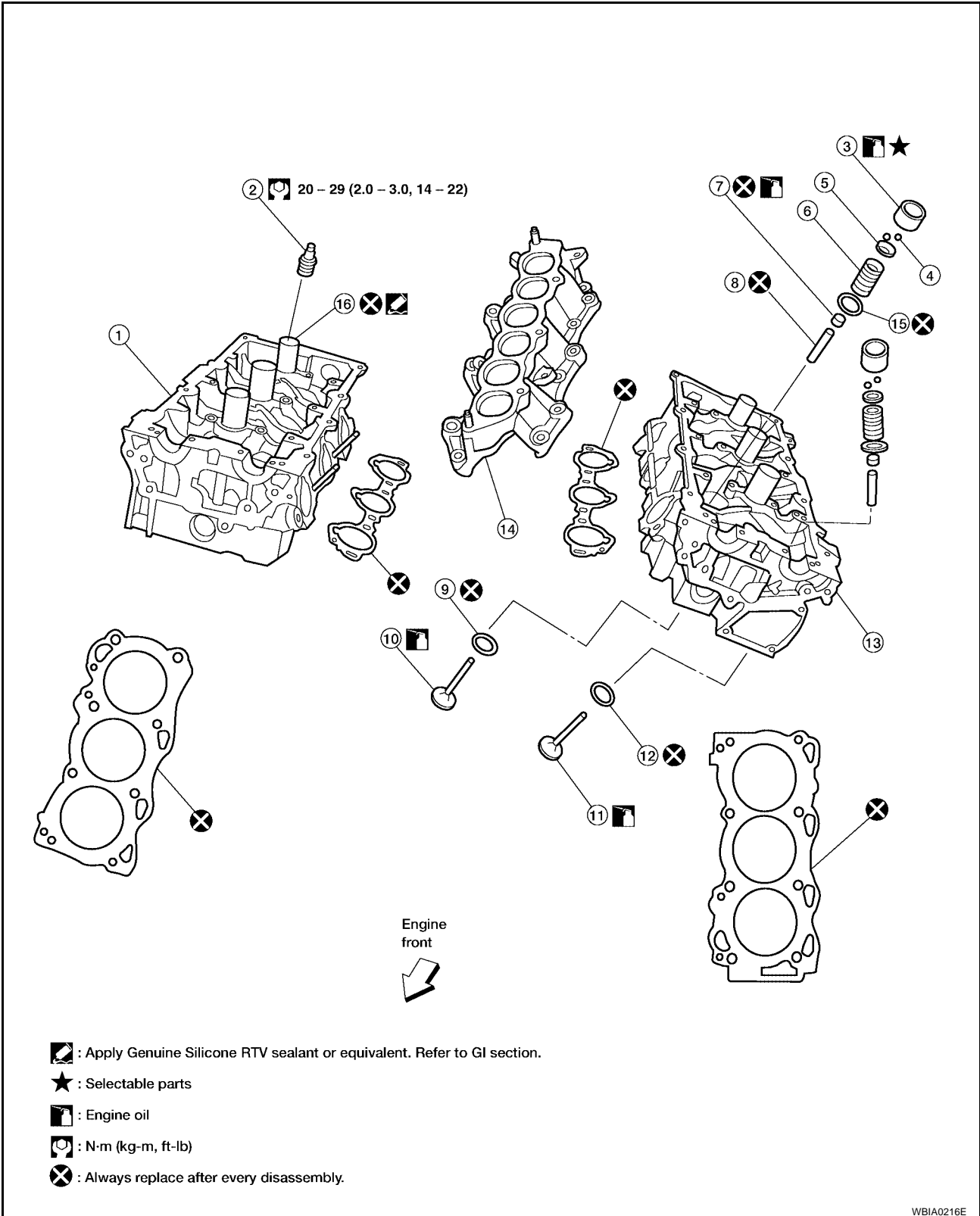
19. Install the fuel rail and injectors. Refer to [EM-140, "Removal and Installation"](#).
20. Install the timing chains. Refer to [EM-169, "Installation"](#).

CYLINDER HEAD

[VQ35DE]

Disassembly and Assembly

EBS00DVH



WBIA0216E

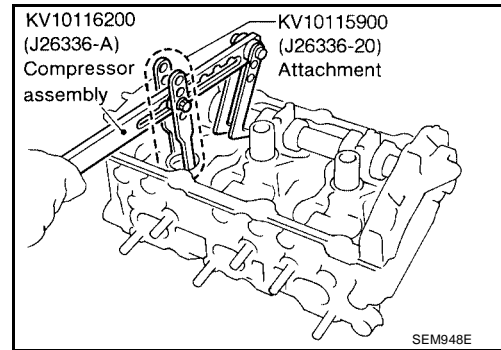
- | | | |
|-------------------------------|--------------------------|-----------------------|
| 1. Cylinder head (right bank) | 2. Spark plug | 3. Valve lifter |
| 4. Valve collet | 5. Valve spring retainer | 6. Valve spring |
| 7. Valve oil seal | 8. Valve guide | 9. Valve seat (INT) |
| 10. Valve (INT) | 11. Valve (EXH) | 12. Valve seat (EXH) |
| 13. Cylinder head (left bank) | 14. Intake manifold | 15. Valve spring seat |
| 16. Spark plug tube | | |

CAUTION:

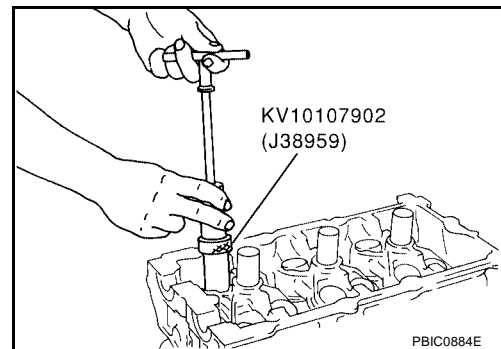
- When installing camshafts, chain tensioners, oil seals, or other sliding parts, lubricate contacting surfaces with new engine oil.
- Apply new engine oil to threads and seat surface when installing cylinder head, camshaft sprocket, crankshaft pulley, and camshaft bracket.
- Attach tags to valve lifters so as not to mix them up.

DISASSEMBLY

1. Remove valve lifter.
 - Mark position for installation.
2. Remove valve collet.
 - Compress valve spring with valve spring compressor. Remove valve collet with magnet driver.
3. Remove valve spring retainer, valve spring, and valve spring seat.
4. Push valve stem to combustion chamber side, and remove valve, mark for assembly.
 - Inspect valve guide clearance before removal. Refer to [EM-199, "VALVE GUIDE CLEARANCE"](#).
 - Confirm installation point.



5. Remove the valve oil seals using Tool.
6. If valve seat must be replaced, refer to [EM-201, "VALVE SEAT REPLACEMENT"](#).
7. If valve guide must be replaced, refer to [EM-199, "VALVE GUIDE REPLACEMENT"](#).
8. Remove spark plug with spark plug wrench.
9. Remove spark plug tube, as necessary.
 - Using a pair of pliers, pull spark plug tube out of cylinder head.



CAUTION:

- Be careful not to damage cylinder head.
- Once removed, a spark plug tube will be deformed and cannot be reused. Do not remove it unless absolutely necessary.

ASSEMBLY

1. Install valve guide. Refer to [EM-199, "VALVE GUIDE REPLACEMENT"](#).
2. Install valve seat. Refer to [EM-201, "VALVE SEAT REPLACEMENT"](#).
3. Install new valve spring seats and new valve oil seals.
 - Install with valve oil seal drift to match dimension in illustration.

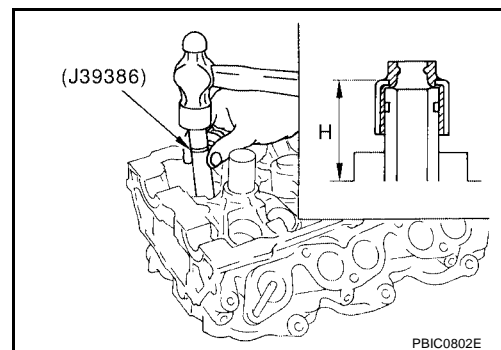
NOTE:

Dimension "H": Height measured before valve spring seat installation.

Height "H"

Intake and exhaust : 14.3 - 14.9 mm (0.563 - 0.587 in)

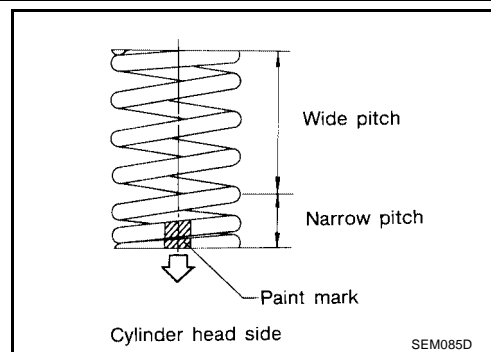
4. Install the valves in their original position, as marked during disassembly.



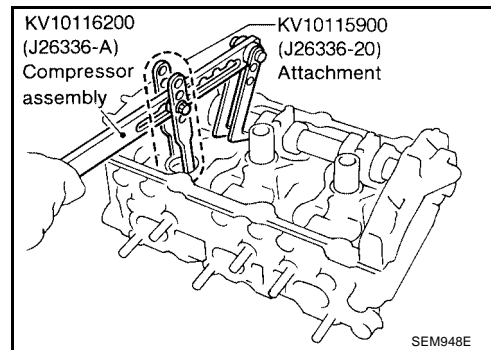
CYLINDER HEAD

[VQ35DE]

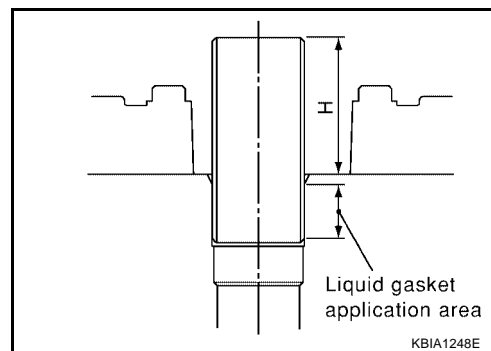
5. Install valve spring (uneven pitch type).
 - Install smaller pitch end (paint mark) to cylinder head side (valve spring seat side).
6. Install valve spring retainer.



7. Install valve collet.
 - 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.
8. Install valve lifter.



9. Install spark plug tube as follows:
 - a. Remove old liquid gasket from cylinder head mounting hole.
 - b. Apply liquid gasket to area within approximately 12 mm (0.47 in) from edge of spark plug tube press fit side.
 - Use Genuine RTV Silicone Sealant or equivalent. Refer to [MA-13. "RECOMMENDED FLUIDS AND LUBRICANTS"](#).
 - c. Using a drift, press fit the spark plug tube so that its height "H" is as specified.



Standard press fit height "H" :38.55 - 38.65 mm (1.5177 - 1.5217 in)

CAUTION:

- When press fitting, take care not to deform spark plug tube.
- After press fitting, wipe off liquid gasket protruding onto cylinder head upper face.

10. Install spark plug with spark plug wrench.

Inspection After Disassembly CYLINDER HEAD DISTORTION

EBS00DV1

Clean the surface of the cylinder head. Use a reliable straightedge and feeler gauge to check the flatness of cylinder head surface.

Check along six positions as shown.

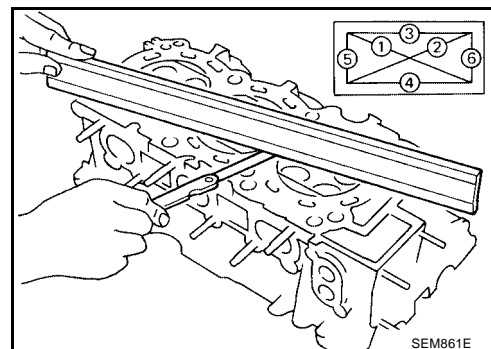
Head surface distortion

Limit : 0.1 mm (0.004 in)
Standard : Less than 0.03 mm (0.0012 in)

If beyond the specified limit, resurface or replace it. The limit for cylinder head resurfacing is determined by the cylinder block resurfacing.

Resurfacing Limit

Amount of cylinder head resurfacing is "A".



Amount of cylinder block resurfacing is "B".

The maximum limit : $A + B = 0.2 \text{ mm (0.008 in)}$

After resurfacing cylinder head, check that camshaft rotates freely by hand. If resistance is felt, cylinder head must be replaced.

Nominal cylinder head height : $126.3 - 126.5 \text{ mm (4.972 - 4.980 in)}$

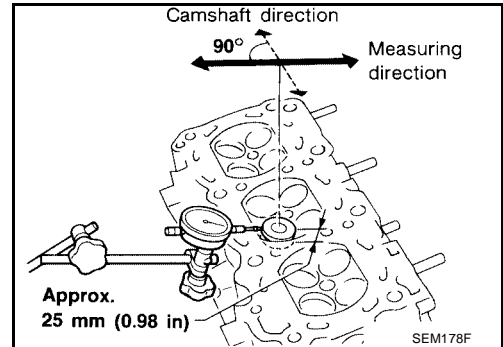
VALVE GUIDE CLEARANCE

1. Measure valve deflection as shown in the figure. (Valve and valve guide mostly wear in this direction.)

Valve deflection limit (dial gauge reading)

Intake : $0.24 \text{ mm (0.0094 in)}$

Exhaust : $0.28 \text{ mm (0.0110 in)}$



2. If it exceeds the limit, check valve to valve guide clearance.
 - a. Measure valve stem diameter and valve guide inner diameter.
 - b. Check that clearance is within specification.

Valve to valve guide clearance standard

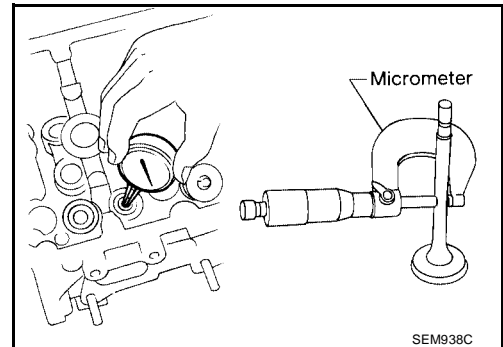
Intake : $0.020 - 0.053 \text{ mm (0.0008 - 0.0021 in)}$

Exhaust : $0.040 - 0.073 \text{ mm (0.0016 - 0.0029 in)}$

Valve to valve guide clearance limit

Intake : $0.08 \text{ mm (0.0031 in)}$

Exhaust : $0.1 \text{ mm (0.004 in)}$

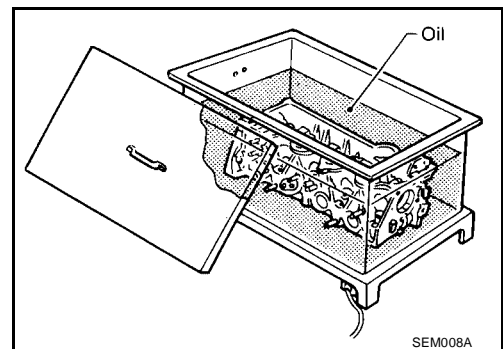


- c. If it exceeds the limit, replace valve or valve guide.

VALVE GUIDE REPLACEMENT

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

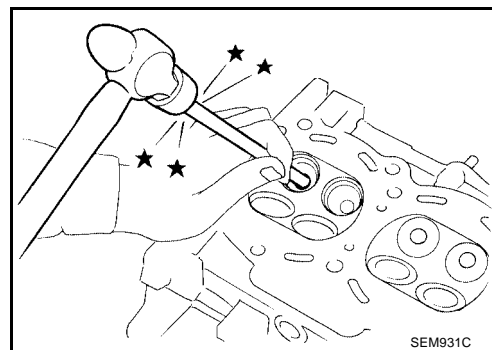
1. To remove valve guide, heat cylinder head to 110° to 130°C (230° to 266°F) by soaking in heated oil.



CYLINDER HEAD

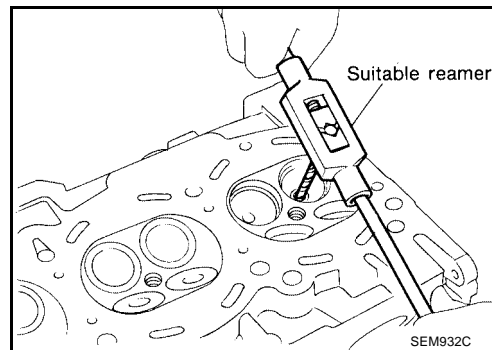
[VQ35DE]

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



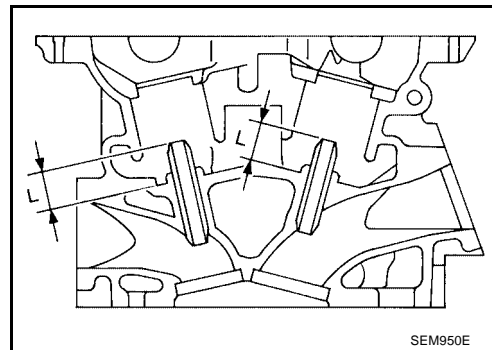
3. Ream cylinder head valve guide hole.

Valve guide hole diameter (for service parts), intake and exhaust : 10.175 - 10.196 mm (0.4006 - 0.4014 in)



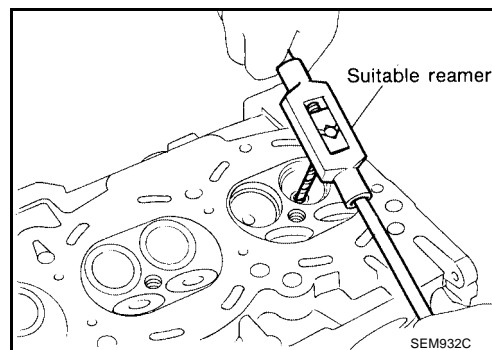
4. Heat cylinder head to 110° to 130°C (230° to 266°F) by soaking in heated oil and press new valve guide from camshaft side into the cylinder head to the dimensions as shown.

Projection "L" : 12.6 - 12.8 mm (0.496 - 0.504 in)



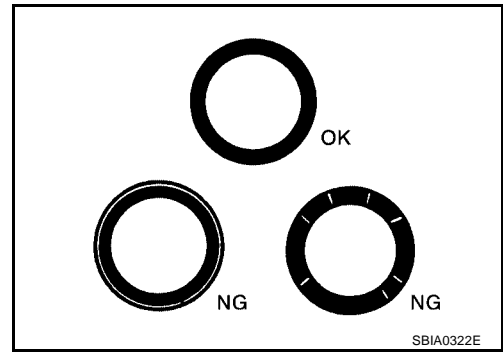
5. Using a valve guide reamer, apply a reamer finish to the valve guide.

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



VALVE SEAT CONTACT

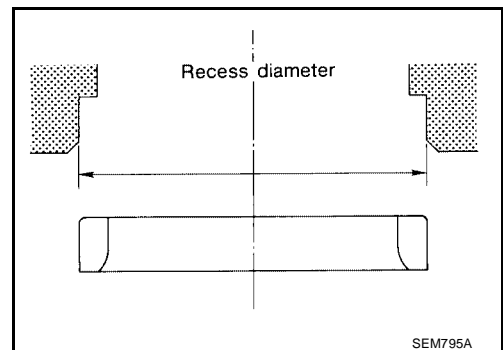
- After confirming that the dimensions of valve guides and valves are within specifications, perform this procedure.
- Apply prussian blue onto contacting surface of valve seat to check the condition of the valve contact on the surface.
- Check if the contact area band is continuous all around the circumference.
- If not, grind to adjust valve fitting and check again. If the contacting surface still has N.G conditions even after the re-check, replace valve seat.



VALVE SEAT REPLACEMENT

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

Oversize	: 0.5 mm (0.020 in)
Intake	: 38.500 - 38.516 mm (1.5157 - 1.5164 in)
Exhaust	: 32.700 - 32.716 mm (1.2874 - 1.2880 in)

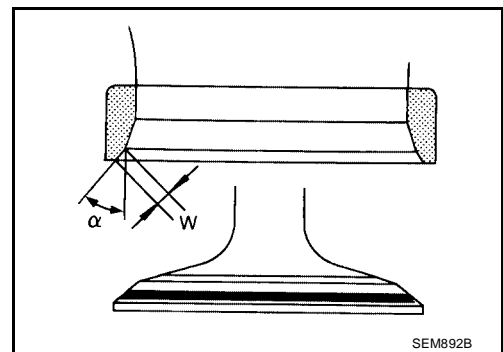


Be sure to ream in circles concentric to the valve guide center.

This will enable valve seat to fit correctly.

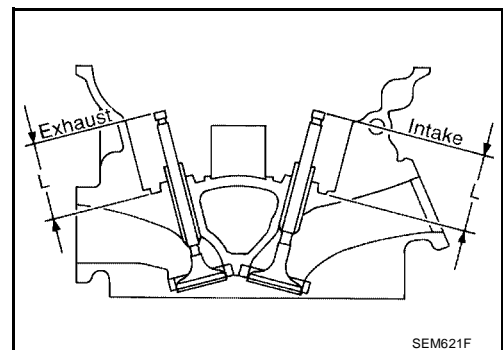
3. Heat cylinder head to 110° to 130°C (230° to 266°F) by soaking in heated oil.
4. Press fit valve seat until it seats on the bottom.
5. Cut or grind valve seat using suitable tool to the specified dimensions. Refer to [EM-230, "VALVE"](#).
6. After cutting, lap valve seat with abrasive compound.
7. Check valve seating condition.

Seat face angle "α"	: 45° 15' - 45° 45' degrees/minutes
Contacting width "W" for intake	: 1.09 - 1.31 mm (0.0429 - 0.0516 in)
Contacting width "W" for exhaust	: 1.29 - 1.51 mm (0.0508 - 0.0594 in)



8. Use a depth gauge to measure the distance between the mounting surface of the cylinder head spring seat and the valve stem end. If the distance is shorter than specified, repeat step 5 to adjust it. If it is longer, replace the valve seat with a new one.

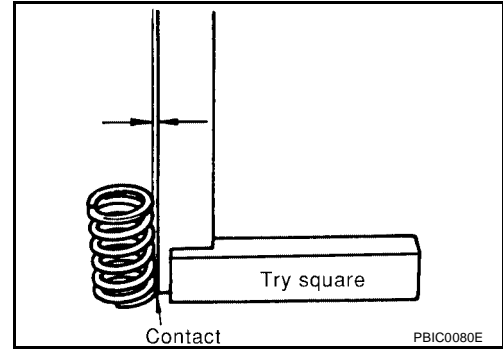
Valve seat resurface limit "L" intake	: 41.07 - 41.67 mm (1.6169 - 1.6405 in)
Valve seat resurface limit "L" exhaust	: 41.00 - 41.60 mm (1.6142 - 1.6378 in)



VALVE SPRING SQUARENESS

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

Out-of-square limit : Less than 2.0 mm (0.079 in)



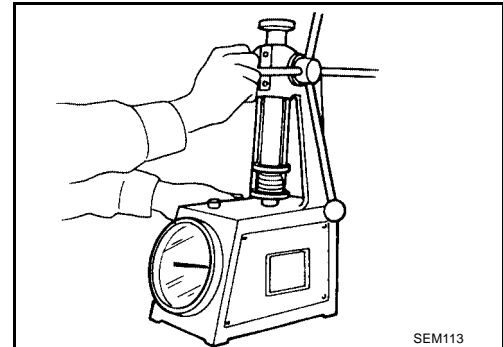
VALVE SPRING DIMENSIONS AND VALVE SPRING PRESSURE LOAD

Check valve spring pressure at specified spring height.

Standard : 166 - 188 N (16.9 - 19.2 kg, 37.3 = 42.3 lb) at height 37.0 mm (1.457 in)

Limit : 373 - 418 N (38.0 - 42.6 kg, 83.9 - 94.0 lb) at height 27.2 mm (1.071 in)

If it is not within specifications, replace the spring.

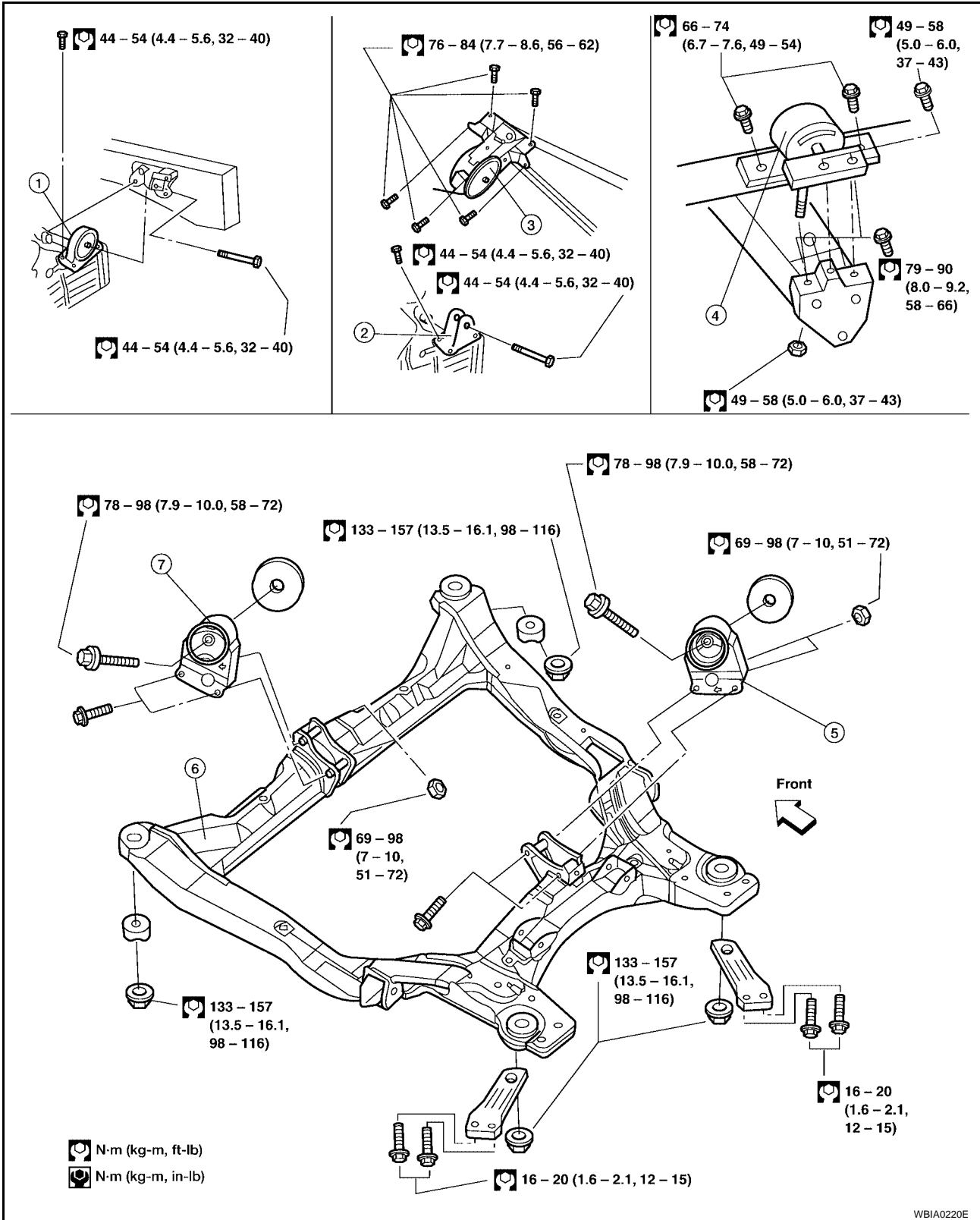


ENGINE ASSEMBLY Removal and Installation

PF10001

EBS00DVJ

A
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1. LH transaxle mounting insulator (A/T) 2. LH transaxle mounting bracket (M/T) 3. LH transaxle mounting bracket (M/T)

- | | | |
|--|---|----------------------------|
| 4. RH engine mounting insulator | 5. Rear engine mounting insulator
(electrically controlled with automatic transaxle) | 6. Front suspension member |
| 7. Front engine mounting insulator
(electrically controlled with automatic transaxle) | | |

WARNING:

- Place chocks at front and back of rear wheels.
- For engines not equipped with engine slingers, attach proper slingers and bolts as described in the NISSAN Parts Catalog.

CAUTION:

- Do not start working until 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-38, "LIFTING POINT"](#) .
- In removing the drive shafts, be careful not to damage any transaxle grease seals.
- Before separating the engine and transaxle, remove the crankshaft position sensor (POS).
- Do not damage the edge of the crankshaft position sensor (POS) or the ring gear teeth.

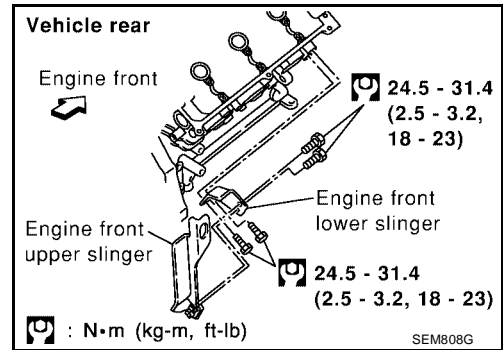
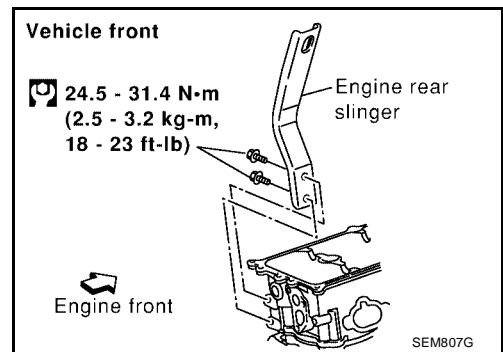
REMOVAL

1. Release fuel pressure. Refer to [EC-646, "FUEL PRESSURE RELEASE"](#) .
2. Remove the engine cover, and the engine under cover using power tool.
3. Drain engine oil. [MA-26, "Changing Engine Oil"](#)
4. Drain coolant. Refer to [EC-1065, "Description"](#) .
5. Remove the following parts:
 - Hood assembly
 - Front tower bar using power tools
 - Battery and tray using power tools
 - Air inlet duct
 - Air intake duct and air cleaner case assembly with mass air flow sensor
 - Power brake booster vacuum hose
 - Drive belts
 - Radiator assembly, coolant reservoir, and system hoses. Refer to [EC-1040, "Component Description"](#) .
 - Front cowl grille and windshield wiper assembly. Refer to [EI-18, "Removal and Installation"](#) .
6. Disconnect engine room harness from the engine side and set it aside. Disconnect engine harness ground connections.
7. Disconnect heater hoses.
8. Remove the front wheel and tires.
9. Remove the front drive shafts. Refer to [FAX-11, "Removal and Installation"](#) .
10. Remove the A/C compressor using power tools. Discharge and recover the R134a refrigerant. Refer to [ATC-118, "HFC-134a \(R-134a\) Service Procedure"](#) .
11. Disconnect fuel hose quick connection at vehicle piping side. Refer to [EM-140, "Removal and Installation"](#) .
12. Disconnect the transaxle shift controls.
13. Remove the starter motor. Refer to [SC-19, "Removal and Installation"](#) .
14. Remove the front exhaust tube using power tools. Refer to [EX-7, "Removal and Installation"](#) .
15. Disconnect reservoir tank for the power steering from engine compartment bracket and position it aside.
16. Remove the front suspension member. Refer to [FSU-14, "Removal and Installation"](#) .
17. Disconnect the power steering pump, without disconnecting the piping, from the engine and move it aside and secure with wire.
18. Position a suitable transmission jack under the engine and transaxle assembly.

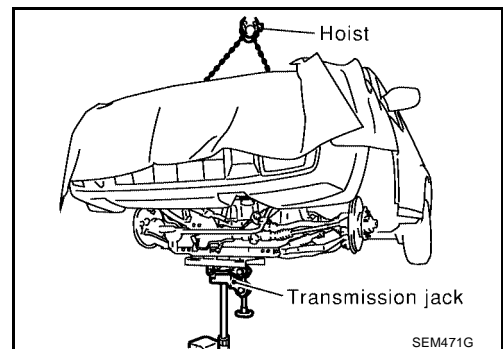
ENGINE ASSEMBLY

[VQ35DE]

19. Install engine slingers into front of left bank cylinder head and rear of right bank cylinder head.

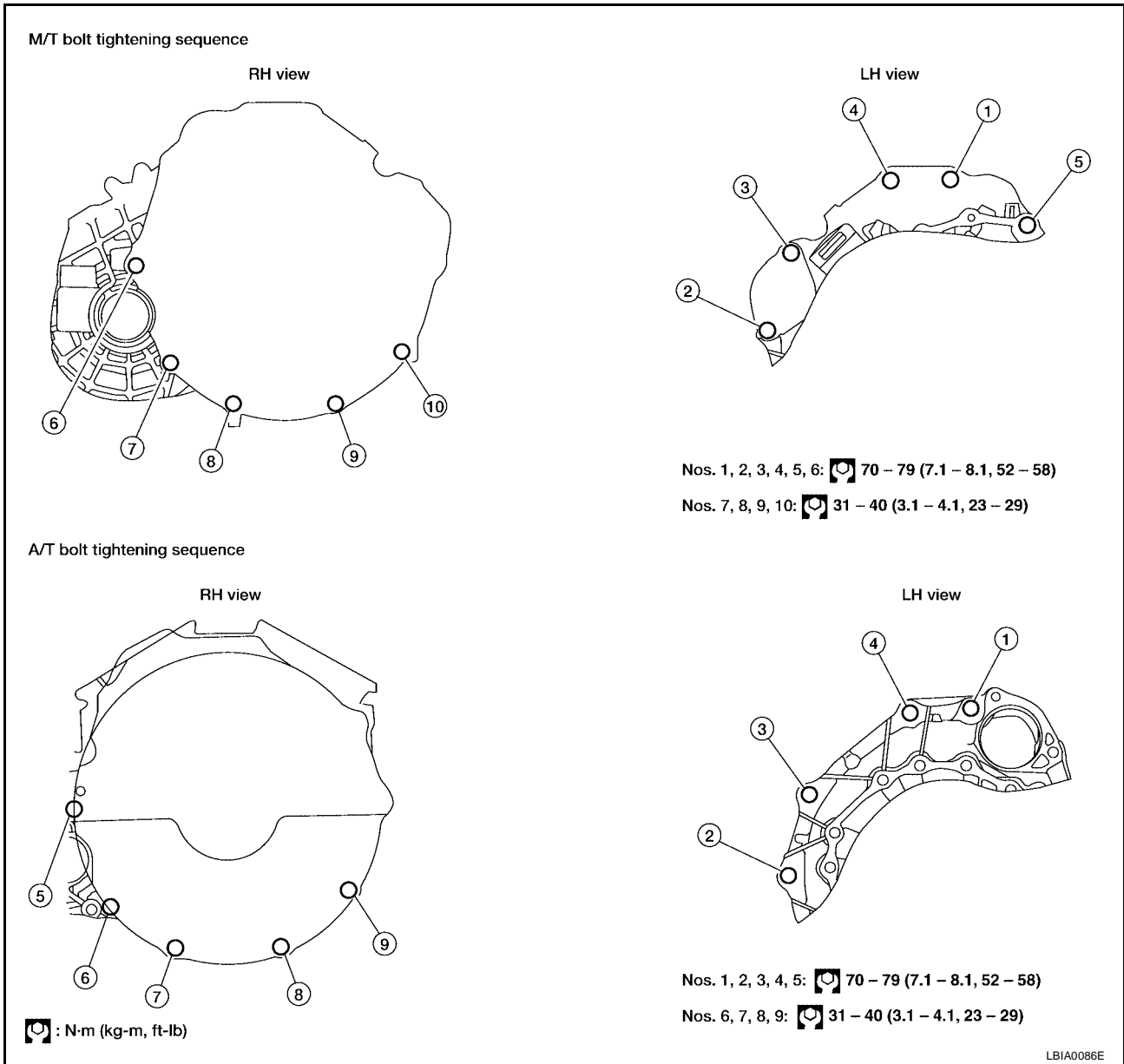


20. For additional safety, secure the engine in position with a hoist.
21. Disconnect the LH transaxle mount and the RH engine mount.
22. Carefully lower the engine and transaxle assembly with the transmission jack, avoiding interference with the vehicle body.
- CAUTION:**
- Before and during this procedure, always check if any harnesses are left connected.
 - Avoid any damage to, or any oil/grease smearing or spills onto the engine mounting insulators.
23. Remove the crankshaft position sensor (POS).
24. Separate the engine and transaxle and mount the engine on a suitable engine stand.



INSTALLATION

Installation is in the reverse order of removal.



INSPECTION AFTER INSTALLATION

- Before starting engine, check the levels of coolant, lubrications, working oils, and of air conditioner refrigerant. If less than required quantity, fill to the specified level.
- Run engine to check for unusual noise and vibration.
- Warm up engine thoroughly to make sure there is no leakage of coolant, lubricants, oil, fuel, or exhaust gas.

CYLINDER BLOCK

[VQ35DE]

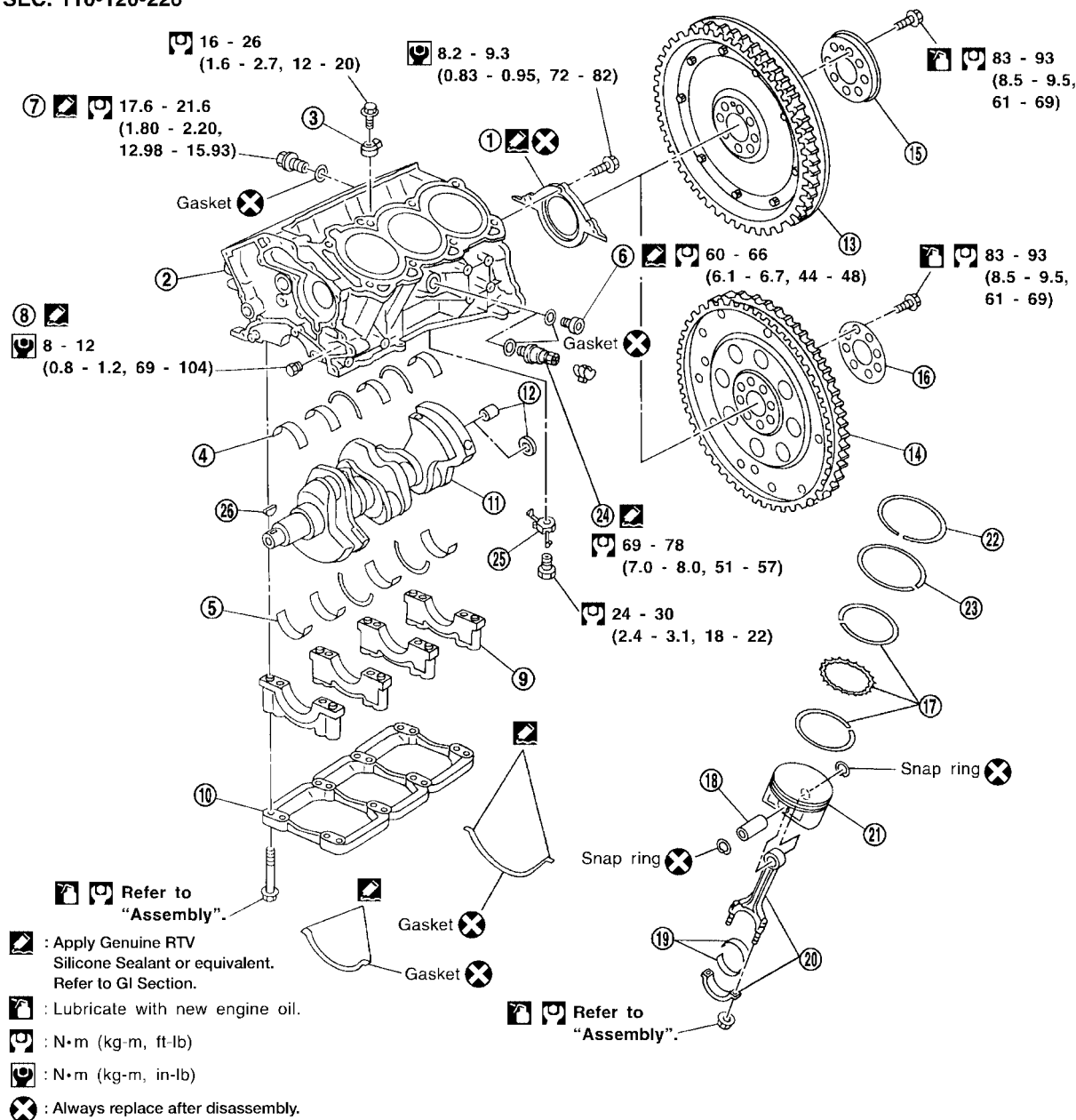
PF11010

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CYLINDER BLOCK

Disassembly and Assembly

SEC. 110•120•226



- | | | |
|--------------------------------------|---|---|
| 1. Rear oil seal retainer | 2. Cylinder block | 3. Knock sensor |
| 4. Upper main bearing | 5. Lower main bearing | 6. Water drain plug (LH side) |
| 7. Water drain plug (RH side) | 8. Water drain plug (water pump side) | 9. Main bearing cap |
| 10. Main bearing beam | 11. Crankshaft | 12. Pilot bushing or pilot converter |
| 13. Flywheel with signal plate (M/T) | 14. Drive plate with signal plate (A/T) | 15. Flywheel reinforcement |
| 16. Drive plate reinforcement | 17. Oil ring set | 18. Piston pin |
| 19. Connecting rod bearing | 20. Connecting rod | 21. Piston |
| 22. Top ring | 23. Second ring | 24. Cylinder block heater (Canada only) |
| 25. Oil jet | 26. Key | |

WBIA0217E

CAUTION:

- Apply new engine oil to parts as marked in illustrations before installation.
- Place removed parts such as bearings and bearing caps in their proper order and direction.
- When installing the connecting rod nuts, and main bearing cap bolts, apply new engine oil to the threads and mating surfaces
- Do not allow any magnetic materials to contact the signal plate teeth on the drive plate.

DISASSEMBLY

1. Remove the engine assembly. Refer to [EM-203, "ENGINE ASSEMBLY"](#) .
2. Install the engine on the engine stand.
3. Remove the knock sensor.

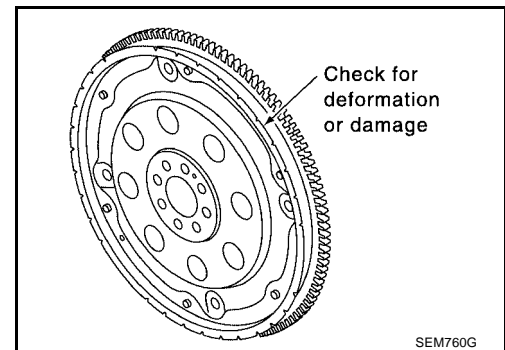
CAUTION:

Carefully handle sensor avoiding shocking it.

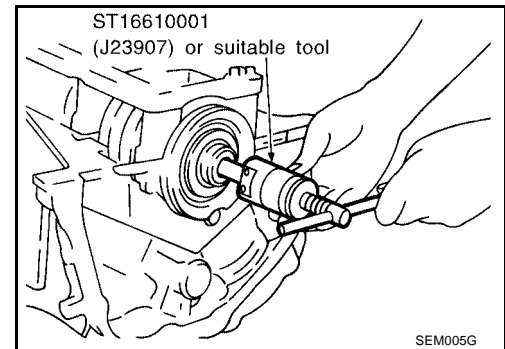
4. Drain the engine of all coolant and oil.
5. Remove the oil pan. Refer to [EM-130, "Removal and Installation"](#) .
6. Remove the timing chain. Refer to [EM-161, "Removal"](#) .
7. Remove the cylinder head. Refer to [EM-185, "Removal and Installation"](#) .
8. Remove drive plate. Fix crankshaft with a ring gear stopper, and remove mounting bolts.
 - Loosen mounting bolts in diagonal order.

CAUTION:

- Do not disassemble drive plate.
- Never place the drive plate with signal late facing down.
- When handling signal plate, take care not to damage or scratch it.
- Handle signal plate in a manner that prevents it from becoming magnetized.



9. Remove pilot bushing (M/T) or converter (A/T) using Tool.



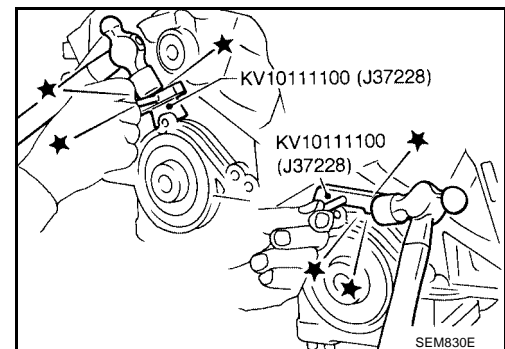
10. Use a seal cutter to cut away liquid gasket and remove rear oil seal retainer. Refer to [EM-112, "REMOVAL OF LIQUID GASKET SEALING"](#) .

CAUTION:

- Be careful not to damage mounting surface.
- If rear oil seal retainer is removed, replace it with a new one.

NOTE:

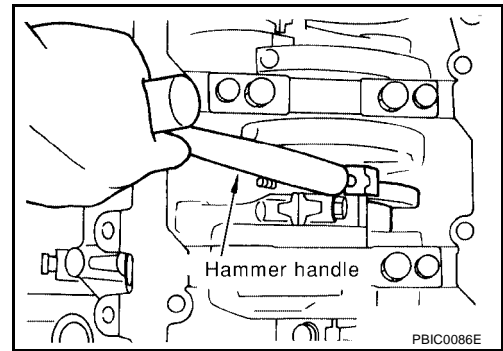
Rear oil seal and retainer form a single part and are handled as an assembly.



CYLINDER BLOCK

[VQ35DE]

11. Remove the piston and connecting rod assemblies.
 - a. Position the crankshaft pin corresponding to the connecting rod to be removed onto the bottom dead center.
 - b. Remove the connecting rod cap.
 - c. Using a hammer handle or similar tool, push the piston and connecting rod assembly out to the cylinder head side.
 - Before removing the piston and connecting rod assembly, check the connecting rod side clearance. Refer to [EM-236, "CONNECTING ROD"](#).



12. Remove the connecting rod bearings.

CAUTION:

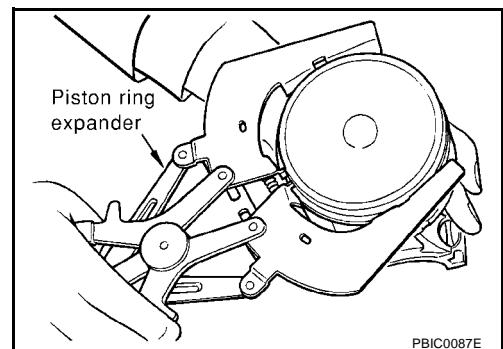
- When removing the connecting rod side bearings, note the installation position. Keep them in the correct order.

13. Remove the piston rings from the piston.

- Use a piston ring expander.

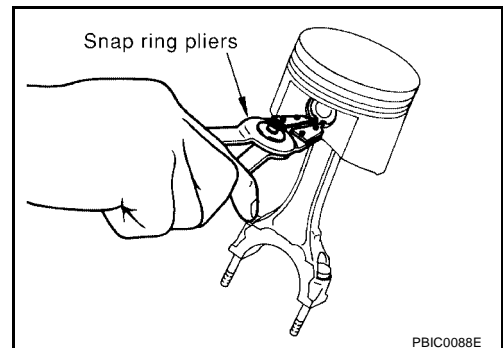
CAUTION:

- When removing the piston rings, be careful not to damage the piston. Do not expand the rings excessively.
- Be careful to mark the rings if they are to be reused so they are installed in their original position.
- Before removing the piston rings, check the piston ring side clearance. Refer to [EM-217, "PISTON RING SIDE CLEARANCE"](#).

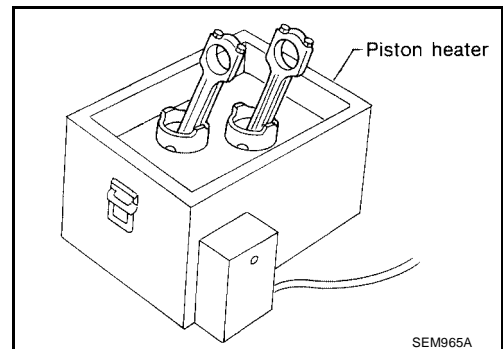


14. Remove the piston from the connecting rod as follows.

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



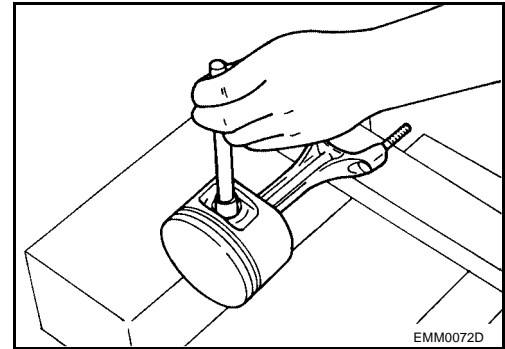
- b. Heat the pistons to 60° - 70°C (140° - 158°F).



CYLINDER BLOCK

[VQ35DE]

- c. Push out the piston pin with a suitable tool, with an outer diameter approximately 20 mm (0.8 in).



15. Remove the rear oil seal retainer from the cylinder block.
- Insert a screwdriver or similar tool between the rear end of the crankshaft counter weight and rear oil seal retainer, and separate the liquid gasket to remove.

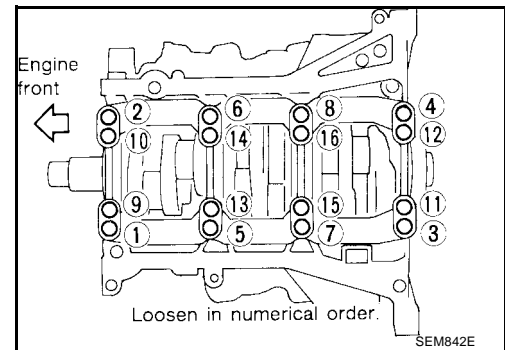
CAUTION:

Be careful not to damage the mating surface.

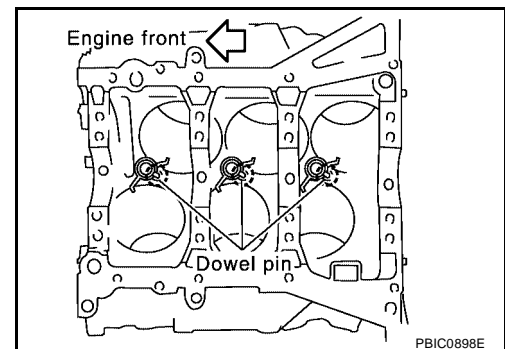
NOTE:

When replacing the rear oil seal during on-vehicle service, it is necessary to remove the oil pan. Refer to [EM-130, "Removal and Installation"](#) .

16. Loosen the bolts in the numerical order as shown and remove the main bearing beam, bearing caps and crankshaft.
- Before loosening the main bearing cap bolts, measure the crankshaft side clearance. Refer to [EM-222, "CRANKSHAFT"](#) .



17. Remove the oil jets.
18. Remove the main bearings and thrust bearings from the cylinder block and main bearing caps.
- When removing them, note the direction and position. Keep them in the correct order for installation.



ASSEMBLY

1. Blow out the coolant and oil passages and cylinder bore to remove any foreign materials.

CAUTION:

Use goggles to protect your eyes.

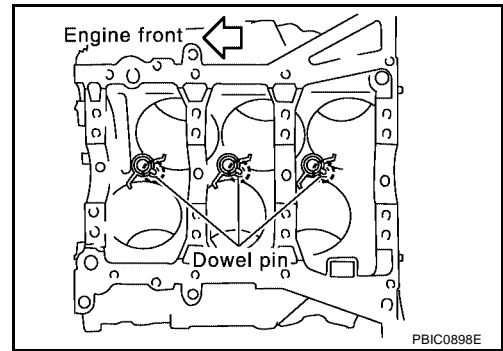
2. Apply liquid gasket and install each plug into the cylinder block.
- Use Genuine Silicone RTV Sealant or equivalent. Refer to [MA-13, "RECOMMENDED FLUIDS AND LUBRICANTS"](#) .

CYLINDER BLOCK

[VQ35DE]

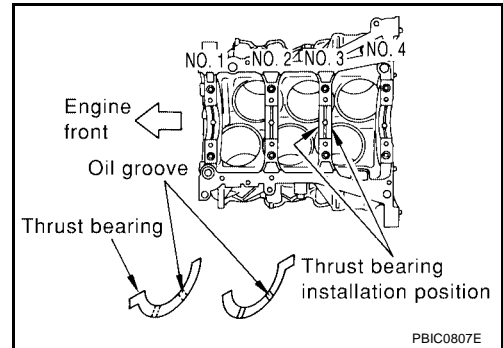
3. Install the oil jets.

- Insert the oil jet dowel pin into the cylinder block dowel pin hole, and tighten the mounting bolts.



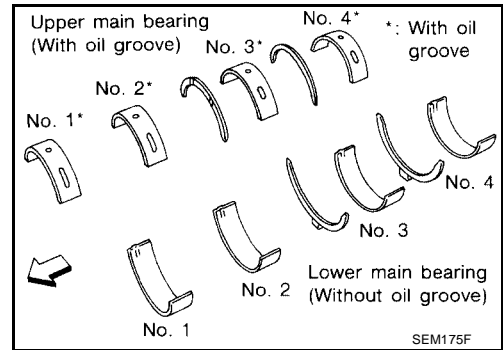
4. Install the main bearings and the thrust bearings.

- Remove dust, dirt, and oil on the bearing mating surfaces of the cylinder block and the main bearing cap.
- Install the thrust bearings to both sides of the No. 3 journal housing on the cylinder block and the main bearing cap.
 - Install the thrust bearings with the oil groove facing the crankshaft arm (outside).
 - Install bearing with a projection on one end on cylinder block and bearing with a projection at center on cap. Align each projection with mating notch.



5. Set the upper main bearings in their proper positions on the cylinder block.

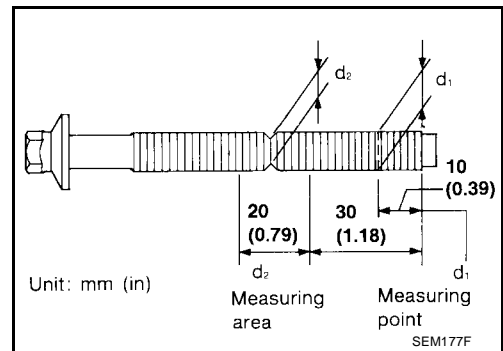
- Confirm the correct main bearings are used. Refer to [EM-220](#), "[PISTON-TO-CYLINDER BORE CLEARANCE](#)".



6. Instructions for the re-use of the main bearing cap bolts.

- A plastic zone tightening method is used for tightening the main bearing cap bolts. Measure d1 and d2 as shown.
- For d2, select the minimum diameter in the measuring area.
- If the difference between d1 and d2 exceeds the limit, replace the bolts for assembly.

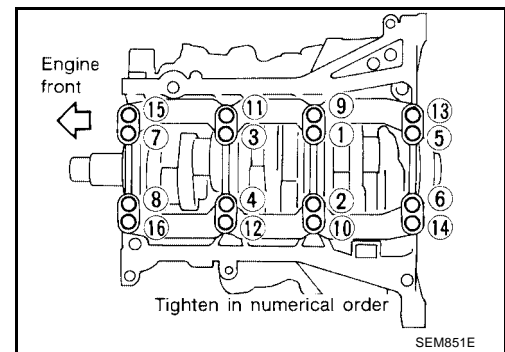
Limit (d1 - d2) : 0.11 mm (0.0043 in)



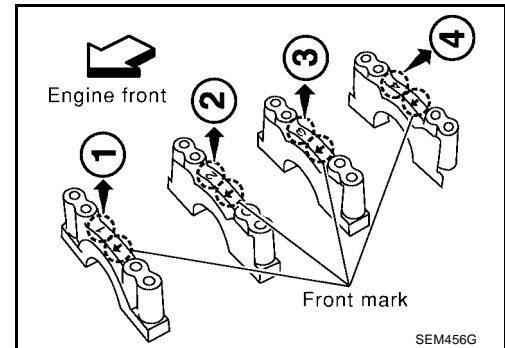
CYLINDER BLOCK

[VQ35DE]

7. After installing the crankshaft, lower main bearings, main bearing caps, main bearing beam, and bearing cap bolts. Tighten the bearing cap bolts in the numerical order as shown.



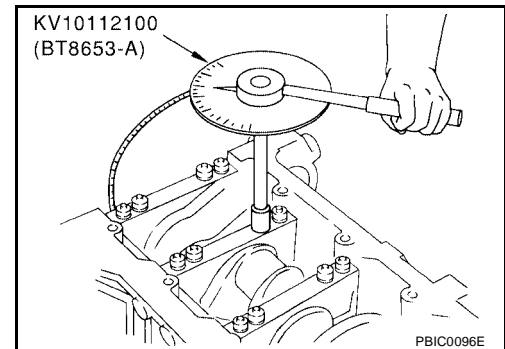
- a. Make sure that the front marks on the main bearing beam faces the front of the engine.
- b. Prior to tightening all the bearing cap bolts, place the bearing beam in its proper position by shifting the crankshaft in the axial position.
- c. After tightening the bearing cap bolts, make sure the crankshaft turns smoothly.
- d. Lubricate the threads and seat surfaces of the bolts with new engine oil.
- e. Tighten the bolts in two stages:



CAUTION:

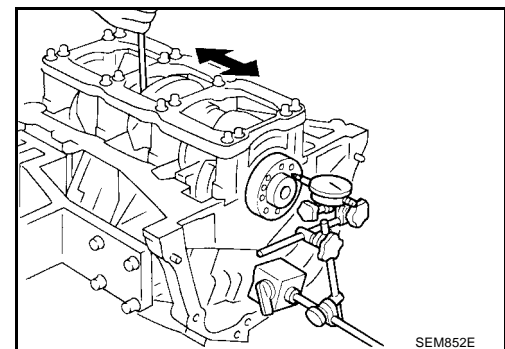
Measure the tighten angle in stage 2 with an angle wrench. Do not measure visually.

- Stage 1** : 32 - 38 N·m (3.3 - 3.9 kg·m, 24 - 28 ft·lb)
- Stage 2** : 90° - 95° degrees clockwise



8. Measure crankshaft end play.
- If beyond the limit, replace the bearing with a new one.

- Standard** : 0.10 - 0.25 mm (0.0039 - 0.0098 in)
- Limit** : 0.30 mm (0.0118 in)



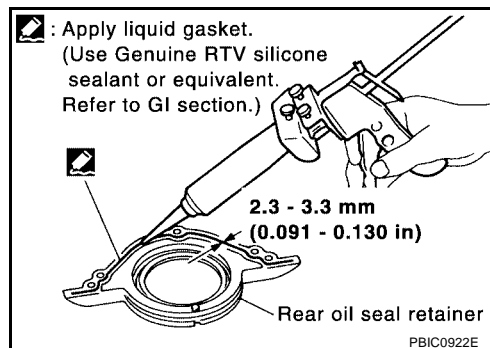
CYLINDER BLOCK

[VQ35DE]

9. Install the rear oil seal retainer.

- Apply sealant to rear oil seal retainer as shown.
Use Genuine Silicone RTV Sealant, or equivalent. Refer to GI-43, "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS" .

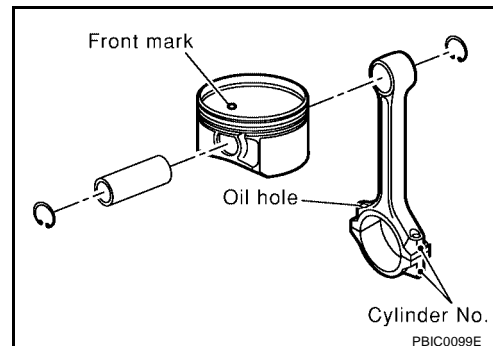
Rear oil seal retainer bolts : 8.2 - 9.3 N·m (0.83 - 0.95 kg·m, 72 - 82 in·lb)



10. Install the piston to the connecting rod.

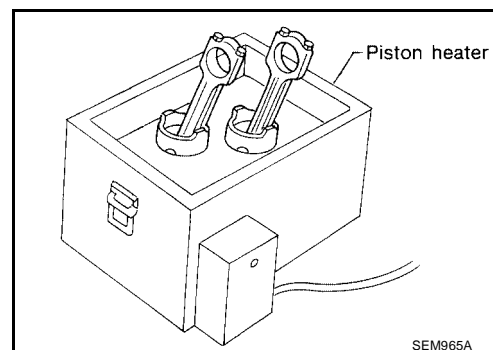
a. Using suitable snap ring pliers, install the snap ring into the pin-groove of the piston rear side.

- Insert it fully into groove to install.

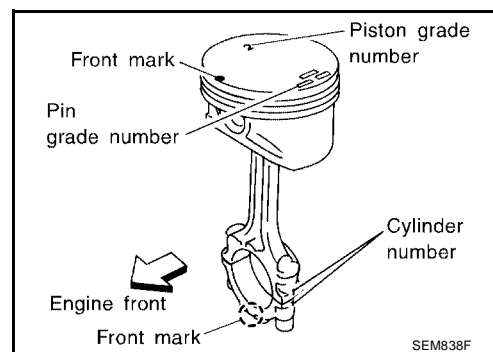


b. Install the piston to the connecting rod.

- Heat the piston until the piston pin can be pushed in by hand without excess force [approx. 60° - 70°C (140° to 158°F)]. From the front to the rear, insert the piston pin into the piston and through the connecting rod.



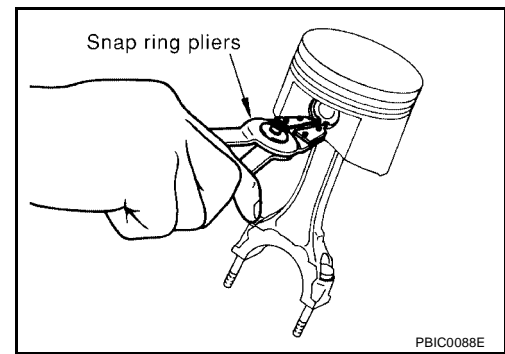
- Assemble so that the front mark on the piston crown and the oil holes and the cylinder No. on the connecting rod are positioned as shown.



CYLINDER BLOCK

[VQ35DE]

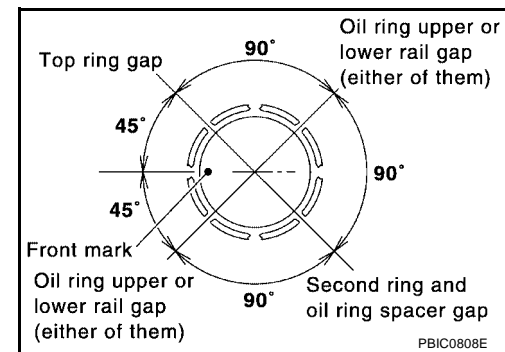
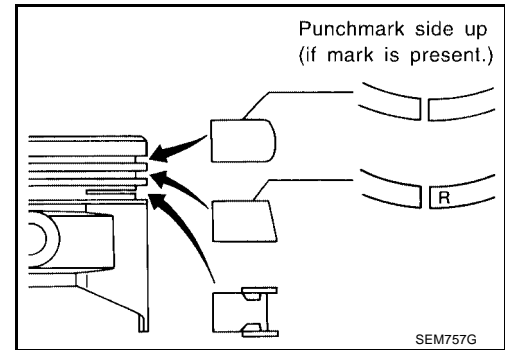
- c. Install the snap ring into the front of the piston pin-groove.
- After installing, check that the connecting rod pivots smoothly on the pin.



11. Using a piston ring expander, install the piston rings.

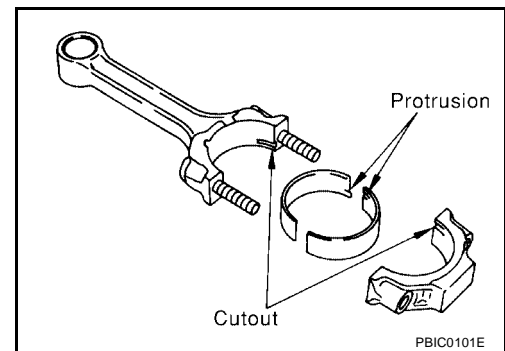
CAUTION:

- Be careful not to damage the piston.
- When the piston rings are not replaced, remount the rings in their original positions.
- When replacing the piston rings, those without punchmarks can be mounted either side up.
- Position each ring with the gap as shown, referring to the piston front mark.
- Install the top ring and the second ring with the stamped surface facing upward. If the ring is not stamped it can face in either direction.



12. Install the connecting rod bearings to the connecting rod and the connecting rod cap.

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

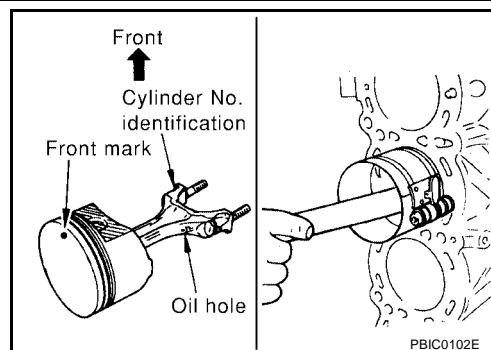


CYLINDER BLOCK

[VQ35DE]

13. Install the piston and connecting rod assembly into the corresponding cylinder.

- Position the crankshaft pin corresponding to the connecting rod to be installed onto the bottom dead center.
- Apply engine oil sufficiently to the cylinder bore, piston, and crankshaft pin.
- Match the cylinder position with the cylinder No. on the connecting rod to install.
- Using a piston ring compressor, install the piston with the front mark on the piston crown facing the front of the engine.

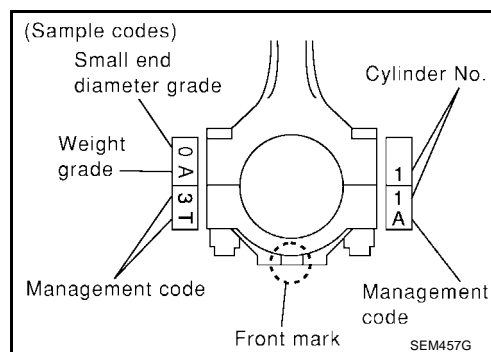


CAUTION:

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

14. Install the connecting rod cap.

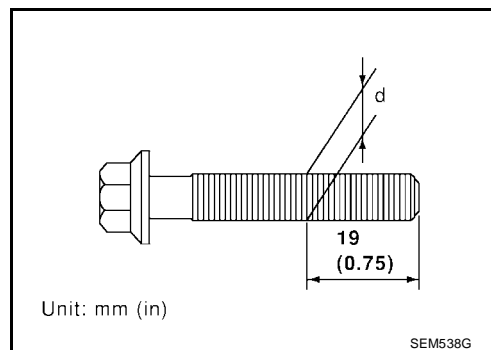
- Match the stamped cylinder number marks on the connecting rod with those on the cylinder cap for installation.
- Install the piston connecting rod assembly and cap so that the front mark on the cap and piston are facing the front of the engine.
- **Lubricate the threads and seat surfaces with new engine oil.**



15. Check the connecting rod cap bolts before reusing, then install in their original position in the connecting rod. The bolts should screw in smoothly by hand.

- Measure the outer diameter of the connecting rod cap bolt as shown.

Outer diameter "d" of the connecting rod bolt
Standard : 7.90 - 8.00 mm (0.3110 - 0.3150 in)
Limit : 7.75 mm (0.3051 in)



16. Tighten the connecting rod nuts in two stages:

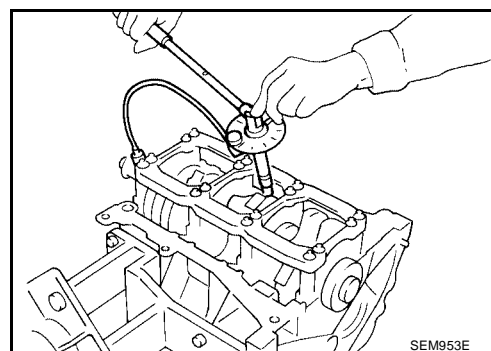
Stage 1 : 19 - 21 N·m (1.9 - 2.1 kg·m, 14 - 15 ft·lb)
Stage 2 : 90° - 95° degrees clockwise

CAUTION:

Always use either an angle wrench or protractor. Avoid tightening based on visual check alone.

- Apply engine oil to the threads and seats of the connecting rod bolts and nuts.
- After tightening the nuts, make sure that the crankshaft rotates smoothly.
- Check the connecting rod side clearance. If beyond the limit, replace the connecting rod and/or crankshaft.

Connecting rod side clearance:
Standard : 0.20 - 0.35 mm (0.0079 - 0.0138 in)
Limit : 0.40 mm (0.0157 in)



CYLINDER BLOCK

[VQ35DE]

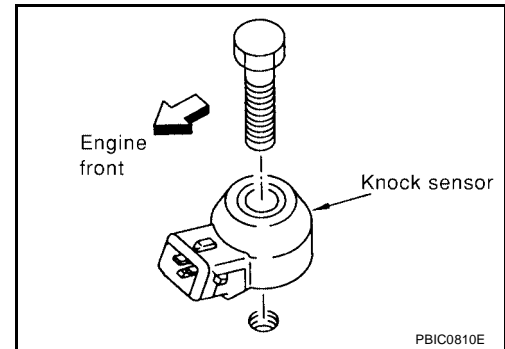
17. Install the knock sensor.

- 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 the rear of the engine.
- Do not tighten the mounting bolts while holding the connector.
- Make sure that the knock sensor does not interfere with other parts.

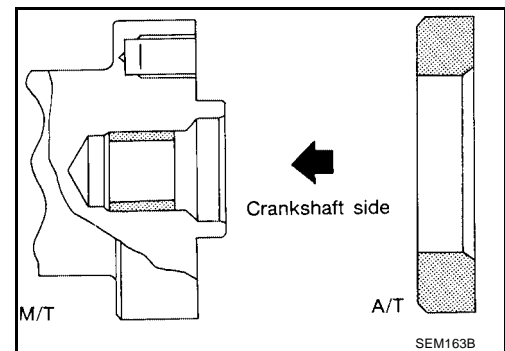
CAUTION:

If any impact by dropping occurs to the knock sensor, replace it with new one.

Knock sensor mounting bolt : 16 - 26 N·m (1.6 - 2.7 kg·m, 12 - 20 in·lb)



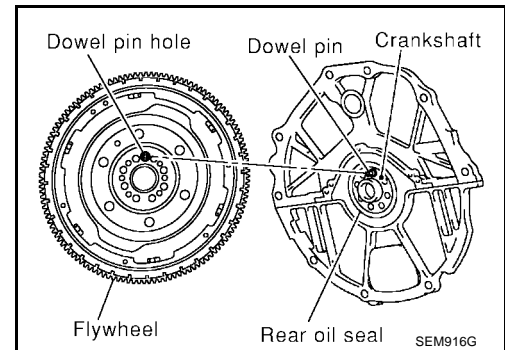
18. Install the pilot bushing (M/T) or converter (A/T) as shown.



19. Install the flywheel (M/T), if equipped.

- When installing flywheel to crankshaft, be sure to correctly align crankshaft side dowel pin and flywheel side dowel pin hole.

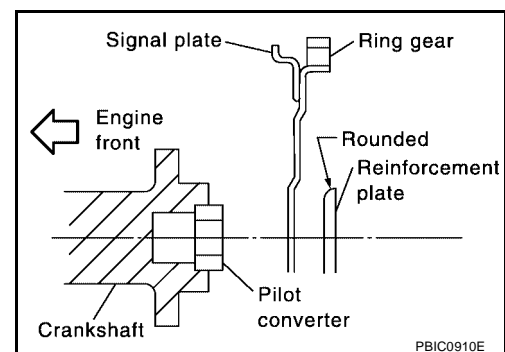
Flywheel mounting bolts : 83 - 93 N·m (8.5 - 95 kg·m, 61 - 69 ft·lb)



20. Install the drive plate (A/T), if equipped.

- Install the drive plate and reinforcement plate in the direction shown.
- Align dowel pins of crankshaft rear and drive plate with pin holes of each part.
- Secure the crankshaft using a ring gear stopper.
- Tighten the drive plate mounting bolts in one or two steps.

Drive plate mounting bolts : 83 - 93 N·m (8.5 - 95 kg·m, 61 - 69 ft·lb)



21. Install the cylinder head. Refer to [EM-185, "Removal and Installation"](#) .

22. Install the timing chain. Refer to [EM-169, "Installation"](#) .

23. Install the oil pan. Refer to [EM-130, "Removal and Installation"](#) .

24. Remove the engine from the stand and install the engine assembly into the vehicle. Refer to [EM-203, "Removal and Installation"](#) .

- 25. Assembly of the remaining parts is in the reverse order of disassembly.
- 26. Fill the engine with the specified oil and coolant. Refer to [MA-13, "Fluids and Lubricants"](#).

CAUTION:

Wait at least 30 minutes for the sealant to set-up before filling the engine with fluids and running it.

Inspection PISTON AND PISTON PIN CLEARANCE

EBS00DVL

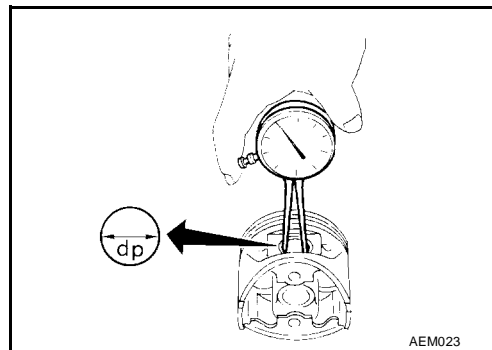
Inner Diameter of Piston Pin Hole

- Measure the inner diameter of piston pin hole "dp".

Standard diameter "dp"

Grade No. 0 : 21.993 - 21.999 mm (0.8659 - 0.8661 in)

Grade No. 1 : 21.999 - 22.005 mm (0.8661 - 0.8663 in)



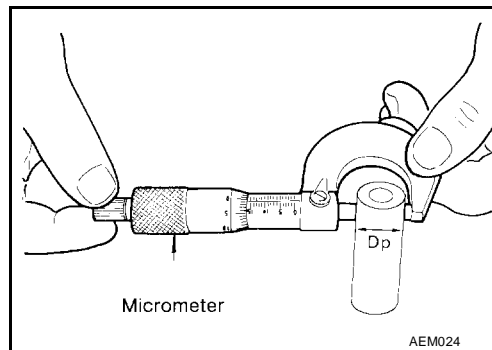
Outer Diameter of Piston Pin

- Measure outer diameter of piston pin "Dp".

Standard diameter "Dp"

Grade No. 0 : 21.989 - 21.995 mm (0.8657 - 0.8659 in)

Grade No. 1 : 21.995 - 22.001 mm (0.8659 - 0.8662 in)

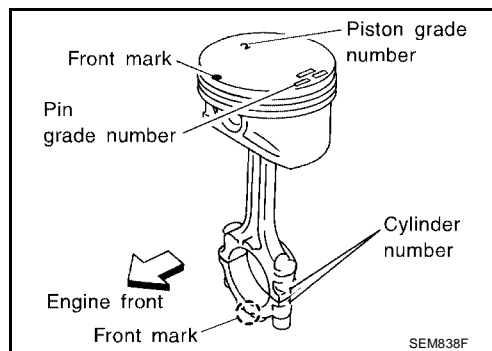


Piston and Piston Pin Interference Fit

Standard Interference Fit = "Dp" – "dp"

Standard : 0.002 mm (0.0001 in) - 0.006 mm (0.0002 in) = - 0.0004 mm (-0.0001 in)

- If clearance is exceeds specification, replace either or both of piston/piston pin assembly and connecting rod assembly with reference to specification of each part.



PISTON RING SIDE CLEARANCE

- Measure side clearance of piston ring and piston ring groove with feeler gauge.

Standard Side Clearance

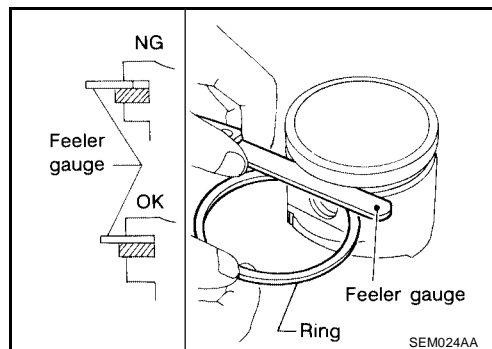
Top ring : 0.045 - 0.080 mm (0.0018 - 0.0031 in)

2nd ring : 0.030 - 0.070 mm (0.0012 - 0.0028 in)

Oil ring : 0.065 - 0.135 mm (0.0026 - 0.0053 in)

Maximum Limit

Top ring : 0.11 mm (0.0043 in)



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

2nd ring : 0.1 mm (0.004 in)
Oil ring : —

- If out of specification, replace piston ring assembly. If clearance exceeds maximum limit with new rings, replace piston

PISTON RING END GAP

- Insert piston ring until it is in the middle of the cylinder bore and measure the end gap.

Standard

Top ring : 0.23 - 0.33 mm (0.0091 - 0.0130 in)

2nd ring : 0.33 - 0.48 mm (0.0130 - 0.0189 in)

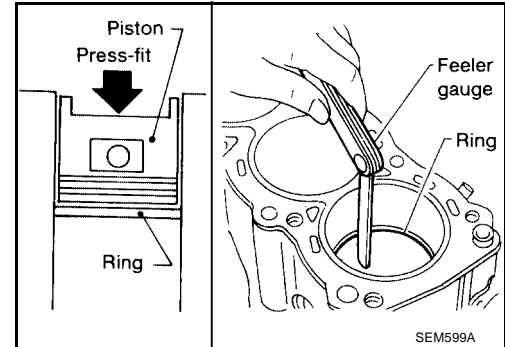
Oil ring : 0.20 - 0.50 mm (0.0079 - 0.0197 in)

Limit:

Top ring : 0.54 mm (0.0213 in)

2nd ring : 0.80 mm (0.0315 in)

Oil ring : 0.95 mm (0.0374 in)

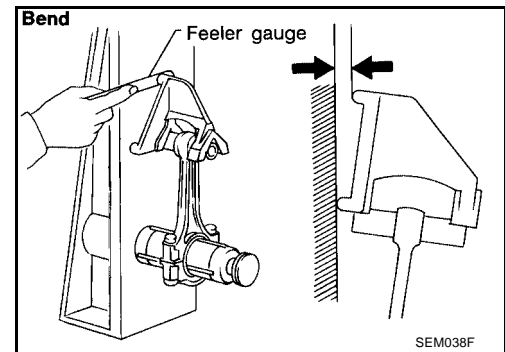


- If out of specification, replace piston ring. If gap still exceeds the limit even with a new ring, re-bore cylinder and use oversized piston and piston ring.

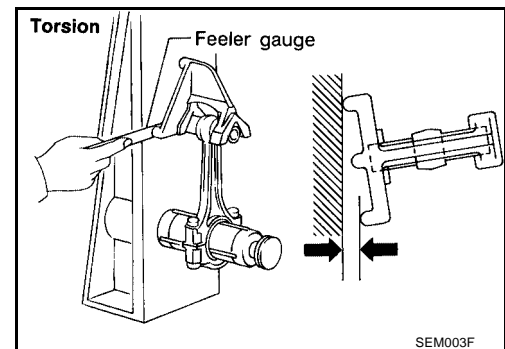
CONNECTING ROD BEND AND TORSION

Bend : Limit 0.15 mm (0.0059 in) per 100 mm (3.94 in) length

Torsion : Limit 0.30 mm (0.0118 in) per 100 mm (3.94 in) length



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



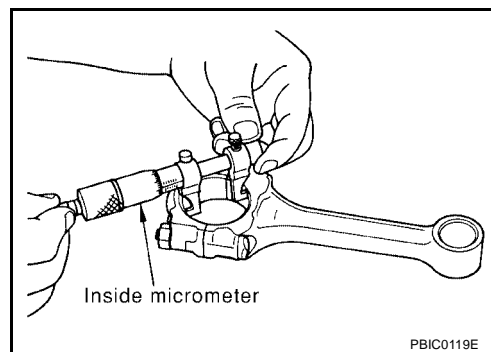
CYLINDER BLOCK

[VQ35DE]

CONNECTING ROD BEARING HOUSING DIAMETER (BIG END)

- Install the connecting rod cap without the connecting rod bearing installed. After tightening the connecting rod nut to the specified torque, measure the connecting rod bearing housing big end inner diameter using an inside micrometer.

Standard : 55.000 - 55.013 mm (2.1654 - 2.1659 in)



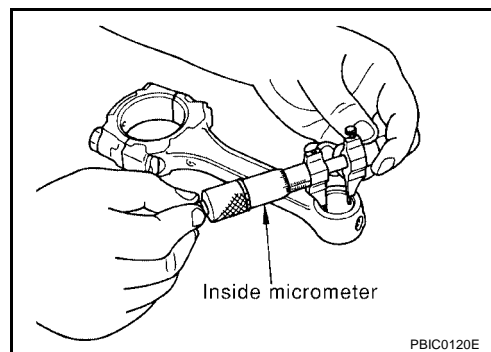
CONNECTING ROD BUSHING OIL CLEARANCE (SMALL END)

Inner Diameter of Connecting Rod (Small End)

- Measure inner diameter of piston pin bushing.

Standard Grade No. 0 : 22.000 - 22.006 mm (0.8661 - 0.8664 in)

Grade No. 1 : 22.006 - 22.012 mm (0.8664 - 0.8666 in)

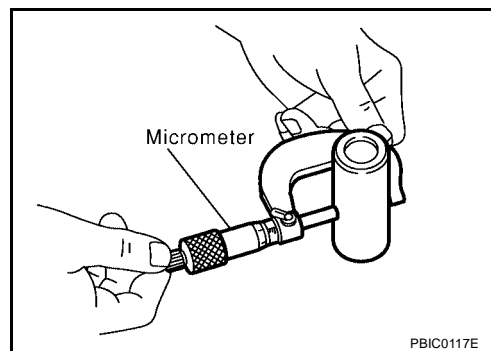


Outer Diameter of Piston Pin

- Measure outer diameter of piston pin.

Standard Grade No. 0 : 21.989 - 21.995 mm (0.8657 - 0.8659 in)

Grade No. 1 : 21.995 - 22.001 mm (0.8659 - 0.8662 in)



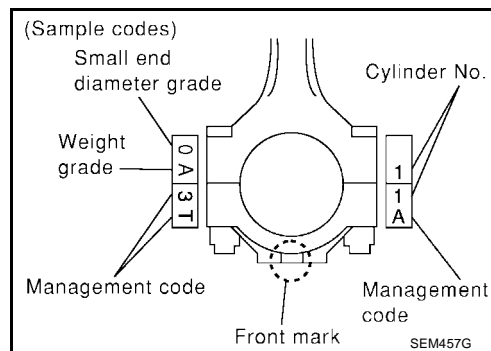
Connecting Rod Bushing Oil Clearance (Small End)

(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 - 0.007 in)

Limit : 0.030 - mm (0.0012 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, refer to the Table for Selective Fitting for Piston to select the piston corresponding to the applicable bore grade of the cylinder block to be used. Refer to [EM-220, "PISTON-TO-CYLINDER BORE CLEARANCE"](#).



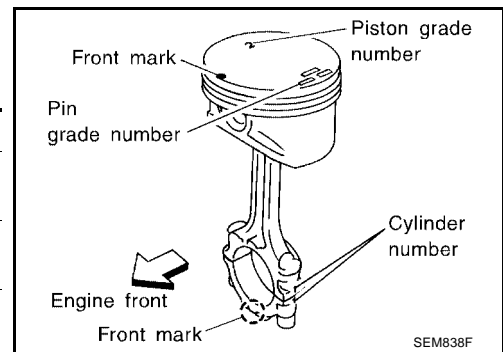
CYLINDER BLOCK

[VQ35DE]

Factory installed parts grading:

- Service parts apply only to grade 0.

Grade	Unit: mm (in)	
	0	1
Connecting rod small end inner diameter	22.000 - 22.006 (0.8661 - 0.8664)	22.006 - 22.012 (0.8664 - 0.8666)
Piston pin outer diameter	21.989 - 21.995 (0.8657 - 0.8659)	21.995 - 22.001 (0.8659 - 0.8662)
Piston pin hole diameter	21.993 - 21.999 (0.8659 - 0.8661)	21.999 - 22.005 (0.8661 - 0.8663)



CYLINDER BLOCK DISTORTION

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

CAUTION:

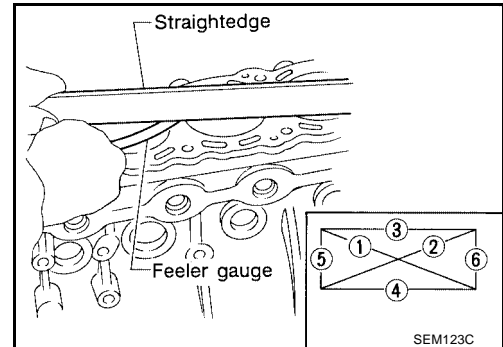
Be careful not to allow gasket flakes to enter the oil or coolant passages.

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

Distortion limit : 0.10 mm (0.0039 in)

- If out of specification, resurface the cylinder block. The allowable amount of resurfacing is dependent on the amount of any cylinder head resurfacing. The resurfacing limit is [amount of cylinder head resurfacing] + [amount of cylinder head resurfacing] = 0.2 mm (0.008 in).

Cylinder block height : 214.95 - 215.05 mm (8.4626 - 8.4665 in)



INNER DIAMETER OF MAIN BEARING HOUSING

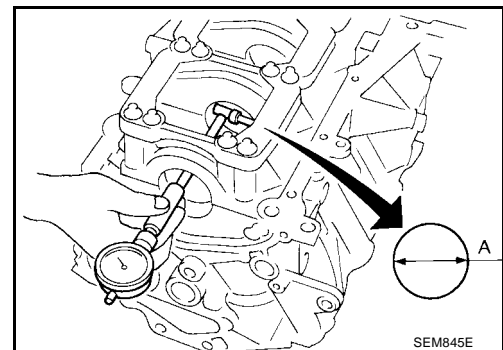
- Install the main bearing caps with the main bearings removed, and tighten the mounting bolts to the specified torque.
- Using a bore gauge, measure the inner diameter of the main bearing housing.

Standard : 63.993 - 64.017 mm (2.5194 - 2.5203 in)

- If out of the standard, replace the cylinder block and main bearing caps as an assembly.

NOTE:

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

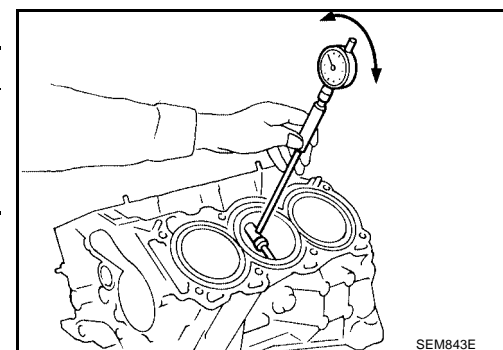


PISTON-TO-CYLINDER BORE CLEARANCE

- Using a bore gauge, measure cylinder bore for wear, out-of-round and taper. The X axis is in the longitudinal direction of the engine.

Cylinder bore inner diameter

Grade No.	Standard inner diameter	Wear limit
No. 1	95.500 - 95.510 mm (3.7598 - 3.7602 in)	0.20 mm (0.0079 in)
No. 2	95.510 - 95.520 mm (3.7602 - 3.7606 in)	
No. 3	95.520 - 95.530 mm (3.7606 - 3.7610 in)	



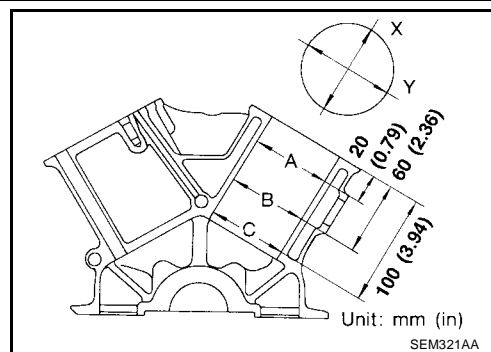
CYLINDER BLOCK

[VQ35DE]

If it exceeds the limit, rebore all cylinders. Replace cylinder block if necessary.

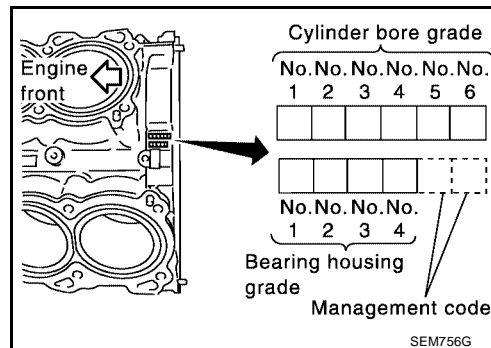
Out-of-round (Difference between X and Y) : limit 0.015 mm (0.0006 in)

Taper (Difference between A and C) : limit 0.015 mm (0.0006 in)



2. Check for scratches and seizure. If seizure is found, hone it.

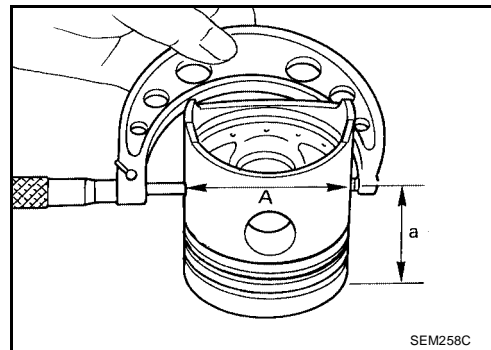
- If both cylinder block and piston are replaced with new ones, select piston of the same grade number punched on cylinder block rear position. These numbers are punched in either Arabic or Roman numerals.



3. Measure piston skirt diameter.

Piston diameter "A" : Refer to [EM-235, "PISTON, PISTON RING AND PISTON PIN"](#).

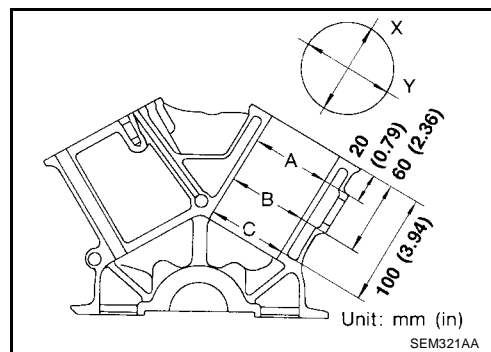
Measuring point "a" (Distance from the top) : 41.0 mm (1.61 in)



4. Check that piston-to-bore clearance is within specification.

Piston-to-bore clearance at "B" : 0.010 - 0.030 mm (0.0004 - 0.0012 in)

- The piston-to-bore clearance is measured at the "B" level in the cylinder as shown.



5. Determine piston oversize according to amount of cylinder wear.

Oversize pistons are available for service.
Refer to [EM-235, "PISTON, PISTON RING AND PISTON PIN"](#).

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

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

where,

D : Bored diameter

A : Piston diameter as measured

- B** : Piston-to-bore clearance
- C** : Honing allowance 0.02 mm (0.0008 in)

7. Install main bearing caps, and tighten to the specified torque. Otherwise, cylinder bores may be distorted after boring.
8. 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.
9. Hone cylinders to obtain specified piston-to-bore clearance.
10. Measure finished cylinder bore for out-of-round and taper.
 - Measurement should be done after cylinder bore cools down.

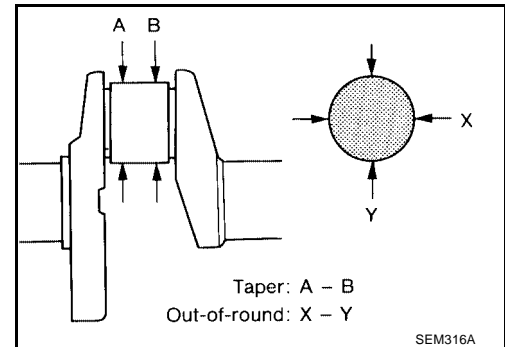
CRANKSHAFT

1. Check the crankshaft main and pin journals for scoring, wear, or cracks.
2. Measure the journals for taper and out-of-round.

Standard

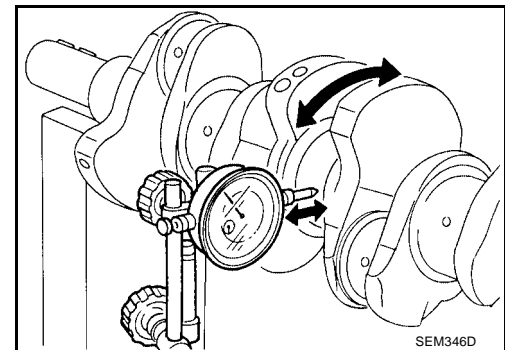
Out-of-round (X - Y) : 0.002 mm (0.0001 in)

Taper (A - B) : 0.002 mm (0.0001 in)



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

Runout limit (total indicator reading) : 0.10 mm (0.0039 in)



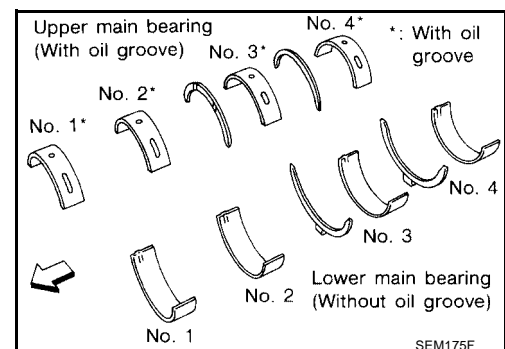
BEARING CLEARANCE

- Use either of the following two methods, however method "A" gives more reliable results and so is the preferred method.

Method A (Using Bore Gauge and Micrometer)

Main Bearing

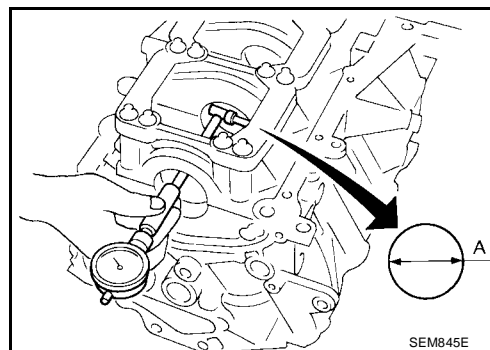
1. Set the main bearings in their proper positions on the cylinder block and the main bearing cap.
2. Install the main bearing caps and bearing beam to the cylinder block. Tighten all bolts in the numerical order as specified. Refer to [EM-207, "Disassembly and Assembly"](#).



CYLINDER BLOCK

[VQ35DE]

3. Measure the inner diameters "A" of each main bearing as shown.



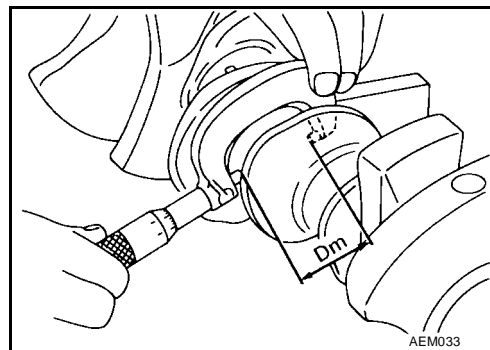
4. Measure the outer diameters "Dm" of each crankshaft main journal as shown.

5. Calculate the main bearing clearance.
Main bearing clearance = "A" - "Dm"

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

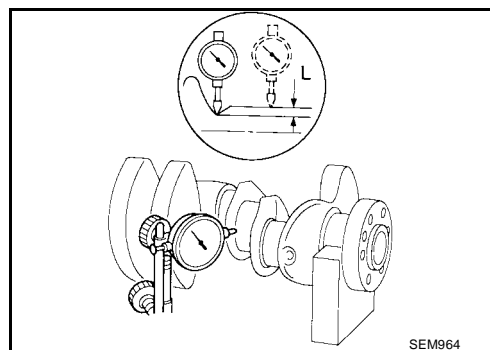
Limit : 0.065 mm (0.0026 in)

- If it exceeds the limit, replace the bearing.
- If clearance cannot be adjusted using any standard bearing grade, grind crankshaft journal and use an undersized bearing.



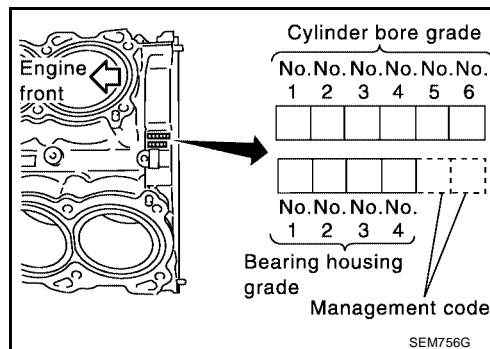
- When grinding the crankshaft journal, confirm that the "L" dimension in the fillet role is more than the specified limit.

"L" : 0.1 mm (0.004 in)



6. If the crankshaft or the cylinder block is replaced with a new one, select thickness of the main bearings as follows:

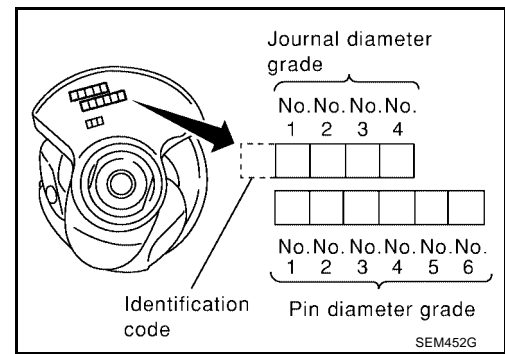
- a. The grade number of each cylinder block main journal is punched on the respective cylinder block. These numbers are punched in either Arabic or Roman numerals. If measured diameter is out of the grade punched, decide suitable grade from available main bearings.



CYLINDER BLOCK

[VQ35DE]

- b. The grade number of each crankshaft main journal is punched on the crankshaft end. These numbers are punched in either Arabic or Roman numerals. If measured diameter is out of grade punched, decide the suitable grade from available main bearings.



- c. Select the main bearing suitable thickness according to the following table:

Cylinder block bearing housing inner diameter Unit: mm (in)		Crankshaft main journal diameter Unit: mm (in)		Hole diameter		Mark																				
						A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	V	W	X
Mark	Axle diameter	63.993 - 63.994 (2.5194 - 2.5194)	63.994 - 63.995 (2.5194 - 2.5195)	63.995 - 63.996 (2.5195 - 2.5195)	63.996 - 63.997 (2.5195 - 2.5196)	63.997 - 63.998 (2.5196 - 2.5196)	63.998 - 63.999 (2.5196 - 2.5196)	63.999 - 64.000 (2.5196 - 2.5197)	64.000 - 64.001 (2.5197 - 2.5197)	64.001 - 64.002 (2.5197 - 2.5198)	64.002 - 64.003 (2.5198 - 2.5198)	64.003 - 64.004 (2.5198 - 2.5198)	64.004 - 64.005 (2.5198 - 2.5199)	64.005 - 64.006 (2.5199 - 2.5199)	64.006 - 64.007 (2.5199 - 2.5200)	64.007 - 64.008 (2.5200 - 2.5200)	64.008 - 64.009 (2.5200 - 2.5200)	64.009 - 64.010 (2.5200 - 2.5201)	64.010 - 64.011 (2.5201 - 2.5201)	64.011 - 64.012 (2.5201 - 2.5202)	64.012 - 64.013 (2.5202 - 2.5202)	64.013 - 64.014 (2.5202 - 2.5202)	64.014 - 64.015 (2.5202 - 2.5203)	64.015 - 64.016 (2.5203 - 2.5203)	64.016 - 64.017 (2.5203 - 2.5203)	
A	59.975 - 59.974 (2.3612 - 2.3612)	0	0	0	01	01	01	1	1	1	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
B	59.974 - 59.973 (2.3612 - 2.3611)	0	0	01	01	01	1	1	1	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
C	59.973 - 59.972 (2.3611 - 2.3611)	0	01	01	01	1	1	1	1	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
D	59.972 - 59.971 (2.3611 - 2.3611)	01	01	01	1	1	1	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
E	59.971 - 59.970 (2.3611 - 2.3610)	01	01	1	1	1	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
F	59.970 - 59.969 (2.3610 - 2.3610)	01	1	1	1	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
G	59.969 - 59.968 (2.3610 - 2.3609)	1	1	1	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
H	59.968 - 59.967 (2.3609 - 2.3609)	1	1	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
J	59.967 - 59.966 (2.3609 - 2.3609)	1	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
K	59.966 - 59.965 (2.3909 - 2.3608)	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
L	59.965 - 59.964 (2.3608 - 2.3608)	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
M	59.964 - 59.963 (2.3608 - 2.3607)	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
N	59.963 - 59.962 (2.3607 - 2.3607)	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
P	59.962 - 59.961 (2.3607 - 2.3607)	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
R	59.961 - 59.960 (2.3607 - 2.3606)	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
S	59.960 - 59.959 (2.3606 - 2.3606)	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
T	59.959 - 59.958 (2.3606 - 2.3605)	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
U	59.958 - 59.957 (2.3605 - 2.3605)	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
V	59.957 - 59.956 (2.3605 - 2.3605)	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
W	59.956 - 59.955 (2.3605 - 2.3604)	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
X	59.955 - 59.954 (2.3604 - 2.3604)	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Y	59.954 - 59.953 (2.3604 - 2.3603)	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
4	59.953 - 59.952 (2.3603 - 2.3603)	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
7	59.952 - 59.951 (2.3603 - 2.3603)	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12

PBIC0814E

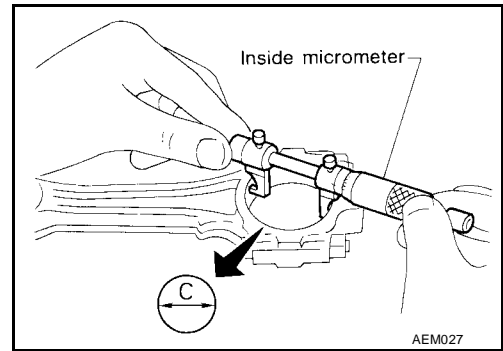
Connecting Rod Bearing (Big End)

1. Install the connecting rod bearing to the connecting rod and cap.
2. Install the connecting rod cap to the connecting rod. Tighten to specification. Refer to [EM-207, "Disassembly and Assembly"](#).

CYLINDER BLOCK

[VQ35DE]

- Measure the inner diameter "C" of each connecting rod (big end) as shown.

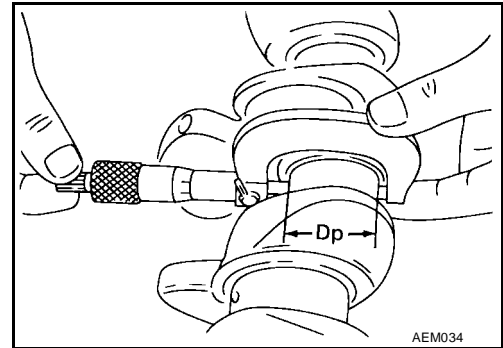


- Measure the outer diameter "Dp" of each crankshaft pin journal.
- Calculate the connecting rod bearing clearance.
Connecting rod bearing clearance = C - Dp

Standard : 0.034 - 0.059 mm (0.0013 - 0.0023 in)

Limit : 0.070 mm (0.0028 in)

- If the calculated clearance exceeds the specified limit, replace the bearings.
- If the clearance cannot be adjusted within the standard of any bearing, grind the crankshaft journal and use undersized bearings.

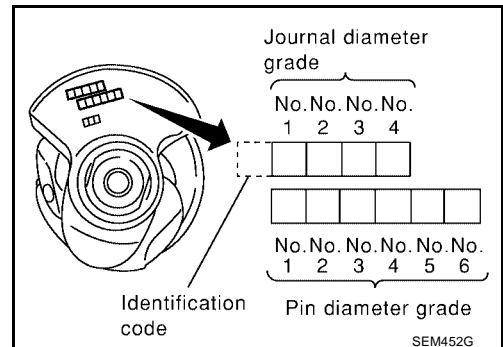


- If the crankshaft is replaced with a new one, select the connecting rod bearings according to the following table:

Connecting Rod Bearing Grade Number (Identification Color)

Crankshaft pin journal grade number	Connecting rod bearing grade number
0	0 (black)
1	1 (brown)
2	2 (green)

These numbers are punched in either Arabic or Roman numerals.



Method B (Using Plastigage)

- Remove oil and dust on the crankshaft pin and the surfaces of each bearing completely.
- Cut a 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 nuts to the specified torque.

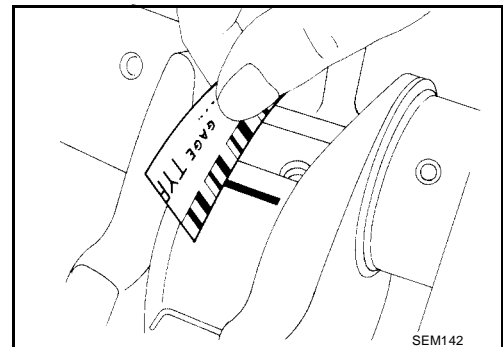
CAUTION:

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 repair limit is same as that described in "Method A (Using Bore Gauge and Micrometer)".



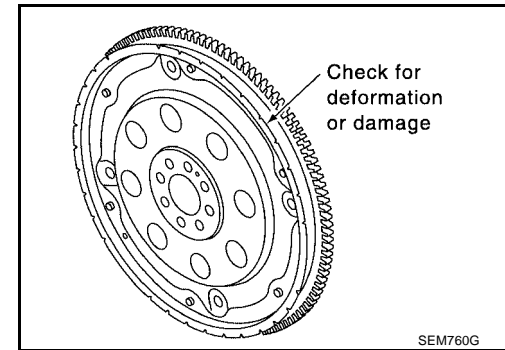
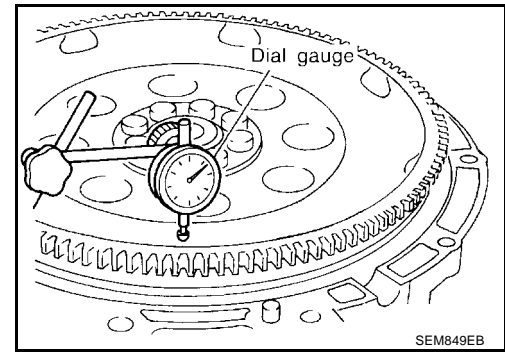
DRIVE PLATE RUNOUT (A/T)

Runout (Total Indicator Reading):

Drive plate (A/T) : less than 0.15 mm (0.0059 in)

CAUTION:

- The signal plate is built into the drive assembly. Be careful not to damage the signal plate, particularly the teeth.
- Check the drive plate and signal plate for deformation or cracks.
- Keep any magnetized objects away from the signal plate, particularly the teeth.

**FLYWHEEL RUNOUT (M/T)****NOTE:**

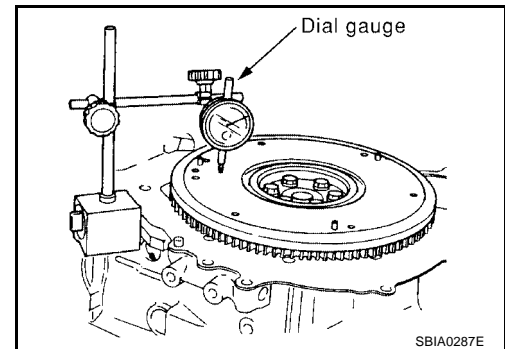
- This inspection is for double mass flywheel only.
- Do not disassemble the double mass flywheel.

Flywheel Deflection

- Measure the deflection of the flywheel contact surface to the clutch with a dial gauge.
- Measure the deflection at 210 mm (8.27 in) diameter.

Standard : 0.45 mm (0.0177 in) or less**Limit** : 1.3 mm (0.051 in) or less

- When measured value exceeds the limit, replace the flywheel with a new one.

**Movement Around in Rotation Direction**

Check the movement amount with the following procedure:

1. Install a bolt to clutch cover mounting hole and place a torque wrench on the extended line of the flywheel center line.
 - Tighten the bolt at a force of 9.8 N·m (1 kg·m, 87 in-lb) to keep it from loosening.
2. Put a mating mark on the circumference of the two flywheel masses without applying any load (measurement standard points).
3. Apply a force of 9.8 N·m (1 kg·m, 87 in-lb) in each direction, and mark the movement amount on the mass on the transaxle side.

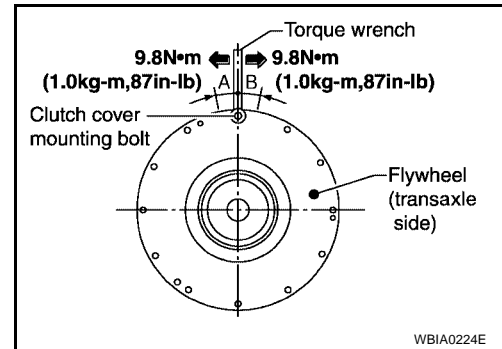
CYLINDER BLOCK

[VQ35DE]

4. Measure dimensions of movement amounts A and B on the circumference of the flywheel on the transaxle side.

**Flywheel movement : 24 mm (0.94 in) or less
in rotation direction**

- When the measured value exceeds the standard, replace the flywheel.

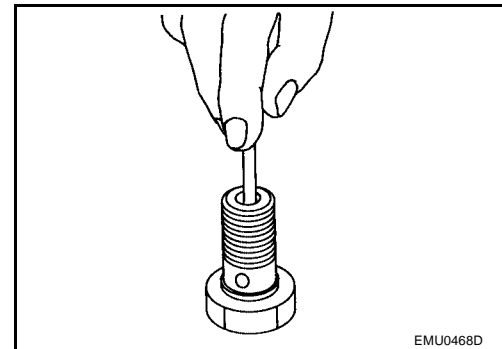


OIL JET

- Check nozzle for deformation and damage.
- Blow compressed air from nozzle, and check for clogs.
- If it is not satisfied, replace oil jet.

OIL JET RELIEF VALVE

- Using a clean plastic stick, press check valve in oil jet relief valve. Make sure that valve moves smoothly with proper reaction force.
- If it is not satisfied, replace oil jet relief valve.



SERVICE DATA AND SPECIFICATIONS (SDS)

[VQ35DE]

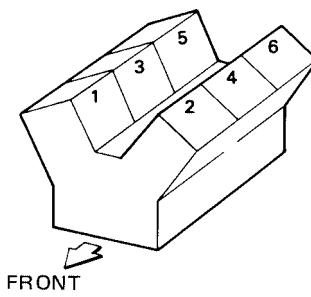
SERVICE DATA AND SPECIFICATIONS (SDS)

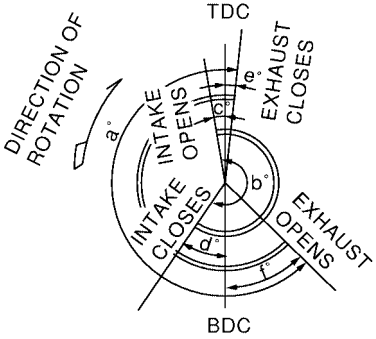
PFP:00100

Standard and Limit GENERAL SPECIFICATIONS

EBS00DVM

Cylinder arrangement		V-6
Displacement cm ³ (cu in)		3,498 (213.45)
Bore and stroke mm (in)		95.5 x 81.4 (3.76 x 3.205)
Valve arrangement		DOHC
Firing order		1-2-3-4-5-6
Number of piston rings	Compression	2
	Oil	1
Number of main bearings		4
Compression ratio		10.0
Compression pressure kPa (kg/cm ² , psi)/300 rpm	Standard	1,275 (13.0, 185)
	Minimum	981 (10.0, 142)
	Differential limit between cylinders	98 (1.0, 14)

Cylinder number	 <p style="text-align: right; margin-top: 10px;">SEM713A</p>
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Valve timing (IVTC - OFF)	 <p style="text-align: right; margin-top: 10px;">PBIC0187E</p>
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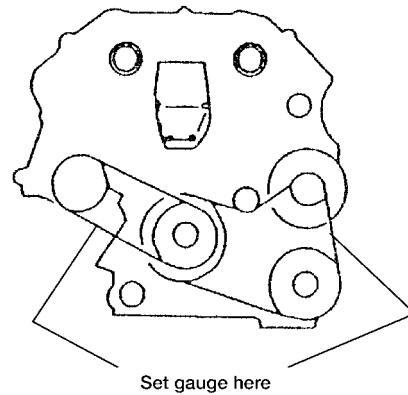
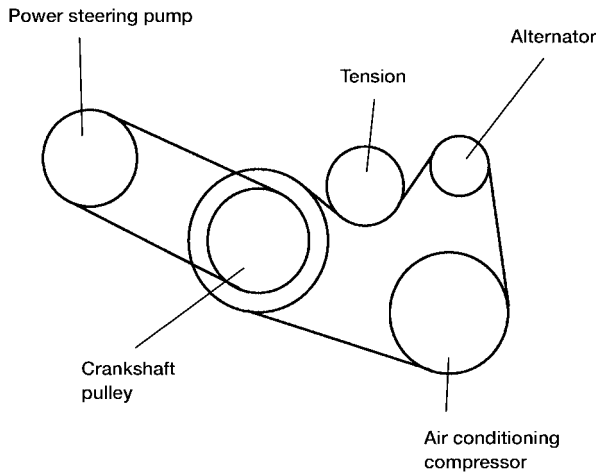
Unit: degree

a	b	c	d	e	f
240	238	- 6	64	8	52

SERVICE DATA AND SPECIFICATIONS (SDS)

[VQ35DE]

DRIVE BELT



LBIA0076E

	Deflection adjustment		Unit: mm (in)	Tension adjustment*		Unit: N (kg, lb)
	Used belt		New belt	Used belt		New belt
	Limit	After adjustment		Limit	After adjustment	
Alternator and air conditioning compressor	7 (0.28)	4.2 - 4.6 (0.17 - 0.18)	3.7 - 4.1 (0.15 - 0.16)	294 (30, 66)	730 - 818 (74.5 - 83.5, 164 - 184)	838 - 926 (85.5 - 94.5, 188 - 208)
Power steering pump	11 (0.43)	7.3 - 8 (0.29 - 0.30)	6.5 - 7.2 (0.26 - 0.28)	196 (20, 44)	495 - 583 (50.5 - 59.5, 111 - 131)	603 - 691 (61.5 - 70.5, 135.6 - 155.4)
Applied pushing force	98 (10, 22)			—		

*: If belt tension gauge cannot be installed at check points shown, check drive belt tension at different location on the belt.

INTAKE MANIFOLD AND EXHAUST MANIFOLD

Unit: mm (in)

Item	Limit
Intake manifold collector	0.1 (0.004)
Intake manifold	0.1 (0.004)
Exhaust manifold	0.3 (0.012)

SPARK PLUG

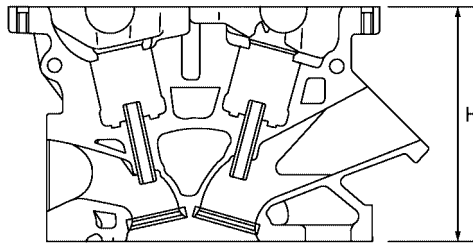
Make	NGK
Standard type	PLFR5A-11
Hot type	PLFR4A-11
Cold type	PLFR6A-11
Gap (nominal)	1.1 mm (0.043 in)

SERVICE DATA AND SPECIFICATIONS (SDS)

[VQ35DE]

CYLINDER HEAD

Unit: mm (in)



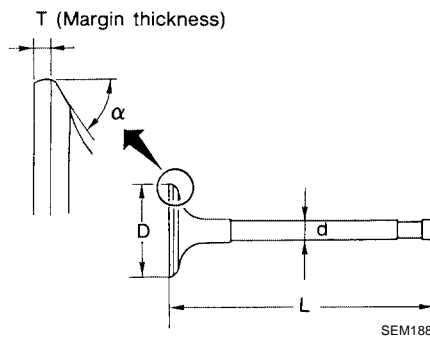
PBIC0924E

	Standard	Limit
Head surface distortion	Less than 0.03 (0.0012)	0.1 (0.004)
Normal cylinder head height "H"	—	126.3 - 126.5 (4.972 - 4.980)

VALVE

Valve Dimensions

Unit: mm (in)



Valve head diameter "D"	Intake	37.0 - 37.3 (1.4567 - 1.4685)
	Exhaust	31.2 - 31.5 (1.228 - 1.240)
Valve length "L"	Intake	96.46 (3.7976)
	Exhaust	96.81 (3.8114)
Valve stem diameter "d"	Intake	5.965 - 5.980 (0.2348 - 0.2354)
	Exhaust	5.945 - 5.960 (0.2341 - 0.2346)
Valve seat angle " α "	Intake	45°15' - 45°45'
	Exhaust	
Valve margin "T"	Intake	1.15 - 1.45 (0.0453 - 0.0571)
	Exhaust	1.45 - 1.75 (0.0571 - 0.0689)
Valve margin "T" limit		More than 0.5 (0.020)
Valve stem end surface grinding limit		Less than 0.2 (0.008)

Valve Clearance

Unit: mm (in)

	Cold	Hot* (reference data)
Intake	0.26 - 0.34 (0.010 - 0.013)	0.304 - 0.416 (0.012 - 0.016)
Exhaust	0.29 - 0.37 (0.011 - 0.015)	0.308 - 0.432 (0.012 - 0.017)

*: Approximately 80°C (176°F)

SERVICE DATA AND SPECIFICATIONS (SDS)

[VQ35DE]

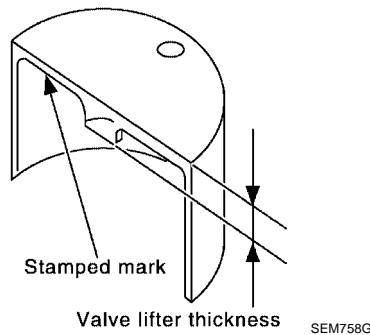
Valve Spring

Free height	mm (in)		46.52 (1.8315)
Pressure	N (kg, lb) at height mm (in)	Standard	184 - 208 (18.8 - 21.2, 41.4 - 46.8) at 37.0 (1.457)
		Limit	407 - 459 (41.5 - 46.8, 91.5 - 103.2) at 28.2 (1.110)
Out-of-square	mm (in)		Less than 2.0 (0.079)

Valve Lifter

Unit: mm (in)

Valve lifter outer diameter	33.977 - 33.987 (1.3377 - 1.3381)
Lifter bore diameter	34.000 - 34.016 (1.3386 - 1.3392)
Clearance between lifter and lifter guide	0.013 - 0.039 (0.0005 - 0.0015)



SEM758G

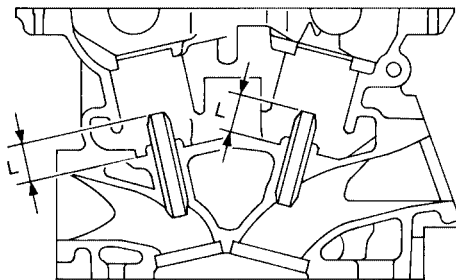
Identification Mark	Thickness mm (in)
788C	7.88 (0.3102)
790C	7.90 (0.3110)
792C	7.92 (0.3118)
794C	7.94 (0.3126)
796C	7.96 (0.3134)
798C	7.98 (0.3142)
800C	8.00 (0.3150)
802C	8.02 (0.3157)
804C	8.04 (0.3165)
806C	8.06 (0.3173)
808C	8.08 (0.3181)
810C	8.10 (0.3189)
812C	8.12 (0.3197)
814C	8.14 (0.3205)
816C	8.16 (0.3213)
818C	8.18 (0.3220)
820C	8.20 (0.3228)
822C	8.22 (0.3236)
824C	8.24 (0.3244)
826C	8.26 (0.3252)
828C	8.28 (0.3260)
830C	8.30 (0.3268)
832C	8.32 (0.3276)
834C	8.34 (0.3283)
836C	8.36 (0.3291)

SERVICE DATA AND SPECIFICATIONS (SDS)

[VQ35DE]

Valve Guide

Unit: mm (in)



SEM950E

		Standard	Service
Valve guide	Outer diameter	10.023 - 10.034 (0.3946 - 0.3950)	10.223 - 10.234 (0.4025 - 0.4029)
Valve guide	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)	
		Standard	Limit
Valve to valve guide clearance	Intake	0.020 - 0.053 (0.0008 - 0.0021)	0.08 (0.0031)
	Exhaust	0.040 - 0.073 (0.0016 - 0.0029)	0.1 (0.004)
Valve deflection	Intake	—	0.24 (0.0094)
	Exhaust	—	0.28 (0.0110)
Projection length "L"		12.6 - 12.8 (0.496 - 0.504)	

SERVICE DATA AND SPECIFICATIONS (SDS)

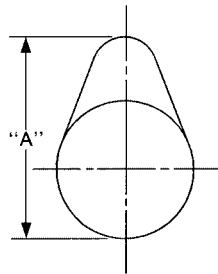
[VQ35DE]

CAMSHAFT AND CAMSHAFT BEARING

Unit: mm (in)

	Standard	Limit
Camshaft journal to bearing clearance	No. 1 0.045 - 0.086 (0.0018 - 0.0034)	0.15 (0.0059)
	No. 2, 3, 4 0.035 - 0.076 (0.0014 - 0.0030)	
Inner diameter of camshaft bearing	No. 1 26.000 - 26.021 (1.0236 - 1.0244)	—
	No. 2, 3, 4 23.500 - 23.521 (0.9252 - 0.9260)	
Outer diameter of camshaft journal	No. 1 25.935 - 25.955 (1.0211 - 1.0218)	—
	No. 2, 3, 4 23.445 - 23.465 (0.9230 - 0.9238)	
Camshaft runout [TIR*]	Less than 0.02 (0.0008)	0.05 (0.0020)
Camshaft sprocket runout [TIR*]	Less than 0.15 (0.0059)	—
Camshaft end play	0.115 - 0.188 (0.0045 - 0.0074)	0.24 (0.0094)

*: Total indicator reading

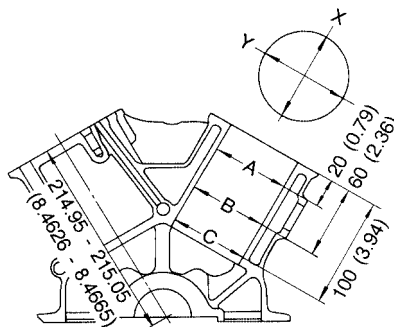


SEM671

Cam lobe height "A"	Intake and exhaust	44.465 - 44.655 (1.7506 - 1.7581)
Wear limit of cam lobe height		0.2 (0.008)

CYLINDER BLOCK

Unit: mm (in)



SEM022EA

Surface distortion	Standard			Less than 0.03 (0.0012)
	Limit			0.10 (0.0039)
Cylinder bore	Inner diameter	Standard	Grade No. 1	95.500 - 95.510 (3.7598 - 3.7602)
			Grade No. 2	95.510 - 95.520 (3.7602 - 3.7606)
			Grade No. 3	95.520 - 95.530 (3.7606 - 3.7610)
		Wear limit		0.20 (0.0079)
Out-of-round (Difference between X and Y)				Less than 0.015 (0.0006)

SERVICE DATA AND SPECIFICATIONS (SDS)

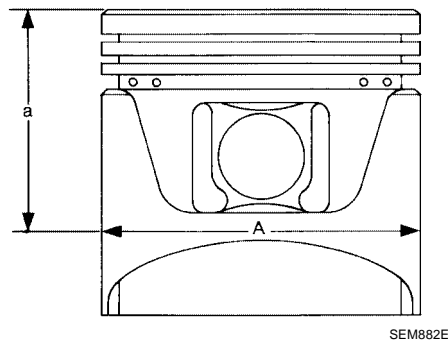
[VQ35DE]

Taper (Difference between A and C)		Less than 0.015 (0.0006)
Main journal inner diameter grade (Without bearing)	Grade No. A	63.993 - 63.994 (2.5194 - 2.5194)
	Grade No. B	63.994 - 63.995 (2.5194 - 2.5195)
	Grade No. C	63.995 - 63.996 (2.5195 - 2.5195)
	Grade No. D	63.996 - 63.997 (2.5195 - 2.5196)
	Grade No. E	63.997 - 63.998 (2.5196 - 2.5196)
	Grade No. F	63.998 - 63.999 (2.5196 - 2.5196)
	Grade No. G	63.999 - 64.000 (2.5196 - 2.5197)
	Grade No. H	64.000 - 64.001 (2.5197 - 2.5197)
	Grade No. J	64.001 - 64.002 (2.5197 - 2.5198)
	Grade No. K	64.002 - 64.003 (2.5198 - 2.5198)
	Grade No. L	64.003 - 64.004 (2.5198 - 2.5198)
	Grade No. M	64.004 - 64.005 (2.5198 - 2.5199)
	Grade No. N	64.005 - 64.006 (2.5199 - 2.5199)
	Grade No. P	64.006 - 64.007 (2.5199 - 2.5200)
	Grade No. R	64.007 - 64.008 (2.5200 - 2.5200)
	Grade No. S	64.008 - 64.009 (2.5200 - 2.5200)
	Grade No. T	64.009 - 64.010 (2.5200 - 2.5201)
	Grade No. U	64.010 - 64.011 (2.5201 - 2.5201)
	Grade No. V	64.011 - 64.012 (2.5201 - 2.5202)
	Grade No. W	64.012 - 64.013 (2.5202 - 2.5202)
Grade No. X	64.013 - 64.014 (2.5202 - 2.5202)	
Grade No. Y	64.014 - 64.015 (2.5202 - 2.5203)	
Grade No. 4	64.015 - 64.016 (2.5203 - 2.5203)	
Grade No. 7	64.016 - 64.017 (2.5203 - 2.5203)	
Difference in inner diameter between cylinders	Standard	Less than 0.03 (0.0012)

PISTON, PISTON RING AND PISTON PIN

Available Piston

Unit: mm (in)



SEM882E

Piston skirt diameter "A"	Standard	Grade No. 1	95.480 - 95.490 (3.7590 - 3.7594)
		Grade No. 2	95.490 - 95.500 (3.7594 - 3.7598)
		Grade No. 3	95.500 - 95.510 (3.7598 - 3.7602)
		0.20 (0.0079) oversize (Service)	95.680 - 95.710 (3.7669 - 3.7681)
"a" dimension			41.0 (1.614)
Piston pin hole diameter	Grade No. 0		21.993 - 21.999 (0.8659 - 0.8661)
	Grade No. 1		21.999 - 22.005 (0.8661 - 0.8663)
Piston-to-bore clearance to cylinder block			0.010 - 0.030 (0.0004 - 0.0012)

SERVICE DATA AND SPECIFICATIONS (SDS)

[VQ35DE]

Piston Ring

Unit: mm (in)

		Standard	Limit
Side clearance	Top	0.045 - 0.080 (0.0018 - 0.0031)	0.11 (0.0043)
	2nd	0.030 - 0.070 (0.0012 - 0.0028)	0.1 (0.004)
	Oil ring	0.065 - 0.135 (0.0026 - 0.0053)	—
End gap	Top	0.23 - 0.33 (0.0091 - 0.0130)	0.54 (0.0213)
	2nd	0.33 - 0.48 (0.0130 - 0.0189)	0.80 (0.0315)
	Oil (rail ring)	0.20 - 0.50 (0.0079 - 0.0197)	0.95 (0.0374)

Piston Pin

Unit: mm (in)

Piston pin outer diameter	Grade No. 0	21.989 - 21.995 (0.8657 - 0.8659)
	Grade No. 1	21.995 - 22.001 (0.8659 - 0.8662)
Interference fit of piston pin to piston		0.002 - 0.006 (0.0001 - 0.0002)
Piston pin to connecting rod bushing oil clearance	Standard	0.005 - 0.017 (0.0002 - 0.0007)
	Limit	0.030 (0.0012)

*: Values measured at ambient temperature of 20°C (68°F)

CONNECTING ROD

Unit: mm (in)

Center distance		144.15 - 144.25 (5.6752 - 5.6791)
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		23.980 - 24.000 (0.9441 - 0.9449)
Piston pin bushing inner diameter*	Grade No. 0	22.000 - 22.006 (0.8661 - 0.8664)
	Grade No. 1	22.006 - 22.012 (0.8664 - 0.8666)
Connecting rod big end inner diameter		55.000 - 55.013 (2.1654 - 2.1659)
Side clearance	Standard	0.20 - 0.35 (0.0079 - 0.0138)
	Limit	0.40 (0.0157)

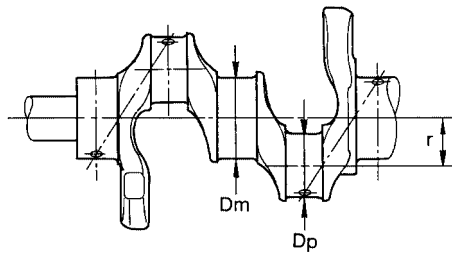
*: After installing in connecting rod

SERVICE DATA AND SPECIFICATIONS (SDS)

[VQ35DE]

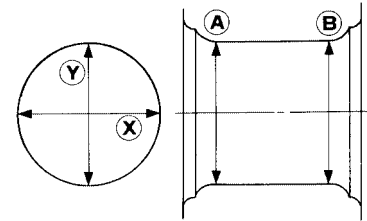
CRANKSHAFT

Unit: mm (in)



SEM645

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



SEM715

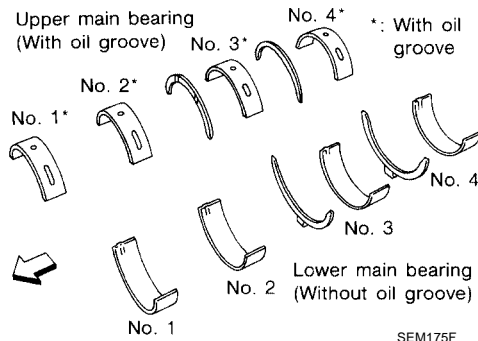
Main journal dia. "Dm" grade	Grade No. A	59.975 - 59.974 (2.3612 - 2.3612)
	Grade No. B	59.974 - 59.973 (2.3612 - 2.3611)
	Grade No. C	59.973 - 59.972 (2.3611 - 2.3611)
	Grade No. D	59.972 - 59.971 (2.3611 - 2.3611)
	Grade No. E	59.971 - 59.970 (2.3611 - 2.3610)
	Grade No. F	59.970 - 59.969 (2.3610 - 2.3610)
	Grade No. G	59.969 - 59.968 (2.3610 - 2.3609)
	Grade No. H	59.968 - 59.967 (2.3609 - 2.3609)
	Grade No. J	59.967 - 59.966 (2.3609 - 2.3609)
	Grade No. K	59.966 - 59.965 (2.3609 - 2.3608)
	Grade No. L	59.965 - 59.964 (2.3608 - 2.3608)
	Grade No. M	59.964 - 59.963 (2.3608 - 2.3607)
	Grade No. N	59.963 - 59.962 (2.3607 - 2.3607)
	Grade No. P	59.962 - 59.961 (2.3607 - 2.3607)
	Grade No. R	59.961 - 59.960 (2.3607 - 2.3606)
	Grade No. S	59.960 - 59.959 (2.3606 - 2.3606)
	Grade No. T	59.959 - 59.958 (2.3606 - 2.3605)
Grade No. U	59.958 - 59.957 (2.3605 - 2.3605)	
Grade No. V	59.957 - 59.956 (2.3605 - 2.3605)	
Grade No. W	59.956 - 59.955 (2.3605 - 2.3604)	
Grade No. X	59.955 - 59.954 (2.3604 - 2.3604)	
Grade No. Y	59.954 - 59.953 (2.3604 - 2.3603)	
Grade No. 4	59.953 - 59.952 (2.3603 - 2.3603)	
Grade No. 7	59.952 - 59.951 (2.3603 - 2.3603)	
Pin journal dia. "Dp"	Grade No. 0	51.968 - 51.974 (2.0460 - 2.0462)
	Grade No. 1	51.962 - 51.968 (2.0457 - 2.0460)
	Grade No. 2	51.956 - 51.962 (2.0445 - 2.0457)
Center distance "r"		40.36 - 40.44 (1.5890 - 1.5921)
Out-of-round (Difference between X and Y)	Standard	Less than 0.002 (0.0001)
Taper (Difference between A and B)	Standard	Less than 0.002 (0.0001)
Runout [TIR*]	Limit	Less than 0.10 (0.0039)
End play	Standard	0.10 - 0.25 (0.0039 - 0.0098)
	Limit	0.30 (0.0118)

*: Total indicator reading

SERVICE DATA AND SPECIFICATIONS (SDS)

[VQ35DE]

AVAILABLE MAIN BEARING



Grade number	Thickness "T" mm (in)	Width "W" mm (in)	Identification color (UPR/LWR)	Remarks
0	2.000 - 2.003 (0.0787 - 0.0789)	19.9 - 20.1 (0.783 - 0.791)	Black	Grade is the same for upper and lower bearings.
1	2.003 - 2.006 (0.0789 - 0.0790)		Brown	
2	2.006 - 2.009 (0.0790 - 0.0791)		Green	
3	2.009 - 2.012 (0.0791 - 0.0792)		Yellow	
4	2.012 - 2.015 (0.0792 - 0.0793)		Blue	
5	2.015 - 2.018 (0.0793 - 0.0794)		Pink	
6	2.018 - 2.021 (0.0794 - 0.0796)		Purple	
7	2.021 - 2.024 (0.0796 - 0.0797)		White	
01	UPP	2.003 - 2.006 (0.0789 - 0.0790)	Brown/Black	Grade is different for upper and lower bearings.
	LWR	2.000 - 2.003 (0.0787 - 0.0789)		
12	UPR	2.006 - 2.009 (0.0790 - 0.0791)	Green/Brown	
	LWR	2.003 - 2.006 (0.0789 - 0.0790)		
23	UPR	2.009 - 2.012 (0.0791 - 0.0792)	Yellow/Green	
	LWR	2.006 - 2.009 (0.0790 - 0.0791)		
34	UPR	2.012 - 2.015 (0.0792 - 0.0793)	Blue/Yellow	
	LWR	2.009 - 2.012 (0.0791 - 0.0792)		
45	UPR	2.015 - 2.018 (0.0793 - 0.0794)	Pink/Blue	
	LWR	2.012 - 2.015 (0.0792 - 0.0793)		
56	UPR	2.018 - 2.021 (0.0794 - 0.0796)	Purple/Pink	
	LWR	2.015 - 2.018 (0.0793 - 0.0794)		
67	UPR	2.021 - 2.024 (0.0796 - 0.0797)	White/Purple	
	LWR	2.018 - 2.021 (0.0794 - 0.0796)		

Undersize

Unit: mm (in)

	Thickness	Main journal diameter "Dm"
0.25 (0.0098)	2.132 - 2.140 (0.0839 - 0.0843)	Grind so that bearing clearance is the specified value.

CONNECTING ROD BEARING

Grade number	Thickness "T" mm (in)	Identification color (mark)
0	1.500 - 1.503 (0.0591 - 0.0592)	Black
1	1.503 - 1.506 (0.0592 - 0.0593)	Brown
2	1.506 - 1.509 (0.0593 - 0.0594)	Green

SERVICE DATA AND SPECIFICATIONS (SDS)

[VQ35DE]

Undersize

Unit: mm (in)

	Thickness	Crank pin journal diameter "Dp"
0.25 (0.0098)	1.626 - 1.634 (0.0640 - 0.0643)	Grind so that bearing clearance is the specified value.

A

EM

MISCELLANEOUS COMPONENTS

Unit: mm (in)

Flywheel deflection [TIR]* - Standard	Less than 0.45 (0.0177)
Flywheel deflection [TIR]* - Limit	1.3 (0.051)
Drive plate runout [TIR]*	Less than 0.15 (0.0059)
Flywheel movement in rotation direction	Less than 24 (0.94)

C

D

*: Total indicator reading

BEARING CLEARANCE

Unit: mm (in)

Main bearing clearance	Standard	0.035 - 0.045 (0.0014 - 0.0018)*
	Limit	0.065 (0.0026)
Connecting rod bearing clearance	Standard	0.034 - 0.059 (0.0013 - 0.0023)*
	Limit	0.070 (0.0028)

E

F

G

*: Actual clearance

H

I

J

K

L

M

