

CYLINDER HEAD

[VQ37VHR]

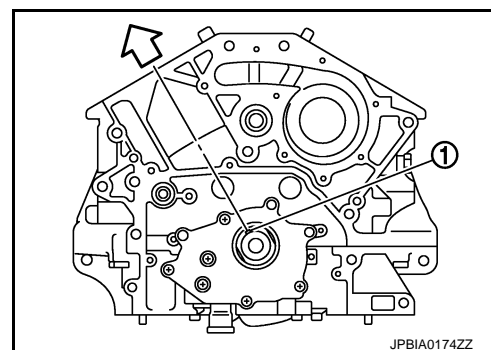
< UNIT DISASSEMBLY AND ASSEMBLY >

7. Turn crankshaft until No. 1 piston is set at TDC.

1 : Crankshaft key

↔ : Bank 1 side

- Crankshaft key should line up with the cylinder center line (bank 1) as shown in the figure.



8. Install cylinder head, and tighten cylinder head bolts in numerical order as shown in figure as follows:

A : Bank 1

B : Bank 2

↔ : Engine front

- Use the cylinder head bolt wrench [commercial service tool: — (J-24239-01)] and power tool.

CAUTION:

- If cylinder head bolts are re-used, check their outer diameters before installation. Refer to [EM-119, "Inspection"](#).
- Before installing cylinder head, inspect cylinder head distortion. Refer to [EM-119, "Inspection"](#).

- Apply new engine oil to threads and seat surfaces of cylinder head bolts.
- Tighten all cylinder head bolts.

: 105 N·m (11 kg-m, 77 ft-lb)

- Completely loosen all cylinder head bolts.

: 0 N·m (0 kg-m, 0 ft-lb)

CAUTION:

In step "c", loosen bolts in the reverse order of that indicated in the figure.

- Tighten all cylinder head bolts.

: 40.0 N·m (4.1 kg-m, 30 ft-lb)

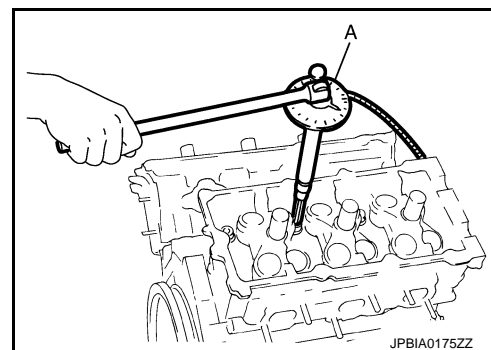
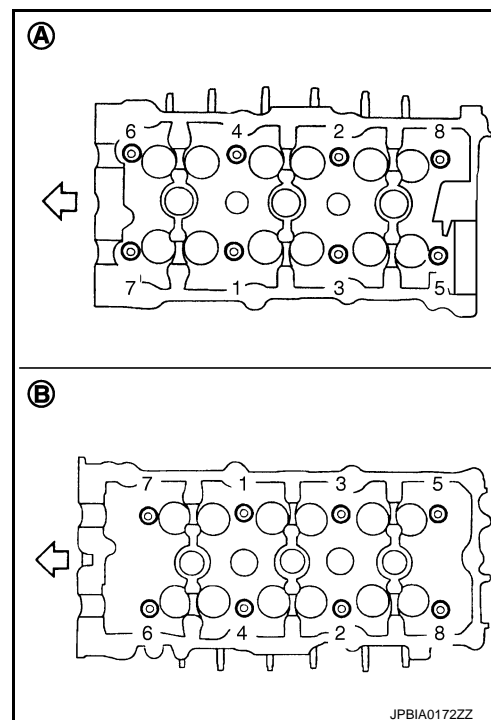
- Turn all cylinder head bolts 95 degrees clockwise (angle tightening).

CAUTION:

Check the tightening angle using the angle wrench [SST: KV10112100 (BT8653-A)] (A). Never make judgment by visual inspection.

- Check tightening angle indicated on the angle wrench indicator plate.

- Turn all cylinder head bolts 95 degrees clockwise again (angle tightening).



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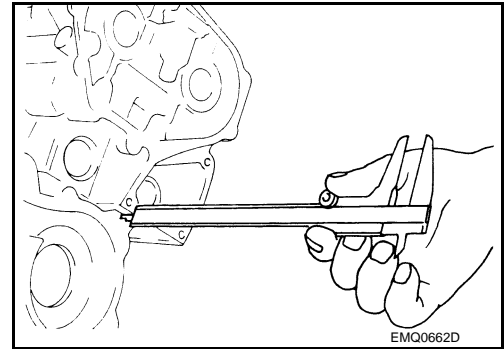
< UNIT DISASSEMBLY AND ASSEMBLY >

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9. After installing cylinder head, measure distance between front end faces of cylinder block and cylinder head (bank 1 and bank 2).

Standard : 14.1 - 14.9 mm (0.555 - 0.587 in)

- If measured value is out of the standard, re-install cylinder head.



10. Install valve spring (uneven pitch type).
- Install narrow pitch (B) end [paint mark (C)] to cylinder head side (valve spring seat side).

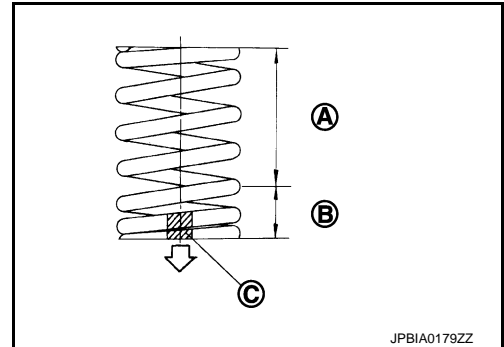
A : Wide pitch

⇐ : Cylinder head side

Paint mark color

Intake : Purple

Exhaust : Yellowish green



11. Install valve spring retainer.

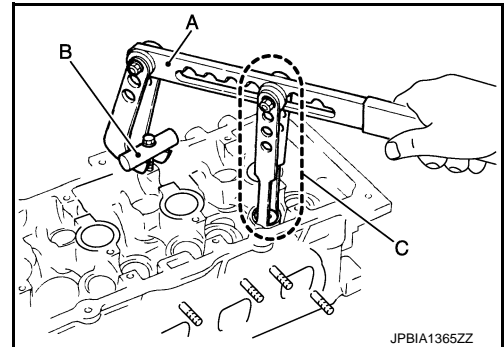
12. Install valve collet.

- Compress valve spring with the valve spring compressor [SST: KV10116200 (J-26336-A)] (A), the attachment [SST: KV10115900 (J-26336-20)] (C) and the adapter [SST: KV10109220 (—)] (B). Install valve collet with a magnet hand.

CAUTION:

When working, take care not to damage valve lifter holes.

- Tap valve stem edge lightly with plastic hammer after installation to check its installed condition.



13. Install valve lifter.

- Install it in the original position.

14. Install spark plug with spark plug wrench (commercial service tool).

15. Install in the reverse order of removal after this step.

Inspection

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INSPECTION AFTER DISASSEMBLY

Cylinder Head Bolts Outer Diameter

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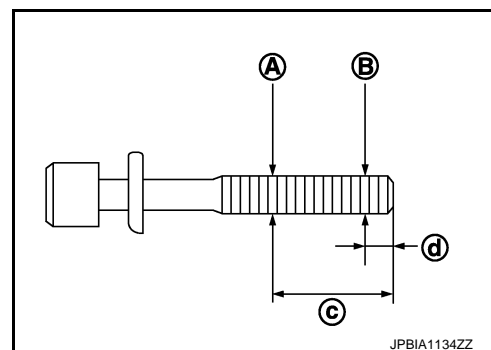
< UNIT DISASSEMBLY AND ASSEMBLY >

- Cylinder head bolts are tightened by plastic zone tightening method. Whenever the size difference between (B) and (A) exceeds the limit, replace them with new one.

c : 48 mm (1.89 in)
d : 11 mm (0.43 in)

Limit [(B) - (A)] : 0.18 mm (0.0071 in)

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



Cylinder Head Distortion

NOTE:

When performing this inspection, cylinder block distortion should be also checked. Refer to [EM-132, "Inspection"](#).

- Using a scraper, wipe off oil, scale, gasket, sealant and carbon deposits from surface of cylinder head.

CAUTION:

Never allow gasket fragments to enter engine oil or engine coolant passages.

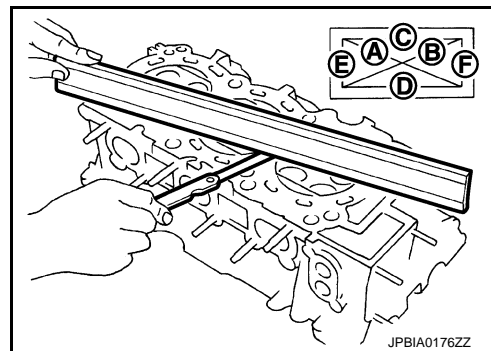
- At each of several locations on bottom surface of cylinder head, measure the distortion in six directions (A), (B), (C), (D), (E), and (F).

Limit : Refer to [EM-151, "Cylinder Head"](#).

- If it exceeds the limit, replace VVEL ladder assembly and cylinder head assembly.

NOTE:

Cylinder head assembly cannot be replaced as a single part, because it is machined together with VVEL ladder assembly.



Valve Dimensions

- Check the dimensions of each valve. For the dimensions, refer to [EM-151, "Cylinder Head"](#).
- If dimensions are out of the standard.
 - Replace valve (EXH) and check valve seat contact. Refer to "VALVE SEAT CONTACT". (Exhaust side)
 - Replace VVEL ladder assembly and cylinder head assembly. Refer to [EM-96, "Exploded View"](#). (Intake side)

NOTE:

Since the valve (INT) cannot be replaced by the piece, VVEL ladder assembly and cylinder head assembly replacement are required.

Valve Guide Clearance

Valve Stem Diameter

- Measure the diameter of valve stem with micrometer (A).

Standard : Refer to [EM-151, "Cylinder Head"](#).

Valve Guide Inner Diameter

- Measure the inner diameter of valve guide with bore gauge.

Standard : Refer to [EM-151, "Cylinder Head"](#).

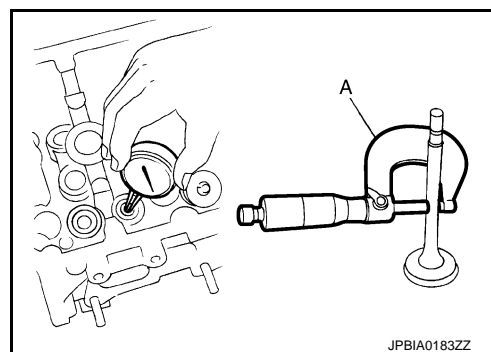
Valve Guide Clearance

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

Standard : Refer to [EM-151, "Cylinder Head"](#).

- If the calculated value exceeds the limit.
 - Replace valve (EXH) and/or valve guide (EXH). Refer to [EM-113, "Exploded View"](#). (Exhaust side)
 - Replace VVEL ladder assembly and cylinder head assembly. Refer to [EM-96, "Exploded View"](#). (Intake side)

NOTE:



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Since the valve (INT) and valve guide (INT) cannot be replaced by the piece, VVEL ladder assembly and cylinder head assembly replacement are required.

Valve Seat Contact

- After confirming that the dimensions of valve guides and valves are within the 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 surface.
- Check if the contact area band is continuous all around the circumference.

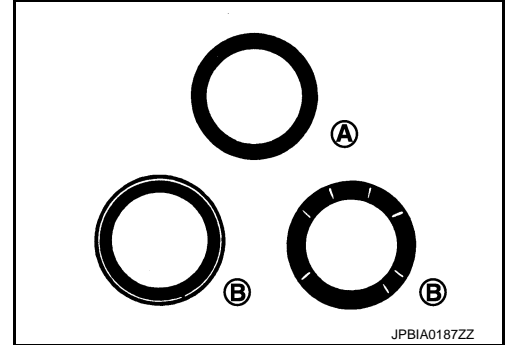
A : OK

B : NG

- If not, grind to adjust valve fitting and check again. If the contacting surface still has "NG" conditions even after the recheck, replace valve seat (EXH). Refer to [EM-113, "Exploded View"](#). (Exhaust side)
- If not, replace VVEL ladder assembly and cylinder head assembly. Refer to [EM-96, "Exploded View"](#). (Intake side)

NOTE:

Since the valve seat (INT) cannot be replaced by the piece, VVEL ladder assembly and cylinder head assembly replacement are required.



Valve Spring Squareness

- Set a try square (A) along the side of valve spring and rotate spring. Measure the maximum clearance between the top of spring and try square.

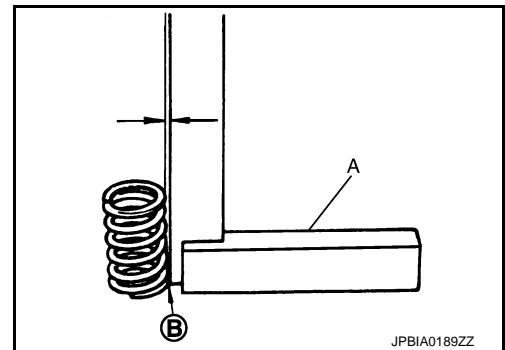
B : Contact

Limit : Refer to [EM-151, "Cylinder Head"](#).

- If it exceeds the limit.
- Replace valve spring (EXH). Refer to [EM-113, "Exploded View"](#). (Exhaust side)
- Replace VVEL ladder assembly and cylinder head assembly. Refer to [EM-96, "Exploded View"](#). (Intake side)

NOTE:

Since the valve spring (INT) cannot be replaced by the piece, VVEL ladder assembly and cylinder head assembly replacement are required.



Valve Spring Dimensions and Valve Spring Pressure Load

- Check the valve spring pressure at specified spring height.

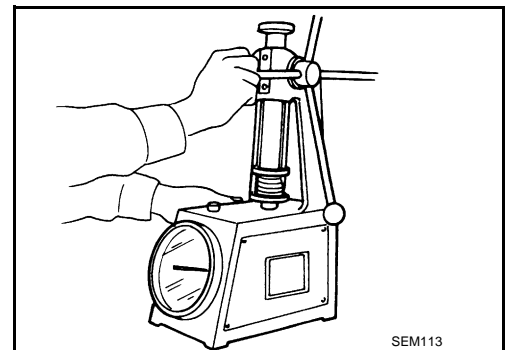
Standard

: Refer to [EM-151, "Cylinder Head"](#).

- If the installation load or load with valve open is out of the standard.
- Replace valve spring (EXH). Refer to [EM-113, "Exploded View"](#). (Exhaust side)
- Replace VVEL ladder assembly and cylinder head assembly. Refer to [EM-96, "Exploded View"](#). (Intake side)

NOTE:

Since the valve spring (INT) cannot be replaced by the piece, VVEL ladder assembly and cylinder head assembly replacement are required.



INSPECTION AFTER INSTALLATION

Inspection for Leakage

The following are procedures for checking fluid leakage, lubricant leakage.

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- Before starting engine, check oil/fluid levels including engine coolant and engine oil. If any are less than the required quantity, fill them to the specified level. Refer to [MA-16, "FOR NORTH AMERICA : Fluids and Lubricants"](#) (FOR NORTH AMERICA) or [MA-18, "FOR MEXICO : Fluids and Lubricants"](#) (FOR MEXICO).
- Follow the procedure below to check for fuel leakage.
- Turn ignition switch to the "ON" position (with engine stopped). With fuel pressure applied to fuel piping, check for fuel leakage at connection points.
- Start engine. With engine speed increased, check again for fuel leakage at connection points.
- Run engine to check for unusual noise and vibration.

NOTE:

If hydraulic pressure inside chain tensioner drops after removal/installation, slack in guide may generate a pounding noise during and just after the engine start. However, this does not indicate a malfunction. The noise will stop after hydraulic pressure rises.

- Warm up engine thoroughly to check that there is no leakage of fuel, or any oil/fluids including engine oil and engine coolant.
- Bleed air from lines and hoses of applicable lines, such as in cooling system.
- After cooling down engine, again check oil/fluid levels including engine oil and engine coolant. Refill them to the specified level, if necessary.

Summary of the inspection items:

Items		Before starting engine	Engine running	After engine stopped
Engine coolant		Level	Leakage	Level
Engine oil		Level	Leakage	Level
Transmission / transaxle fluid	AT & CVT Models	Leakage	Level / Leakage	Leakage
	MT Models	Level / Leakage	Leakage	Level / Leakage
Other oils and fluids*		Level	Leakage	Level
Fuel		Leakage	Leakage	Leakage
Exhaust gases		—	Leakage	—

*: Power steering fluid, brake fluid, etc.

CYLINDER BLOCK

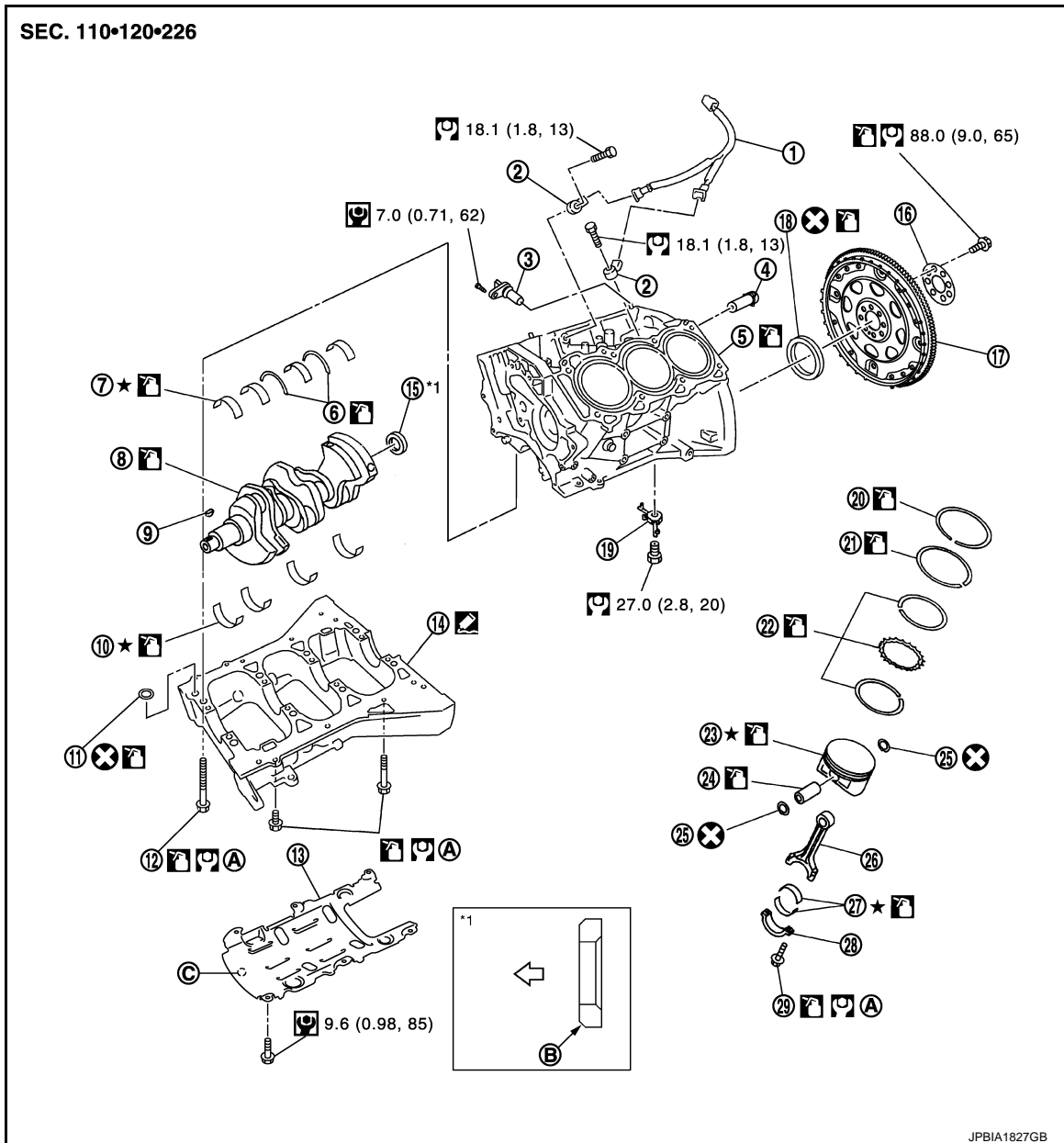
< UNIT DISASSEMBLY AND ASSEMBLY >

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CYLINDER BLOCK

Exploded View

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- | | | |
|---------------------------------------|--------------------------|-------------------------------|
| 1. Sub harness | 2. Knock sensor | 3. Crankshaft position sensor |
| 4. Cylinder block heater (for Canada) | 5. Cylinder block | 6. Thrust bearing |
| 7. Main bearing (upper) | 8. Crankshaft | 9. Crankshaft key |
| 10. Main bearing (lower) | 11. O-ring | 12. Lower cylinder block bolt |
| 13. Baffle plate | 14. Lower cylinder block | 15. Pilot converter |
| 16. Reinforcement plate | 17. Drive plate | 18. Rear oil seal |
| 19. Oil jet | 20. Top ring | 21. Second ring |
| 22. Oil ring | 23. Piston | 24. Piston pin |
| 25. Snap ring | 26. Connecting rod | 27. Connecting rod bearing |
| 28. Connecting rod bearing cap | 29. Connecting rod bolt | |

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- A. Comply with the assembly procedure when tightening. Refer to [EM-124](#).

C. Front mark

↩ : Crankshaft side

Disassembly and Assembly

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DISASSEMBLY

- Remove the following parts:
 - Oil pan (lower): Refer to [EM-45, "Exploded View"](#).
 - Oil pan (upper): Refer to [EM-84, "2WD : Exploded View"](#) (2WD models) or [EM-87, "AWD : Exploded View"](#) (AWD models).
 - Front and rear timing chain case: Refer to [EM-52, "Exploded View"](#) and [EM-91, "Exploded View"](#).
 - Cylinder head: Refer to [EM-113, "Exploded View"](#).

- Remove knock sensor.

CAUTION:

Carefully handle sensor avoiding shocks.

- Remove baffle plate from lower cylinder block.

- Remove piston and connecting rod assembly with the following procedure:

- Before removing piston and connecting rod assembly, check the connecting rod side clearance. Refer to [EM-132, "Inspection"](#).

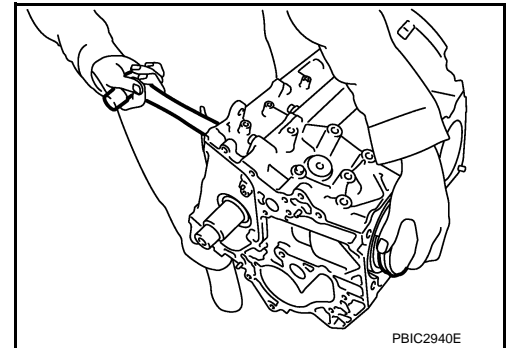
CAUTION:

Never drop connecting rod bearing, and to scratch the surface.

- Position crankshaft pin corresponding to connecting rod to be removed onto the bottom dead center.
- Remove connecting rod bearing cap.
- Using a hammer handle or similar tool, push piston and connecting rod assembly out to the cylinder head side.

CAUTION:

Never damage the cylinder wall and crankshaft pin, resulting from an interference of the connecting rod big end.



- Remove connecting rod bearings from connecting rod and connecting rod bearing cap.

CAUTION:

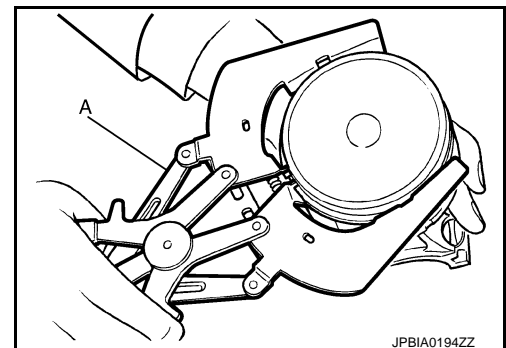
- Never drop connecting rod bearing, and to scratch the surface.**
- Identify installation positions, and store them without mixing them up.**

- Remove piston rings from piston.

- Before removing piston rings, check the piston ring side clearance. Refer to [EM-132, "Inspection"](#).
- Use a piston ring expander (commercial service tool) (A).

CAUTION:

- When removing piston rings, be careful not to damage piston.**
- Never damage piston rings by expanding them excessively.**



- Remove piston from connecting rod as follows: