2009 ENGINE

Engine Mechanical - M35-M45

SERVICE INFORMATION

PRECAUTIONS

Precaution for Procedure without Cowl Top Cover

When performing the procedure after removing cowl top cover, cover the lower end of windshield with urethane, etc.

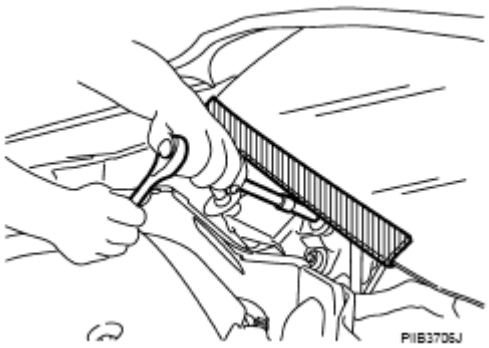


Fig. 1: Identifying Windshield Precaution
Courtesy of NISSAN MOTOR CO., U.S.A.

Precaution Necessary for Steering Wheel Rotation After Battery Disconnect

NOTE:

- **This Procedure is applied only to models with Intelligent Key system and NVIS/IVIS (NISSAN/INFINITI VEHICLE IMMOBILIZER SYSTEM - NATS).**
- **Remove and install all control units after disconnecting both battery cables with the ignition knob in the "LOCK" position.**
- **Always use CONSULT-III to perform self-diagnosis as a part of each function inspection after finishing work.**

If DTC is detected, perform trouble diagnosis according to self-diagnostic results.

For models equipped with the Intelligent Key system and NVIS/IVIS, an electrically controlled steering lock mechanism is adopted on the key cylinder.

For this reason, if the battery is disconnected or if the battery is discharged, the steering wheel will lock and steering wheel rotation will become impossible.

If steering wheel rotation is required when battery power is interrupted, follow the procedure below before starting the repair operation.

OPERATION PROCEDURE

1. Connect both battery cables.

NOTE: Supply power using jumper cables if battery is discharged.

2. Use the Intelligent Key or mechanical key to turn the ignition switch to the "ACC" position. At this time, the steering lock will be released.
3. Disconnect both battery cables. The steering lock will remain released and the steering wheel can be rotated.
4. Perform the necessary repair operation.
5. When the repair work is completed, return the ignition switch to the "LOCK" position before connecting the battery cables. (At this time, the steering lock mechanism will engage.)
6. Perform a self-diagnosis check of all control units using CONSULT-III.

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

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

WARNING:

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

Precaution for Drain Engine Coolant and Engine Oil

Drain engine coolant and engine oil when engine is cooled.

Precaution for Disconnecting Fuel Piping

- Before starting work, check no fire or spark producing items are in the work area.

- Release fuel pressure before disconnecting and disassembly.
- After disconnecting pipes, plug openings to stop fuel leakage.

Precaution for Removal and Disassembly

- When instructed to use special service tools, use 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 equivalent, if necessary, to seal out foreign materials.
- Mark and arrange disassembly parts in an organized way for easy troubleshooting and reassembly.
- When loosening bolts and nuts, 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 in the step.

Precaution for Inspection, Repair and Replacement

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

Precaution for Assembly and Installation

- Use torque wrench to tighten bolts or nuts to specification.
- When tightening bolts and nuts, 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.
- Dowel pins are used for several parts alignment. When replacing and reassembling with dowel pins, check that dowel pins are installed in the original portion.
- Thoroughly wash, clean, and air-blow each part. Carefully check engine oil or engine 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 when refilling after draining engine coolant.
- After repairing, start engine and increase engine speed to check engine coolant, fuel, engine oil, and exhaust gases for leakage.

Parts Requiring Angle Tightening

- Use angle wrench [SST: KV10112100 (BT8653-A)] for the final tightening of the following engine parts:
  - Cylinder head bolts
  - Lower cylinder block bolts
  - Connecting rod cap bolts
- Do not use a torque value for final tightening.

- The torque value for these parts are for a preliminary step.
- Ensure thread and seat surfaces are clean and coated with engine oil.

Precaution for Liquid Gasket

REMOVAL OF LIQUID GASKET SEALING

- After removing mounting bolts and nuts, separate the mating surface using seal cutter [SST: KV10111100 (J37228)] (A) and remove old liquid gasket sealing.

CAUTION: Be careful not to damage the mating surfaces.

- Tap (B) seal cutter [SST: KV10111100 (J37228)] to insert it, and then slide (C) it by tapping on the side as shown in the figure.
- In areas where seal cutter [SST: KV10111100 (J37228)] is difficult to use, use plastic hammer to lightly tap the parts, to remove it.

CAUTION: If for some unavoidable reason tool such as screwdriver is used, be careful not to damage the mating surfaces.

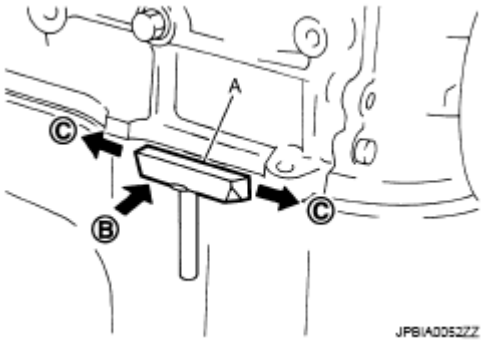


Fig. 2: Sliding Seal Cutter By Tapping On Side Of Seal Cutter
Courtesy of NISSAN MOTOR CO., U.S.A.

LIQUID GASKET APPLICATION PROCEDURE

1. Using scraper (A), remove old liquid gasket adhering to the gasket application surface and the mating surface.
   - Remove liquid gasket completely from the groove of the gasket application surface, mounting bolts, and bolt holes.
2. Wipe the liquid gasket application surface and the mating surface with white gasoline (lighting and heating use) to remove adhering moisture, grease and foreign materials.

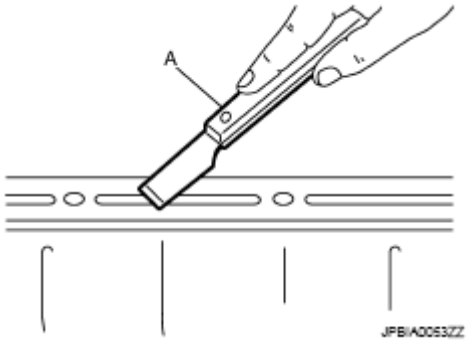


Fig. 3: Removing Liquid Gasket
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Attach liquid gasket tube to tube presser (commercial service tool).

   Use Genuine RTV Silicone Sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCT AND SEALANT ".

4. Apply liquid gasket without breaks to the specified location with the specified dimensions.
   - If there is a groove for liquid gasket application, apply liquid gasket to the groove.

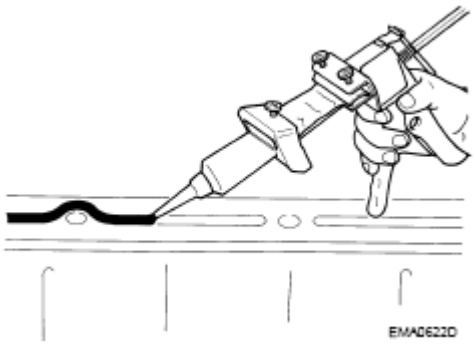


Fig. 4: Identifying Liquid Gasket Applying Area
Courtesy of NISSAN MOTOR CO., U.S.A.

   - As for bolt holes (B), normally apply liquid gasket inside the holes. Occasionally, it should be applied outside the holes. Check to read the text of this information.
   - Within five minutes of liquid gasket application, install the mating component.
   - If liquid gasket protrudes, wipe it off immediately.
   - Do not retighten mounting bolts or nuts after the installation.
   - After 30 minutes or more have passed from the installation, fill engine oil and engine coolant.

A : Groove
⇦ : Inside

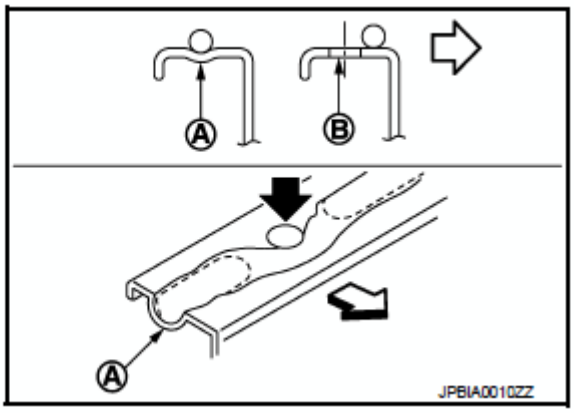


Fig. 5: Applying Liquid Gasket Inside Holes
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: If there are specific instructions in this information, observe them.

Definitions of Bank Names

- In this information, each bank name is defined as follows:

A : Bank 1 (The conventional right bank)
B : Bank 2 (The conventional left bank)
⇦ : Engine front

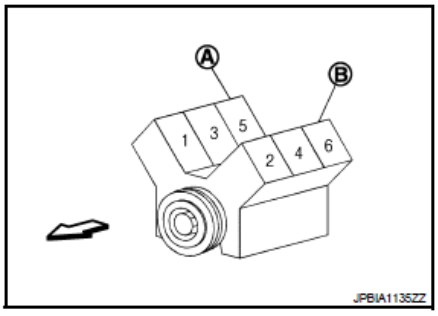


Fig. 6: Identifying Cylinder Numbers And Bank Layout
Courtesy of NISSAN MOTOR CO., U.S.A.

- For cylinder numbers and bank layout, refer to the illustration.

Bank 1 : The bank side including cylinder No. 1 (odd-numbered cylinder side)

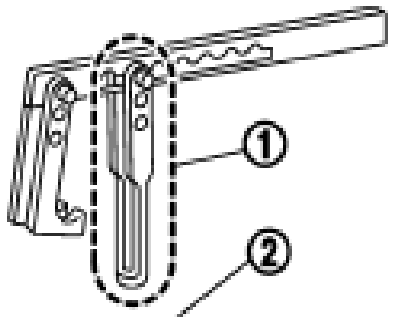
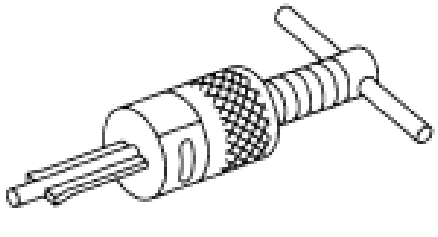
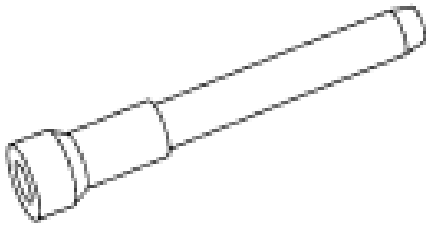
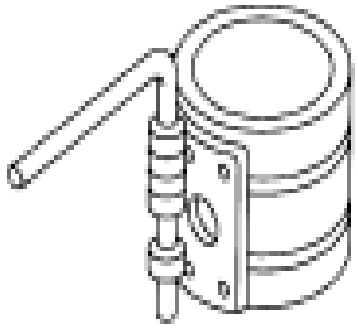
Bank 2 : The other bank side of the above (even-numbered cylinder side)

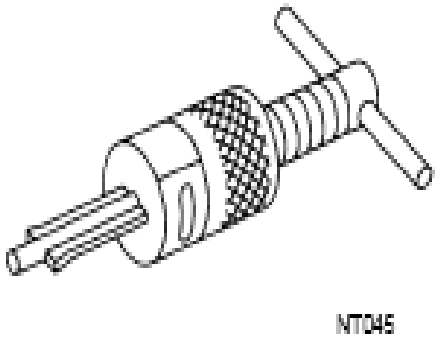
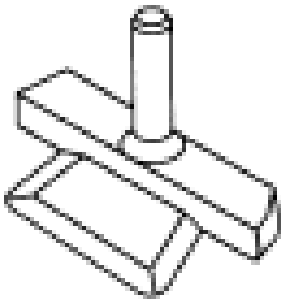
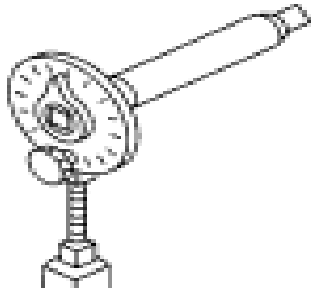
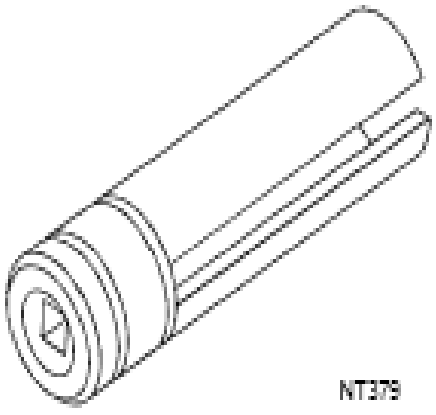
PREPARATION

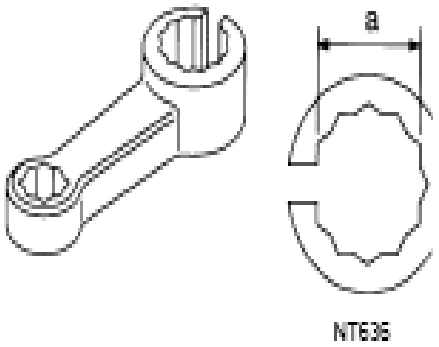
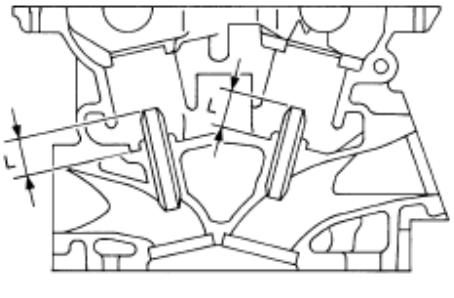
Special Service Tool

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

SPECIAL SERVICE TOOL REFERENCE

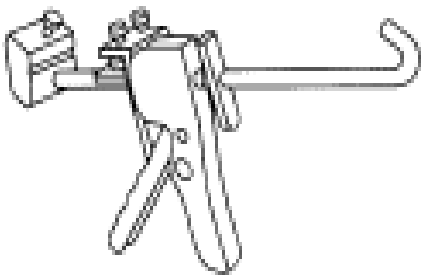
Tool number (Kent-Moore No.) Tool name		Description
KV10116200 (J26336-A) Valve spring compressor 1. KV10115900 (J26336-20) Attachment 2. KV10109220 (-) Adapter		Disassembling valve mechanism Part (1) is a component of KV10116200 (J26336-A), but Part (2) is not so.
KV10107902 (J38959) Valve oil seal puller		Replacing valve oil seal
- (J39386) Valve oil seal drift		Installing valve oil seal
EM03470000 (J8037) Piston ring compressor		Installing piston assembly into cylinder bore

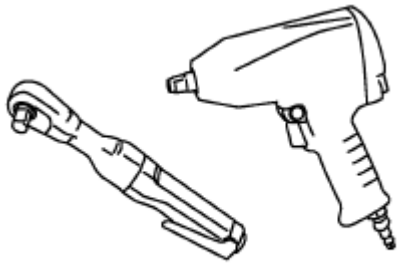
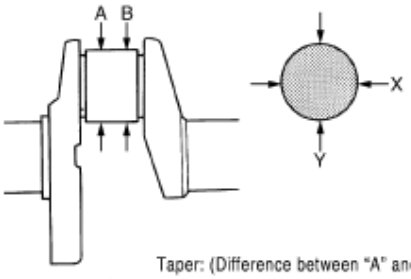
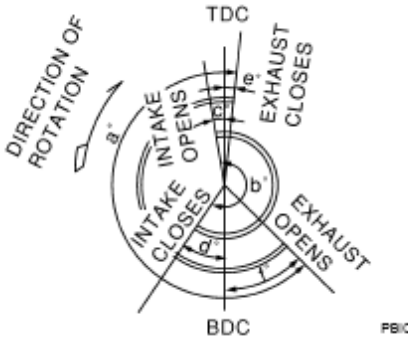
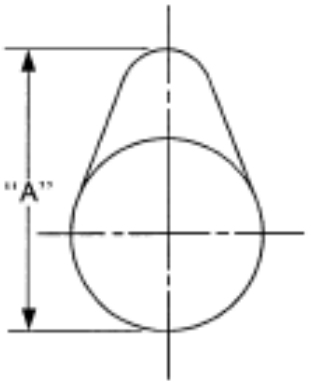
ST16610001 (J23907) Pilot bushing puller	 NT045	Removing pilot converter
KV10111100 (J37228) Seal cutter	 NT046	Removing oil pan (lower and upper), front and rear timing chain case, etc.
KV10112100 (BT8653-A) Angle wrench		Tightening bolts for bearing cap, cylinder head, etc. in angle
KV10117100 (J3647-A) Heated oxygen sensor wrench	 NT379	Loosening or tightening heated oxygen sensor 2 **For 22 mm (0.87 in) width hexagon nut**

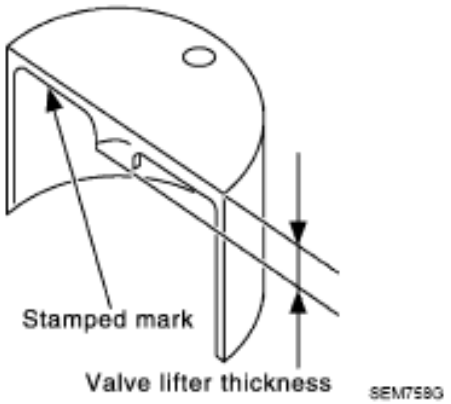
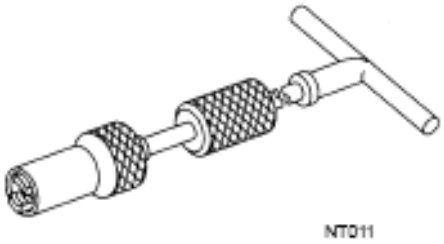
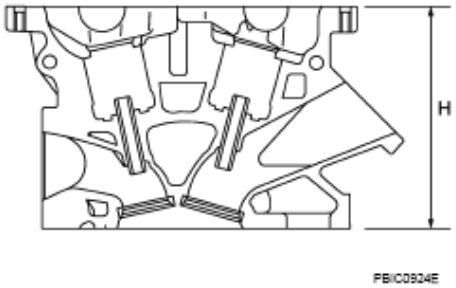
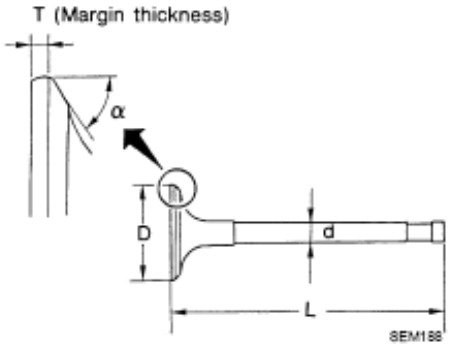
KV10114400 (J38365) Heated oxygen sensor wrench		Loosening or tightening air fuel ratio sensor 1 a. **22 mm (0.87 in)**
KV10118600 (J-48641) Ring gear stopper		Removing and installing crankshaft pulley

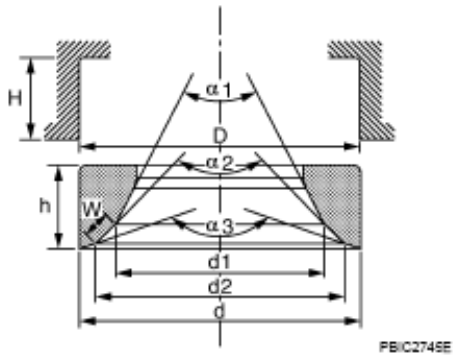
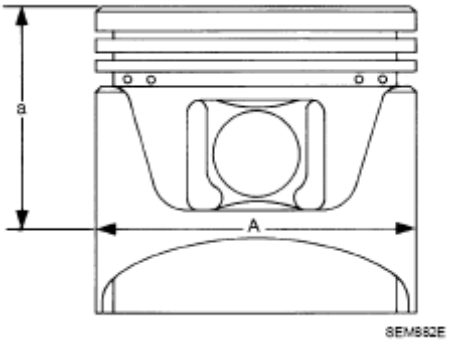
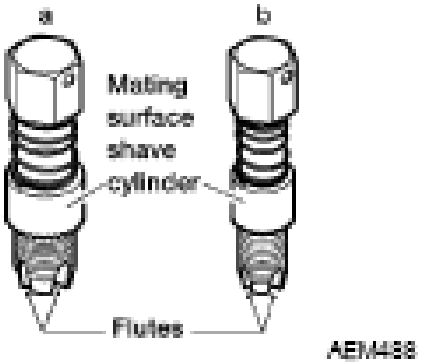
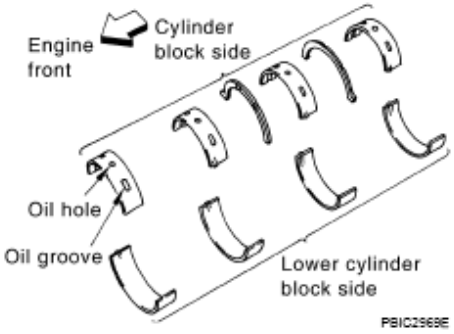
Commercial Service Tool

COMMERCIAL SERVICE TOOL REFERENCE

(Kent-Moore No.) Tool name		Description
(-) Tube presser		Pressing the tube of liquid gasket
(-) Power tool		Loosening bolts and nuts

	 PBIC0190E	
(-) TORX socket	 Taper: (Difference between "A" and "B") Out-of-round: (Difference between "X" and "Y") SBIA0535E	Removing and installing flywheel **Size: T55**
(-) Manual lift table caddy	 PBIC0187E	Removing and installing engine
(J24239-01) Cylinder head bolt wrench	 SEM671	Loosening and tightening cylinder head bolt, and used with angle wrench [SST: KV10112100 (BT8653-A)] a. **13 (0.51) dia** . b. **12 (0.47)** c. **10 (0.39)** Unit: mm (in)

(-) 1. Compression gauge 2. Adapter		Checking compression pressure
(-) Spark plug wrench		Removing and installing spark plug
(-) Valve seat cutter set		Finishing valve seat dimensions
(-) Piston ring expander		Removing and installing piston ring
(-) Valve guide drift		Removing and installing valve guide **Intake and Exhaust:** a. **9.5 mm (0.374 in) dia** . b. **5.5 mm (0.217 in) dia** .

		
(-) Valve guide reamer		1. Reaming valve guide inner hole 2. Reaming hole for oversize valve guide **Intake and 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		Reconditioning the exhaust system threads before installing a new air fuel ratio sensor and heated oxygen sensor (Use with anti-seize lubricant shown below.) a. **J-43897-18 [18 mm (0.71 in) dia.] for zirconia heated oxygen sensor and air fuel ratio sensor** b. **J-43897-12 [12 mm (0.47 in) dia.] for titania heated oxygen sensor**
(-) Anti-seize lubricant (Permatex 133AR or equivalent meeting MIL specification MIL-A-907)		Lubricating oxygen sensor thread cleaning tool when reconditioning exhaust system threads

NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING

NVH Troubleshooting - Engine Noise

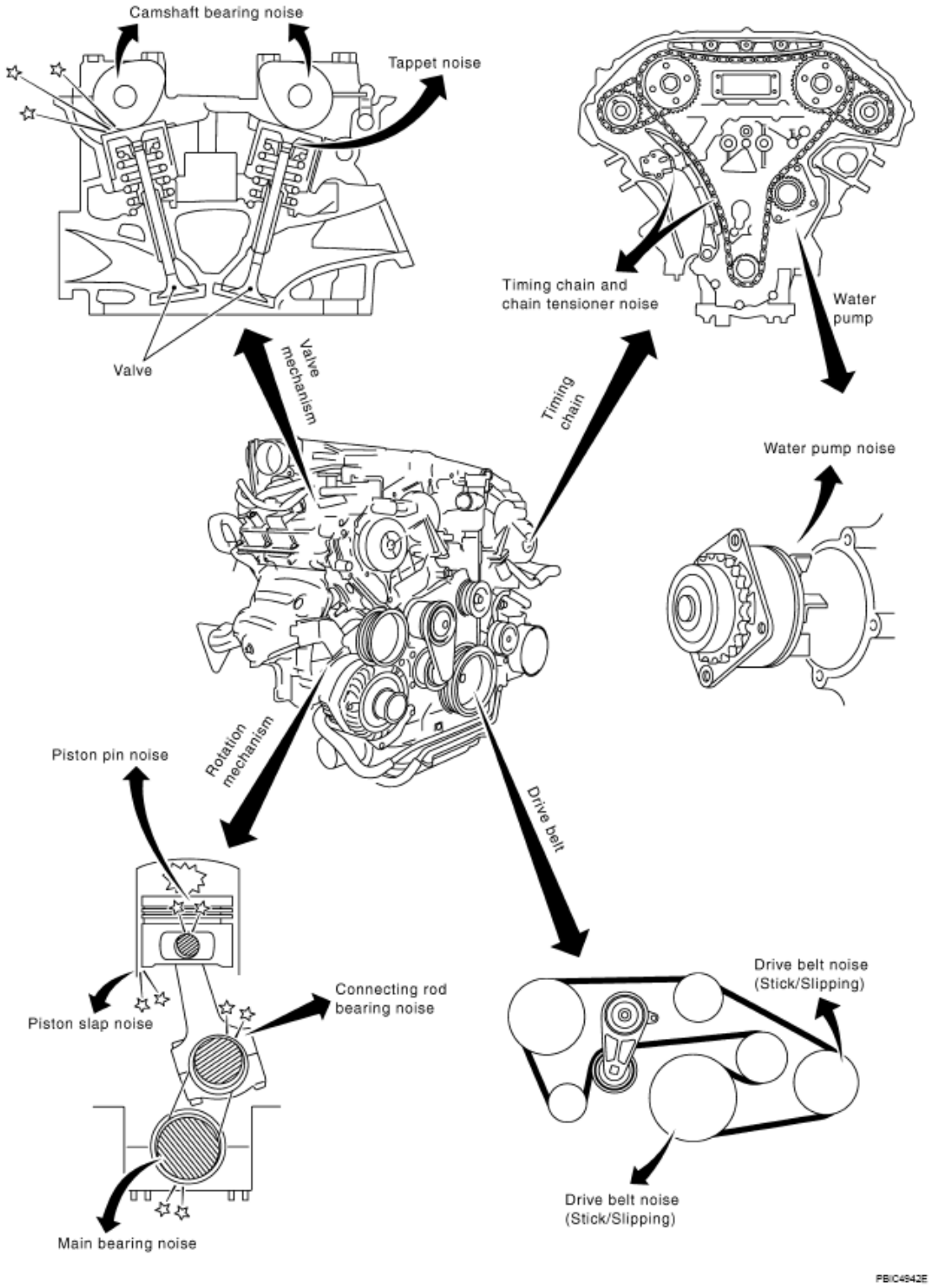


Fig. 7: NVH Troubleshooting Chart - Engine Noise
Courtesy of NISSAN MOTOR CO., U.S.A.

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.

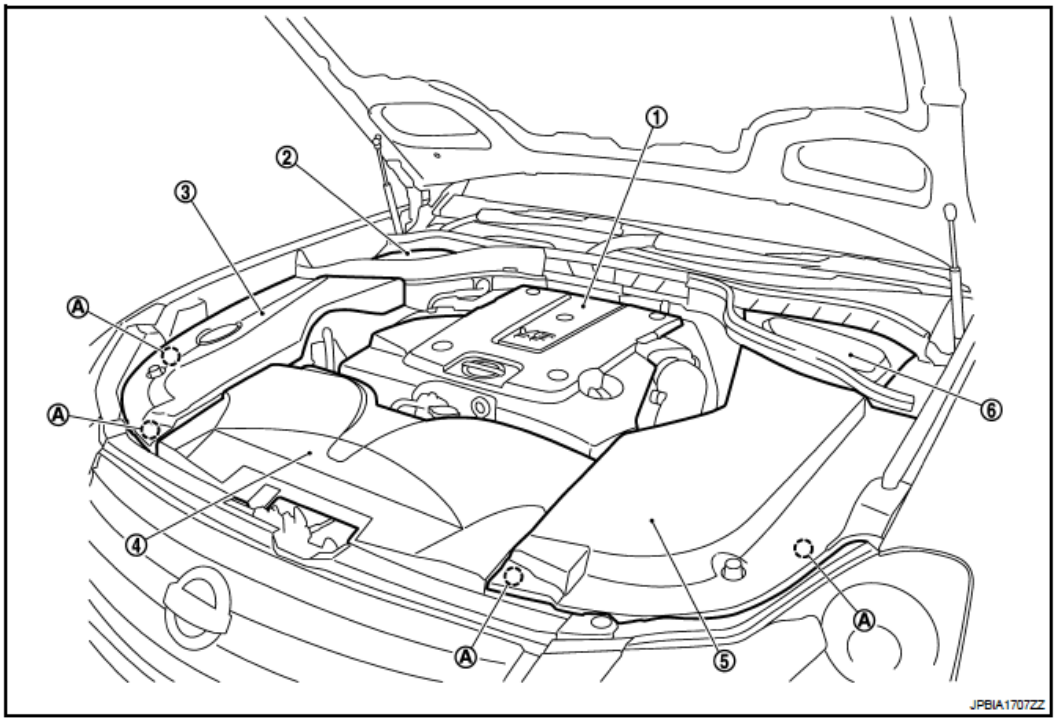
ENGINE OPERATING CONDITION

Location of noise	Type of noise	Operating condition of engine						Source of noise	Check item	Reference
		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	**VALVE CLEARANCE**
	Rattle	C	A	-	A	B	C	Camshaft bearing noise	Camshaft runout Camshaft journal oil clearance	**CAMSHAFT**
Crankshaft pulley Cylinder block (Side of engine) Oil pan	Slap or knock	-	A	-	B	B	-	Piston pin noise	Piston to piston pin oil clearance Connecting rod bushing oil clearance	**PISTON TO PISTON PIN OIL CLEARANCE**
	Slap or rap	A	-	-	B	B	A	Piston slap noise	Piston to cylinder bore clearance Piston ring side clearance Piston ring end gap Connecting rod bend and torsion	**PISTON TO CYLINDER BORE CLEARANCE**
	Knock	A	B	C	B	B	B	Connecting rod bearing noise	Connecting rod bushing oil clearance Connecting	**CONNECTING ROD BUSHING OIL**

									rod bearing oil clearance	**CLEARANCE**
	Knock	A	B	-	A	B	C	Main bearing noise	Main bearing oil clearance Crankshaft runout	**MAIN BEARING HOUSING INNER DIAMETER**
Front of engine Timing chain case	Tapping or ticking	A	A	-	B	B	B	Timing chain and chain tensioner noise	Timing chain cracks and wear Timing chain tensioner operation	**TIMING CHAIN**
Front of engine	Squeaking or fizzing	A	B	-	B	-	C	Drive belt (Sticking or slipping)	Drive belt deflection	**DRIVE BELT**
	Creaking	A	B	A	B	A	B	Drive belt (Slipping)	Idler pulley bearing operation	
	Squall Creak	A	B	-	B	A	B	Water pump noise	Water pump operation	"**COMPONENT**"
A: Closely related B: Related C: Sometimes related -: Not related										

ENGINE ROOM COVER

Component



1. Engine cover
2. Brake master cylinder cover
3. Engine room cover (RH)
4. Air duct (inlet)
5. Engine room cover (LH)
6. Battery cover
A. Clip (secure at back surface)

Fig. 8: Identifying Engine Room Cover Components
Courtesy of NISSAN MOTOR CO., U.S.A.

Removal and Installation

REMOVAL

CAUTION: Never damage or scratch cover when installing or removing.

- Refer to "**REMOVAL AND INSTALLATION**" for removal and installation of engine cover.
- Refer to "**COMPONENT**" for removal and installation of air duct (inlet).
- Remove the washer tank cap before removing the engine room cover (RH).
- Remove the engine room covers (RH and LH) by lifting the clipped point using a clip driver.
- Major parts and inspection points under each cover are as follows: (numbered as in figure)

1. Upper side of engine assembly
2. Brake master cylinder, brake booster
3. Power steering fluid reservoir tank, engine coolant reservoir tank, Mass air flow sensor, air cleaner case, relay box
4. Engine assembly front side, drive belt, cooling fan

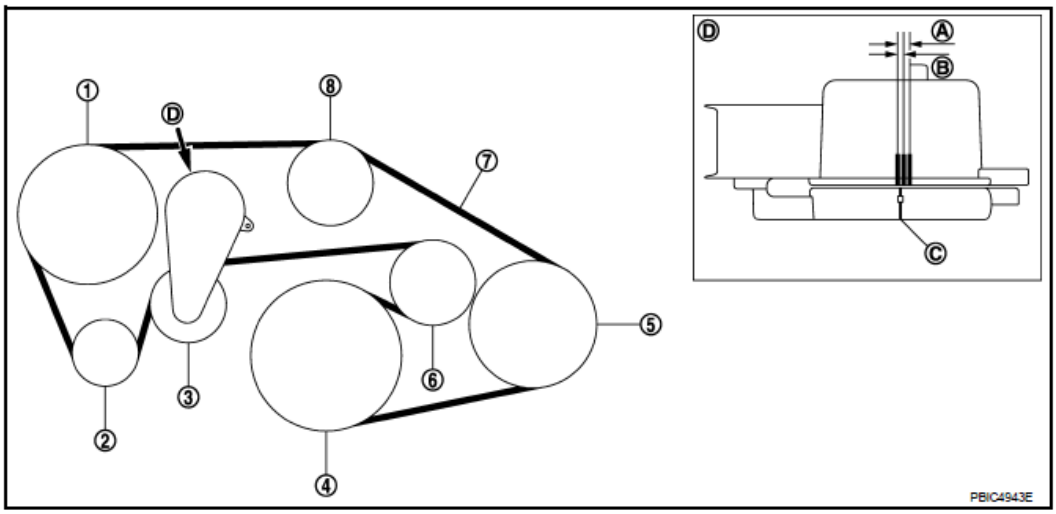
5. Mass air flow sensor, air cleaner case
6. Battery, relay box

INSTALLATION

Install in the reverse order of removal.

DRIVE BELT

Checking Drive Belt



1. Power steering oil pump
2. Alternator
3. Drive belt auto-tensioner
4. Crankshaft pulley
5. A/C compressor
6. Idler pulley
7. Drive belt
8. Idler pulley
A. Possible use range
B. Range when new drive belt is installed
C. Indicator
D. View D

Fig. 9: Drive Belt Routing Diagram
Courtesy of NISSAN MOTOR CO., U.S.A.

WARNING: Be sure to perform this step when engine is stopped.

- Check that the indicator (notch on fixed side) of drive belt auto-tensioner is within the possible use range (A).

NOTE: Check the drive belt auto-tensioner indication when the engine is cold.

- When new drive belt is installed, the indicator (notch on fixed side) should be within the range (B) in the figure.
- Visually check entire drive belt for wear, damage or cracks.

- If the indicator (notch on fixed side) is out of the possible use range or belt is damaged, replace drive belt.

Tension Adjustment

Belt tension is not necessary, as it is automatically adjusted by drive belt auto-tensioner.

Removal and Installation

REMOVAL

1. Remove front engine undercover with power tool.
2. While securely holding the square hole (A) in pulley center of auto tensioner (1) with a spinner handle, move spinner handle in the direction of arrow (loosening direction of drive belt).

⬅ : Loosing direction of drive belt

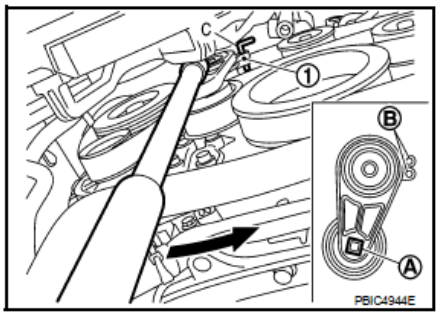


Fig. 10: Identifying Auto Tensioner
Courtesy of NISSAN MOTOR CO., U.S.A.

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

3. Under the above condition, insert a metallic bar of approximately 6 mm (0.24 in) diameter [hexagonal wrench (C) shown as example in the figure] through the holding boss (B) to lock auto-tensioner pulley arm.
4. Remove drive belt.

INSTALLATION

Note the following, and install in the reverse order of removal.

CAUTION:

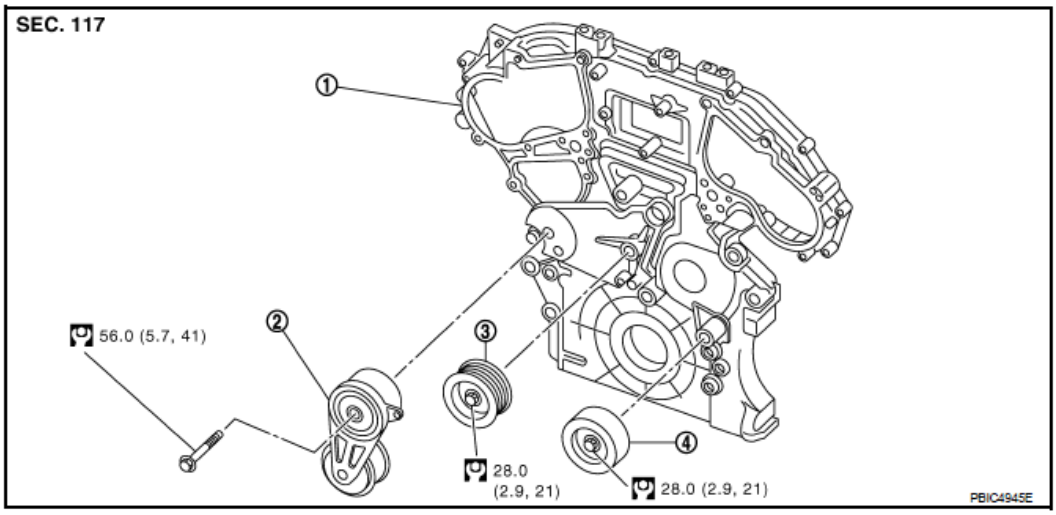
- **Check drive belt is securely installed around all pulleys.**
- **Check drive belt is correctly engaged with the pulley groove.**
- **Check for engine oil and engine coolant are not adhered drive belt and pulley groove.**

INSPECTION AFTER INSTALLATION

Turn crankshaft pulley clockwise several times to equalize tension between each pulley, and then confirm tension of drive belt at indicator (notch on fixed side) is within the possible use range. Refer to "**CHECKING DRIVE BELT**".

Component

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.



1. Front timing chain case
2. Drive belt auto-tensioner
3. Idler pulley
4. Idler pulley

Fig. 11: Identifying Front Timing Chain Case And Idler Pulley With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to "**COMPONENT** " for symbols in the figure.

Removal and Installation of Drive Belt Auto Tensioner

REMOVAL

1. Remove drive belt. Refer to "**REMOVAL AND INSTALLATION**".
   - Keep auto-tensioner pulley arm locked after drive belt is removed.
2. Remove auto-tensioner and idler pulley.
   - Keep auto-tensioner pulley arm locked to install or remove auto-tensioner.

INSTALLATION

Install in the reverse order of removal.

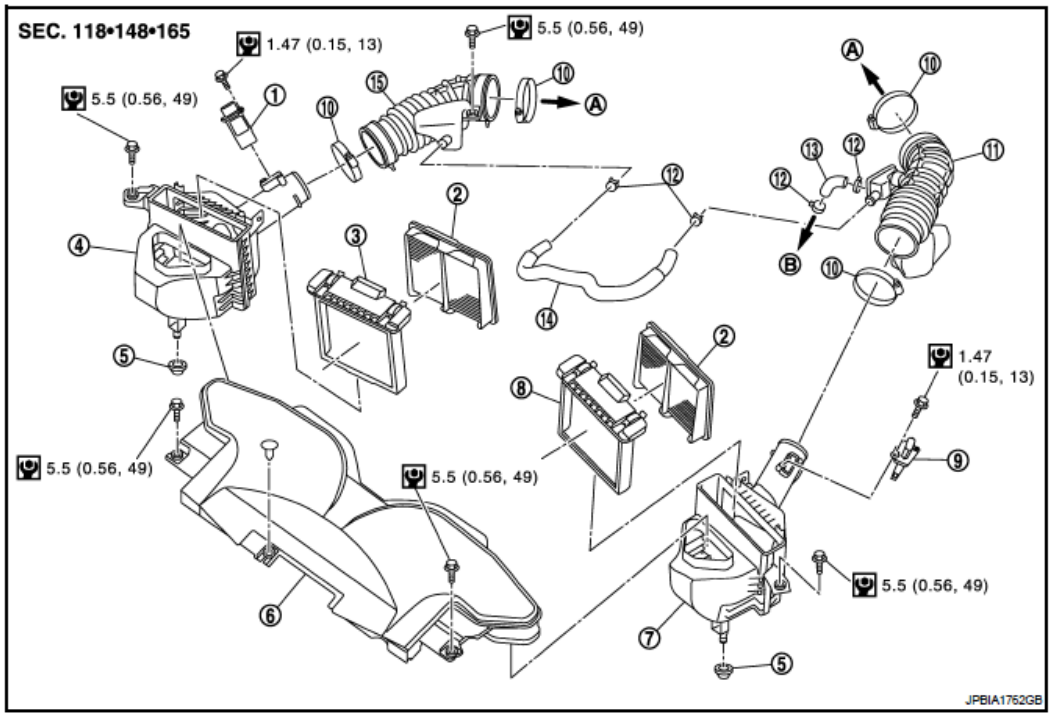
CAUTION: If there is damage greater than peeled paint, replace drive belt auto-

tensioner.

AIR CLEANER AND AIR DUCT

Component

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.



1. Mass air flow sensor (bank 1)
2. Air cleaner filter
3. Holder (LH)
4. Air cleaner case (RH)
5. Grommet
6. Air duct
7. Air cleaner case (LH)
8. Holder (LH)
9. Mass air flow sensor (bank 2)
10. Clamp
11. Air duct (LH)
12. Clamp
13. PCV hose
14. PCV hose
15. Air duct (RH)

A. To electric throttle control actuator
B. To rocker cover (bank 2)

Fig. 12: Exploded View Of Air Cleaner And Air Duct With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to "**COMPONENT** " for symbols in the figure.

Removal and Installation

REMOVAL

NOTE: Mass air flow sensor is removable under the car-mounted condition.

1. Remove engine room cover (RH and LH). Refer to "**COMPONENT**".
2. Remove air duct (inlet).
3. Disconnect mass air flow sensor harness connector.
4. Disconnect PCV hose.
5. Remove air cleaner case with mass air flow sensor assembly and air duct assembly disconnecting their joints.
   - Add marks if necessary for easier installation.
6. Remove mass air flow sensor from air cleaner case if necessary.

CAUTION: Handle the mass air flow sensor with care.

- **Never shock the mass air flow sensor.**
- **Never disassemble the mass air flow sensor.**
- **Never touch the sensor of the mass air flow sensor.**

INSTALLATION

Note the following, and install in the reverse order of removal.

- Align marks. Attach each joint. Screw clamps firmly.

Changing Air Cleaner Filter

REMOVAL

1. Unhook clips (A).

1 : Holder
2 : Air cleaner case

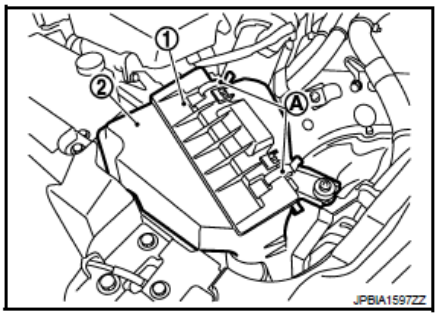


Fig. 13: Identifying Holder And Air Cleaner Case
Courtesy of NISSAN MOTOR CO., U.S.A.

2. Remove air cleaner filter (1) from air cleaner case (2).

3 : Holder

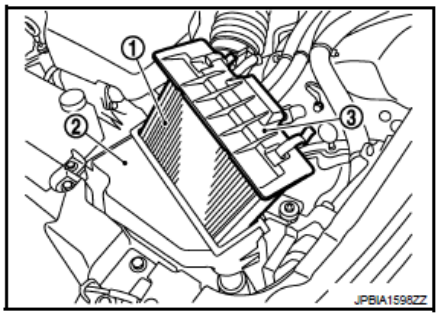


Fig. 14: Identifying Air Cleaner Filter And Air Cleaner Case
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

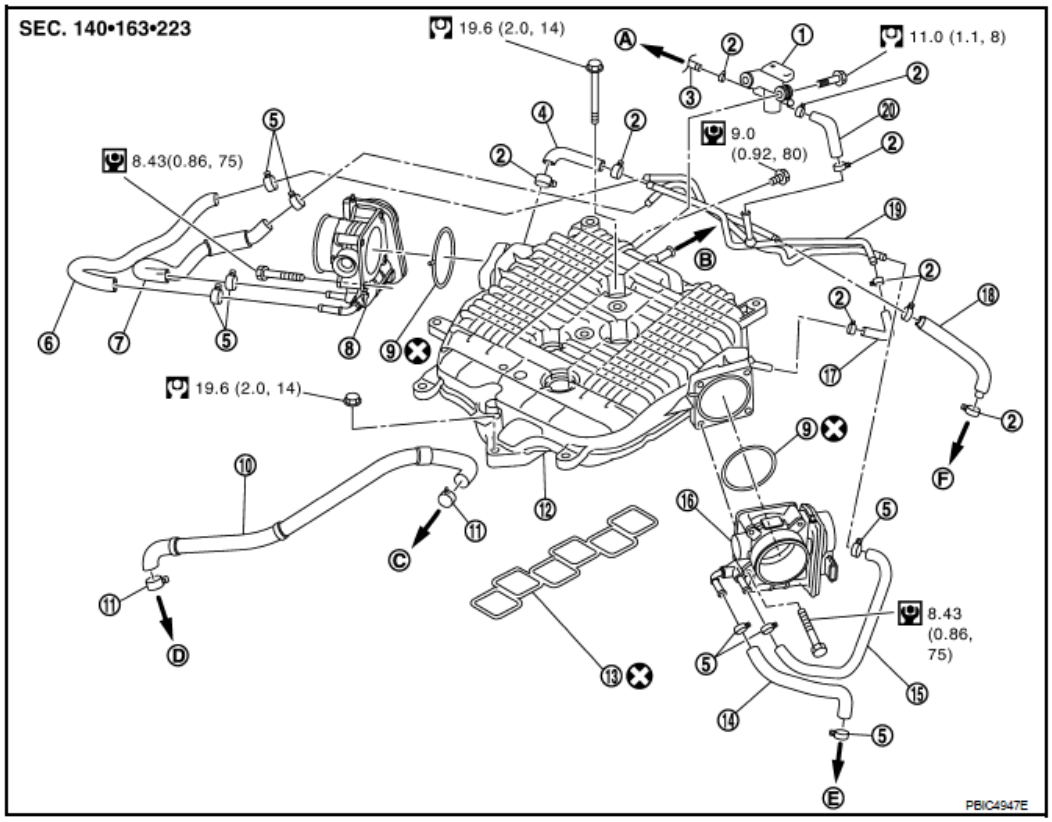
Note the following, and install in the reverse order of removal.

- Install the air cleaner filter by aligning the seal with the notch of air cleaner case.

INTAKE MANIFOLD COLLECTOR

Component

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.



1.	EVAP canister purge control solenoid valve	2.	Clamp	3.	EVAP hose
4.	EVAP hose	5.	Clamp	6.	Water hose
7.	Water hose	8.	Electric throttle control actuator (bank 1)	9.	Gasket
10.	PCV hose	11.	Clamp	12.	Intake manifold collector
13.	Gasket	14.	Water hose	15.	Water hose
16.	Electric throttle control actuator (bank 2)	17.	EVAP hose	18.	Water hose
19.	EVAP tube assembly	20.	EVAP hose		
A.	To vacuum pipe	B.	To brake booster	C.	To intake manifold collector
D.	To PCV valve	E.	To heater pipe	F.	To water outlet (rear)

Fig. 15: Exploded View Of Intake Manifold Collector With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to "**COMPONENT** " for symbols in the figure.

Removal and Installation

REMOVAL

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

1. Remove engine room cover (RH and LH). Refer to "**COMPONENT**".
2. Remove engine cover (1) and (2) with power tool.

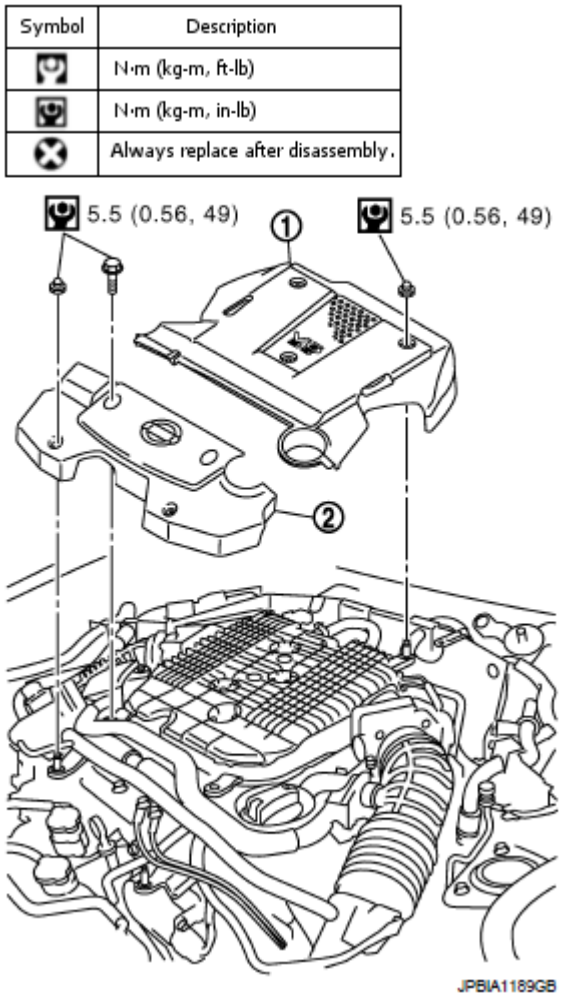


Fig. 16: Identifying Engine Cover And With Power Tool With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Remove air cleaner case and air duct (RH and LH). Refer to **AIR CLEANER AND AIR DUCT**.
4. Remove electric throttle control actuator (bank 1 and bank 2) as follows:

NOTE: When removing only intake manifold collector, move electric throttle control actuator without disconnecting water hose.

a. Drain engine coolant.

CAUTION: Perform this step when engine is cold.

b. Disconnect water hoses from electric throttle control actuator. When engine coolant is not drained from radiator, attach plug to water hoses to prevent engine coolant leakage.

CAUTION: Never spill engine coolant on drive belt.

c. Disconnect harness connector.
d. Loosen mounting bolts in reverse order as shown in the figure.

CAUTION:
- **Handle carefully to avoid any shock to electric throttle control actuator.**
- **Never disassemble.**

NOTE:
- **Figure shows electric throttle control actuator (bank 1) viewed from the air duct side.**
- **Viewed from the air duct side, order of loosening mounting bolts of electric throttle control actuator (bank 2) is the same as that of the electric throttle control actuator (bank 1).**

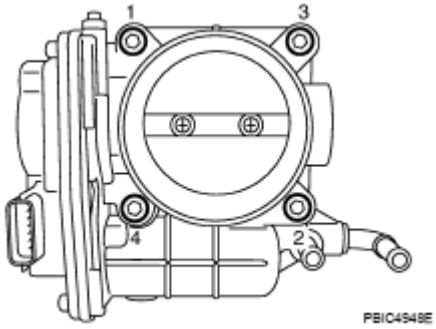


Fig. 17: Identifying Electric Throttle Control Actuator Mounting Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

5. Disconnect vacuum hose, PCV hose and EVAP hose from intake manifold collector.
6. Remove EVAP canister purge volume control solenoid valve and EVAP tube assembly from intake manifold collector.
7. Loosen mounting bolts with power tool in reverse order as shown in the figure to remove intake manifold collector.

⇦ : Engine front

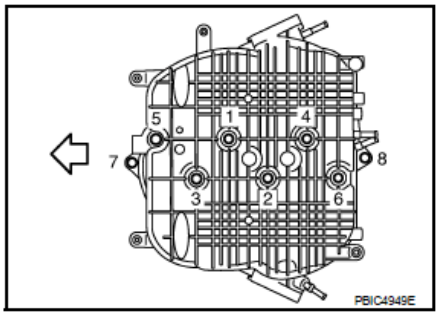


Fig. 18: Identifying Intake Manifold Collector Mounting Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: Cover engine openings to avoid entry of foreign materials.

8. Remove PCV hose [between intake manifold collector and rocker cover (bank 1)].

INSTALLATION

Note the following, and install in the reverse order of removal.

Intake Manifold Collector

If stud bolts were removed, install them and tighten to the specified torque below.

10.8 N.m (1.1 kg-m, 8 ft-lb)

- Tighten mounting bolts in numerical order as shown in the figure.

NOTE: Tighten mounting bolts to secure gasket and intake manifold collector.

⇦ : Engine front

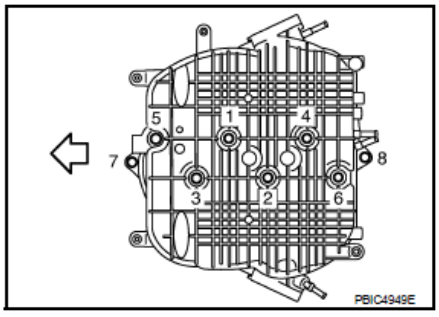


Fig. 19: Identifying Intake Manifold Collector Mounting Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

Water Hose

- Insert hose by 27 to 32 mm (1.06 to 1.26 in) from connector end.
- Clamp hose at location of 3 to 7 mm (0.12 to 0.28 in) from hose end.

Electric Throttle Control Actuator

- Install in the reverse order of removal.
- Tighten mounting bolts in numerical order as shown in the figure.

CAUTION:

- **Handle carefully to avoid any shock to electric throttle control actuator.**
- **Never disassemble.**
- **The figure shows the electric throttle control actuator (bank 1) viewed from the air duct side.**
- **Viewed from the air duct side, order of tightening mounting bolts of electric throttle control actuator (bank 2) is the same as that of the electric throttle control actuator (bank 1).**

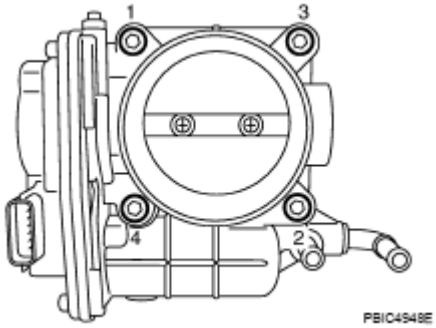


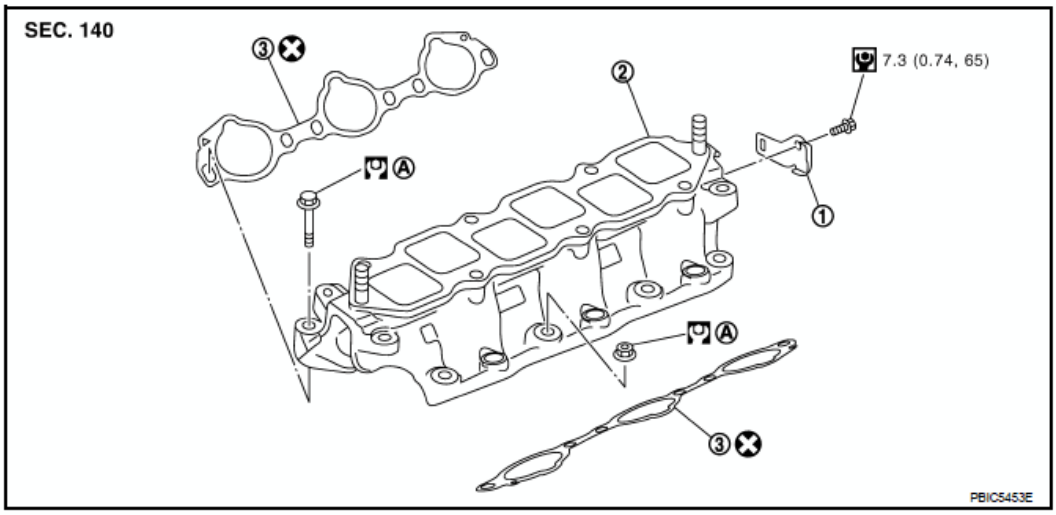
Fig. 20: Identifying Electric Throttle Control Actuator Mounting Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

- Perform the "Throttle Valve Closed Position Learning" when harness connector of electric throttle control actuator is disconnected. Refer to "**THROTTLE VALVE CLOSED POSITION LEARNING : DESCRIPTION** ".
- Perform the "Idle Air Volume Learning" and "Throttle Valve Closed Position Learning" when electric throttle control actuator is replaced. Refer to "**IDLE AIR VOLUME LEARNING : DESCRIPTION** " and "**THROTTLE VALVE CLOSED POSITION LEARNING : DESCRIPTION** ".

INTAKE MANIFOLD

Component

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.



1. Harness bracket
2. Intake manifold
3. Gasket

A. Refer to INTAKE MANIFOLD

Fig. 21: Identifying Intake Manifold Components With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to "**COMPONENT** " for symbols in the figure.

Removal and Installation

REMOVAL

1. Release fuel pressure. Refer to "**INSPECTION** ".
2. Remove intake manifold collector. Refer to **INTAKE MANIFOLD COLLECTOR**.
3. Remove fuel tube and fuel injector assembly. Refer to **FUEL INJECTOR AND FUEL TUBE**.
4. Remove harness bracket.
5. Loosen mounting nuts and bolts with power tool in reverse order as shown in the figure to remove intake manifold.

CAUTION:

- **Cover engine openings to avoid entry of foreign materials.**
- **Put a mark on the intake manifold and the cylinder head with pair removal because they need installed in the specified direction.**
- **Loosen mounting bolts and nuts from the inside of manifold to th outside.**

⇦ : Engine front

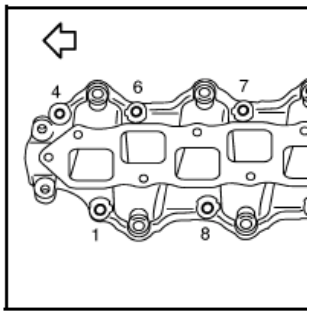


Fig. 22: Identifying Intake Manifold Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

6. Remove gaskets.

INSPECTION AFTER REMOVAL

Surface Distortion

- Check the surface distortion of the intake manifold mating surface with straightedge (A) and feeler gauge (B).

  Limit : 0.1 mm (0.004 in)

- If it exceeds the limit, replace intake manifold.

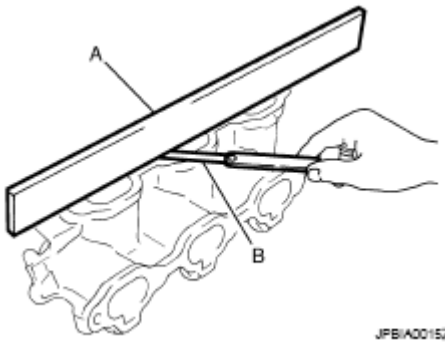


Fig. 23: Checking Surface Distortion Of Intake Manifold Mating Surface
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

Note the following, and install in the reverse order of removal.

Intake Manifold

- If stud bolts were removed, install them and tighten to the specified torque below.

10.8 N.m (1.1 kg-m, 96 in-lb)

- Tighten all mounting nuts and bolts to the specified torque in two or more steps in numerical order shown in the figure.

CAUTION:

- **Install intake manifold with the marks (put on the intake manifold cylinder head before removal) aligned.**
- **Tighten mounting bolts and nuts from the outside of manifold to inside.**

⇦ : Engine front

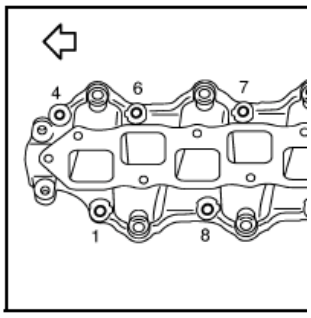


Fig. 24: Identifying Intake Manifold Nuts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

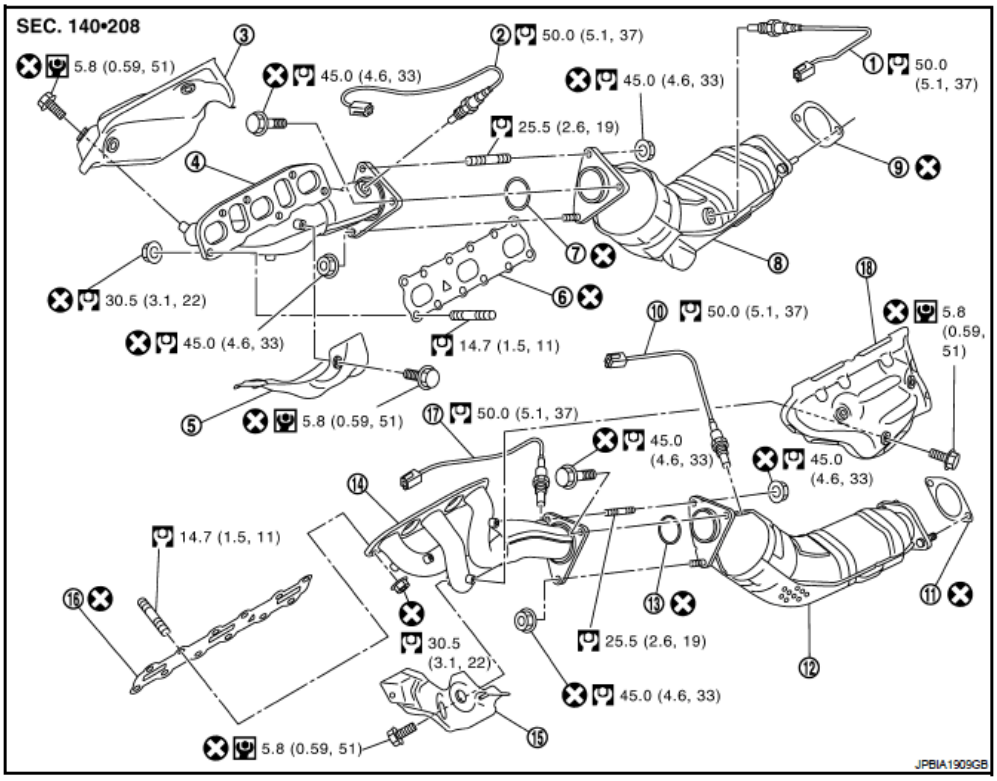
1st step: 7.4 N.m (0.75 kg-m, 5 ft-lb)

2nd step and after: 25.5 N.m (2.6 kg-m, 19 ft-lb)

EXHAUST MANIFOLD AND THREE WAY CATALYST

Component

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.



1. Heated oxygen sensor 2 (bank 1)
2. Air fuel ratio sensor 1 (bank 1)
3. Exhaust manifold cover (upper)
4. Exhaust manifold (bank 1)
5. Exhaust manifold cover (lower)
6. Gasket
7. Ring gasket
8. Three way catalyst (bank 1)
9. Gasket
10. Heated oxygen sensor 2 (bank 2)
11. Gasket
12. Three way catalyst (bank 2)
13. Ring gasket
14. Exhaust manifold (bank 2)
15. Exhaust manifold cover (lower)
16. Gasket
17. Air fuel ratio sensor 1 (bank 2)
18. Exhaust manifold cover (upper)

Fig. 25: Exploded View Of Exhaust Manifold And Three Way Catalyst With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to "**COMPONENT** " for symbols in the figure.

Removal and Installation

REMOVAL

WARNING: Perform the work when the exhaust and cooling system have completely cooled down.

NOTE: When removing bank 1 side parts only, step 3, 10 and 11 are unnecessary.

1. Remove engine room cover (RH and LH). Refer to "**COMPONENT**".

2. Remove engine cover with power tool. Refer to **INTAKE MANIFOLD COLLECTOR**.
3. Drain engine coolant. Refer to "**INSPECTION** ".

CAUTION:
- **Perform this step when engine is cold.**
- **Never spill engine coolant on drive belt.**

4. Remove air cleaner case and air duct. Refer to **AIR CLEANER AND AIR DUCT**.
5. Remove front and rear undercover with power tool.
6. Disconnect heated oxygen sensor harness connectors.

CAUTION:
- **Be careful not to damage heated oxygen sensor 2.**
- **Discard any heated oxygen sensor 2 which has been dropped onto a hard surface such as a concrete floor. Replace with a new sensor.**

7. Remove exhaust mounting bracket between three way catalysts (bank 1 and bank 2) and transmission. Refer to "**COMPONENT** ".
8. Remove exhaust front tube and three way catalysts (bank 1 and bank 2).
9. Disconnect harness connector and remove air fuel ratio sensor 1 on both banks using heated oxygen sensor wrench [SST: KV10114400 (J38365)] (C).

A : Bank 1
B : Bank 2

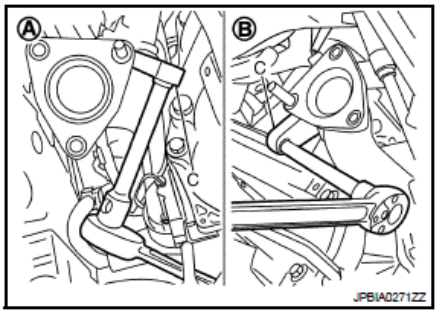


Fig. 26: Removing Air Fuel Ratio Sensor
Courtesy of NISSAN MOTOR CO., U.S.A.

- Put marks to identify installation positions of each air fuel ratio sensor 1.

CAUTION:
- **Be careful not to damage air fuel ratio sensor 1.**
- **Discard any air fuel ratio sensor 1 which has been dropped onto a hard surface such as a concrete floor. Replace with a new sensor.**

10. Disconnect steering lower joint at power steering gear assembly side, and release steering lower shaft. Refer to "**REMOVAL AND INSTALLATION** ".

11. Remove water bypass pipe and heater pipe. Refer to "**COMPONENT** ".
12. Remove exhaust manifold cover.
13. Loosen mounting nuts in reverse order as shown in the figure to remove exhaust manifold.

A : Bank 1
B : Bank 2
⇦ : Engine front

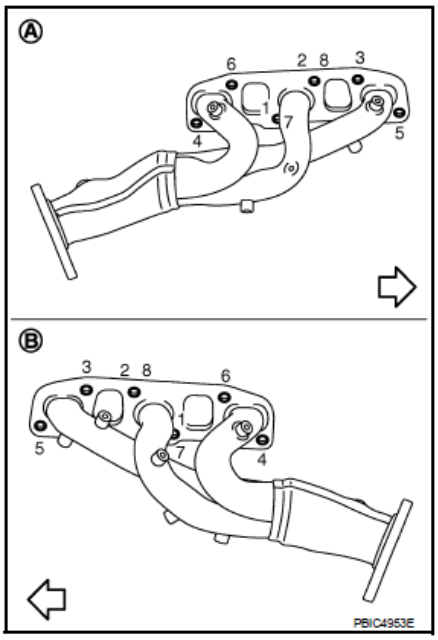


Fig. 27: Identifying Exhaust Manifold Nuts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

NOTE: Disregard the numerical order No. 7 and 8 in removal.

14. Remove gaskets.

CAUTION: Cover engine openings to avoid entry of foreign materials.

INSPECTION AFTER REMOVAL

Surface Distortion

- Check the surface distortion of the exhaust manifold mating surface with straightedge (A) and feeler gauge (B).

  Limit : 0.7 mm (0.028 in)

- If it exceeds the limit, replace exhaust manifold.

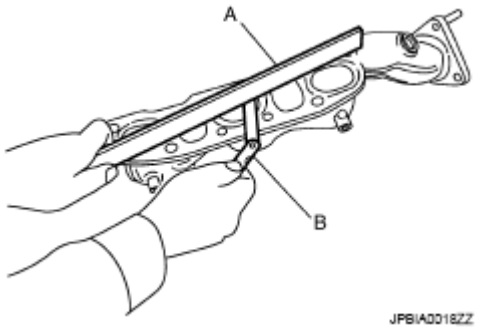


Fig. 28: Checking Surface Distortion Of Exhaust Manifold Mating Surface
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

Note the following, and install in the reverse order of removal.

Exhaust Manifold Gasket

- Install exhaust manifold gasket in direction shown in the figure.

A : Bank 1
B : Triangle press
C : Bank 2
⇦ : Engine front

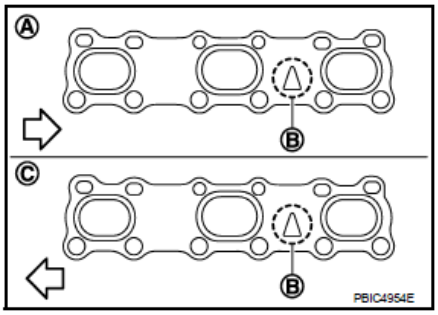


Fig. 29: Identifying Exhaust Manifold Gasket
Courtesy of NISSAN MOTOR CO., U.S.A.

Exhaust Manifold

- If stud bolts were removed, install them and tighten to the specified torque below.

  14.7 N.m (1.5 kg-m, 11 ft-lb)

- Install mounting exhaust manifold in numerical order as shown in the figure.

NOTE: **Tighten nuts No. 1 and 2 in two steps. The numerical order No. 7 and 8 shown second step.**

A : Bank 1
B : Bank 2
⇦ : Engine front

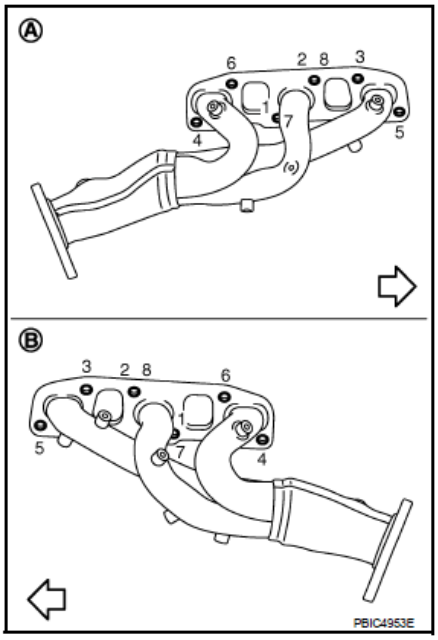


Fig. 30: Identifying Mounting Exhaust Manifold Nuts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

Air Fuel Ratio Sensor 1 and Heated Oxygen Sensor 2

CAUTION:

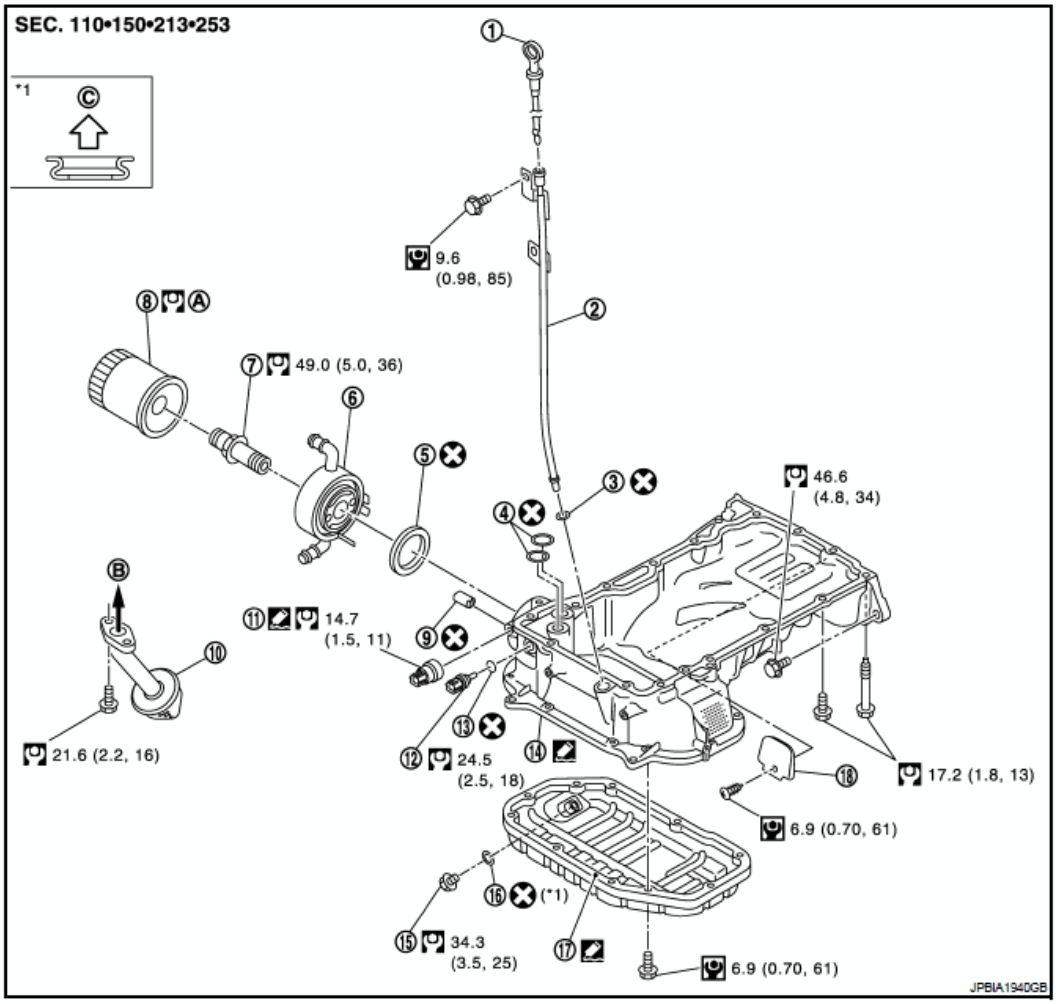
- **Before installing a new air fuel ratio sensor 1 and heated oxygen sensor 2, clean exhaust system threads using oxygen sensor thread cleaner (commercial service tool: J-43897-18 or J43897-12) and apply anti-seize lubricant (commercial service tool).**
- **Never over torque air fuel ratio sensor 1 and heated oxygen sensor 2. Doing so may cause damage to air fuel ratio sensor 1 and heated oxygen sensor 2, resulting in the "MIL" coming on.**

OIL PAN AND OIL STRAINER

2WD

2WD : Component

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.



1. Oil level gauge
2. Oil level gauge guide
3. O-ring
4. O-ring
5. O-ring
6. Oil cooler
7. Connector bolt
8. Oil filter
9. Relief valve
10. Oil strainer
11. Oil pressure switch
12. Oil temperature sensor
13. Washer
14. Oil pan (upper)
15. Drain plug
16. Drain plug washer
17. Oil pan (lower)
18. Rear plate cover

A. Refer to "Removal and Installation"
B. To oil pump
C. Oil pan (lower) side

Fig. 31: Exploded View Of Oil Pan And Oil Strainer With Torque Specifications (2WD)
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to "**COMPONENT** " for symbols in the figure.

2WD : Removal and Installation

REMOVAL

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

CAUTION: To remove oil pan (upper), remove engine assembly first.

NOTE: When removing oil pan (lower) only, remove engine assembly is not necessary. Perform step 1, 2 and 10.

1. Remove front and rear undercover with power tool.
2. Drain engine oil. Refer to "**CHANGING ENGINE OIL** ".

CAUTION:
- **Perform this step when engine is cold.**
- **Never spill engine oil on drive belt.**

3. Remove engine assembly from the vehicle, and separate front suspension member and transmission from engine. Refer to "**2WD : COMPONENT**".
4. Lift the engine with hoist, and mount it onto widely use engine stand. Refer to "**COMPONENT**".
5. Remove alternator. Refer to "**REMOVAL AND INSTALLATION** ".
6. Remove starter motor. Refer to "**REMOVAL AND INSTALLATION** ".
7. Remove idler pulley and bracket assembly. Refer to **TIMING CHAIN**.
8. Remove oil filter, if necessary. Refer to "**REMOVAL AND INSTALLATION** ".
9. Remove oil temperature sensor, if necessary.
10. Remove oil pan (lower) as follows:
    a. Loosen mounting bolts with power tool in reverse order as shown in the figure to remove.

⇦ : Engine front

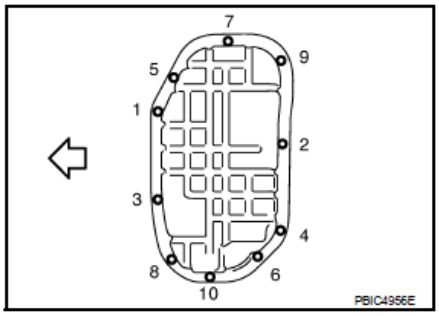


Fig. 32: Identifying Oil Pan Mounting Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

    b. Insert seal cutter [SST: KV10111100 (J37228)] (A) between oil pan (upper) and oil pan (lower).

CAUTION:
- **Be careful not to damage the mating surfaces.**

- **Never insert screwdriver, this will damage the mating surface.**

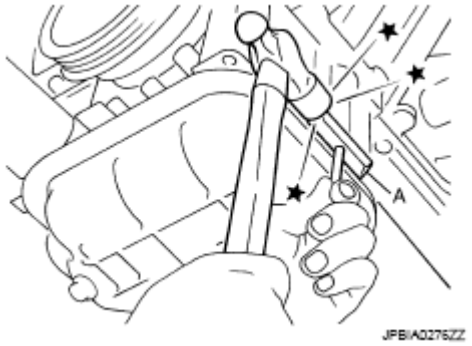


Fig. 33: Inserting Seal Cutter Between Oil Pan (Upper) And Oil Pan (Lower)
Courtesy of NISSAN MOTOR CO., U.S.A.

11. Remove oil strainer.
12. Remove rear cover plate.
13. Loosen mounting bolts with power tool in reverse order as shown in the figure to remove oil pan (upper).
    - Insert seal cutter [SST: KV10111100 (J37228)] between oil pan (upper) and cylinder block. Slide seal cutter by tapping on the side of tool with hammer. Remove oil pan (upper).

CAUTION:
- **Be careful not to damage mating surfaces.**
- **Never insert screwdriver, this will damage the mating surfac**

⇦ : Engine front

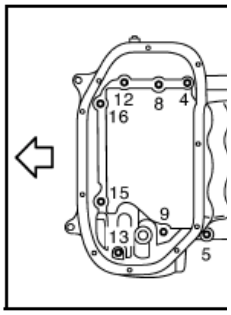


Fig. 34: Identifying Oil Pan Mounting Bolts Tightening Sequ
Courtesy of NISSAN MOTOR CO., U.S.A.

14. Remove O-rings (2) from bottom of lower cylinder block (1) and oil pump (3).

⇦ : Engine front

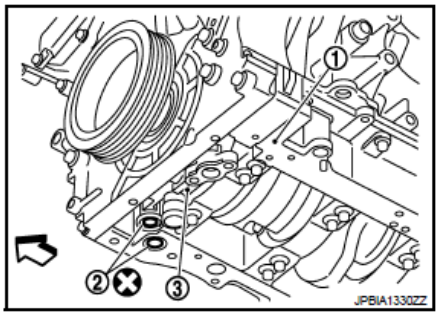


Fig. 35: Identifying Oil Pump O-Rings
Courtesy of NISSAN MOTOR CO., U.S.A.

INSPECTION AFTER REMOVAL

Clean oil strainer if any object attached.

INSTALLATION

1. Install oil pan (upper) as follows:
   a. Use scraper (A) to remove old liquid gasket from mating surfaces.
      - Also remove the old liquid gasket from mating surface of lower cylinder block.
      - Remove old liquid gasket from the bolt holes and threads.

CAUTION: Never scratch or damage the mating surfaces when cleaning off old liquid gasket.

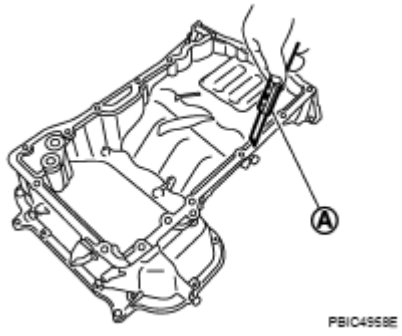


Fig. 36: Scraping Liquid Gasket From Mating Surface Of Lower Cylinder Block
Courtesy of NISSAN MOTOR CO., U.S.A.

   b. Install new O-rings (2) on the bottom of lower cylinder block (1) and oil pump (3).

⇦ : Engine front

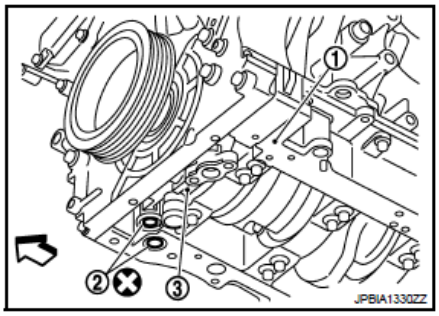


Fig. 37: Identifying Lower Cylinder Block O-Rings
Courtesy of NISSAN MOTOR CO., U.S.A.

c. Apply a continuous bead of liquid gasket with tube presser (commercial service tool) to the lower cylinder block mating surface of oil pan (upper) to a limited portion as shown in the figure. **Use Genuine RTV Silicone Sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCT AND SEALANT ".**

⇦ : Engine front

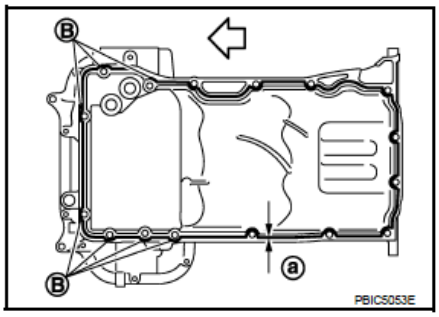


Fig. 38: Applying Continuous Bead Of Liquid Gasket
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION:
- **For bolt holes (B) (7 locations), apply liquid gasket outside the holes.**
- **Attaching should be done within 5 minutes after coating.**

d. Install oil pan (upper).

CAUTION: Install avoiding misalignment of both oil pan gasket and O-rings.

- Tighten mounting bolts in numerical order as shown in the figure.

⇦ : Engine front

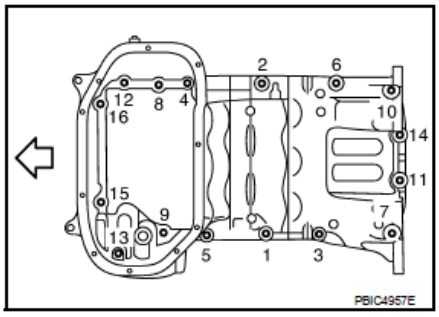


Fig. 39: Identifying Oil Pan Mounting Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

- There are two types of mounting bolts. Refer to the following for locating bolts.

  M8 x 92 mm (3.62 in) : 7, 10, 13

  M8 x 25 mm (0.98 in) : Except the above

e. Tighten transmission joint bolts. Refer to "**2WD : COMPONENT**".

2. Install oil strainer to oil pump.
   - Apply locking sealant to the thread of mounting bolts. **Use genuine high strength thread locking sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCT AND SEALANT ".**
3. Install oil pan (lower) as follows:
   a. Use scraper (A) to remove old liquid gasket from mating surfaces.
      - Also remove old liquid gasket from mating surface of oil pan (upper).
      - Remove old liquid gasket from the bolt holes and thread.

CAUTION: Never scratch or damage the mating surfaces when cleaning off old liquid gasket.

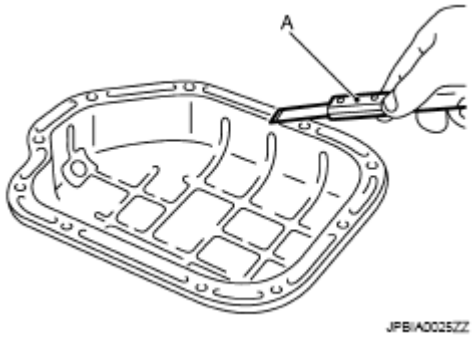


Fig. 40: Using Scraper To Remove Old Liquid Gasket
Courtesy of NISSAN MOTOR CO., U.S.A.

b. Apply a continuous bead of liquid gasket with tube presser (commercial service tool) (A) to the oil pan (lower) as shown in the figure.

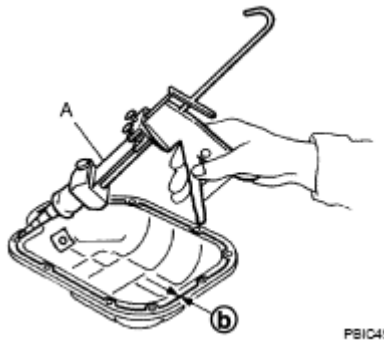


Fig. 41: Applying Bead Of Liquid Gasket With Tube Presser
Courtesy of NISSAN MOTOR CO., U.S.A.

Use Genuine RTV Silicone Sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCT AND SEALANT ".

CAUTION: Attaching should be done within 5 minutes after coating.

c. Install oil pan (lower).
   - Tighten mounting bolts in numerical order as shown in the figure.

⇦ : Engine front

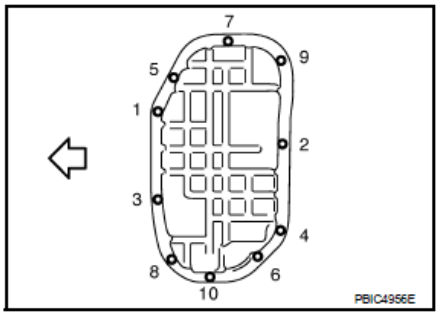


Fig. 42: Identifying Oil Pan Mounting Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

4. Install oil pan drain plug.
   - Refer to the figure of components for installation direction of drain plug washer. Refer to "**2WD : COMPONENT**".
5. Install in the reverse order of removal after this step.

NOTE: At least 30 minutes after oil pan is installed, pour engine oil.

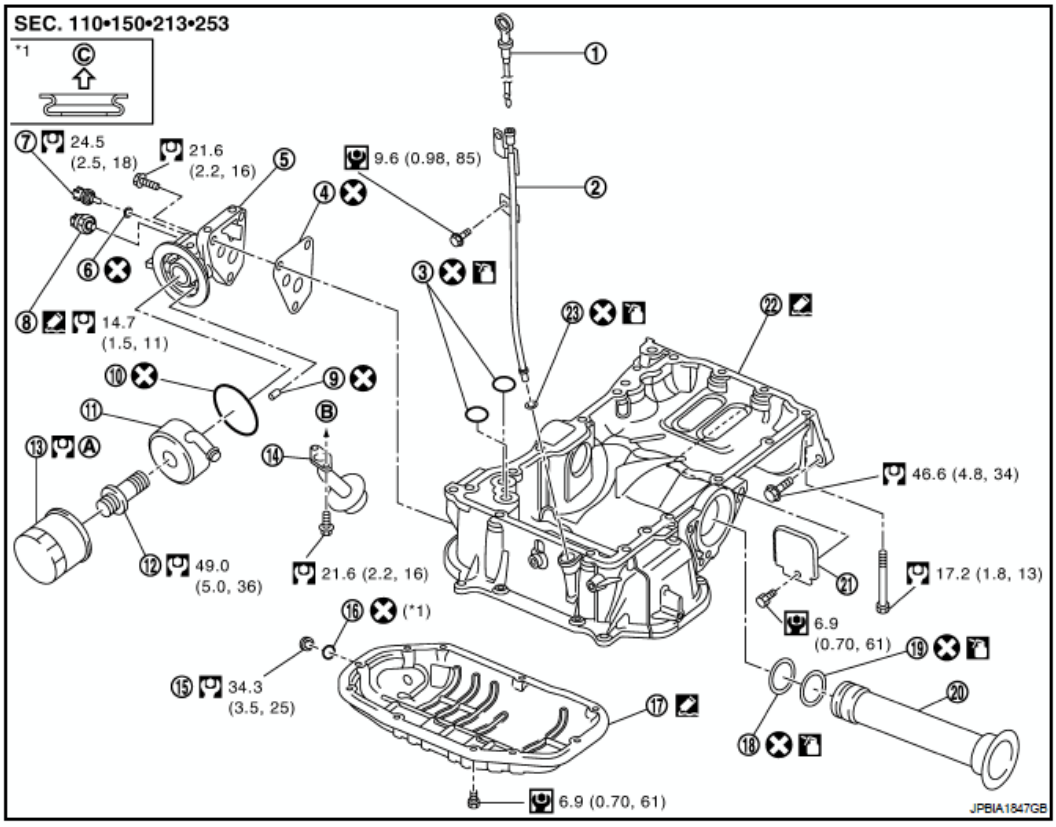
INSPECTION AFTER INSTALLATION

1. Check engine oil level and adjust engine oil. Refer to "**INSPECTION** ".
2. Start engine, and check there is no leakage of engine oil.
3. Stop engine and wait for 10 minutes.
4. Check engine oil level again. Refer to "**INSPECTION** ".

AWD

AWD : Component

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.



1. Oil level gauge	2. Oil level gauge guide	3. O-ring
4. Gasket	5. Oil filter bracket	6. Washer
7. Oil temperature sensor	8. Oil pressure switch	9. Relief valve
10. O-ring	11. Oil cooler	12. Connector bolt
13. Oil filter	14. Oil strainer	15. Drain plug
16. Drain plug washer	17. Oil pan (lower)	18. O-ring (small)
19. O-ring (large)	20. Axle pipe	21. Rear plate cover
22. Oil pan (upper)	23. O-ring	
A. Refer to "Removal and Installation"	B. To oil pump	C. Oil pan (lower) side

Fig. 43: Identifying Oil Temperature Sensor Components With Torque Specifications

Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to "**COMPONENT** " for symbols in the figure.

AWD : Removal and Installation

REMOVAL

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

CAUTION: To remove oil pan (upper), remove engine assembly first.

NOTE: When removing oil pan (lower) only, remove engine assembly is not necessary. Perform step 1, 2 and 10.

1. Remove front and rear undercover with power tool.
2. Drain engine oil. Refer to "**CHANGING ENGINE OIL** ".

CAUTION:
- **Perform this step when engine is cold.**
- **Never spill engine oil on drive belt.**

3. Remove engine assembly from the vehicle, and separate front suspension member and transmission from engine. Refer to "**AWD : COMPONENT**".
4. Lift the engine with hoist, and mount it onto widely use engine stand. Refer to "**COMPONENT**".
5. Remove alternator. Refer to "**REMOVAL AND INSTALLATION** ".
6. Remove starter motor. Refer to "**REMOVAL AND INSTALLATION** ".
7. Remove idler pulley and bracket assembly. Refer to **TIMING CHAIN**.
8. Remove oil filter, if necessary. Refer to "**REMOVAL AND INSTALLATION** ".
9. Remove oil temperature sensor, if necessary.
10. Remove oil pan (lower) as follows:
    a. Loosen mounting bolts with power tool in reverse order as shown in the figure to remove.

⇦ : Engine front

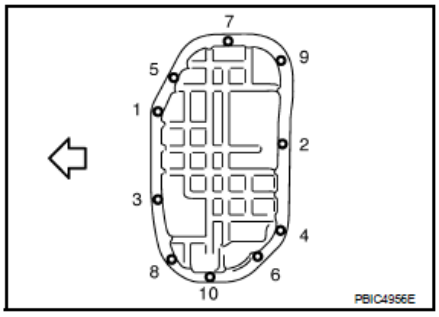


Fig. 44: Identifying Oil Pan Mounting Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

b. Insert seal cutter [SST: KV10111100 (J37228)] (A) between oil pan (upper) and oil pan (lower).

CAUTION:

- **Be careful not to damage the mating surfaces.**
- **Never insert screwdriver, this will damage the mating surface.**

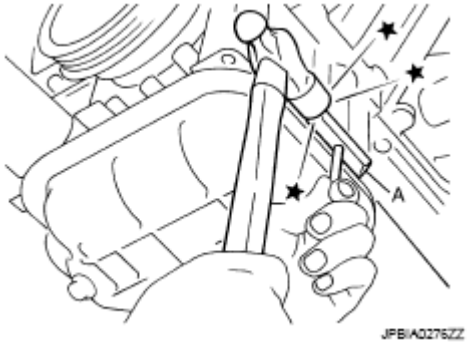


Fig. 45: Inserting Seal Cutter Between Oil Pan (Upper) And Oil Pan (Lower)
Courtesy of NISSAN MOTOR CO., U.S.A.

11. Remove oil strainer.
12. Remove rear cover plate.
13. Loosen mounting bolts with power tool in reverse order as shown in the figure to remove oil pan (upper).

⇦ : Engine front

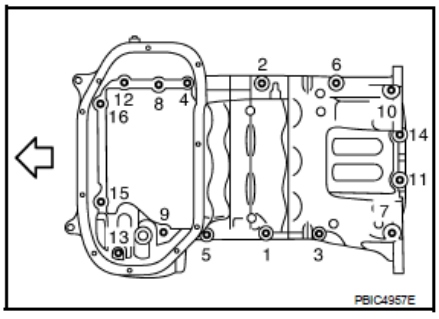


Fig. 46: Identifying Oil Pan Mounting Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

- Insert seal cutter [SST: KV10111100 (J37228)] between oil pan (upper) and cylinder block. Slide seal cutter by tapping on the side of tool with hammer. Remove oil pan (upper).

CAUTION:
- **Be careful not to damage mating surfaces.**
- **Never insert screwdriver, this will damage the mating surface.**

14. Remove O-rings (2) from bottom of lower cylinder block (1) and oil pump (3).

⇦ : Engine front

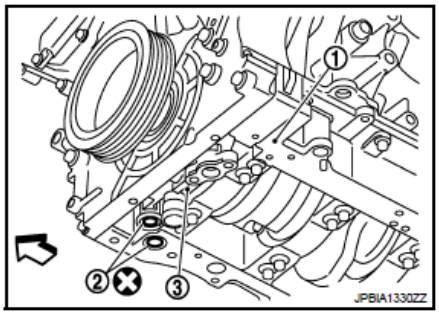


Fig. 47: Identifying Lower Cylinder Block And Oil Pump
Courtesy of NISSAN MOTOR CO., U.S.A.

15. Remove axle pipe, if necessary.
    - Remove axle pipe from oil pan (upper) using a suitable drift (A) [outer diameter: 37 mm (1.46 in)].

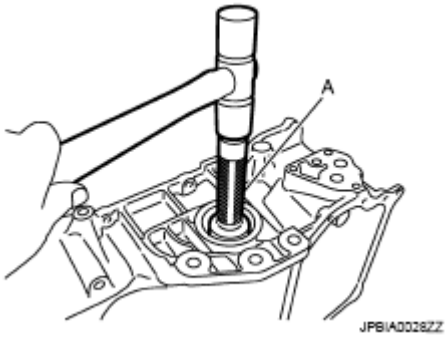


Fig. 48: View Of Axle Pipe And Oil Pan
Courtesy of NISSAN MOTOR CO., U.S.A.

INSPECTION AFTER REMOVAL

Clean oil strainer if any object attached.

INSTALLATION

1. Install axle pipe (3) to oil pan (upper), if removed.
   - Lubricate O-ring groove of axle pipe, O-rings (1), (2), and O-ring joint of oil pan with new engine oil.

O-RING INNER DIAMETER SPECIFICATION

	Unit: mm (in)
Items	**O-ring inner diameter**
Final drive side (right side)	31.4 (1.236)
Axle pipe flange side (left side)	33.6 (1.323)

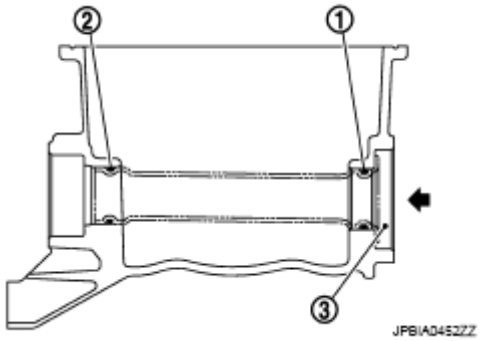


Fig. 49: Identifying Axle Pipe
Courtesy of NISSAN MOTOR CO., U.S.A.

   - Install axle pipe (1) to oil pan (upper) from axle pipe flange side (left side) using a suitable drift (A) [outer diameter: 43 to 57 mm (1.69 to 2.24 in)].

CAUTION: Insert it with care to prevent O-ring from sliding.

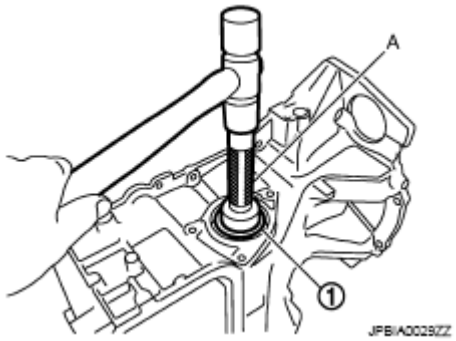


Fig. 50: Installing Axle Pipe To Oil Pan
Courtesy of NISSAN MOTOR CO., U.S.A.

2. Install oil pan (upper) as follows:
   a. Use scraper (A) to remove old liquid gasket from mating surfaces.

- Also remove the old liquid gasket from mating surface of lower cylinder block.
- Remove old liquid gasket from the bolt holes and threads.

CAUTION: Never scratch or damage the mating surfaces when cleaning off old liquid gasket.

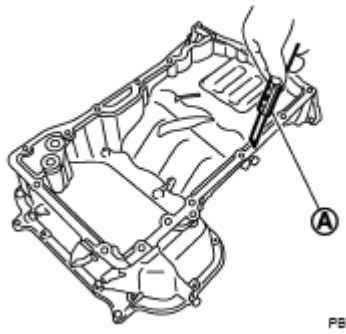


Fig. 51: Scraping Liquid Gasket From Mating Surface Of Lower Cylinder Block
Courtesy of NISSAN MOTOR CO., U.S.A.

b. Install new O-rings (2) on the bottom of lower cylinder block (1) and oil pump (3).

⇦ : Engine front

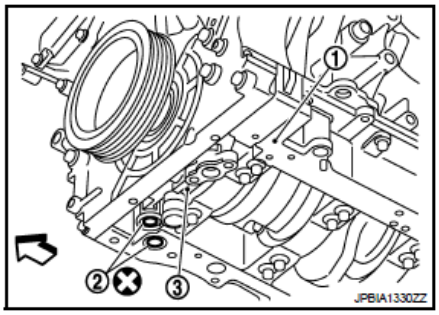


Fig. 52: Identifying Lower Cylinder Block And Oil Pump
Courtesy of NISSAN MOTOR CO., U.S.A.

c. Apply a continuous bead of liquid gasket with tube presser (commercial service tool) to the lower cylinder block mating surface of oil pan (upper) to a limited portion as shown in the figure. **Use Genuine RTV Silicone Sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCT AND SEALANT ".**

a : ϕ4.0 - 5.0 mm (0.157 - 0.197 in)
⇦ : Engine front

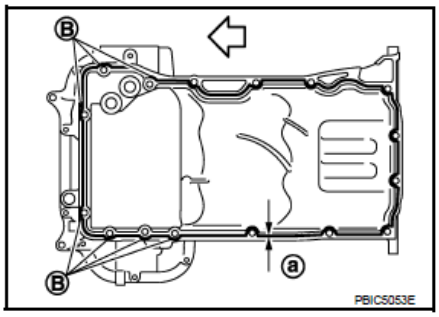


Fig. 53: Applying Continuous Bead Of Liquid Gasket
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION:
- **For bolt holes (B) (7 locations), apply liquid gasket outside the holes.**
- **Attaching should be done within 5 minutes after coating.**

d. Install oil pan (upper).

CAUTION: Install avoiding misalignment of both oil pan gasket and O-rings.

- Tighten mounting bolts in numerical order as shown in the figure.

⇦ : Engine front

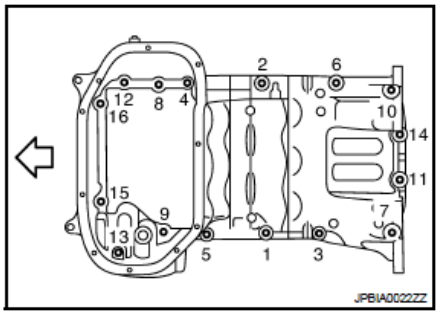


Fig. 54: Identifying Oil Pan Mounting Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

- There are three types of mounting bolts. Refer to the following for locating bolts.

M8 x 25 mm (0.98 in) : 3, 6, 8, 9, 11, 12, 14, 15, 16

M8 x 50 mm (1.97 in) : 2

M8 x 90 mm (3.54 in) : 1, 4, 5, 7, 10, 13

e. Tighten transmission joint bolts. Refer to "**AWD : COMPONENT**".

3. Install oil strainer to oil pump.

- Apply locking sealant to the thread of mounting bolts.

Use genuine high strength thread locking sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCT AND SEALANT ".

4. Install oil pan (lower) as follows:
   a. Use scraper (A) to remove old liquid gasket from mating surfaces.
      - Also remove old liquid gasket from mating surface of oil pan (upper).
      - Remove old liquid gasket from the bolt holes and thread.

CAUTION: Never scratch or damage the mating surfaces when cleaning off old liquid gasket.

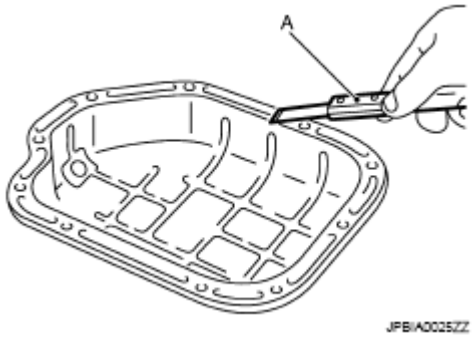


Fig. 55: Using Scraper To Remove Old Liquid Gasket
Courtesy of NISSAN MOTOR CO., U.S.A.

   b. Apply a continuous bead of liquid gasket with tube presser (commercial service tool) (A) to the oil pan (lower) as shown in the figure.

Use Genuine RTV Silicone Sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCT AND SEALANT ".

CAUTION: Attaching should be done within 5 minutes after coating.

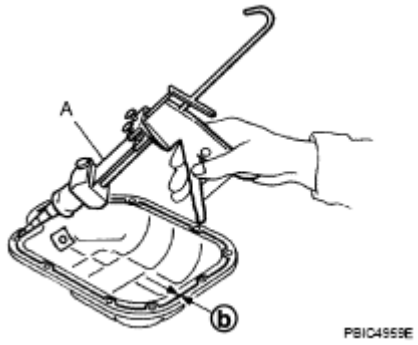


Fig. 56: Applying Bead Of Liquid Gasket With Tube Presser
Courtesy of NISSAN MOTOR CO., U.S.A.

c. Install oil pan (lower).
   - Tighten mounting bolts in numerical order as shown in the figure.

⇦ : Engine front

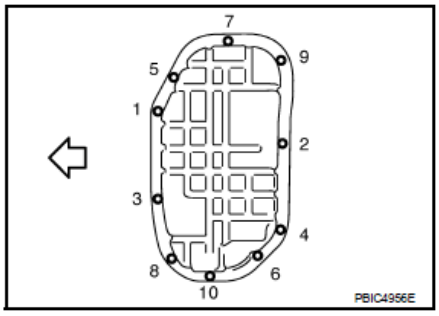


Fig. 57: Identifying Oil Pan Mounting Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

5. Install oil pan drain plug.
   - Refer to the figure of components for installation direction of drain plug washer. Refer to "**AWD : COMPONENT**".
6. Install in the reverse order of removal after this step.

NOTE: At least 30 minutes after oil pan is installed, pour engine oil.

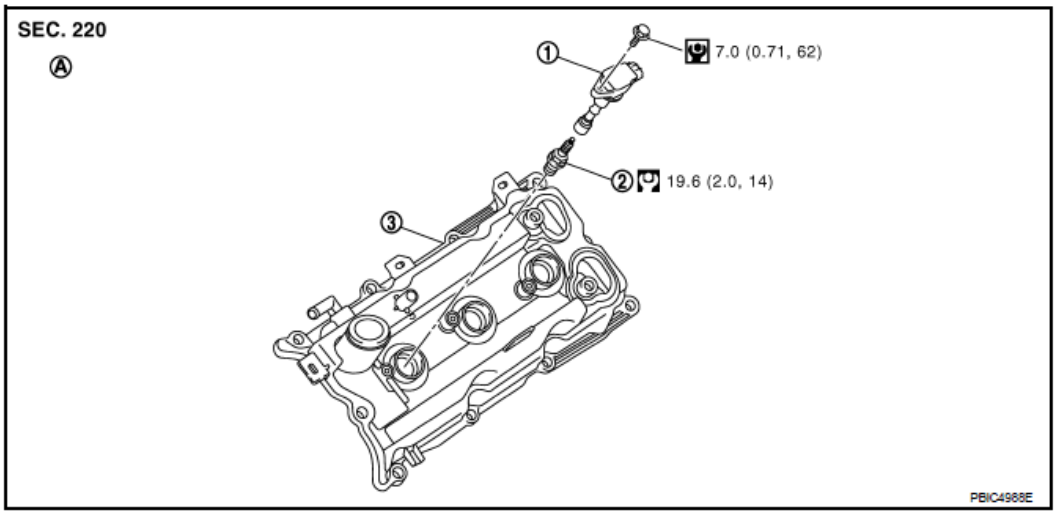
INSPECTION AFTER INSTALLATION

1. Check engine oil level and adjust engine oil. Refer to "**INSPECTION** ".
2. Start engine, and check there is no leakage of engine oil.
3. Stop engine and wait for 10 minutes.
4. Check engine oil level again. Refer to "**INSPECTION** ".

IGNITION COIL

Component

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.



1. Ignition coil
2. Spark plug
3. Rocker cover

A. Bank 2

Fig. 58: Identifying Ignition Coil Components With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to "**COMPONENT** " for symbols in the figure.

Removal and Installation

REMOVAL

1. Remove engine room cover (RH and LH). Refer to "**COMPONENT**".
2. Remove engine cover with power tool. Refer to **INTAKE MANIFOLD COLLECTOR**.
3. Remove air cleaner case and air duct. Refer to **AIR CLEANER AND AIR DUCT**.
4. Move aside harness, harness bracket, and hoses located above ignition coil.
5. Remove electric throttle control actuator. Refer to "**COMPONENT**".
6. Disconnect harness connector from ignition coil.
7. Remove ignition coil.

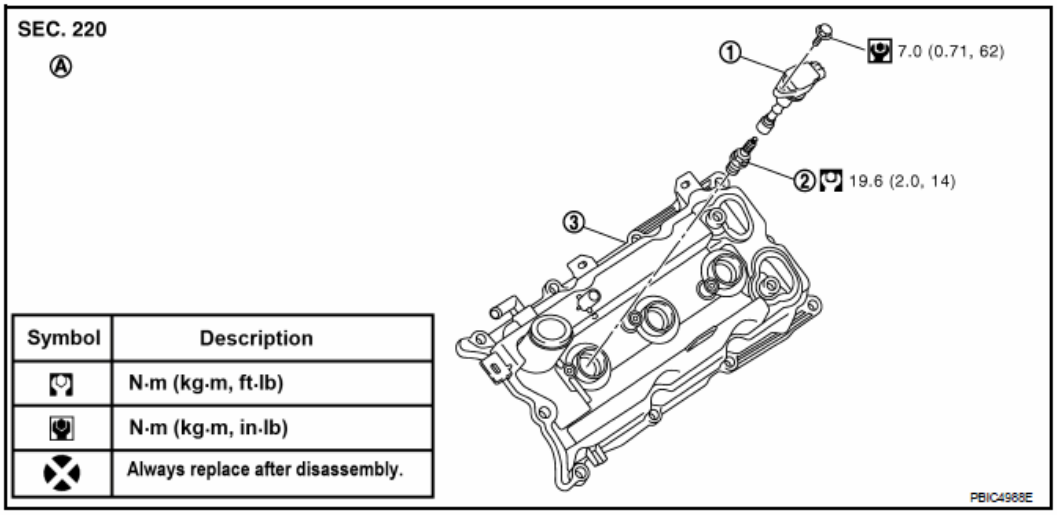
CAUTION: Never shock ignition coil.

INSTALLATION

Install in the reverse order of removal.

SPARK PLUG (IRIDIUM-TIPPED TYPE)

Component



1. Ignition coil
2. Spark plug
3. Rocker cover

A. Bank 2

Fig. 59: Identifying Spark Plug Components (Iridium-Tipped Type)
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to "**COMPONENT** " for symbols in the figure.

Removal and Installation

REMOVAL

1. Remove engine cover with power tool. Refer to **INTAKE MANIFOLD COLLECTOR**.
2. Remove ignition coil. Refer to **IGNITION COIL**.
3. Remove spark plug using spark plug wrench (commercial service tool).

a : 14 mm (0.55 in)

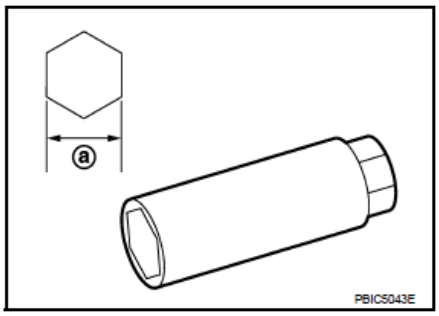


Fig. 60: Identifying Spark Plug Dimension
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: Never drop or shock spark plug.

INSPECTION AFTER REMOVAL

INSPECTION CHART

Make	DENSO
Standard type	FXE22HR-11

Gap (Nominal) : 1.1 mm (0.043 in)

CAUTION:

- **Never drop or shock spark plug.**
- **Never use wire brush for cleaning.**
- **If plug tip is covered with carbon, spark plug cleaner may be used.**

  Cleaner air pressure:

  Less than 588 kPa (6 kg/cm^2 , 85 psi)

  Cleaning time:

  Less than 20 seconds

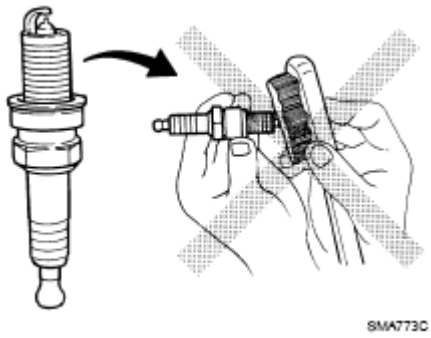


Fig. 61: Caution - Do Not Use Wire Brush For Cleaning Spark Plugs
Courtesy of NISSAN MOTOR CO., U.S.A.

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

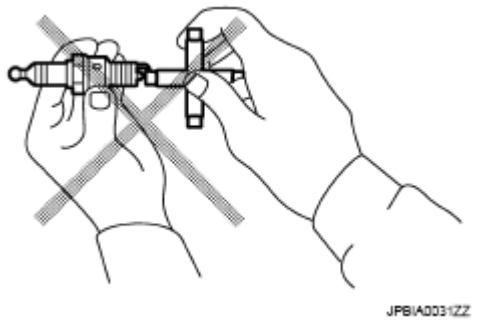


Fig. 62: Caution - Spark Plug Gap Adjustment
Courtesy of NISSAN MOTOR CO., U.S.A.

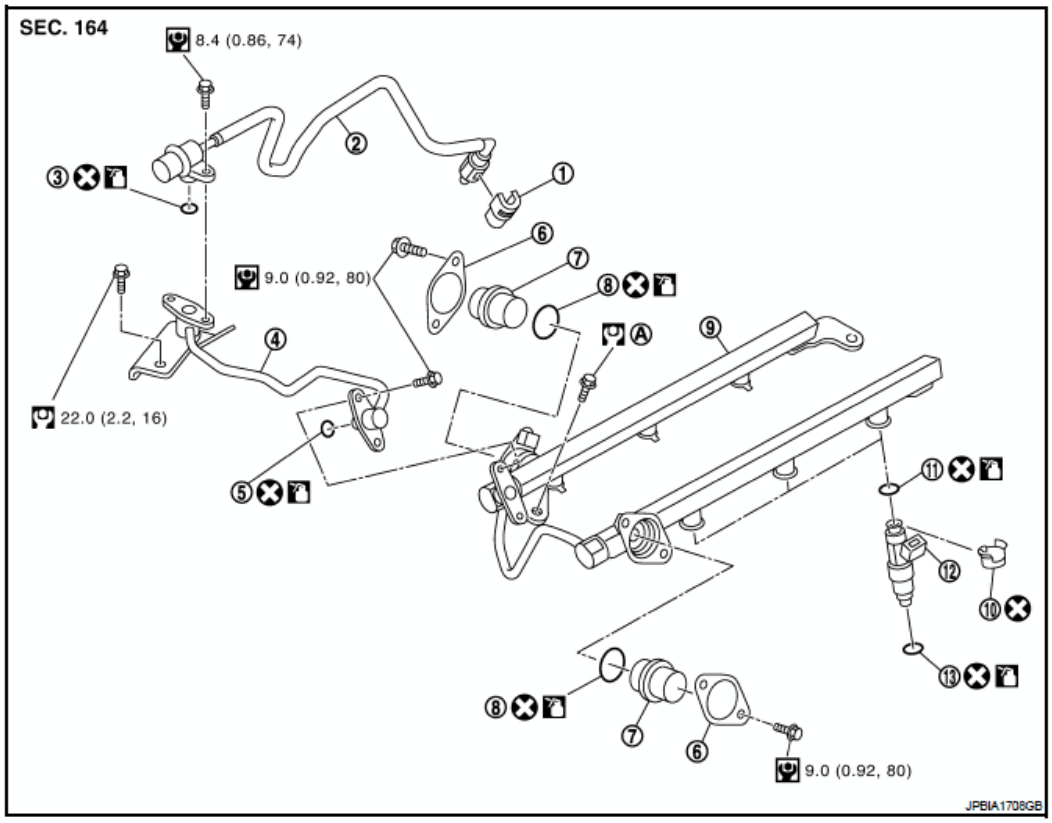
INSTALLATION

Install in the reverse order of removal.

FUEL INJECTOR AND FUEL TUBE

Component

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.



1. Quick connector cap
2. Fuel feed hose (with damper)
3. O-ring
4. Fuel sub tube
5. O-ring
6. Fuel damper cap
7. Fuel damper
8. O-ring
9. Fuel tube
10. Clip
11. O-ring (black)
12. Fuel injector
13. O-ring (green)

A. Refer to FUEL INJECTOR AND FUEL TUBE

Fig. 63: Identifying Fuel Injector And Fuel Tube Components With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to "**COMPONENT** " for symbols in the figure.

CAUTION: Never remove or disassemble parts unless instructed as shown in the figure.

Removal and Installation

REMOVAL

WARNING:

- **Put a "CAUTION: FLAMMABLE" sign in the workshop.**

- **Be sure to work in a well ventilated area and furnish workshop with a CO2 fire extinguisher.**
- **Never smoke while servicing fuel system. Keep open flames and sparks away from the work area.**
- **To avoid the danger of being scalded, never drain engine coolant when engine is hot.**

1. Remove engine room cover (RH and LH). Refer to "**COMPONENT**".
2. Remove engine cover with power tool. Refer to **INTAKE MANIFOLD COLLECTOR**.
3. Release fuel pressure. Refer to "**INSPECTION** ".
4. Drain engine coolant, or when water hoses are disconnected, attach plug to prevent engine coolant leakage. Refer to "**CHANGING ENGINE COOLANT** " and **INTAKE MANIFOLD COLLECTOR**.

CAUTION: Perform this step when engine is cold.

5. Remove intake manifold collector. Refer to **INTAKE MANIFOLD COLLECTOR**.
6. Remove fuel feed hose (with damper) (1) from fuel sub-tube (2) and harness bracket (3).

⇦ : Engine front

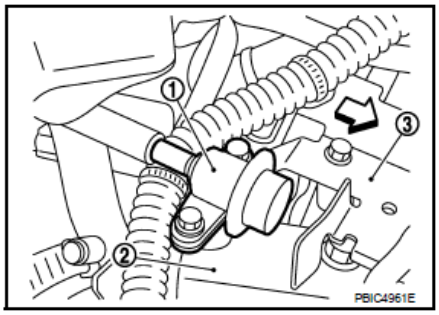


Fig. 64: Removing Fuel Feed Hose (With Damper) From Fuel Sub-Tube And Harness Bracket
Courtesy of NISSAN MOTOR CO., U.S.A.

NOTE: There is no fuel return route.

CAUTION:
- **While hoses are disconnected, plug them to prevent fuel from draining.**
- **Never separate fuel damper and fuel feed hose.**

7. When separating fuel feed hose (with damper) and centralized under-floor piping connection, disconnect quick connector as follows:
   a. Remove quick connector cap (2) from quick connector connection on right member side.
   b. Disconnect fuel feed hose (with damper) (1) from bracket hose clamp.

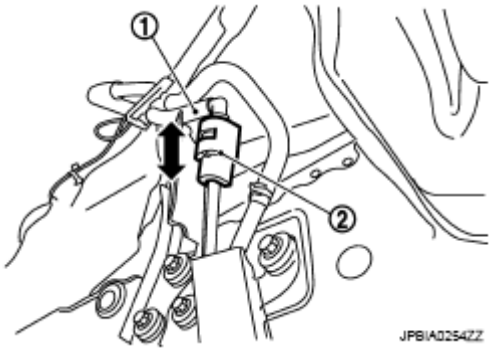


Fig. 65: Disconnecting Fuel Feed Hose (With Damper) From Bracket Hose Clamp
Courtesy of NISSAN MOTOR CO., U.S.A.

c. Push in retainer tabs (2).
d. Draw and pull out quick connector (1) straight from centralized under-floor piping (3).

CAUTION:

- **Pull quick connector holding (A) position as shown in the figure.**
- **Never pull with lateral force applied. O-ring inside quick connector may be damaged.**
- **Prepare container and cloth beforehand because fuel will leakage out.**
- **Avoid fire and sparks.**
- **Keep parts away from heat source. Especially, be careful when welding is performed around them.**

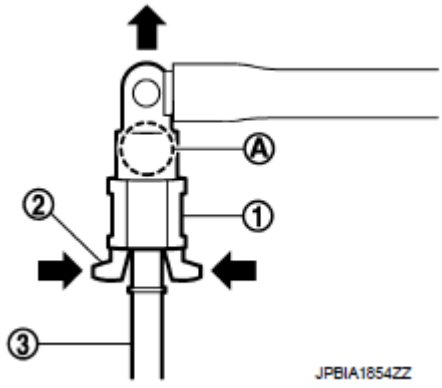


Fig. 66: Pulling Out Quick Connector
Courtesy of NISSAN MOTOR CO., U.S.A.

- **Never expose parts to battery electrolyte or other acids.**
- **Never bend or twist connection between quick connector and fuel feed hose (with damper) during installation/removal.**

- **To keep clean the connecting portion and to avoid damage and foreign materials, cover them completely with plastic bags, etc. (A) or something similar.**

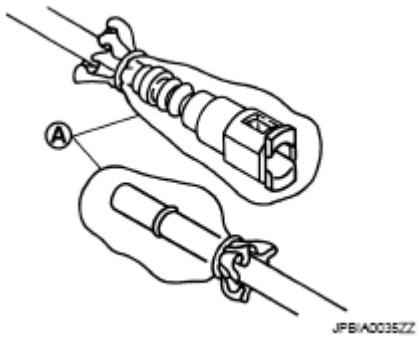


Fig. 67: Covering Connector And Hoses Using Plastic Bags
Courtesy of NISSAN MOTOR CO., U.S.A.

8. Disconnect harness connector from fuel injector.
9. Loosen mounting bolts in reverse order as shown in the figure, and remove fuel tube and fuel injector assembly.

CAUTION: Never tilt it, or remaining fuel in pipes may flow out from pipes.

⇦ : Engine front

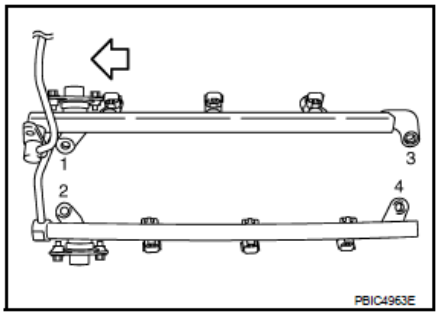


Fig. 68: Identifying Fuel Tube And Fuel Injector Assembly Mounting Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

10. Remove fuel injector (2) from fuel tube (4) as follows:

3 : O-ring
A : Installed condition
B : Clip mounting groove

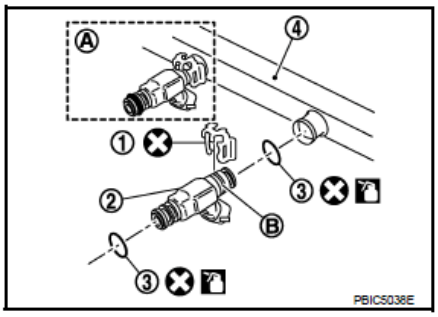


Fig. 69: Identifying Fuel Injector And Fuel Tube Components
Courtesy of NISSAN MOTOR CO., U.S.A.

a. Open and remove clip (1).
b. Remove fuel injector from fuel tube by pulling straight.

CAUTION:
- **Be careful with remaining fuel that may go out from fuel tube.**
- **Be careful not to damage injector nozzles during removal.**
- **Never bump or drop fuel injector.**
- **Never disassemble fuel injector.**

11. Remove fuel sub-tube and fuel damper, if necessary.

INSTALLATION

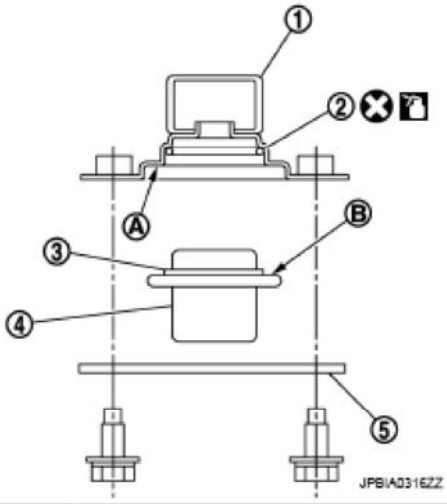
1. Install fuel damper (4) as follows:
   a. Install new O-ring (2) to fuel tube (1) as shown.
      - When handling new O-ring, be careful of the following caution:

CAUTION:
- **Handle O-ring with bare hands. Never wear gloves.**
- **Lubricate O-ring with new engine oil.**
- **Never clean O-ring with solvent.**
- **Check that O-ring and its mating part are free of foreign material.**
- **When installing O-ring, be careful not to scratch it with tool or fingernails. Also be careful not to twist or stretch O-ring. If O-ring was stretched while it was being attached, never insert it quickly into fuel tube.**
- **Insert new O-ring straight into fuel tube. Never twist it.**

   b. Install spacer (3) to fuel damper.
   c. Insert fuel damper straight into fuel tube.

CAUTION:

- **Insert straight, checking that the axis is lined up.**
- **Never pressure-fit with excessive force.**



Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.

Fig. 70: Identifying Fuel Damper
Courtesy of NISSAN MOTOR CO., U.S.A.

Reference value : 130 N (13.3 kg, 29.2 lb)

- Insert fuel damper unit (B) is touching (A) of fuel tube.

d. Tighten bolts evenly in turn.

- After tightening bolts, check that there is no gap between fuel damper cap (5) and fuel tube.

2. Install fuel sub-tube.

- When handling new O-ring, be careful of the following caution:

CAUTION:

- **Handle O-ring with bare hands. Never wear gloves.**
- **Lubricate O-ring with new engine oil.**
- **Never clean O-ring with solvent.**
- **Check that O-ring and its mating part are free of foreign material.**
- **When installing O-ring, be careful not to scratch it with tool or fingernails. Also be careful not to twist or stretch O-ring. If O-ring was stretched while it was being attached, never**

insert it quickly into fuel tube.

- **Insert O-ring straight into fuel tube. Never decenter or twist it.**

- Insert fuel sub-tube straight into fuel tube.
- Tighten mounting bolts evenly in turn.
- After tightening mounting bolts, check that there is no gap between flange and fuel sub-tube.

3. Install O-rings to fuel injector, paying attention to the following.

CAUTION:

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

  Fuel tube side : Black

  Nozzle side : Green

- **Handle O-ring with bare hands. Never wear gloves.**
- **Lubricate O-ring with new engine oil.**
- **Never clean O-ring with solvent.**
- **Check that O-ring and its mating part are free of foreign material.**
- **When installing O-ring, be careful not to scratch it with tool or fingernails. Also be careful not to twist or stretch O-ring. If O-ring was stretched while it was being attached, never insert it quickly into fuel tube.**
- **Insert O-ring straight into fuel injector. Never decenter or twist it.**

4. Install fuel injector (5) to fuel tube (1) as follows:
   a. Insert clip (3) into clip mounting groove (D) on fuel injector.

CAUTION:

- **Never reuse clip. Replace it with a new one.**
- **Be careful to keep clip from interfering with O-ring. If interference occurs, replace O-ring.**

   b. Insert fuel injector into fuel tube with clip attached.
      - Insert it while matching it to the axial center.
      - Insert fuel injector so that protrusion (A) of fuel tube matches cutout (B) of clip.
      - Check that fuel tube flange (E) is securely fixed in flange fixing groove (C) on clip.
   c. Check that installation is complete by checking that fuel injector does not rotate or come off.
      - Check that protrusions of fuel injectors are aligned with cutouts of clips after installation.

2 : O-ring (Black)
4 : O-ring (Green)

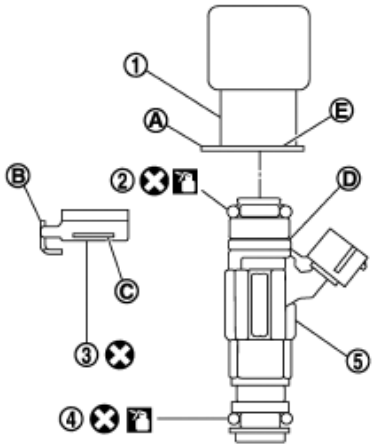


Fig. 71: Inserting Clip Into Clip Mounting Groove On Fuel Injector
Courtesy of NISSAN MOTOR CO., U.S.A.

5. Install fuel tube and fuel injector assembly to intake manifold.

CAUTION: Be careful not to let tip of injector nozzle come in contact with other parts.

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

1st step : 10.1 N.m (1.0 kg-m, 7 ft-lb)

2nd step : 23.6 N.m (2.4 kg-m, 17 ft-lb)

⇦ : Engine front

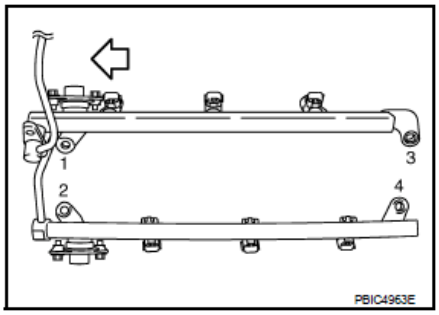


Fig. 72: Identifying Fuel Injector Assembly Mounting Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

6. Connect fuel injector harness connector.
7. Connect fuel feed hose (with damper).

- Handling procedure of O-ring is the same as that of fuel damper and fuel sub-tube.
- Insert fuel damper straight into fuel sub-tube.
- Tighten mounting bolts evenly in turn.
- After tightening mounting bolts, check that there is no gap between flange and fuel sub-tube.

8. Connect quick connector between fuel feed hose (with damper) and centralized under-floor piping connection as follows:
   a. Check no foreign substances are deposited in and around centralized under-floor piping and quick connector, and no damage on them.
   b. Thinly apply new engine oil around centralized under-floor piping from tip end to spool end.
   c. Align center to insert quick connector straightly into centralized under-floor piping.
      - Insert quick connector to centralized under-floor piping until top spool is completely inside quick connector, and 2nd level spool exposes right below quick connector.

CAUTION:
- **Hold align center to avoid inclined insertion to prevent to O-ring inside quick connector.**
- **Insert until you hear a "click" sound and actually feel the engagement.**
- **To avoid mis-identification of engagement with a similar sound, be sure to perform the next step.**

   d. Pull quick connector by hand holding position (A). Check it is completely engaged (connected) so that it does not come out from centralized under-floor piping (1).

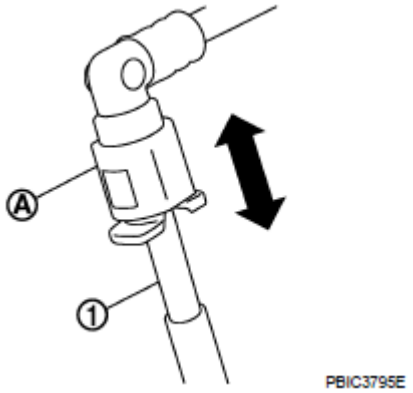


Fig. 73: Checking Quick Connector Engagement
Courtesy of NISSAN MOTOR CO., U.S.A.

   e. Install quick connector cap (3) to quick connector connection.

1 : Centralized under-floor piping
2 : Fuel feed hose
B : Under view

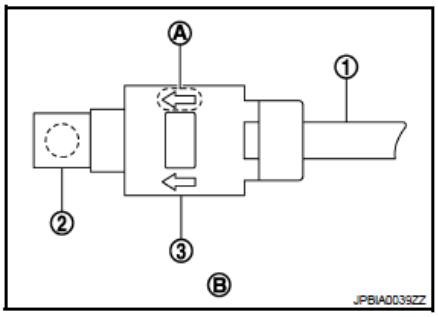


Fig. 74: Identifying Quick Connector Cap To Quick Connector Connection
Courtesy of NISSAN MOTOR CO., U.S.A.

- Install quick connector cap with arrow (A) on surface facing in direction of quick connector (fuel feed hose side).

CAUTION: If quick connector cap cannot be installed smoothly, quick connector may have not been installed correctly. Check the connection again.

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

INSPECTION AFTER INSTALLATION

Check on Fuel Leakage

1. Turn ignition switch "ON" (with engine stopped). With fuel pressure applied to fuel piping, check for fuel leakage at connection points.

NOTE: Use mirrors for checking at points out of clear sight.

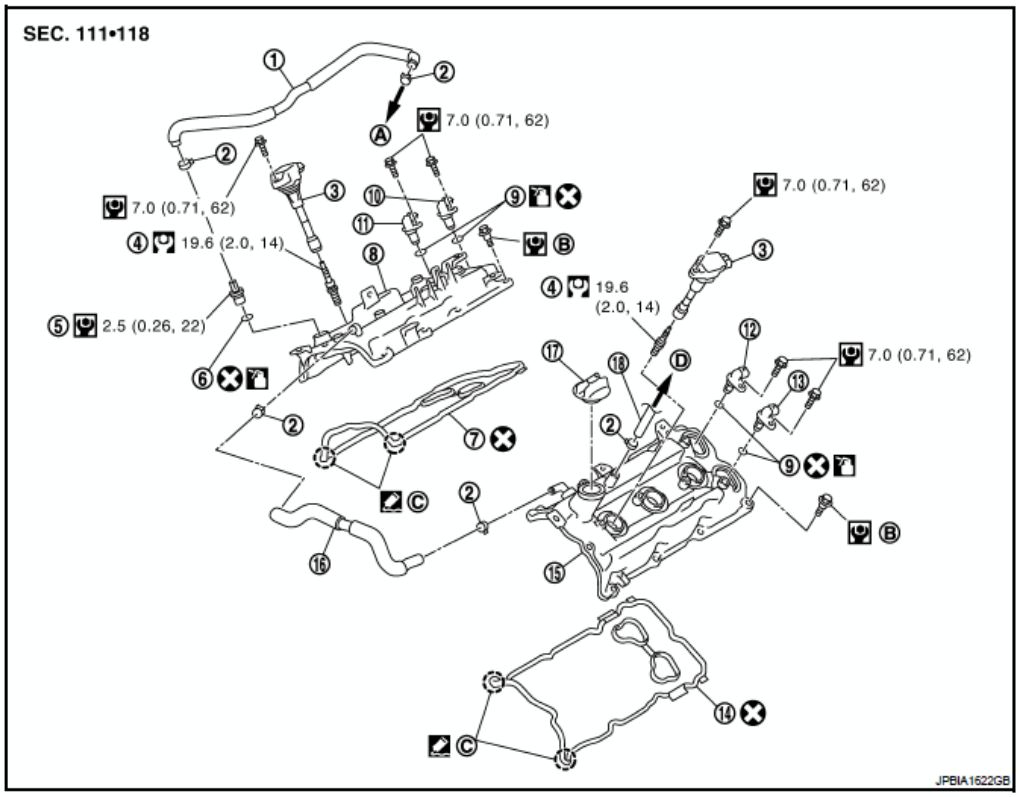
2. Start engine. With engine speed increased, check again for fuel leakage at connection points.

CAUTION: Never touch engine immediately after stopped, as engine becomes extremely hot.

ROCKER COVER

Component

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.



1.	PCV hose	2.	Clamp	3.	Ignition coil
4.	Spark plug	5.	PCV valve	6.	O-ring
7.	Rocker cover gasket (bank 1)	8.	Rocker cover (bank 1)	9.	O-ring
10.	Camshaft position sensor (bank 1)	11.	Exhaust valve timing control position sensor (bank 1)	12.	Camshaft position sensor (bank 2)
13.	Exhaust valve timing control position sensor (bank 2)	14.	Rocker cover gasket (bank 2)	15.	Rocker cover (bank 2)
16.	PCV hose	17.	Oil filler cap	18.	PCV hose
A.	To intake manifold collector	B.	Refer to ROCKER COVER	C.	Camshaft bracket side
D.	To air duct				

Fig. 75: Exploded View Of Rocker Cover With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to "**COMPONENT** " for symbols in the figure.

Removal and Installation

REMOVAL

1. Remove engine room cover (RH and LH). Refer to "**COMPONENT**".
2. Remove engine cover. Refer to **INTAKE MANIFOLD COLLECTOR**.
3. Remove intake manifold collector. Refer to **INTAKE MANIFOLD COLLECTOR**.

4. Separate engine harness removing their brackets from rocker covers.
5. Remove ignition coil. Refer to **IGNITION COIL**.
6. Remove camshaft position sensor and exhaust valve timing control position sensor.

CAUTION:

- **Handle carefully to avoid dropping and shocks.**
- **Never disassemble.**
- **Never allow metal powder to adhere to magnetic part at sensor ti**
- **Never place sensors in a location where they are exceed to magn**

A : Keep off any magnetic materials

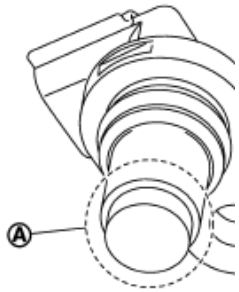


Fig. 76: Identifying Magnetic Materials Portion Area
Courtesy of NISSAN MOTOR CO., U.S.A.

7. Remove PCV hoses from rocker covers.
8. Remove PCV valve and O-ring from rocker cover, if necessary.
9. Remove oil filler cap from rocker cover, if necessary.
10. Loosen mounting bolts with power tool in reverse order as shown in the figure.

⇦ : Engine front

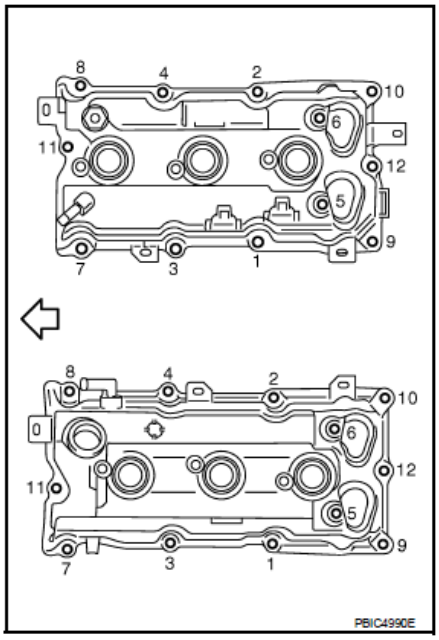


Fig. 77: Identifying Mounting Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

11. Remove rocker cover gaskets from rocker covers.
12. Use scraper to remove all trances of liquid gasket from cylinder head and camshaft bracket (No. 1).

CAUTION: Never scratch or damage the mating surface when cleaning off old liquid gasket.

INSTALLATION

1. Apply liquid gasket with tube presser (commercial service tool) to joint part among rocker cover, cylinder head and camshaft bracket (No. 1) as follows:

A : Liquid gasket application point
F : View F
I : End surface of camshaft bracket (No. 1)
b : 4 mm (0.16 in)
c : ϕ2.5 - 3.5 mm (0.098 - 0.138 in)
d : 5 mm (0.20 in)
g : 10 mm (0.39 in)
⇦ : Engine front

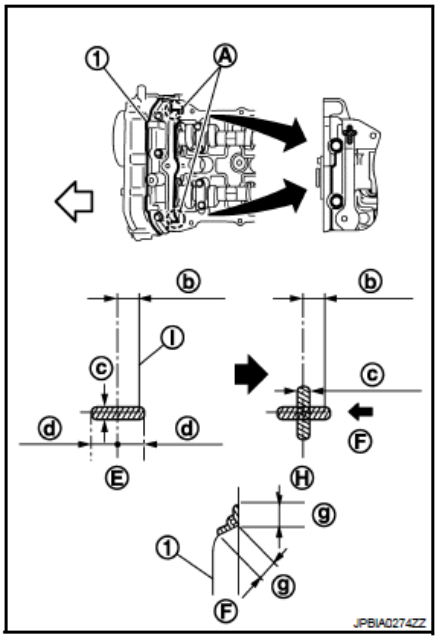


Fig. 78: Identifying Liquid Gasket Application Area
Courtesy of NISSAN MOTOR CO., U.S.A.

Use Genuine RTV Silicone Sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCT AND SEALANT ".

NOTE: The figure shows an example of bank 2 side [zoomed in shows camshaft bracket (No. 1)].

a. Refer to the figure (E) to apply liquid gasket to joint part of camshaft bracket (No. 1) (1) and cylinder head.
b. Refer to the figure (H) to apply liquid gasket in 90 degrees to figure.

2. Install new rocker cover gasket to rocker cover.

3. Install rocker cover.
   - Check if rocker cover gasket is not dropped from installation groove of rocker cover.
4. Tighten bolts in two steps separately in numerical order as shown in the figure.

⇦ : Engine front

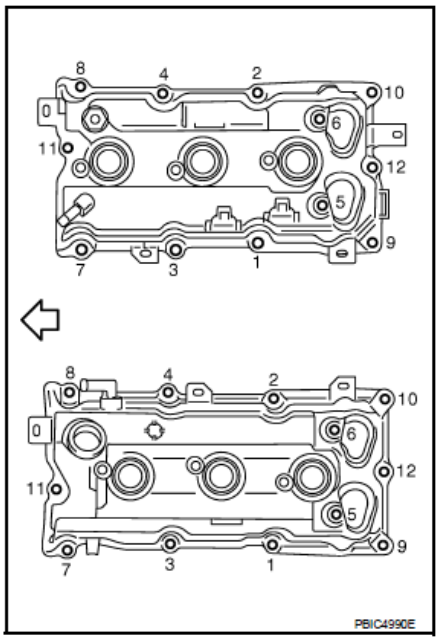


Fig. 79: Identifying Mounting Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

1st step : 2.0 N.m (0.2 kg-m, 18 in-lb)

2nd step : 8.3 N.m (0.85 kg-m, 73 in-lb)

5. Install oil filler cap to rocker cover (bank 2), if removed.
6. Install new O-ring and PCV valve to rocker cover (bank 1), if removed.
7. Install PCV hose.
   - Insert PCV hose by 25 to 30 mm (0.98 to 1.18 in) from connector end.
   - When installing, be careful not to twist or come in contact with other parts.
   - Install PCV hose between bank 1 and bank 2 rocker covers with its identification paint facing upward [rocker cover (bank 1) side]. Refer to component figure in "**COMPONENT**".
8. Install in the reverse order of removal after this step.

FRONT TIMING CHAIN CASE

Removal and Installation

NOTE:

- **This article describes removal/installation procedure of front timing chain case and timing chain related parts without removing oil pan (upper) on**

vehicle.

- **When oil pan (upper) needs to be removed or installed, or when rear timing chain case is removed or installed, remove oil pans (upper and lower) first. Then remove front timing chain case, timing chain related parts, and rear timing chain case in this order, and install in the reverse order of removal. Refer to TIMING CHAIN.**
- **Refer to TIMING CHAIN for component parts location.**

REMOVAL

1. Remove engine cover with power tool. Refer to "**REMOVAL AND INSTALLATION**".
2. Remove front and rear undercover with power tool.
3. Release the fuel pressure. Refer to "**INSPECTION** ".
4. Disconnect the battery cable from the negative terminal.
5. Drain engine oil. Refer to "**CHANGING ENGINE OIL** ".

CAUTION:
- **Perform this step when engine is cold.**
- **Never spill engine oil on drive belt.**

6. Drain engine coolant from radiator. Refer to "**CHANGING ENGINE COOLANT** ".

CAUTION:
- **Perform this step when engine is cold.**
- **Never spill engine coolant on drive belt.**

7. Remove radiator cooling fan assembly. Refer to "**COMPONENT** ".
8. Separate engine harnesses removing their brackets from front timing chain case.
9. Remove drive belt. Refer to **DRIVE BELT**.
10. Remove intake manifold collector. Refer to **INTAKE MANIFOLD COLLECTOR**.
11. Remove harness bracket and fuel sub tube mounting bolt on front timing chain case.
12. Remove oil level gauge and guide.
13. Remove power steering oil pump from bracket with piping connected, and temporarily secure it to aside. Refer to "**REMOVAL AND INSTALLATION** ".
14. Remove power steering oil pump bracket. Refer to "**COMPONENT**".
15. Remove alternator. Refer to "**REMOVAL AND INSTALLATION** ".
16. Remove water outlet and water piping. Refer to "**COMPONENT** ".
17. Remove left and right valve timing control covers with the following procedure.
    a. Disconnect valve timing control harness connector.
    b. Loosen mounting bolts in reverse order as shown in the figure.

A : Bank 1
B : Bank 2
C : Dowel pin hole

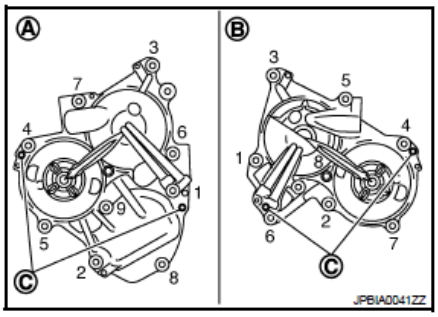


Fig. 80: Identifying Mounting Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

c. Shaft is engaged with intake side camshaft sprocket center hole on inside. Pull straight out so as not to tilt until the joint is disengaged.
   - The mating surface of magnet retarder (2) may be fitted with the exhaust side camshaft sprocket via the engine oil. Open valve timing control cover (1) carefully.
   - If the mating surface of magnet retarder is fitted with the camshaft sprocket, open the cover within the range that the load is not applied to the harness. And then, remove it so as to prevent magnet retarder from dropping.

CAUTION:
- **Be careful not to damage magnet retarder.**
- **When carrying valve timing control cover, face the magnet retarder side up to prevent the cover from falling from magnet retarder.**
- **Never remove magnet retarder from valve timing control cover. (Disassembly prohibited parts)**

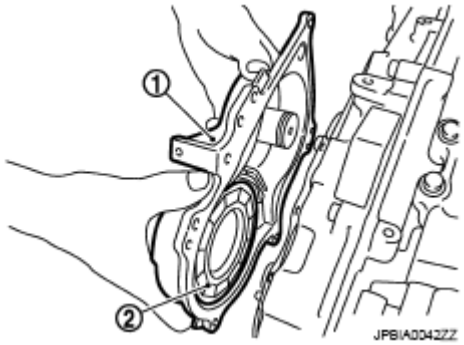


Fig. 81: Identifying Magnet Retarder And Open Valve Timing Control Cover
Courtesy of NISSAN MOTOR CO., U.S.A.

18. Remove rocker covers (bank 1 and bank 2). Refer to **ROCKER COVER**.

NOTE: **When only timing chain (primary) is removed, rocker cover does not need**

to be removed.

19. Obtain No. 1 cylinder at TDC of its compression stroke as follows:

NOTE: When timing chain is not removed/installed, this step is not required.

a. Rotate crankshaft pulley clockwise to align timing mark (grooved line without color) with timing indicator.

⬅ : Timing mark (grooved without color)

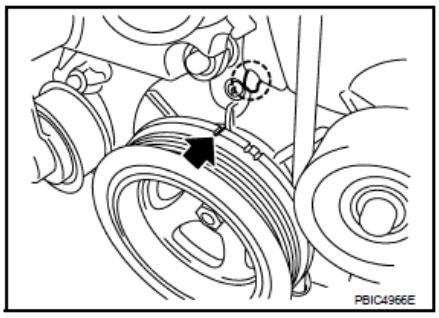


Fig. 82: Aligning Timing Mark (Grooved Line Without Color) With Timing Indicator
Courtesy of NISSAN MOTOR CO., U.S.A.

b. Check that intake and exhaust cam noses on No. 1 cylinder (engine front side of bank 1) are located as shown in the figure.

⇦ : Engine front

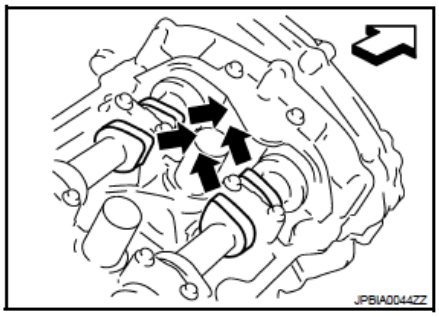


Fig. 83: Locating Intake And Exhaust Cam
Courtesy of NISSAN MOTOR CO., U.S.A.

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

NOTE: When only timing chain (primary) is removed, rocker cover does not need to be removed. To check that No. 1 cylinder is at its compression TDC, remove front timing chain case first. Then check mating marks on camshaft sprockets. Refer to "COMPONENT".

20. Remove crankshaft pulley as follows:

a. Remove rear cover plate and set ring gear stopper [SST: KV10118600 (J-48641)] (A) as shown in the figure.

1 : Oil pan (upper)
2 : Drive plate
⇦ : Vehicle front

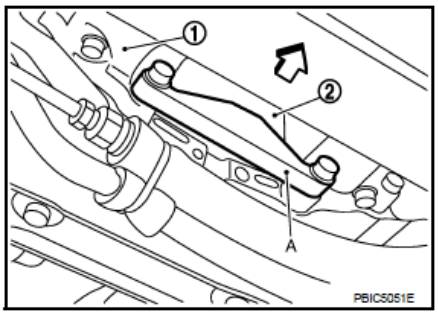


Fig. 84: Identifying Oil Pan (Upper) And Drive Plate
Courtesy of NISSAN MOTOR CO., U.S.A.

b. Loosen crankshaft pulley bolt and locate bolt seating surface as 10 mm (0.39 in) from its original position.

CAUTION: Never remove crankshaft pulley bolt as it will be used as a supporting point for suitable puller.

1 : Crankshaft pulley

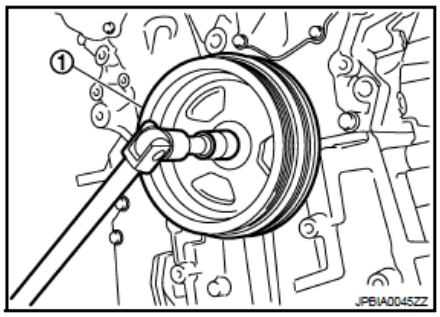


Fig. 85: Loosening Crankshaft Pulley Bolt
Courtesy of NISSAN MOTOR CO., U.S.A.

c. Place suitable puller tab on holes of crankshaft pulley, and pull crankshaft pulley through.

CAUTION: Never put suitable puller tab on crankshaft pulley periphery, as this will damage internal damper.

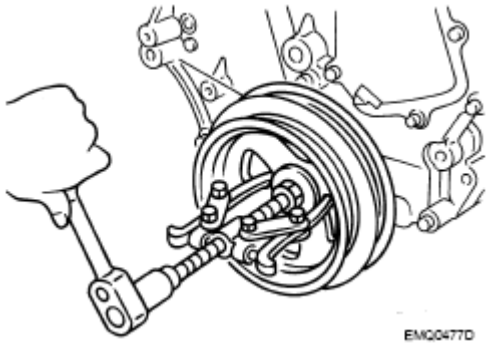


Fig. 86: Placing Puller Tab On Holes Of Crankshaft Pulley
Courtesy of NISSAN MOTOR CO., U.S.A.

21. Remove oil pan (lower). Refer to **OIL PAN AND OIL STRAINER**.
22. Loosen two mounting bolts in front of oil pan (upper) in reverse order as shown in the figure.

⇦ : Engine front

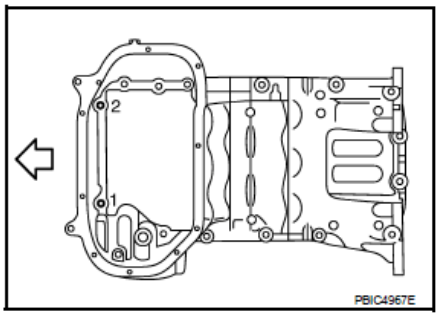


Fig. 87: Identifying Oil Pan Mounting Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

23. Remove front timing chain case as follows:
    a. Loosen mounting bolts in reverse order as shown in the figure.

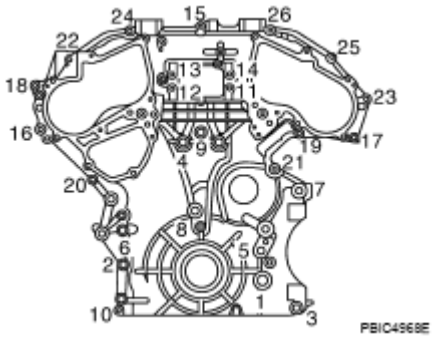


Fig. 88: Identifying Front Timing Chain Case Mounting Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

    b. Insert suitable tool (A) into the notch at the top of the front timing chain case as shown.

c. Pry off case by moving tool as shown.
   - Use seal cutter [SST: KV10111100 (J37228)] to cut liquid gasket for removal.

CAUTION:
- **Never use screwdriver or something similar.**
- **After removal, handle front timing chain case carefully so it never tilt, cant, or warp under a load.**

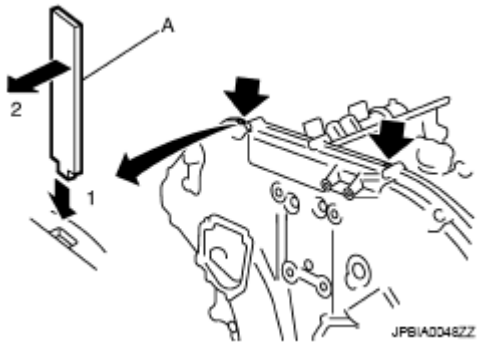


Fig. 89: Identifying Front Timing Chain Case
Courtesy of NISSAN MOTOR CO., U.S.A.

24. Remove O-ring (1) from rear timing chain case.

A : Bank 1
B : Bank 2

Symbol	Description
	N·m (kg·m, ft·lb)
	N·m (kg·m, in·lb)
	Always replace after disassembly.

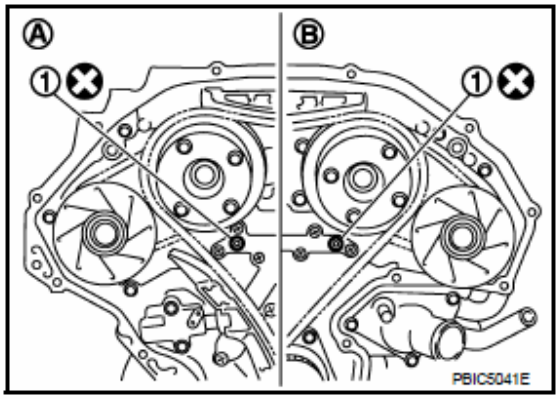


Fig. 90: Identifying From Rear Timing Chain Case O-Ring
Courtesy of NISSAN MOTOR CO., U.S.A.

25. Remove front oil seal from front timing chain case using suitable tool.
   - Use screwdriver for removal.

CAUTION: Be careful not to damage front timing chain case.

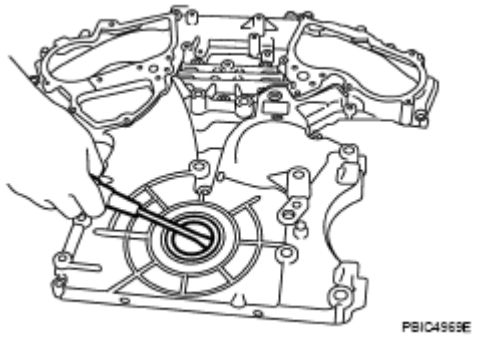


Fig. 91: View Of Removing Front Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

26. Remove timing chain and related parts. Refer to **TIMING CHAIN**.
27. Use scraper to remove all traces of old liquid gasket from front and rear timing chain cases and oil pan (upper), and liquid gasket mating surfaces.

CAUTION: Be careful not to allow gasket fragments to enter oil pan.

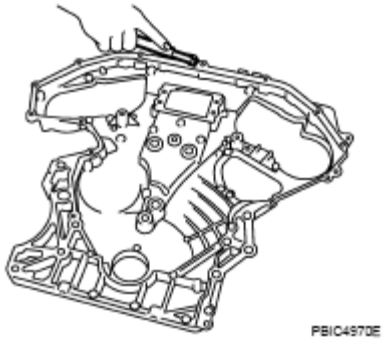


Fig. 92: scraping Liquid Gasket From Front And Rear Timing Chain Cases
Courtesy of NISSAN MOTOR CO., U.S.A.

- Remove old liquid gasket from bolt hole and thread.

A : Remove sticking old liquid gasket
B : Bolt hole

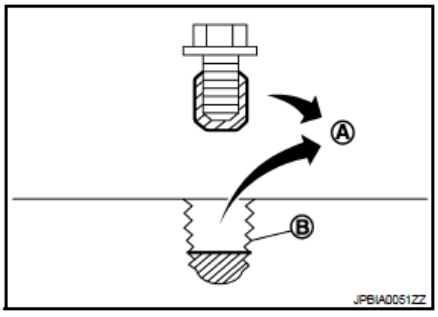


Fig. 93: Removing Old Liquid Gasket From Bolt Hole And Thread

Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

1. Install timing chain and related parts. Refer to **TIMING CHAIN**.
2. Install new O-ring (1) on rear timing chain case.

A : Bank 1
B : Bank 2

Symbol	Description
	N·m (kg·m, ft·lb)
	N·m (kg·m, in·lb)
	Always replace after disassembly.

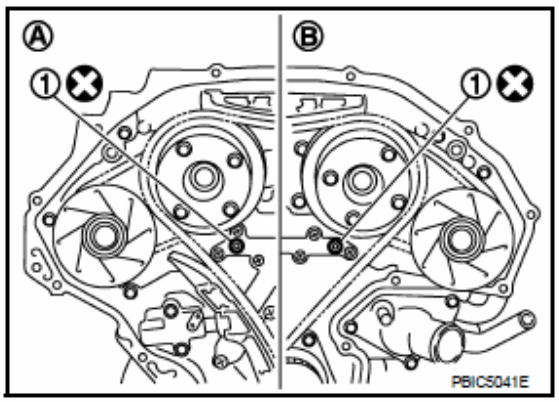


Fig. 94: Identifying Rear Timing Chain Case O-Ring
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Hammer dowel pins (right and left) (A) into front timing chain case (1) up to a point close to taper in order to shorten protrusion length.

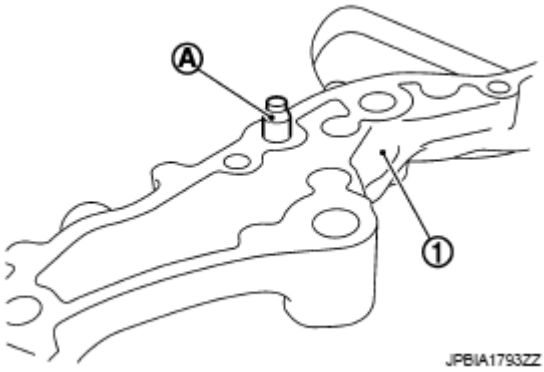


Fig. 95: Identifying Dowel Pins (Right And Left)
Courtesy of NISSAN MOTOR CO., U.S.A.

4. Install new front oil seal on the front timing chain case.
   - Apply new engine oil to both oil seal lip (A) and dust seal lip (B).

⇦ : Engine inside
⬅ : Engine outside

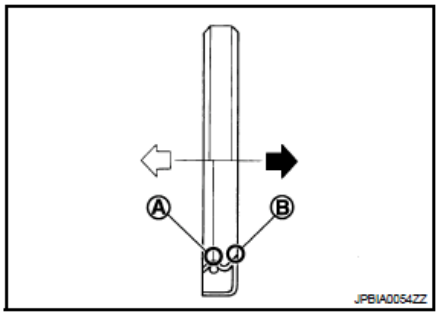


Fig. 96: Identifying Oil Seal Lip And Dust Seal Lip
Courtesy of NISSAN MOTOR CO., U.S.A.

- Install it so that each seal lip is oriented as shown in the figure.
- Using suitable drift [outer diameter: 60 mm (2.36 in)] (A), press-fit oil seal until it becomes flush with front timing chain case end face.
- Check the garter spring is in position and seal lip is not inverted.

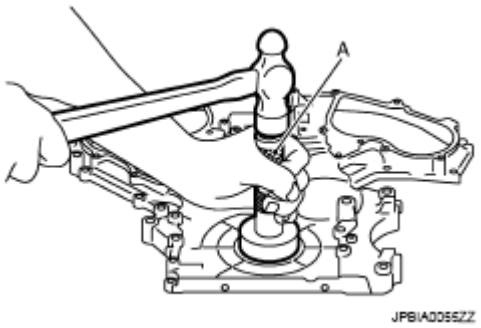


Fig. 97: Installing Timing Chain Case Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

5. Install front timing chain case as follows:
   a. Apply a continuous bead of liquid gasket with tube presser (commercial service tool) to front timing chain case back side as shown in the figure.

B : Protrusion
c : ϕ3.4 - 4.4 mm (0.134 - 0.173 in)
d : ϕ2.6 - 3.6 mm (0.102 - 0.142 in)
e : 4.0 - 5.6 mm (0.157 - 0.220 in)

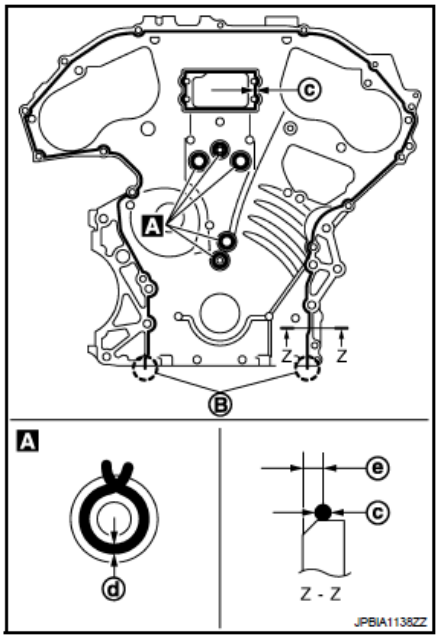


Fig. 98: Identifying Liquid Gasket Application Area
Courtesy of NISSAN MOTOR CO., U.S.A.

Use Genuine RTV Silicone Sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCT AND SEALANT ".

NOTE: Apply liquid gasket, start and end up application at the portions (A) shown in the figure.

A : ϕ4.0 - 5.0 mm (0.157 - 0.197 in)

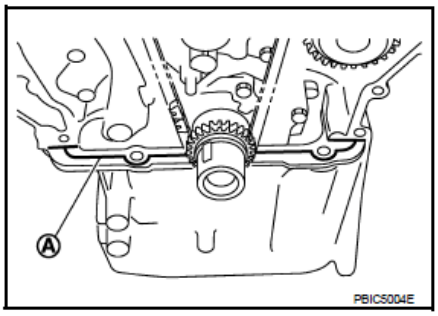


Fig. 99: Identifying Liquid Gasket Application Area
Courtesy of NISSAN MOTOR CO., U.S.A.

- Apply liquid gasket with tube presser (commercial service tool) to top surface of oil pan (upper) as shown in the figure.

  Use Genuine RTV Silicone Sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCT AND SEALANT ".

b. Assemble front timing chain case as follows:

Fit lower end of front timing chain case (1) tightly onto top face of oil pan (upper). From the fitting point, make entire front timing chain case contact rear timing chain case completely.

2 : Oil pan (upper)
3 : Cylinder block
⇦ : Engine front

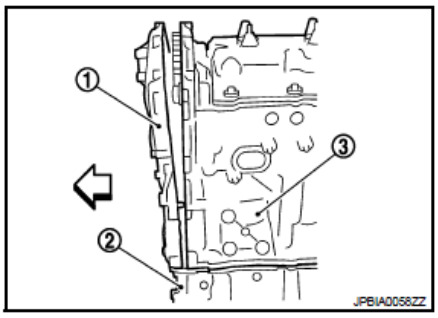


Fig. 100: Identifying Front Timing Chain Case And Oil Pan (Upper) Cylinder Block
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION:
- **Be careful not to damage front oil seal by interference with front end of crankshaft.**
- **Attaching should be done within 5 minutes after liquid gasket application.**

c. Install front timing chain case as to fit its dowel pin hole together dowel pin on rear timing chain case.
d. Tighten mounting bolts to the specified torque in numerical order as shown in the figure.
   - There are two types of mounting bolts. Refer to the following for locating bolts.

   M10 bolts : 1, 2, 3, 4, 5, 6, 7

   55.0 N.m (5.6 kg-m, 41 ft-lb)

   M6 bolts : Except the above

   12.7 N.m (1.3 kg-m, 9 ft-lb)

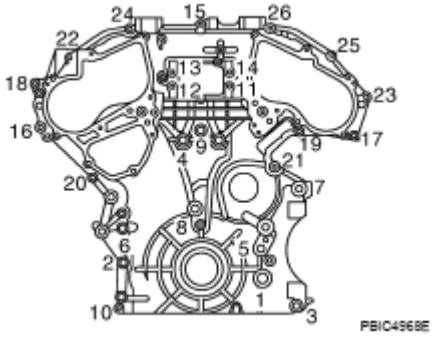


Fig. 101: Identifying Front Timing Chain Case Mounting Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

e. After all bolts tightened, retighten them to the specified torque in numerical order as shown in the figure.

6. Install two mounting bolts in front of oil pan (upper) in numerical order as shown in the figure.

⇦ : Engine front

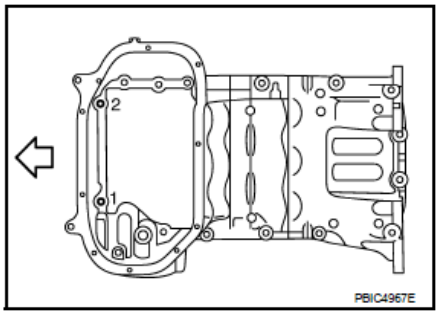


Fig. 102: Identifying Oil Pan (Upper) Mounting Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

17.2 N.m (1.8 kg-m, 13 ft-lb)

7. Install oil pan (lower). Refer to **OIL PAN AND OIL STRAINER**.
8. Install right and left valve timing control covers as follows.
   a. Install new seal rings (1) in shaft grooves.

A : Bank 2

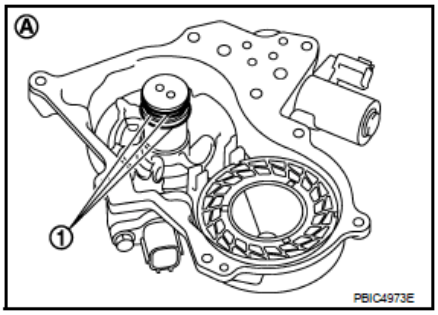


Fig. 103: Identifying Seal Rings
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: When replacing seal ring, replace all rings with new one.

   b. To check the joint between dowel pins and dowel pin holes, check the looseness in the axle direction by pushing the mating surface of magnet retarder (A) at several places and the circumferential looseness (between dowel pins and dowel pin holes) by twisting in the circumferential direction.

B : Moves slightly
C : Not shaken

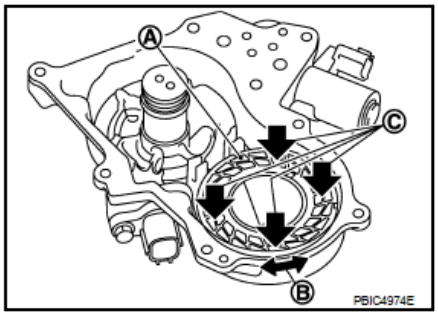


Fig. 104: Checking Joint Between Dowel Pins And Dowel Pin Holes
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: Always perform this procedure when removing because the gap between dowel pins and dowel pin holes may not be caused on purpose.

c. Install valve timing control cover (1) with new gasket to front timing chain case.

2 : Magnet retarder

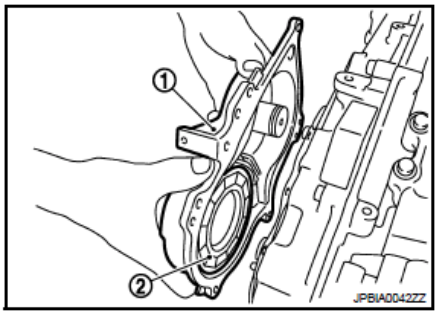


Fig. 105: Identifying Valve Timing Control Cover With Gasket To Front Timing Chain Case
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION:

- **Never face the magnet retarder side down to prevent magnet retarder from dropping.**
- **Check the mating surface of magnet retarder and the drum of exhaust side camshaft sprocket for foreign materials.**
- **Align the center of both shaft holes of the shaft and the intake side camshaft sprocket, and then insert them.**
- **Be careful not to drop the seal ring from the shaft groove.**
- **When setting the valve timing control cover in position by hand, if valve timing control cover is not contacting with the front timing chain case, the dowel pin of magnet retarder may not be aligned with the dowel pin holes of cover. In this case, return to step "b".**

d. Tighten mounting bolts in numerical order as shown in the figure.

A : Bank 1
B : Bank 2
C : Dowel pin hole

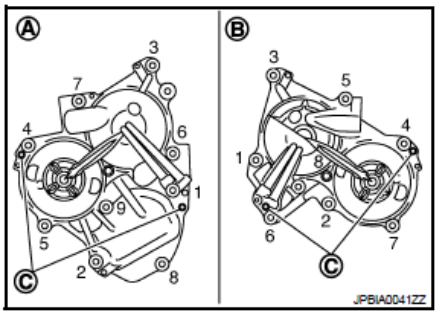


Fig. 106: Identifying Mounting Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: Completely tighten the mounting bolts with the seat surface of valve timing control cover contacting with front timing chain case.

11.3 N.m (1.2 kg-m, 8 ft-lb)

- After all bolt are tightened, tighten No. 1 bolt to the specified torque again.

9. Install crankshaft pulley as follows:
   a. Fix crankshaft using ring gear stopper [SST: KV10118600 (J-48641)].
   b. Install crankshaft pulley, taking care not to damage front oil seal.
      - When press-fitting crankshaft pulley with plastic hammer, tap on its center portion (not circumference).
   c. Tighten crankshaft pulley bolt.

      44.1 N.m (4.5 kg-m, 33 ft-lb)

   d. Tighten the bolt 90 degrees (one mark) (b).
      - Place a matching mark (A) on crankshaft pulley (2) aligning with the matching (C) of crankshaft pulley bolt (1).

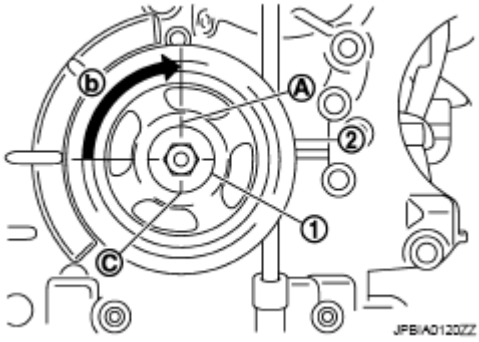


Fig. 107: Identifying Crankshaft Pulley Bolt Tightening Angle
Courtesy of NISSAN MOTOR CO., U.S.A.

e. Rotate crankshaft pulley in normal direction (clockwise when viewed from front) to confirm it turns smoothly.

10. Install power steering oil pump bracket and idler pulley bracket as follows:
    a. Tighten mounting bolts in numerical order as shown in the figure. (temporarily)

1 : Idler pulley bracket
2 : Power steering oil pump bracket
3 : Crankshaft pulley
A : Engine front side
B : Engine right side
⇦ : Engine front

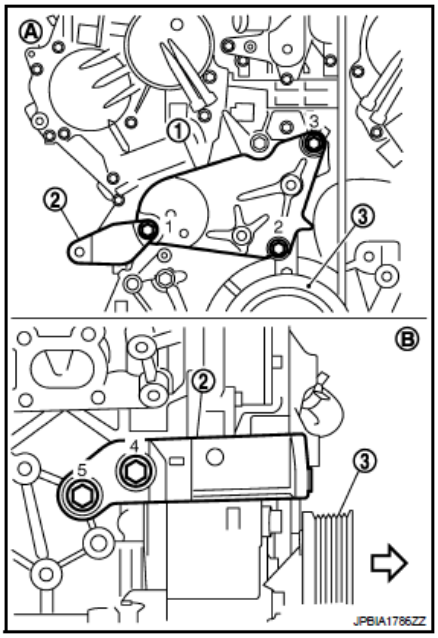


Fig. 108: Identifying Power Steering Oil Pump Bracket And Idler Pulley Bracket
Courtesy of NISSAN MOTOR CO., U.S.A.

    b. Tighten mounting bolts to specified torque in numerical order as shown in the figure.

11. For the following operations, perform steps in the reverse order of removal.

INSPECTION AFTER INSTALLATION

Inspection for Leakage

The following are procedures for checking fluid leakage, lubricates leakage, and exhaust gases leakage.

- Before starting engine, check oil/fluid levels including engine coolant and engine oil. If less than required quantity, fill to the specified level. Refer to "**RECOMMENDED FLUIDS AND LUBRICANTS** ".
- Run engine to check for unusual noise and vibration.

NOTE: **If hydraulic pressure inside timing chain tensioner drops after removal/installation, slack in the guide may generate a pounding noise during and just after engine start. However, this is normal. Noise will stop after hydraulic pressure rises.**

- Warm up engine thoroughly to check there is no leakage of exhaust gases, 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 to the specified level, if necessary.

Summary of the inspection items:

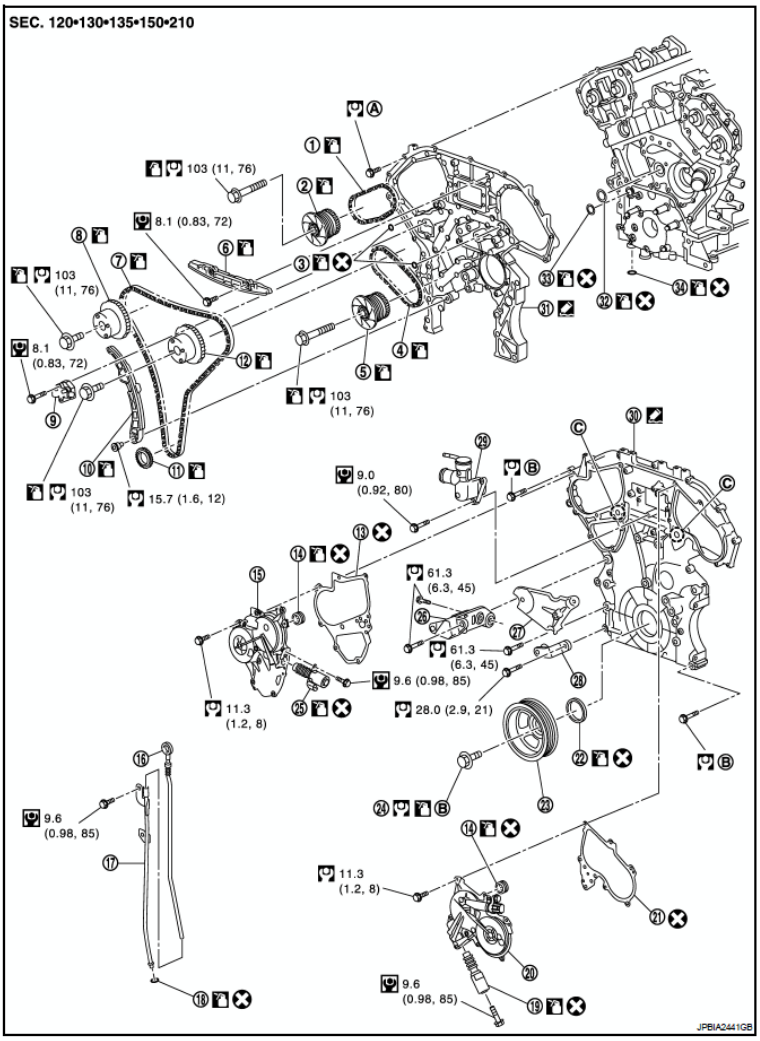
INSPECTION CHART

Items	Before starting engine	Engine running	After engine stopped
Engine coolant	Level	Leakage	Level
Engine oil	Level	Leakage	Level
Other oils and fluid(1)	Level	Leakage	Level
(1) Transmission/transaxle/CVT fluid, power steering fluid, brake fluid, etc.			

TIMING CHAIN

Component

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.



1. Timing chain (secondary)	2. Camshaft sprocket (EXH)	3. O-ring
4. Timing chain (secondary)	5. Camshaft sprocket (EXH)	6. Internal chain guide
7. Timing chain (primary)	8. Camshaft sprocket (INT)	9. Timing chain tensioner (primary)
10. Slack guide	11. Crankshaft sprocket	12. Camshaft sprocket (INT)
13. Valve timing control cover gasket (bank 1)	14. Seal ring	15. Valve timing control cover (bank 1)
16. Oil level gauge	17. Oil level gauge guide	18. O-ring
19. Intake valve timing control solenoid valve (bank 2)	20. Valve timing control cover (bank 2)	21. Valve timing control cover gasket (bank 2)
22. Front oil seal	23. Crankshaft pulley	24. Crankshaft pulley bolt
25. Intake valve timing control solenoid valve (bank 1)	26. Power steering oil pump bracket	27. Idler pulley bracket
28. Alternator bracket	29. Water outlet (front)	30. Front timing chain case
31. Rear timing chain case	32. O-ring	33. O-ring
34. O-ring		
A. Refer to Removal and Installation in TIMING CHASE	B. Refer to FRONT TIMING CHAIN CASE	C. Oil filter

Fig. 109: Exploded View Of Timing Chain With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to "**COMPONENT** " for symbols in the figure.

Removal and Installation

NOTE:

- **This article describes procedures for removing/installing front timing chain case and timing chain related parts, and rear timing chain case, when oil pan (upper) needs to be removed/installed for engine overhaul, etc.**
- **To remove/install front timing chain case, timing chain, and its related parts without removing oil pan (upper), refer to FRONT TIMING CHAIN CASE.**

REMOVAL

1. Remove engine assembly from the vehicle, and separate front suspension member and transmission from engine. Refer to "**2WD : COMPONENT**" (2WD models) or "**AWD : COMPONENT**" (AWD models).
2. Lift the engine with hoist and mount it onto widely use engine stand. Refer to "**DISASSEMBLY AND ASSEMBLY**".
3. Remove intake manifold collector. Refer to **INTAKE MANIFOLD COLLECTOR**.
4. Remove power steering oil pump bracket. Refer to "**COMPONENT**".
5. Remove alternator. Refer to "**REMOVAL AND INSTALLATION** ".
6. Remove water bypass hose, water hose clamp and idler pulley bracket from front timing chain case.
7. Remove left and right valve timing control covers (including magnet retarder and cover) with the following procedure.
   a. Loosen mounting bolts in reverse order as shown in the figure.

A : Bank 1
B : Bank 2
C : Dowel pin hole

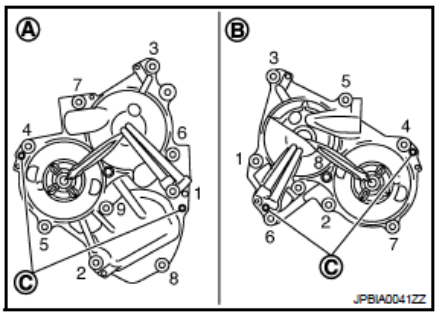


Fig. 110: Identifying Valve Timing Control Covers Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

   b. Shaft is engaged with intake side camshaft sprocket center hole on inside. Pull straight out so as not to tilt until the joint is disengaged.
      - The mating surface of magnet retarder (2) may be fitted with the exhaust side camshaft sprocket via the engine oil. Open valve timing control cover (1) carefully.
      - If the mating surface of magnet retarder is fitted with the camshaft sprocket, open the cover within the range that the load is not applied to the harness. And then, remove it so as to prevent magnet retarder from dropping.

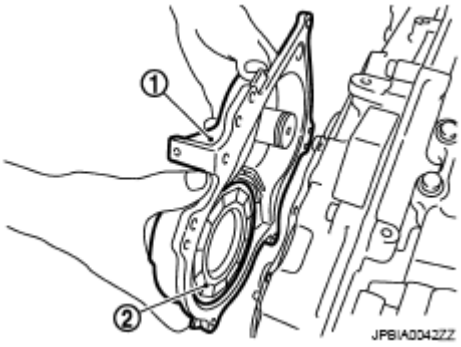


Fig. 111: Identifying Magnet Retarder And Open Valve Timing Control Cover
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION:
- **Be careful not to damage magnet retarder.**
- **When carrying valve timing control cover, face the magnet retarder side up to prevent the cover from falling from magnet retarder.**
- **Never remove magnet retarder from valve timing control cover. (Disassembly prohibited parts)**

8. Remove rocker covers (bank 1 and bank 2). Refer to **ROCKER COVER**.
9. Obtain No. 1 cylinder at TDC of its compression stroke as follows:
   a. Rotate crankshaft pulley clockwise to align timing mark (grooved line without color) with timing indicator.

⬅ : Timing mark (grooved line without color)

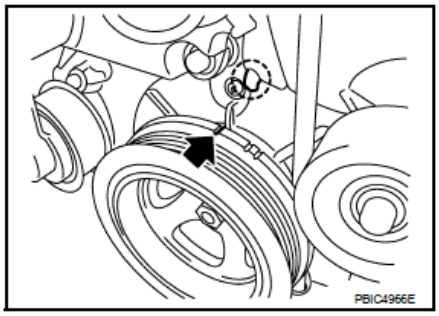


Fig. 112: Aligning Timing Mark (Grooved Line Without Color) With Timing Indicator
Courtesy of NISSAN MOTOR CO., U.S.A.

   b. Check that intake and exhaust cam noses on No. 1 cylinder (engine front side of bank 1) are located as shown in the figure.

⇦ : Engine front

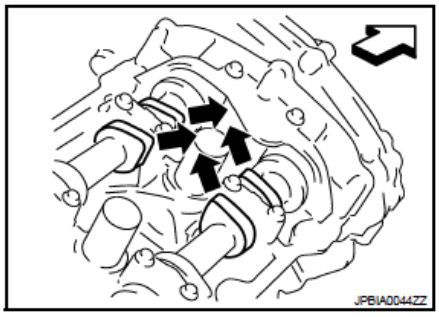


Fig. 113: Locating Intake And Exhaust Cam
Courtesy of NISSAN MOTOR CO., U.S.A.

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

10. Remove crankshaft pulley as follows:
    a. Remove rear cover plate and set ring gear stopper [SST: KV10118600 (J-48641)] (A) as shown in the figure.

1 : Oil pan
2 : Drive plate
⇦ : Vehicle front

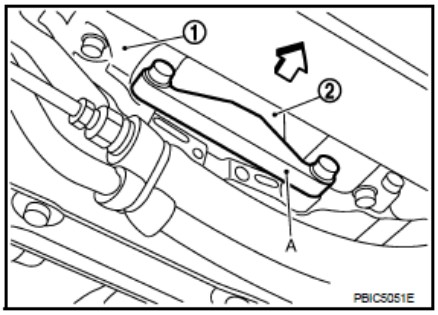


Fig. 114: Identifying Oil Pan And Drive Plate
Courtesy of NISSAN MOTOR CO., U.S.A.

    b. Loosen crankshaft pulley bolt and rotate bolt seating surface at 10 mm (0.39 in) from its original position.

CAUTION: Never remove crankshaft pulley bolt as it will be used as a supporting point for suitable puller.

1 : Crankshaft pulley

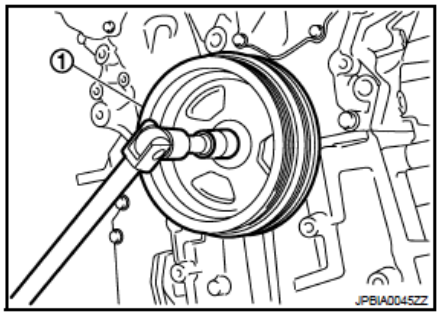


Fig. 115: View Of Crankshaft Pulley Bolt Removal

Courtesy of NISSAN MOTOR CO., U.S.A.

c. Place suitable puller tab on holes of crankshaft pulley, and pull crankshaft pulley through.

CAUTION: Never put suitable puller tab on crankshaft pulley periphery, as this will damage internal damper.

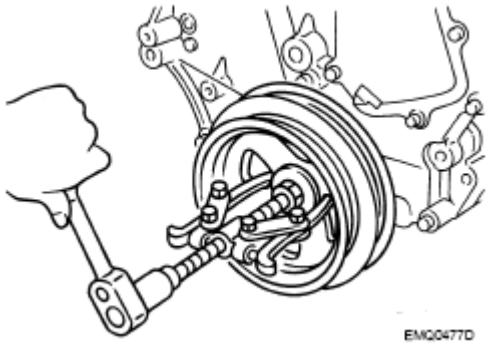


Fig. 116: Placing Puller Tab On Holes Of Crankshaft Pulley
Courtesy of NISSAN MOTOR CO., U.S.A.

11. Remove oil pans (upper and lower). Refer to **OIL PAN AND OIL STRAINER**.
12. Remove front timing chain case as follows:
    a. Loosen mounting bolts in reverse order as shown in the figure.

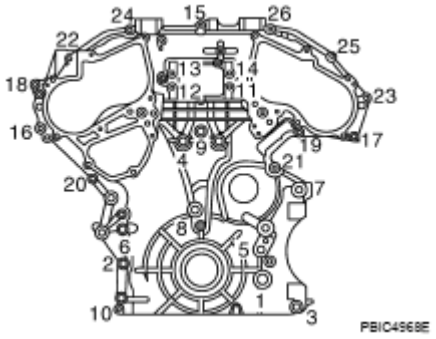


Fig. 117: Identifying Front Timing Chain Case Mounting Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

    b. Insert suitable tool (A) into the notch at the top of the front timing chain case as shown.
    c. Pry off case by moving the tool as shown.
        - Use seal cutter [SST: KV10111100 (J37228)] to cut liquid gasket for removal.

CAUTION:
- **Never use screwdriver or something similar.**
- **After removal, handle front timing chain case carefully so it never tilt, cant, or warp under a load.**

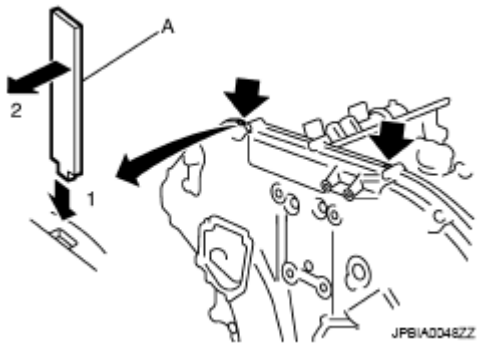


Fig. 118: Inserting Suitable Tool Into Notch At Top Of Front Timing Chain Case
Courtesy of NISSAN MOTOR CO., U.S.A.

13. Remove O-ring (1) from rear timing chain case.

A : Bank 1
B : Bank 2

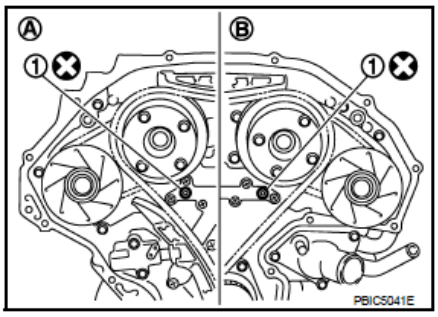


Fig. 119: Identifying Rear Timing Chain Case O-Ring
Courtesy of NISSAN MOTOR CO., U.S.A.

14. Remove front oil seal from front timing chain case using suitable tool.
    - Use screwdriver for removal.

CAUTION: Be careful not to damage front timing chain case.

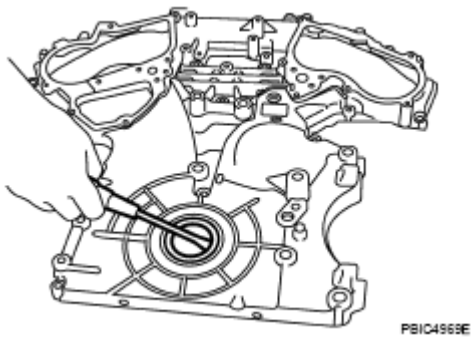


Fig. 120: View Of Removing Front Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

15. Remove timing chain tensioner (primary) as follows:
    a. Remove lower mounting bolt (A).
    b. Loosen upper mounting bolt (B) slowly, and then turn timing chain tensioner (primary) (1) on the mounting bolt so that plunger (C) is fully expanded.

    NOTE: Even if plunger is fully expanded, it is not dropped from the body of timing chain tensioner (primary).

    c. Remove upper mounting bolt, and then remove timing chain tensioner (primary).

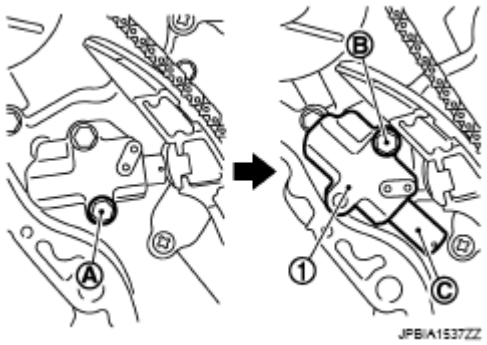


Fig. 121: Identifying Lower/Upper Mounting Bolt
Courtesy of NISSAN MOTOR CO., U.S.A.

16. Remove internal chain guide (1) and slack guide (2).

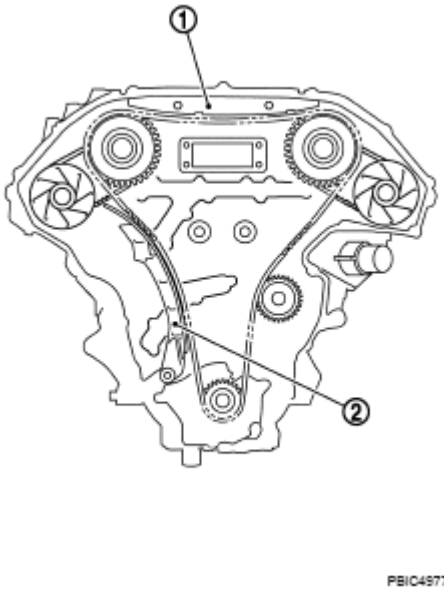


Fig. 122: Identifying Internal Chain Guide And Slack Guide

Courtesy of NISSAN MOTOR CO., U.S.A.

17. Remove timing chain (primary) and crankshaft sprocket.

CAUTION: After removing timing chain (primary), never turn crankshaft and camshaft separately, or valves will strike the piston heads.

18. Remove timing chain (secondary) and camshaft sprockets as follows:
    a. Attach suitable stopper pin (2) to the right and left timing chain tensioners (secondary) (1).

A : Bank 1
B : Bank 2

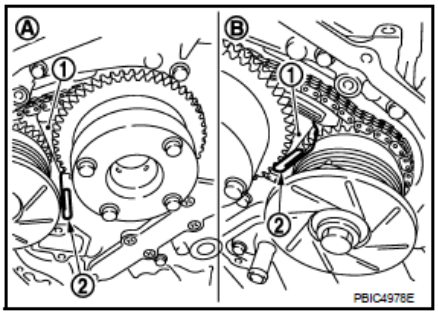


Fig. 123: Identifying Timing Chain Tensioners
Courtesy of NISSAN MOTOR CO., U.S.A.

NOTE:

- **Use approximately 0.5 mm (0.020 in) dia. hard metal pin as a stopper pin.**
- **For removal of timing chain tensioner (secondary), refer to CAMSHAFT. [Removing camshaft bracket (No. 1) is required.]**

    b. Remove intake and exhaust camshaft sprocket bolts.
    - Secure the hexagonal portion of camshaft using wrench to loosen mounting bolts.

CAUTION: Never loosen mounting bolts with securing anything other than the camshaft hexagonal portion or with tensioning the timing chain.

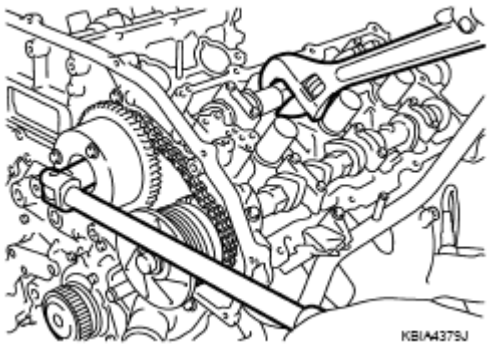


Fig. 124: Identifying Intake And Exhaust Camshaft Sprocket Bolt
Courtesy of NISSAN MOTOR CO., U.S.A.

c. Remove timing chain (secondary) together with camshaft sprockets.

CAUTION:
- **Handle carefully to avoid any shock to camshaft sprocket.**
- **Never disassemble. [Never loosen bolts (A) and (B) as shown in the figure.]**

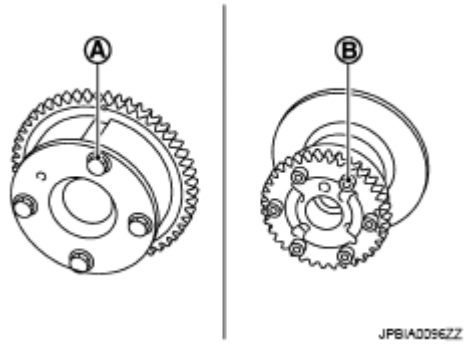


Fig. 125: Identifying Camshaft Sprockets Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

19. Remove water pump. Refer to "**COMPONENT** ".
20. Remove rear timing chain case as follows:
    a. Loosen and remove mounting bolts in reverse order as shown in the figure.
    b. Cut liquid gasket using seal cutter [SST: KV10111100 (J37228)] and remove rear timing chain case.

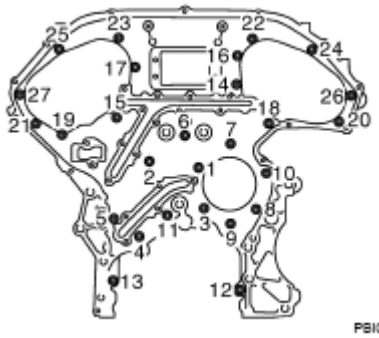


Fig. 126: Identifying Mounting Bolts Rear Timing Chain Case Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION:
- **Never remove plate metal cover (1) of oil passage.**
- **After removal, handle rear timing chain case carefully so it never tilt, cant, or warp under a load.**

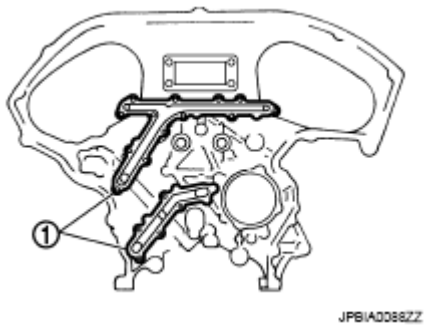


Fig. 127: Identifying Plate Metal Cover
Courtesy of NISSAN MOTOR CO., U.S.A.

21. Remove O-rings (1) from cylinder block.

⇦ : Engine front

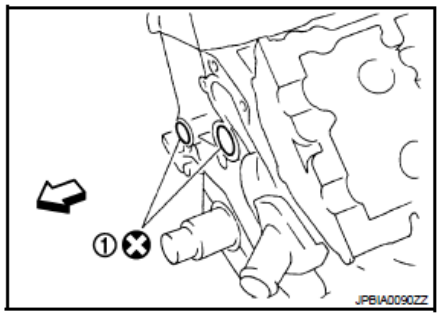


Fig. 128: Identifying Cylinder Block O-Rings
Courtesy of NISSAN MOTOR CO., U.S.A.

22. Remove timing chain tensioners (secondary) from cylinder head as follows, if necessary.
    a. Remove camshaft brackets (No. 1). Refer to "**REMOVAL AND INSTALLATION**".
    b. Remove timing chain tensioners (secondary) with stopper pin (A) attached.

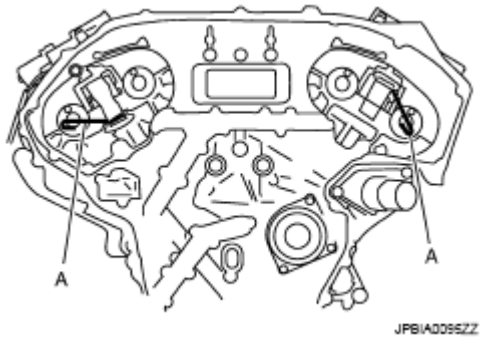


Fig. 129: Identifying Stopper Pin
Courtesy of NISSAN MOTOR CO., U.S.A.

23. Use scraper to remove all traces of old liquid gasket from front and rear timing chain cases, and opposite

mating surfaces.

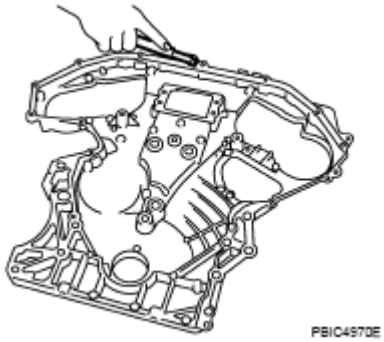


Fig. 130: scraping Liquid Gasket From Front And Rear Timing Chain Cases
Courtesy of NISSAN MOTOR CO., U.S.A.

- Remove old liquid gasket from bolt hole and thread.

A : Remove sticking old liquid gasket
B : Bolt hole

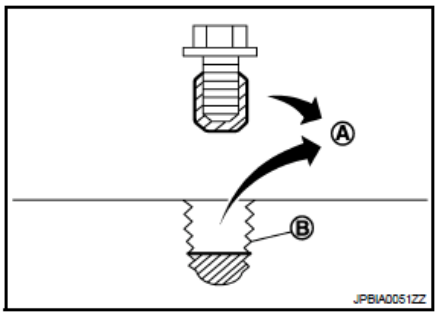


Fig. 131: Removing Old Liquid Gasket From Bolt Hole And Thread
Courtesy of NISSAN MOTOR CO., U.S.A.

INSPECTION AFTER REMOVAL

Timing Chain

Check for cracks (A) and any excessive wear (B) at link plates and roller links of timing chain. Replace timing chain if necessary.

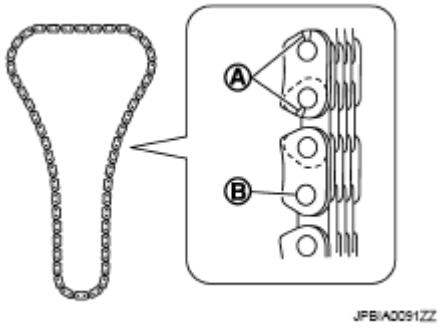


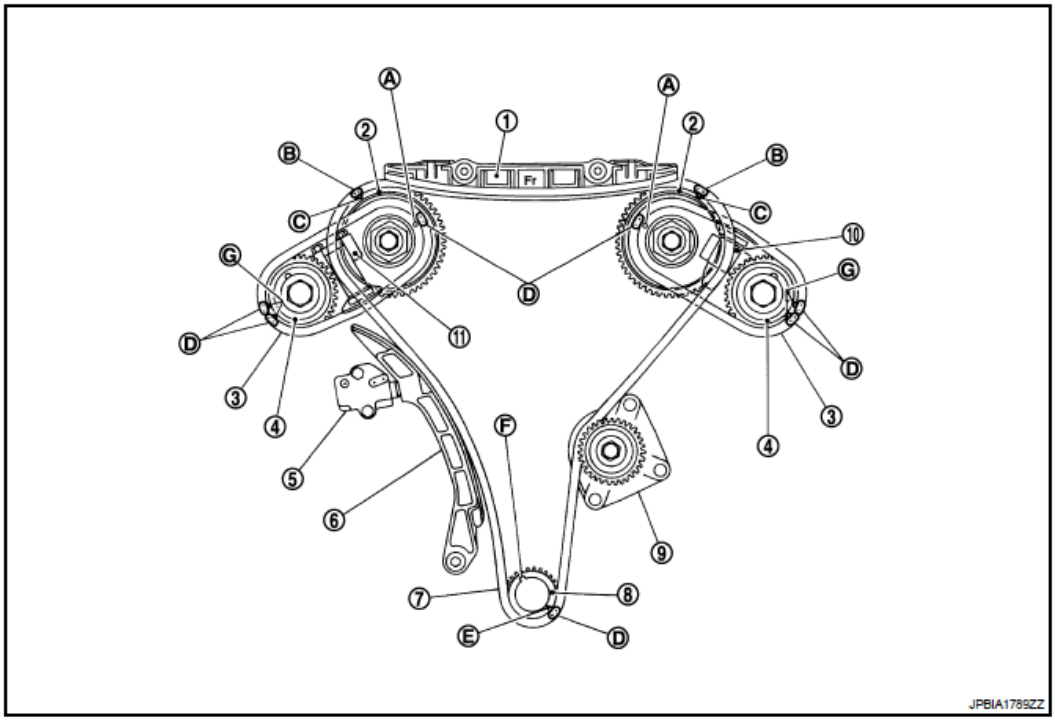
Fig. 132: Identifying Roller Links Of Timing Chain

Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

NOTE:

- **The below figure shows the relationship between the mating mark on each timing chain and that on the corresponding sprocket, with the components installed.**
- **In this figure, the drum of exhaust side camshaft sprocket has been omitted.**



1.	Internal chain guide	2.	Camshaft sprocket (INT)	3.	Timing chain (secondary)
4.	Camshaft sprocket (EXH)	5.	Timing chain tensioner (primary)	6.	Slack guide
7.	Timing chain (primary)	8.	Crankshaft sprocket	9.	Water pump
10.	Timing chain tensioner (secondary) (bank 2)	11.	Timing chain tensioner (secondary) (bank 1)		
A.	Mating mark [punched (back side)]	B.	Mating mark (colored link)	C.	Mating mark (punched)
D.	Mating mark (colored link)	E.	Mating mark (notched)	F.	Crankshaft key

Fig. 133: Identifying Relationship Between Mating Mark On Each Timing Chain And On Corresponding Sprocket
Courtesy of NISSAN MOTOR CO., U.S.A.

1. Install timing chain tensioners (secondary) to cylinder head as follows if removed. Refer to "**REMOVAL AND INSTALLATION**".
   a. Install timing chain tensioners (secondary) with stopper pin attached and new O-ring.
   b. Install camshaft brackets (No. 1). Refer to "**REMOVAL AND INSTALLATION**".
2. Measure difference in levels between front end faces of camshaft bracket (No. 1) and cylinder head.

Standard : -0.14 to 0.14 mm (-0.0055 to 0.0055 in)

- Measure two positions (Both intake and exhaust side) for a single bank.
- If the measured value is out of the standard, reinstall camshaft bracket (No. 1).

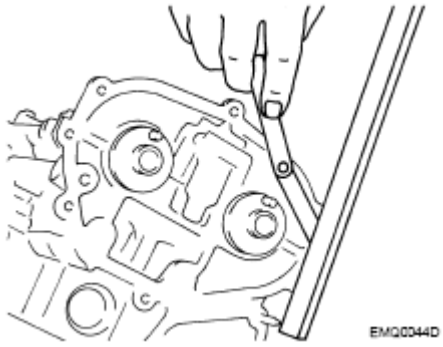


Fig. 134: Measuring Between Front End Faces Of No 1 Camshaft Bracket And Cylinder Head
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Install rear timing chain case as follows:
   a. Install new O-rings (1) onto cylinder block.

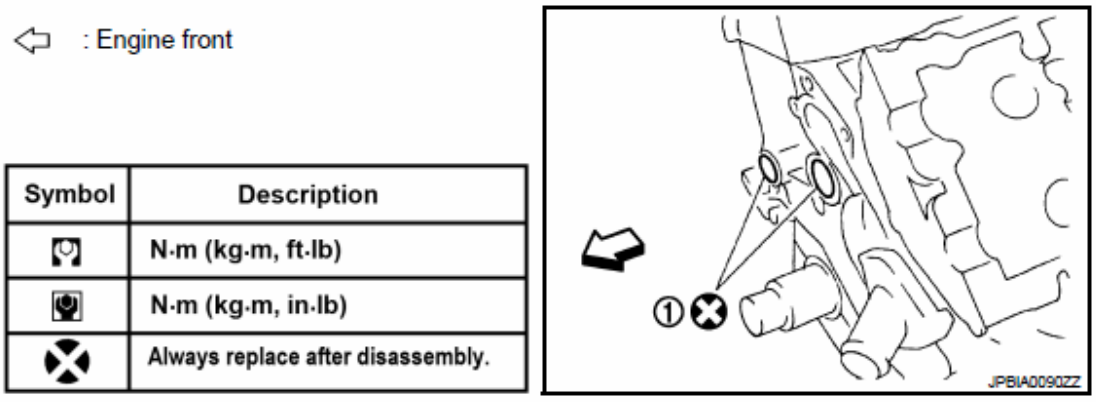


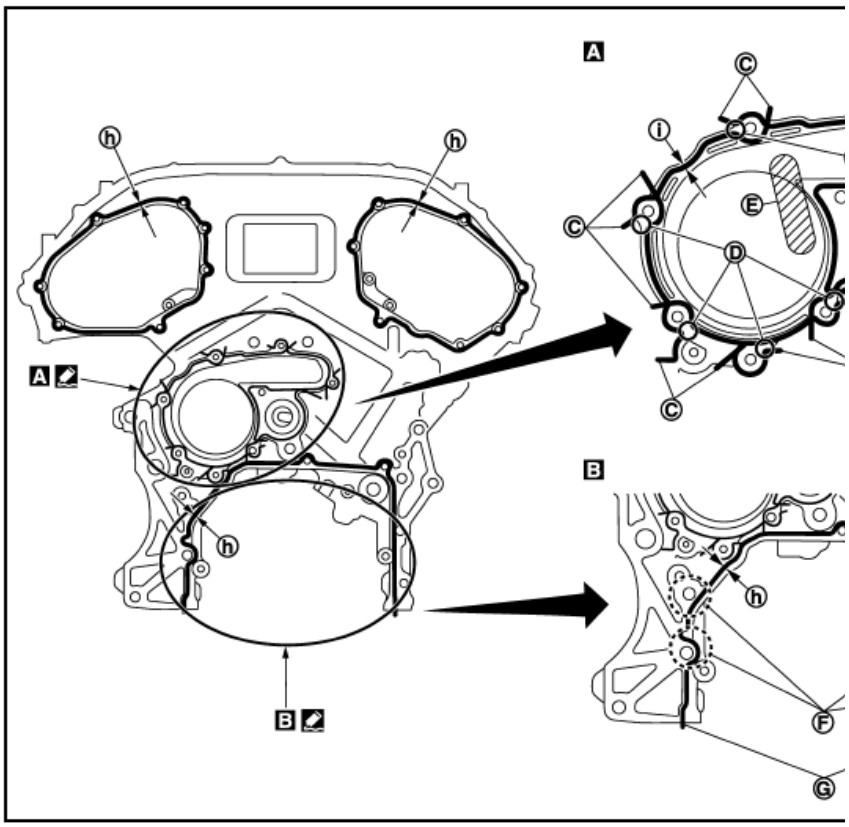
Fig. 135: Identifying Cylinder Block O-Rings
Courtesy of NISSAN MOTOR CO., U.S.A.

   b. Apply liquid gasket with tube presser (commercial service tool) to rear timing chain case back side as shown in the figure.

Use Genuine RTV Silicone Sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCT AND SEALANT ".

CAUTION:
- **For "A" in the figure, completely wipe out liquid gasket exte portion touching at engine coolant.**

- **Apply liquid gasket on installation position of water pump a head very completely.**



C. Protrusion
D. Clearance 1 mm (0.04 in)
E. Do not
F. Run along bolt hole inner side
G. Protrusions at beginning and end of gasket
h. ϕ3.9 mm (0.154 in)
i ϕ2.7 mm (0.106 in)

Fig. 136: Applying Liquid Gasket On Installation Position Of And Cylinder Head
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to "**COMPONENT** " for symbols in the figure.

c. Align rear timing chain case and water pump assembly with dowel pins (right and left) on cylinder block and install rear timing chain case.
   - Check O-rings stay in place during installation to cylinder block.
d. Tighten mounting bolts in numerical order as shown in the figure.
   - There are two types of mounting bolts. Refer to the following for locating bolts.

Bolt length: Bolt position

20 mm (0.79 in) : 1, 2, 3, 6, 7, 8, 9, 10

16 mm (0.63 in) : 4, 5, 11, 12, 13

12.7 N.m (1.3 kg-m, 9 ft-lb)

16 mm (0.63 in) : Except the above

15.0 N.m (1.5 kg-m, 11 ft-lb)

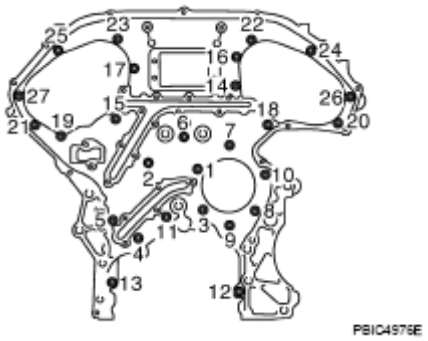


Fig. 137: Identifying Mounting Bolts Rear Timing Chain Case Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

e. After all bolts are tightened, retighten them to the specified in numerical order shown in the figure.
   - If liquid gasket protrudes, wipe it off immediately.

f. After installing rear timing chain case, check the surface height difference between following parts on oil pan (upper) mounting surface.

1 : Rear timing chain case
2 : Lower cylinder block

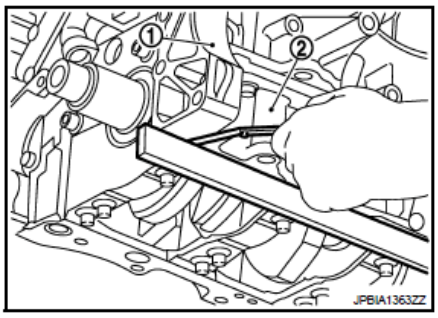


Fig. 138: Checking Surface Height Difference Between Oil Pan (Upper) Mounting Surface
Courtesy of NISSAN MOTOR CO., U.S.A.

Standard

Rear timing chain case to cylinder block:

-0.24 to 0.14 mm (-0.0094 to 0.0055 in)

- If not within standard, repeat the installation procedure.

4. Install water pump with new O-rings. Refer to "**COMPONENT** ".

5. Check that dowel pin (A) and crankshaft key (1) are located as shown in the figure. (No. 1 cylinder at compression TDC)

NOTE: **Though camshaft does not stop at the position as shown in the figure, for the placement of cam nose, it is generally accepted camshaft is placed for the same direction of the figure.**

Camshaft dowel pin

: At cylinder head upper face side in each bank .

Crankshaft key

: At cylinder head side of bank 1 .

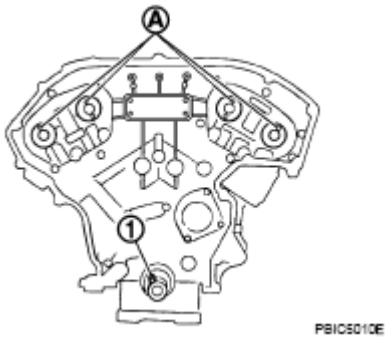


Fig. 139: Identifying Camshaft Dowel Pin
Courtesy of NISSAN MOTOR CO., U.S.A.

6. Install timing chains (secondary) and camshaft sprockets as follows:

CAUTION:
- **When replacing camshaft sprocket (EXH), replace valve timing control cover (including magnet retarder and cover).**
- **Mating marks between timing chain and sprockets slip easily. Confirm all mating mark positions repeatedly during the installation process.**

a. Push plunger of timing chain tensioner (secondary) and keep it pressed in with stopper pin (A).

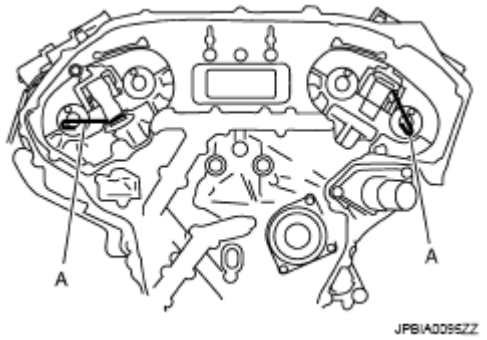


Fig. 140: Identifying Stopper Pin
Courtesy of NISSAN MOTOR CO., U.S.A.

b. Install timing chains (secondary) and camshaft sprockets.

NOTE: Figure shows bank 1 (rear view).

A : Camshaft sprocket (INT) back face
B : Colored link
C : Mating mark (circle)
D : Mating mark (oval)
E : Dowel groove
F : Mating mark (2 oval)
G : Camshaft sprocket (EXH) back face
H : Mating mark (2 circle)
I : Dowel pin hole
J : Timing chain (secondary)

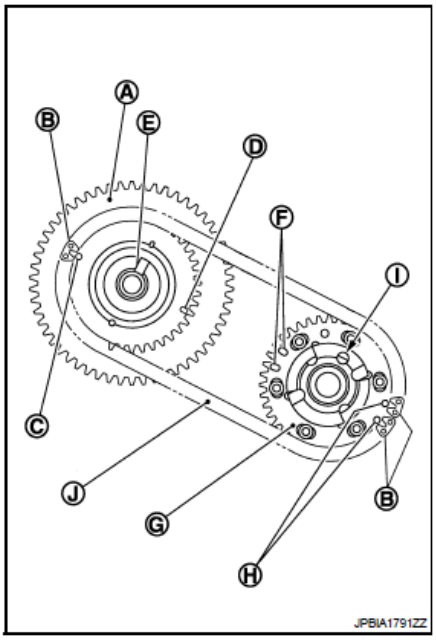


Fig. 141: Identifying Timing Chains (Secondary) And Camshaft Sprockets Timing Mark Location
Courtesy of NISSAN MOTOR CO., U.S.A.

- Align the mating marks on timing chain (secondary) (orange link) with the ones on intake and exhaust camshaft sprockets (punched), and install them.

NOTE:

- **Mating marks for intake camshaft sprocket are on the back side of camshaft sprocket (secondary).**
- **There are two types of mating marks, circle and oval types.**

They should be used for the bank 1 and bank 2, respectively.

Bank 1 : Use circle type

Bank 2 : Use oval type

- Align dowel pin hole on the small diameter side of the camshaft front end with dowel pin on the back side of camshaft sprockets, and install them.
- In case that positions of each mating mark and each dowel pin are not fit on mating parts, make fine adjustment to the position holding the hexagonal portion on camshaft with wrench or equivalent.
- Mounting bolts for camshaft sprockets must be tightened in the step "d". Tightening them by hand is enough to prevent the dislocation of dowel pins.

c. Check that timing chain (secondary) is not loose from each camshaft sprocket.
- Check the mating marks (punched) (D) on each camshaft sprocket are positioned on the mating marks (orange link) (C) on timing chain (secondary).

A : Intake side
B : Exhaust side

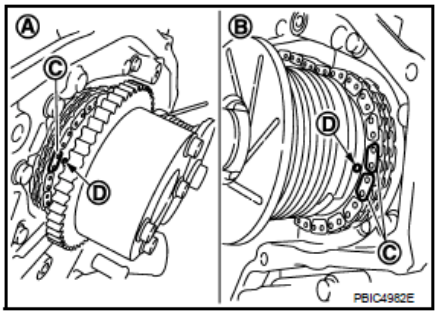


Fig. 142: Identifying Mating Marks Location
Courtesy of NISSAN MOTOR CO., U.S.A.

NOTE: Mating mark (punched) in the figure is for checking loose at this step.

d. Tighten camshaft sprocket mounting bolts.
- Secure camshaft using wrench at the hexagonal portion to tighten mounting bolts.

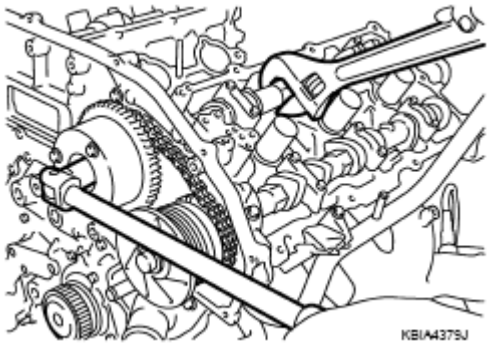


Fig. 143: Identifying Intake And Exhaust Camshaft Sprocket Bolt
Courtesy of NISSAN MOTOR CO., U.S.A.

e. Pull stopper pins (2) out from timing chain tensioners (secondary) (1).

A : Bank 1
B : Bank 2

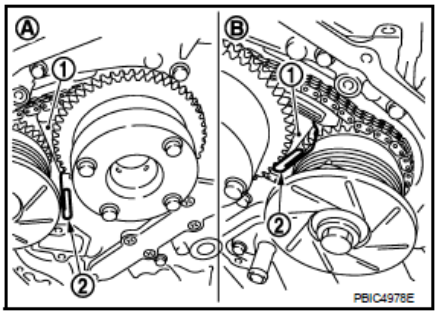


Fig. 144: Identifying Stopper Pins
Courtesy of NISSAN MOTOR CO., U.S.A.

7. Install timing chain (primary) as follows:
   a. Install crankshaft sprocket (1).

A : Crankshaft side
B : Engine front
C : Mating mark (Front side)

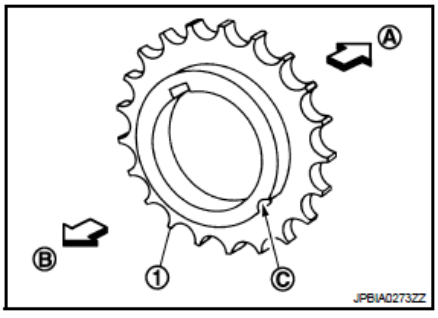


Fig. 145: Identifying Crankshaft Sprocket
Courtesy of NISSAN MOTOR CO., U.S.A.

- Check the mating marks on crankshaft sprocket face the front of engine.

   b. Install timing chain (primary).
- Install timing chain (primary) so the mating mark (punched) (B) on camshaft sprocket (INT)

(1) is aligned with the yellow link (A) on timing chain, while the mating mark (notched) (C) on crankshaft sprocket (2) is aligned with the orange link (D) on timing chain, as shown in the figure.

- When it is difficult to align mating marks of timing chain (primary) with each sprocket, gradually turn camshaft using wrench on the hexagonal portion to align it with the mating marks.
- During alignment, be careful to prevent dislocation of mating mark alignments of timing chains (secondary).

3 : Water pump

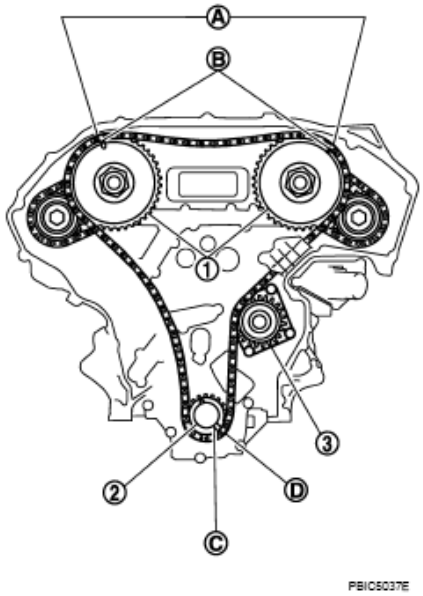


Fig. 146: Aligning Mating Mark On Camshaft Sprocket
Courtesy of NISSAN MOTOR CO., U.S.A.

8. Install internal chain guide (1) and slack guide (2).

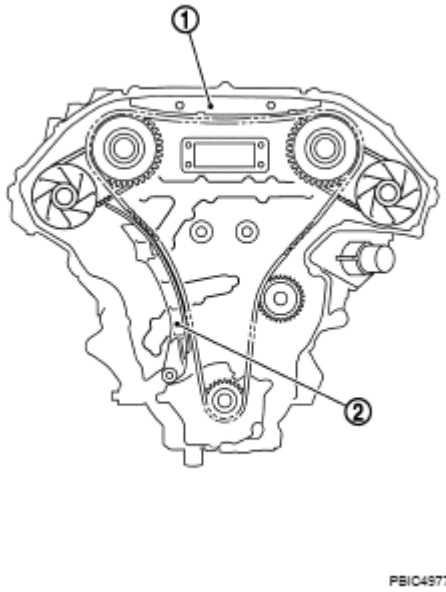


Fig. 147: Identifying Internal Chain Guide And Slack Guide
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: Never over tighten slack guide mounting bolts (2). It is normal for a gap (A) to exist under the bolt seats when mounting bolts are tightened to specification.

1 : Slack guide
3 : Cylinder block

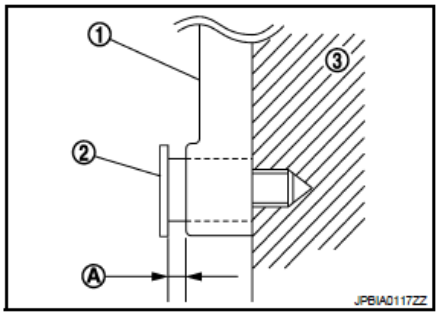


Fig. 148: Identifying Gap Between Slack Guide And Cylinder Block
Courtesy of NISSAN MOTOR CO., U.S.A.

9. Install the timing chain tensioner (primary) with the following procedure:
   a. Pull plunger stopper tab (A) up (or turn lever downward) so as to remove plunger stopper tab from the ratchet of plunger (D).

      NOTE: Plunger stopper tab and lever (C) are synchronized.

   b. Push plunger into the inside of tensioner body.
   c. Hold plunger in the fully compressed position by engaging plunger stopper tab with the tip of ratchet.

d. To secure lever, insert stopper pin (E) through hole of lever into tensioner body hole (B).

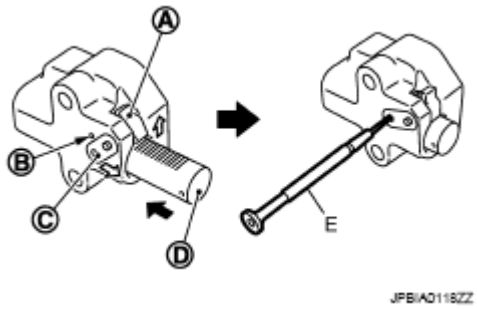


Fig. 149: Identifying Plunger Stopper Tab And Plunger
Courtesy of NISSAN MOTOR CO., U.S.A.

- The lever parts and the tab are synchronized. Therefore, the plunger will be secured under this condition.

NOTE: Figure shows the example of 1.2 mm (0.047 in) diameter thin screwdriver being used as the stopper pin.

e. Install timing chain tensioner (primary) (1).
   - Remove any dirt and foreign materials completely from the back and the mounting surfaces of timing chain tensioner (primary).
f. Pull out stopper pin (A) after installing, and then release plunger.

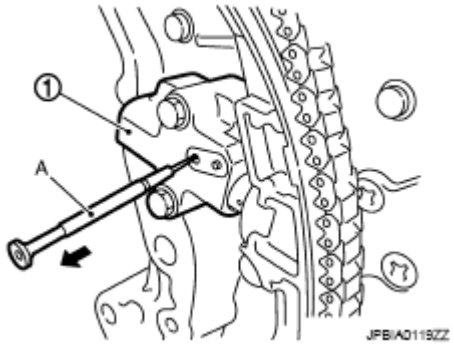


Fig. 150: Pulling Out Stopper Pin
Courtesy of NISSAN MOTOR CO., U.S.A.

10. Check again that the mating marks on sprockets and timing chain have not slipped out of alignment.
11. Install new O-ring (1) on rear timing chain case.

A : Bank 1
B : Bank 2

Symbol	Description
	N·m (kg·m, ft·lb)
	N·m (kg·m, in·lb)
	Always replace after disassembly.

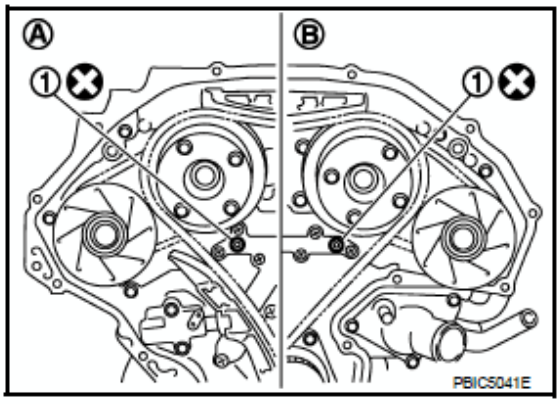


Fig. 151: Identifying Rear Timing Chain Case O-Ring
Courtesy of NISSAN MOTOR CO., U.S.A.

12. Hammer dowel pins (right and left) (A) into front timing chain case (1) up to a point close to taper in order to shorten protrusion length.

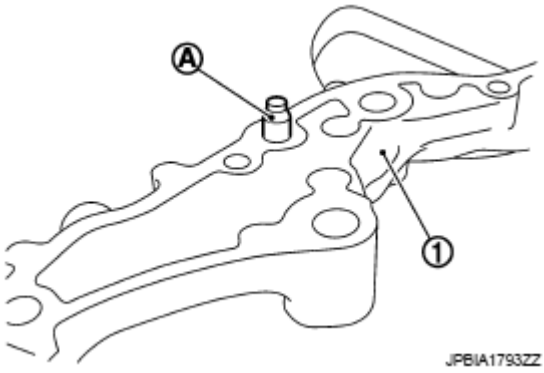


Fig. 152: Identifying Dowel Pins (Right And Left)
Courtesy of NISSAN MOTOR CO., U.S.A.

13. Install new front oil seal on front timing chain case.
    - Apply new engine oil to both oil seal lip (A) and dust seal lip (B).

⇦ : Engine inside
⬅ : Engine outside

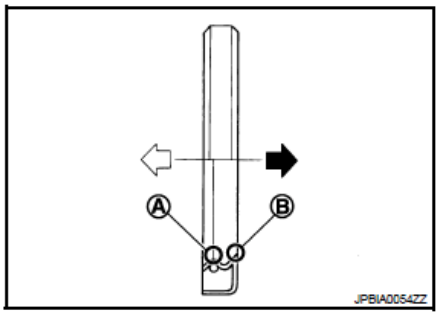


Fig. 153: Identifying Oil Seal Lip And Dust Seal Lip
Courtesy of NISSAN MOTOR CO., U.S.A.

- Install it so that each seal lip is oriented as shown in the figure.
- Using suitable drift (1), press-fit oil seal until it becomes flush with front timing chain case end face.
- Check the garter spring is in position and seal lip is not inverted.

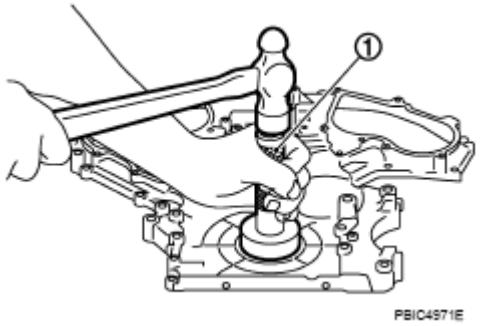


Fig. 154: Pressing Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

14. Install front timing chain case as follows:
    a. Apply a continuous bead of liquid gasket with tube presser (commercial service tool) to front timing chain case back side as shown in the figure.

B : Protrusion
c :ϕ3.4 - 4.4 mm (0.134 - 0.173 in)
d :ϕ2.6 - 3.6 mm (0.102 - 0.142 in)
e : 4.0 - 5.6 mm (0.157 - 0.220 in)

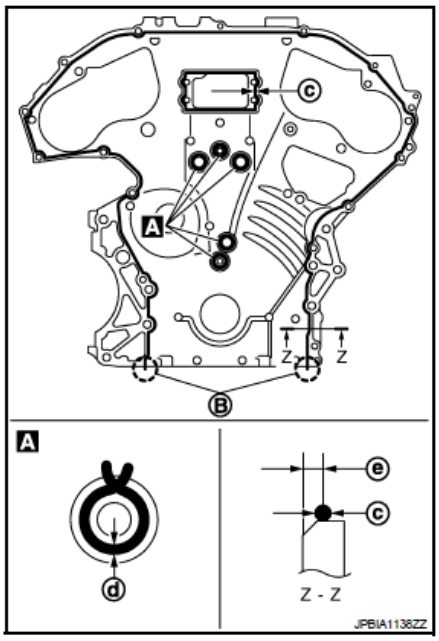


Fig. 155: Applying Continuous Bead Of Liquid Gasket With Tube Presser
Courtesy of NISSAN MOTOR CO., U.S.A.

Use Genuine RTV Silicone Sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCT AND SEALANT ".

NOTE: Apply liquid gasket, start and end up application at the portions (A) shown in the figure.

b. Install front timing chain case as to fit its dowel pin hole together dowel pin on rear timing chain case.

c. Tighten mounting bolts to the specified torque in numerical order as shown in the figure.

- There are two types of mounting bolts. Refer to the following for locating bolts.

M8 bolts : 1, 2, 3, 4, 5, 6, 7

55.0 N.m (5.6 kg-m, 41 ft-lb)

M6 bolts : Except the above

12.7 N.m (1.3 kg-m, 9 ft-lb)

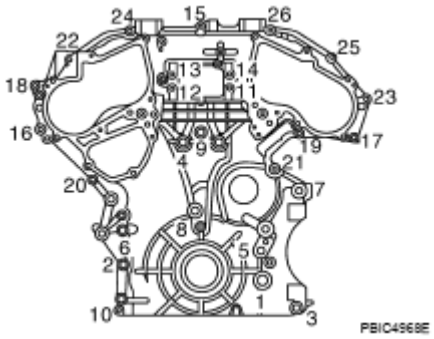


Fig. 156: Identifying Front Timing Chain Case Mounting Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

d. After all bolts are tightened, retighten them to the specified torque in numerical order shown in the figure.

CAUTION: Be sure to wipe off any excessive liquid gasket leaking on surface mating with oil pan (upper).

e. After installing front timing chain case, check the surface height difference between the following parts on the oil pan (upper) mounting surface.

1 : Front timing chain case
2 : Rear timing chain case
3 : Lower cylinder block

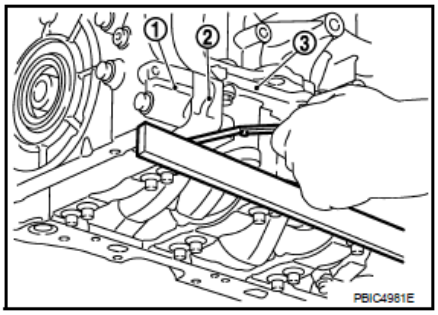


Fig. 157: Checking Surface Height Difference Between Oil Pan (Upper) Mounting Surface
Courtesy of NISSAN MOTOR CO., U.S.A.

Standard

Front timing chain case to rear timing chain case: -0.24 to 0.14 mm (-0.0094 to 0.0055 in)

- If not within standard, repeat the installation procedure.

15. Install right and left valve timing control covers as follows:
    a. Install new seal rings (1) in shaft grooves.

CAUTION: When replacing seal rings, replace all rings with new one.

A : Bank 2

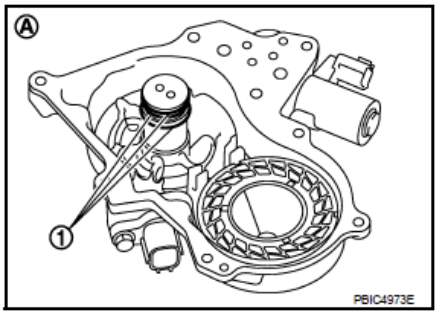


Fig. 158: Identifying Seal Rings
Courtesy of NISSAN MOTOR CO., U.S.A.

    b. To check the joint between dowel pins and dowel pin holes, check the looseness in the axle direction by pushing the mating surface of magnet retarder (A) at several places and the circumferential looseness (between dowel pins and dowel pin holes) by twisting in the circumferential direction.

B : Moves slightly
C : Not shaken

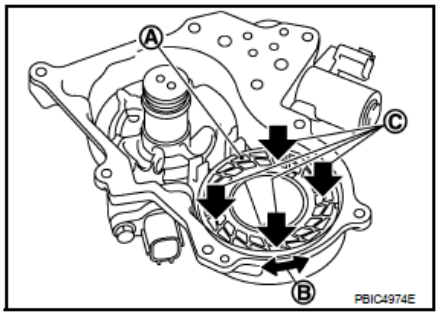


Fig. 159: Checking Joint Between Dowel Pins And Dowel Pin Holes
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: Always perform this procedure when removing because the gap between dowel pins and dowel pin holes may not be caused on purpose.

c. Install valve timing control cover (1) to front timing chain case.

2 : Magnet retarder

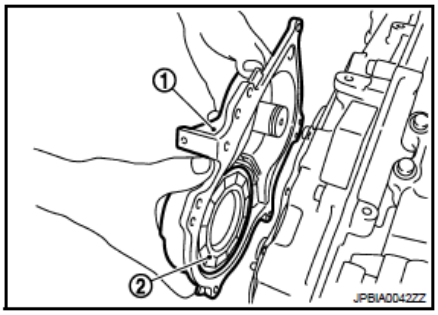


Fig. 160: Identifying Valve Timing Control Cover To Front Timing Chain Case
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION:

- **Never face the magnet retarder side down to prevent magnet retarder from dropping.**
- **Check the mating surface of magnet retarder and the drum of exhaust side camshaft sprocket for foreign materials.**
- **Align the center of both shaft holes of the shaft and the intake side camshaft sprocket, and then insert them.**
- **Be careful not to drop the seal ring from the shaft groove.**
- **When setting the valve timing control cover in position by hand, if valve timing control cover is not contacting with the front timing chain case, the dowel pin of magnet retarder may not be aligned with the dowel pin holes of cover. In this case, return to step "b".**

d. Tighten mounting bolts in numerical order as shown in the figure.

11.3 N.m (1.2 kg-m, 8 ft-lb)

A : Bank 1
B : Bank 2
C : Dowel pin hole

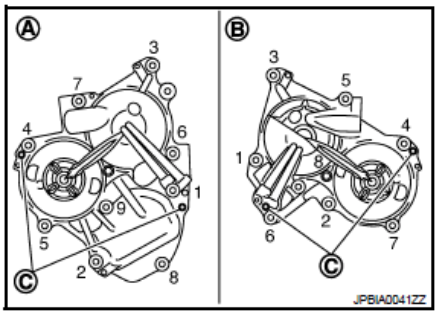


Fig. 161: Identifying Mounting Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: Completely tighten the mounting bolts with the seat surface of valve timing control cover contacting with front timing chain case.

- After all bolts are tightened, tighten No. 1 bolt to the specified torque again.

16. Install oil pans (upper and lower). Refer to **OIL PAN AND OIL STRAINER**.
17. Install rocker covers (bank 1 and bank 2). Refer to **ROCKER COVER**.
18. Install crankshaft pulley as follows:
    a. Fix crankshaft using ring gear stopper [SST: KV10118600 (J-48641)].
    b. Install crankshaft pulley, taking care not to damage front oil seal.
        - When press-fitting crankshaft pulley with plastic hammer, tap on its center portion (not circumference).
    c. Tighten crankshaft pulley bolt.

    44.1 N.m (4.5 kg-m, 33 ft-lb)

    d. Tighten the bolt 90 degrees (one mark) (b).
        - Place a matching mark (A) on crankshaft pulley (2) aligning with the matching (C) of crankshaft pulley bolt (1).

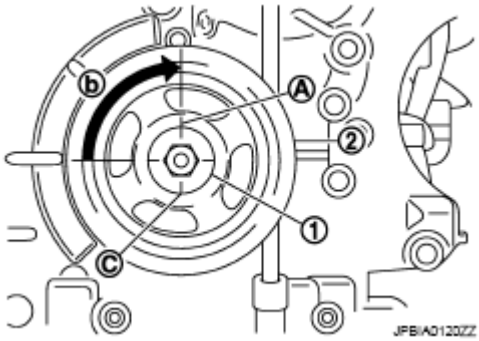


Fig. 162: Identifying Crankshaft Pulley Bolt Tightening Angle
Courtesy of NISSAN MOTOR CO., U.S.A.

e. Rotate crankshaft pulley in normal direction (clockwise when viewed from front) to confirm it turns smoothly.

19. Install power steering oil pump bracket and idler pulley bracket as follows:
    a. Tighten mounting bolts in numerical order as shown in the figure. (temporarily)

1 : Idler pulley bracket
2 : Power steering oil pump bracket
3 : Crankshaft pulley
A : Engine front side
B : Engine right side
⇦ : Engine front

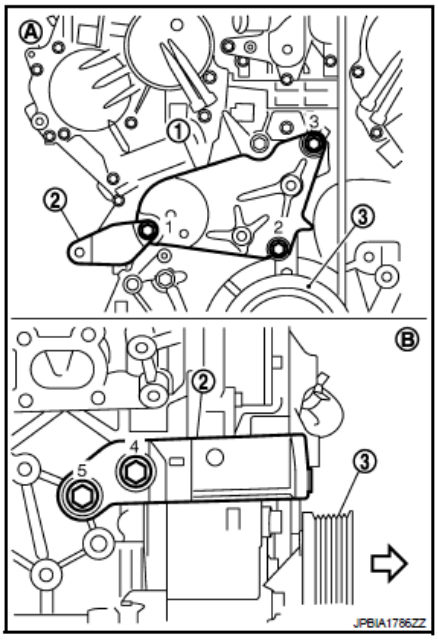


Fig. 163: Identifying Power Steering Oil Pump Bracket And Idler Pulley Bracket With Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

    b. Tighten mounting bolts to specified torque in numerical order as shown in the figure.

20. For the following operations, perform steps in the reverse order of removal.

INSPECTION AFTER INSTALLATION

Inspection for Leakage

The following are procedures for checking fluids leakage, lubricates leakage, and exhaust gases leakage.

- Before starting engine, check oil/fluid levels including engine coolant and engine oil. If less than required quantity, fill to the specified level. Refer to "**RECOMMENDED FLUIDS AND LUBRICANTS** ".
- Use procedure below to check for fuel leakage.
  - Turn ignition switch "ON" (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 timing chain tensioner drops after removal/installation, slack in the guide may generate a pounding noise during and just after engine start. However, this is normal. Noise will stop after hydraulic pressure rises.

- Warm up engine thoroughly to check there is no leakage of fuel, exhaust gases, 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 to the specified level, if necessary.

Summary of the inspection items:

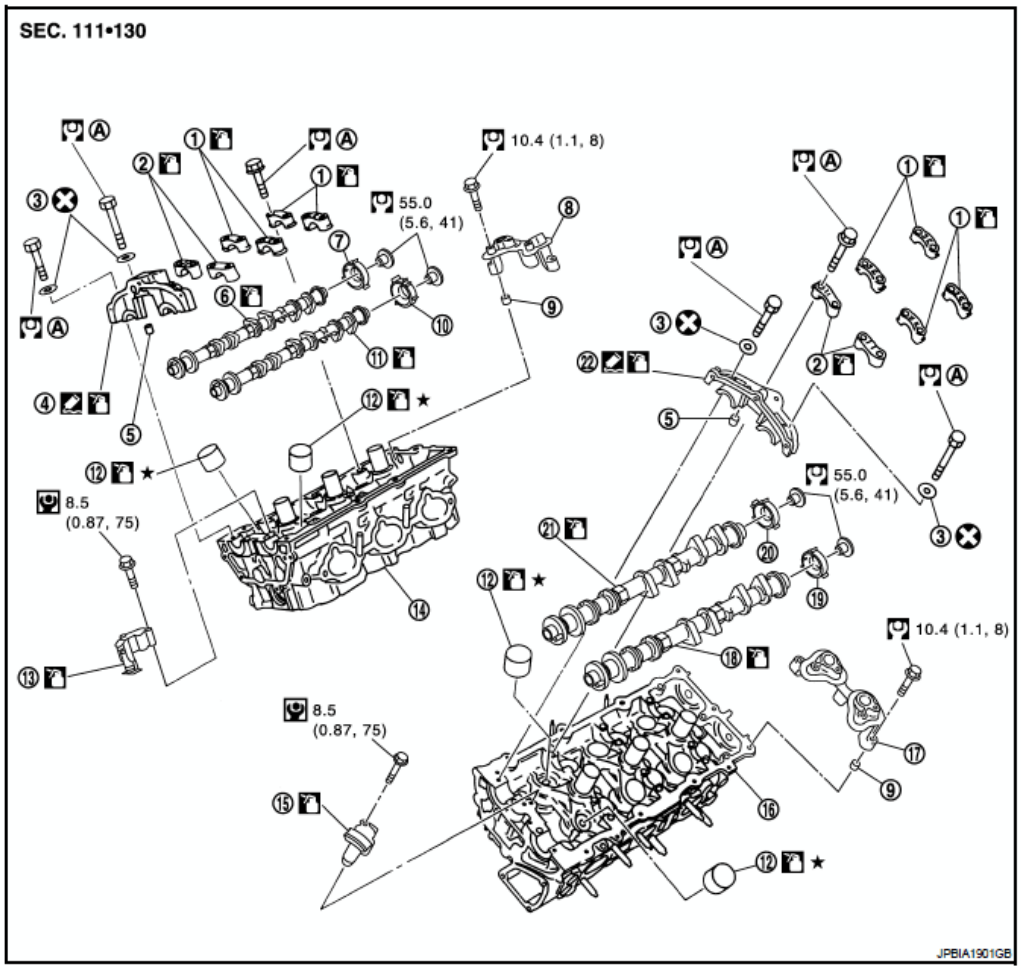
INSPECTION CHART

Items	Before starting engine	Engine running	After engine stopped
Engine coolant	Level	Leakage	Level
Engine oil	Level	Leakage	Level
Other oils and fluid(1)	Level	Leakage	Level
Fuel	Leakage	Leakage	Leakage
Exhaust gases	-	Leakage	-
(1) Transmission/transaxle/CVT fluid, power steering fluid, brake fluid, etc.			

CAMSHAFT

Component

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.



1. Camshaft bracket (No. 3, 4)
2. Camshaft bracket (No. 2)
3. Seal washer
4. Camshaft bracket (No. 1) (bank 1)
5. Dowel pin
6. Camshaft (EXH) (bank 1)
7. Camshaft signal plate (EXH)
8. Camshaft sensor bracket (bank 1)
9. Dowel pin
10. Camshaft signal plate (INT)
11. Camshaft (INT) (bank 1)
12. Valve lifter
13. Timing chain tensioner (secondary) (bank 1)
14. Cylinder head (bank 1)
15. Timing chain tensioner (secondary) (bank 2)
16. Cylinder head (bank 2)
17. Camshaft sensor bracket
18. Camshaft (EXH)
19. Camshaft signal plate (EXH)
20. Camshaft signal plate (INT)
21. Camshaft (INT)
22. Camshaft bracket (No. 1) (bank 2)

A. Refer to CAMSHAFT

Fig. 164: Disassembled View Of Camshaft Components With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to "**COMPONENT** " for symbols in the figure.

Removal and Installation

REMOVAL

1. Remove front timing chain case, camshaft sprocket, and timing chain. Refer to **REMOVAL AND INSTALLATION**.
2. Remove fuel sub tube. Refer to **FUEL INJECTOR AND FUEL TUBE**.
3. Remove camshaft sensor bracket bolts in reverse order as shown in the figure.

⇦ : Engine front

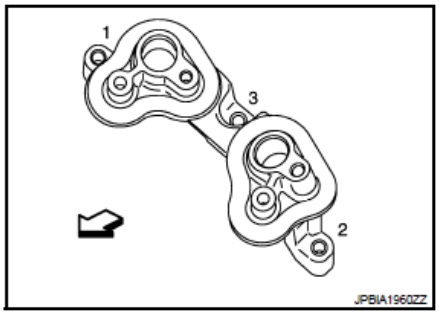


Fig. 165: Identifying Camshaft Sensor Bracket Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

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

⇦ : Engine front

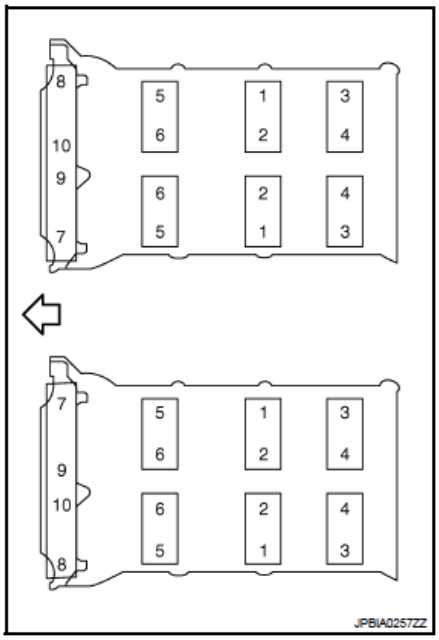


Fig. 166: Identifying Intake And Exhaust Camshaft Brackets Installation Position
Courtesy of NISSAN MOTOR CO., U.S.A.

5. Remove camshaft.

6. Remove valve lifter.
   - Identify installation positions, and store them without mixing them up.
7. Remove timing chain tensioner (secondary) (1) from cylinder head.

A : Bank 1
B : Bank 2

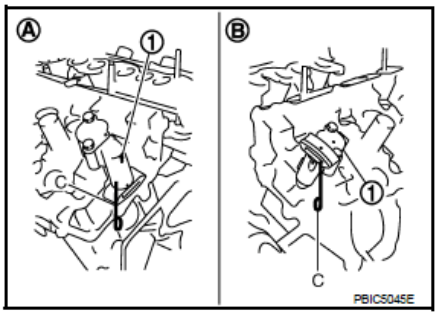


Fig. 167: Identifying Timing Chain Tensioner (Secondary)
Courtesy of NISSAN MOTOR CO., U.S.A.

- Remove timing chain tensioner (secondary) with its stopper pin (C) attached.

NOTE: Stopper pin was attached when timing chain (secondary) was removed.

INSPECTION AFTER REMOVAL

Camshaft Runout

1. Put V-block on precise flat table, and support No. 2 and 4 journals of camshaft.

CAUTION: Never support journal No. 1 (on the side of camshaft sprocket) because it has a different diameter from the other three locations.

2. Set dial indicator vertically to No. 3 journal.
3. Turn camshaft to one direction with hands, and measure the camshaft runout on a dial indicator. (Total indicator reading)

   Standard : Less than 0.02 mm (0.0008 in)

   Limit : 0.05 mm (0.0020 in)

4. If it exceeds the limit, replace camshaft.

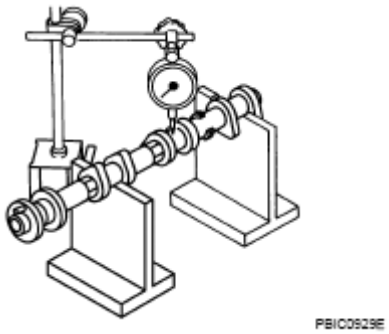


Fig. 168: Checking Camshaft Runout
Courtesy of NISSAN MOTOR CO., U.S.A.

Camshaft Cam Height

1. Measure the camshaft cam height with a micrometer.

   Standard cam height:

   Intake : 45.865 - 46.055 mm (1.8057 - 1.8132 in)

   Exhaust : 45.875 - 46.065 mm (1.8061 - 1.8136 in)

   Cam wear limit

   : 0.2 mm (0.008 in)

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

Fig. 169: Checking Camshaft Cam Height
Courtesy of NISSAN MOTOR CO., U.S.A.

Camshaft Journal Oil Clearance

CAMSHAFT JOURNAL DIAMETER

- Measure the outer diameter of camshaft journal with a micrometer (A).

  Standard:

  No. 1 : 25.935 - 25.955 mm (1.0211 - 1.0218 in)

  No. 2, 3, 4 : 23.445 - 23.465 mm (0.9230 - 0.9238 in)

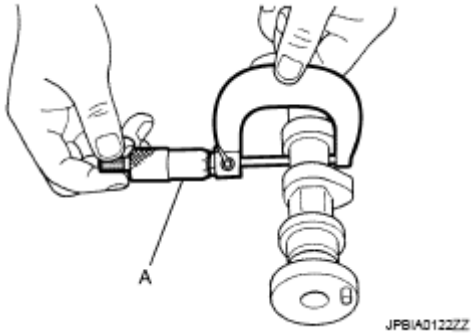


Fig. 170: Measuring Outer Diameter Of Camshaft (EXH) Journal
Courtesy of NISSAN MOTOR CO., U.S.A.

CAMSHAFT BRACKET INNER DIAMETER

- Tighten camshaft bracket bolt with the specified torque. Refer to "**COMPONENT**" for the tightening procedure.
- Measure the inner diameter "A" of camshaft bracket with a bore gauge.

  Standard:

  No. 1 : 26.000 - 26.021 mm (1.0236 - 1.0244 in)

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

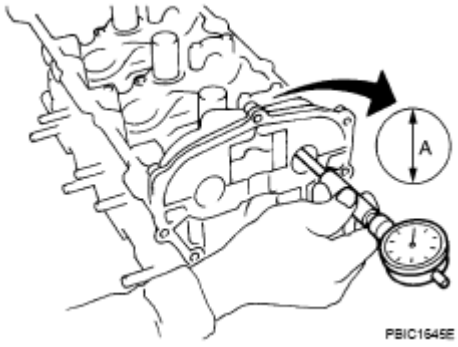


Fig. 171: Checking Inner Diameter A Of Camshaft Bracket With Bore Gauge
Courtesy of NISSAN MOTOR CO., U.S.A.

CAMSHAFT JOURNAL OIL CLEARANCE

- (Oil clearance) = (Camshaft bracket inner diameter) - (Camshaft journal diameter)

  Standard:

  No. 1 : 0.045 - 0.086 mm (0.0018 - 0.0034 in)

  No. 2, 3, 4 : 0.035 - 0.076 mm (0.0014 - 0.0030 in)

  Limit : 0.15 mm (0.0059 in)

- If it exceeds the limit, replace either or both camshaft and cylinder head.

NOTE: Camshaft brackets cannot be replaced as single parts, because there are machined together with cylinder head. Replace whole cylinder head assembly.

Camshaft End Play

- Install a dial indicator in thrust direction on front end of camshaft. Measure the end play of a dial indicator when camshaft is moved forward/backward (in direction to axis).

  Standard : 0.115 - 0.188 mm (0.0045 - 0.0074 in)

  Limit : 0.24 mm (0.0094 in)

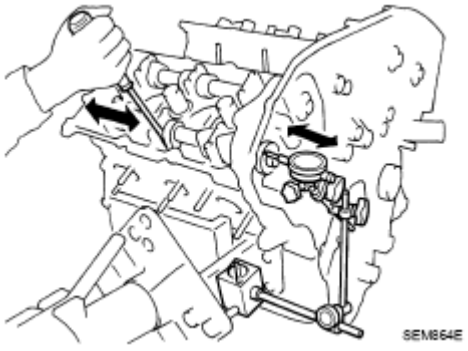


Fig. 172: Checking Camshaft (EXH) End Play
Courtesy of NISSAN MOTOR CO., U.S.A.

- Measure the following parts if out of the limit.
  - Dimension "A" for camshaft No. 1 journal

    Standard : 27.500 - 27.548 mm (1.0827 - 1.0846 in)

  - Dimension "B" for cylinder head No. 1 journal bearing

Standard : 27.360 - 27.385 mm (1.0772 - 1.0781 in)

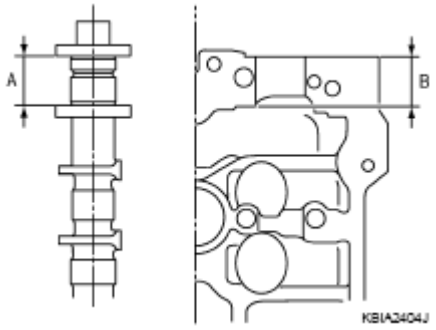


Fig. 173: Identifying Camshaft Journal Dimensions
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to the standards above, and then replace camshaft and/or cylinder head.

Camshaft Sprocket Runout

1. Put V-block on precise flat table, and support No. 2 and 4 journal of camshaft.

CAUTION: Never support journal No. 1 (on the side of camshaft sprocket) because it has a different diameter from the other three locations.

2. Measure the camshaft sprocket runout with a dial indicator. (Total indicator reading)

Limit : 0.15 mm (0.0059 in)

- If it exceeds the limit, replace camshaft sprocket.

CAUTION: When replacing camshaft sprocket (EXH), replace valve timing control cover (including magnet retarder and cover).

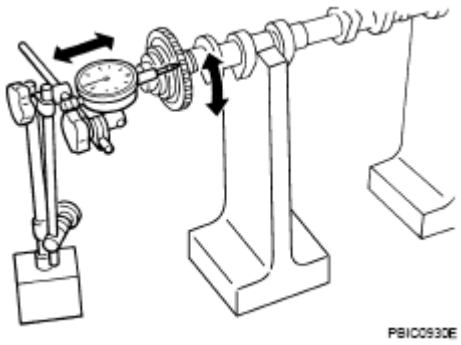


Fig. 174: Measuring Camshaft Sprocket (EXH) Runout
Courtesy of NISSAN MOTOR CO., U.S.A.

Valve Lifter

Check if surface of valve lifter has any wear or cracks.

- If anything above is found, replace valve lifter. Refer to "**STANDARD AND LIMIT**".

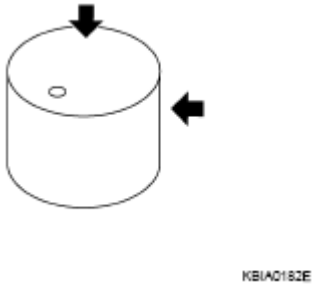


Fig. 175: Identifying Surface Of Valve Lifter
Courtesy of NISSAN MOTOR CO., U.S.A.

Valve Lifter Clearance

VALVE LIFTER OUTER DIAMETER

- Measure the outer diameter at 1/2 height of valve lifter with a micrometer (A) since valve lifter is in barrel shape.

  Standard (Intake and exhaust)

  : 33.980 - 33.990 mm (1.3378 - 1.3382 in)

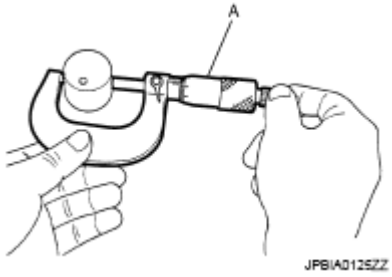


Fig. 176: Measuring Of Valve Lifter
Courtesy of NISSAN MOTOR CO., U.S.A.

VALVE LIFTER HOLE DIAMETER

- Measure the inner diameter of valve lifter hole of cylinder head with an inside micrometer.

  Standard (Intake and exhaust)

  : 34.000 - 34.016 mm (1.3386 - 1.3392 in)

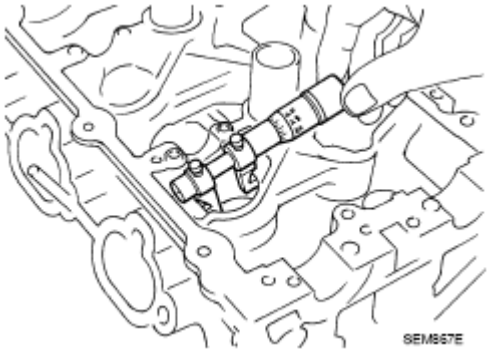


Fig. 177: Measuring Diameter Of Valve Lifter Bore Of Cylinder Head
Courtesy of NISSAN MOTOR CO., U.S.A.

VALVE LIFTER CLEARANCE

- (Valve lifter clearance) = (Valve lifter hole diameter) - (Valve lifter outer diameter)

  Standard (Intake and exhaust)

  : 0.010 - 0.036 mm (0.0004 - 0.0014 in)

- If the calculated value is out of the standard, referring to each standard of valve lifter outer diameter and valve lifter hole diameter, replace either or both valve lifter and cylinder head.

INSTALLATION

1. Install timing chain tensioners (secondary) (1) on both sides of cylinder head.
   - Install timing chain tensioner with its stopper pin (C) attached.
   - Install timing chain tensioner with sliding part facing downward on right-side cylinder head, and with sliding part facing upward on left-side cylinder head.

A : Bank 1
B : Bank 2

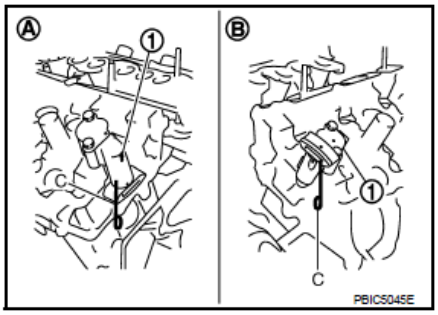


Fig. 178: Identifying Timing Chain Tensioners (Secondary)
Courtesy of NISSAN MOTOR CO., U.S.A.

2. Install valve lifter.
   - Install it in the original position.

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

⇦ : Engine front

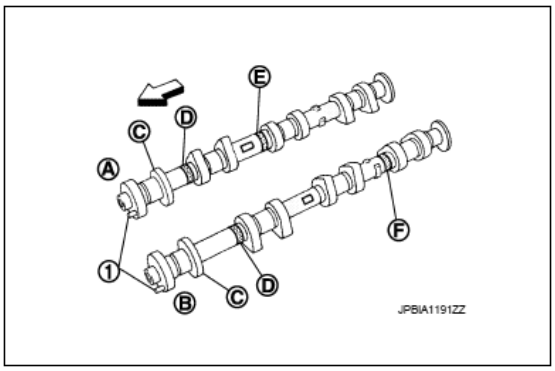


Fig. 179: Identifying Camshafts Mark Location
Courtesy of NISSAN MOTOR CO., U.S.A.

CAMSHAFTS MARK REFERENCE

Bank	INT/EXH	Dowel pin (1)	Paint marks			Identification mark (C)
			M1 (E)	M2 (F)	M3 (D)	
1	EXH (B)	Yes	No	Green	Light blue	1F
	INT (A)	Yes	Green	No	Light blue	1E
2	INT (A)	Yes	Green	No	Light blue	1G
	EXH (B)	Yes	No	Green	Light blue	1H

- Install camshaft so that and dowel pin (A) on front end face are positioned as shown in the figure. (No. 1 cylinder TDC on its compression stroke)

NOTE: **Though camshaft does not stop at the portion as shown in the figure, for the placement of cam nose, it is generally accepted camshaft is placed for the same direction of the figure.**

1 : Crankshaft key

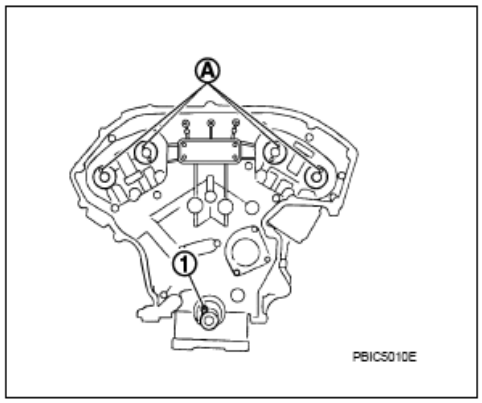


Fig. 180: Identifying Dowel Pin

Courtesy of NISSAN MOTOR CO., U.S.A.

4. Install camshaft brackets.

A : No. 1
B : No. 2
C : No. 3
D : No. 4
E : Right camshaft bracket
F : Exhaust side
G : Intake side
H : Left camshaft bracket
I : Intake side
J : Exhaust side
⇦ : Engine front

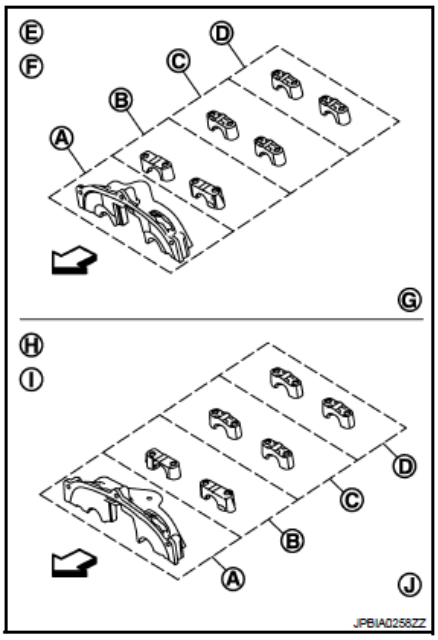


Fig. 181: Identifying Camshaft Brackets Installation Position
Courtesy of NISSAN MOTOR CO., U.S.A.

- Remove foreign material completely from camshaft bracket backside and from cylinder head installation face.
- Install camshaft bracket in original position and direction as shown in the figure.
- Install camshaft brackets (No. 2 to 4) aligning the stamp marks (A) as shown in the figure.

B : Bank 1
C : Bank 2
⇦ : Engine front

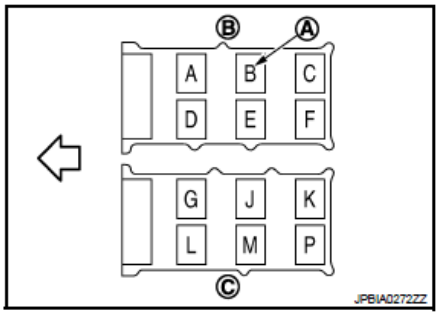


Fig. 182: Identifying Camshaft Brackets Stamp Marks
Courtesy of NISSAN MOTOR CO., U.S.A.

NOTE: There are no identification marks indicating left and right for camshaft bracket (No. 1).

- Apply liquid gasket to mating surface of camshaft bracket (No. 1) as shown on bank 1 and bank 2.

a : 8.5 mm (0.335 in)
b : 2.0 mm
c : Clearance 5.0 mm (0.20 in)
d : ϕ 2.5 mm (0.098 in)
* : Apply liquid gasket to rear timing chain side

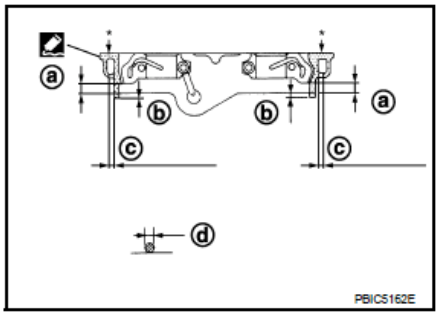


Fig. 183: Applying Liquid Gasket To Mating Surface Of Camshaft Bracket
Courtesy of NISSAN MOTOR CO., U.S.A.

Use Genuine RTV Silicone Sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCT AND SEALANT ".

- Apply liquid gasket to camshaft bracket (No. 1) contact surface on the rear timing chain case backside as shown on both bank 1 and bank 2.

Use Genuine RTV Silicone Sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCT AND SEALANT ".

CAUTION: For camshaft bracket (No. 1) near installation position, and install it without disturbing the liquid gasket applied to the surfaces.

1 : Rear timing chain case
a : ϕ3.9 mm (0.154 in)

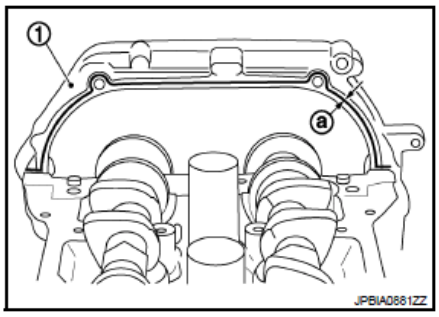


Fig. 184: Identifying Liquid Gasket Application Area
Courtesy of NISSAN MOTOR CO., U.S.A.

5. Tighten camshaft bracket bolts in the following steps, in numerical order as shown in the figure.
   a. Tighten No. 7 to 10 in numerical order as shown.

      1.96 N.m (0.2 kg-m, 1 ft-lb)

   b. Tighten No. 1 to 6 in numerical order as shown.

      1.96 N.m (0.2 kg-m, 1 ft-lb)

c. Tighten No. 1 to 10 in numerical order as shown.

5.88 N.m (0.6 kg-m, 4 ft-lb)

d. Tighten No. 1 to 10 in numerical order as shown.

10.4 N.m (1.1 kg-m, 8 ft-lb)

CAUTION: After tightening mounting bolts of camshaft brackets (No. 1), be sure to wipe off excessive liquid gasket from the parts list below.

- **Mating surface of rocker cover**
- **Mating surface of rear timing chain case**

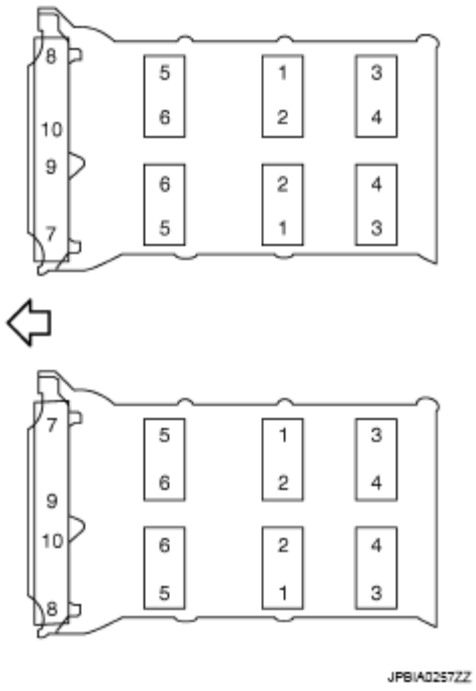


Fig. 185: Identifying Camshaft Bracket Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

6. Inspect and adjust the valve clearance. Refer to "**VALVE CLEARANCE**".
7. Install camshaft sensor bracket.
   - Tighten camshaft sensor bracket bolts in numerical order as shown in the figure.

NOTE: The order of tightening bolts is the same for bank 1 and bank 2.

⇦ : Engine front

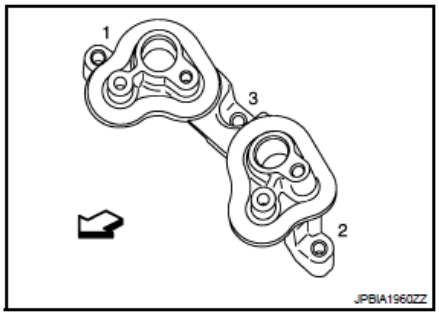


Fig. 186: Identifying Camshaft Sensor Bracket Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

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

INSPECTION AFTER INSTALLATION

Inspection of Camshaft Sprocket (INT) Oil Groove

CAUTION:

- **Perform this inspection only when DTC P0011 or P0021 are detected in self-diagnostic results of CONSULT-III and it is directed according to inspection procedure of appropriate Engine Control article. Refer to "DIAGNOSIS DESCRIPTION ".**
- **Check when engine is cold so as to prevent burns from any splashing engine oil.**

1. Check the engine oil level. Refer to "**INSPECTION** ".
2. Perform the following procedure so as to prevent the engine from being unintentionally started while checking.
   a. Release fuel pressure. Refer to "**INSPECTION** ".
   b. Disconnect ignition coil and injector harness connectors.
3. Remove intake valve timing control solenoid valve. Refer to "**COMPONENT**".
4. Crank the engine, and then check that engine oil comes out from valve timing control solenoid valve hole (A). End crank after checking.

1 : Valve timing control solenoid valve
⇦ : Engine front

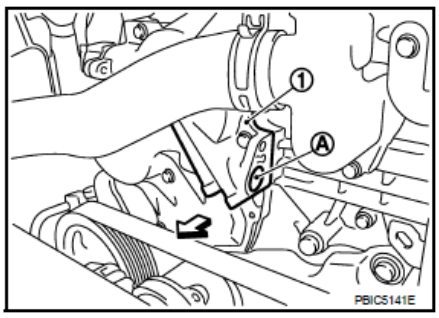


Fig. 187: Identifying Valve Timing Control Solenoid Valve
Courtesy of NISSAN MOTOR CO., U.S.A.

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

CAUTION: Engine oil may squirt from intake valve timing control solenoid valve installation hole during cranking. Use a shop cloth to prevent the engine components and the vehicle. Never allow engine oil to get on rubber components such as drive belt or engine mount insulators. Immediately wipe off any splashed engine oil.

- Clean oil groove between oil strainer and intake valve timing control solenoid valve if engine oil does not come out from valve timing control solenoid valve hole. Refer to "**LUBRICATION CIRCUIT** ".

5. Remove components between intake valve timing control solenoid valve and camshaft sprocket (INT), and then check each oil groove for clogging.
   - Clean oil groove if necessary. Refer to "**LUBRICATION CIRCUIT** ".
6. After inspection, install removed parts.

Inspection for Leakage

The following are procedures for checking fluids leakage, lubricates leakage, and exhaust gases leakage.

- Before starting engine, check oil/fluid levels including engine coolant and engine oil. If less than required quantity, fill to the specified level. Refer to "**RECOMMENDED FLUIDS AND LUBRICANTS** ".
- Use procedure below to check for fuel leakage.
  - Turn ignition switch "ON" (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 timing chain tensioner drops after removal/installation, slack in the guide may generate a pounding noise during and just after engine start. However, this is normal. Noise will stop after hydraulic pressure rises.

- Warm up engine thoroughly to check there is no leakage of fuel, exhaust gases, 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 to the specified level, if necessary.

Summary of the inspection items:

INSPECTION CHART

Items	Before starting engine	Engine running	After engine stopped

Engine coolant	Level	Leakage	Level
Engine oil	Level	Leakage	Level
Other oils and fluid(1)	Level	Leakage	Level
Fuel	Leakage	Leakage	Leakage
Exhaust gases	-	Leakage	-
(1) Transmission/transaxle/CVT fluid, power steering fluid, brake fluid, etc.			

Valve Clearance

INSPECTION

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.

In cases of removing/installing or replacing camshaft and valve-related parts, or of unusual engine conditions due to changes in valve clearance (found malfunctions during stating, idling or causing noise), perform inspection as follows:

⇦ : Engine front

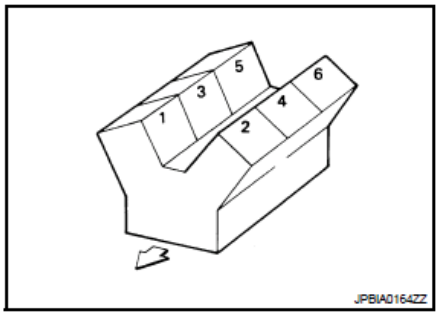


Fig. 188: Identifying Cylinder Block Number
Courtesy of NISSAN MOTOR CO., U.S.A.

1. Remove rocker covers (bank 1 and bank 2). Refer to **ROCKER COVER**.
2. Measure the valve clearance as follows:
    a. Set No. 1 cylinder at TDC of its compression stroke.
        - Rotate crankshaft pulley clockwise to align timing mark (grooved line without color) with timing indicator.

: Timing mark (grooved line without color)

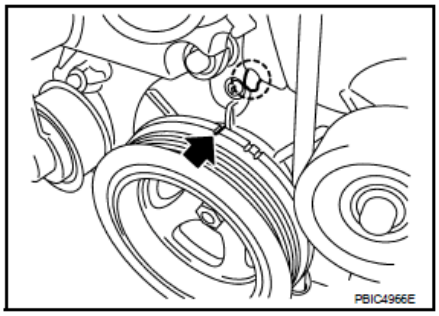


Fig. 189: Aligning Timing Mark (Grooved Line Without Color) With Timing Indicator
Courtesy of NISSAN MOTOR CO., U.S.A.

- Check that intake and exhaust cam nose on No. 1 cylinder (engine front side of bank 1) are located as shown in the figure.
- If not, turn crankshaft one revolution (360 degrees) and align as shown in the figure.

: Engine front

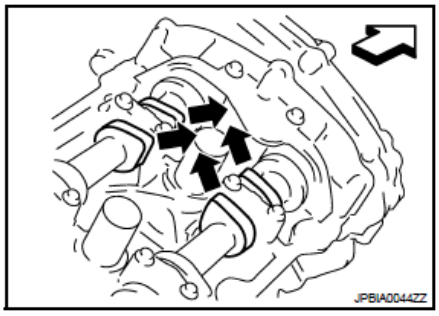


Fig. 190: Locating Intake And Exhaust Cam
Courtesy of NISSAN MOTOR CO., U.S.A.

b. Use a feeler gauge, measure the clearance between valve lifter and camshaft.

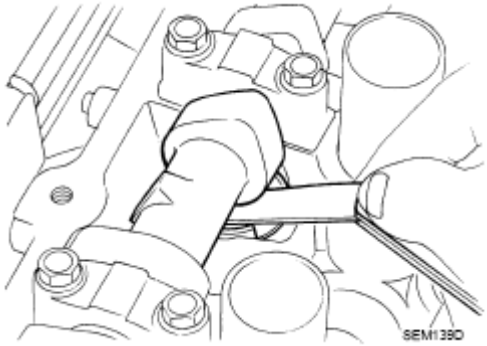


Fig. 191: Checking Clearance Between Valve Lifter And Camshaft
Courtesy of NISSAN MOTOR CO., U.S.A.

Valve clearance:

INTAKE AND EXHAUST VALVE REFERENCE

Unit: mm (in)		
Items	**Cold**	**Hot (1) (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)
(1) Approximately 80°C (176°F)		

- By referring to the figure, measure the valve clearances at locations marked "x" as shown in the table below (locations indicated in the figure).

⇦ : Engine front

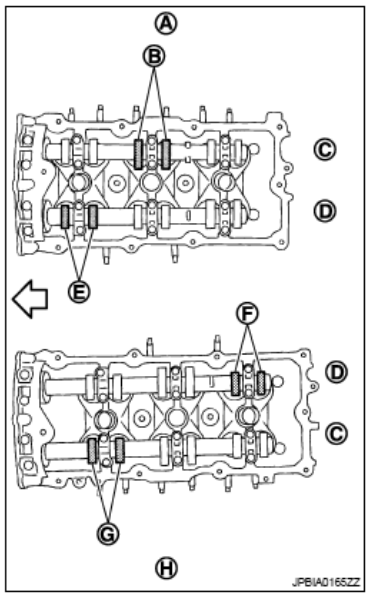


Fig. 192: Identifying Intake And Exhaust Valve Clearances
Courtesy of NISSAN MOTOR CO., U.S.A.

- No. 1 cylinder at compression TDC

INTAKE AND EXHAUST VALVE POSITION

Measuring position [bank 1 (A)]		No. 1 CYL.	No. 3 CYL.	No. 5 CYL.
No. 1 cylinder at compression TDC	EXH (C)		x (B)	
	INT (D)	x (E)		
Measuring position [bank 2 (H)]		No. 2 CYL.	No. 4 CYL.	No. 6 CYL.
No. 1 cylinder at compression TDC	INT (D)			x (F)
	EXH (C)	x (G)		

c. Rotate crankshaft by 240 degrees clockwise (when viewed from engine front) to align No. 3 cylinder at TDC of its compression stroke.

NOTE: Mark a position 240 degrees (b) from a corner of the hexagonal part of crankshaft pulley mounting bolt as shown in the figure. Use the

hexagonal part as a guide.

1 : Crankshaft pulley
A : Paint mark

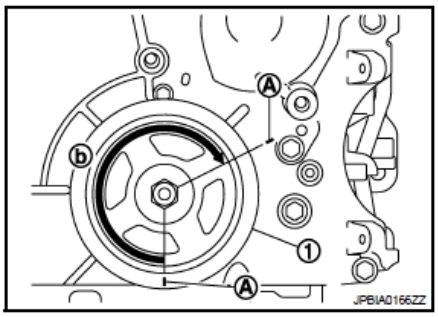


Fig. 193: Aligning No. 3 Cylinder At TDC Of Compression Stroke
Courtesy of NISSAN MOTOR CO., U.S.A.

- By referring to the figure, measure the valve clearances at locations marked "x" as shown in the table below (locations indicated in the figure).

⇦ : Engine front

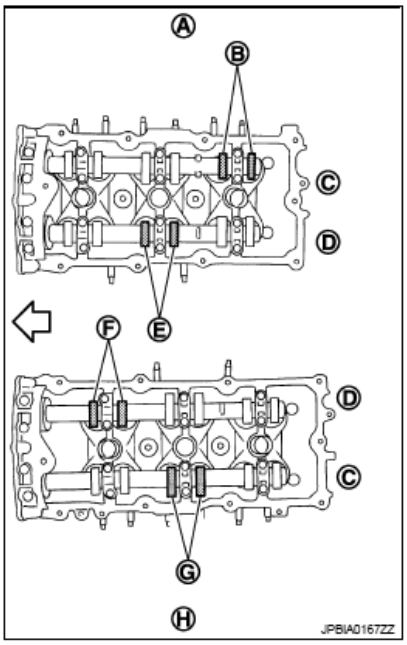


Fig. 194: Identifying Intake And Exhaust Valve Clearances
Courtesy of NISSAN MOTOR CO., U.S.A.

- No. 3 cylinder at compression TDC

INTAKE AND EXHAUST VALVE POSITION

Measuring position [bank 1 (A)]		No. 1 CYL.	No. 3 CYL.	No. 5 CYL.
No. 3 cylinder at compression TDC	EXH (C)			x (B)
	INT (D)		x (E)	
Measuring position [bank 2 (H)]		No. 2 CYL.	No. 4 CYL.	No. 6 CYL.

No. 3 cylinder at compression TDC	INT (D)	x (F)		
	EXH (C)		x (G)	

d. Rotate crankshaft by 240 degrees clockwise (when viewed from engine front) to align No. 5 cylinder at TDC of its compression stroke.

NOTE: Mark a position 240 degrees (b) from a corner of the hexagonal part of crankshaft pulley mounting bolt as shown in the figure. Use the hexagonal part as a guide.

1 : Crankshaft pulley
A : Paint mark

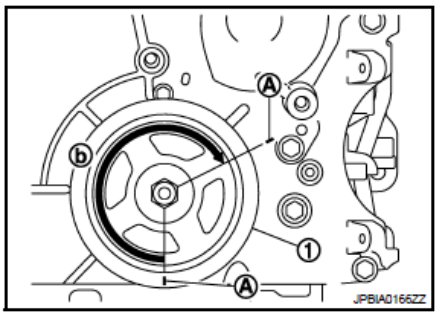


Fig. 195: Aligning No. 5 Cylinder At TDC Of Compression Stroke
Courtesy of NISSAN MOTOR CO., U.S.A.

- By referring to the figure, measure the valve clearances at locations marked "x" as shown in the table below (locations indicated in the figure).

⇦ : Engine front

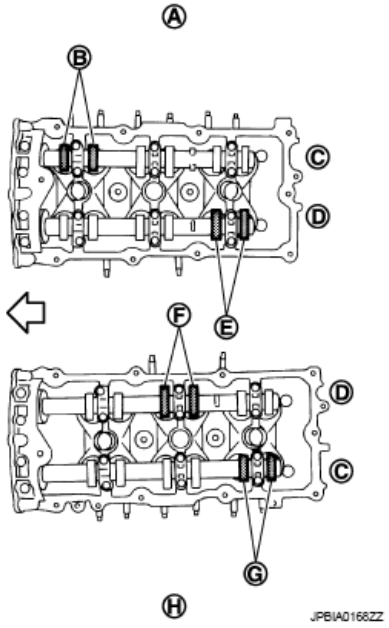


Fig. 196: Identifying Intake And Exhaust Valve Clearances
Courtesy of NISSAN MOTOR CO., U.S.A.

- No. 5 cylinder at compression TDC

INTAKE AND EXHAUST VALVE POSITION

Measuring position [bank 1 (A)]		No. 1 CYL.	No. 3 CYL.	No. 5 CYL.
No. 5 cylinder at compression TDC	EXH (C)	x (B)		
	INT (D)			x (E)
Measuring position [bank 2 (H)]		No. 2 CYL.	No. 4 CYL.	No. 6 CYL.
No. 5 cylinder at compression TDC	INT (D)		x (F)	
	EXH (C)			x (G)

3. If the measured values are out of the standard, perform adjustment. Refer to "**ADJUSTMENT**".

ADJUSTMENT

- Perform adjustment depending on selected head thickness of valve lifter.

1. Measure the valve clearance. Refer to "**INSPECTION**".
2. Remove camshaft. Refer to "**COMPONENT**".
3. Remove valve lifters at the locations that are out of the standard.
4. Measure the center thickness of removed valve lifters with a micrometer (A).

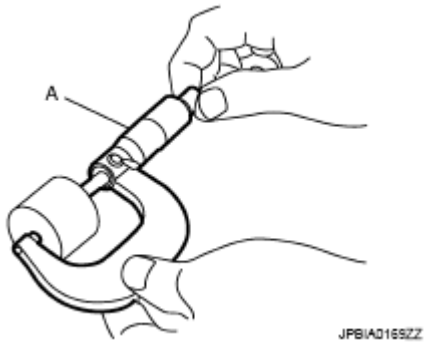


Fig. 197: Measuring Center Thickness Of Valve Lifters
Courtesy of NISSAN MOTOR CO., U.S.A.

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

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

t = Valve lifter thickness to be replaced

t1 = Removed valve lifter thickness

C1 = Measured valve clearance

C2 = Standard valve clearance:

Intake : 0.30 mm (0.012 in)*

Exhaust : 0.33 mm (0.013 in)*

***: Approximately 20°C (68°F)**

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

  Stamp mark 788 indicates 7.88 mm (0.3102 in) in thickness.

A : Stamp
B : Thickness of valve lifter

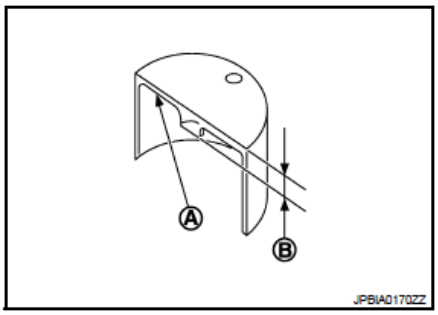


Fig. 198: Identifying Valve Lifter Thickness
Courtesy of NISSAN MOTOR CO., U.S.A.

Available thickness of valve lifter: 27 sizes with range 7.88 to 8.40 mm (0.3102 to 0.3307 in) in steps of 0.02 mm (0.0008 in) (when manufactured at factory). Refer to "**STANDARD AND LIMIT**".

6. Install selected valve lifter.
7. Install camshaft. Refer to "**COMPONENT**".
8. Manually turn crankshaft pulley a few turns.
9. Check that the valve clearances for cold engine are within the specifications by referring to the specified values. Refer to "**INSPECTION**".
10. Install all removal parts in the reverse order of removal. Refer to "**COMPONENT**".
11. Warm up the engine, and check for unusual noise and vibration.

OIL SEAL

Removal and Installation of Valve Oil Seal

REMOVAL

1. Remove camshaft relating to valve oil seal to be removed. Refer to **CAMSHAFT**.
2. Remove valve lifters. Refer to **CAMSHAFT**.
3. Turn crankshaft until the cylinder requiring new oil seals is at TDC. This will prevent valve from dropping into cylinder.

4. Remove valve collet.
   - Compress valve spring with valve spring compressor [SST: KV10116200 (J26336-A)] (A), attachment [SST: KV10115900 (J26336-20)] (C), adapter [SST: KV10109220 (-)] (B). Remove valve collet with magnet hand.

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

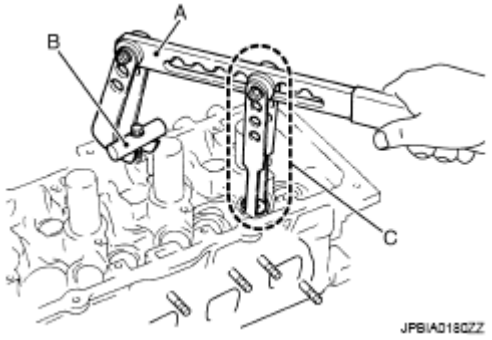


Fig. 199: Compressing Valve Spring Using Valve Spring Compressor
Courtesy of NISSAN MOTOR CO., U.S.A.

5. Remove valve spring retainer, valve spring and valve spring seat.
6. Remove valve oil seal using valve oil seal puller [SST: KV10107902 (J38959)] (A).

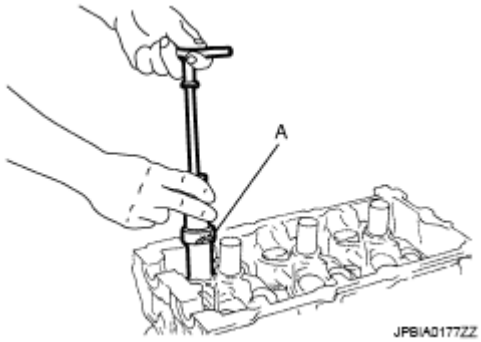


Fig. 200: Using Valve Oil Seal Puller To Remove Valve Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

1. Apply engine oil on new valve oil seal joint and seal lip.
2. Using valve oil seal drift [SST: KV10115600 (J38958)] (A), press fit valve oil seal to height (b) shown in the figure.

NOTE: Dimension: Height measured before valve spring seat installation

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

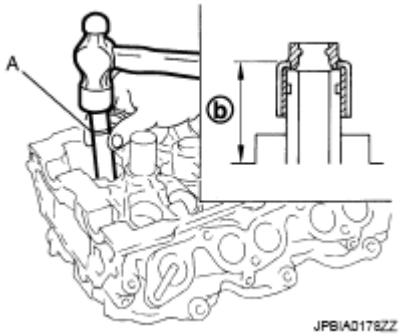


Fig. 201: Pressing Valve Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

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

Removal and Installation of Front Oil Seal

REMOVAL

1. Remove the following parts:
   - Front engine undercover
   - Drive belt: Refer to **DRIVE BELT**.
   - Radiator cooling fan assembly: Refer to "**COMPONENT** ".
   - Crankshaft pulley: Refer to **TIMING CHAIN**.
2. Remove front oil seal using suitable tool.

CAUTION: Be careful not to damage front timing chain case and crankshaft.

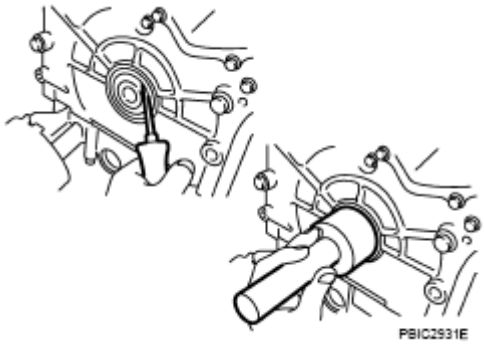


Fig. 202: Fitting Front Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

1. Apply engine oil to both oil seal lip and dust seal lip of new front oil seal.
2. Install front oil seal.
   - Install front oil seal so that each seal lip is oriented as shown in the figure.

A : Oil seal lip
B : Dust seal lip
⇦ : Engine inside
⬅ : Engine outside

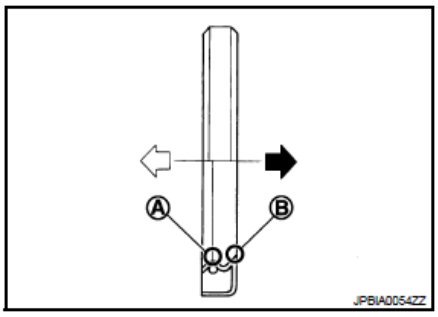


Fig. 203: Applying Engine Oil To Both Oil Seal Lip And Dust Seal Lip Of Front Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

   - Using suitable drift, press-fit until the height of front oil seal is level with the mounting surface.
     - Suitable drift: outer diameter 60 mm (2.36 in), inner diameter 50 mm (1.97 in).

CAUTION:
- **Be careful not to damage front timing chain case and crankshaft.**
- **Press-fit straight and avoid causing burrs or tilting oil seal.**

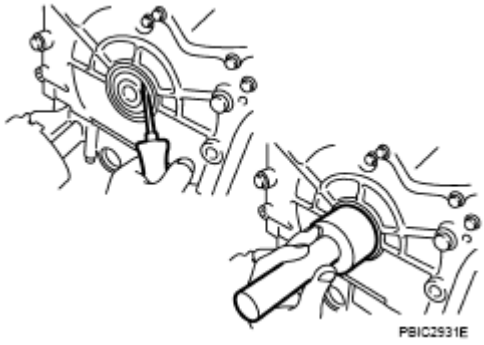


Fig. 204: Fitting Front Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

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

Removal and Installation of Rear Oil Seal

REMOVAL

1. Remove transmission assembly. Refer to "**REMOVAL AND INSTALLATION (2WD MODELS)** " or "**REMOVAL AND INSTALLATION (AWD MODELS)** ", "**EXPLODED VIEW** ".
2. Remove drive plate. Refer to **CYLINDER BLOCK**.

3. Remove rear oil seal with a suitable tool.

CAUTION: Be careful not to damage crankshaft and cylinder block.

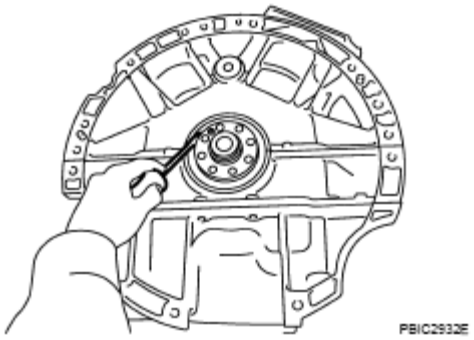


Fig. 205: Removing Rear Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

1. Apply new engine oil to new rear oil seal joint surface and seal lip.
2. Install rear oil seal so that each seal lip is oriented as shown in the figure.

A : Oil seal lip
B : Dust seal lip
⇦ : Engine inside
⬅ : Engine outside

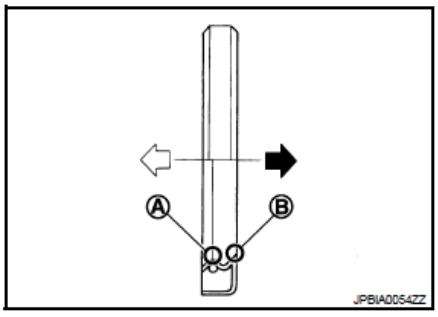


Fig. 206: Installing Front Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

- Press in rear oil seal (1) to the position as shown in the figure.

B : Cylinder block rear end face
a : 0 - 0.5 mm (0 - 0.020 in)

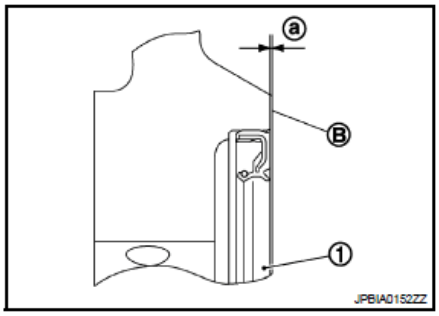


Fig. 207: Pressing Rear Oil Seal To Position
Courtesy of NISSAN MOTOR CO., U.S.A.

- Using suitable drift (A), press-fit until the height of front oil seal is level with the mounting surface.
  - Suitable drift: outer diameter 100 mm (3.94 in), inner diameter 85 mm (3.35 in).

CAUTION:
- **Be careful not to damage crankshaft and cylinder block.**
- **Press-fit oil seal straight to avoid causing burrs or tilting.**

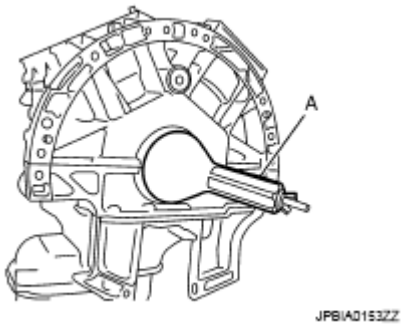


Fig. 208: Installing Rear Oil Seal Using Drift
Courtesy of NISSAN MOTOR CO., U.S.A.

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

CYLINDER HEAD

On-Vehicle Service

CHECKING COMPRESSION PRESSURE

1. Warm up engine thoroughly. Then, stop it.
2. Release fuel pressure. Refer to "**INSPECTION** ".
3. Disconnect fuel pump fuse (1) from IPDM E/R (2) to avoid fuel injection during measurement.

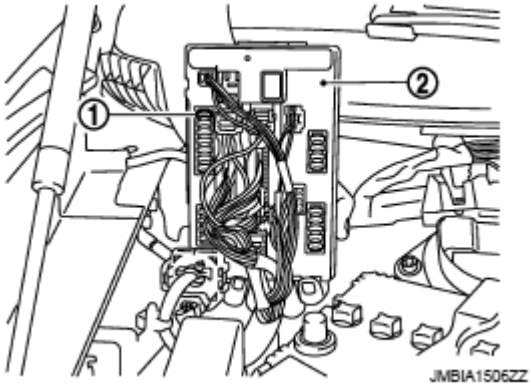


Fig. 209: Identifying Fuel Pump Fuse And IPDM E/R
Courtesy of NISSAN MOTOR CO., U.S.A.

4. Remove engine cover with power tool. Refer to "**REMOVAL AND INSTALLATION**".
5. Remove ignition coil and spark plug from each cylinder. Refer to **IGNITION COIL** and **SPARK PLUG (IRIDIUM-TIPPED TYPE)**.
6. Connect engine tachometer (not required in use of CONSULT-III).
7. Install compression tester (commercial service tool) with adapter onto spark plug hole.

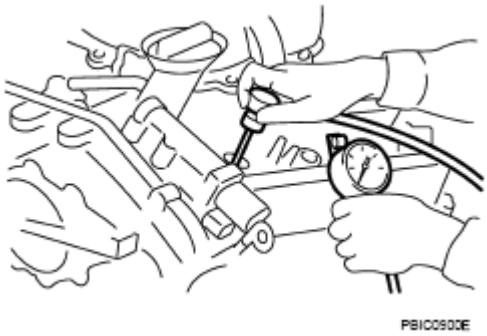


Fig. 210: Installing Compression Gauge With Adapter Onto Spark Plug Hole
Courtesy of NISSAN MOTOR CO., U.S.A.

- Use the adapter 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.

a : 20 mm (0.79 in)

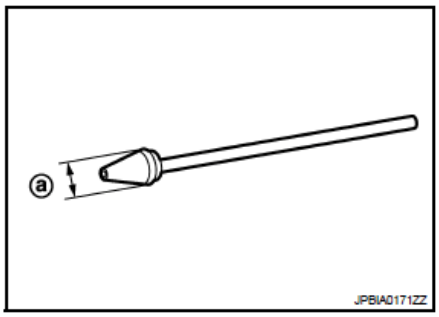


Fig. 211: Identifying Adapter Dimension
Courtesy of NISSAN MOTOR CO., U.S.A.

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

   Compression pressure:

COMPRESSION PRESSURE SPECIFICATION

Unit: kPa (kg/cm^2 , psi)/rpm		
Standard	**Minimum**	**Differential limit between cylinders**
1,275 (13.0, 185)/300	981 (10.0, 142)/300	98 (1.0, 14)/300

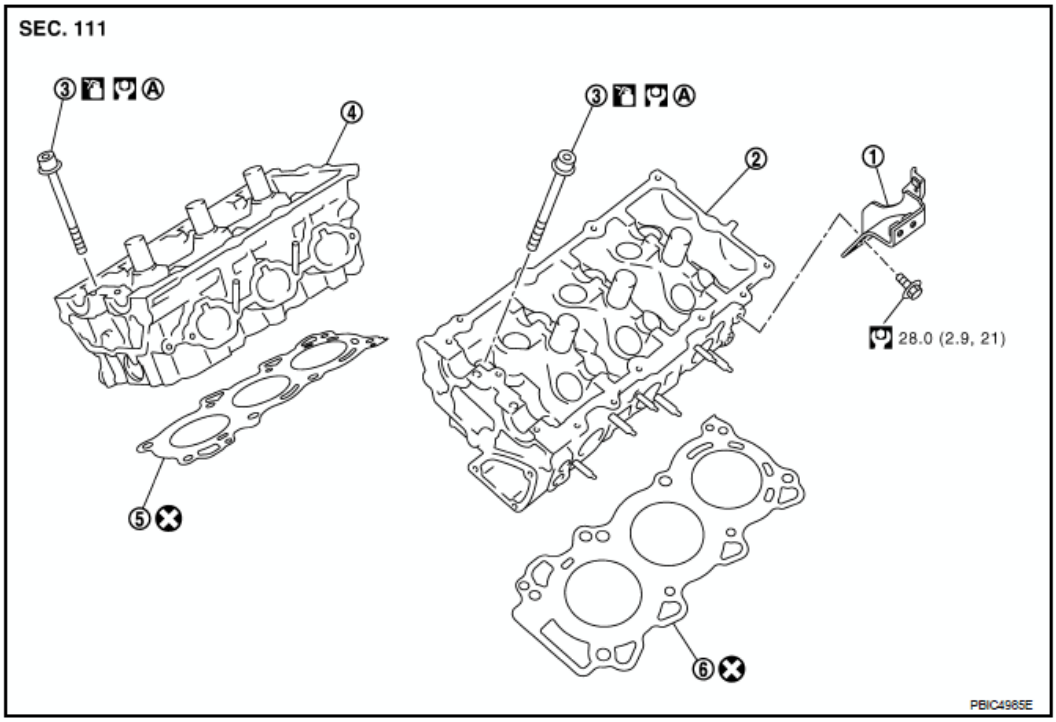
CAUTION: Always use a fully charged battery to obtain specified engine speed.

- If the engine speed is out of specified range, check battery liquid for proper gravity. Check engine speed again with normal battery gravity.
- 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 recheck it for compression.
  - If the added engine oil improves the compression, piston rings may be worn out or damaged. Check the piston rings and replace if necessary.
  - If the compression pressure remains at low level despite the addition of engine oil, valves may be malfunctioning. Check valves for damage. Replace valve or valve seat accordingly.
- If two adjacent cylinders have respectively low compression pressure and their compression remains low even after the addition of engine oil, cylinder head gaskets are leaking. In such a case, replace cylinder head gaskets.

9. After inspection is completed, install removed parts.
10. Start engine, and check that engine runs smoothly.
11. Perform trouble diagnosis. If DTC appears, erase it. Refer to "**DESCRIPTION** ".

Component

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.



1. Engine rear lower slinger
2. Cylinder head (bank 2)
3. Cylinder head bolt
4. Cylinder head (bank 1)
5. Cylinder head gasket (bank 1)
6. Cylinder head gasket (bank 2)

Refer to On-Vehicle Service in CYLINDER HEAD

Fig. 212: Identifying Cylinder Block Components With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to "**COMPONENT** " for symbols in the figure.

Removal and Installation

REMOVAL

1. Remove engine assembly from vehicle, and separate front suspension member and transmission from engine. Refer to "**2WD : COMPONENT**" (2WD models) or "**AWD : COMPONENT**" (AWD models).
2. Remove the following parts:
   - Fuel tube and fuel injector assembly: Refer to **FUEL INJECTOR AND FUEL TUBE**.
   - Intake manifold: Refer to **INTAKE MANIFOLD**.
   - Exhaust manifold: Refer to **EXHAUST MANIFOLD AND THREE WAY CATALYST**.
   - Water inlet and thermostat assembly: Refer to "**COMPONENT** ".
   - Water outlet and water pipe: Refer to "**COMPONENT** ".
   - Front and rear timing chain case: Refer to **REMOVAL AND INSTALLATION**.

3. Remove camshaft (INT and EXH). Refer to **CAMSHAFT**.
4. Remove cylinder head bolts in reverse order as shown in the figure with cylinder head bolt wrench (commercial service tool).

A : Bank 1
B : Bank 2
⇦ : Engine front

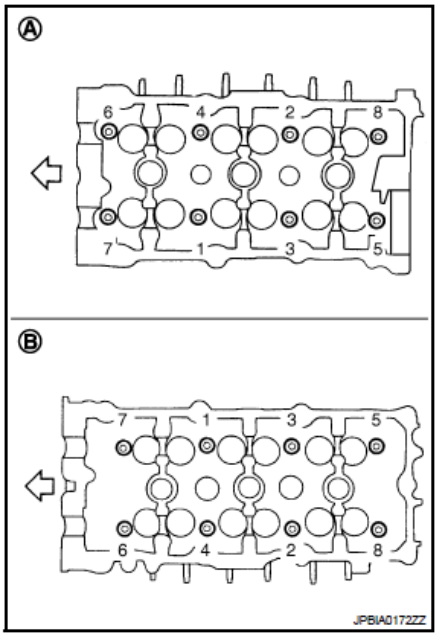


Fig. 213: Identifying Cylinder Head Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

5. Remove cylinder head gaskets.

INSPECTION AFTER REMOVAL

Cylinder Head Bolts Outer Diameter

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

A : Measurement point
e : 48 mm (1.89 in)
d : 11 mm (0.43 in)

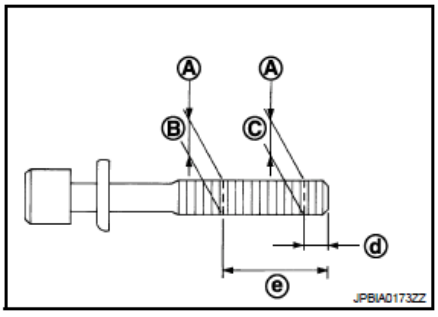


Fig. 214: Identifying Cylinder Head Bolts Outer Diameter
Courtesy of NISSAN MOTOR CO., U.S.A.

Limit (C - B) : 0.18 mm (0.0071 in)

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

Cylinder Head Distortion

NOTE: When performing this inspection, cylinder block distortion should be also checked. Refer to "INSPECTION AFTER DISASSEMBLY".

1. Using 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.

2. 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 : 0.1 mm (0.004 in)

- If it exceeds the limit, replace cylinder head.

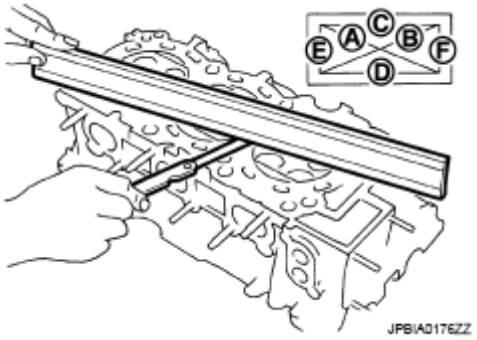


Fig. 215: Checking Cylinder Head Surface
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

1. Install new cylinder head gaskets.
2. Turn crankshaft until No. 1 piston is set at TDC.
   - Crankshaft key (1) should line up with the bank 1 cylinder center line as shown in the figure.

⇦: Bank 1 side

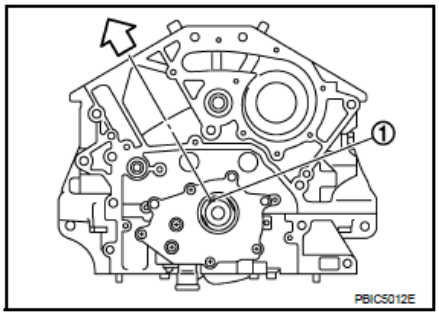


Fig. 216: Identifying Crankshaft Key
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Install cylinder head follow the steps below to tighten cylinder head bolts in numerical order as shown in the figure.

CAUTION: If cylinder head bolts reused, check their outer diameters before installation. Refer to "CYLINDER HEAD BOLTS OUTER DIAMETER".

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

105 N.m (11 kg-m, 77 ft-lb)

c. Completely loosen all cylinder head bolts.

0 N.m (0 kg-m, 0 ft-lb)

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

d. Tighten all cylinder head bolts.

40.0 N.m (4.1 kg-m, 30 ft-lb)

e. Turn all bolts 95 degrees clockwise (angle tightening).

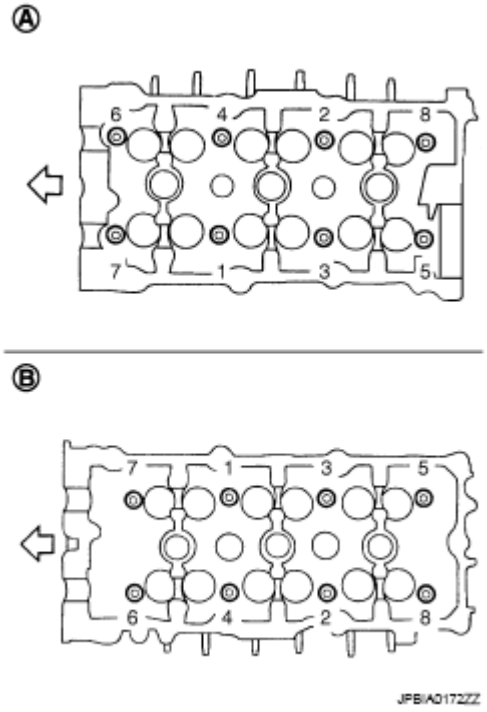


Fig. 217: Identifying Cylinder Head Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: Check the tightening angle by using angle wrench [SST: KV10112100 (BT8653-A)] (A). Avoid judgment by visual inspection without tool.

- Check tightening angle indicated on angle wrench (SST) indicator plate.

f. Turn all bolts 95 degrees clockwise again (angle tightening).

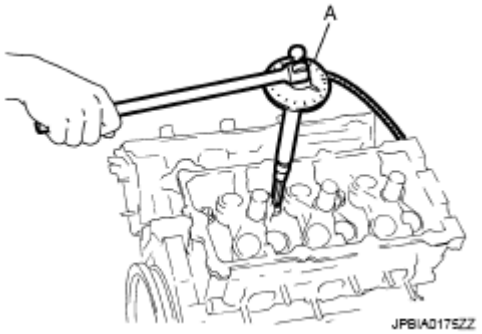


Fig. 218: Checking Cylinder Head Tightening Angle
Courtesy of NISSAN MOTOR CO., U.S.A.

4. 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 the measured value is out of the standard, reinstall cylinder head.

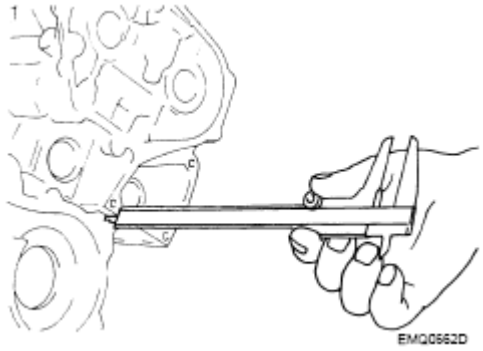


Fig. 219: Measuring Distance Between Front End Faces Of Cylinder Block And Cylinder Head
Courtesy of NISSAN MOTOR CO., U.S.A.

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

INSPECTION AFTER INSTALLATION

Inspection for Leakage

The following are procedures for checking fluids leakage, lubricates leakage, and exhaust gases leakage.

- Before starting engine, check oil/fluid levels including engine coolant and engine oil. If less than required quantity, fill to the specified level. Refer to "**RECOMMENDED FLUIDS AND LUBRICANTS** ".
- Use procedure below to check for fuel leakage.
  - Turn ignition switch "ON" (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.
- Warm up engine thoroughly to check there is no leakage of fuel, exhaust gases, 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 to the specified level, if necessary.

Summary of the inspection items:

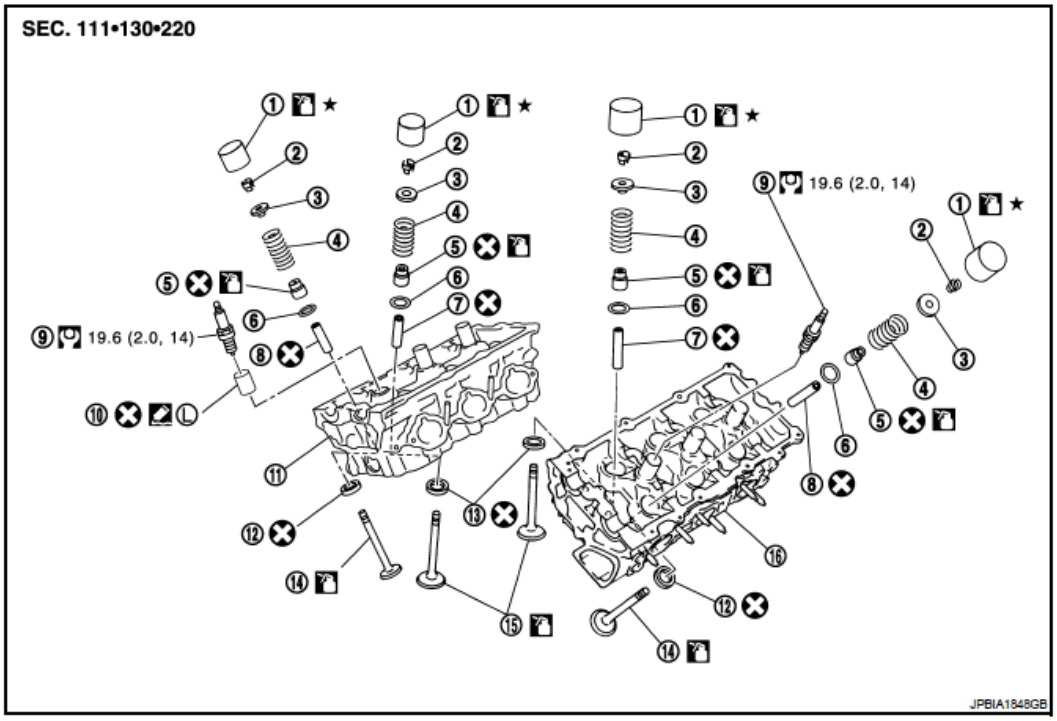
INSPECTION CHART

Items	Before starting engine	Engine running	After engine stopped
Engine coolant	Level	Leakage	Level

Engine oil	Level	Leakage	Level
Other oils and fluid(1)	Level	Leakage	Level
Fuel	Leakage	Leakage	Leakage
Exhaust gases	-	Leakage	-
(1) Transmission/transaxle/CVT fluid, power steering fluid, brake fluid, etc.			

Disassembly and Assembly

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.



1. Valve lifter
2. Valve collet
3. Valve spring retainer
4. Valve spring
5. Valve oil seal
6. Valve spring seat
7. Valve guide (INT)
8. Valve guide (EXH)
9. Spark plug
10. Spark plug tube
11. Cylinder head (bank 1)
12. Valve seat (EXH)
13. Valve seat (INT)
14. Valve (EXH)
15. Valve (INT)
16. Cylinder head (bank 2)

Fig. 220: Disassembled View Of Cylinder Block With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to "**COMPONENT** " for symbols in the figure.

DISASSEMBLY

1. Remove spark plug with spark plug wrench (commercial service tool).
2. Remove valve lifter.
   - Identify installation positions, and store them without mixing them up.
3. Remove valve collet.
   - Compress valve spring with valve spring compressor [SST: KV10116200 (J26336-A)] (A), attachment [SST: KV10115900 (J26336-20)] (C) and adapter [SST: KV10109220 (-)] (B). Remove valve collet with magnet hand.

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

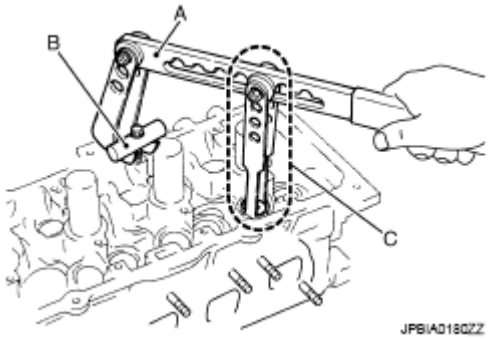


Fig. 221: Compressing Valve Spring Using Valve Spring Compressor
Courtesy of NISSAN MOTOR CO., U.S.A.

4. Remove valve spring retainer, valve spring and valve spring seat.
5. Push valve stem to combustion chamber side, and remove valve.
   - Identify installation positions, and store them without mixing them up.
6. Remove valve oil seals using valve oil seal puller [SST: KV10107902 (J38959)] (A).

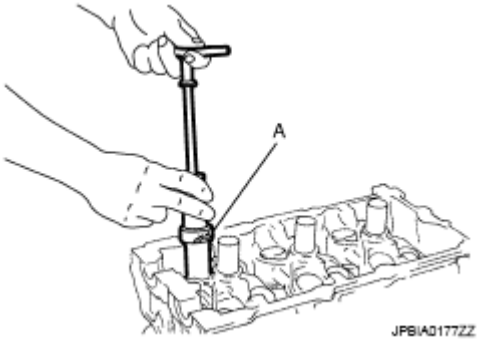


Fig. 222: Using Valve Oil Seal Puller To Remove Valve Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

7. If valve seat must be replaced, refer to "**INSPECTION AFTER DISASSEMBLY**".

8. If valve guide must be replaced, refer to "**INSPECTION AFTER DISASSEMBLY**".
9. Remove spark plug tube, if necessary.
    - Using pair of pliers, pull spark plug tube out of cylinder head.

CAUTION:
- **Take care not to damage cylinder head.**
- **Once removed, spark plug tube will be deformed and cannot be reused. Never remove it unless absolutely necessary.**

ASSEMBLY

1. When valve guide is removed, install it. Refer to "**INSPECTION AFTER DISASSEMBLY**".
2. When valve seat is removed, install it. Refer to "**INSPECTION AFTER DISASSEMBLY**".
3. Install valve oil seals.
    - Install with valve oil seal drift [SST: KV10115600 (J38958)] (A) to match dimension in the figure.

    Height (b) (Without valve spring seat installed)

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

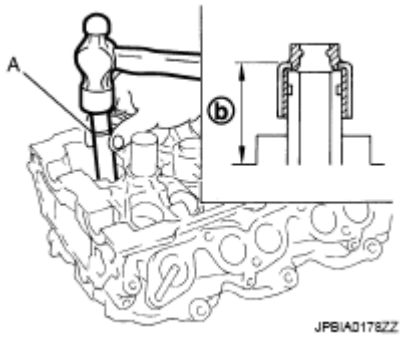


Fig. 223: Pressing Valve Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

4. Install valve spring seat.
5. Install valves.

NOTE: **Larger diameter valves are for intake side.**

6. 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

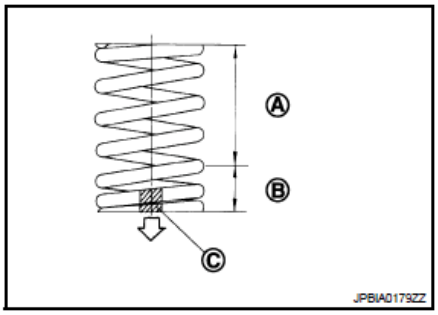


Fig. 224: Identifying Valve Spring Diameter
Courtesy of NISSAN MOTOR CO., U.S.A.

Paint mark color : Yellowish green

7. Install valve spring retainer.
8. Install valve collet.
   - Compress valve spring with valve spring compressor [SST: KV10116200 (J26336-A)] (A), attachment [SST: KV10115900 (J26336-20)] (C) and adapter [SST: KV10109220 (-)] (B). Install valve collet with 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.

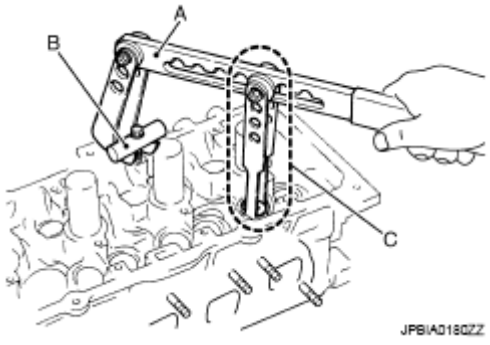


Fig. 225: Compressing Valve Spring Using Valve Spring Compressor
Courtesy of NISSAN MOTOR CO., U.S.A.

9. Install valve lifter.
   - Install it in the original position.
10. Install spark plug tube.
   - Press-fit spark plug tube as follows:
     a. Remove old liquid gasket adhering to 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 high strength thread locking sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCT AND SEALANT ".

c. Using drift, press-fit spark plug tube so that its height (A) is as specified in the figure.

Standard press-fit height

: 37.7 - 38.7 mm (1.484 - 1.524 in)

CAUTION:

- **When press-fitting, take care not to deform spark plug**
- **After press-fitting, wipe off liquid gasket protruding on upper face.**

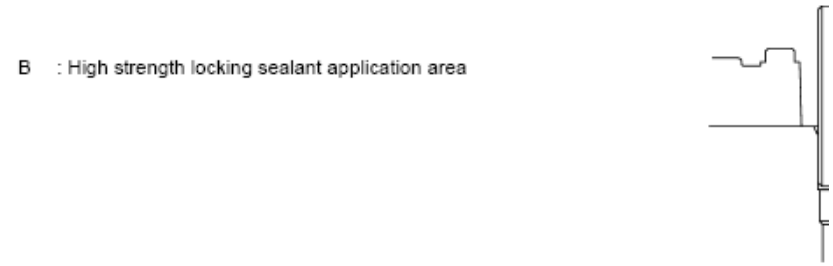


Fig. 226: Identifying High Strength Thread Locking Sea
Courtesy of NISSAN MOTOR CO., U.S.A.

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

Inspection After Disassembly

VALVE DIMENSIONS

- Check dimensions of each valve. For dimensions, refer to "**STANDARD AND LIMIT**".
- If dimensions are out of the standard, replace valve and check valve seat contact. Refer to "**VALVE SEAT CONTACT**".

VALVE GUIDE CLEARANCE

Valve Stem Diameter

Measure diameter of valve stem with micrometer (A).

Standard

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

Exhaust : 5.962 - 5.970 mm (0.2347 - 0.2350 in)

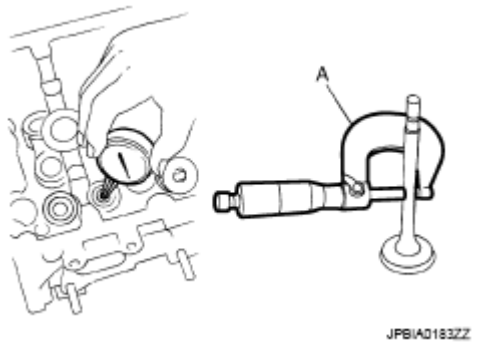


Fig. 227: Measuring Inner Diameter Of Valve Guide
Courtesy of NISSAN MOTOR CO., U.S.A.

Valve Guide Inner Diameter

Measure inner diameter of valve guide with inside micrometer.

Standard

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

Valve Guide Clearance

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

Valve guide clearance:

Standard

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

Exhaust : 0.030 - 0.056 mm (0.0012 - 0.0022 in)

Limit

Intake : 0.08 mm (0.0031 in)

Exhaust : 0.09 mm (0.0035 in)

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

VALVE GUIDE REPLACEMENT

When valve guide is removed, replace with Oversize (Service) [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 (A).

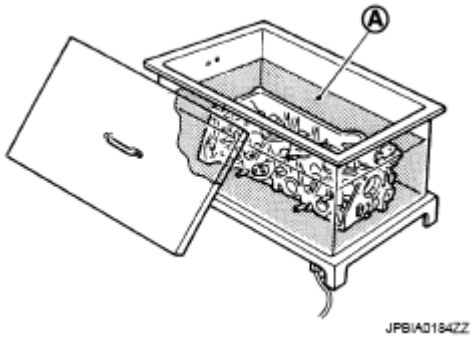


Fig. 228: Heating Cylinder Head
Courtesy of NISSAN MOTOR CO., U.S.A.

2. Drive out valve guide with a press [under a 20 kN (2 ton, 2.2 US ton, 2.0 lmp ton) pressure] or hammer and suitable tool.

WARNING: Cylinder head contains heat. When working, wear protective equipment to avoid getting burned.

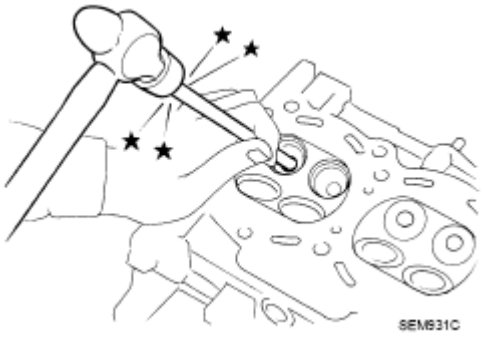


Fig. 229: Driving Out Valve Guide
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Using valve guide reamer (commercial service tool) (A), 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)

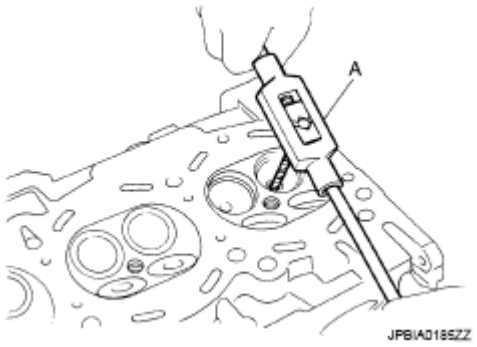


Fig. 230: Reaming Cylinder Head Valve Guide (EXH) Hole
Courtesy of NISSAN MOTOR CO., U.S.A.

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

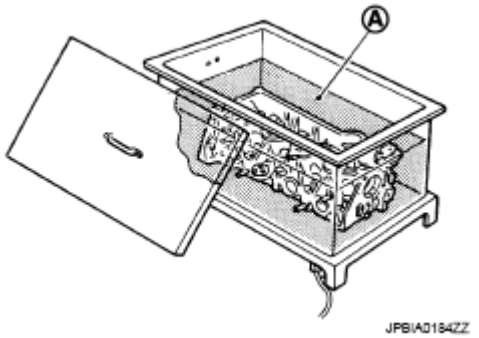


Fig. 231: Heating Cylinder Head
Courtesy of NISSAN MOTOR CO., U.S.A.

5. Using valve guide drift (commercial service tool), press valve guide from camshaft side to the dimensions as in the figure.

Projection "L"

Intake and exhaust

: 12.6 - 12.8 mm (0.496 - 0.504 in)

WARNING: Cylinder head contains heat. When working, wear protective equipment to avoid getting burned.

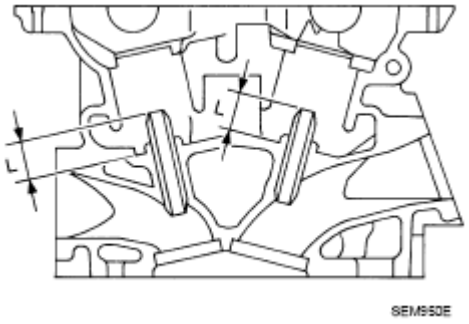


Fig. 232: Identifying Valve Guide Dimensions
Courtesy of NISSAN MOTOR CO., U.S.A.

6. Using valve guide reamer (commercial service tool) (A), apply reamer finish to valve guide.

   Standard:

   Intake and exhaust

   : 6.000 - 6.018 mm (0.2362 - 0.2369 in)

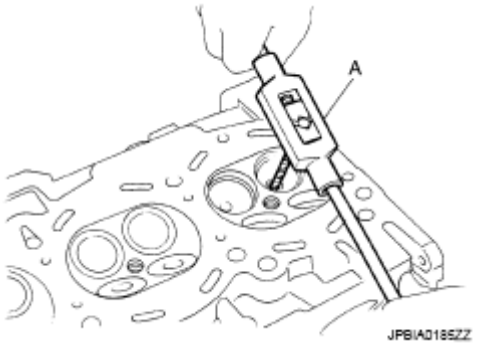


Fig. 233: Reaming Cylinder Head Valve Guide (EXH) Hole
Courtesy of NISSAN MOTOR CO., U.S.A.

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.
- If not, grind to adjust valve fitting and check again. If the contacting surface still has "NG" conditions (B) even after the recheck, replace valve seat. Refer to "**VALVE SEAT REPLACEMENT**".

A : OK

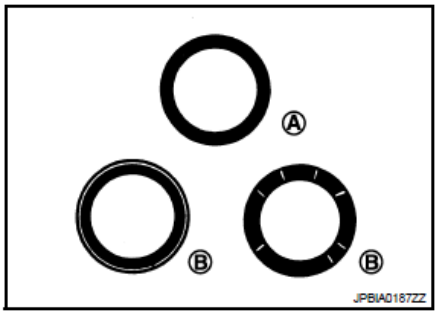


Fig. 234: Identifying Valve Condition
Courtesy of NISSAN MOTOR CO., U.S.A.

VALVE SEAT REPLACEMENT

When valve seat is removed, replace with Oversize (Service) [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 cylinder head. Set the machine depth stop to ensure this. Refer to "**STANDARD AND LIMIT**".

CAUTION: Prevent to scratch cylinder head by excessive boring.

2. Ream cylinder head recess diameter (a) for service valve seat.

   Oversize (Service) [0.5 mm (0.020 in)]

   Intake : 38.500 - 38.516 mm (1.5157 - 1.5164 in)

   Exhaust : 32.100 - 32.116 mm (1.2638 - 1.2644 in)

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

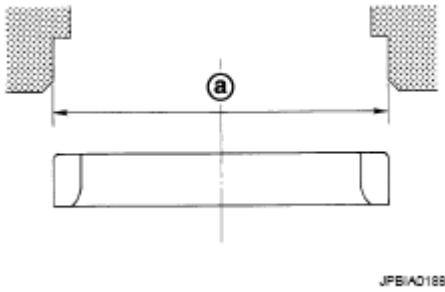


Fig. 235: Identifying Cylinder Head Diameter
Courtesy of NISSAN MOTOR CO., U.S.A.

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

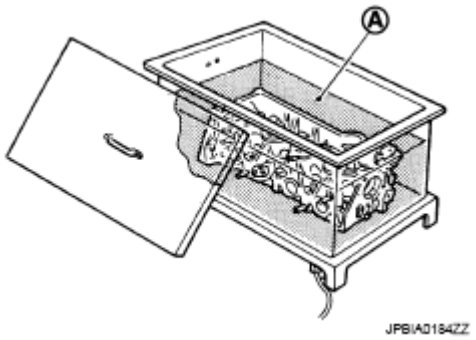


Fig. 236: Heating Cylinder Head
Courtesy of NISSAN MOTOR CO., U.S.A.

4. Provide valve seats cooled well with dry ice. Force fit valve seat into cylinder head.

WARNING:
- **Avoid directly touching cold valve seats.**
- **Cylinder head contains heat. When working, wear protective equipment to avoid getting burned.**

5. Using valve seat cutter set (commercial service tool) or valve seat grinder, finish seat to the specified dimensions. Refer to "**STANDARD AND LIMIT**".

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

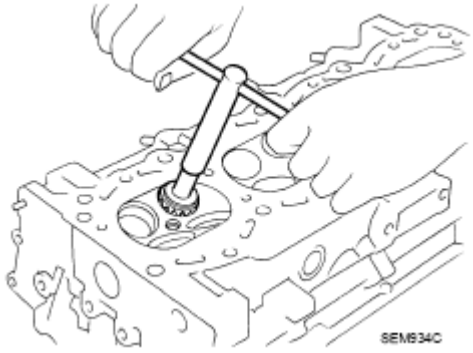


Fig. 237: Cutting Valve Seat
Courtesy of NISSAN MOTOR CO., U.S.A.

6. Using compound, grind to adjust valve fitting.
7. Check again for normal contact. Refer to "**VALVE SEAT CONTACT**".

VALVE SPRING SQUARENESS

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

  Limit : 1.9 mm (0.075 in)

- If it exceeds the limit, replace valve spring.

B : Contact

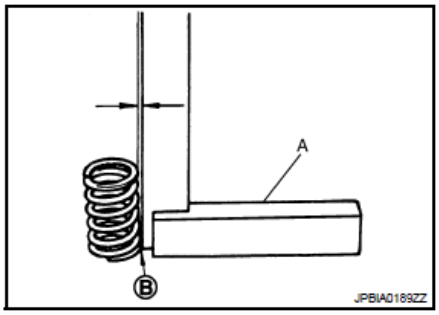


Fig. 238: Measuring Maximum Clearance Between Top Of Spring And Try Square
Courtesy of NISSAN MOTOR CO., U.S.A.

VALVE SPRING DIMENSIONS AND VALVE SPRING PRESSURE LOAD

- Check valve spring pressure at specified spring height.

  Standard:

  Intake and exhaust

  Free height : 43.85 mm (1.7264 in)

  Installation height : 37.00 mm (1.4567 in)

  Installation load : 166 - 188 N (16.9 - 19.2 kg, 37 - 42 lb)

  Height during valve open : 26.8 mm (1.055 in)

  Load with valve open : 502 - 566 N (51.2 - 57.7 kg, 113 - 127 lb)

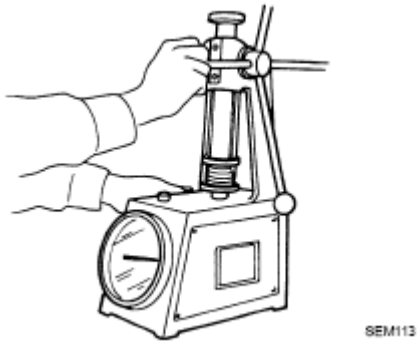


Fig. 239: Checking Valve Spring Dimensions And Valve Spring Pressure Load
Courtesy of NISSAN MOTOR CO., U.S.A.

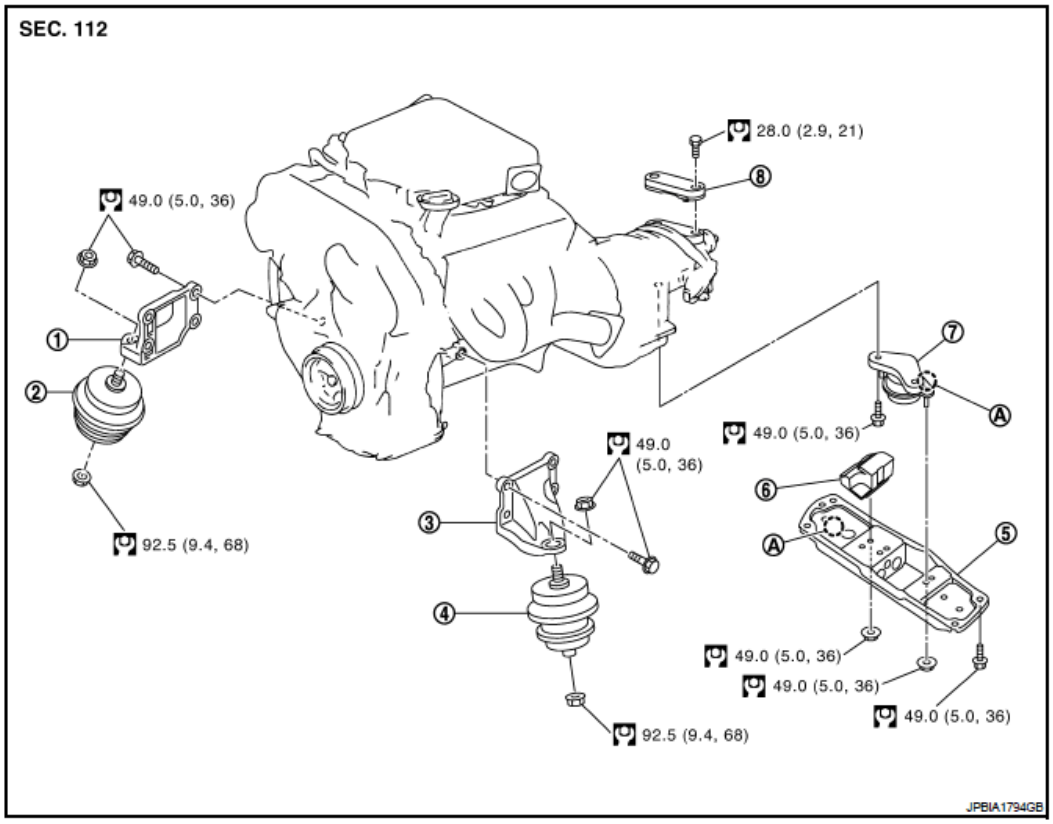
- If the installation load or load with valve open is out of the standard, replace valve spring.

ENGINE ASSEMBLY

2WD

2WD : Component

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.



1. Engine mounting bracket (RH)
2. Engine mounting insulator (RH)
3. Engine mounting bracket (LH)
4. Engine mounting insulator (LH)
5. Rear engine mounting member
6. Dynamic damper
7. Engine mounting insulator (rear)
8. Dynamic damper

Fig. 240: Identifying Engine Assembly Components With Torque Specifications (2WD)
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to "**COMPONENT** " for symbols in the figure.

2WD : Removal and Installation

WARNING:

- **Situate the vehicle on a flat and solid surface.**
- **Place chocks at front and back of rear wheels.**
- **For engines not equipped with engine slingers, attach proper slingers and bolts described in appropriate parts information.**

CAUTION:

- **Always be careful to work safely, avoid forceful or uninstructed operations.**
- **Never start working until exhaust system and engine coolant are cool**

enough.

- **If items or work required are not covered by the engine information, refer to the applicable article.**
- **Always use the support point specified for lifting.**
- **Use either 2-pole lift type or separate type lift as best you can. If board-on type is used for unavoidable reasons, support at rear axle jacking point with transmission jack or similar tool before starting work, in preparation for the backward shift of center of gravity.**
- **For supporting points for lifting and jacking point at rear axle, refer to "GARAGE JACK AND SAFETY STAND AND 2-POLE LIFT ".**

REMOVAL

Outline

At first, remove the engine and the transmission assembly with front suspension member downward. Then separate the engine from transmission.

Preparation

1. Release fuel pressure. Refer to "**INSPECTION** ".
2. Disconnect both battery cables. Refer to "**HOW TO HANDLE BATTERY** ".
3. Drain engine coolant from radiator. Refer to "**CHANGING ENGINE COOLANT** ".

CAUTION:

- **Perform this step when engine is cold.**
- **Never spill engine coolant on drive belt.**

4. Remove the following parts:
   - Engine room cover (RH and LH): Refer to "**COMPONENT**".
   - Radiator reservoir tank: Refer to "**COMPONENT** ".
   - Engine cover: Refer to "**REMOVAL AND INSTALLATION**".
   - Front road wheel and tires (power tool)
   - Front and rear engine undercover (power tool)
   - Cowl top cover: Refer to "**COMPONENT PARTS LOCATION** ".
   - Air duct and air cleaner case assembly (RH and LH): Refer to "**COMPONENT**".
   - Drive belt: Refer to "**REMOVAL AND INSTALLATION**".
5. Discharge refrigerant from A/C circuit. Refer to "**VQ35HR : COMPONENT** ".
6. Remove radiator hoses (upper and lower). Refer to "**COMPONENT** ".

Engine Room LH

1. Disconnect heater hose from vehicle-side, and fit a plug onto hose end to prevent engine coolant leakage.

2. Disconnect ground cable.
3. Disconnect A/C piping from A/C compressor, and temporarily fasten it on vehicle with a rope. Refer to "**VQ35HR : REMOVAL AND INSTALLATION OF COMPRESSOR** ".

Engine Room RH

1. Disconnect battery positive cable at vehicle side and temporarily fasten it on engine.
2. Disconnect brake booster vacuum hose.
3. Disconnect all clips and connector of the engine room harness from engine back side.
4. Disconnect fuel feed hose (with damper) and EVAP hose. Refer to "**COMPONENT**".

CAUTION: Fit plugs onto disconnected hoses to prevent fuel leakage.

5. Remove reservoir tank of power steering oil pump and piping from vehicle, and temporarily secure them on engine. Refer to "**REMOVAL AND INSTALLATION** ".

CAUTION: When temporarily securing, keep the reservoir tank upright to avoid a fluid leakage.

Vehicle Inside

Follow procedure below to disconnect engine room harness connectors at passenger room side, and temporarily secure them on engine.

1. Remove passenger-side kicking plate and dash side finisher. Refer to "**COMPONENT PARTS LOCATION** ".
2. Disconnect engine room harness connectors at unit sides TCM, ECM and other.
3. Disengage intermediate fixing point. Pull out engine room harnesses to engine room side, and temporarily secure them on engine.

CAUTION:

- **When pulling out harnesses, take care not to damage harnesses and connectors.**
- **After temporarily securing, cover connectors with vinyl or similar material to protect against foreign material adhesion.**

Vehicle Underbody

1. Remove A/T fluid cooler hoses and power steering oil pump oil cooler hoses.
   - Install plug to avoid leakage of A/T fluid and power steering fluid.
2. Disconnect heated oxygen sensor 2 harness.
3. Remove three way catalyst and exhaust front tube. Refer to "**COMPONENT** ".

4. Disconnect steering lower joint at power steering gear assembly side, and release steering lower shaft. Refer to "**REMOVAL AND INSTALLATION** ".
5. Remove rear propeller shaft. Refer to "**COMPONENT** ".
6. Disengage A/T control rod at control device assembly side. Then, temporarily secure it on the transmission assembly, so that it does not sag. Refer to "**CONTROL DEVICE REMOVAL AND INSTALLATION** " or "**EXPLODED VIEW** ".
7. Remove rear plate cover from oil pan (upper). Then remove bolts fixing drive plate to torque converter. Refer to "**2WD : COMPONENT**".
8. Remove transmission joint bolts which pierce at oil pan (upper) lower rear side. Refer to "**2WD : COMPONENT**".
9. Remove front stabilizer connecting rod from transverse link. Refer to "**COMPONENT** ".
10. Remove lower ends of left and right steering knuckle from transverse link. Refer to "**COMPONENT** ".
11. Separate steering outer sockets from steering knuckle. Refer to "**REMOVAL AND INSTALLATION** ".
12. Remove transverse links mounting bolts at suspension member side. Refer to "**COMPONENT** ".

Removal Work

1. Use a manual lift table caddy (commercial service tool) or equivalently rigid tool such as a transmission jack. Securely support bottom of suspension member and the transmission assembly.

CAUTION: Put a piece of wood or something similar as the supporting surface, secure a completely stable condition.

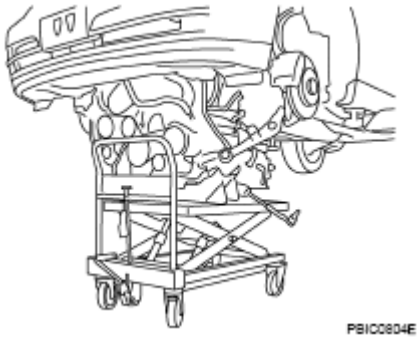


Fig. 241: Identifying Manual Lift Table Caddy (Commercial Service Tool)
Courtesy of NISSAN MOTOR CO., U.S.A.

2. Remove rear engine mounting member bolts.
3. Remove front suspension member mounting bolts and nuts. Refer to "**COMPONENT** ".
4. Carefully lower jack, or raise lift to remove the engine, the transmission assembly and front suspension member. When performing work, observe the following caution:

CAUTION:
- **Confirm there is no interference with the vehicle.**
- **Check that all connection points have been disconnected.**

- **Keep in mind the center of vehicle gravity changes. If necessary, use jack(s) to support the vehicle at rear jacking point(s) to prevent it from falling it off the lift.**

Separation Work

1. Install engine slingers into front of cylinder head (bank 1) and rear of cylinder head (bank 2).

1 : Engine front slinger
2 : Engine rear upper slinger
3 : Spacer
4 : Engine rear lower slinger
A : Bank 1
B : Bank 2
⇦: Engine front

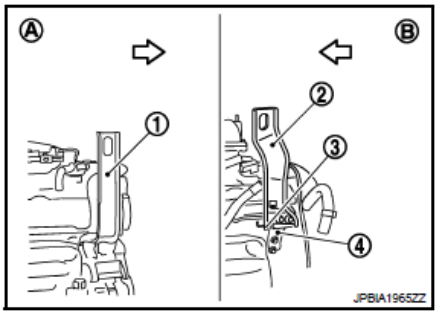


Fig. 242: Identifying Engine Slingers Into Front Of Cylinder Head (Bank 1) And Rear Of Cylinder Head (Bank 2)
Courtesy of NISSAN MOTOR CO., U.S.A.

Slinger bolts:

28.0 N.m (2.9 kg-m, 21 ft-lb)

- To protect rocker cover against damage caused by tilting of engine slinger, insert spacer between cylinder head and engine rear lower slinger (3), in direction shown in the figure.

NOTE: Spacer (2) is a component part of engine rear upper slinger assembly.

1 : Engine rear upper slinger
⇦: Engine front

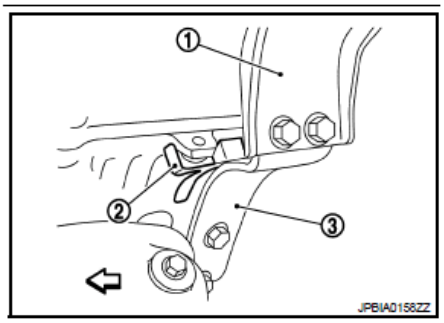


Fig. 243: Identifying Engine Rear Lower And Upper Slinger
Courtesy of NISSAN MOTOR CO., U.S.A.

2. Remove power steering oil pump from engine side. Refer to "**REMOVAL AND INSTALLATION** ".
3. Remove engine mounting insulators (RH and LH) under side nuts with power tool.

4. Lift with hoist and separate the engine and the transmission assembly from front suspension member.

CAUTION:

- **Before and during this lifting, always check that any harnesses are left connected.**
- **Avoid damage to and oil/grease smearing or spills onto engine mounting insulator.**

5. Remove alternator. Refer to "**REMOVAL AND INSTALLATION** ".
6. Remove starter motor. Refer to "**REMOVAL AND INSTALLATION** ".
7. Separate the engine from the transmission assembly. Refer to "**REMOVAL AND INSTALLATION (AWD MODELS)** " or "**EXPLODED VIEW** ".
8. Remove each engine mounting insulator and each engine mounting bracket from the engine with power tool.

INSTALLATION

Note the following, and install in the reverse order of removal.

- Do not allow engine mounting insulator to be damage and careful no oil gets on it.
- For a location with a positioning pin, insert it securely into hole of mating part.
- For a part with a specified installation orientation, refer to component figure in "**2WD : COMPONENT**".
- When installing engine mounting bracket (RH and LH) on cylinder block, tighten two upper bolts [shown as (B) in the figure] first. Then tighten two lower bolts [shown as (C) in the figure].

A : Example Left

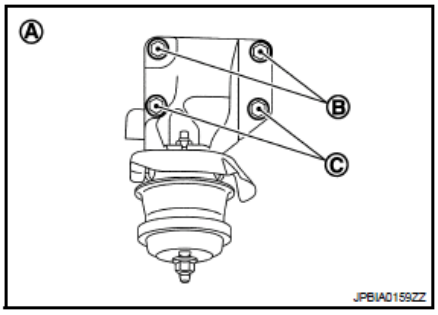


Fig. 244: Identifying Engine Mounting Bracket
Courtesy of NISSAN MOTOR CO., U.S.A.

- Check all engine mounting insulators are seated properly, then tighten mounting nuts.
- Tighten rear engine mounting member bolts in numerical order as shown in the figure.

⇦ : Vehicle front

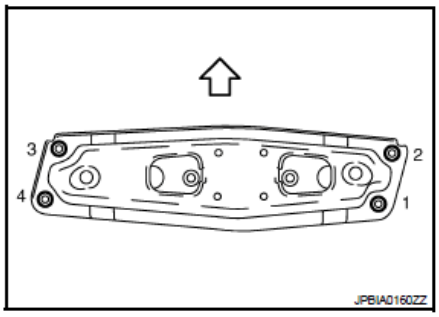


Fig. 245: Identifying Rear Engine Mounting Member Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

INSPECTION AFTER INSTALLATION

Inspection for Leakage

The following are procedures for checking fluids leakage, lubricates leakage, and exhaust gases leakage.

- Before starting engine, check oil/fluid levels including engine coolant and engine oil. If less than required quantity, fill to the specified level. Refer to "**RECOMMENDED FLUIDS AND LUBRICANTS** ".
- Use procedure below to check for fuel leakage.
  - Turn ignition switch "ON" (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.
- Warm up engine thoroughly to check there is no leakage of fuel, exhaust gases, 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 to the specified level, if necessary.

Summary of the inspection items:

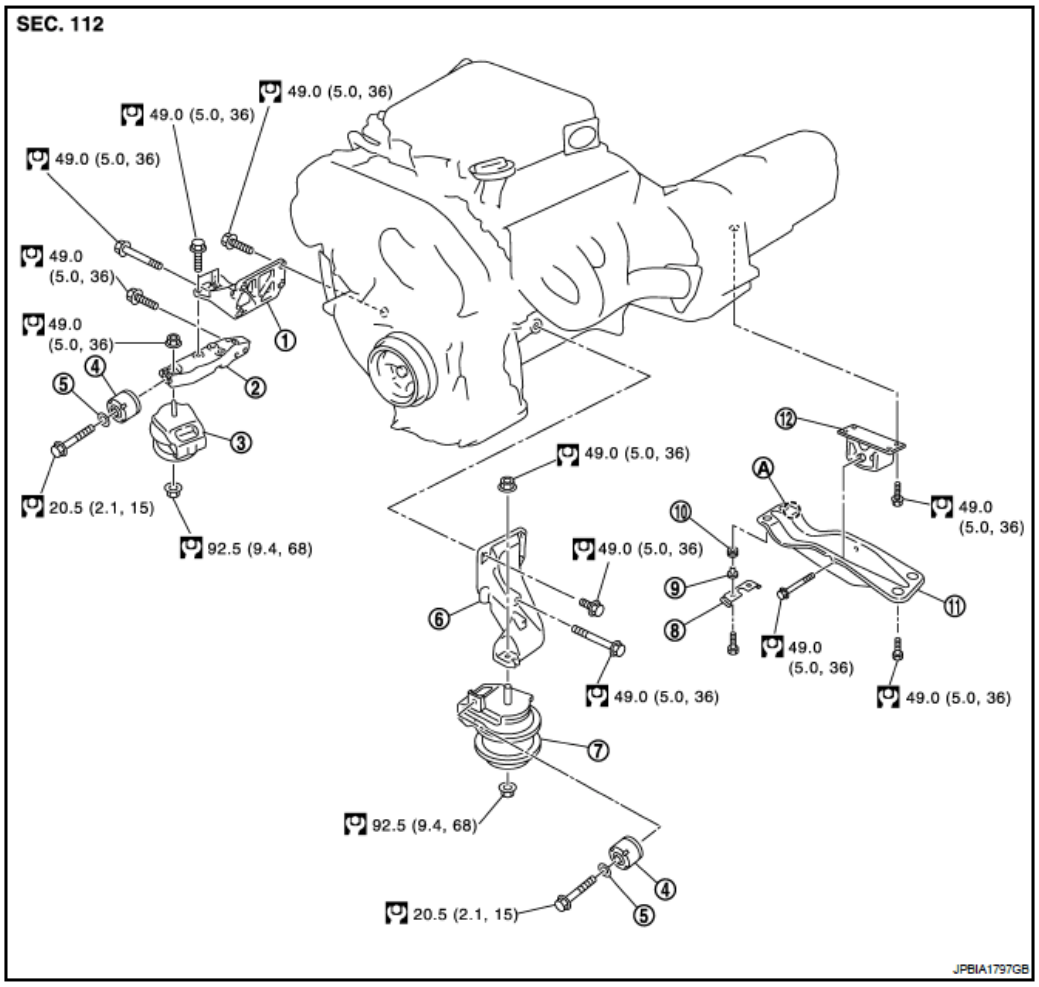
INSPECTION CHART

Items	Before starting engine	Engine running	After engine stopped
Engine coolant	Level	Leakage	Level
Engine oil	Level	Leakage	Level
Other oils and fluid(1)	Level	Leakage	Level
Fuel	Leakage	Leakage	Leakage
Exhaust gases	-	Leakage	-
(1) Transmission/transaxle/CVT fluid, power steering fluid, brake fluid, etc.			

AWD

AWD : Component

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.



1.	Engine mounting bracket (RH)	2.	Engine mounting bracket (RH) (lower)	3.	Engine mounting insulator (RH)
4.	Dynamic damper	5.	Washer	6.	Engine mounting bracket (LH)
7.	Engine mounting insulator (LH)	8.	Heat insulator	9.	Caller
10.	Bush	11.	Rear engine mounting member	12.	Engine mounting insulator (rear)
A.	Front mark				

Fig. 246: Identifying Engine Assembly Components With Torque Specifications (AWD)
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to "**COMPONENT** " for symbols in the figure.

AWD : Removal and Installation

WARNING:

- **Situate the vehicle on a flat and solid surface.**

- **Place chocks at front and back of rear wheels.**
- **For engines not equipped with engine slingers, attach proper slingers and bolts described in appropriate parts information.**

CAUTION:

- **Always be careful to work safely, avoid forceful or uninstructed operations.**
- **Never start working until exhaust system and engine coolant are cool enough.**
- **If items or work required are not covered by the engine information, refer to the appropriate article.**
- **Always use the support point specified for lifting.**
- **Use either 2-pole lift type or separate type lift as best you can. If board-on type is used for unavoidable reasons, support at rear axle jacking point with transmission jack or similar tool before starting work, in preparation for the backward shift of center of gravity.**
- **For supporting points for lifting and jacking point at rear axle, refer to "GARAGE JACK AND SAFETY STAND AND 2-POLE LIFT ".**

REMOVAL

Outline

At first, remove the engine, the transmission assembly, the transfer assembly and the front final drive assembly with front suspension member downward. Then separate the engine, the transmission assembly, the transfer and the front final drive assembly.

Preparation

1. Release fuel pressure. Refer to "**INSPECTION** ".
2. Disconnect both battery terminals. Refer to "**HOW TO HANDLE BATTERY** ".
3. Drain engine coolant from radiator. Refer to "**CHANGING ENGINE COOLANT** ".

CAUTION:

- **Perform this step when engine is cold.**
- **Never spill engine coolant on drive belt.**

4. Remove the following parts:
   - Engine room cover (RH and LH): Refer to "**COMPONENT**".
   - Radiator reservoir tank: Refer to "**COMPONENT** ".
   - Engine cover: Refer to "**REMOVAL AND INSTALLATION**".
   - Front road wheel and tires (power tool)
   - Front and rear engine undercover (power tool)
   - Front cross bar: Refer to "**COMPONENT** ".

- Cowl top cover: Refer to "**COMPONENT PARTS LOCATION** ".
- Air duct and air cleaner case assembly (RH and LH): Refer to "**COMPONENT**".
- Drive belt: Refer to "**REMOVAL AND INSTALLATION**".

5. Discharge refrigerant from A/C circuit. Refer to "**VQ35HR : COMPONENT** ".
6. Remove radiator hoses (upper and lower). Refer to "**COMPONENT** ".

Engine Room LH

1. Disconnect heater hose from vehicle-side, and fit a plug onto hose end to prevent engine coolant leakage.
2. Disconnect A/C piping from A/C compressor, and temporarily fasten it on vehicle with a rope. Refer to "**VQ35HR : REMOVAL AND INSTALLATION OF COMPRESSOR** ".
3. Disconnect ground cables.

Engine Room RH

1. Disconnect battery positive cable vehicle side and temporarily fasten it on engine.
2. Disconnect brake booster vacuum hose.
3. Disconnect all clips and connectors of the engine room harness from engine back side.
4. Disconnect fuel feed hose (with damper) and EVAP hose. Refer to "**COMPONENT**".

CAUTION: Fit plugs onto disconnected hoses to prevent fuel leakage.

5. Remove reservoir tank of power steering oil pump and piping from vehicle, and temporarily secure them on engine. Refer to "**REMOVAL AND INSTALLATION** ".

CAUTION: When temporarily securing, keep the reservoir tank upright to avoid a fluid leakage.

Vehicle Inside

Follow procedure below to disconnect engine room harness connectors at passenger room side, and temporarily secure them on engine.

1. Remove passenger-side kicking plate and dash side finisher. Refer to "**COMPONENT PARTS LOCATION** ".
2. Disconnect engine room harness connectors at unit sides TCM, ECM and other.
3. Disengage intermediate fixing point. Pull out engine room harnesses to engine room side, and temporarily secure them on engine.

CAUTION:

- **When pulling out harnesses, take care not to damage harnesses and connectors.**

- **After temporarily securing, cover connectors with vinyl or similar material to protect against foreign material adhesion.**

Vehicle Underbody

1. Remove A/T fluid cooler hoses and power steering oil pump oil cooler hoses.
   - Install plug to avoid leakage of A/T fluid and power steering fluid.
2. Disconnect heated oxygen sensor 2 harness. Refer to "**COMPONENT** ".
3. Remove three way catalyst and exhaust front tube. Refer to "**COMPONENT** ".
4. Disconnect steering lower joint at power steering gear assembly side, and release steering lower shaft. Refer to "**REMOVAL AND INSTALLATION** " (without 4WAS models).
5. Remove rear propeller shaft. Refer to "**COMPONENT** ".
6. Remove front drive shaft (both side). Refer to "**REMOVAL AND INSTALLATION** ".
7. Disconnect harness connector from transmission assembly and transfer assembly.
8. Disengage A/T control rod at control device assembly side. Then, temporarily secure it on the transmission assembly, so that it does not sag. Refer to "**CONTROL DEVICE REMOVAL AND INSTALLATION** ".
9. Remove rear plate cover from oil pan (upper). Then remove bolts fixing drive plate to torque converter. Refer to "**AWD : COMPONENT**".
10. Remove bolts fixing the transmission assembly to lower rear side of oil pan (upper). Refer to "**REMOVAL AND INSTALLATION (AWD MODELS)** ".
11. Remove front stabilizer connecting rod from transverse link. Refer to "**COMPONENT** ".
12. Remove lower ends of left and right steering knuckle from transverse link. Refer to "**COMPONENT** ".
13. Separate steering outer sockets from steering knuckle. Refer to "**REMOVAL AND INSTALLATION** ".
14. Remove transverse links mounting bolts at suspension member side. Refer to "**COMPONENT** ".

Removal Work

1. Use a manual lift table caddy (commercial service tool) or equivalently rigid tool such as a transmission jack. Securely support bottom of suspension member and transmission.

CAUTION: Put a piece of wood or something similar as the supporting surface, secure a completely stable condition.

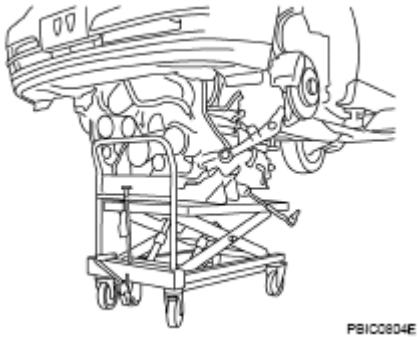


Fig. 247: Identifying Manual Lift Table Caddy (Commercial Service Tool)
Courtesy of NISSAN MOTOR CO., U.S.A.

2. Remove rear engine mounting member bolts.
3. Remove front suspension member mounting bolts and nuts. Refer to "**COMPONENT** ".
4. Carefully lower jack, or raise lift to remove the engine, transmission assembly, transfer, front final drive assembly and front suspension member. When performing work, observe the following caution:

CAUTION:

- **Confirm there is no interference with the vehicle.**
- **Check that all connection points have been disconnected.**
- **Keep in mind the center of the vehicle gravity changes. If necessary, use jack(s) to support the vehicle at rear jacking point(s) to prevent it from falling it off the lift.**

Separation Work

1. Install engine slingers into front of cylinder head (bank 1) and rear of cylinder head (bank 2).

1 : Engine front slinger
2 : Engine rear upper slinger
3 : Spacer
4 : Engine rear lower slinger
A : Bank 1
B : Bank 2
⇦ : Engine front

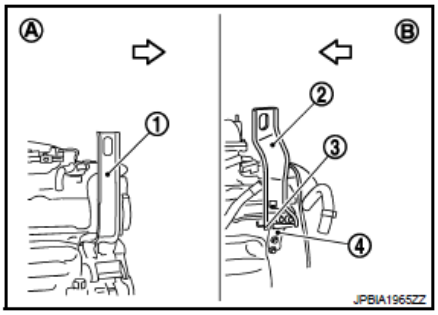


Fig. 248: Identifying Engine Slingers Into Front Of Cylinder Head (Bank 1) And Rear Of Cylinder Head (Bank 2)
Courtesy of NISSAN MOTOR CO., U.S.A.

Slinger bolts:

28.0 N.m (2.9 kg-m, 21 ft-lb)

- To protect rocker cover against damage caused by tilting of engine slinger, insert spacer between cylinder head and engine rear lower slinger (3), in direction shown in the+ figure.

1 : Engine rear upper slinger
⇦: Engine front

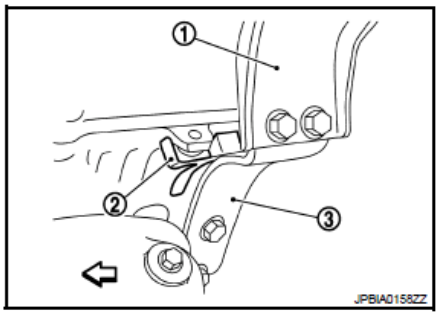


Fig. 249: Identifying Engine Rear Lower And Upper Slinger
Courtesy of NISSAN MOTOR CO., U.S.A.

NOTE: Spacer (2) is a component part of engine rear upper slinger assembly.

2. Remove power steering oil pump from engine side. Refer to "**REMOVAL AND INSTALLATION** " (without 4WAS models).
3. Remove engine mounting insulators (RH and LH) under side nuts with power tool.
4. Lift with hoist and separate the engine, the transmission assembly, the transfer assembly and the front final drive assembly from front suspension member.

CAUTION:
- **Before and during this lifting, always check if any harnesses are left connected.**
- **Avoid damage to and oil/grease smearing or spills onto engine mounting insulator.**

5. Remove alternator. Refer to "**REMOVAL AND INSTALLATION** ".
6. Remove starter motor. Refer to "**REMOVAL AND INSTALLATION** ".
7. Remove front propeller shaft from the front final drive assembly side. Refer to "**COMPONENT** ".
8. Separate the engine from the transmission assembly. Refer to "**REMOVAL AND INSTALLATION (AWD MODELS)** ".
9. Remove the front final drive assembly from oil pan (upper). Refer to "**REMOVAL AND INSTALLATION (VQ35HR)** ".
10. Remove each engine mounting insulator and each engine mounting bracket from the engine with power tool.

INSTALLATION

Note the following, and install in the reverse order of removal.

- Do not allow engine mounting insulator to be damage and careful no engine oil gets on it.

- For a location with a positioning pin, insert it securely into hole of mating part.
- For a part with a specified installation orientation, refer to component figure in "**AWD : COMPONENT**".
- When installing engine mounting bracket (RH and LH) on cylinder block, tighten two upper bolts [shown as (B) in the figure] first. Then tighten two lower bolts [shown as (C) in the figure].

3 : Engine mounting bracket (LH)
A : Right side
G : Left side

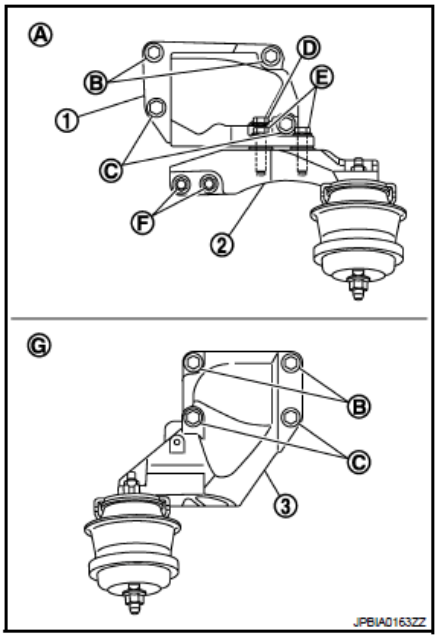


Fig. 250: Identifying Engine Mounting Bracket With Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

- Install engine mounting bracket (RH) (lower) (2) as follows:
  - Temporarily tighten mounting bolts [shown as (D), (E) and (F) in the figure].
  - Tighten mounting bolts to the specified torque with following mounting surfaces touched.
- Engine mounting bracket (RH) (1) to engine mounting bracket (RH) (lower) [shown as and in figure].
- Front final drive to engine mounting bracket (RH) (lower) [shown as in figure].
- Check all engine mounting insulators are seated properly, then tighten mounting nuts.
- Tighten rear engine mounting member bolts in numerical order as shown in the figure.

⇦ : Vehicle front

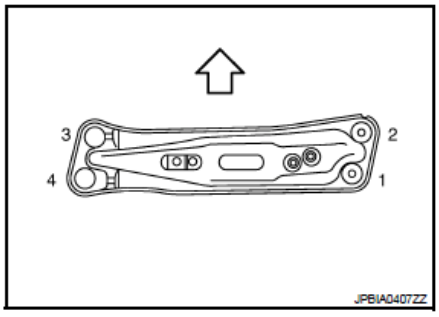


Fig. 251: Identifying Rear Engine Mounting Member Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

INSPECTION AFTER INSTALLATION

Inspection for Leakage

The following are procedures for checking fluids leakage, lubricates leakage, and exhaust gases leakage.

- Before starting engine, check oil/fluid levels including engine coolant and engine oil. If less than required quantity, fill to the specified level. Refer to "**RECOMMENDED FLUIDS AND LUBRICANTS** ".
- Use procedure below to check for fuel leakage.
  - Turn ignition switch "ON" (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.
- Warm up engine thoroughly to check there is no leakage of fuel, exhaust gases, 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 to the specified level, if necessary.

Summary of the inspection items:

INSPECTION CHART

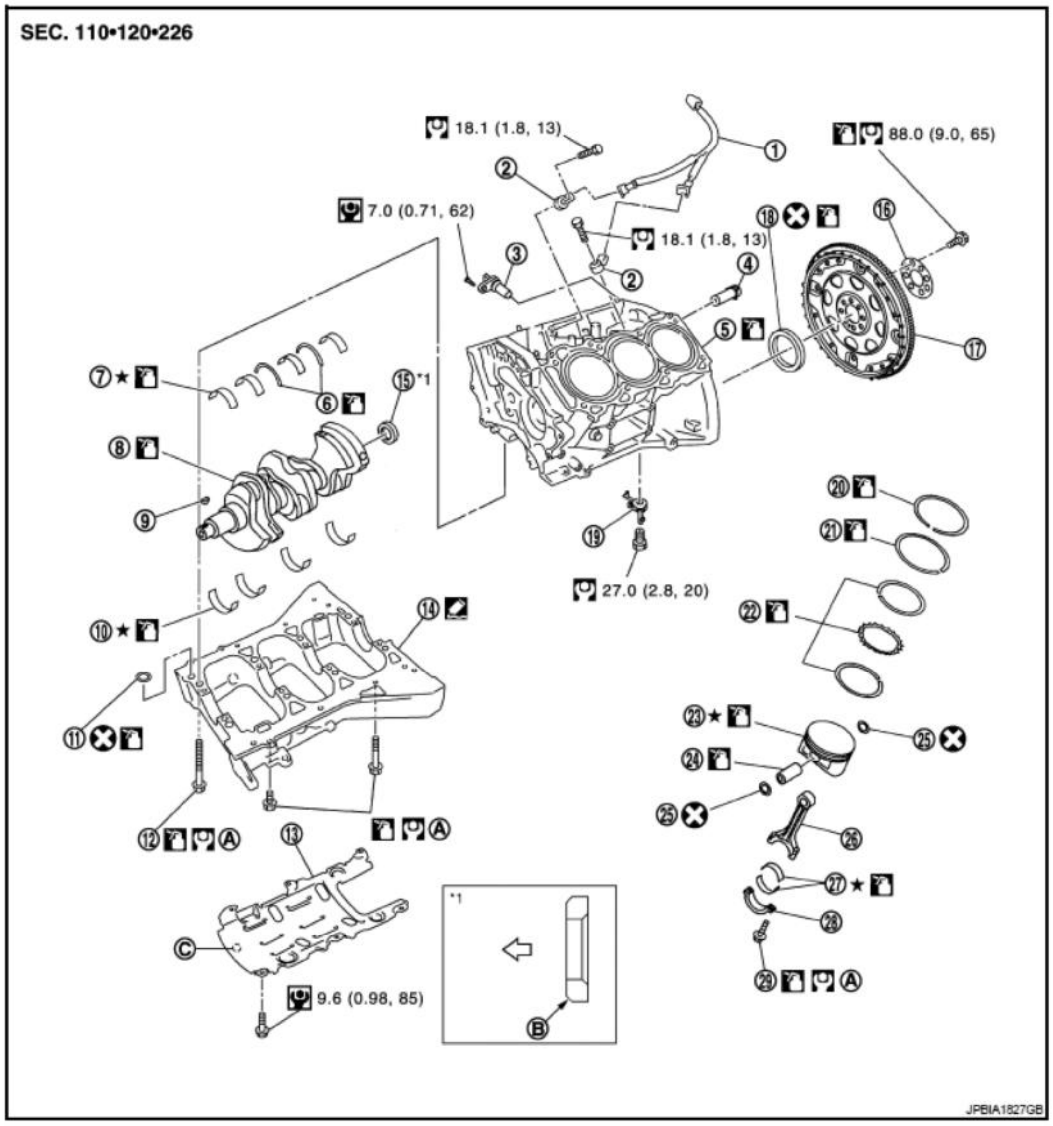
Items	Before starting engine	Engine running	After engine stopped
Engine coolant	Level	Leakage	Level
Engine oil	Level	Leakage	Level
Other oils and fluid(1)	Level	Leakage	Level
Fuel	Leakage	Leakage	Leakage
Exhaust gases	-	Leakage	-
(1) Transmission/transaxle/CVT fluid, power steering fluid, brake fluid, etc.			

CYLINDER BLOCK

Component

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.

SEC. 110•120•226



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

A. Refer to Disassembly and Assembly in CYLINDER BLOCK
B. Chamfered
C. Front mark

⇦ : Crankshaft side

Fig. 252: Disassembled View Of Cylinder Block With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to "**COMPONENT** " for symbols in the figure.

Disassembly and Assembly

DISASSEMBLY

1. Remove engine assembly from vehicle, and separate front suspension member and transmission from engine. Refer to "**2WD : COMPONENT**" (2WD models) or "**AWD : COMPONENT**" (AWD models).
2. Remove engine mounting brackets (RH and LH). Refer to "**2WD : COMPONENT**" (2WD models) or "**AWD : COMPONENT**" (AWD models).
3. Remove the parts that may restrict installation of engine to widely use engine stand.

NOTE: The procedure is described assuming that you use a widely use engine stand holding the surface, to which transmission is installed.

- Remove drive plate. Fix crankshaft with a ring gear stopper [SST: KV10118600 (J-48641)], and remove mounting bolts.
- Loosen mounting bolts in diagonal order.
- Check for deformation or damage.

CAUTION:
- **Never disassemble drive plate.**
- **Never place drive plate with signal plate 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.**

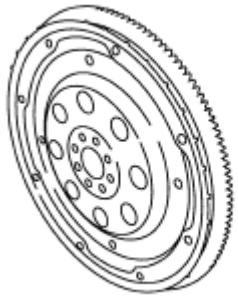


Fig. 253: Identifying Drive Plate
Courtesy of NISSAN MOTOR CO., U.S.A.

4. Remove pilot converter using pilot bushing puller [SST: ST16610001 (J23907)] (A) or suitable tool if necessary.

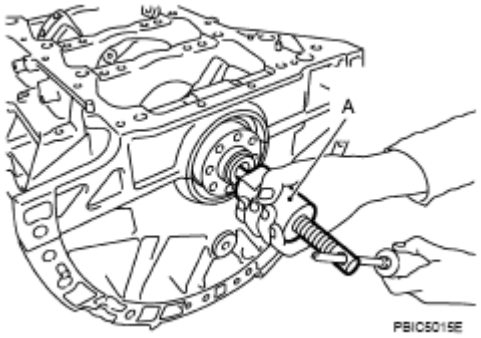


Fig. 254: Using Appropriate Tool To Remove Pilot Bushing Or Pilot Converter
Courtesy of NISSAN MOTOR CO., U.S.A.

5. Lift the engine with hoist to install it onto the widely use engine stand.
   - A widely use engine stand (A) can be used.

CAUTION: Use engine stand that has a load capacity [approximately 220 kg (485 lb) or more] large enough for supporting the engine weight.

NOTE: This example is engine stand for holding at transmission mounting side with drive plate removed.

Fig. 255: Identifying Engine Stand
Courtesy of NISSAN MOTOR CO., U.S.A.

6. Drain engine oil. Refer to "**CHANGING ENGINE OIL** ".
7. Drain engine coolant by removing water drain plugs (1) from cylinder block both sides as shown in the figure.

2 : Washer
3 : Plug
4 : Plug
⇦ : Engine front

Symbol	Description
	N·m (kg·m, ft·lb)
	N·m (kg·m, in·lb)
	Always replace after disassembly.

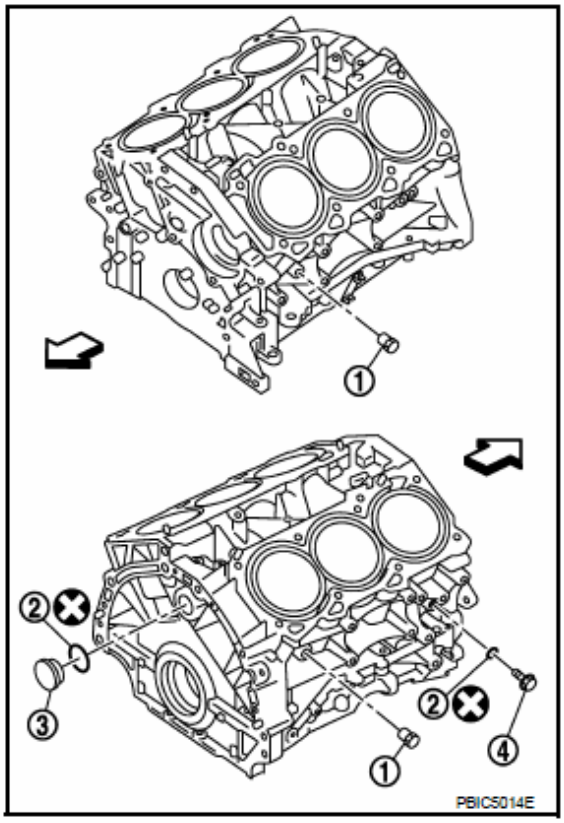


Fig. 256: Identifying Water Drain Plugs
Courtesy of NISSAN MOTOR CO., U.S.A.

8. Remove oil pan (upper and lower). Refer to **OIL PAN AND OIL STRAINER**.
9. Remove front timing chain case, timing chain and rear timing chain case. Refer to **REMOVAL AND INSTALLATION**.
10. Remove cylinder head. Refer to "**COMPONENT**".
11. Remove knock sensor.

CAUTION: Carefully handle sensor avoiding shocks.

12. Remove rear oil seal.
13. Remove baffle plate from lower cylinder block.
14. Remove piston and connecting rod assembly as follows:
    - Before removing piston and connecting rod assembly, check the connecting rod side clearance. Refer to "**INSPECTION AFTER DISASSEMBLY**".
    a. Position crankshaft pin corresponding to connecting rod to be removed onto the bottom dead center.
    b. Remove connecting rod bearing cap.
    c. Using hammer handle or similar tool, push piston and connecting rod assembly out to the cylinder

head side.

CAUTION: Be careful not to damage the cylinder wall and crankshaft pin, resulting from an interference of the connecting rod big end.

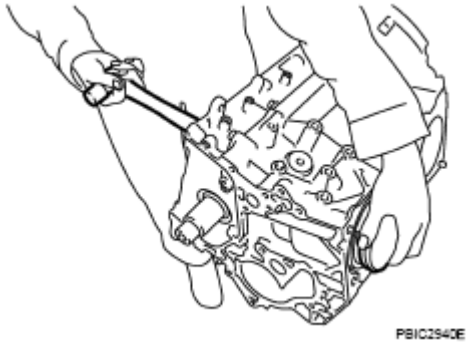


Fig. 257: Pushing Piston And Connecting Rod Assembly
Courtesy of NISSAN MOTOR CO., U.S.A.

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

CAUTION: Identify installation position, and store them without mixing them up.

16. Remove piston rings form piston.
    - Before removing piston rings, check the piston ring side clearance. Refer to "**INSPECTION AFTER DISASSEMBLY**".
    - Use piston ring expander (commercial service tool) (A).

CAUTION:
- **When removing piston rings, be careful not to damage piston.**
- **Be careful not to damage piston rings by expanding them excessively.**

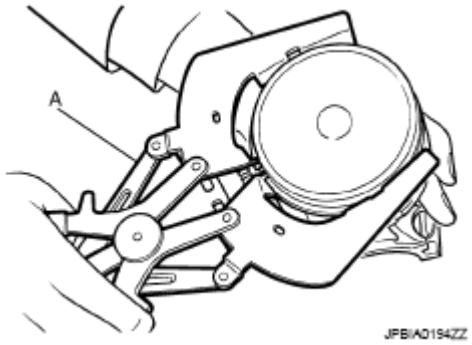


Fig. 258: Installing Piston Ring
Courtesy of NISSAN MOTOR CO., U.S.A.

17. Remove piston from connecting rod as follows:
    a. Using snap ring pliers (A), remove snap ring.

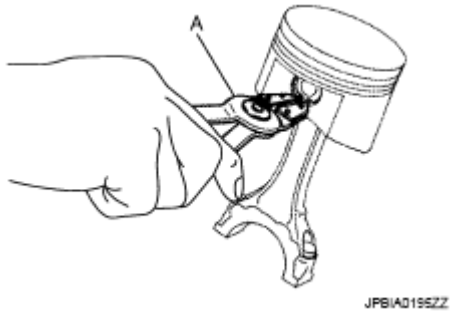


Fig. 259: View Of Snap Rings
Courtesy of NISSAN MOTOR CO., U.S.A.

    b. Heat piston to 60 to 70°C (140 to 158°F) with industrial use drier (A) or equivalent.

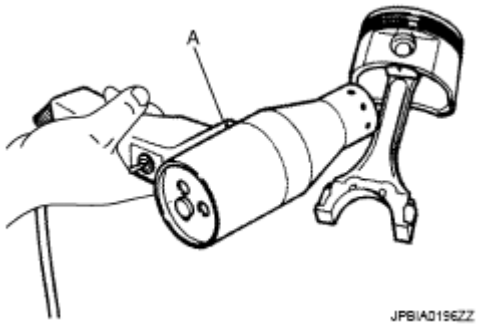


Fig. 260: Heating Piston
Courtesy of NISSAN MOTOR CO., U.S.A.

    c. Push out piston pin with stick of outer diameter approximately 20 mm (0.79 in).

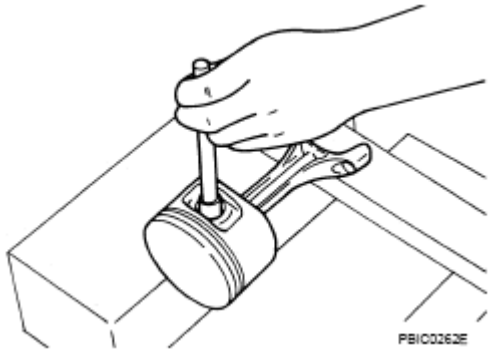


Fig. 261: Pushing Out Piston Pin
Courtesy of NISSAN MOTOR CO., U.S.A.

18. Remove lower cylinder block bolts.

NOTE: Use TORX socket (size E14).

- Before loosening lower cylinder block bolts, measure the crankshaft end play. Refer to "**INSPECTION AFTER DISASSEMBLY**".
- Loosen lower cylinder block bolts in reverse order shown in the figure in several different steps.

⇦ : Engine front

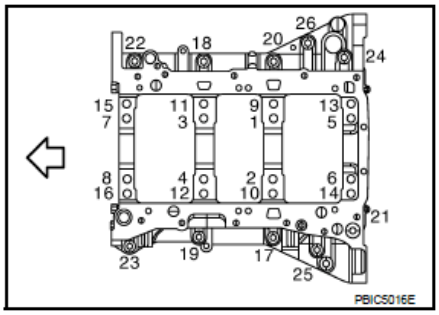


Fig. 262: Identifying Lower Cylinder Block Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

19. Remove lower cylinder block as follows:

Screw M8 bolt [Pitch: 1.25 mm (0.0492 in), Length: approximately 50 mm (1.97 in)] into bolt holes (A) shown in the figure. Then equally tighten each bolt, and remove lower cylinder block.

CAUTION:
- **Be careful not to damage the mating surface.**
- **Never tighten bolts too much.**
- **Never insert screw driver, this will damage the mating surface.**

⇦ : Engine front

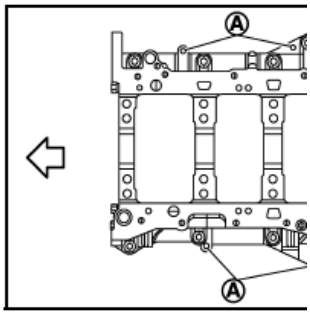


Fig. 263: Identifying Lower Cylinder Block Bolts Tightening Sequ
Courtesy of NISSAN MOTOR CO., U.S.A.

20. Remove crankshaft.

21. Pull rear oil seal out from rear end of crankshaft.
22. Remove main bearings and thrust bearings from cylinder block and lower cylinder block.

CAUTION:
- **Identify installation positions, and store them without mixing them up.**
- **Be careful not to drop main bearing, and to scratch the surface.**

23. Remove oil jet.

ASSEMBLY

1. Fully air-blow engine coolant and engine oil passages in cylinder block, cylinder bore and crankcase to remove any foreign material.

CAUTION: Use a goggles to protect your eye.

2. Install each plug to cylinder block as shown in the figure.
   - Apply sealant to the thread of water drain plug (1).

     Use Genuine RTV Silicone Sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCT AND SEALANT ".

   - Apply sealant to the thread of plugs (3) and (4).

     Use genuine high strength thread locking sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCT AND SEALANT ".

   - Replace washers (2) with new one.

⇦ : Engine front

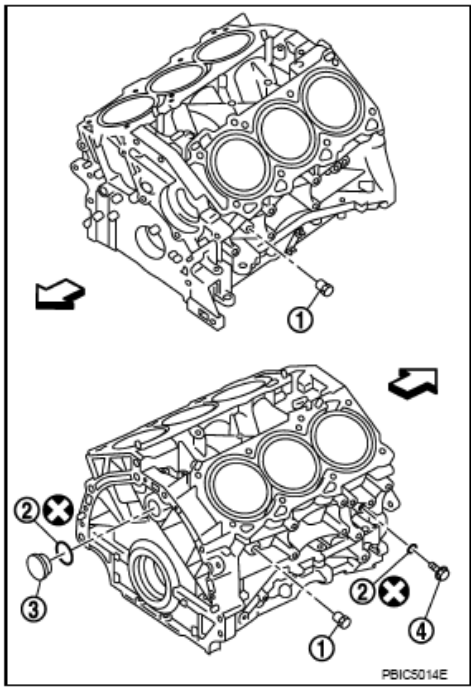


Fig. 264: Identifying Water Drain Plug
Courtesy of NISSAN MOTOR CO., U.S.A.

- Tighten each plug as specified below.

TORQUE SPECIFICATION

Part	Washer	Tightening torque
1	No	19.6 N.m (2.0 kg-m, 14 in-lb)
3	Yes	78.0 N.m (8.0 kg-m, 58 ft-lb)
4	Yes	12.3 N.m (1.3 kg-m, 9 ft-lb)

3. Install oil jet.
   - Insert oil jet dowel pin (A) into cylinder block dowel pin hole, and tighten mounting bolts.

⇦ : Engine front

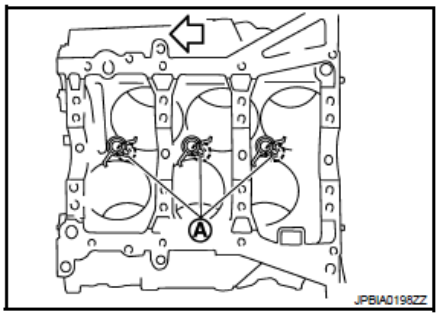


Fig. 265: Identifying Oil Jet Dowel Pin
Courtesy of NISSAN MOTOR CO., U.S.A.

4. Install main bearings and thrust bearings as follows:
   a. Remove dust, dirt, and engine oil on bearing mating surfaces of cylinder block and lower cylinder block.
   b. Install thrust bearings to the both sides of the No. 3 journal housing on cylinder block.
      - Install thrust bearings (1) with the oil groove (E) facing crankshaft arm (outside).

A : No. 1
B : No. 2
C : No. 3
D : No. 4
F : Thrust bearing installation position
⇦ : Engine front

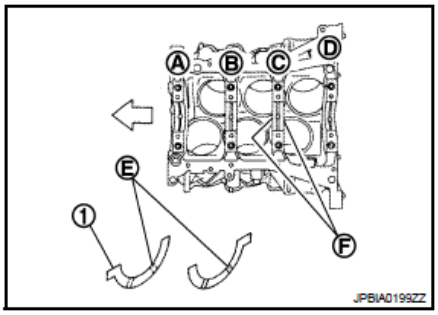


Fig. 266: Identifying Thrust Bearings
Courtesy of NISSAN MOTOR CO., U.S.A.

      - Install thrust bearing with a protrusion on one end on cylinder block. Align each protrusion with mating notch.
   c. Install main bearings paying attention to the direction.
      - Main bearing with oil hole (B) and groove (C) goes on cylinder block. The one without them goes on lower cylinder block.
      - Before installing main bearings, apply engine oil to the bearing surface (inside). Do not apply engine oil to the back surface, but thoroughly clean it.
      - When installing, align main bearing stopper protrusion to cutout of cylinder block and lower cylinder block.
      - Ensure the oil holes on cylinder block and those on the corresponding bearing are aligned.

A : Cylinder block side
D : Lower cylinder block side
⇦ : Engine front

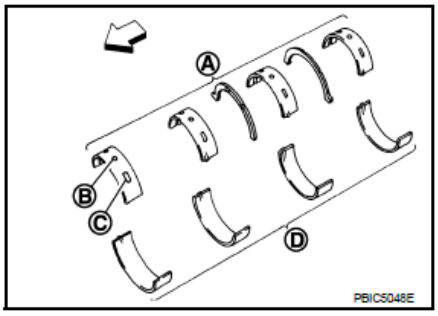


Fig. 267: Identifying Main Bearing
Courtesy of NISSAN MOTOR CO., U.S.A.

5. Install crankshaft to cylinder block.
   - While turning crankshaft by hand, check that it turns smoothly.
6. Install lower cylinder block.

NOTE: Lower cylinder block cannot be replaced as a single part, because it is machined together with cylinder block.

- Apply a continuous bead of liquid gasket with the tube presser (commercial service tool) to lower cylinder block as shown in the figure.

  B : Apply to end

  a : 4.0 - 5.0 mm (0.157 - 0.197 in) dia

  Use genuine high strength thread locking sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCT AND SEALANT ".

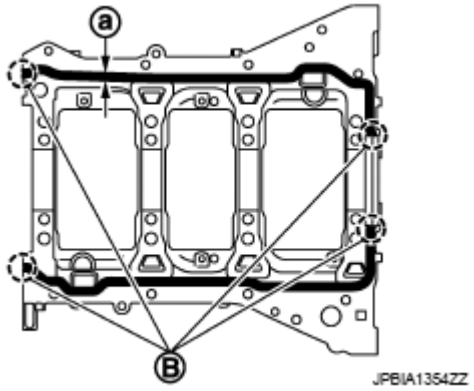


Fig. 268: Identifying Lower Cylinder Block Sealant Area
Courtesy of NISSAN MOTOR CO., U.S.A.

7. Inspect the outer diameter of lower cylinder block bolt. Refer to "**INSPECTION AFTER DISASSEMBLY**".
8. Install lower cylinder block bolts in numerical order as shown in the figure as follows:
   a. Apply new engine oil to threads and seat surfaces of lower cylinder block bolts.
   b. Tighten lower cylinder block bolt (No. 17 to 26) in numerical order as shown in the figure.

⇦ : Engine front

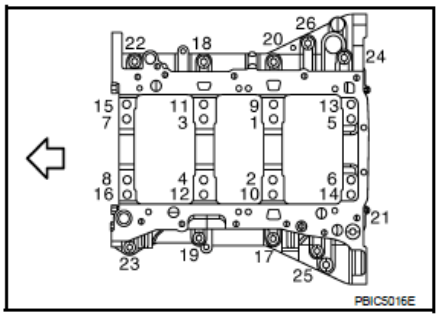


Fig. 269: Identifying Lower Cylinder Block Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

25.0 N.m (2.6 kg-m, 18 ft-lb)

c. Repeat step b.
d. Tighten lower cylinder block bolts (No. 1 to 16) in numerical order as shown in the figure.

NOTE: Use TORX socket (size E14) for bolts No. 1 to 16.

⇦ : Engine front

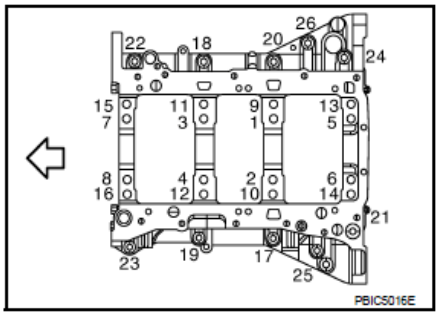


Fig. 270: Identifying Lower Cylinder Block Bolts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

35.3 N.m (3.6 kg-m, 26 ft-lb)

e. Turn lower cylinder block bolts (No. 1 to 16) 90 degrees clockwise (angle tightening).

CAUTION: Use the angle wrench [SST: KV10112100 (BT8653-A)] (A) to check tightening angle. Never make judgment by visual inspection.

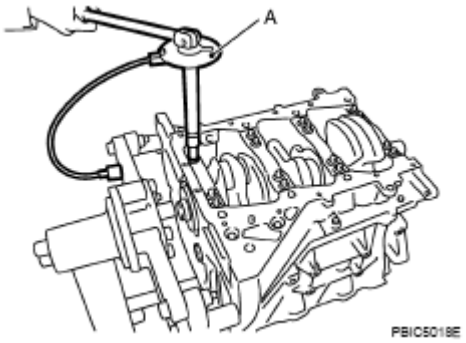


Fig. 271: Checking Cylinder Block Bolts Tightening Angle
Courtesy of NISSAN MOTOR CO., U.S.A.

- After installing lower cylinder block bolts, check that crankshaft can be rotated smoothly by hand.
- Check the crankshaft end play. Refer to "**INSPECTION AFTER DISASSEMBLY**".

9. Install piston to connecting rod as follows:
   a. Using snap ring pliers, install new snap ring to the groove of piston rear side.

- Insert it fully into groove to install.

b. Install piston to connecting rod.
   - Using industrial use drier or similar tool, heat piston until piston pin can be pushed in by hand without excess force [approximately 60 to 70°C (140 to 158°F)]. From the front to the rear, insert piston pin into piston and connecting rod.
   - Assemble so that the front mark on the piston head and the cylinder number on connecting rod are positioned as shown in the figure.

A : Piston grade number
B : Front mark
C : Pin grade number
D : Cylinder number
E : Front mark
⇦ : Engine front

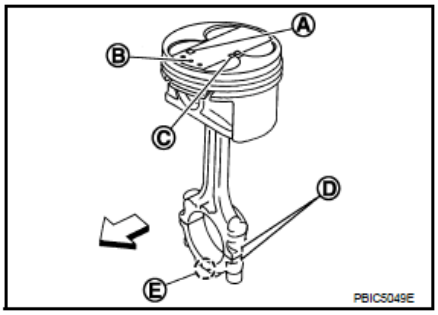


Fig. 272: Installing Piston To Connecting Rod
Courtesy of NISSAN MOTOR CO., U.S.A.

c. Install new snap ring to the groove of the piston front side.
   - Insert it fully into groove to install.
   - After installing, check that connecting rod moves smoothly.

10. Using piston ring expander (commercial service tool) (A), install piston rings.

CAUTION:
- **When installing piston rings, be careful not to damage piston.**
- **Be careful not to damage piston rings by expending them excessively.**

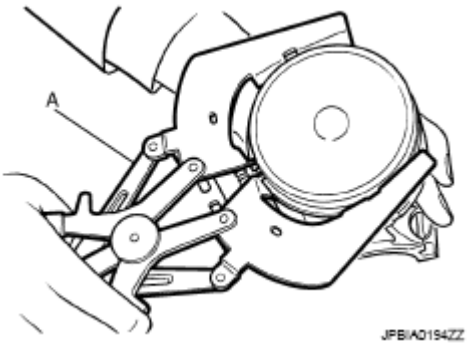


Fig. 273: Installing Piston Ring
Courtesy of NISSAN MOTOR CO., U.S.A.

- If there is stamped mark on ring, mount it with marked side up.

Stamped mark:

Top ring (A) : 1 N

Second ring (B) : 2 N

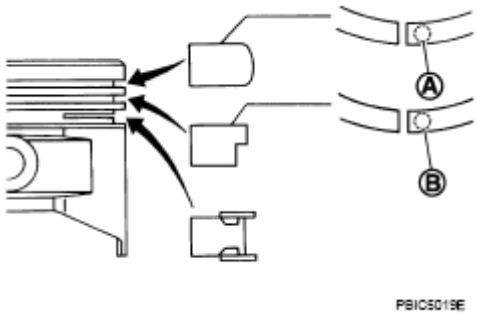


Fig. 274: Identifying Stamped Mark On Ring
Courtesy of NISSAN MOTOR CO., U.S.A.

- Mount second ring with cut out side down.
- Position each ring with the gap as shown in the figure referring to the piston front mark (D).

C : Top ring gap
E : Oil ring upper or lower rail gap
F : Second ring and oil ring spacer gap
a : 90 degrees
b : 45 degrees

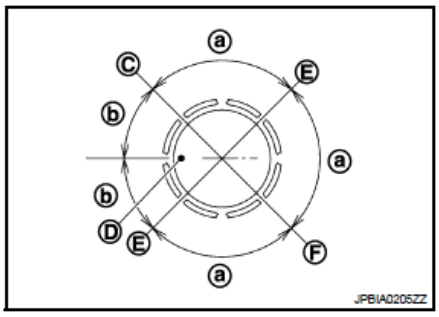


Fig. 275: Identifying Piston Ring Installation Position
Courtesy of NISSAN MOTOR CO., U.S.A.

- Check the piston ring side clearance. Refer to "**INSPECTION AFTER DISASSEMBLY**".

11. Install connecting rod bearings to connecting rod and connecting rod bearing cap.
    - Before installing connecting rod bearings, apply engine oil to the bearing surface (inside). Do not apply engine oil to the back surface, but thoroughly clean it.
    - When installing, align connecting rod bearing stopper protrusion (B) with cutout (C) of connecting rods and connecting rod bearing caps to install.
    - Ensure the oil hole (A) on connecting rod and that on the corresponding bearing are aligned.

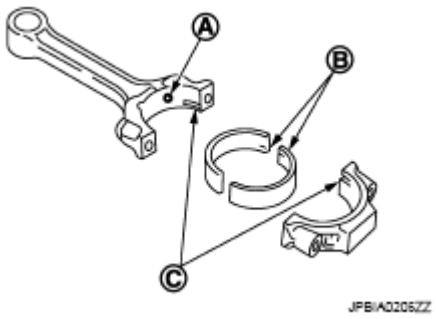


Fig. 276: Aligning Connecting Rod Bearing Stopper Protrusion
Courtesy of NISSAN MOTOR CO., U.S.A.

12. Install piston and connecting rod assembly to crankshaft.
    - Position crankshaft pin corresponding to connecting rod to be installed onto the bottom dead center.
    - Apply engine oil sufficiently to the cylinder bore, piston and crankshaft pin journal.
    - Match the cylinder position with the cylinder number on connecting rod to install.
    - Be sure that front mark on piston head is facing front of engine.
    - Using piston ring compressor [SST: EM03470000 (J8037)] (A) or suitable tool, install piston with the front mark on the piston head facing the front of engine.

CAUTION: Be careful not to damage the cylinder wall and crankshaft pin, resulting from an interference of the connecting rod big end.

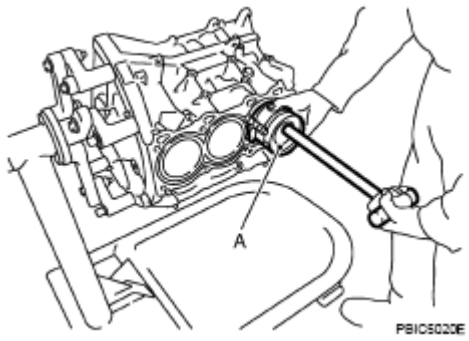


Fig. 277: Installing Piston With Front Mark On Piston Head Facing Front Of Engine
Courtesy of NISSAN MOTOR CO., U.S.A.

13. Install connecting rod bearing cap.
    - Match the stamped cylinder number marks on connecting rod with those on connecting rod bearing cap to install.
    - Be sure that front mark (H) on connecting rod bearing cap is facing front of engine.

A : Sample code
B : Bearing stopper groove
C : Small-end diameter grade
D : Big end diameter grade
E : Weight grade
F : Cylinder No.
G : Management code
I : Management code

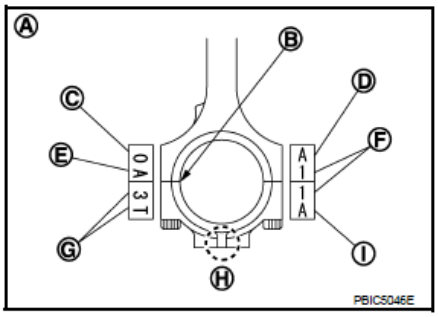


Fig. 278: Identifying Front Mark On Connecting Rod Bearing Cap Position
Courtesy of NISSAN MOTOR CO., U.S.A.

14. Inspect the outer diameter of connecting rod bolt. Refer to "**INSPECTION AFTER DISASSEMBLY**".
15. Tighten connecting rod bolts as follows:
    a. Apply engine oil to the threads and seats of connecting rod bolts.
    b. Tighten connecting rod bolts.

       28.4 N.m (2.9 kg-m, 21 ft-lb)

    c. Completely loosen connecting rod bolts.

       0 N.m (0 kg-m, 0 ft-lb)

    d. Tighten connecting rod bolts.

       24.5 N.m (2.5 kg-m, 18 ft-lb)

    e. Then turn connecting rod bolts 90 degrees clockwise (angle tightening).

       CAUTION: Use angle wrench [SST: KV10112100 (BT8653-A)] (A) to check tightening angle. Never make judgment by visual inspection.

       - After tightening connecting rod bolts, check that crankshaft rotates smoothly.
       - Check the connecting rod side clearance. Refer to "**INSPECTION AFTER DISASSEMBLY**".

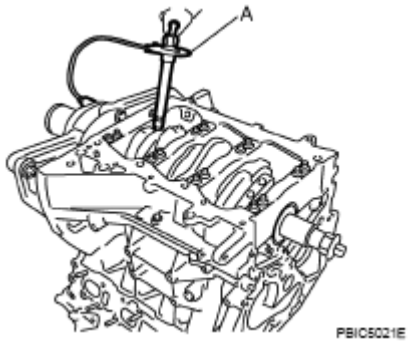


Fig. 279: Checking Tightening Angle
Courtesy of NISSAN MOTOR CO., U.S.A.

16. Install baffle plate.
17. Install new rear oil seal. Refer to "**REMOVAL AND INSTALLATION OF REAR OIL SEAL**".
18. Install pilot converter.
    - With drift of the following outer diameter, press-fit as far as it will go.

      Pilot converter : Approximately 33 mm (1.30 in)

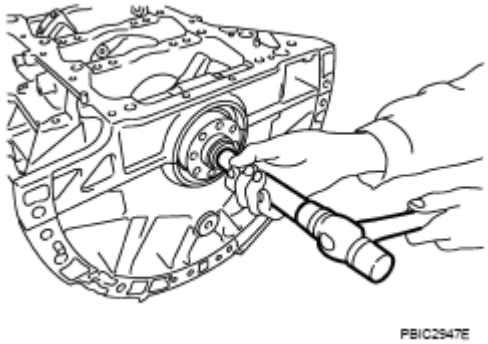


Fig. 280: Installing Pilot Bushing And Converter
Courtesy of NISSAN MOTOR CO., U.S.A.

    - Press-fit pilot converter with its chamfer facing crankshaft as shown in the figure.

⇦ : Crankshaft side

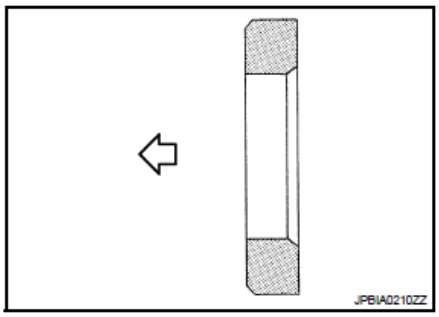


Fig. 281: [Identifying Pilot Converter With Chamfer Facing Crankshaft]

Courtesy of NISSAN MOTOR CO., U.S.A.

19. Install cylinder head. Refer to "**COMPONENT**".
20. Install rear timing chain case. Refer to **REMOVAL AND INSTALLATION**.
21. Install oil pan (upper). Refer to **OIL PAN AND OIL STRAINER**.
22. Install knock sensors.

A : Bank 1
B : Bank 2
⇦ : Engine front

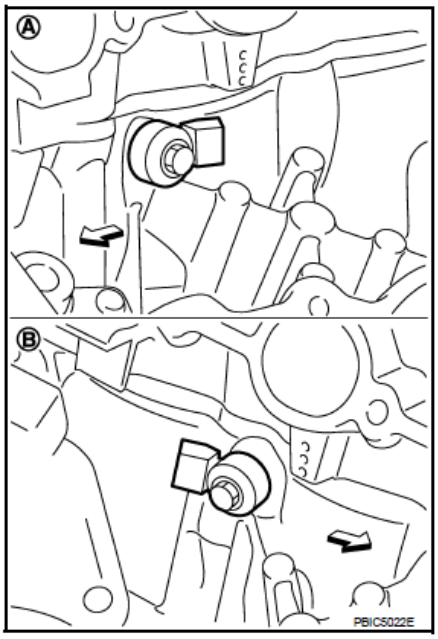


Fig. 282: Identifying Knock Sensors
Courtesy of NISSAN MOTOR CO., U.S.A.

- Install knock sensor so that connector faces rear of engine.
- After installing knock sensor, connect harness connector, and lay it out to rear of engine.

CAUTION:
- **Never tighten mounting bolts while holding connector.**
- **If any impact by dropping is applied to knock sensor, replace it with new one.**

NOTE:
- **Check that there is no foreign material on the cylinder block mating surface and the back surface of knock sensor.**
- **Check that knock sensor does not interfere with other parts.**

23. Note the following, assemble in the reverse order of disassembly after this step.

Drive plate

- When installing drive plate to crankshaft, be sure to correctly align crankshaft side dowel pin and

drive plate side dowel pin hole.

CAUTION: If these are not aligned correctly, engine runs roughly and "MIL" turns on.

- Install drive plate (2) and reinforcement plate (3) as shown in the figure.

1 : Ring gear
4 : Pilot converter
5 : Crankshaft
A : Rounded
⇦ : Engine front

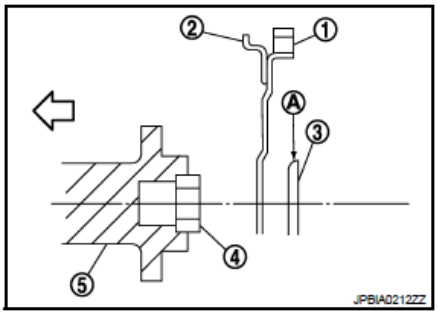


Fig. 283: Identifying Drive Plate And Reinforcement Plate
Courtesy of NISSAN MOTOR CO., U.S.A.

- Holding ring gear with ring gear stopper [SST: KV10118600 (J-48641)].
- Tighten the mounting bolts crosswise over several times.

How to Select Piston and Bearing

DESCRIPTION

DESCRIPTION CHART

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 diameter and crankshaft pin outer diameter determine connecting rod bearing selection.
Between cylinder block to piston	Piston and piston pin assembly (Piston is available together with piston pin as assembly.)	Piston grade (piston skirt diameter)	Piston grade = cylinder bore grade (inner diameter of bore)
Between piston to connecting rod(1)	-	-	-

(1) For the service parts, the grade for fitting cannot be selected between piston pin and 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 PISTON

When New Cylinder Block is Used

Check the cylinder bore grade ("1", "2" or "3") on rear side of cylinder block, and select piston of the same grade.

A : Bearing housing grade No. 1
B : Bearing housing grade No. 2
C : Bearing housing grade No. 3
D : Bearing housing grade No. 4
E : Cylinder bore grade No. 1
F : Cylinder bore grade No. 2
G : Cylinder bore grade No. 3
H : Cylinder bore grade No. 4
I : Cylinder bore grade No. 5
J : Cylinder bore grade No. 6
K : Identification code
⇦ : Engine front

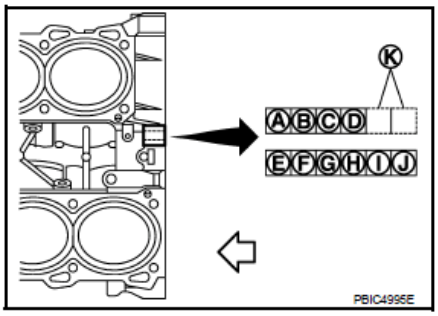


Fig. 284: Identifying Cylinder Bore Grade Number
Courtesy of NISSAN MOTOR CO., U.S.A.

NOTE: Piston is available with piston pin as a set for the service part. (Only "0" grade piston pin is available.)

When Cylinder Block is Reused

1. Measure the cylinder bore inner diameter. Refer to "**INSPECTION AFTER DISASSEMBLY**".
2. Determine the bore grade by comparing the measurement with the values under the cylinder bore inner diameter of the "Piston Selection Table".

A : Piston grade number
B : Front mark
C : Piston pin grade number

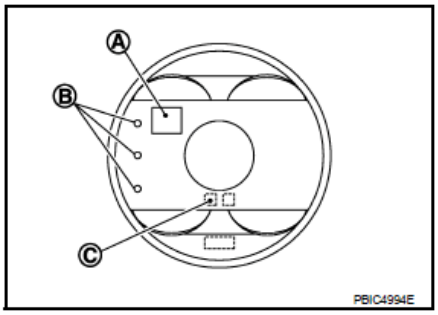


Fig. 285: Identifying Piston Grade Number
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Select piston of the same grade.

Piston Selection Table

PISTON SELECTION CHART

Unit: mm (in)

Grade	1	2	3
Cylinder bore inner diameter	95.500 - 95.510 (3.7598 - 3.7602)	95.510 - 95.520 (3.7602 - 3.7606)	95.520 - 95.530 (3.7606 - 3.7610)
Piston skirt diameter	95.480 - 95.490 (3.7590 - 3.7594)	95.490 - 95.500 (3.7594 - 3.7598)	95.500 - 95.510 (3.7598 - 3.7602)

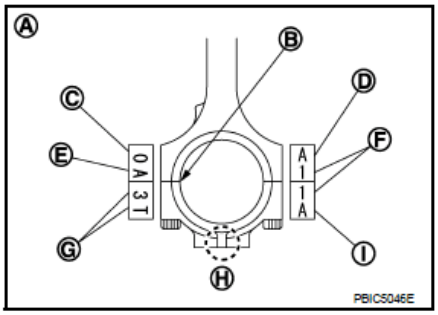
NOTE:

- **Piston is available together with piston pin as assembly.**
- **Piston pin (piston pin hole) grade is provided only for the parts installed at the plant. For service parts, no piston pin grades can be selected. (Only "0" grade is available.)**
- **No second grade mark is available on piston.**

HOW TO SELECT CONNECTING ROD BEARING

When New Connecting Rod and Crankshaft are Used

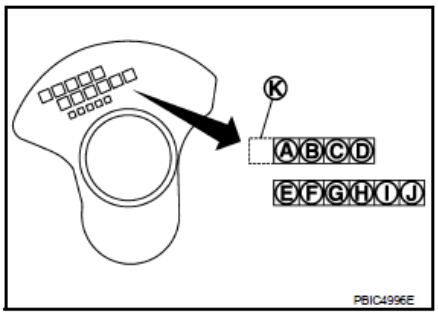
1. "Connecting Rod Bearing Selection Table" rows correspond to connecting rod big end diameter grade (D) stamped on side face of connecting rod.



A : Sample code
B : Bearing stopper groove
C : Small end diameter grade
E : Weight grade
F : Cylinder No.
G : Management code
H : Front mark
I : Management code

Fig. 286: Identifying Connecting Rod Big End Diameter Grade
Courtesy of NISSAN MOTOR CO., U.S.A.

2. "Connecting Rod Bearing Selection Table" columns correspond to pin journal diameter grade on front side of crankshafts.



A : Main journal diameter grade No. 1
B : Main journal diameter grade No. 2
C : Main journal diameter grade No. 3
D : Main journal diameter grade No. 4
E : Pin diameter grade No. 1
F : Pin diameter grade No. 2
G : Pin diameter grade No. 3
H : Pin diameter grade No. 4
I : Pin diameter grade No. 5
J : Pin diameter grade No. 6
K : Identification code

Fig. 287: Identifying Pin Journal Diameter Grade
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Select connecting rod bearing grade at the point where selected row and column meet in "Connecting Rod Bearing Selection Table".

When Crankshaft and Connecting Rod are Reused

1. Measure the connecting rod big end diameter and crankshaft pin journal diameter. Refer to "**INSPECTION AFTER DISASSEMBLY**".
2. Correspond the measured dimension in "Connecting rod big end diameter" row of "Connecting Rod Bearing Selection Table".
3. Correspond the measured dimension in "Crankshaft pin journal diameter" column of "Connecting Rod Bearing Selection Table".
4. Select connecting rod bearing grade at the point where selected row and column meet in following selection table.

Connecting Rod Bearing Selection Table

Crankshaft pin journal diameter Unit: mm (in) / Connecting rod big end diameter Unit: mm (in)		Mark	A	B	C	D	E	F	G	H	J	K	L	M	N
		Hole diameter	57.000 - 57.001 (2.2441 - 2.2441)	57.001 - 57.002 (2.2441 - 2.2442)	57.002 - 57.003 (2.2442 - 2.2442)	57.003 - 57.004 (2.2442 - 2.2442)	57.004 - 57.005 (2.2442 - 2.2443)	57.005 - 57.006 (2.2443 - 2.2443)	57.006 - 57.007 (2.2443 - 2.2444)	57.007 - 57.008 (2.2444 - 2.2444)	57.008 - 57.009 (2.2444 - 2.2444)	57.009 - 57.010 (2.2444 - 2.2445)	57.010 - 57.011 (2.2445 - 2.2445)	57.011 - 57.012 (2.2445 - 2.2446)	57.012 - 57.013 (2.2446 - 2.2446)
Mark	Axle diameter														
A	53.974 - 53.973 (2.1250 - 2.1249)		0	0	0	0	0	0	1	1	1	1	1	1	2
B	53.973 - 53.972 (2.1249 - 2.1249)		0	0	0	0	0	1	1	1	1	1	1	2	2
C	53.972 - 53.971 (2.1249 - 2.1248)		0	0	0	0	1	1	1	1	1	1	2	2	2
D	53.971 - 53.970 (2.1248 - 2.1248)		0	0	0	1	1	1	1	1	1	2	2	2	2
E	53.970 - 53.969 (2.1248 - 2.1248)		0	0	1	1	1	1	1	1	2	2	2	2	2
F	53.969 - 53.968 (2.1248 - 2.1247)		0	1	1	1	1	1	1	2	2	2	2	2	2
G	53.968 - 53.967 (2.1247 - 2.1247)		1	1	1	1	1	1	2	2	2	2	2	2	3
H	53.967 - 53.966 (2.1247 - 2.1246)		1	1	1	1	1	2	2	2	2	2	2	3	3
J	53.966 - 53.965 (2.1246 - 2.1246)		1	1	1	1	2	2	2	2	2	2	3	3	3
K	53.965 - 53.964 (2.1246 - 2.1246)		1	1	1	2	2	2	2	2	2	3	3	3	3
L	53.964 - 53.963 (2.1246 - 2.1245)		1	1	2	2	2	2	2	2	3	3	3	3	3
M	53.963 - 53.962 (2.1245 - 2.1245)		1	2	2	2	2	2	2	3	3	3	3	3	3
N	53.962 - 53.961 (2.1245 - 2.1244)		2	2	2	2	2	2	3	3	3	3	3	3	4
P	53.961 - 53.960 (2.1244 - 2.1244)		2	2	2	2	2	3	3	3	3	3	3	4	4
R	53.960 - 53.959 (2.1244 - 2.1244)		2	2	2	2	3	3	3	3	3	3	4	4	4
S	53.959 - 53.958 (2.1244 - 2.1243)		2	2	2	3	3	3	3	3	3	4	4	4	4
T	53.958 - 53.957 (2.1243 - 2.1243)		2	2	3	3	3	3	3	3	4	4	4	4	4
U	53.957 - 53.956 (2.1243 - 2.1242)		2	3	3	3	3	3	3	4	4	4	4	4	4

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Fig. 288: Axle Diameter And Hole Diameter Chart
Courtesy of NISSAN MOTOR CO., U.S.A.

Connecting Rod Bearing Grade Table

THICKNESS SPECIFICATION

Unit: mm (in)

Grade number	Thickness	Identification color (mark)
0	1.497 - 1.500 (0.0589 - 0.0591)	Black
1	1.500 - 1.503 (0.0591 - 0.0592)	Brown
2	1.503 - 1.506 (0.0592 - 0.0593)	Green
3	1.506 - 1.509 (0.0593 - 0.0594)	Yellow
4	1.509 - 1.512 (0.0594 - 0.0595)	Blue

Undersize Bearings Usage Guide

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

CAUTION: In grinding crankshaft pin to use undersize bearings, keep the fillet R (A) [1.5 - 1.7 mm (0.059 - 0.067 in)].

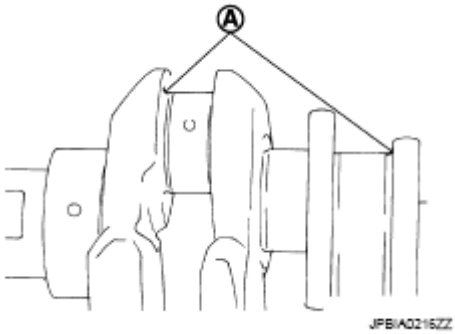


Fig. 289: Identifying Connecting Rod Bearing
Courtesy of NISSAN MOTOR CO., U.S.A.

Bearing undersize table

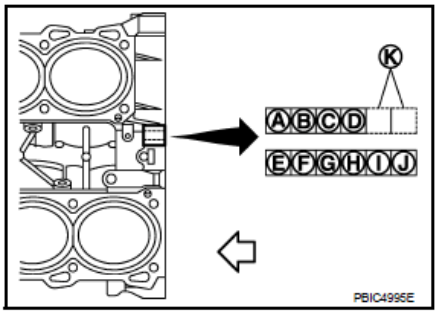
THICKNESS SPECIFICATION

Unit: mm (in)	
Size	**Thickness**
US 0.25 (0.0098)	1.626 - 1.634 (0.0640 - 0.0643)

HOW TO SELECT MAIN BEARING

When New Cylinder Block and Crankshaft are Used

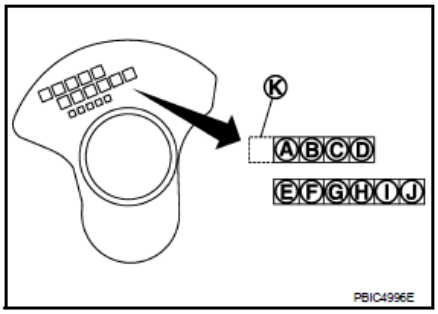
1. "Main Bearing Selection Table" rows correspond to bearing housing grade on rear left side of cylinder block.



A : Bearing housing grade No. 1
B : Bearing housing grade No. 2
C : Bearing housing grade No. 3
D : Bearing housing grade No. 4
E : Cylinder bore grade No. 1
F : Cylinder bore grade No. 2
G : Cylinder bore grade No. 3
H : Cylinder bore grade No. 4
I : Cylinder bore grade No. 5
J : Cylinder bore grade No. 6
K : Identification code
⇦ : Engine front

Fig. 290: Identifying Bearing Housing Grade
Courtesy of NISSAN MOTOR CO., U.S.A.

2. "Main Bearing Selection Table" columns correspond to journal diameter grade on front side of crankshaft.



A : Main journal diameter grade No. 1
B : Main journal diameter grade No. 2
C : Main journal diameter grade No. 3
D : Main journal diameter grade No. 4
E : Pin diameter grade No. 1
F : Pin diameter grade No. 2
G : Pin diameter grade No. 3
H : Pin diameter grade No. 4
I : Pin diameter grade No. 5
J : Pin diameter grade No. 6
K : Identification code

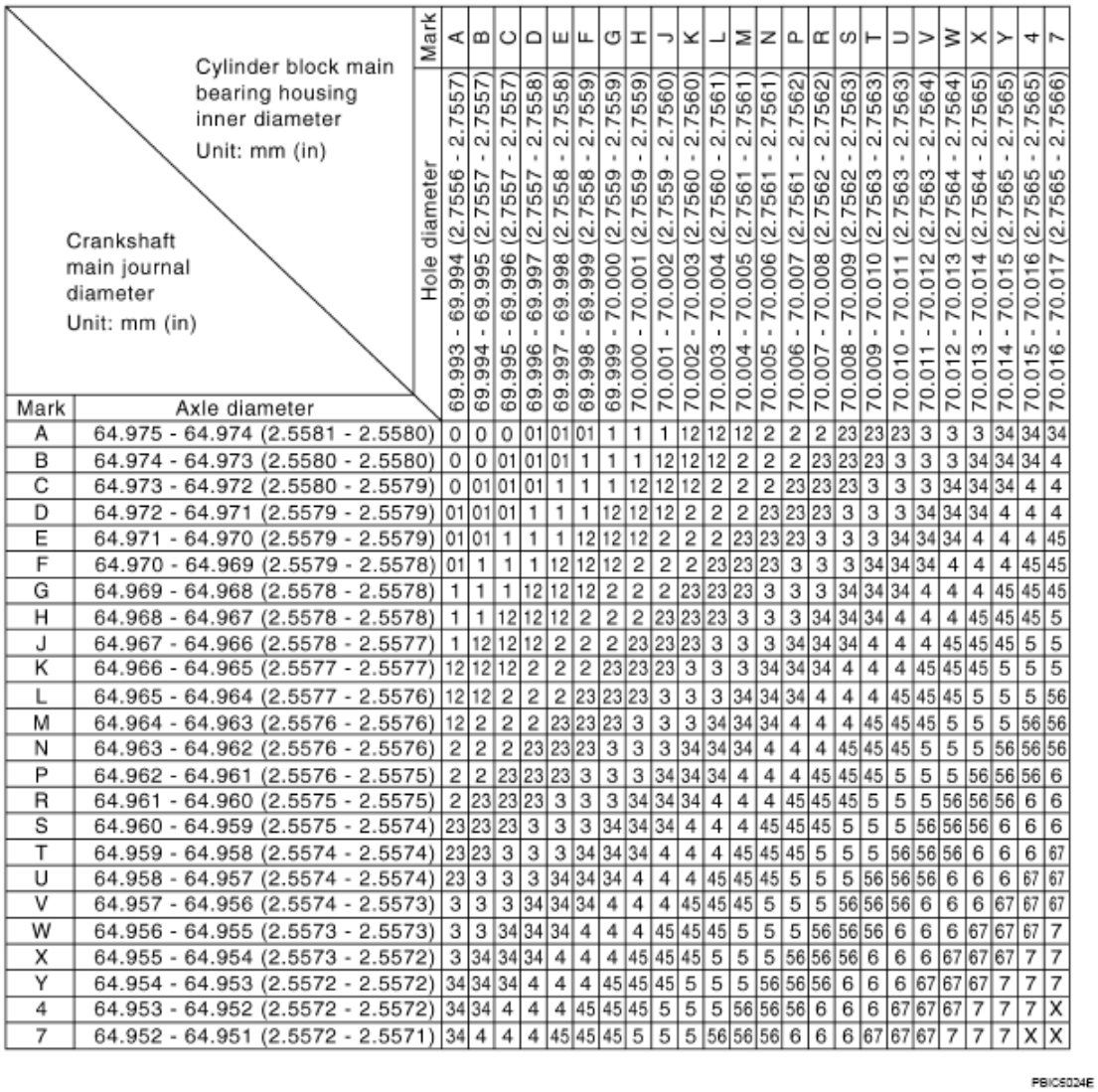
Fig. 291: Identifying Journal Diameter Grade
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Select main bearing grade at the point where selected row and column meet in "Main Bearing Selection Table".

When Cylinder Block and Crankshaft are Reused

1. Measure cylinder block main bearing housing inner diameter and crankshaft main journal diameter. Refer to "**INSPECTION AFTER DISASSEMBLY**".
2. Correspond the measured dimension in "Cylinder block main bearing housing inner diameter" row of "Main Bearing Selection Table".
3. Correspond the measured dimension in "Crankshaft main journal diameter" column of "Main Bearing Selection Table".
4. Select main bearing grade at the point where selected row and column meet in following selection table.

Main Bearing Selection Table



Cylinder block main bearing housing inner diameter Unit: mm (in) / Crankshaft main journal diameter Unit: mm (in)		Mark	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	V	W	X	Y	4	7
Mark	Axle diameter	Hole diameter	69.993 - 69.994 (2.7556 - 2.7557)	69.994 - 69.995 (2.7557 - 2.7557)	69.995 - 69.996 (2.7557 - 2.7557)	69.996 - 69.997 (2.7557 - 2.7558)	69.997 - 69.998 (2.7558 - 2.7558)	69.998 - 69.999 (2.7558 - 2.7559)	69.999 - 70.000 (2.7559 - 2.7559)	70.000 - 70.001 (2.7559 - 2.7559)	70.001 - 70.002 (2.7559 - 2.7560)	70.002 - 70.003 (2.7560 - 2.7560)	70.003 - 70.004 (2.7560 - 2.7561)	70.004 - 70.005 (2.7561 - 2.7561)	70.005 - 70.006 (2.7561 - 2.7561)	70.006 - 70.007 (2.7561 - 2.7562)	70.007 - 70.008 (2.7562 - 2.7562)	70.008 - 70.009 (2.7562 - 2.7563)	70.009 - 70.010 (2.7563 - 2.7563)	70.010 - 70.011 (2.7563 - 2.7563)	70.011 - 70.012 (2.7563 - 2.7564)	70.012 - 70.013 (2.7564 - 2.7564)	70.013 - 70.014 (2.7564 - 2.7565)	70.014 - 70.015 (2.7565 - 2.7565)	70.015 - 70.016 (2.7565 - 2.7565)	70.016 - 70.017 (2.7565 - 2.7566)
A	64.975 - 64.974 (2.5581 - 2.5580)		0	0	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34
B	64.974 - 64.973 (2.5580 - 2.5580)		0	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4
C	64.973 - 64.972 (2.5580 - 2.5579)		0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4
D	64.972 - 64.971 (2.5579 - 2.5579)		01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4
E	64.971 - 64.970 (2.5579 - 2.5579)		01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45
F	64.970 - 64.969 (2.5579 - 2.5578)		01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45
G	64.969 - 64.968 (2.5578 - 2.5578)		1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45
H	64.968 - 64.967 (2.5578 - 2.5578)		1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5
J	64.967 - 64.966 (2.5578 - 2.5577)		1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5
K	64.966 - 64.965 (2.5577 - 2.5577)		12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5
L	64.965 - 64.964 (2.5577 - 2.5576)		12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56
M	64.964 - 64.963 (2.5576 - 2.5576)		12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56
N	64.963 - 64.962 (2.5576 - 2.5576)		2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56
P	64.962 - 64.961 (2.5576 - 2.5575)		2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6
R	64.961 - 64.960 (2.5575 - 2.5575)		2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6
S	64.960 - 64.959 (2.5575 - 2.5574)		23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6
T	64.959 - 64.958 (2.5574 - 2.5574)		23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67
U	64.958 - 64.957 (2.5574 - 2.5574)		23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67
V	64.957 - 64.956 (2.5574 - 2.5573)		3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67
W	64.956 - 64.955 (2.5573 - 2.5573)		3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7
X	64.955 - 64.954 (2.5573 - 2.5572)		3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7
Y	64.954 - 64.953 (2.5572 - 2.5572)		34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7
4	64.953 - 64.952 (2.5572 - 2.5572)		34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7	X
7	64.952 - 64.951 (2.5572 - 2.5571)		34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7	X	X

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Fig. 292: Main Bearing Selection Table
Courtesy of NISSAN MOTOR CO., U.S.A.

Main Bearing Grade Table (All Journals)

THICKNESS SPECIFICATION

Grade number	UPR/LWR	Thickness	Width	Identification color	Remarks
0	-	2.500 - 2.503 (0.0984 - 0.0985)		Black	
1	-	2.503 - 2.506 (0.0985 - 0.0987)		Brown	
2	-	2.506 - 2.509		Green	

		(0.0987 - 0.0988)			
3	-	2.509 - 2.512 (0.0988 - 0.0989)		Yellow	
4	-	2.512 - 2.515 (0.0989 - 0.0990)		Blue	
5	-	2.515 - 2.518 (0.0990 - 0.0991)		Pink	Grade and color are the same for upper and lower bearings.
6	-	2.518 - 2.521 (0.0991 - 0.0993)		Purple	
7	-	2.521 - 2.524 (0.0993 - 0.0994)		White	
01	UPR	2.503 - 2.506 (0.0985 - 0.0987)		Brown	
	LWR	2.500 - 2.503 (0.0984 - 0.0985)		Black	
12	UPR	2.506 - 2.509 (0.0987 - 0.0988)		Green	
	LWR	2.503 - 2.506 (0.0985 - 0.0987)	19.9 - 20.1 (0.783 - 0.791)	Brown	
23	UPR	2.509 - 2.512 (0.0988 - 0.0989)		Yellow	
	LWR	2.506 - 2.509 (0.0987 - 0.0988)		Green	
34	UPR	2.512 - 2.515 (0.0989 - 0.0990)		Blue	Grade and color are different for upper and lower bearings.
	LWR	2.509 - 2.512 (0.0988 - 0.0989)		Yellow	
45	UPR	2.515 - 2.518 (0.0990 - 0.0991)		Pink	
	LWR	2.512 - 2.515 (0.0989 - 0.0990)		Blue	
56	UPR	2.518 - 2.521 (0.0991 - 0.0993)		Purple	
	LWR	2.515 - 2.518 (0.0990 - 0.0991)		Pink	
67	UPR	2.521 - 2.524 (0.0993 - 0.0994)		White	
	LWR	2.518 - 2.521 (0.0991 - 0.0993)		Purple	

Undersize Bearing Usage Guide

- When the specified main bearing oil clearance is not obtained with standard size main bearings, use underside (US) bearing.

- When using undersize (US) bearing, measure the main bearing inner diameter with bearing installed, and grind main journal so that the main bearing oil clearance satisfies the standard.

CAUTION: In grinding crankshaft main journal to use undersize bearings, keep the fillet R (A) [1.5 - 1.7 mm (0.059 - 0.067 in)].

Fig. 293: Identifying Main Bearing Inner Diameter
Courtesy of NISSAN MOTOR CO., U.S.A.

Bearing undersize table

THICKNESS SPECIFICATION

Unit: mm (in)	
Size	**Thickness**
US 0.25 (0.0098)	2.633 - 2.641 (0.1037 - 0.1040)

Inspection After Disassembly

CRANKSHAFT END PLAY

- Measure the clearance between thrust bearings and crankshaft arm when crankshaft is moved fully forward or backward with dial indicator.

  Standard : 0.10 - 0.25 mm (0.0039 - 0.0098 in)

  Limit : 0.30 mm (0.0118 in)

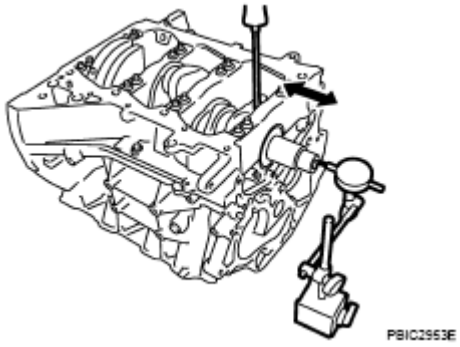


Fig. 294: Measuring Clearance Between Thrust Bearings And Crankshaft Arm
Courtesy of NISSAN MOTOR CO., U.S.A.

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

CONNECTING ROD SIDE CLEARANCE

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

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

  Limit : 0.40 mm (0.0157 in)

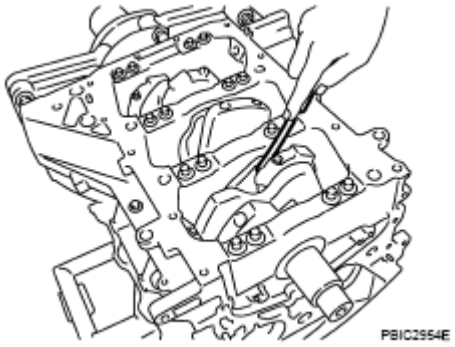


Fig. 295: Measuring Side Clearance Between Connecting Rod And Crankshaft Arm
Courtesy of NISSAN MOTOR CO., U.S.A.

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

PISTON TO PISTON PIN OIL CLEARANCE

Piston Pin Hole Diameter

Measure the inner diameter of piston pin hole with inside micrometer (A).

Standard : 21.993 - 22.005 mm (0.8659 - 0.8663 in)

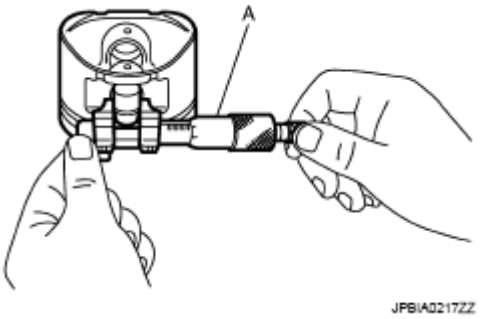


Fig. 296: Measuring Inner Diameter Of Piston Pin Hole
Courtesy of NISSAN MOTOR CO., U.S.A.

Piston Pin Outer Diameter

Measure the outer diameter of piston pin with micrometer (A).

Standard : 21.989 - 22.001 mm (0.8657 - 0.8662 in)

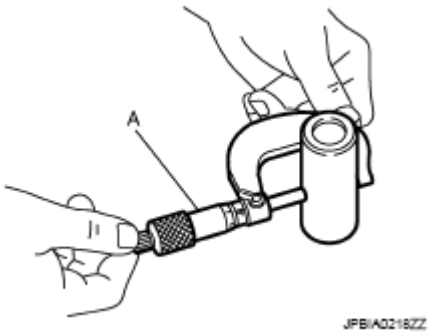


Fig. 297: Measuring Outer Diameter Of Piston Pin
Courtesy of NISSAN MOTOR CO., U.S.A.

Piston to Piston Pin Oil Clearance

(Piston to piston pin oil clearance) = (Piston pin hole diameter) - (Piston pin outer diameter)

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

- If the calculated value is out of the standard, replace piston and piston pin assembly.
- When replacing piston and piston pin assembly, refer to "**HOW TO SELECT PISTON AND BEARING**".

NOTE:

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

PISTON RING SIDE CLEARANCE

- Measure the side clearance of piston ring (1) and piston ring groove with feeler gauge (C).

  Standard:

  Top ring : 0.040 - 0.080 mm (0.0016 - 0.0031 in)

  2nd ring : 0.030 - 0.070 mm (0.0012 - 0.0028 in)

  Oil ring : 0.055 - 0.155 mm (0.0022 - 0.0061 in)

  Limit

  Top ring : 0.11 mm (0.0043 in)

  2nd ring : 0.10 mm (0.0039 in)

  Oil ring : -

A : NG
B : OK

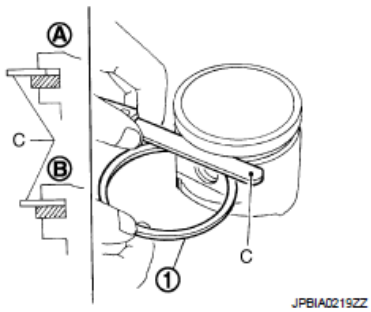


Fig. 298: Measuring Side Clearance Of Piston Ring And Piston Ring Groove
Courtesy of NISSAN MOTOR CO., U.S.A.

- If the measured value exceeds the limit replace piston ring, and measure again. If it still exceeds the limit replace piston also.

PISTON RING END GAP

- Check that cylinder bore inner diameter is within the specification. Refer to "**CYLINDER BORE INNER DIAMETER**".
- Lubricate with new engine oil to piston (1) and piston ring (2), and then insert piston ring until middle of cylinder with piston, and measure the piston ring end gap with feeler gauge (B).

  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 : 0.17 - 0.47 mm (0.0067 - 0.0185 in)

Limit:

Top ring : 0.42 mm (0.0165 in)

2nd ring : 0.57 mm (0.0224 in)

Oil ring : 0.63 mm (0.0248 in)

A : Press-fit
C : Measuring point

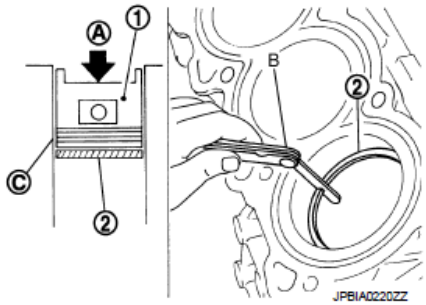


Fig. 299: Measuring Piston Ring End Gap
Courtesy of NISSAN MOTOR CO., U.S.A.

- If the measured value exceeds the limit, replace piston ring, and measure again. If it still exceeds the limit, rebore cylinder and use oversize piston and piston rings.

CONNECTING ROD BEND AND TORSION

- Check with connecting rod aligner.

  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.

A : Bend
B : Torsion
C : Feeler gauge

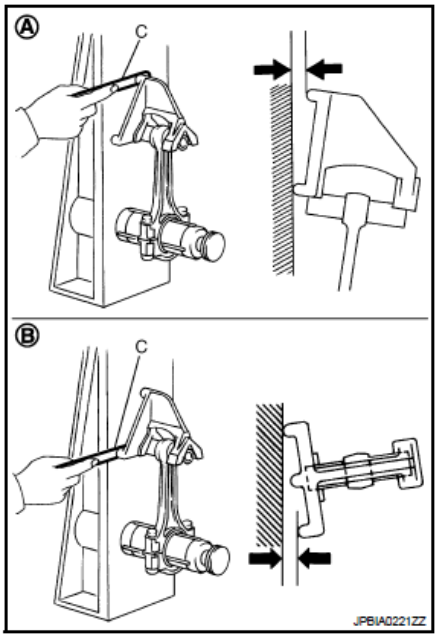


Fig. 300: Checking Connecting Rod Aligner
Courtesy of NISSAN MOTOR CO., U.S.A.

CONNECTING ROD BIG END DIAMETER

- Install connecting rod bearing cap without installing connecting rod bearing, and tightening connecting rod bolts to the specified torque. Refer to "**COMPONENT**" for the tightening procedure.
- Measure the inner diameter of connecting rod big end with inside micrometer.

  Standard : 57.000 - 57.013 mm (2.2441 - 2.2446 in)

- If out of the standard, replace connecting rod assembly.

1 : Connecting rod

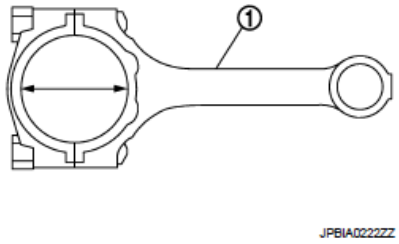


Fig. 301: Measuring Inner Diameter Of Connecting Rod Big End
Courtesy of NISSAN MOTOR CO., U.S.A.

CONNECTING ROD BUSHING OIL CLEARANCE

Connecting Rod Bushing Inner Diameter

Measure the inner diameter of connecting rod bushing with inside micrometer (A).

Standard : 22.000 - 22.012 mm (0.8661 - 0.8666 in)

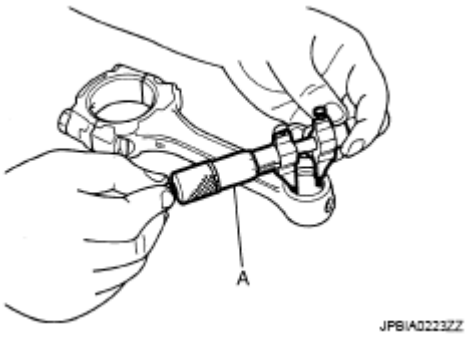


Fig. 302: Measuring Inner Diameter Of Connecting Rod Bushing
Courtesy of NISSAN MOTOR CO., U.S.A.

Piston Pin Outer Diameter

Measure the outer diameter of piston pin with micrometer (A).

Standard : 21.989 - 22.001 mm (0.8657 - 0.8662 in)

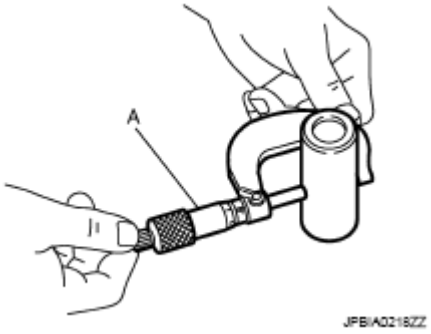


Fig. 303: Measuring Outer Diameter Of Piston Pin
Courtesy of NISSAN MOTOR CO., U.S.A.

Connecting Rod Bushing Oil Clearance

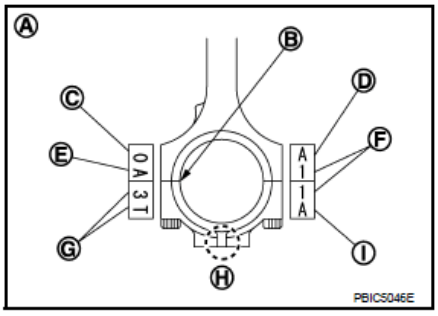
(Connecting rod bushing oil clearance) = (Connecting rod bushing inner diameter) - (Piston pin outer diameter)

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

Limit : 0.030 mm (0.0012 in)

- If the measured value exceeds the limit, replace connecting rod assembly and/or piston and piston pin assembly.
- If replacing piston and piston pin assembly, refer to "**HOW TO SELECT PISTON AND BEARING**".
- If replacing connecting rod assembly, refer to "**CONNECTING ROD BEARING OIL CLEARANCE**"

to select the connecting rod bearing.

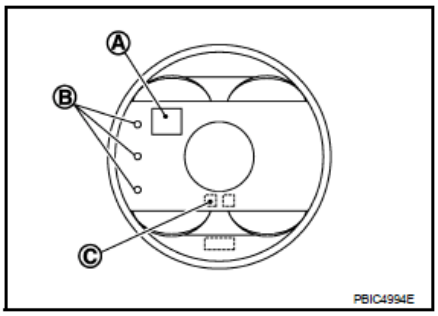


A : Sample code
B : Bearing stopper groove
C : Small end diameter grade
D : Big end diameter grade
E : Weight grade
F : Cylinder No.
G : Management code
H : Front mark
I : Management code

Fig. 304: Identifying Piston And Piston Pin Assembly Installation Position
Courtesy of NISSAN MOTOR CO., U.S.A.

Factory installed parts grading:

- Service parts apply only to grade "0".



A : Piston grade number
B : Front mark
C : Piston pin grade number

Fig. 305: Identifying Piston Grade Number
Courtesy of NISSAN MOTOR CO., U.S.A.

CONNECTING ROD BUSHING INNER DIAMETER SPECIFICATION

Unit: mm (in)

Grade	0	1
Connecting rod bushing inner diameter (1)	22.000 - 22.006 (0.8661 - 0.8664)	22.006 - 22.012 (0.8664 - 0.8666)
Piston pin hole diameter	21.993 - 21.999 (0.8659 - 0.8661)	21.999 - 22. 005 (0.8661 - 0.8663)
Piston pin outer diameter	21.989 - 21.995 (0.8657 - 0.8659)	21.995 - 22.001 (0.8659 - 0.8662)
(1) After installing in connecting rod		

CYLINDER BLOCK DISTORTION

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

CAUTION: Be careful not to allow gasket flakes to enter engine oil or engine coolant passages.

- Measure the distortion on the cylinder block upper face at some different points in six directions (C), (D), (E), (F), (G), and (H) with a straightedge (A) and feeler gauge (B).

Limit : 0.1 mm (0.004 in)

- If it exceeds the limit, replace cylinder block.

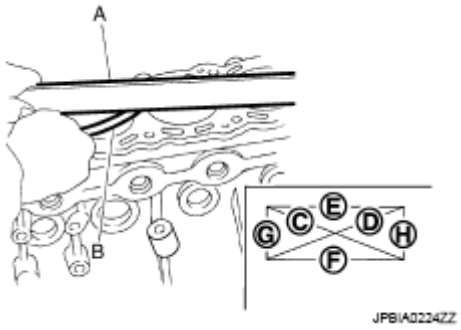


Fig. 306: Measuring Cylinder Block Upper Face
Courtesy of NISSAN MOTOR CO., U.S.A.

MAIN BEARING HOUSING INNER DIAMETER

- Install lower cylinder block (2) without installing main bearings, and tighten lower cylinder block bolts to the specified torque. Refer to "**COMPONENT**" for the tightening procedure.
- Measure the inner diameter of main bearing housing with bore gauge.

Standard : 69.993 - 70.017 mm (2.7556 - 2.7566 in)

- If out of the standard, replace cylinder block (1) and lower cylinder block as assembly.

NOTE: Cylinder block cannot be replaced as a single part, because it is machined together with lower cylinder block.

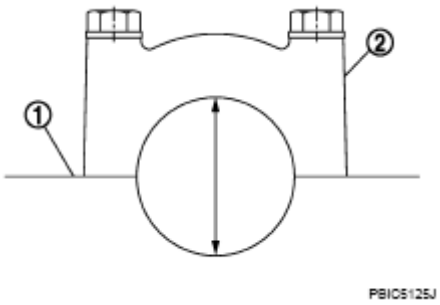


Fig. 307: Measuring Inner Diameter Of Main Bearing Housing
Courtesy of NISSAN MOTOR CO., U.S.A.

PISTON TO CYLINDER BORE CLEARANCE

Cylinder Bore Inner Diameter

- Using bore gauge, measure cylinder bore for wear, out-of-round and taper at six different points on each cylinder. [(A) and (B) directions at (C), (D) and (E)] is in longitudinal direction of engine).

  Standard inner diameter:

  95.500 - 95.530 mm (3.7598 - 3.7610 in)

  Wear limit:

  0.2 mm (0.008 in)

  Out-of-round (Difference between "A" and "B"):

  0.015 mm (0.0006 in)

  Taper limit (Difference between "C" and "E"):

  0.01 mm (0.0004 in)

f : 10 mm (0.39 in)
g : 60 mm (2.36 in)
h : 125 mm (4.92 in)

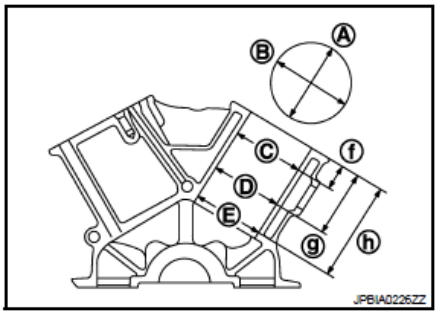


Fig. 308: Identifying Piston To Cylinder Bore Clearance
Courtesy of NISSAN MOTOR CO., U.S.A.

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

CAUTION: When using oversize piston, use over size pistons for all cylinders with oversize piston rings.

Oversize (O/S) : 0.2 mm (0.008 in)

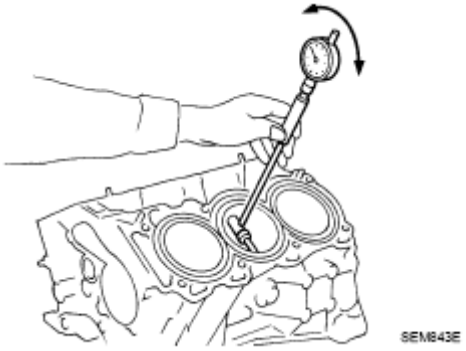


Fig. 309: Checking Clearance Of Piston-To-Cylinder Bore
Courtesy of NISSAN MOTOR CO., U.S.A.

Piston Skirt Diameter

Measure the outer diameter of piston skirt with micrometer (A).

Measure point

: Distance from the top 38.8 mm (1.528 in)

Standard

: 95.480 - 95.510 mm (3.7590 - 3.7602 in)

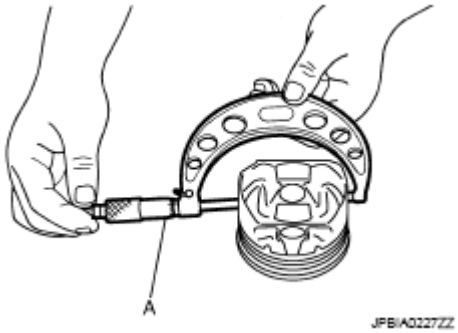


Fig. 310: Measuring Outer Diameter Of Piston Skirt
Courtesy of NISSAN MOTOR CO., U.S.A.

Piston to Cylinder Bore Clearance

Calculate by piston skirt diameter and cylinder bore inner diameter [direction (B), position (C)].

A : Direction A
C : Position C
E : Position E
f : 10 mm (0.39 in)
g : 60 mm (2.36 in)
h : 125 mm (4.92 in)

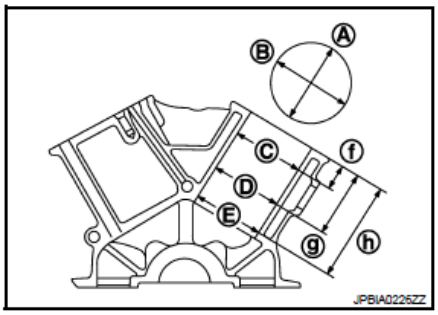


Fig. 311: Identifying Cylinder Bore Inner Diameter
Courtesy of NISSAN MOTOR CO., U.S.A.

(Clearance) = (Cylinder bore inner diameter) - (Piston skirt diameter).

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

Limit : 0.08 mm (0.0031 in)

- If calculated value exceeds the limit, replace piston and piston pin assembly. Refer to "**HOW TO SELECT PISTON AND BEARING**".

Reboring Cylinder Bore

1. Cylinder bore size is determined by adding piston to cylinder bore clearance to piston skirt diameter.

   Rebored size calculation: D = A + B - C

   where,

   A: Piston skirt diameter as measured

   B: Piston to cylinder bore clearance (standard value)

   C: Honing allowance 0.02 mm (0.0008 in)

   D: Bored diameter

2. Install lower cylinder block, and tighten to the specified torque. Otherwise, cylinder bores may be distorted in final assembly.
3. Cut cylinder bores.

NOTE:

- **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 the specified piston to cylinder bore clearance.
5. Measure finished cylinder bore for the out-of-round and taper.

NOTE: Measurement should be done after cylinder bore cools down.

CRANKSHAFT MAIN JOURNAL DIAMETER

- Measure the outer diameter of crankshaft main journals with micrometer.

  Standard : 64.951 - 64.975 mm (2.5571 - 2.5581 in) dia .

- If out of the standard, measure the main bearing oil clearance. Then use undersize bearing. Refer to "**MAIN BEARING OIL CLEARANCE**".

CRANKSHAFT PIN JOURNAL DIAMETER

- Measure the outer diameter of crankshaft pin journal with micrometer (A).

  Standard : 53.956 - 53.974 mm (2.1242 - 2.1250 in) dia .

- If out of the standard, measure the connecting rod bearing oil clearance. Then use undersize bearing. Refer to "**CONNECTING ROD BEARING OIL CLEARANCE**".

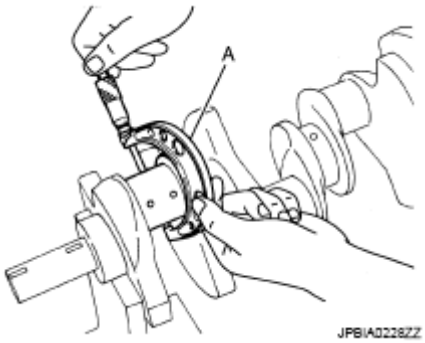


Fig. 312: Measuring Connecting Rod Bearing Oil Clearance
Courtesy of NISSAN MOTOR CO., U.S.A.

CRANKSHAFT OUT-OF-ROUND AND TAPER

- Measure the dimensions at four different points as shown in the figure on each main journal and pin journal with micrometer.
- Out-of-round is indicated by the difference in the dimensions between (c) and (d) at (a) and (b).

- Taper is indicated by the difference in the dimensions between.

  Limit:

  Out-of-round (Difference between "X" and "Y")

  : 0.0025 mm (0.0001 in)

  Taper (Difference between "A" and "B")

  : 0.0025 mm (0.0001 in)

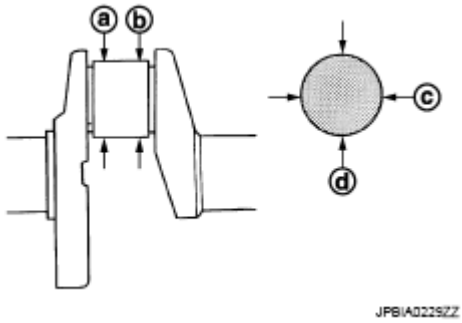


Fig. 313: Identifying Crankshaft Out-Of-Round And Taper
Courtesy of NISSAN MOTOR CO., U.S.A.

- If the measured value exceeds the limit, correct or replace crankshaft.
- If corrected, measure the bearing oil clearance of the corrected main journal and/or pin journal. Then select the main bearing and/or connecting rod bearing. Refer to "**MAIN BEARING OIL CLEARANCE**" and/or "CONNECTING ROD BEARING OIL CLEARANCE".

CRANKSHAFT RUNOUT

- Place V-block on precise flat table, and support the journals on the both end of crankshaft.
- Place dial indicator straight up on the No. 3 journal.
- While rotating crankshaft, read the movement of the pointer on dial indicator. (Total indicator reading)

  Standard : Less than 0.05 mm (0.0020 in)

  Limit : 0.10 mm (0.0039 in)

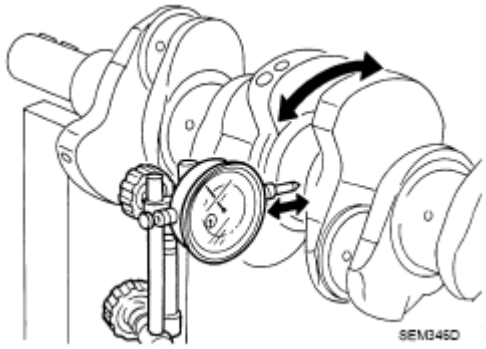


Fig. 314: Checking Crankshaft Runout
Courtesy of NISSAN MOTOR CO., U.S.A.

- If it exceeds the limit, replace crankshaft.

CONNECTING ROD BEARING OIL CLEARANCE

Method by Calculation

- Install connecting rod bearings (1) to connecting rod (2) and cap, and tighten connecting rod bolts to the specified torque. Refer to "**COMPONENT**" for the tightening procedure.
- Measure the inner diameter of connecting rod bearing with inside micrometer.

  (Bearing oil clearance) = (Connecting rod bearing inner diameter) - (Crankshaft pin journal diameter)

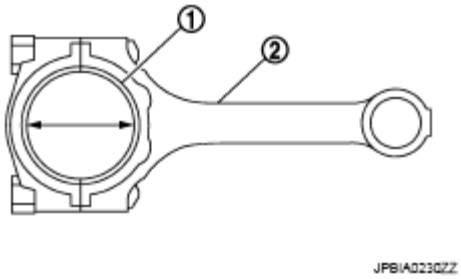


Fig. 315: Identifying Connecting Rod Bearings To Connecting Rod
Courtesy of NISSAN MOTOR CO., U.S.A.

Standard : 0.040 - 0.053 mm (0.0016 - 0.0021 in) (actual clearance)

Limit : 0.070 mm (0.0028 in)

- If the calculated value exceeds the limit, select proper connecting rod bearing according to connecting rod big end diameter and crankshaft pin journal diameter to obtain the specified bearing oil clearance. Refer to "**HOW TO SELECT PISTON AND BEARING**".

Method of Using Plastigage

- Remove oil and dust on crankshaft pin journal and the surfaces of each bearing completely.
- Cut plastigage slightly shorter than the bearing width, and place it in crankshaft axial direction, avoiding oil holes.
- Install connecting rod bearings to connecting rod and cap, and tighten connecting rod bolts to the specified torque. Refer to "**COMPONENT**" for the tightening procedure.

CAUTION: Never rotate crankshaft.

- Remove connecting rod bearing cap and bearing, and using scale on 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".

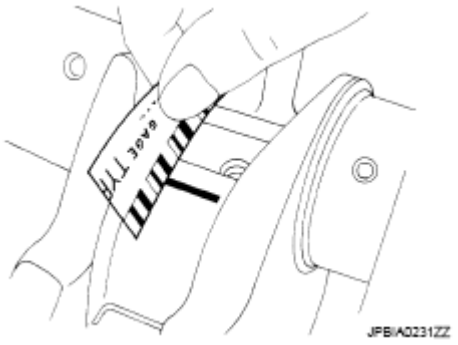


Fig. 316: Measuring Plastigage Width
Courtesy of NISSAN MOTOR CO., U.S.A.

MAIN BEARING OIL CLEARANCE

Method by Calculation

- Install main bearings (3) to cylinder block (1) and lower cylinder block (2), and tighten lower cylinder block bolts to the specified torque. Refer to "**COMPONENT**" for the tightening procedure.
- Measure the inner diameter of main bearing with bore gauge. (Bearing clearance) = (Main bearing inner diameter) - (Crankshaft main journal diameter)

Standard : 0.035 - 0.045 mm (0.0014 - 0.0018 in) (actual clearance)

Limit : 0.065 mm (0.0026 in)

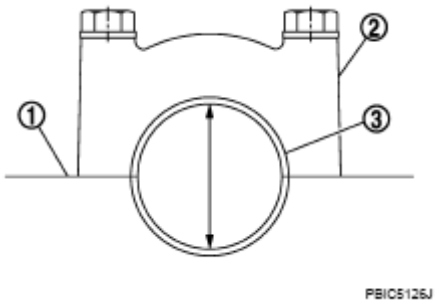


Fig. 317: Measuring Inner Diameter Of Main Bearing
Courtesy of NISSAN MOTOR CO., U.S.A.

- If the clearance exceeds the limit, select proper main bearing according to main bearing inner diameter and crankshaft main journal diameter to obtain the specified bearing oil clearance. Refer to "**HOW TO SELECT PISTON AND BEARING**".

Method of Using Plastigage

- Remove oil and dust on crankshaft main journal and the surfaces of each bearing completely.
- Cut plastigage slightly shorter than the bearing width, and place it in crankshaft axial direction, avoiding oil holes.
- Install main bearings to cylinder block and lower cylinder block, and tighten lower cylinder block bolts with lower cylinder block to the specified torque. Refer to "**COMPONENT**" for the tightening procedure.

CAUTION: Never rotate crankshaft.

- Remove lower cylinder block and bearings, and using scale on 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".

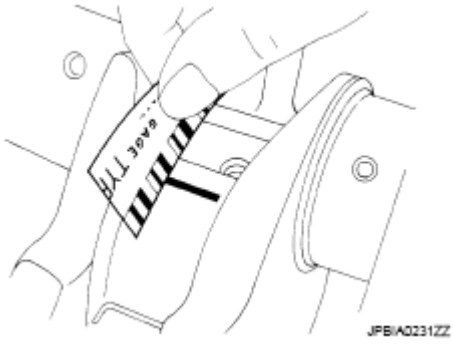


Fig. 318: Measuring Plastigage Width

Courtesy of NISSAN MOTOR CO., U.S.A.

CRUSH HEIGHT OF MAIN BEARING

- When lower cylinder block is removed after being tightened to the specified torque with main bearings (1) installed, the tip end of bearing must protrude. Refer to "**COMPONENT**" for the tightening procedure.

  Standard : There must be crush height .

A : Crush height

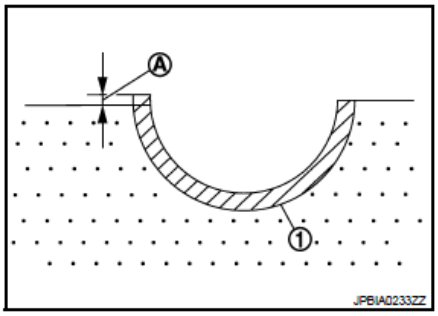


Fig. 319: Identifying Crush Height Of Main Bearing
Courtesy of NISSAN MOTOR CO., U.S.A.

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

CRUSH HEIGHT OF CONNECTING ROD BEARING

- When connecting rod bearing cap is removed after being tightened to the specified torque with connecting rod bearings (1) installed, the tip end of bearing must protrude. Refer to "**COMPONENT**" for the tightening procedure.

A : Crush height

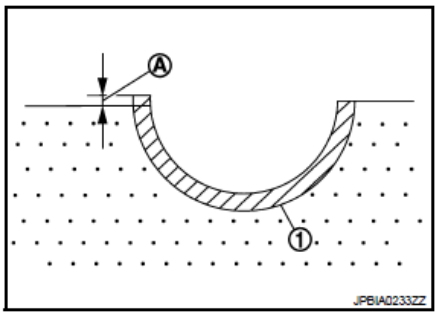


Fig. 320: Identifying Crush Height Of Connecting Rod Bearing
Courtesy of NISSAN MOTOR CO., U.S.A.

Standard : There must be crush height .

- If the standard is not met, replace connecting rod bearings.

LOWER CYLINDER BLOCK BOLT OUTER DIAMETER

- Measure the outer diameters (c), (d) at two positions as shown in the figure.

a : 20 mm (0.79 in)
b : 30 mm (1.18 in)
e : 10 mm (0.39 in)

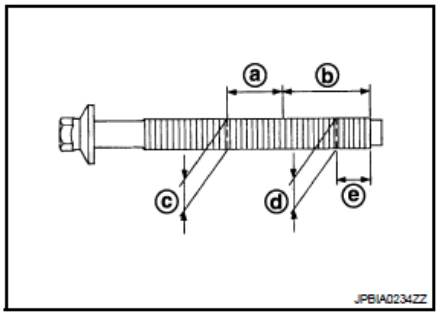


Fig. 321: Identifying Lower Cylinder Block Bolt Outer Diameter
Courtesy of NISSAN MOTOR CO., U.S.A.

- If reduction appears in (a) range, regard it as "d2".

Limit [(d) - (c)] : 0.11 mm (0.0043 in)

- If it exceeds the limit (large difference in dimensions), replace lower cylinder block bolt with new one.

CONNECTING ROD BOLT OUTER DIAMETER

- Measure the outer diameter [(a), (b) and (c)] at the position shown in the figure.

a : Value at the end of the smaller diameter of the bolt
b : Value at the end of the smaller diameter of the bolt [opposite side (a)]
c : Value of the smallest diameter of the smaller of the bolt

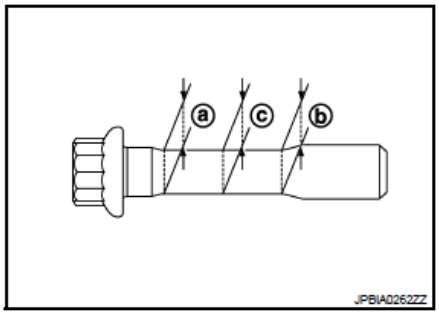


Fig. 322: Identifying Connecting Rod Bolt Outer Diameter
Courtesy of NISSAN MOTOR CO., U.S.A.

- Obtain a mean value (d) of (a) and (b).
- Subtract (c) from (d).

Limit [(d) - (c)] : 0.09 mm (0.0035 in)

- If it exceeds the limit (large difference in dimensions), replace the bolt with new one.

DRIVE PLATE

- Check drive plate and signal plate for deformation or cracks.

CAUTION:

- **Never disassemble drive plate.**
- **Never place drive plate with signal plate 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.**

- If anything is found, replace drive plate.

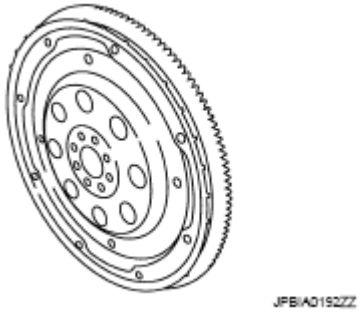


Fig. 323: Identifying Drive Plate
Courtesy of NISSAN MOTOR CO., U.S.A.

OIL JET

- Check nozzle for deformation and damage.
- Blow compressed air from nozzle, and check for clogs.
- If it is not satisfied, clean or replace oil jet.

OIL JET RELIEF VALVE

- Using clean plastic stick, press check valve in oil jet relief valve. Check that valve moves smoothly with proper reaction force.
- If it is not satisfied, replace oil jet relief valve.

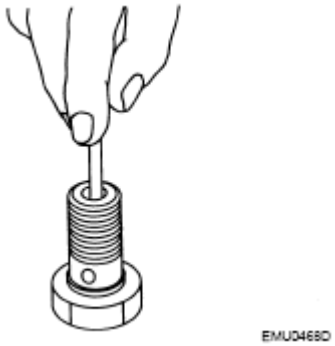


Fig. 324: Checking Oil Jet Relief Valve

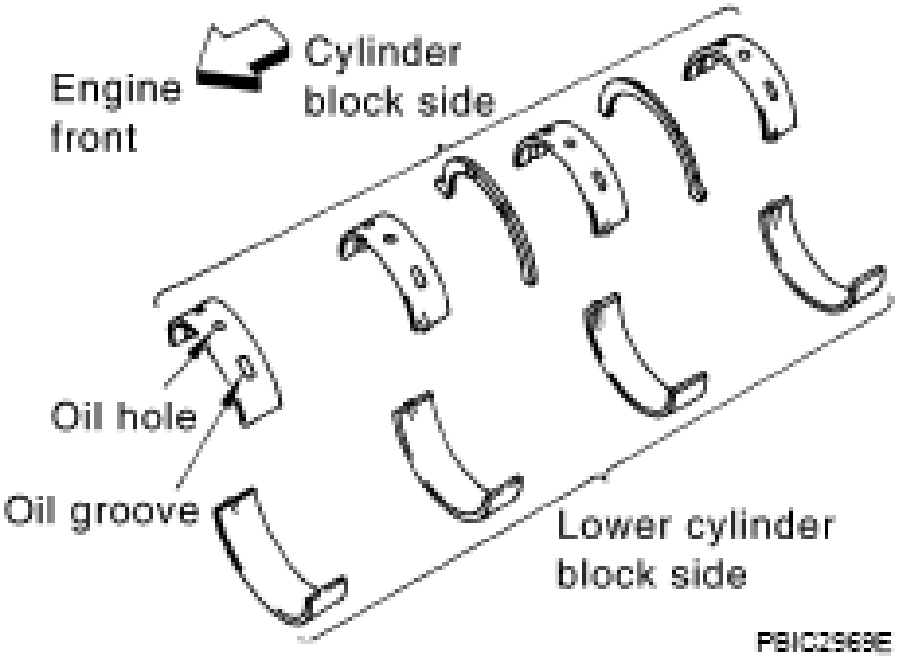
Courtesy of NISSAN MOTOR CO., U.S.A.

SERVICE DATA AND SPECIFICATIONS (SDS)

Standard and Limit

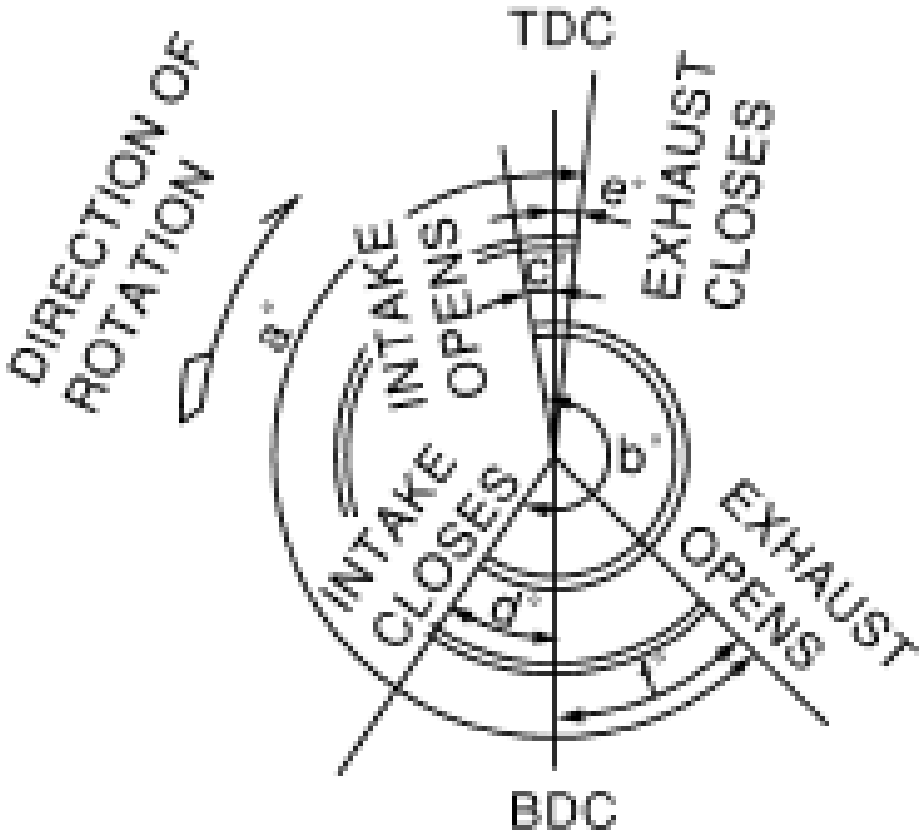
GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Cylinder arrangement		V-6
Displacement cm^3 (cu in)		3,498 (213.45)
Bore and stroke mm (in)		95.5 x 81.4 (3.760 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		10.6
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		

VALVE TIMING REFERENCE

Valve timing (Intake valve timing control - "OFF")



Unit: degree

a	b	c	d	e	f
248	248	2	66	0	68

DRIVE BELT

DRIVE BELT TENSION REFERENCE

Tension of drive belt	Auto adjustment by auto tensioner

INTAKE MANIFOLD COLLECTOR, INTAKE MANIFOLD AND EXHAUST MANIFOLD

INTAKE AND EXHAUST MANIFOLD SPECIFICATION

Unit: mm (in)

Items		Limit
Surface distortion	Intake manifold	0.1 (0.004)
	Exhaust manifold	0.7 (0.028)

SPARK PLUG

SPARK PLUG SPECIFICATION

Unit: mm (in)

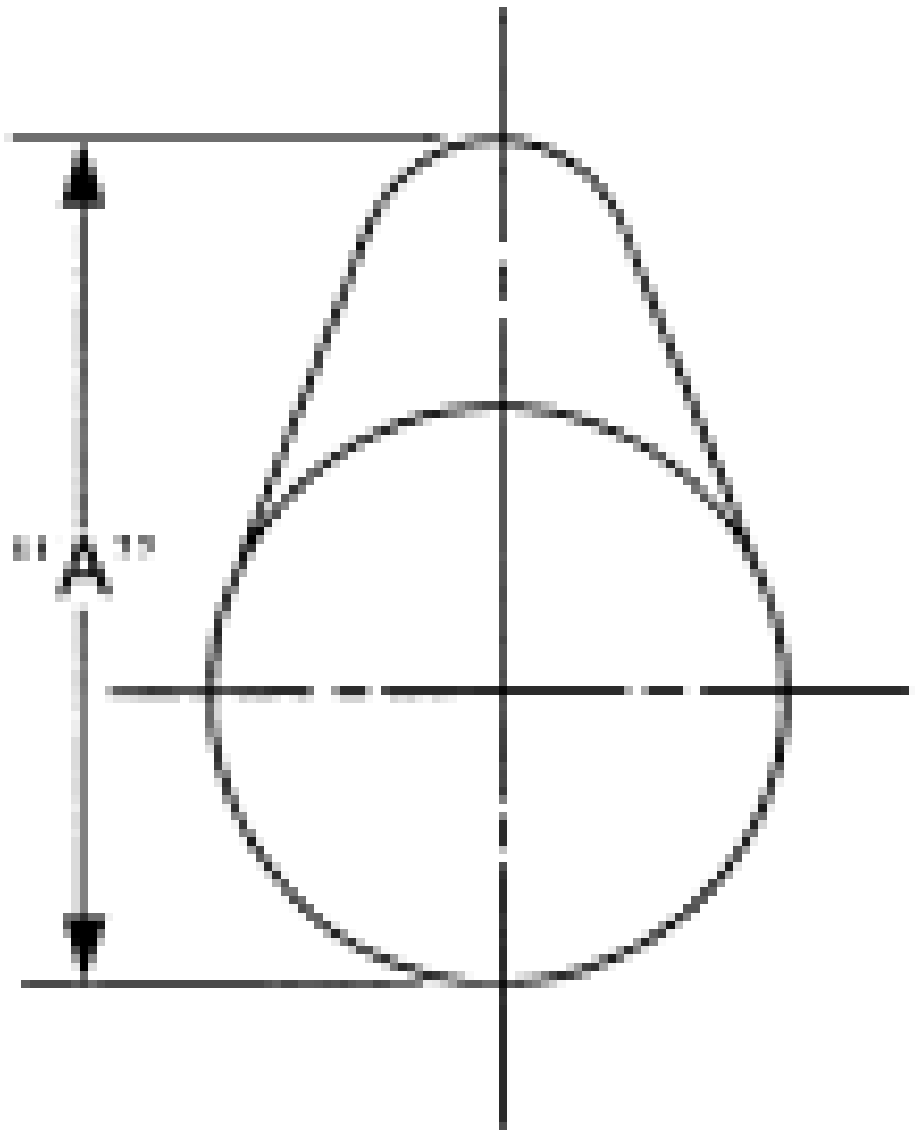
Make	DENSO
Standard type	FXE22HR11
Gap (Nominal)	1.1 (0.043)

CAMSHAFT AND CAMSHAFT BEARING

CAMSHAFT AND CAMSHAFT BEARING SPECIFICATION

Unit: mm (in)

Items		Standard	Limit
Camshaft journal oil 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)	
Camshaft bracket inner diameter	No. 1	26.000 - 26.021 (1.0236 - 1.0244)	-
	No. 2, 3, 4	23.500 - 23.521 (0.9252 - 0.9260)	-
Camshaft journal diameter	No. 1	25.935 - 25.955 (1.0211 - 1.0218)	-
	No. 2, 3, 4	23.445 - 23.465 (0.9230 - 0.9238)	-
Camshaft end play		0.115 - 0.188 (0.0045 - 0.0074)	0.24 (0.0094)
Camshaft cam height "A"	Intake	45.865 - 46.055 (1.8057 - 1.8132)	0.2 (0.008)(1)
	Exhaust	45.875 - 46.065 (1.8061 - 1.8136)	
Camshaft runout (TIR(2))		Less than 0.02 (0.0008)	0.05 (0.0020)
Camshaft sprocket runout (TIR(2))		-	0.15 (0.0059)



(1) Cam wear limit

(2) Total indicator reading

VALVE LIFTER

VALVE LIFTER SPECIFICATION

Unit: mm (in)

Items	Standard
Valve lifter outer diameter	33.980 - 33.990 (1.3378 - 1.3382)
Valve lifter hole diameter	34.000 - 34.016 (1.3386 - 1.3392)
Valve lifter clearance	0.010 - 0.036 (0.0004 - 0.0014)

VALVE CLEARANCE

VALVE CLEARANCE SPECIFICATION

Unit: mm (in)

Items	Cold	Hot(1) (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)

(1) Approximately 80°C (176°F)

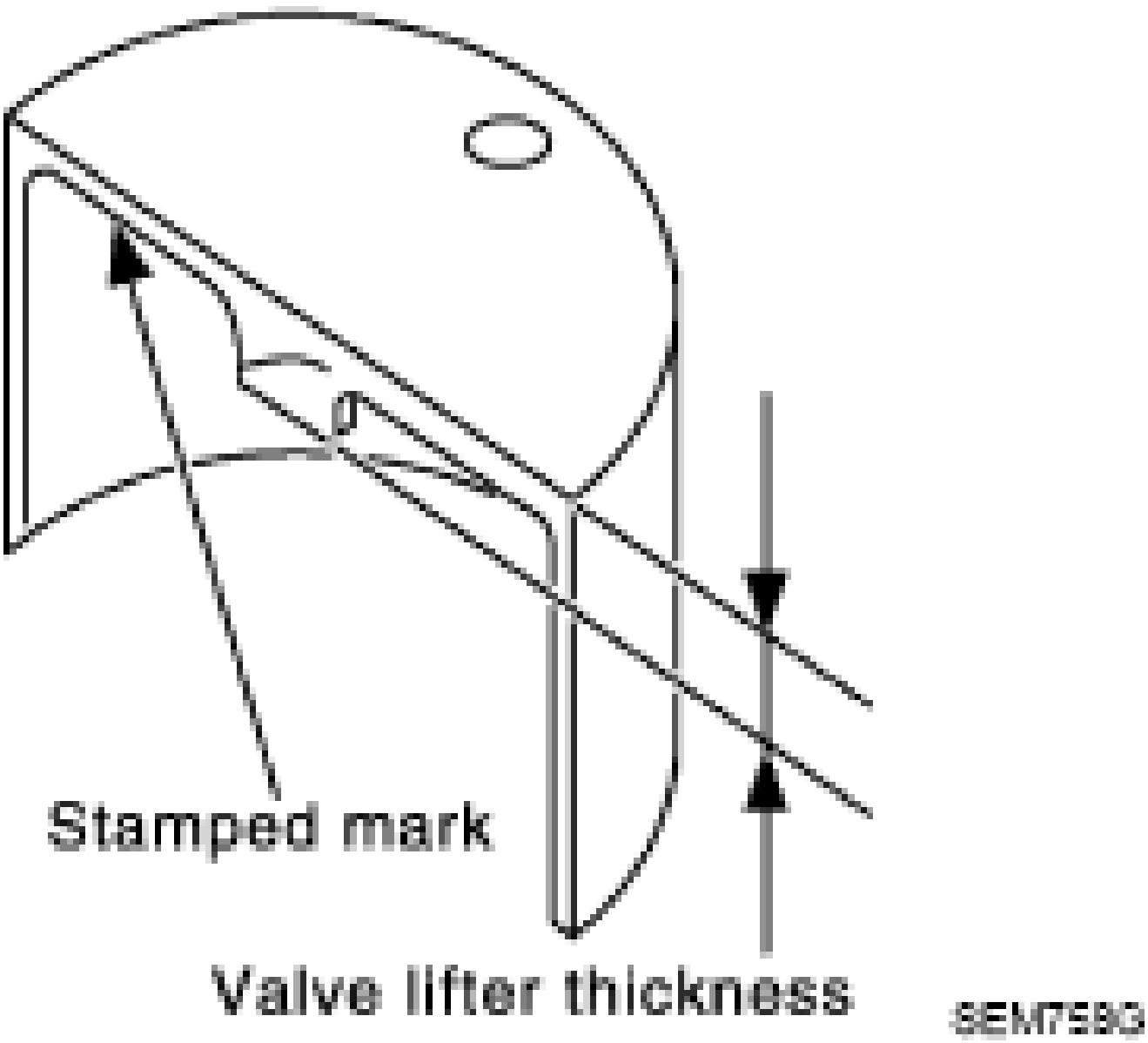
AVAILABLE VALVE LIFTER

AVAILABLE VALVE LIFTER SPECIFICATION

Unit: mm (in)

Identification (stamped) mark	Thickness
788	7.88 (0.3102)
790	7.90 (0.3110)
792	7.92 (0.3118)
794	7.94 (0.3126)
796	7.96 (0.3134)
798	7.98 (0.3142)
800	8.00 (0.3150)
802	8.02 (0.3157)
804	8.04 (0.3165)
806	8.06 (0.3173)
808	8.08 (0.3181)
810	8.10 (0.3189)
812	8.12 (0.3197)
814	8.14 (0.3205)
816	8.16 (0.3213)
818	8.18 (0.3220)
820	8.20 (0.3228)
822	8.22 (0.3236)
824	8.24 (0.3244)
826	8.26 (0.3252)
828	8.28 (0.3260)
830	8.30 (0.3268)

832	8.32 (0.3276)
834	8.34 (0.3283)
836	8.36 (0.3291)
838	8.38 (0.3299)
840	8.40 (0.3307)

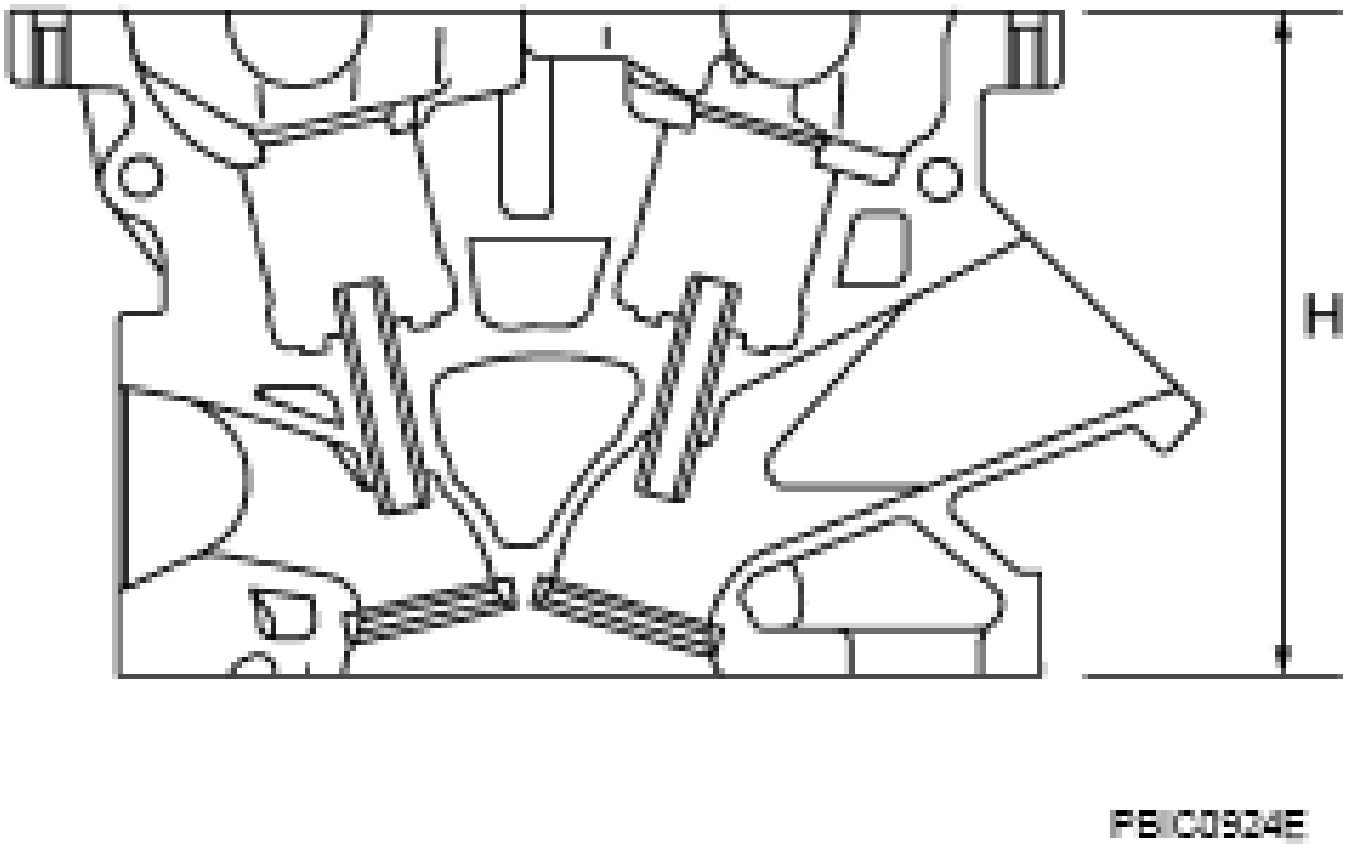


CYLINDER HEAD

CYLINDER HEAD SPECIFICATION

Unit: mm (in)

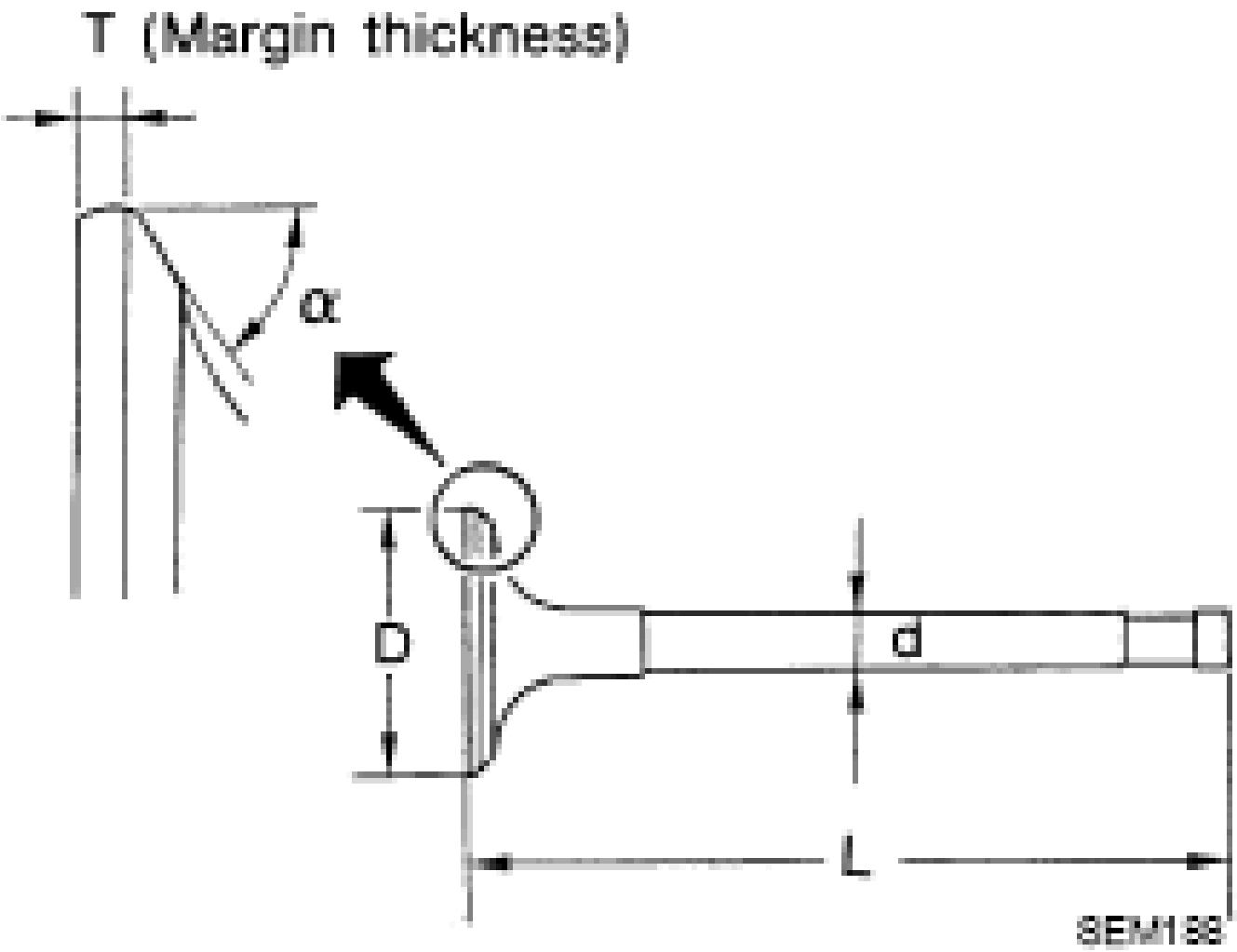
Items	Standard	Limit
Head surface distortion	Less than 0.03 (0.0012)	0.1 (0.004)
Normal cylinder head height "H"	126.3 - 126.5 (4.97 - 4.98)	-



VALVE DIMENSIONS

VALVE DIMENSIONS SPECIFICATION

Unit: mm (in)

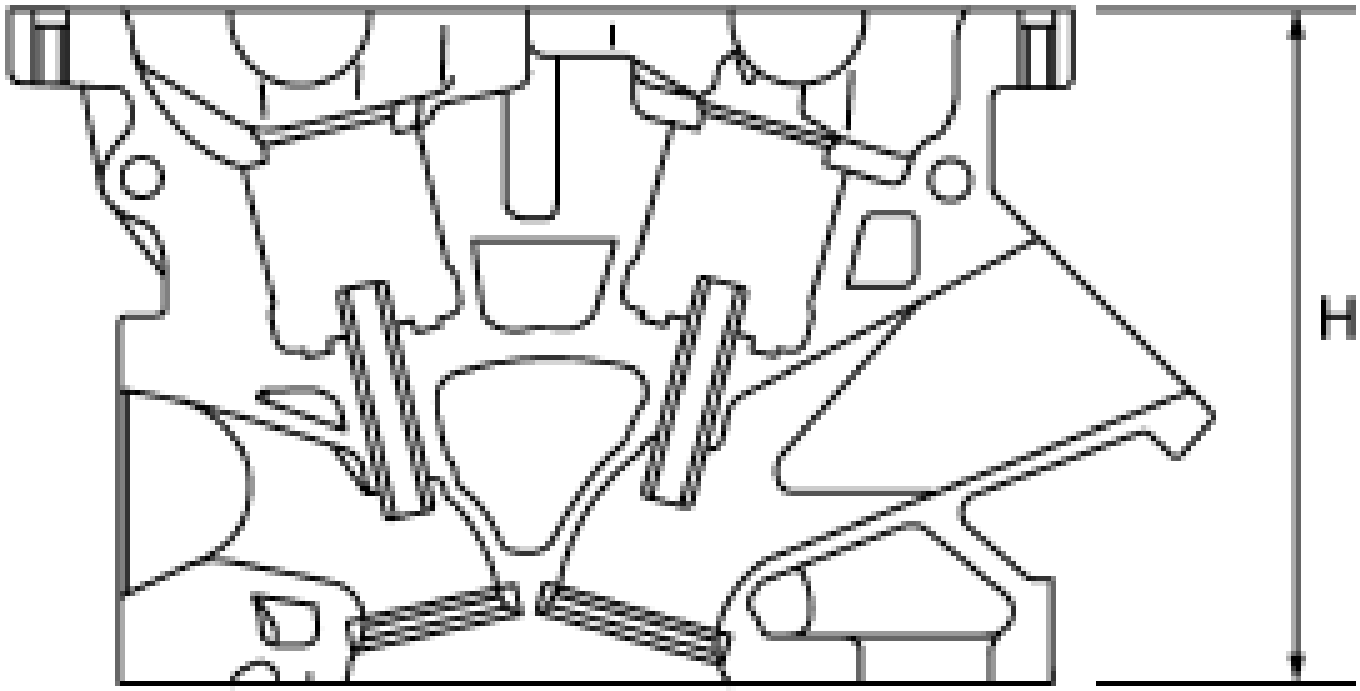


Valve head diameter "D"	Intake	36.6 - 36.9 (1.441 - 1.453)
	Exhaust	30.2 - 30.5 (1.189 - 1.201)
Valve length "L"	Intake	97.13 (3.8240)
	Exhaust	94.67 (3.7272)
Valve stem diameter "d"	Intake	5.965 - 5.980 (0.2348 - 0.2354)
	Exhaust	5.962 - 5.970 (0.2347 - 0.2350)
Valve seat angle "a"	Intake	45°15' - 45°45'
	Exhaust	
Valve margin "T"	Intake	1.1 (0.043)
	Exhaust	1.3 (0.051)
Valve margin "T" limit		0.5 (0.020)
Valve stem end surface grinding limit		0.2 (0.008)

VALVE GUIDE

VALVE GUIDE SPECIFICATION

Unit: mm (in)



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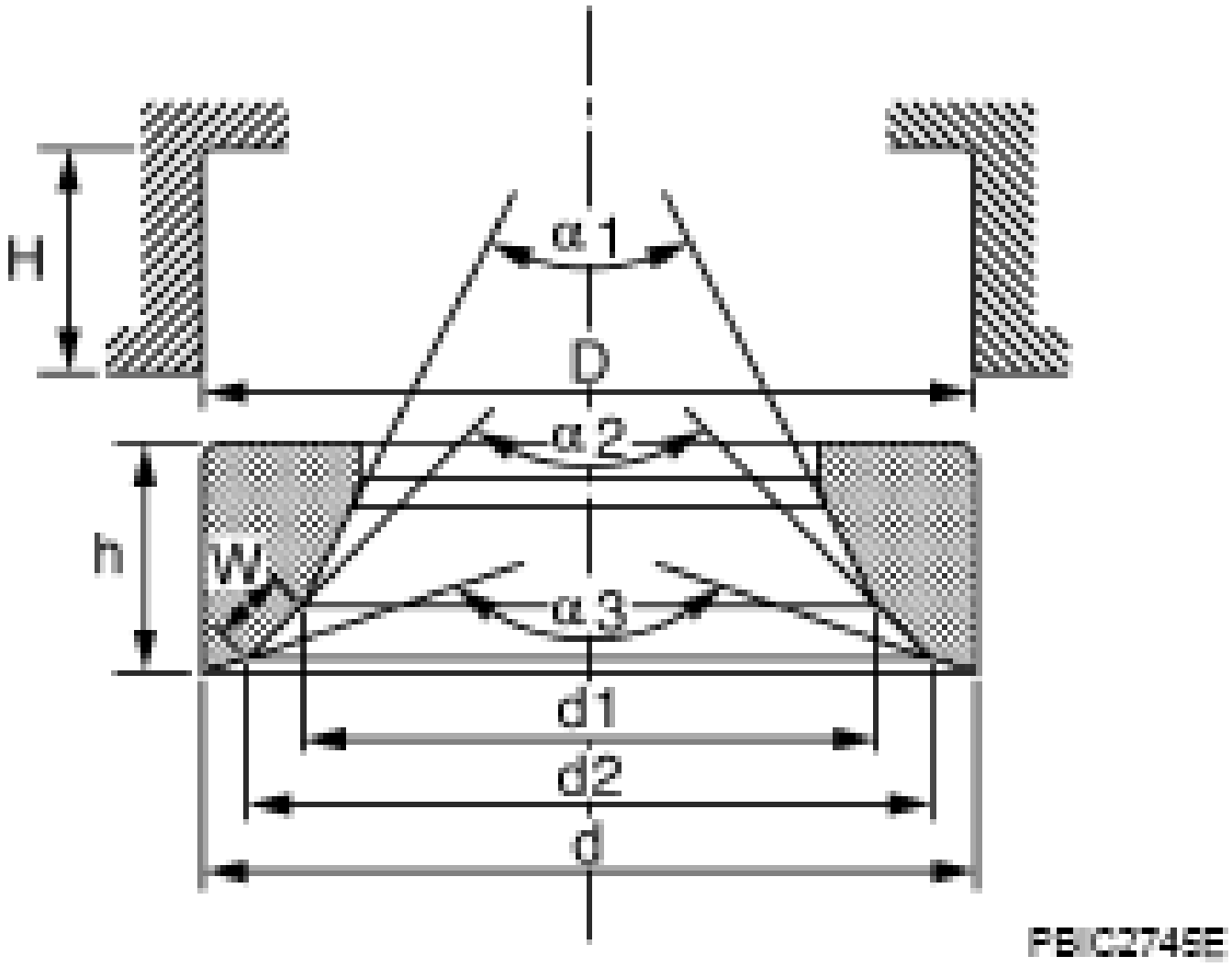
Items		Standard	Oversize (Service) [0.2 (0.008)]
Valve guide	Outer diameter	10.023 - 10.034 (0.3946 - 0.3950)	10.223 - 10.234 (0.4025 - 0.4029)
	Inner diameter (Finished size)	6.000 - 6.018 (0.2362 - 0.2369)	
Cylinder head valve guide hole diameter		9.975 - 9.996 (0.3927 - 0.3935)	10.175 - 10.196 (0.4006 - 0.4014)
Interference fit of valve guide		0.027 - 0.059 (0.0011 - 0.0023)	
Items		Standard	Limit
Valve guide clearance	Intake	0.020 - 0.053 (0.0008 - 0.0021)	0.08 (0.0031)
	Exhaust	0.030 - 0.056 (0.0012 - 0.0022)	0.09 (0.0035)
Projection length "L"		12.6 - 12.8 (0.496 - 0.504)	

VALVE SEAT

VALVE SEAT SPECIFICATION

Unit: mm (in)



Items		Standard	Oversize (Service) [0.5 (0.020)]
Cylinder head seat recess diameter "D"	Intake	38.000 - 38.016 (1.4961 - 1.4967)	38.500 - 38.516 (1.5157 - 1.5164)
	Exhaust	31.600 - 31.616 (1.2441 - 1.2447)	32.100 - 32.116 (1.2638 - 1.2644)
Valve seat outer diameter "d"	Intake	38.097 - 38.113 (1.4999 - 1.5005)	38.597 - 38.613 (1.5196 - 1.5202)
	Exhaust	31.680 - 31.696 (1.2472 - 1.2479)	32.180 - 32.196 (1.2669 - 1.2676)
Valve seat interference fit	Intake	0.081 - 0.113 (0.0032 - 0.0044)	
	Exhaust	0.064 - 0.096 (0.0025 - 0.0038)	

Diameter "d1"(1)	Intake	34.6 (1.362)	
	Exhaust	27.7 (1.091)	
Diameter "d2"(2)	Intake	35.9 - 36.4 (1.413 - 1.433)	
	Exhaust	29.3 - 29.8 (1.154 - 1.173)	
Angle "a1"	Intake	60°	
	Exhaust	60°	
Angle "a2"	Intake	88°45' - 90°15'	
	Exhaust	88°45' - 90°15'	
Angle "a3"	Intake	120°	
	Exhaust	120°	
Contacting width "W"(3)	Intake	1.0 - 1.4 (0.039 - 0.055)	
	Exhaust	1.2 - 1.6 (0.047 - 0.063)	
Height "h"	Intake	5.9 - 6.0 (0.232 - 0.236)	5.05 - 5.15 (0.1988 - 0.2028)
	Exhaust	5.9 - 6.0 (0.232 - 0.236)	4.95 - 5.05 (0.1949 - 0.1988)
Depth "H"		6.0 (0.236)	

(1) Diameter made by intersection point of conic angles "a1" and "a2"

(2) Diameter made by intersection point of conic angles "a2" and "a3"

(3) Machining data

VALVE SPRING

VALVE SPRING SPECIFICATION

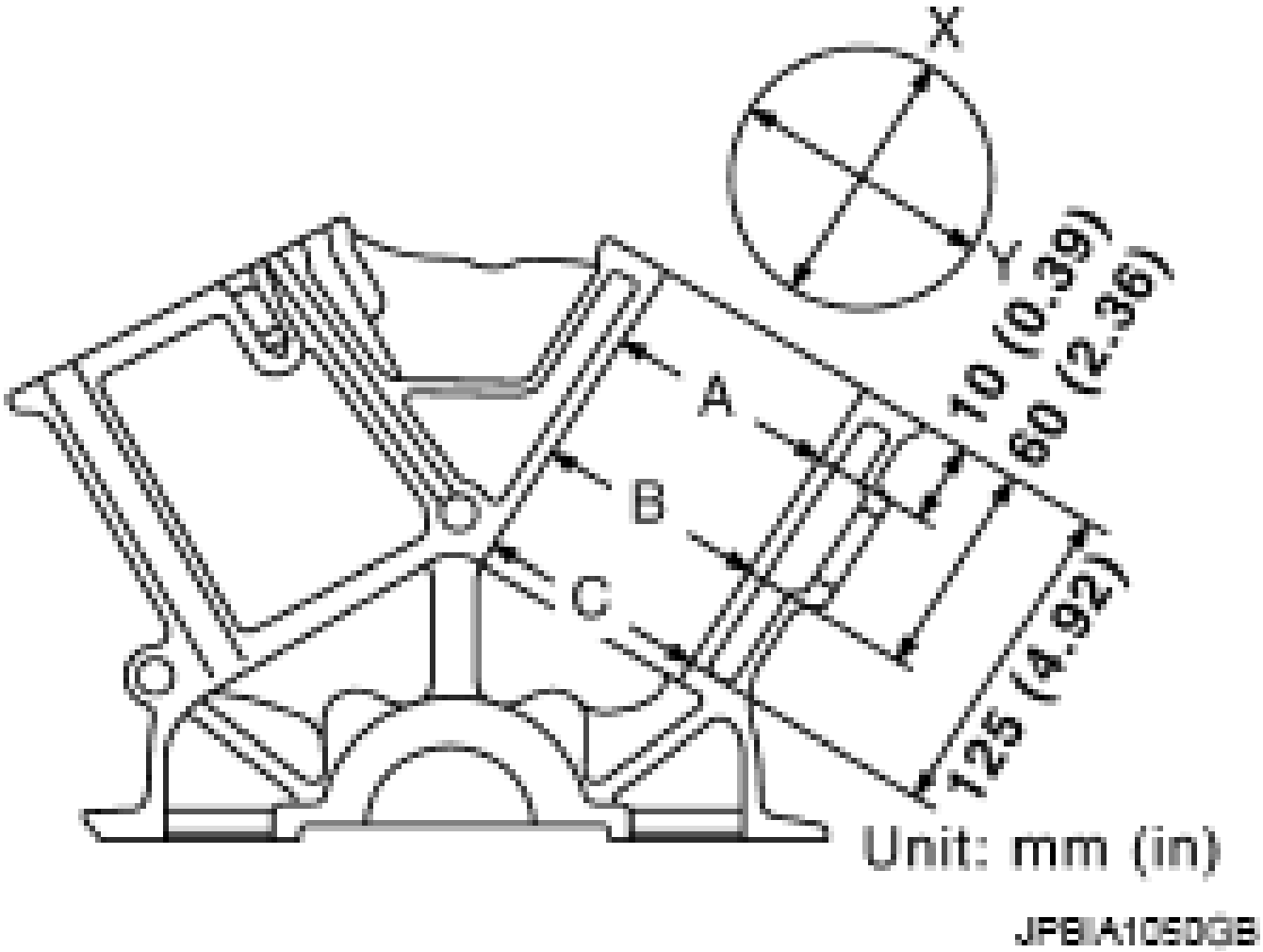
Unit: mm (in)

Items	Standard
Free height	43.85 (1.7264)
Installation height	37.00 (1.4567)
Installation load	166 - 188 N (16.9 - 19.2 kg, 37 - 42 lb)
Height during valve open	26.8 (1.055)
Load with valve open	502 - 566 N (51.2 - 57.7 kg, 113 - 127 lb)
Items	Limit
squareness	1.9 (0.075)

CYLINDER BLOCK

CYLINDER BLOCK SPECIFICATION

Unit: mm (in)



Surface distortion		Standard		Less than 0.03 (0.0012)
		Limit		0.1 (0.004)
Main bearing housing inner diameter		Standard		69.993 - 70.017 (2.7556 - 2.7566)
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		0.2 (0.008)
Out-of-round (Difference between "X" and "Y")		Limit		0.015 (0.0006)
Taper (Difference between "A" and "C")				0.010 (0.0004)
			Grade No. A	69.993 - 69.994 (2.7556 - 2.7557)
			Grade No. B	69.994 - 69.995 (2.7557 - 2.7557)
			Grade No. C	69.995 - 69.996 (2.7557 - 2.7557)
			Grade No. D	69.996 - 69.997 (2.7557 - 2.7558)
			Grade No. E	69.997 - 69.998 (2.7558 - 2.7558)

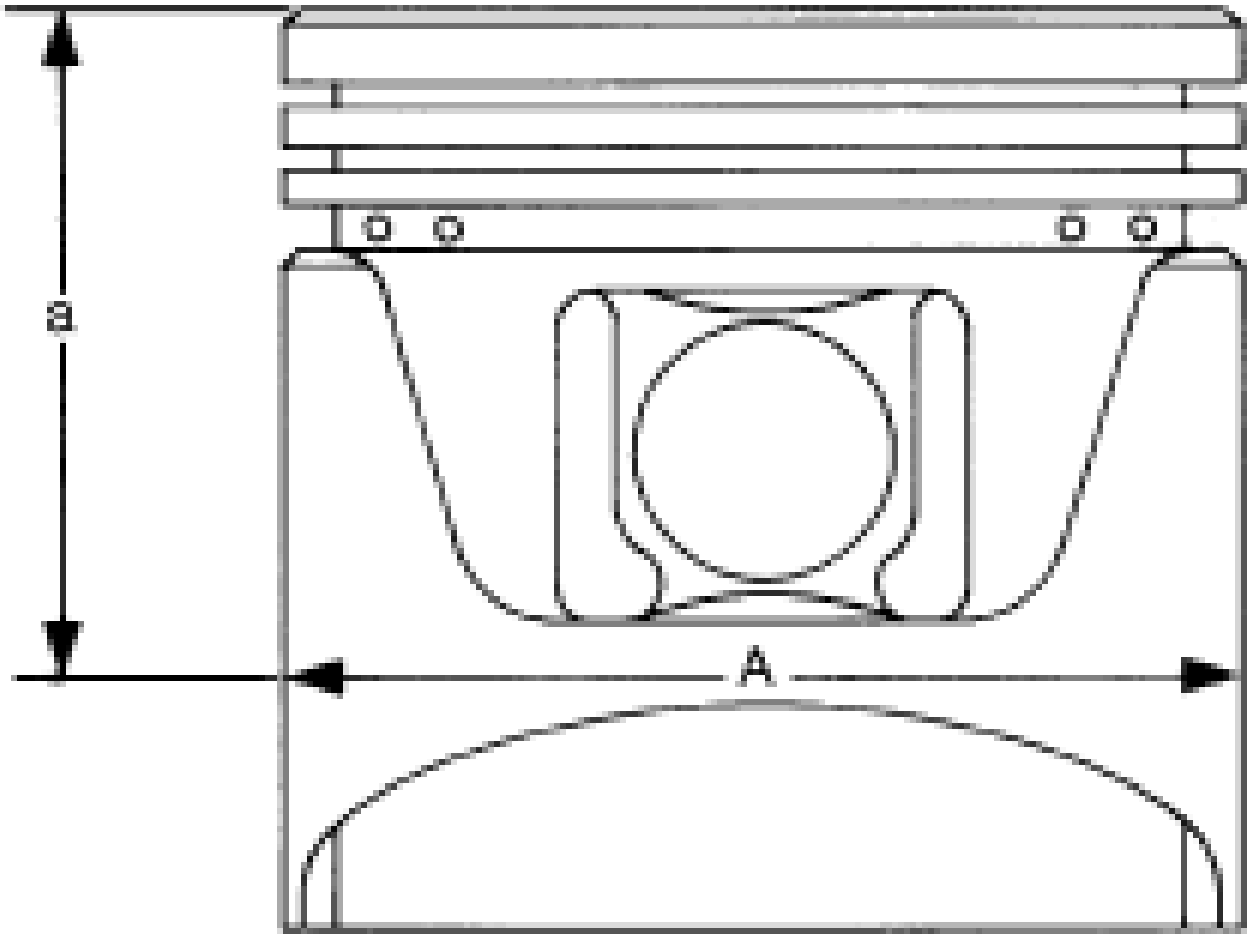
Main bearing housing inner diameter (Without bearing)		Grade No. F	69.998 - 69.999 (2.7558 - 2.7559)
		Grade No. G	69.999 - 70.000 (2.7559 - 2.7559)
		Grade No. H	70.000 - 70.001 (2.7559 - 2.7559)
		Grade No. J	70.001 - 70.002 (2.7559 - 2.7560)
		Grade No. K	70.002 - 70.003 (2.7560 - 2.7560)
		Grade No. L	70.003 - 70.004 (2.7560 - 2.7561)
		Grade No. M	70.004 - 70.005 (2.7561 - 2.7561)
		Grade No. N	70.005 - 70.006 (2.7561 - 2.7561)
		Grade No. P	70.006 - 70.007 (2.7561 - 2.7562)
		Grade No. R	70.007 - 70.008 (2.7562 - 2.7562)
		Grade No. S	70.008 - 70.009 (2.7562 - 2.7563)
		Grade No. T	70.009 - 70.010 (2.7563 - 2.7563)
		Grade No. U	70.010 - 70.011 (2.7563 - 2.7563)
		Grade No. V	70.011 - 70.012 (2.7563 - 2.7564)
		Grade No. W	70.012 - 70.013 (2.7564 - 2.7564)
		Grade No. X	70.013 - 70.014 (2.7564 - 2.7565)
		Grade No. Y	70.014 - 70.015 (2.7565 - 2.7565)
		Grade No. 4	70.015 - 70.016 (2.7565 - 2.7565)
		Grade No. 7	70.016 - 70.017 (2.7565 - 2.7566)
Difference in inner diameter between cylinders	Standard		Less than 0.03 (0.0012)

PISTON, PISTON RING AND PISTON PIN

AVAILABLE PISTON

PISTON DIAMETER SPECIFICATION

Unit: mm (in)



Items		Standard	Oversize (Service) [0.2 (0.008)]
"a" dimension		38.8 (1.528)	
Piston skirt diameter "A"	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)	-
	Service	-	95.680 - 95.710 (3.7669 - 3.7681)
Items		Standard	Limit
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 cylinder bore clearance	0.010 - 0.030 (0.0004 - 0.0012)	0.08 (0.0031)

PISTON RING

PISTON RING SPECIFICATION

Unit: mm (in)

Items		Standard	Limit
Side clearance	Top	0.040 - 0.080 (0.0016 - 0.0031)	0.11 (0.0043)
	2nd	0.030 - 0.070 (0.0012 - 0.0028)	0.10 (0.0039)
	Oil ring	0.055 - 0.155 (0.0022 - 0.0061)	-
End gap	Top	0.23 - 0.33 (0.0091 - 0.0130)	0.42 (0.0165)
	2nd	0.33 - 0.48 (0.0130 - 0.0189)	0.57 (0.0224)
	Oil (rail ring)	0.17 - 0.47 (0.0067 - 0.0185)	0.63 (0.0248)

PISTON PIN

PISTON PIN SPECIFICATION

Unit: mm (in)

Items		Standard	Limit
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)	-
Piston to piston pin oil clearance		0.002 - 0.006 (0.0001 - 0.0002)	-
Connecting rod bushing oil clearance		0.005 - 0.017 (0.0002 - 0.0007)	0.030 (0.0012)

CONNECTING ROD

CONNECTING ROD SPECIFICATION

Unit: mm (in)

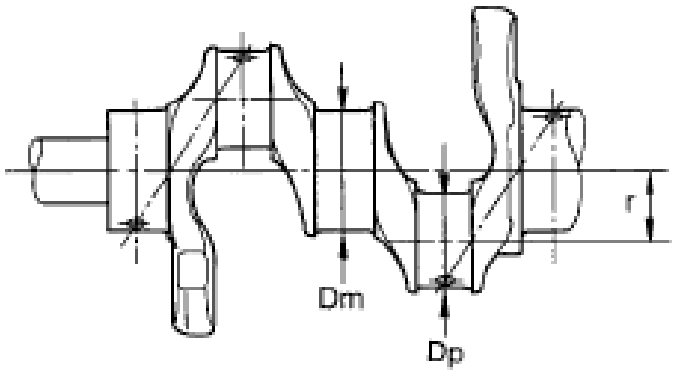
Items		Standard	Limit
Center distance		144.15 - 144.25 (5.68 - 5.68)	-
Bend [per 100 (3.94)]		-	0.15 (0.0059)
Torsion [per 100 (3.94)]		-	0.30 (0.0118)
Connecting rod bushing inner diameter(1)	Grade No. 0	22.000 - 22.006 (0.8661 - 0.8664)	-
	Grade No. 1	22.006 - 22.012 (0.8664 - 0.8666)	-
Connecting rod big end diameter (Without bearing)		57.000 - 57.013 (2.2441 - 2.2446)	-
Side clearance		0.20 - 0.35 (0.0079 - 0.0138)	0.40 (0.0157)

(1) After installing in connecting rod

CRANKSHAFT

CRANKSHAFT SPECIFICATION

Unit: mm (in



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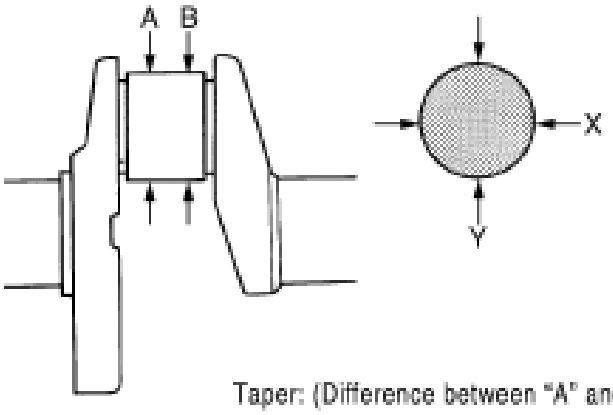


Taper: (Difference between "A" and "B")
Out-of-round: (Difference between "X" and "Y")

SBIA0535E

Main journal diameter. "Dm" grade	Standard	Grade No. A	64.975 - 64.974 (2.5581 - 2.5580)
		Grade No. B	64.974 - 64.973 (2.5580 - 2.5580)
		Grade No. C	64.973 - 64.972 (2.5580 - 2.5579)
		Grade No. D	64.972 - 64.971 (2.5579 - 2.5579)
		Grade No. E	64.971 - 64.970 (2.5579 - 2.5579)
		Grade No. F	64.970 - 64.969 (2.5579 - 2.5578)
		Grade No. G	64.969 - 64.968 (2.5578 - 2.5578)
		Grade No. H	64.968 - 64.967 (2.5578 - 2.5578)
		Grade No. J	64.967 - 64.966 (2.5578 - 2.5577)
		Grade No. K	64.966 - 64.965 (2.5577 - 2.5577)
		Grade No. L	64.965 - 64.964 (2.5577 - 2.5576)
		Grade No. M	64.964 - 64.963 (2.5576 - 2.5576)
		Grade No. N	64.963 - 64.962 (2.5576 - 2.5576)
		Grade No. P	64.962 - 64.961 (2.5576 - 2.5575)
		Grade No. R	64.961 - 64.960 (2.5575 - 2.5575)
		Grade No. S	64.960 - 64.959 (2.5575 - 2.5574)
		Grade No. T	64.959 - 64.958 (2.5574 - 2.5574)
		Grade No. U	64.958 - 64.957 (2.5574 - 2.5574)
		Grade No. V	64.957 - 64.956 (2.5574 - 2.5573)
		Grade No. W	64.956 - 64.955 (2.5573 - 2.5573)
		Grade No. X	64.955 - 64.954 (2.5573 - 2.5572)
		Grade No. Y	64.954 - 64.953 (2.5572 - 2.5572)
		Grade No. 4	64.953 - 64.952 (2.5572 - 2.5572)
		Grade No. 7	64.952 - 64.951 (2.5572 - 2.5571)
		Grade No. A	53.974 - 53.973 (2.1250 - 2.1249)
		Grade No. B	53.973 - 53.972 (2.1249 - 2.1249)
		Grade No. C	53.972 - 53.971 (2.1249 - 2.1248)
		Grade No. D	53.971 - 53.970 (2.1248 - 2.1248)
		Grade No. E	53.970 - 53.969 (2.1248 - 2.1248)

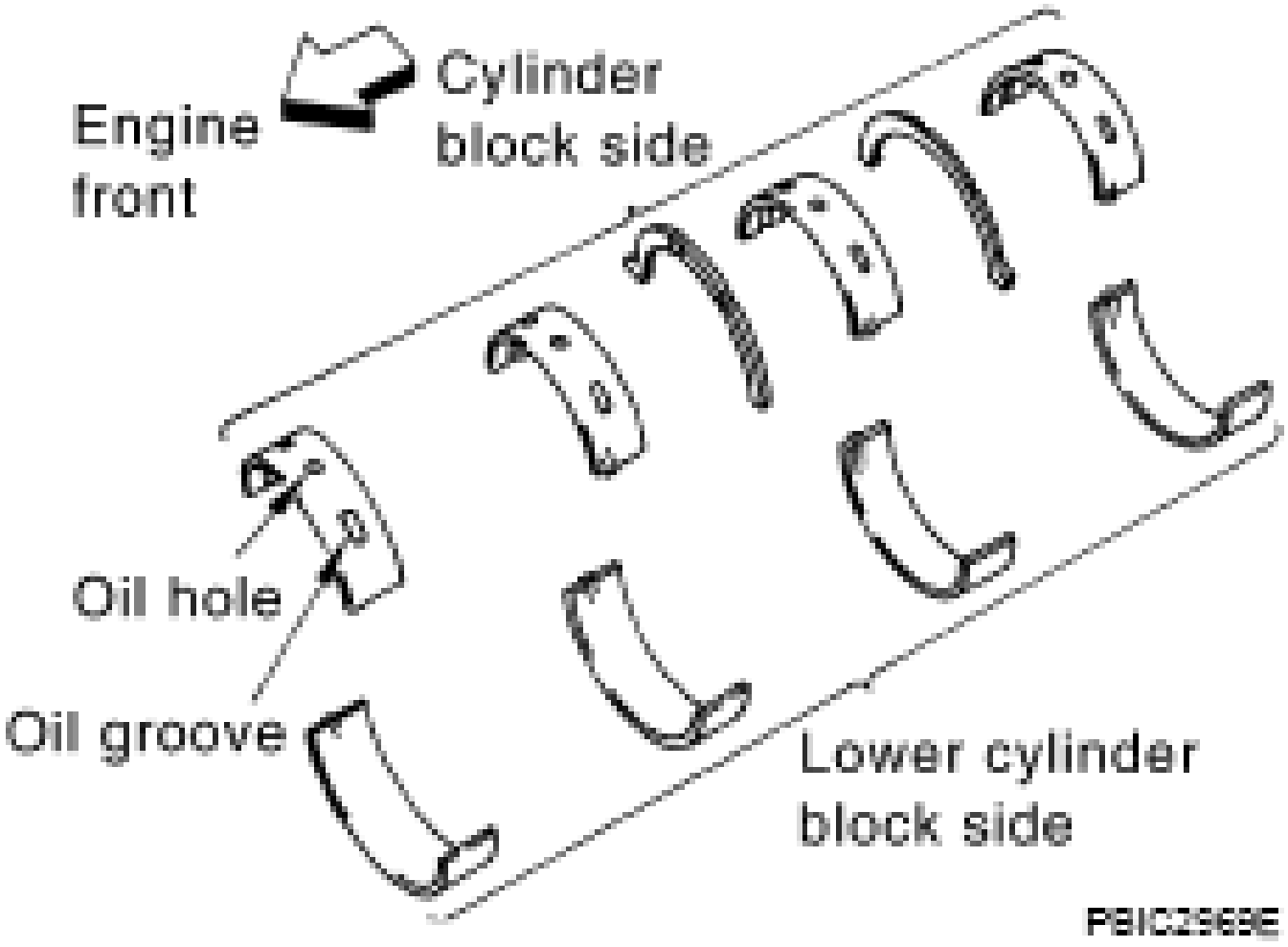
Pin journal diameter. "Dp" grade	Standard	Grade No. F	53.969 - 53.968 (2.1248 - 2.1247)
		Grade No. G	53.968 - 53.967 (2.1247 - 2.1247)
		Grade No. H	53.967 - 53.966 (2.1247 - 2.1246)
		Grade No. J	53.966 - 53.965 (2.1246 - 2.1246)
		Grade No. K	53.965 - 53.964 (2.1246 - 2.1246)
		Grade No. L	53.964 - 53.963 (2.1246 - 2.1245)
		Grade No. M	53.963 - 53.962 (2.1245 - 2.1245)
		Grade No. N	53.962 - 53.961 (2.1245 - 2.1244)
		Grade No. P	53.961 - 53.960 (2.1244 - 2.1244)
		Grade No. R	53.960 - 53.959 (2.1244 - 2.1244)
		Grade No. S	53.959 - 53.958 (2.1244 - 2.1243)
		Grade No. T	53.958 - 53.957 (2.1243 - 2.1243)
		Grade No. U	53.957 - 53.956 (2.1243 - 2.1242)
Center distance "r"			40.66 - 40.74 (1.6008 - 1.6039)
Out-of-round (Difference between "X" and "Y")	Limit		0.0025 (0.0001)
Taper (Difference between "A" and "B")			0.0025 (0.0001)
Crankshaft runout (TIR(1))	Standard		Less than 0.05 (0.0020)
	Limit		0.10 (0.0039)
Crankshaft end play	Standard		0.10 - 0.25 (0.0039 - 0.0098)
	Limit		0.30 (0.0118)

(1) Total indicator reading

MAIN BEARING

MAIN BEARING SPECIFICATION

Unit: mm (in)



Grade number	UPR/LWR	Thickness	Width	Identification color	Remarks
0	-	2.500 - 2.503 (0.0984 - 0.0985)		Black	
1	-	2.503 - 2.506 (0.0985 - 0.0987)		Brown	
2	-	2.506 - 2.509 (0.0987 - 0.0988)		Green	
3	-	2.509 - 2.512 (0.0988 - 0.0989)		Yellow	Grade is the same for upper and lower bearings.
4	-	2.512 - 2.515 (0.0989 - 0.0990)		Blue	
5	-	2.515 - 2.518 (0.0990 - 0.0991)		Pink	
6	-	2.518 - 2.521 (0.0991 - 0.0993)		Purple	

7	-	2.521 - 2.524 (0.0993 - 0.0994)	19.9 - 20.1 (0.783 - 0.791)	White	Grade is different for upper and lower bearings.
01	UPR	2.503 - 2.506 (0.0985 - 0.0987)		Brown	
	LWR	2.500 - 2.503 (0.0984 - 0.0985)		Black	
12	UPR	2.506 - 2.509 (0.0987 - 0.0988)		Green	
	LWR	2.503 - 2.506 (0.0985 - 0.0987)		Brown	
23	UPR	2.509 - 2.512 (0.0988 - 0.0989)		Yellow	
	LWR	2.506 - 2.509 (0.0987 - 0.0988)		Green	
34	UPR	2.512 - 2.515 (0.0989 - 0.0990)		Blue	
	LWR	2.509 - 2.512 (0.0988 - 0.0989)		Yellow	
45	UPR	2.515 - 2.518 (0.0990 - 0.0991)		Pink	
	LWR	2.512 - 2.515 (0.0989 - 0.0990)		Blue	
56	UPR	2.518 - 2.521 (0.0991 - 0.0993)		Purple	
	LWR	2.515 - 2.518 (0.0990 - 0.0991)		Pink	
67	UPR	2.521 - 2.524 (0.0993 - 0.0994)		White	
	LWR	2.518 - 2.521 (0.0991 - 0.0993)		Purple	

UNDERSIZE

UNDERSIZE SPECIFICATION

Unit: mm (in)

Items	Thickness	Main journal diameter
0.25 (0.0098)	2.633 - 2.641 (0.1037 - 0.1040)	Grind so that bearing clearance is the specified value.

MAIN BEARING OIL CLEARANCE

MAIN BEARING OIL CLEARANCE SPECIFICATION

Unit: mm (in)

Items	Standard	Limit
Main bearing oil clearance	0.035 - 0.045 (0.0014 - 0.0018)(1)	0.065 (0.0026)

(1) Actual clearance

CONNECTING ROD BEARING

CONNECTING ROD BEARING SPECIFICATION

Unit: mm (in)

Grade number	Thickness	Identification color (mark)
0	1.497 - 1.500 (0.0589 - 0.0591)	Black
1	1.500 - 1.503 (0.0591 - 0.0592)	Brown
2	1.503 - 1.506 (0.0592 - 0.0593)	Green
3	1.506 - 1.509 (0.0593 - 0.0594)	Yellow
4	1.509 - 1.512 (0.0594 - 0.0595)	Blue

UNDERSIZE

UNDERSIZE SPECIFICATION

Unit: mm (in)

Items	Thickness	Crank pin journal diameter
0.25 (0.0098)	1.626 - 1.634 (0.0640 - 0.0643)	Grind so that bearing clearance is the specified value.

CONNECTING ROD BEARING OIL CLEARANCE

CONNECTING ROD BEARING OIL CLEARANCE SPECIFICATION

Unit: mm (in)

Items	Standard	Limit
Connecting rod bearing oil clearance	0.040 - 0.053 (0.0016 - 0.0021)(1)	0.070 (0.0028)

(1) Actual clearance

