2010 ENGINE

Engine Mechanical (VK45DE) - 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.

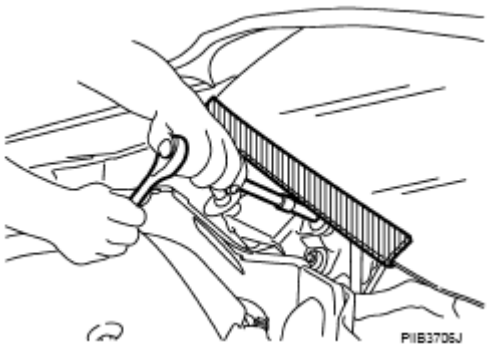


Fig. 1: Identifying Windshield Precaution
Courtesy of NISSAN MOTOR CO., U.S.A.

Precaution Necessary for Steering Wheel Rotation after Battery Disconnect

NOTE:

- **Before removing and installing any control units, first turn the push-button ignition switch to the LOCK position, then disconnect both battery cables.**
- **After finishing work, confirm that all control unit connectors are connected properly, then re-connect both battery cables.**
- **Always use CONSULT-III to perform self-diagnosis as a part of each function inspection after finishing work.**

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

This vehicle is equipped with a push-button ignition switch and a steering lock unit.

If the battery is disconnected or discharged, the steering wheel will lock and cannot be turned.

If turning the steering wheel is required with the battery disconnected or discharged, 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. Turn the push-button ignition switch to ACC position.

   (At this time, the steering lock will be released.)

3. Disconnect both battery cables. The steering lock will remain released with both battery cables disconnected and the steering wheel can be turned.
4. Perform the necessary repair operation.
5. When the repair work is completed, re-connect both battery cables. With the brake pedal released, turn the push-button ignition switch from ACC position to ON position, then to LOCK position. (The steering wheel will lock when the push-button ignition switch is turned to LOCK position.)
6. Perform 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 **SUPPLEMENTAL RESTRAINT SYSTEM (SRS)** 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 (SRS) .**
- **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 SST, 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 the equivalent, if necessary, to seal out foreign materials.
- Mark and arrange disassembly parts in an organized way for easy troubleshooting and assembly.
- When loosening nuts and bolts, as a basic rule, start with the one furthest outside, then the one diagonally opposite, and so on. If the order of loosening is specified, do exactly as specified. Power tools may be used where noted in the step.

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 nuts and bolts, as a basic rule, equally tighten in several different steps starting with the ones in center, then ones on inside and outside diagonally in this order. If the order of tightening is specified, do exactly as specified.
- Replace with new gasket, packing, oil seal or O-ring.
- Thoroughly wash, clean, and air-blow each part. Carefully check engine oil or engine coolant passages for any restriction and blockage.
- Guide pins are used for several parts alignment. When replacing and reassembling parts with guide pins, check that guide pins are installed in the original position.
- 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
  - Main bearing cap bolts
  - Connecting rod cap nuts

- Crankshaft pulley bolt (No angle wrench is required as the bolt flange is provided with notches for angle tightening)

- Do not use a torque value for final tightening.
- The torque value for these parts are for a preliminary step.
- Ensure thread and seat surfaces are clean and coated with engine oil.

Precaution for Liquid Gasket

REMOVAL OF LIQUID GASKET SEALING

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

CAUTION: Be careful not to damage the mating surfaces.

- Tap seal cutter (SST) to insert it, and then slide it by tapping on the side as shown below.
- In areas where seal cutter (SST) 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.

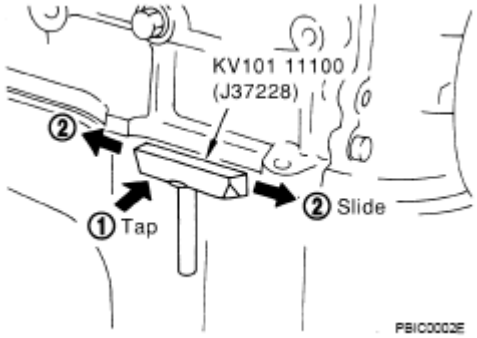


Fig. 2: Inserting Tap Seal Cutter And Slide By Tapping On Side
Courtesy of NISSAN MOTOR CO., U.S.A.

LIQUID GASKET APPLICATION PROCEDURE

1. Using scraper, remove old liquid gasket adhering to the liquid gasket application surface and the mating surface.
   - Remove liquid gasket completely from the groove of the liquid 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.

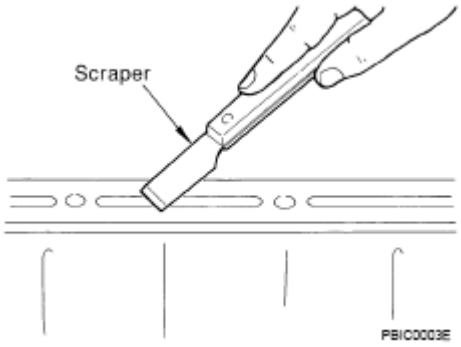


Fig. 3: Identifying Liquid Gasket With Scraper
Courtesy of NISSAN MOTOR CO., U.S.A.

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

   Use Genuine RTV Silicone Sealant or equivalent. Refer to RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS .

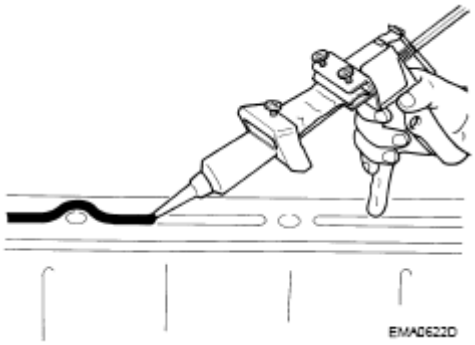


Fig. 4: Applying Liquid Gasket
Courtesy of NISSAN MOTOR CO., U.S.A.

4. Apply liquid gasket without breaks to the specified location with the specified dimensions.
   - If there is a groove for the liquid gasket application, apply liquid gasket to the groove.
   - As for the bolt holes, normally apply liquid gasket inside the holes. Occasionally, it should be applied outside the holes. Check to read the text of this article.
   - Within five minutes of liquid gasket application, install the mating component.
   - If liquid gasket protrudes, wipe it off immediately.
   - Do not retighten mounting bolts and nuts after the installation.
   - Wait 30 minutes or more after installation before refilling engine with engine oil and engine coolant.

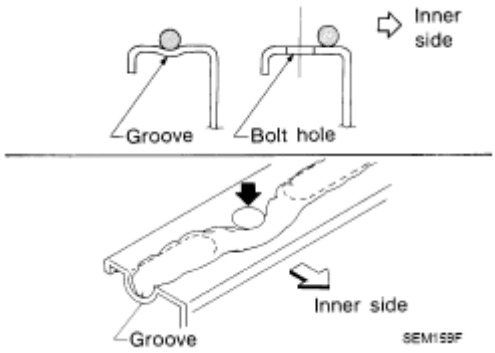


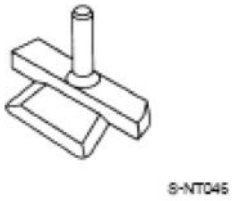
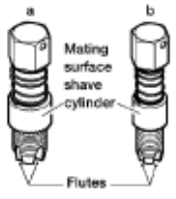
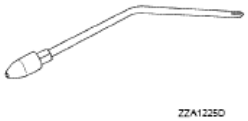
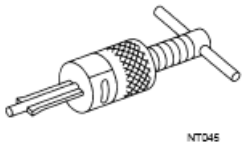
Fig. 5: Applying Bead Of Sealant To Bolt Holes
Courtesy of NISSAN MOTOR CO., U.S.A.

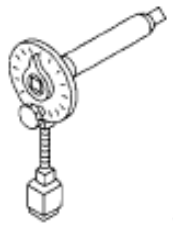
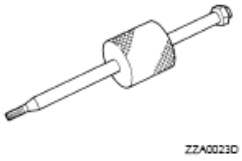
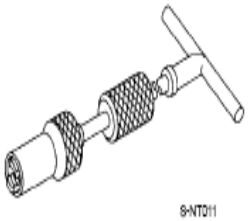
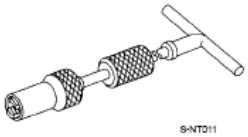
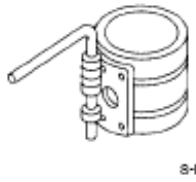
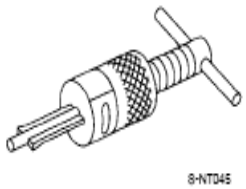
CAUTION: If there are specific instructions in this information, observe them.

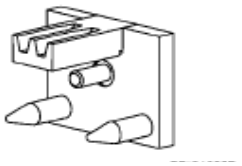
PREPARATION

Special Service Tool

SPECIAL SERVICE TOOL REFERENCE

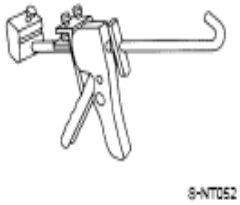
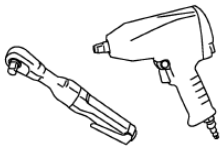
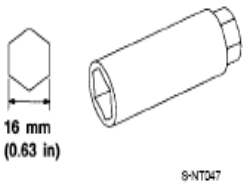
Tool number (Kent-Moore No.) Tool name	Description
KV10111100 (J-37228) Seal cutter 	Removing steel oil pan and front cover
KV10114400 (J-38365) Heated oxygen sensor wrench 	Loosening or tightening air fuel ratio sensor 1 a. **22 mm (0.87 in)**
EG15050500 (J-45402) Compression gauge adapter 	Inspecting of compression pressure
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.

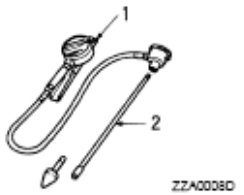
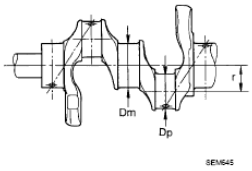
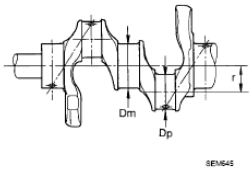
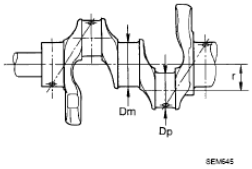
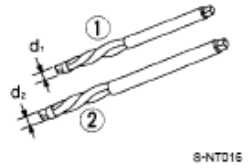
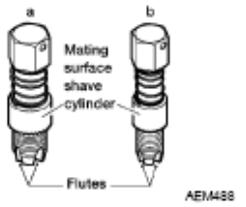
KV10112100 (BT8653-A) Angle wrench	 S-NT014	Tightening bolts for bearing cap, cylinder head, etc.
KV10114700 (J-38139) Main bearing cap remover	 ZZA0023D	Removing crankshaft main bearing cap
KV10107902 (J-38959) Valve oil seal puller	 S-NT011	Removing valve oil seal
KV10115600 (J-38958) Valve oil seal drift	 S-NT011	Installing valve oil seal **Use side A** . a. **20 (0.79) dia** . b. **13 (0.51) dia** . c. **10.3 (0.406) dia** . d. **8 (0.31) dia** . e. **10.7 (0.421)** f. **5 (0.20)** Unit: mm (in)
EM03470000 (J-8037) Piston ring compressor	 S-NT044	Installing piston assembly into cylinder bore
ST16610001 (J-23907) Pilot bushing puller	 S-NT045	Removing crankshaft pilot converter
- (J-45476) Ring gear stopper		Removing and installing crankshaft pulley

Commercial Service Tool

COMMERCIAL SERVICE TOOL REFERENCE

(Kent-Moore No.) Tool name	Description
(J-45488) Quick connector release  PBIC0198E	Removing fuel tube quick connectors in engine room
(-) Tube presser  S-NT052	Pressing the tube of liquid gasket
(-) Power tool  PBIC0192E	Loosening nuts and bolts
(-) Spark plug wrench  S-NT047	Removing and installing spark plug
(-) Manual lift table caddy  ZZA1210D	Removing and installing engine
(-) 1. Compression gauge 2. Adapter	Checking compression pressure

		
(-) 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** .
a. (J-43897-18) b. (J-43897-12) Oxygen sensor thread cleaner		Reconditioning the exhaust system threads before installing a new air fuel ratio sensor (Use with anti-seize lubricant shown below.) a. **J-43897-18 [18 mm (0.71 in) dia.] for zirconia air fuel ratio sensor** b. **J-43897-12 [12 mm (0.47 in) dia.] for titania air fuel ratio 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

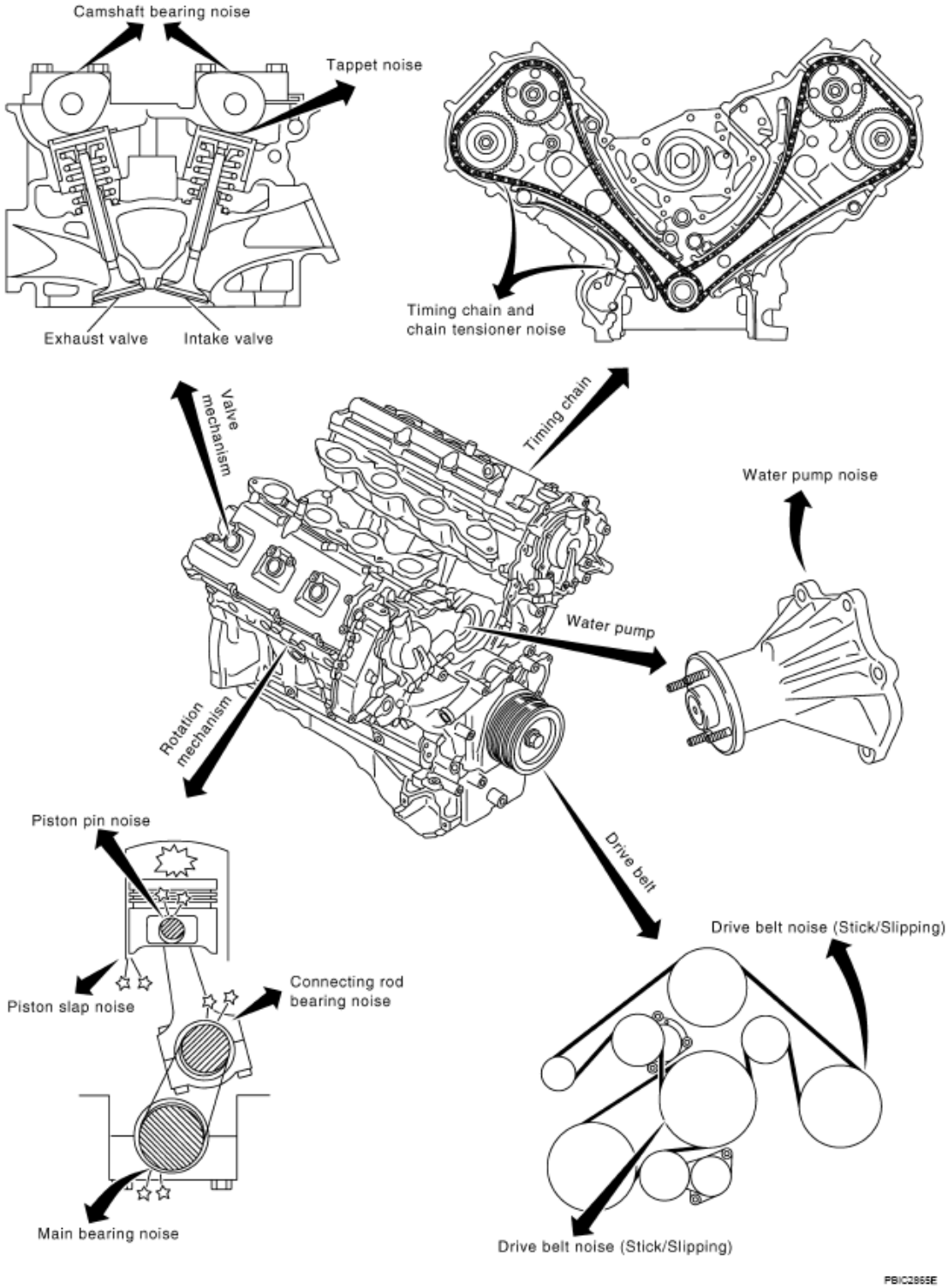


Fig. 6: NVH Troubleshooting - Engine Noise Flow Diagram
Courtesy of NISSAN MOTOR CO., U.S.A.

Use the Table 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.

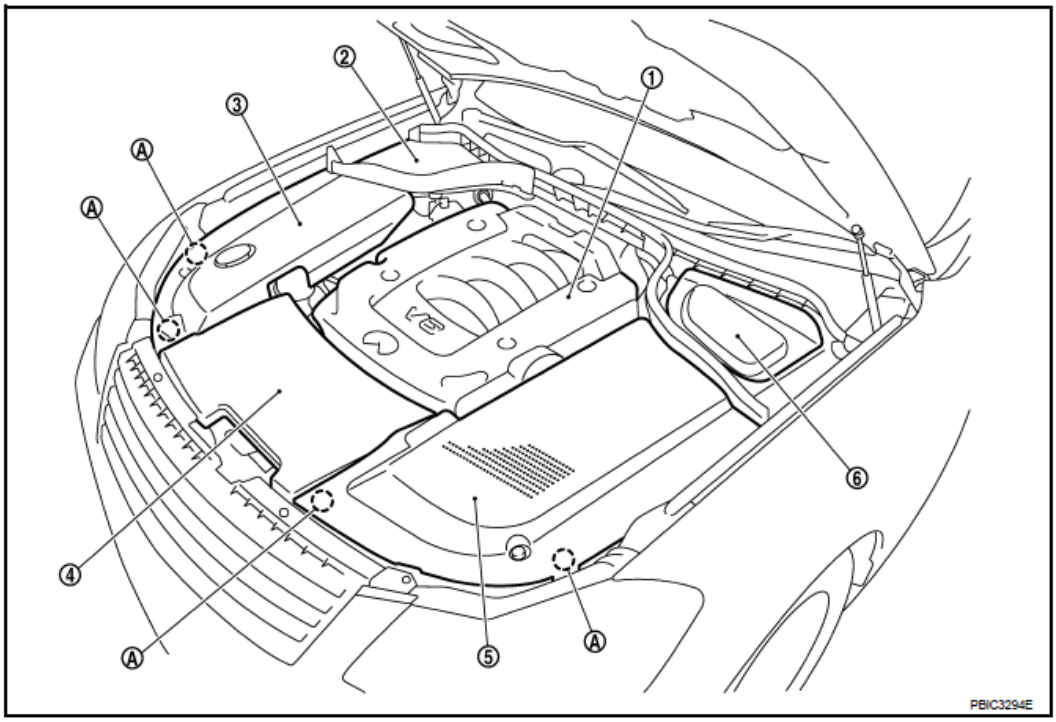
ITEM REFERENCE

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	**OIL PAN AND OIL STRAINER**
	Rattle	C	A	-	A	B	C	Camshaft bearing noise	Camshaft journal oil clearance Camshaft runout	**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 rod bearing	**CONNECTING ROD BUSHING OIL CLEARANCE**

									oil clearance	
	Knock	A	B	-	A	B	C	Main bearing noise	Main bearing oil clearance Crankshaft runout	**MAIN BEARING OIL CLEARANCE**
Front of engine front cover	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 TIMING CHAIN**
Front of engine	Squeaking or fizzing	A	B	-	B	-	C	Drive belts (Sticking or slipping)	Drive belts deflection	**DRIVE BELTS**
	Creaking	A	B	A	B	A	B	Drive belts (Slipping)	Idler pulley bearing operation	
	Squall Creak	A	B	-	B	A	B	Water pump noise	Water pump operation	**COMPONENT**
A: Closely related B: Related C: Sometimes related -: Not related										

ENGINE ROOM COVER

Component



1. Engine cover
2. Battery cover
3. Engine room cover (RH)
4. Air duct (inlet)
5. Engine room cover (LH)
6. Brake master cylinder cover

A. Clip (secure at back surface)

Fig. 7: 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 **AIR CLEANER AND AIR DUCT** 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 below)

1. Upper side of engine assembly
2. Battery, relay box
3. Power steering fluid reservoir tank, engine coolant reservoir tank, relay box
4. Engine assembly front side, drive belts, cooling fan
5. Mass air flow sensor, air cleaner case

6. Brake master cylinder, brake booster

INSTALLATION

Install in the reverse order of removal.

DRIVE BELTS

Component

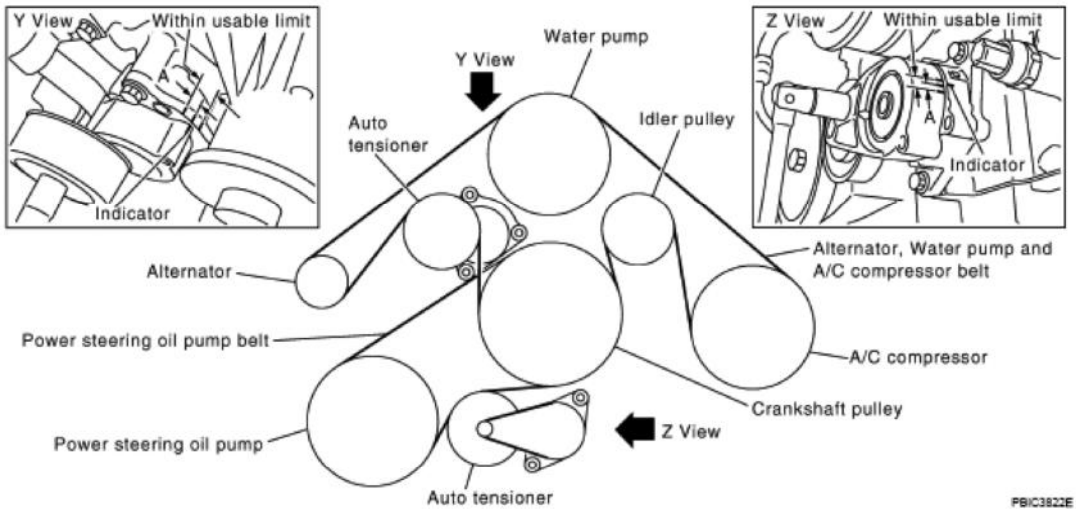


Fig. 8: Identifying Drive Belts Component
Courtesy of NISSAN MOTOR CO., U.S.A.

Checking Drive Belts

WARNING: Be sure to perform when engine is stopped.

- Remove air duct (inlet) when inspecting drive belt for alternator, water pump and A/C compressor.
- Remove front engine undercover with power tool when inspecting power steering oil pump belt.
- Check that indicator (single line notch) of each auto tensioner is within the allowable working range (between three line notches).

NOTE:

- **Check auto tensioner indication when engine is cold.**
- **When new drive belt is installed, the range should be "A".**
- **The indicator notch is located on the moving side of auto tensioner for alternator, water pump and A/C compressor belt, while it is found on the fixed side for power steering oil pump belt.**

- Visually check entire belt for wear, damage or cracks.

- If the indicator is out of allowable working range or belt is damaged, replace belt.

Tension Adjustment

Belt tensioning is not necessary, as it is automatically adjusted by auto tensioner.

Removal and Installation

REMOVAL

Alternator, Water Pump and A/C Compressor Belt

1. Remove air duct (inlet). Refer to **AIR CLEANER AND AIR DUCT**.
2. With box wrench, and while securely holding the hexagonal part in pulley center of auto tensioner, move wrench handle in the direction of arrow (loosening direction of tensioner).

CAUTION:

- **Avoid placing hand in a location where pinching may occur if the holding tool accidentally comes off.**
- **Never loosen the hexagonal part in center of drive belt auto tensioner pulley (Never turn it clockwise). If turned clockwise, the complete drive belt auto tensioner must be replaced as a unit, including the pulley.**

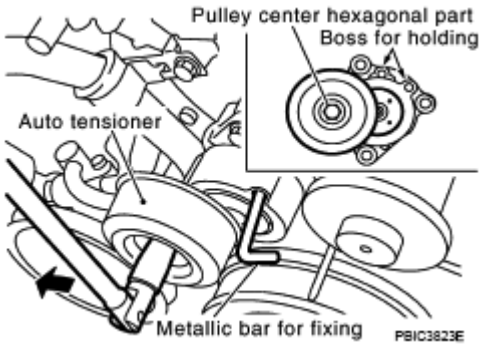


Fig. 9: Holding Hexagonal Part In Pulley Center Of Auto Tensioner
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Under the above condition, insert a metallic bar of approximately 6 mm (0.24 in) in diameter (hexagonal bar wrench shown as example below) through the holding boss to lock auto tensioner pulley arm.
   - Leave auto tensioner pulley arm locked until belt is installed again.
4. Remove alternator, water pump and A/C compressor belt.

Power Steering Oil Pump Belt

1. Remove air duct (inlet). Refer to **AIR CLEANER AND AIR DUCT**.

2. Remove front engine undercover with power tool.
3. Remove alternator, water pump and A/C compressor belt. Refer to **ALTERNATOR, WATER PUMP AND A/C COMPRESSOR BELT**.
4. While securely holding the hexagonal protrusion part of auto tensioner pulley with box wrench, move wrench handle in the direction of arrow (loosening direction of tensioner).

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

5. Under the above condition, insert a metallic bar of approximately 6 mm (0.24 in) in diameter (hexagonal bar wrench shown as example below) through the holding boss to lock auto tensioner pulley arm.
   - Leave auto tensioner pulley arm locked until belt is installed again.

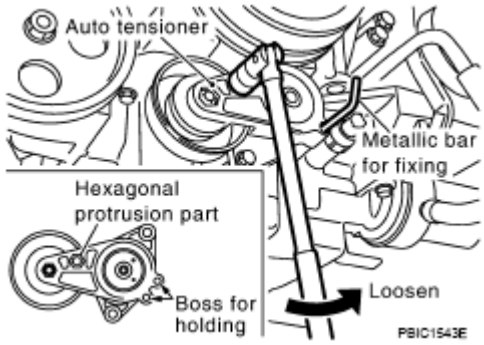


Fig. 10: Loosening Auto Tensioner
Courtesy of NISSAN MOTOR CO., U.S.A.

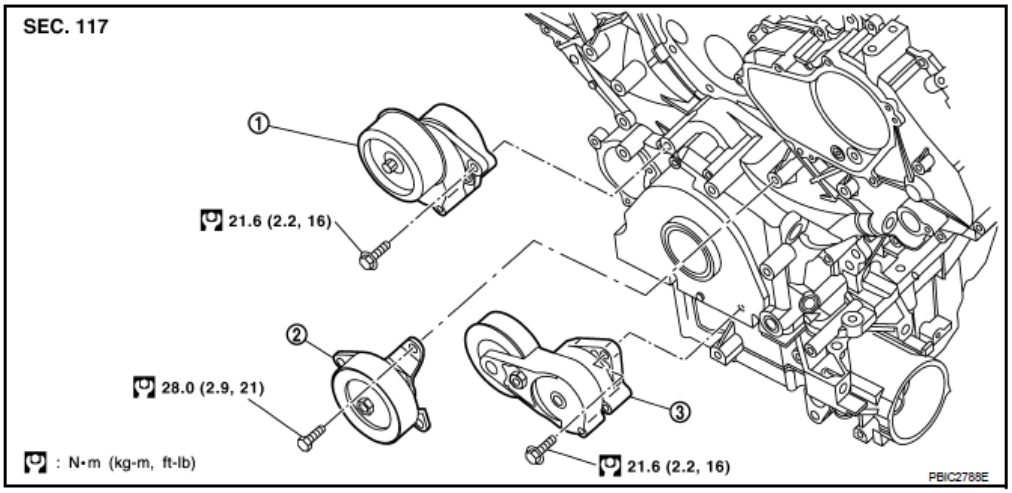
6. Remove power steering oil pump belt.

INSTALLATION

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

CAUTION:
- **Check belt is securely installed around all pulleys.**
- **Check belt is correctly engaged with the pulley groove.**
- **Check for engine oil and engine coolant are not adhered belt and pulley groove.**
- **Check that belt tension is within the allowable working range, using indicator notch on auto tensioner. Refer to CHECKING DRIVE BELTS.**

Component



1. Auto tensioner (Used for alternator, water pump and A/C compressor)
2. Idler pulley
3. Auto tensioner (Used for power steering oil pump belt)

Fig. 11: Identifying Auto Tensioner Components With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: The complete drive belt auto tensioner must be replaced as a unit, including the pulley.

Drive Belt Auto Tensioner and Idler Pulley

REMOVAL

1. Remove air duct (inlet). Refer to **AIR CLEANER AND AIR DUCT**.
2. Remove front engine undercover with power tool.
3. Remove drive belts. Refer to **REMOVAL AND INSTALLATION**.
   - Keep auto tensioner pulley arm locked after belt is removed.
4. Remove auto tensioner and idler pulley with power tool.
   - Keep auto tensioner pulley arm locked to install or remove auto tensioner.

CAUTION: Never loosen the hexagonal part in center of drive belt auto tensioner pulley (Never turn it clockwise). If turned clockwise, the complete drive belt auto tensioner must be replaced as a unit, including the pulley.

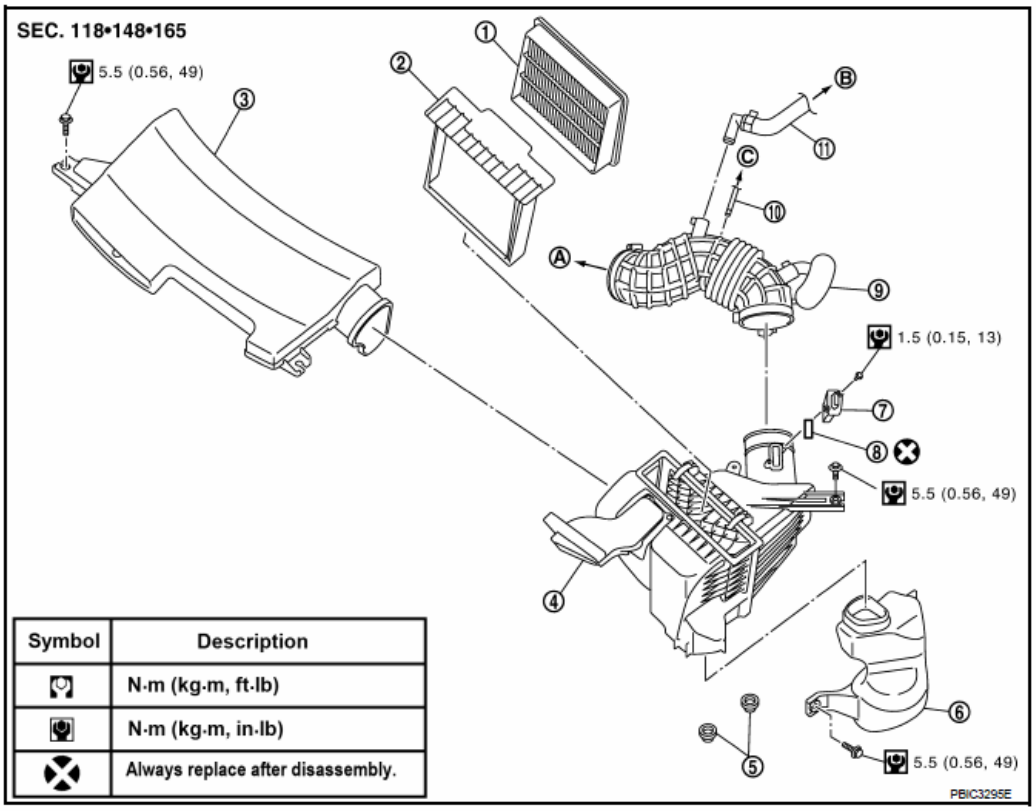
INSTALLATION

Install in the reverse order of removal.

CAUTION: Never swap the pulley between new and old drive belt auto tensioner.

AIR CLEANER AND AIR DUCT

Component



1. Air cleaner filter
2. Holder
3. Air duct (inlet)
4. Air cleaner case
5. Mounting rubber
6. Resonator
7. Mass air flow sensor
8. O-ring
9. Air duct and resonator assembly
10. Vacuum hose
11. PCV hose
A. To electric throttle control actuator
B. To rocker cover (left bank)
C. To VIAS control solenoid valve

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

- Refer to **COMPONENT** for symbols above.

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 **ENGINE ROOM COVER**.
2. Disconnect harness connector from mass air flow sensor.
3. Disconnect vacuum hose and PCV hose.
4. Remove air duct (inlet), air cleaner case and mass air flow sensor assembly, and air duct and resonator

assembly disconnecting their joints.

- Add marks if necessary for easier installation.

5. Remove mass air flow sensor from air cleaner case if necessary.

CAUTION: Handle mass air flow sensor with following cares.

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

6. Remove resonator in fender lifting front fender protector (LH). Refer to **FENDER PROTECTOR** .

INSPECTION AFTER REMOVAL

Inspect air duct and resonator assembly for crack or tear.

- If anything found, replace air duct and resonator assembly.

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. Remove engine room cover (LH). Refer to **ENGINE ROOM COVER**.
2. Unhook clips (1).

2 : Air cleaner case
3 : Holder

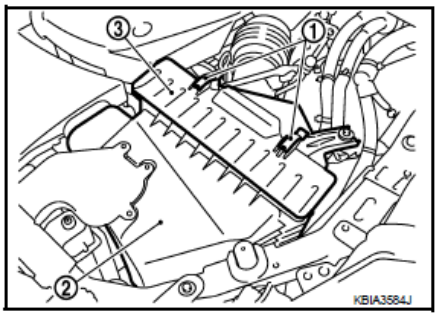


Fig. 13: Identifying Air Cleaner Case And Holder
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Remove holder and air cleaner filter assembly (2) from air cleaner case (1).

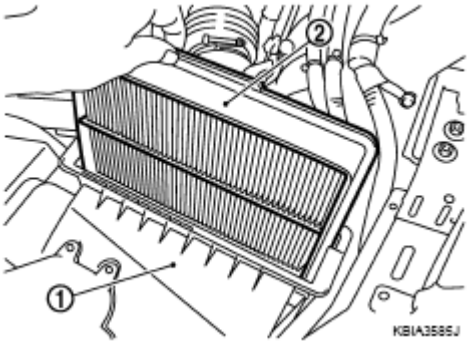


Fig. 14: Identifying Air Cleaner Filter Assembly And Air Cleaner Case
Courtesy of NISSAN MOTOR CO., U.S.A.

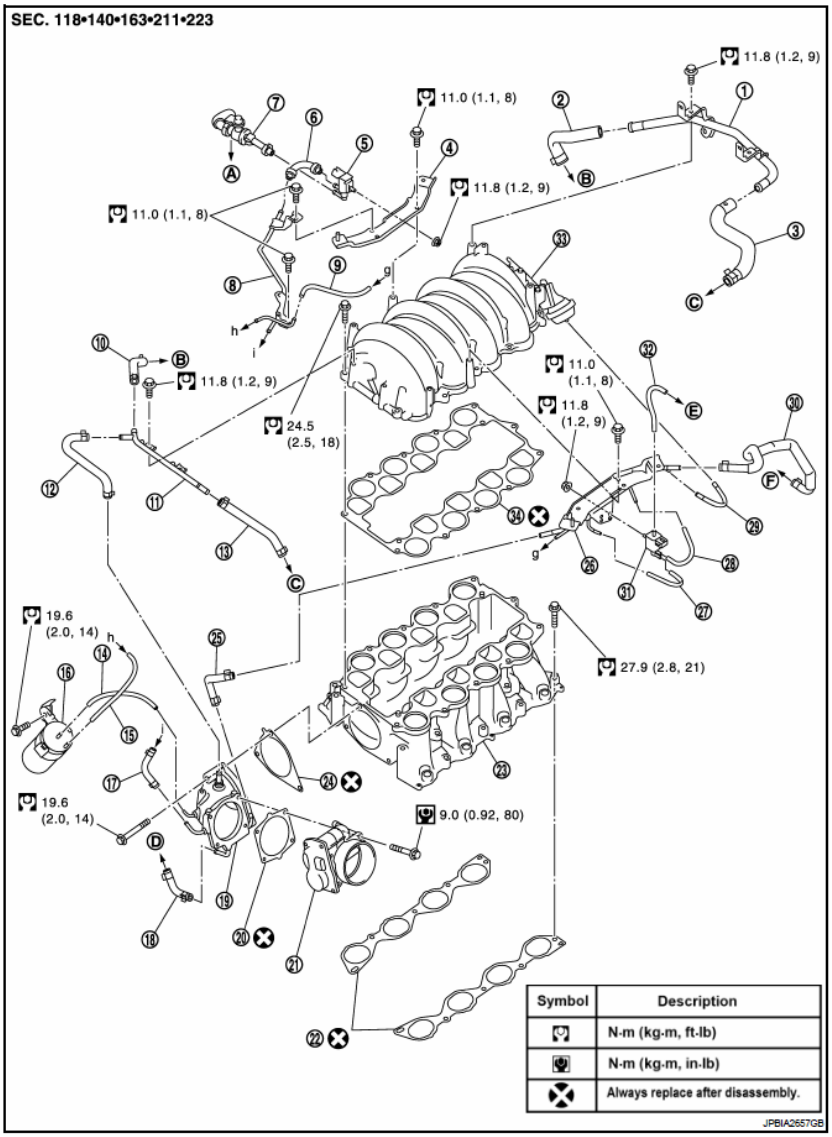
INSTALLATION

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

Component



1. PCV tube	2. PCV hose	3. PCV hose
4. Engine cover bracket (RH)	5. EVAP canister purge control solenoid valve	6. EVAP hose
7. EVAP service port	8. EVAP tube	9. Vacuum hose
10. PCV hose	11. PCV tube	12. PCV hose
13. PCV hose	14. Vacuum hose	15. Vacuum hose
16. Vacuum tank	17. EVAP hose	18. Water hose
19. Intake manifold adapter	20. Gasket	21. Electric throttle control actuator
22. Gasket	23. Intake manifold (lower)	24. Gasket
25. Water hose	26. Engine cover bracket (LH)	27. Vacuum hose
28. Vacuum hose	29. Vacuum hose	30. Water hose
31. VIAS control solenoid valve	32. Vacuum hose	33. Intake manifold (upper)
34. Gasket		
A. To centralized under-floor piping	B. To rocker cover (right bank)	C. To rocker cover (left bank)
D. To thermostat housing	E. To air duct and resonator assembly	F. To heater pipe

Fig. 15: Identifying Intake Manifold Component With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to **COMPONENT** for symbols above.

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 **ENGINE ROOM COVER**.
2. Remove engine cover with power tool.

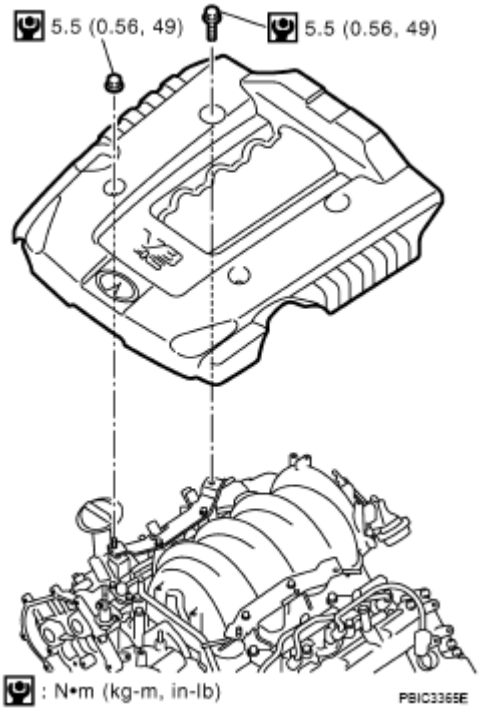


Fig. 16: Identifying Engine Cover And Bolts With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Release fuel pressure. Refer to **FUEL PRESSURE CHECK** .
4. Remove air duct (inlet), air cleaner case, and air duct and resonator assembly. Refer to **AIR CLEANER AND AIR DUCT**.
5. Drain engine coolant from radiator. Refer to **CHANGING ENGINE COOLANT** .

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

6. Disconnect fuel feed hose quick connector (1) on engine side. Refer to **FUEL INJECTOR AND FUEL TUBE**.

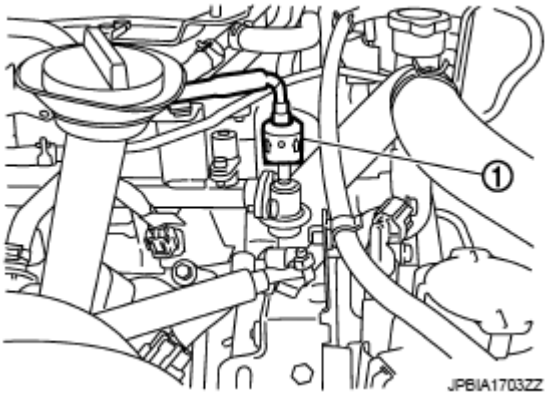


Fig. 17: Identifying Fuel Feed Hose Quick Connector
Courtesy of NISSAN MOTOR CO., U.S.A.

7. Remove fuel damper and fuel hose assembly. Refer to **FUEL INJECTOR AND FUEL TUBE**.

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

8. Remove or disconnect harnesses, engine cover bracket (RH and LH), vacuum hose, EVAP tube and hose and PCV hose and tube from intake manifold (upper).
9. Loosen mounting bolts in reverse order as shown below to remove intake manifold (upper) with power tool.

⇦ : Engine front

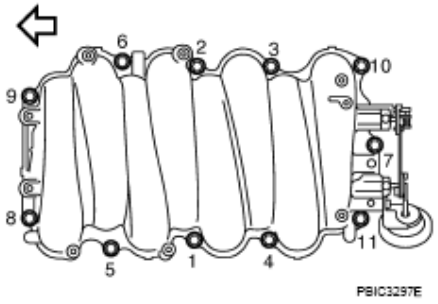


Fig. 18: Identifying Intake Manifold Bolt Loosening Sequence (Upper)
Courtesy of NISSAN MOTOR CO., U.S.A.

10. Remove electric throttle control actuator as follows:
    a. Disconnect harness connector.
    b. Loosen mounting bolts diagonally.

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

11. Remove fuel injector and fuel tube assembly. Refer to **FUEL INJECTOR AND FUEL TUBE**.
12. Disconnect water hoses from intake manifold adaptor.
13. Loosen mounting bolts in reverse order as shown below to remove intake manifold (lower) with power tool.

⇦ : Engine front

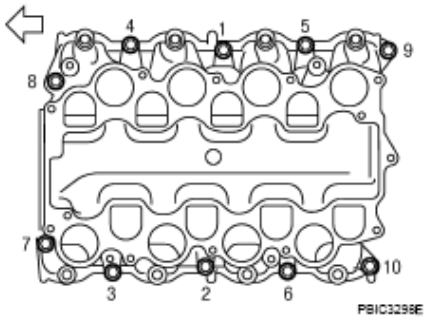


Fig. 19: Identifying Intake Manifold Bolt Loosening Sequence (Lower)
Courtesy of NISSAN MOTOR CO., U.S.A.

14. Remove intake manifold adaptor from intake manifold (lower).
15. Remove vacuum tank.
16. Remove intake manifold gaskets.

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

INSPECTION AFTER REMOVAL

Surface Distortion

- Check the surface distortion of both the intake manifold (upper and lower) mating surfaces with straightedge and feeler gauge.

  Limit: 0.1 mm (0.004 in)

- If it exceeds the limit, replace intake manifolds (lower and/or upper).

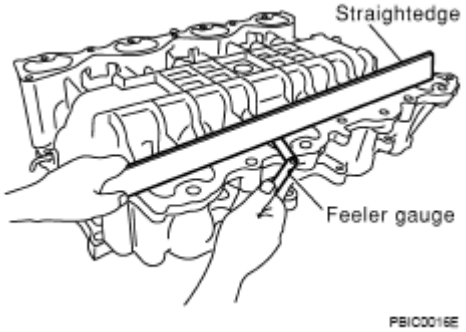


Fig. 20: Checking Surface Distortion Of Intake Manifold (Upper And Lower) Mating Surfaces
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

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

Intake Manifold (Lower)

Tighten in numerical order as shown below.

⇦ : Engine front

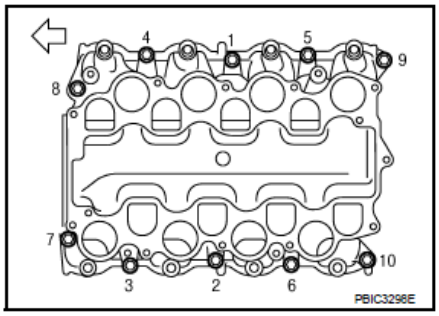


Fig. 21: Identifying Intake Manifold Bolt Tightening Sequence (Lower)
Courtesy of NISSAN MOTOR CO., U.S.A.

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

  M8 x 90 mm (3.54 in): 7, 8

  M8 x 35 mm (1.38 in): Except the above

Intake Manifold (Upper)

Tighten in numerical order as shown below.

⇦ : Engine front

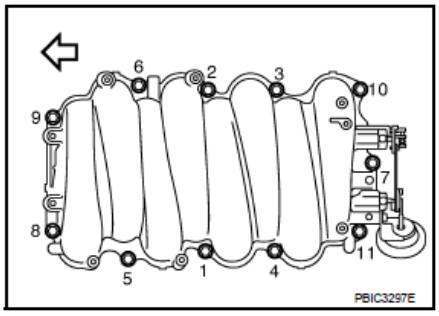


Fig. 22: Identifying Intake Manifold Bolt Tightening Sequence (Upper)
Courtesy of NISSAN MOTOR CO., U.S.A.

Electric Throttle Control Actuator

- Install gasket with its directional protrusion set up/downward.
- Tighten mounting bolts of electric throttle control actuator equally and diagonally in several steps.
- After installation perform procedure in "INSPECTION AFTER INSTALLATION".

Water Hose

Insert hose by 27 to 32 mm (1.06 to 1.26 in) from connector end.

Vacuum Hose

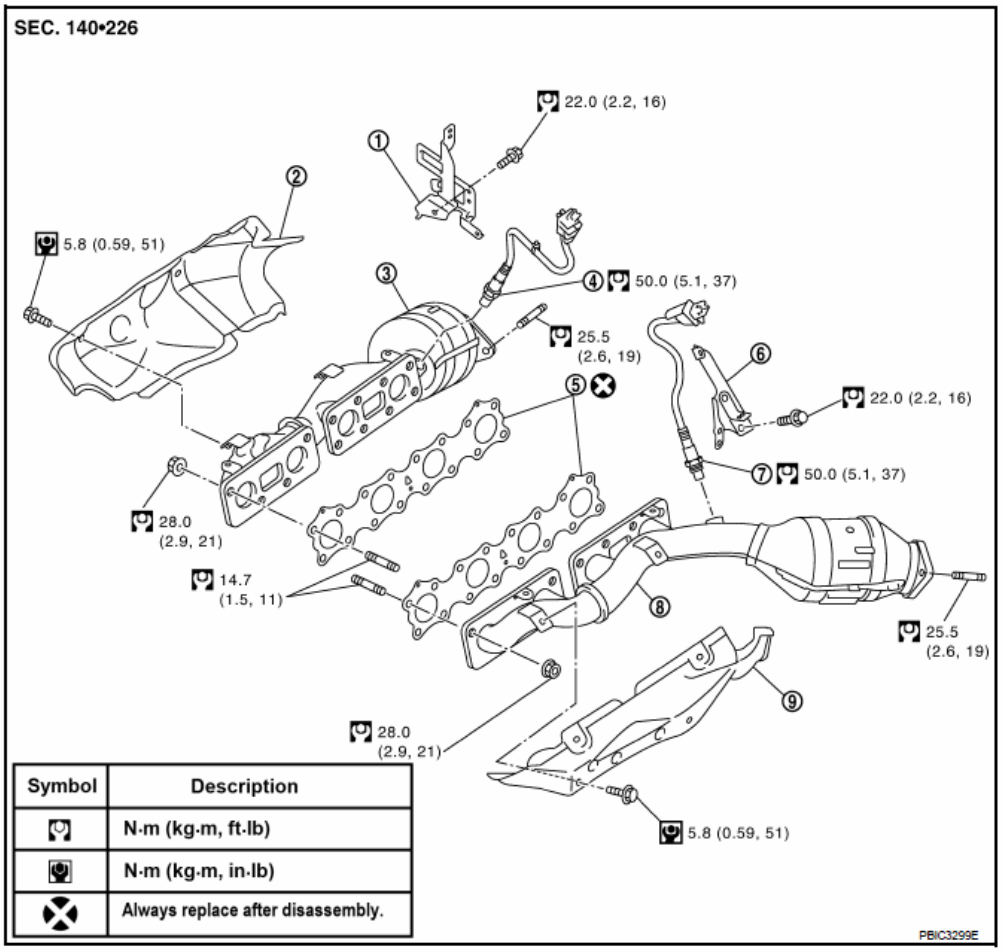
Refer to **VACUUM HOSE DRAWING** .

INSPECTION AFTER INSTALLATION

- Perform the "Throttle Valve Closed Position Learning" when harness connector of electric throttle control actuator is disconnected. Refer to **THROTTLE VALVE CLOSED POSITION LEARNING** .
- 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** and **THROTTLE VALVE CLOSED POSITION LEARNING** .

EXHAUST MANIFOLD AND THREE WAY CATALYST

Component



1. Harness bracket
2. Exhaust manifold cover (right bank)
3. Exhaust manifold and three way catalyst (right bank)
4. Air fuel ratio sensor 1 (bank 2)
5. Gasket
6. Harness bracket
7. Air fuel ratio sensor 1 (bank 1)
8. Exhaust manifold and three way catalyst (left bank)
9. Exhaust manifold cover (left bank)

Fig. 23: Identifying Exhaust Manifold And Three Way Catalyst Components With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to **COMPONENT** for symbols above.

Removal and Installation

REMOVAL

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

1. Remove engine room cover (RH and LH). Refer to **ENGINE ROOM COVER**.
2. Remove engine cover with power tool. Refer to **REMOVAL AND INSTALLATION**.
3. Remove air duct (inlet), air cleaner case and air duct and resonator assembly. Refer to **AIR CLEANER**

AND AIR DUCT.

4. Remove front and rear engine undercovers with power tool.
5. Drain engine coolant from radiator. Refer to **CHANGING ENGINE COOLANT** .

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

6. Remove radiator. Refer to **RADIATOR** .
7. Remove drive belts. Refer to **DRIVE BELTS**.
8. Remove exhaust front tube with power tool. Refer to **EXHAUST SYSTEM** .
9. Remove each air fuel ratio sensor 1 as follows:
   a. Disconnect harness connector of each air fuel ratio sensor 1.
   b. Remove each air fuel ratio sensor 1 on both bank with heated oxygen sensor wrench (SST).

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 one.**

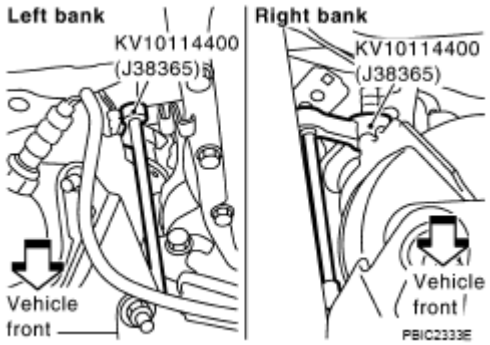


Fig. 24: Identifying Air Fuel Ratio Sensor 1
Courtesy of NISSAN MOTOR CO., U.S.A.

10. Remove exhaust manifold and three way catalyst (left bank) as follows:
    a. Disconnect A/C piping from A/C compressor, then remove A/C compressor with power tool. Refer to **REFRIGERANT LINES** .
    b. Remove steering lower joint to enable steering shaft to move freely. Refer to **STEERING COLUMN** .
    c. Remove starter motor. Refer to **REMOVAL AND INSTALLATION** .
    d. Remove nuts on bottom of engine mounting insulator (LH), and lift up left side of engine approximately 3 cm (1.18 in) with transmission jack. Refer to **2WD: COMPONENT** (2WD models) or **AWD: COMPONENT** (AWD models).
    e. Remove exhaust manifold cover (left bank).

f. Loosen nuts in the reverse order shown below to remove exhaust manifold and three way catalyst (left bank) with power tool.

A : Left bank
B : Right bank
⇦ : Engine front

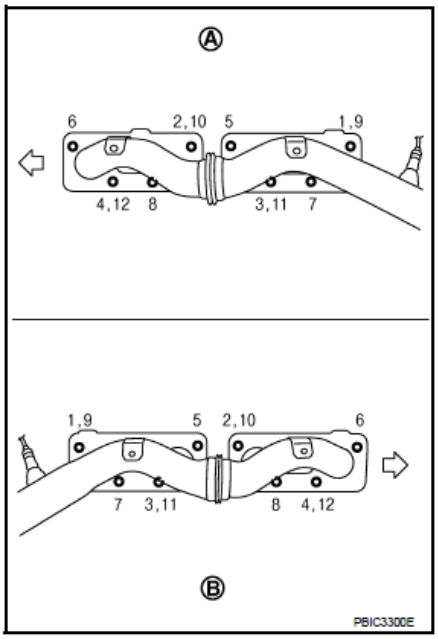


Fig. 25: Identifying Exhaust Manifold Nuts Loosening Sequence (Left Bank)
Courtesy of NISSAN MOTOR CO., U.S.A.

NOTE: Disregard No. 9 to No. 12 when loosening.

11. Remove exhaust manifold and three way catalyst (right bank) as follows:
    a. Remove alternator and bracket. Refer to **CHARGING SYSTEM** .
    b. Remove nuts on bottom of engine mounting insulator (RH), and lift up right side of engine approximately 3 cm (1.18 in) with transmission jack. Refer to **2WD: COMPONENT** (2WD models) or **AWD: COMPONENT** (AWD models).
    c. Remove exhaust manifold cover (right bank).
    d. Loosen nuts in the reverse order shown below to remove exhaust manifold and three way catalyst (right bank) with power tool.

A : Left bank
B : Right bank
⇦ : Engine front

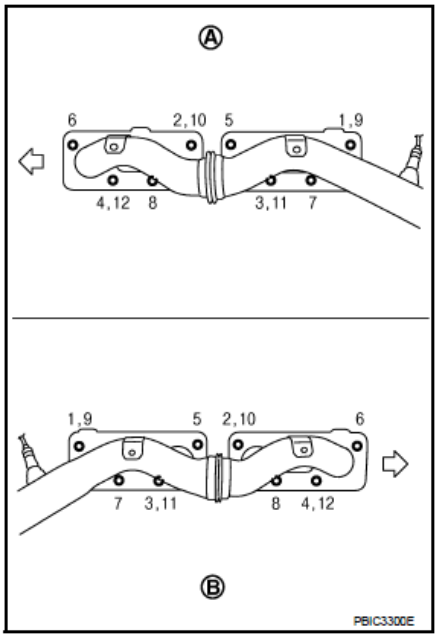


Fig. 26: Identifying Exhaust Manifold Nuts Loosening Sequence (Right Bank)
Courtesy of NISSAN MOTOR CO., U.S.A.

NOTE: Disregard No. 9 to No. 12 when loosening.

12. Remove exhaust manifold gaskets.

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

INSPECTION AFTER REMOVAL

Surface Distortion

- Check the surface distortion of the each exhaust manifold flange mating surface with straightedge and feeler gauge.

  Limit: 0.3 mm (0.012 in)

- If it exceeds the limit, replace exhaust manifold and three way catalyst.

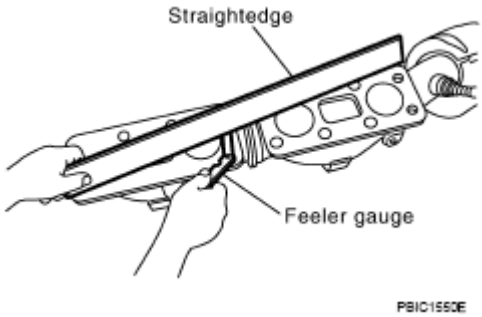


Fig. 27: Checking Surface Distortion Of Exhaust Manifold Flange Mating Surface
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

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

Exhaust Manifold Gasket

Install exhaust manifold gasket with its directional protrusion set upward.

A : Protrusion for confirming installation
⇦ : Above

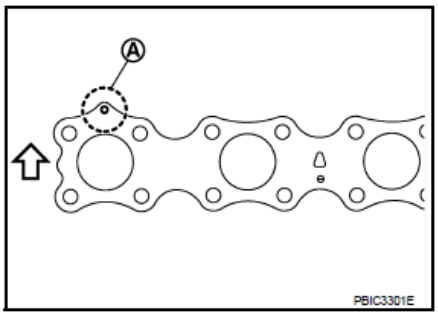


Fig. 28: Identifying Exhaust Manifold Gasket
Courtesy of NISSAN MOTOR CO., U.S.A.

Exhaust Manifold

- Install exhaust manifold and tighten mounting nuts in numerical order as shown below.

A : Left bank
B : right bank
⇦ : Engine front

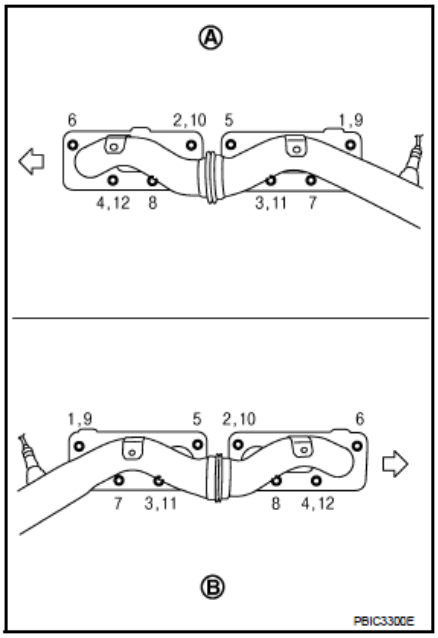


Fig. 29: Identifying Exhaust Manifold Mounting Nuts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

NOTE: **Tighten mounting nuts No. 1 to 4 in two steps. The numerical order No. 9 to 12 shown second steps.**

Air Fuel Ratio Sensor 1

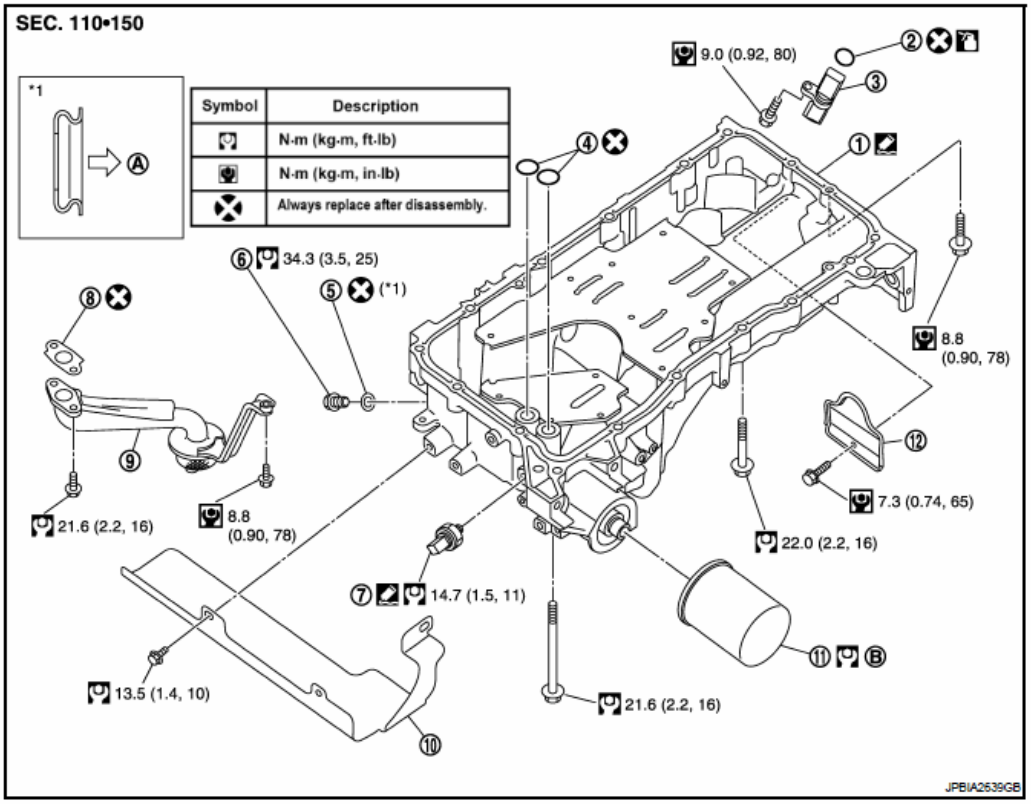
CAUTION:

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

OIL PAN AND OIL STRAINER

Component

2WD models

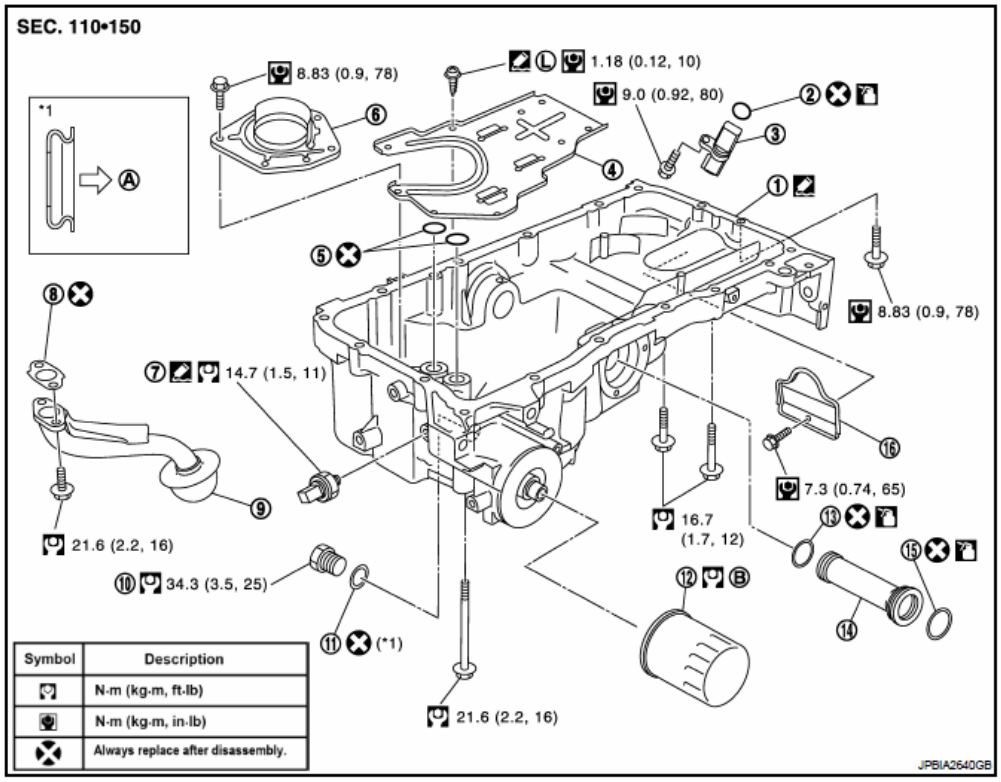


1. Oil pan
2. O-ring
3. Crankshaft position sensor (POS)
4. O-ring
5. Drain plug washer
6. Drain plug
7. Oil pressure switch
8. Gasket
9. Oil strainer
10. Harness bracket
11. Oil filter
12. Rear plate cover
A. Oil pan side
B. Refer to FUEL FILTER

Fig. 30: Identifying Oil Pan And Oil Strainer Components With Torque Specifications (2WD Model)
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to **COMPONENT** for symbols above.

AWD models



1.	Oil pan	2.	O-ring	3.	Crankshaft position sensor (POS)
4.	Baffle plate	5.	O-ring	6.	Baffle plate
7.	Oil pressure switch	8.	Gasket	9.	Oil strainer
10.	Drain plug	11.	Drain plug washer	12.	Oil filter
13.	O-ring	14.	Axle pipe	15.	O-ring
16.	Rear plate cover				
A.	Oil pan side	B.	Refer to FUEL FILTER		

: Apply Genuine High Strength Thread Locking Sealant or equivalent.

Fig. 31: Identifying Oil Pan And Oil Strainer Components With Torque Specifications (4WD Model)
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to **COMPONENT** for symbols not described on the above.

Removal and Installation

REMOVAL

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

1. Remove front and rear engine undercovers 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 belts.**

3. Remove engine assembly from vehicle. Refer to **2WD: COMPONENT** (2WD models) or **AWD: COMPONENT** (AWD models).
4. Install engine slingers into front of cylinder head (left bank) and front of cylinder head (right bank).

Slinger bolts:

33.4 N.m (3.4 kg-m, 25 ft-lb)

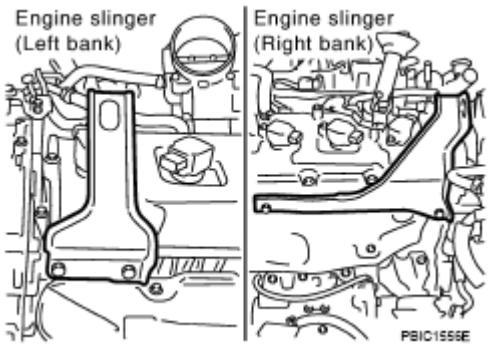


Fig. 32: Identifying Engine Slingers Into Front Of Cylinder Head
Courtesy of NISSAN MOTOR CO., U.S.A.

5. Remove engine mounting insulators (RH and LH) under side nut with power tool.
6. Lift with hoist and separate engine and transmission assembly from front suspension member.

CAUTION: Avoid damage to and oil/grease smearing or spills onto engine mounting insulator.

7. Remove harness bracket from oil pan. (2WD models)
8. Remove oil filter. Refer to **OIL FILTER** .
9. Remove oil pan as the follows:
   a. Remove rear plate cover.
   b. Remove transmission joint bolts which pierce oil pan. Refer to **COMPONENT**.
   c. Loosen mounting bolts with power tool in reverse order as shown below.

NOTE: Disregard the numerical order No. 11 and 17 in removal.

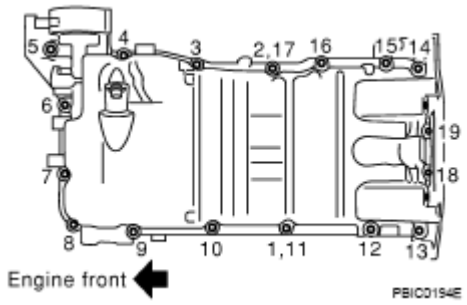


Fig. 33: Identifying Transmission Joint Bolt Loosening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

d. Insert seal cutter (SST) between oil pan and cylinder block. Slide seal cutter (SST) by tapping on the side of seal cutter (SST) with hammer. Remove oil pan.

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

e. Remove O-rings from bottom of oil pump and front cover.

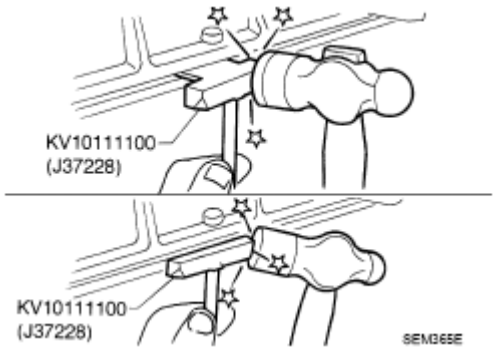


Fig. 34: Inserting Seal Cutter Between Oil Pan (Upper) And Oil Pan (Lower)
Courtesy of NISSAN MOTOR CO., U.S.A.

10. Remove oil pressure switch if necessary. Refer to **INSPECTION** .
11. If necessary, pull axle pipe from oil pan. (AWD models)
    - Hold pipes and pull them out to front drive shaft (left) installing side.
12. Remove oil strainer.

INSPECTION AFTER REMOVAL

Clean oil strainer if any object attached.

INSTALLATION

1. Install oil strainer.
2. Install axle pipe to oil pan, if removed. (AWD models)
   - Lubricate O-ring groove of axle pip, O-ring, and O-ring joint of oil pan with new engine oil.
   - Right/left O-ring diameters differ from each other. O-ring with identification paint mark is installed on front drive shaft (left) installing side.
   - Install axle pipe to oil pan from left side.

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

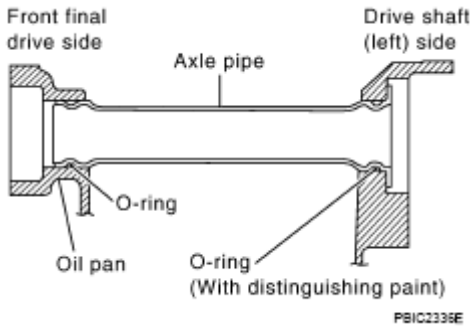


Fig. 35: Identifying Paint Mark On Front Drive Shaft (Left)
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Install oil pan as follows:
   a. Use scraper to remove old liquid gasket from mating surfaces.
      - Also remove the old liquid gasket from mating surface of 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.

   b. Install new O-rings to oil pump and front cover side.
   c. Apply a continuous bead of liquid gasket with tube presser (commercial service tool) to the cylinder block mating surfaces of oil pan to a limited portion as shown below.

Use Genuine RTV Silicone Sealant or equivalent. Refer to RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS .

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

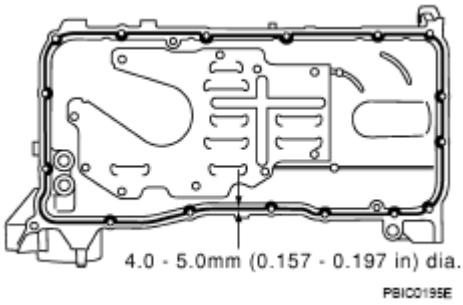


Fig. 36: Identifying Sealant Area Of Cylinder Block Mating Surfaces And Oil Pan
Courtesy of NISSAN MOTOR CO., U.S.A.

d. Install oil pan.

CAUTION: Install avoiding misalignment of O-rings.

- Tighten mounting bolts in numerical order as shown below.

NOTE: Tighten mounting bolts No. 1 and 2 in two steps. The numerical order No. 11 and 17 shown second steps.

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

M6 x 30 mm. (1.18 in): 18, 19

M8 x 100 mm (3.94 in): 5, 9

M8 x 45 mm (1.77 in): Except the above

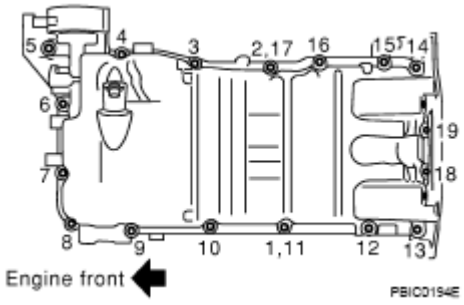


Fig. 37: Identifying Oil Pan Mounting Bolt Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

e. Tighten transmission joint bolts. Refer to **COMPONENT**.
f. Install rear plate cover.

4. Install oil pan drain plug with new drain plug washer.

- Refer to the graphic of components of previous information for installation direction of drain plug washer. Refer to **COMPONENT**.

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

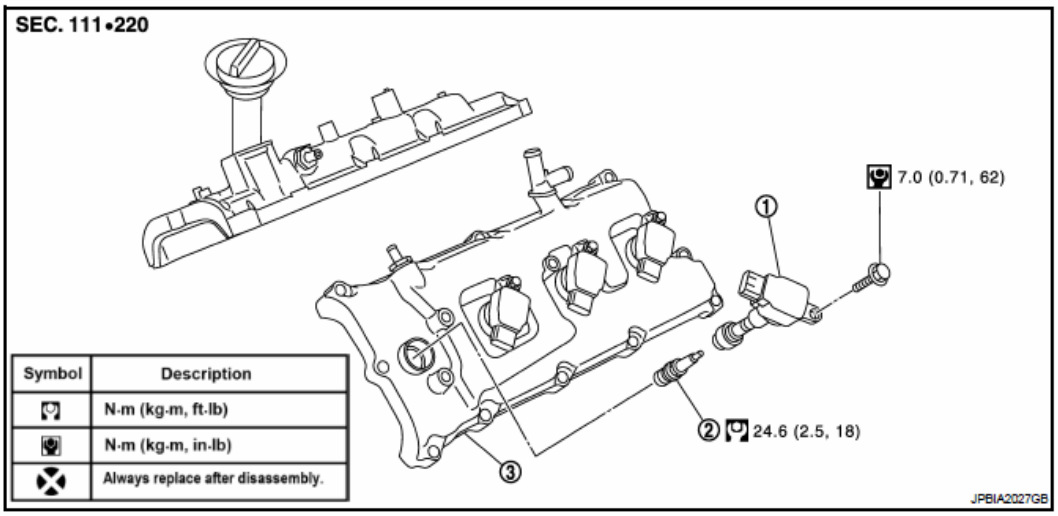
NOTE: At least 30 minutes after oil pan is installed, pour engine oil.

INSPECTION AFTER INSTALLATION

1. Check engine oil level and adjust engine oil. Refer to **ENGINE OIL** .
2. Start engine, and check there is no leakage of engine oil.
3. Stop engine and wait for 15 minutes.
4. Check engine oil level again. Refer to **ENGINE OIL** .

IGNITION COIL

Component



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

Fig. 38: Identifying Ignition Coil, Spark Plug And Rocker Cover With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to **COMPONENT** for symbols above.

Removal and Installation

REMOVAL

1. Remove engine room cover (RH and LH). Refer to **ENGINE ROOM COVER**.
2. Remove engine cover with power tool. Refer to **REMOVAL AND INSTALLATION**.
3. Remove air duct (inlet), air cleaner case, and air duct and resonator assembly. Refer to **AIR CLEANER**

AND AIR DUCT.

4. Disconnect harness connector from ignition coil.
5. Remove ignition coil.

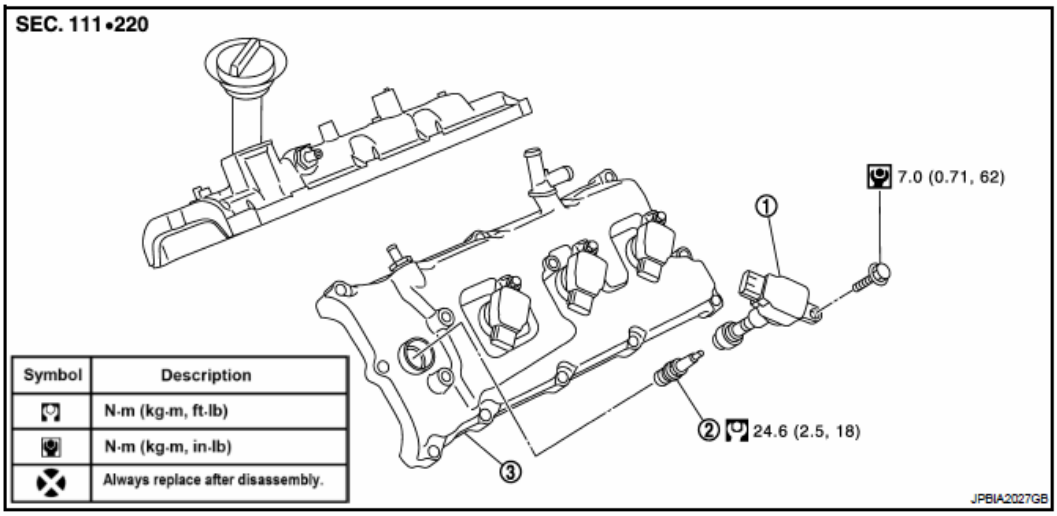
CAUTION: Never shock ignition coil.

INSTALLATION

Install in the reverse order of removal.

SPARK PLUG (PLATINUM-TIPPED TYPE)

Component



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

Fig. 39: Identifying Ignition Coil, Spark Plug And Rocker Cover With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to **COMPONENT** for symbols above.

Removal and Installation

REMOVAL

1. Remove ignition coil. Refer to **IGNITION COIL**.
2. Remove spark plug with spark plug wrench (commercial service tool).

CAUTION: Never drop or shock spark plug.

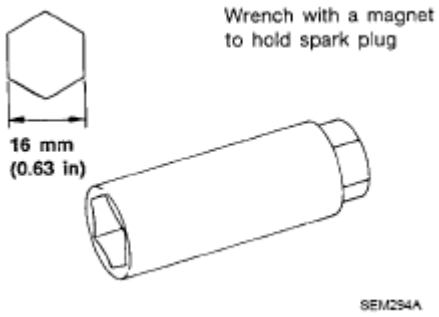


Fig. 40: Identifying Park Plug Tool
Courtesy of NISSAN MOTOR CO., U.S.A.

INSPECTION AFTER REMOVAL

Use standard type spark plug for normal condition .

Hot type spark plug is suitable when fouling occurs with standard type spark plug under conditions such as:

- Frequent engine starts
- Low ambient temperatures

Cold type spark plug is suitable when spark plug knock occurs with standard type spark plug under conditions such as:

- Extended highway driving
- Frequent high engine revolution

STANDARD SPECIFICATION

Make	NGK
Standard type	PLFR5A-11
Hot type	PLFR4A-11
Cold type	PLFR6A-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

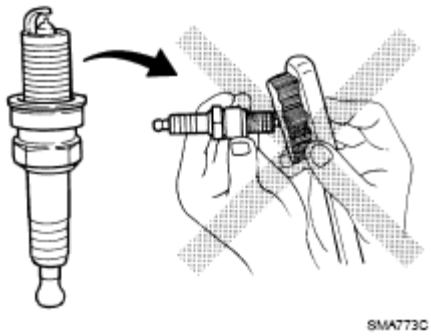


Fig. 41: Caution For Cleaning Spark Plug
Courtesy of NISSAN MOTOR CO., U.S.A.

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

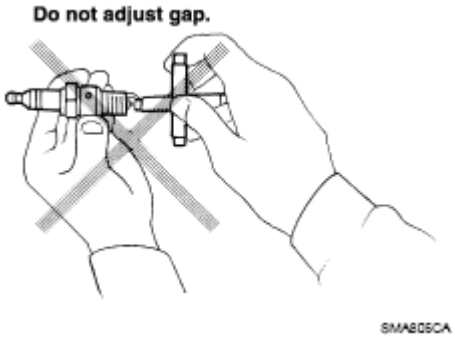


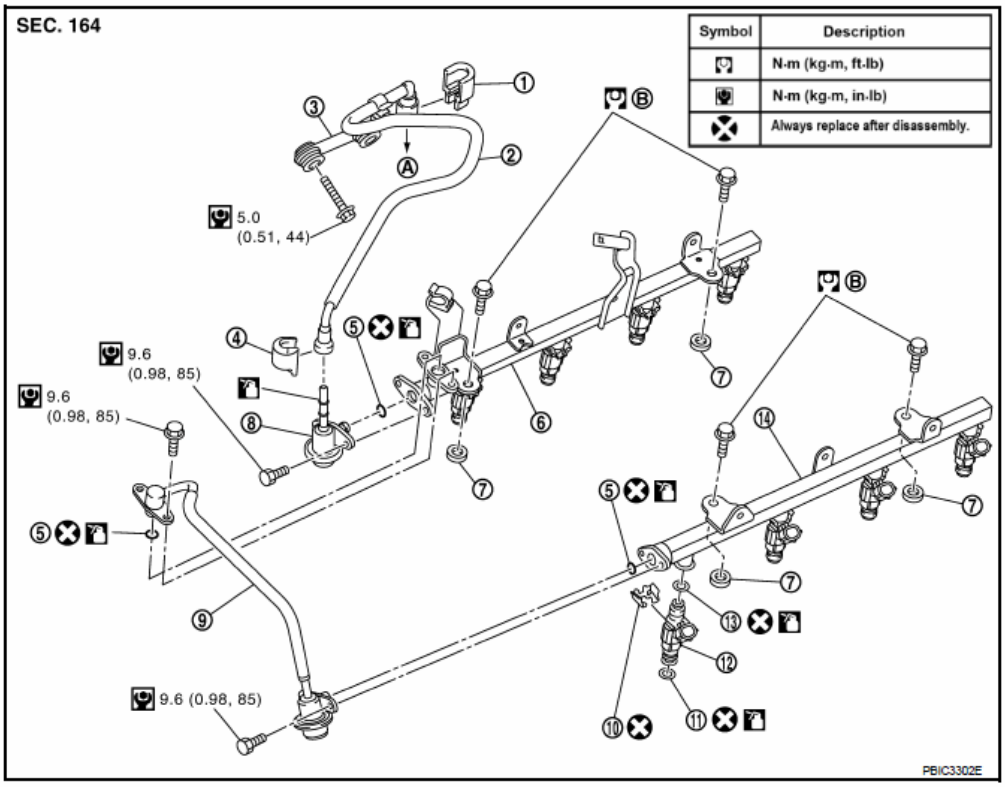
Fig. 42: View Of Caution For Adjusting Plug Gap
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

Install in the reverse order of removal.

FUEL INJECTOR AND FUEL TUBE

Component



1. Quick connector cap
2. Fuel feed hose
3. Fuel feed hose bracket
4. Quick connector cap
5. O-ring
6. Fuel tube (RH)
7. Spacer
8. Fuel feed damper
9. Fuel damper and fuel hose assembly
10. Clip
11. O-ring (green)
12. Fuel injector
13. O-ring (black)
14. Fuel tube (LH)

A. To centralized under-floor piping
B. Refer to FUEL INJECTOR AND FUEL TUBE

Fig. 43: Identifying Fuel Injector And Fuel Tube Components With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to **COMPONENT** for symbols above.

CAUTION: Never remove or disassemble parts unless instructed as shown above.

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 **ENGINE ROOM COVER**.
2. Remove engine cover with power tool. Refer to **REMOVAL AND INSTALLATION**.
3. Release fuel pressure. Refer to **FUEL PRESSURE CHECK** .
4. Disconnect fuel feed hose (1) on engine side as follows: (Perform same procedure for the side of centralized under-floor piping as well.)

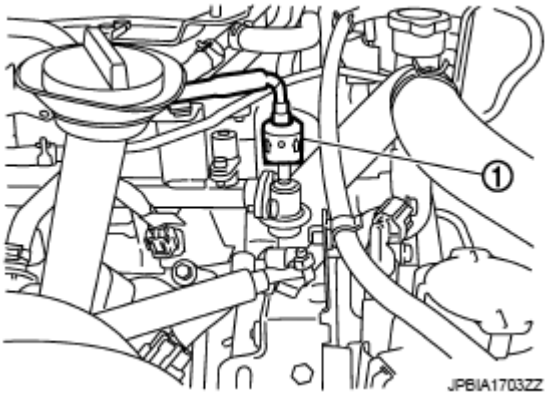


Fig. 44: Identifying Fuel Feed Hose
Courtesy of NISSAN MOTOR CO., U.S.A.

a. Remove quick connector cap from quick connector connection.

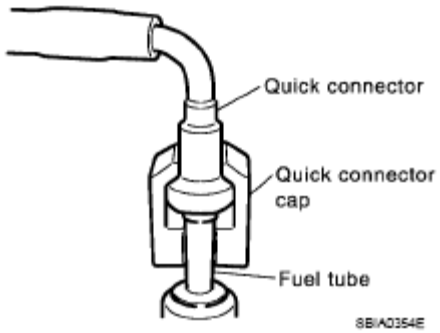


Fig. 45: Identifying Quick Connector Cap On Quick Connector Joint
Courtesy of NISSAN MOTOR CO., U.S.A.

b. Disconnect quick connector from fuel feed damper as follows:

CAUTION: Disconnect quick connector by using quick connector release (commercial service tool: J-45488), not by picking out retainer tabs (centralized under-floor piping side).

i. With the sleeve side of quick connector release facing to quick connector, install quick

connector release onto fuel tube.

ii. Insert quick connector release into quick connector until sleeve contacts and goes no further. Hold quick connector release on that position.

CAUTION: Inserting quick connector release hard will not disconnect quick connector. Hold quick connector release where it contacts and goes no further.

iii. Draw and pull out quick connector straight from fuel feed damper.

CAUTION:

- **Pull quick connector holding "A" position as shown below.**

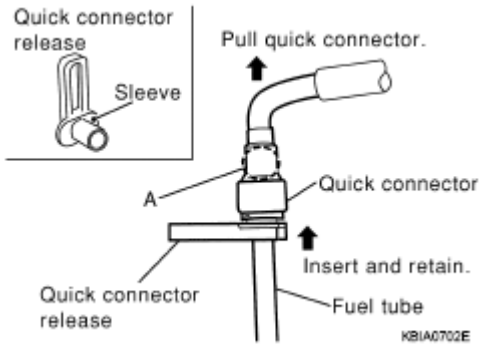


Fig. 46: Inserting Quick Connector Release Into Quick Connector
Courtesy of NISSAN MOTOR CO., U.S.A.

- **Never pull with lateral force applied. O-ring inside quick connector may be damaged.**
- **Prepare container and cloth beforehand as fuel will leakage out.**
- **Avoid fire and sparks.**
- **Keep parts away from heat source. Especially, be careful when welding is performed around them.**
- **Never expose parts to battery electrolyte or other acids.**
- **Never bend or twist connection between quick connector and fuel feed hose during installation/removal.**
- **To keep clean the connecting portion and to avoid damage and foreign materials, cover them completely with plastic bags or something similar.**

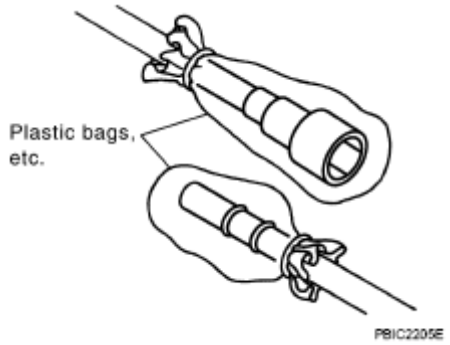


Fig. 47: Covering Quick Connector In Plastic Bags
Courtesy of NISSAN MOTOR CO., U.S.A.

5. Disconnect fuel damper and fuel hose assembly from fuel tubes (RH and LH).

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

6. Disconnect harness connector from fuel injector.
7. Loosen mounting bolts in reverse order as shown below, and remove fuel tube and fuel injector assembly.

A. : Right bank
B. : Left bank
⇦ : Engine front

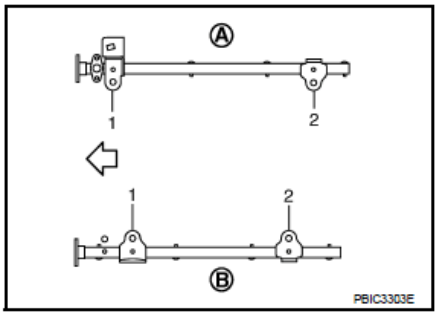


Fig. 48: Identifying Fuel Tube And Fuel Injector Assembly
Courtesy of NISSAN MOTOR CO., U.S.A.

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

8. Remove spacers on intake manifold (lower).
9. Remove fuel injector from fuel tube as follows:
   a. Open and remove clip.
   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.**

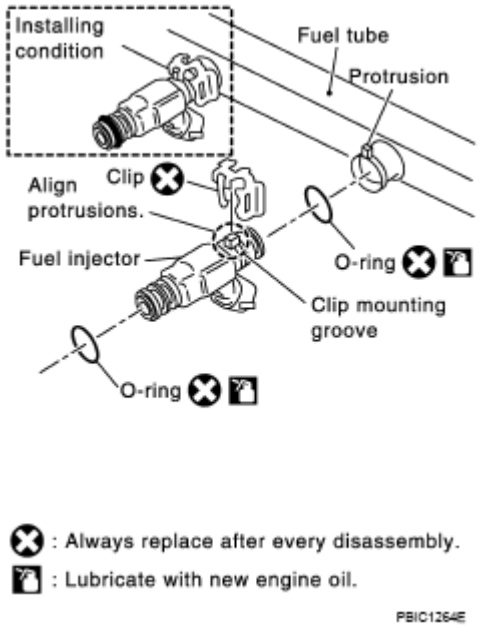


Fig. 49: Identifying Fuel Injector And Fuel Tube
Courtesy of NISSAN MOTOR CO., U.S.A.

10. Remove fuel feed damper.

INSTALLATION

1. Install fuel feed damper.
   - When handling new O-rings, 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 decenter or twist it.**

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

2. Install new O-rings to fuel injector paying attention to the following caution.

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.**

3. Install fuel injector to fuel tube as follows:
   a. Insert clip into clip mounting groove on fuel injector.
      - Insert clip so that "protrusion A" of fuel injector matches "cutout A" of clip.

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 B" of fuel tube matches "cutout B" of clip.
      - Check that fuel tube flange is securely fixed in flange fixing groove 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.

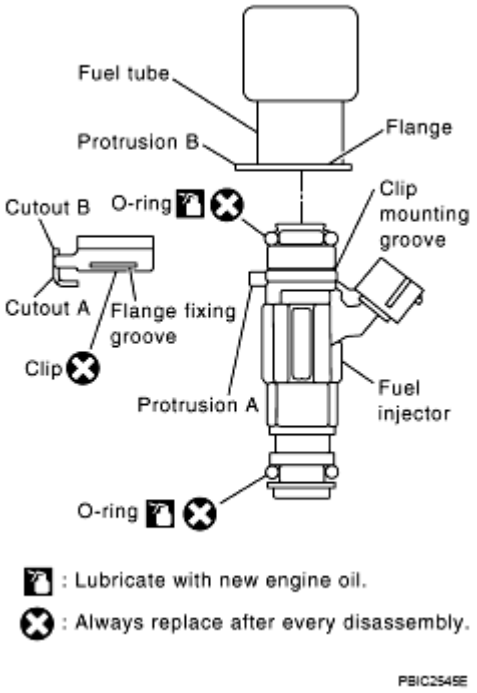


Fig. 50: Checking Fuel Injector
Courtesy of NISSAN MOTOR CO., U.S.A.

4. Install spacers on intake manifold (lower).
5. Install fuel tube and fuel injector assembly to intake manifold (lower).

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 below.

A : Right bank
B : Left bank
⇦ : Engine front

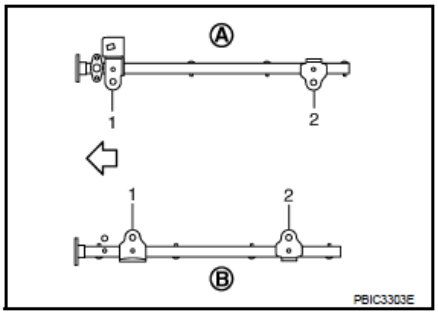


Fig. 51: Identifying Fuel Tube And Fuel Injector Assembly
Courtesy of NISSAN MOTOR CO., U.S.A.

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

2nd step: 23.5 N.m (2.4 kg-m, 17 ft-lb)

6. Connect fuel feed hose on engine side as follows: (Unless otherwise indicated, the installation to the engine side and centralized under-floor piping side is exactly alike.)
   a. Check no foreign substances are deposited in and around fuel tube and quick connector, and no damage on them.
   b. Thinly apply new engine oil around fuel tube from tip end to spool end.
   c. Align center to insert quick connector straightly into fuel tube. Engine side:
      - Insert fuel tube into quick connector until top spool is completely inside quick connector, and 2nd level spool exposes right below quick connector.

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

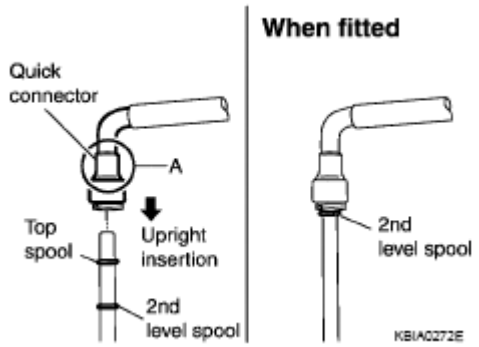


Fig. 52: Inserting Fuel Tube Into Quick Connector
Courtesy of NISSAN MOTOR CO., U.S.A.

Centralized under-floor piping side:

- Visually confirm that the two retainer tabs are connected to the connector.

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

   d. Pull quick connector by hand holding position. Check it is completely engaged (connected) so that

it does not come out from fuel tube.

e. Install quick connector cap on quick connector connection.

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

f. Install fuel feed hose to hose clamps.

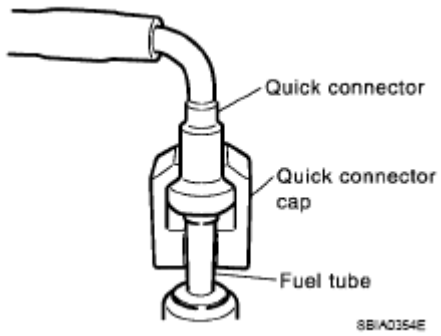


Fig. 53: Identifying Quick Connector Cap On Quick Connector Joint
Courtesy of NISSAN MOTOR CO., U.S.A.

7. 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.

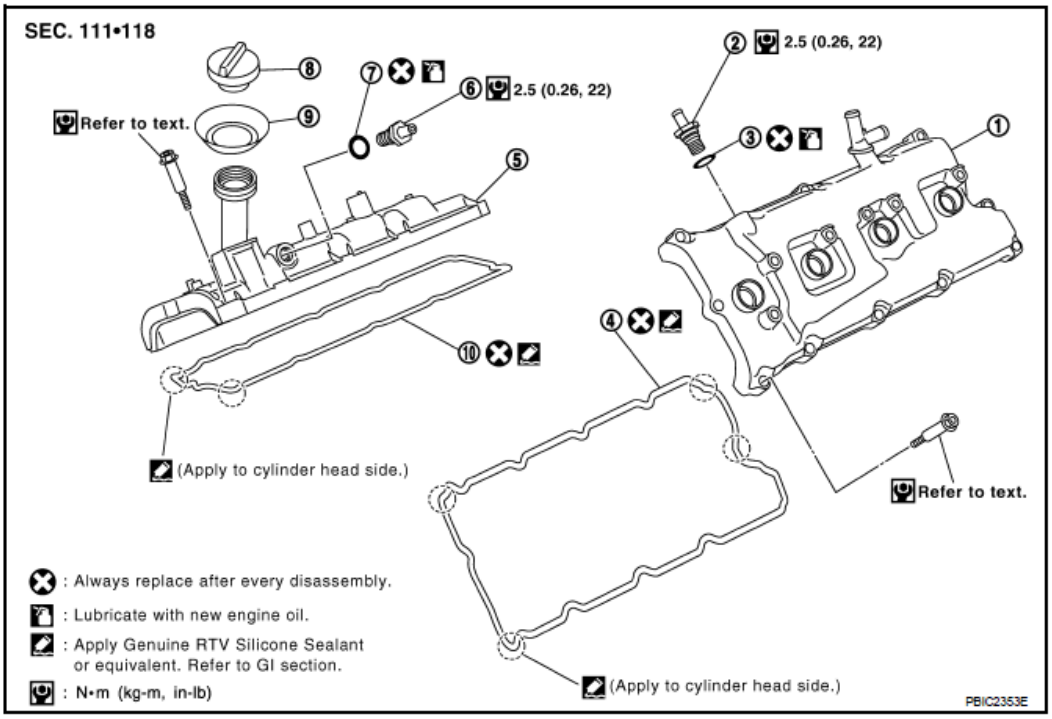
NOTE: Use mirrors for checking at points out of clear sight.

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



1. Rocker cover (left bank)
2. PCV valve
3. O-ring
4. Rocker cover gasket (left bank)
5. Rocker cover (right bank)
6. PCV valve
7. O-ring
8. Oil filler cap
9. Oil catcher
10. Rocker cover gasket (right bank)

Fig. 54: Identifying Rocker Cover Components With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

Removal and Installation

REMOVAL

1. Remove engine room cover (RH and LH). Refer to **ENGINE ROOM COVER**.
2. Remove engine cover with power tool. Refer to **REMOVAL AND INSTALLATION**.
3. Refer to **the following for incidental works related to left bank** .
   a. Remove air duct (inlet), air cleaner case, and air duct and resonator assembly. Refer to **AIR CLEANER AND AIR DUCT**.
   b. Move harness on upper rocker cover and its peripheral aside.
   c. Remove harness bracket from camshaft bracket (No. 6). Refer to **CAMSHAFT**.
   d. Remove ignition coil. Refer to **IGNITION COIL**.
   e. Remove PCV hose from PCV valve.
4. Refer to **the following for incidental works related to right bank** .
   a. Move harness on upper rocker cover and its peripheral aside.
   b. Remove ignition coil. Refer to **IGNITION COIL**.
   c. Remove PCV hose from PCV valve.

5. Remove PCV valves and O-rings from rocker covers (right bank and left bank), if necessary.
6. Remove oil filler cap and oil catcher from rocker cover (right bank), if necessary.
7. Remove rocker cover (right bank) as follows:
   a. Remove battery cover. Refer to **ENGINE ROOM COVER**.
   b. Remove battery and battery tray. Refer to **BATTERY** .
   c. Remove grommet (2) from cowl top panel hole (RH).

1 : Relay box
⇦ : Engine front

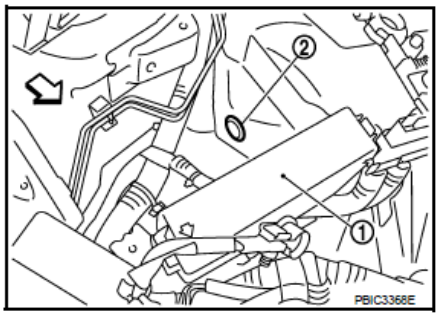


Fig. 55: Identifying Grommet From Cowl Top Panel Hole (RH)
Courtesy of NISSAN MOTOR CO., U.S.A.

   d. Loosen mounting bolts in reverse order as that shown below.

CAUTION: Never hold oil filler neck (right bank) so as not to damage it.

NOTE: Loosen No. 10 bolt of right bank from cowl top panel hole using tool.

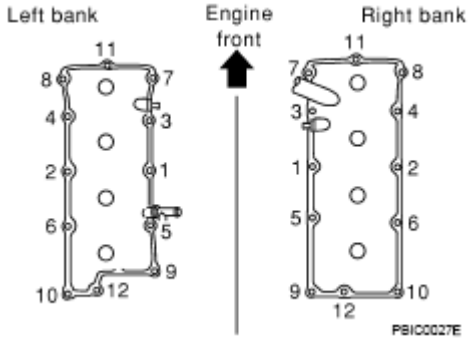


Fig. 56: Identifying Oil Filter Mounting Bolt Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

8. Remove rocker cover (left bank) as follows:
   a. Remove brake master cylinder cover. Refer to **ENGINE ROOM COVER**.
   b. Remove two grommets (1) from cowl top panel hole (LH).

2 : Brake master cylinder
⇦ : Engine front

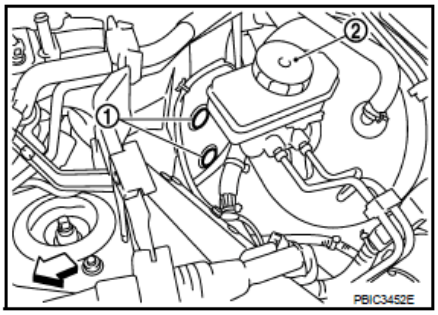


Fig. 57: Identifying Grommets From Cowl Top Panel Hole (LH)
Courtesy of NISSAN MOTOR CO., U.S.A.

c. Loosen mounting bolts in reverse order as shown below.

NOTE: Loosen No. 10 and 12 bolts of the left bank from cowl top panel hole using tool.

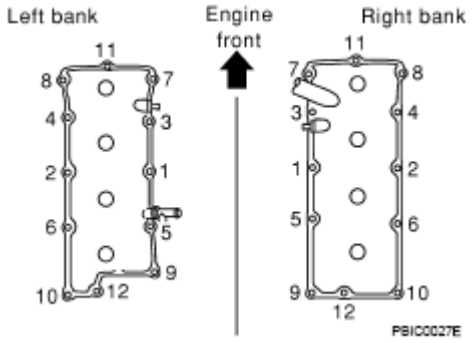


Fig. 58: Identifying Oil Filter Mounting Bolt Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to **the following procedure for removal of mounting bolts No. 10 and 12. (For ICC models**)

CAUTION: Never bend or damage brake piping by tools.

  - No. 10 bolt. See the graphic and remove them using a 300 mm (11.81 in) expansion bar.

A : Cowl top panel hole
⇦ : Engine front

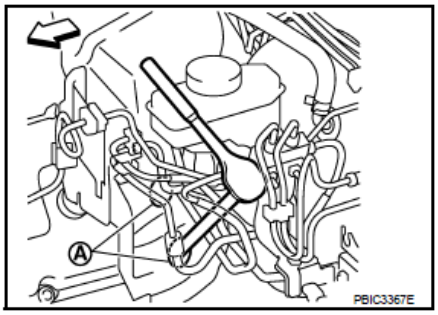


Fig. 59: View Of Removing Expansion Bar
Courtesy of NISSAN MOTOR CO., U.S.A.

- No. 12 bolt. See the graphic and remove them using a 300 mm (11.81 in) expansion bar.

A : Cowl top panel hole
⇦ : Engine front

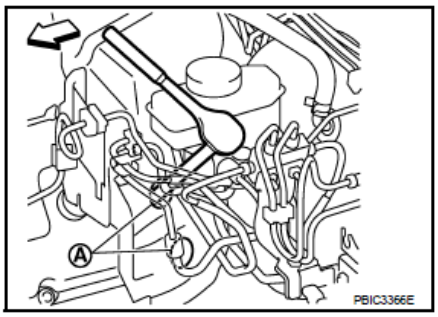


Fig. 60: Illustrating Removing Expansion Bar
Courtesy of NISSAN MOTOR CO., U.S.A.

NOTE: Slide the brake piping frontward to obtain working space.

9. Remove rocker cover gaskets from rocker covers.
10. Use scraper to remove all traces of liquid gasket from cylinder head and camshaft bracket (No. 1 and 6).

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

INSTALLATION

1. Apply liquid gasket with tube presser (commercial service tool) to joint among rocker cover, cylinder head and camshaft bracket (No. 1 and 6) as follows:

Use Genuine RTV Silicone Sealant or equivalent. Refer to RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS .

NOTE: The graphic shows an example of left bank side [zoomed in shows camshaft bracket (No. 1)]. Apply only to camshaft bracket (No. 1) for right

bank side.

a. Refer to "a" to apply liquid gasket to joint part of camshaft bracket (both No. 1 and 6) and cylinder head.
b. Refer to "b" to apply liquid gasket to "a" squarely.

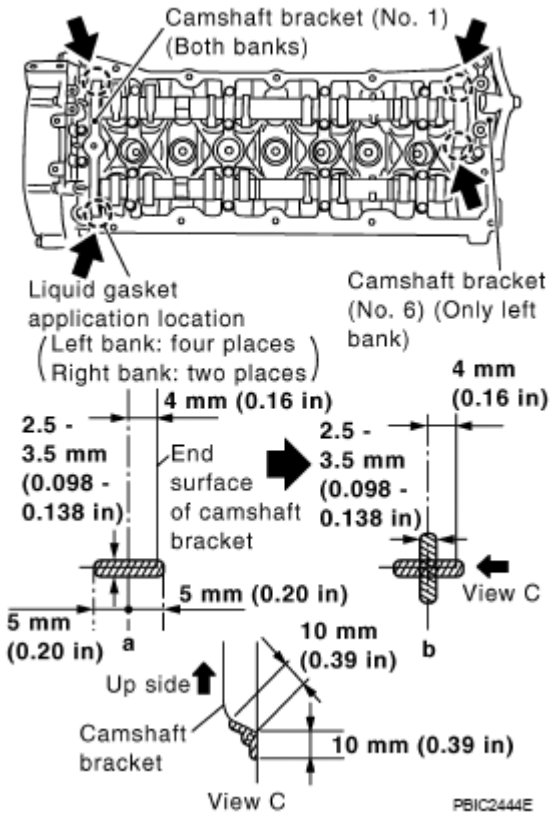


Fig. 61: Locating Camshaft Bracket Sealant Area
Courtesy of NISSAN MOTOR CO., U.S.A.

2. Install new rocker cover gaskets to rocker covers.
3. Install rocker cover.
   - Check if rocker cover gasket is not dropped from installation groove of rocker cover.
4. Tighten mounting bolts in two steps separately in numerical order as shown below.

CAUTION:
- **Never hold oil filler neck (right bank) so as not to damage it.**
- **Never bend or damage brake piping by tools. (ICC models)**

NOTE: **Tighten No. 10 bolt of the right bank and No. 10 and 12 bolts of the bank 1 from cowl top panel hole with using tool.**

1st step: 2.0 N.m (0.20 kg-m, 18 in-lb)

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

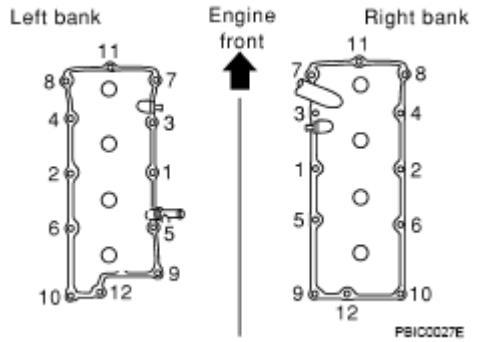
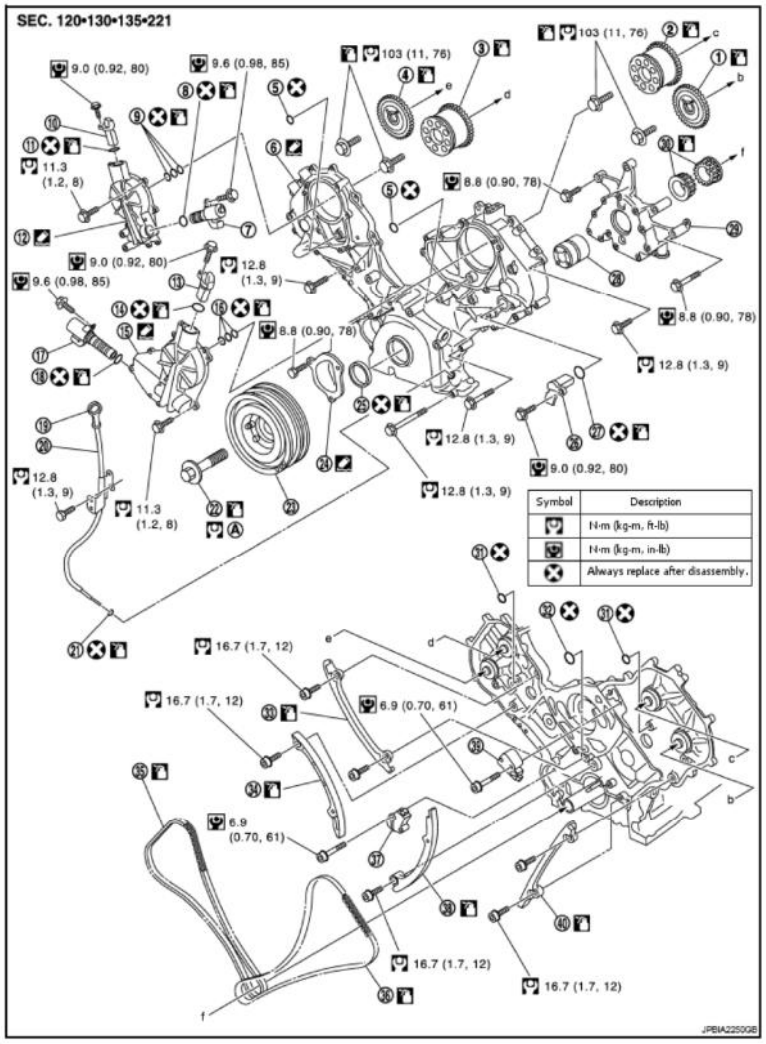


Fig. 62: Identifying Oil Filter Mounting Bolt Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

5. Install oil filler cap and oil catcher to rocker cover (right bank), if removed.
6. Install new O-rings and PCV valves to rocker covers (right bank and left bank), if removed.
7. Install in the reverse order of removal.

TIMING CHAIN

Component



1. Camshaft sprocket (EXH) (left bank)	2. Camshaft sprocket (INT) (left bank)	3. Camshaft sprocket (INT) (right bank)
4. Camshaft sprocket (EXH) (right bank)	5. O-ring	6. Front cover
7. Intake valve timing control solenoid valve (bank 2)	8. O-ring	9. Seal ring
10. Intake valve timing control position sensor (bank 2)	11. O-ring	12. Intake valve timing control cover (right bank)
13. Intake valve timing control position sensor (bank 1)	14. O-ring	15. Intake valve timing control cover (left bank)
16. Seal ring	17. Intake valve timing control solenoid valve (bank 1)	18. O-ring
19. Oil level gauge	20. Oil level gauge guide	21. O-ring
22. Crankshaft pulley bolt	23. Crankshaft pulley	24. Chain tensioner cover
25. Front oil seal	26. Camshaft position sensor (PHASE)	27. O-ring
28. Oil pump drive spacer	29. Oil pump assembly	30. Crankshaft sprocket
31. O-ring	32. O-ring	33. Timing chain tension guide (right bank)
34. Timing chain slack guide (right bank)	35. Timing chain (right bank)	36. Timing chain (left bank)
37. Chain tensioner (left bank)	38. Timing chain slack guide (left bank)	39. Chain tensioner (right bank)
40. Timing chain tension guide (left bank)		
A. Refer to Engine Mechanical		

Fig. 63: Identifying Timing Chain Components With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to **COMPONENT** for symbols above.

Removal and Installation

REMOVAL

1. Remove engine assembly from vehicle. Refer to **2WD: COMPONENT** (2WD models) or **AWD: COMPONENT** (AWD models).
2. Remove the following components and related parts:
   - Drive belt auto tensioner and idler pulley: Refer to **DRIVE BELT AUTO TENSIONER AND IDLER PULLEY**.
   - Thermostat housing and hoses: Refer to **THERMOSTAT AND WATER CONTROL VALVE** .
   - Ignition coil: Refer to **IGNITION COIL**.
   - Rocker cover: Refer to **ROCKER COVER**.
3. If necessary, remove intake valve timing control position sensor (right bank and left bank) and camshaft position sensor (PHASE) from intake valve timing control cover and front cover.

CAUTION:
- **Handle carefully to avoid dropping and shocks.**
- **Never disassemble.**

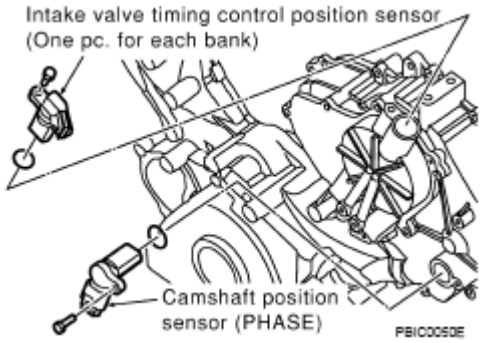


Fig. 64: Identifying Intake Valve Timing Control Position Sensor
Courtesy of NISSAN MOTOR CO., U.S.A.

4. If necessary, remove intake valve timing control solenoid valve from intake valve timing control cover.

CAUTION:
- **Handle components and parts carefully to avoid dropping and shocks.**
- **Never disassemble.**
- **Never allow metal powder to adhere to magnetic part at sensor tip.**
- **Never place sensors in a location where they are exposed to magnetism.**

5. Remove intake valve timing control cover as follows:
   a. Loosen and remove mounting bolts in the reverse order as shown below.

b. Use seal cutter [SST: KV10111100 (J-37228)] to cut liquid gasket for removal.

CAUTION:

- **Exercise care not to damage mating surfaces.**
- **Pull out cover keeping levelness without an angle, as inner part of cover is engaged with the center of camshaft sprocket (INT).**

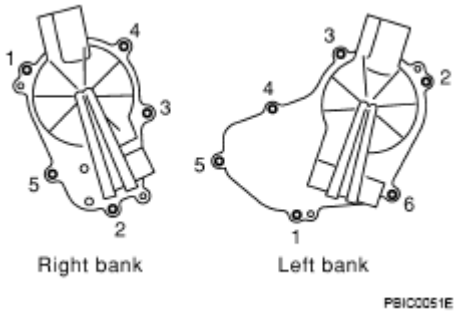


Fig. 65: Identifying Intake Valve Timing Control Cover Loosening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

6. Remove O-rings from front cover.

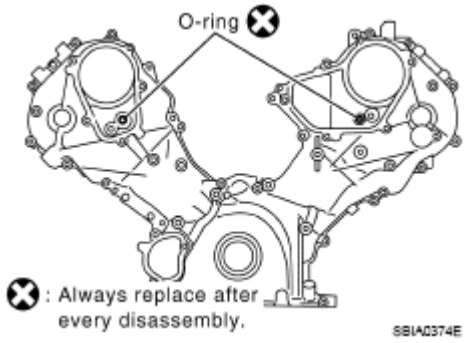


Fig. 66: Identifying O-Rings On Front Cover
Courtesy of NISSAN MOTOR CO., U.S.A.

7. Obtain No. 1 cylinder at TDC of its compression stroke as follows:
   a. Rotate crankshaft pulley clockwise to align the TDC identification notch (without paint mark) with timing indicator on front cover.

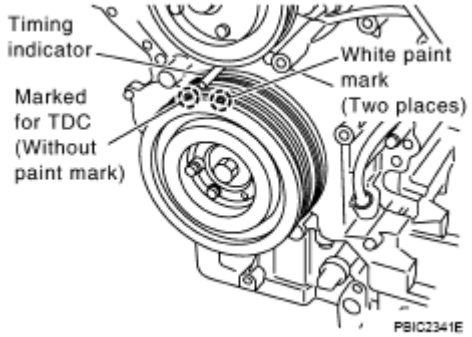


Fig. 67: Identifying TDC Identification Notch With Timing Indicator On Front Cover
Courtesy of NISSAN MOTOR CO., U.S.A.

b. Check that both intake and exhaust cam noses of No. 1 cylinder (engine front side of left bank) are located as shown below.
   - If not, turn crankshaft one revolution (360 degrees) and align as shown below.

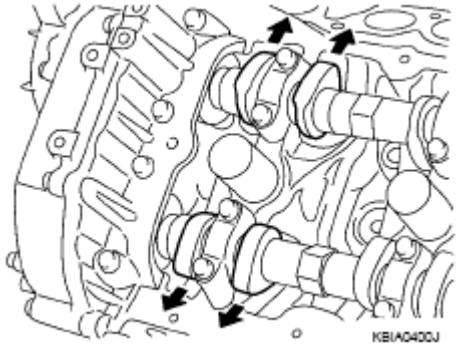


Fig. 68: Checking Intake And Exhaust Cam Lobes Of No. 1 Cylinder
Courtesy of NISSAN MOTOR CO., U.S.A.

8. Remove crankshaft pulley as follows:
   a. Remove rear plate cover, and set ring gear stopper (SST).
   b. Loosen crankshaft pulley bolt, and then pull crankshaft pulley with both hands to remove it.

CAUTION:
- **Never remove crankshaft pulley bolt. Keep loosened crankshaft pulley bolt in place to protect removed crankshaft pulley from dropping.**
- **Never remove balance weight (inner hexagon bolt) at the front of crankshaft pulley.**

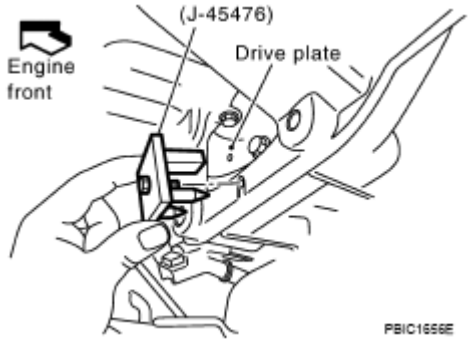


Fig. 69: Identifying Rear Plate Cover
Courtesy of NISSAN MOTOR CO., U.S.A.

9. Remove oil pan and oil strainer. Refer to **OIL PAN AND OIL STRAINER**.
10. Remove front cover as follows:
    a. Loosen mounting bolts in reverse order as shown below.
    b. Use seal cutter [SST: KV10111100 (J-37228)] to cut liquid gasket for removal.

CAUTION:
- **Exercise care not to damage mating surfaces.**
- **After removal, handle front cover carefully so it never tilt, cant, or warp under a load.**

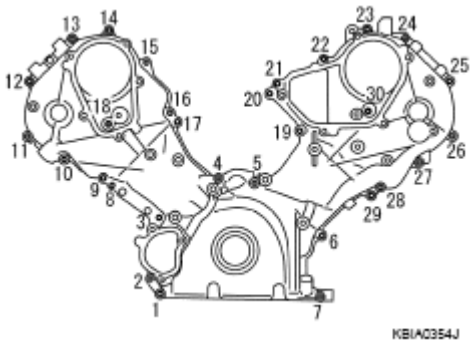


Fig. 70: Identifying Oil Pan And Oil Strainer Bolt Loosening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

11. Remove front oil seal from front cover using suitable tool.
    - Use screwdriver for removal.

CAUTION: Be careful not to damage front cover.

12. Remove O-rings from cylinder heads (right bank and left bank) and cylinder block.

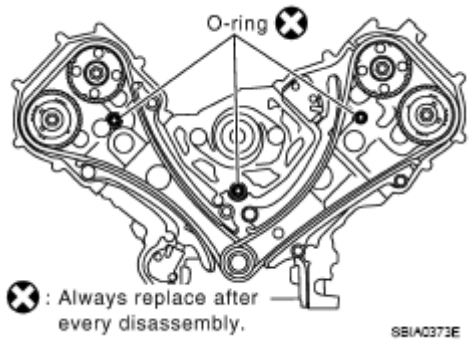


Fig. 71: Identifying O-Rings Location
Courtesy of NISSAN MOTOR CO., U.S.A.

13. Remove chain tensioner cover from front cover.
    - Use seal cutter [SST: KV10111100 (J-37228)] to cut liquid gasket for remove.
14. Remove oil pump drive spacer.
    - Set bolts in the two bolt holes [M6 x pitch 1.0 mm (0.039 in)] on front surface. Using suitable puller, pull oil pump drive spacer off from crankshaft.

NOTE: **The dimension between the centers of the two bolt holes is 33 mm (1.30 in).**
In the graphic, a commercial steering puller is used.

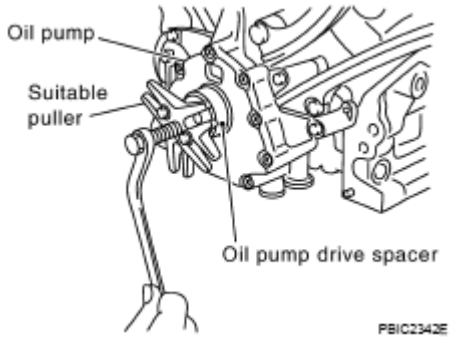


Fig. 72: Using Special Tools To Remove Oil Pump Drive Spacer
Courtesy of NISSAN MOTOR CO., U.S.A.

15. Remove oil pump. Refer to **OIL PUMP** .
16. Remove chain tensioner (left bank) as follows:

NOTE: **To remove timing chain and related parts, start with those on left bank. The procedure for removing parts on right bank is omitted because it is the same as that for left bank.**

a. Press tab in the direction of arrow (or turn lever in the direction of arrow) to unlock the locking with the groove that stops tensioner plunger from returning.

- Lightly press tensioner plunger to release the tension of spring for this operation.

b. Push in tensioner plunger to align the hole on lever and that on pump main body.
   - Pushing in tensioner too far does not allow the holes to align. Therefore, push in plunger to the degree at which the start of stopper groove and tab engages.

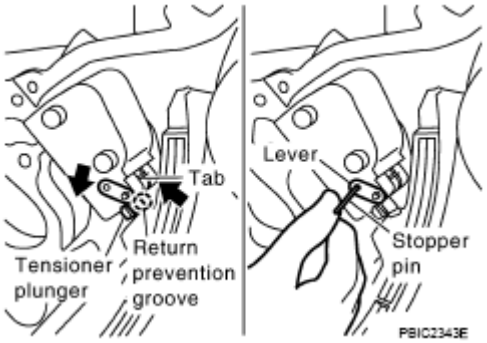


Fig. 73: Pressing Tab In Groove
Courtesy of NISSAN MOTOR CO., U.S.A.

c. Insert stopper pin [hard wire with approximately 0.5 mm (0.020 in) diameter or similar tool] to fix plunger. With plunger fixed, remove chain tensioner.

17. Remove chain tension guide and timing chain slack guide.
18. Remove timing chain and crankshaft sprocket.

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

19. With hexagonal part of camshaft locked with wrench, loosen mounting bolts securing camshaft sprocket to remove camshaft sprocket.

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

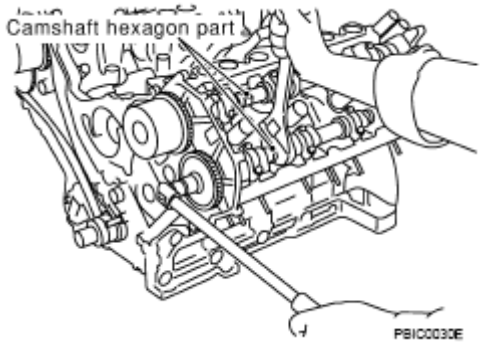


Fig. 74: Identifying Camshaft Sprocket Bolt
Courtesy of NISSAN MOTOR CO., U.S.A.

20. Perform same procedure as for left bank, remove timing chain and related parts on right side.
21. Use scraper to remove all traces of old liquid gasket from front cover and opposite mating surfaces.
    - Remove oil liquid gasket from bolt hole and thread.

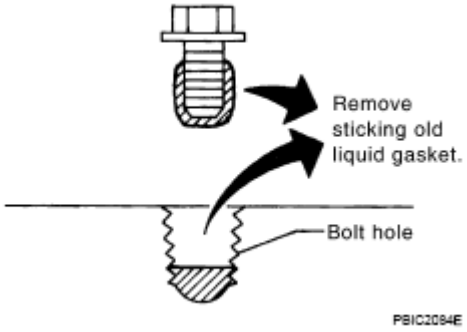


Fig. 75: Identifying Old Liquid Gasket In Bolt Hole And Thread
Courtesy of NISSAN MOTOR CO., U.S.A.

22. Use scraper to remove all trace of liquid gasket from chain tensioner cover and intake valve timing control covers.

INSPECTION AFTER REMOVAL

Timing Chain

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

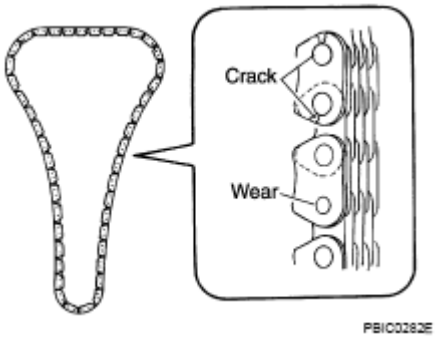


Fig. 76: Checking Cracks And Any Excessive Wear At Link Plates
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

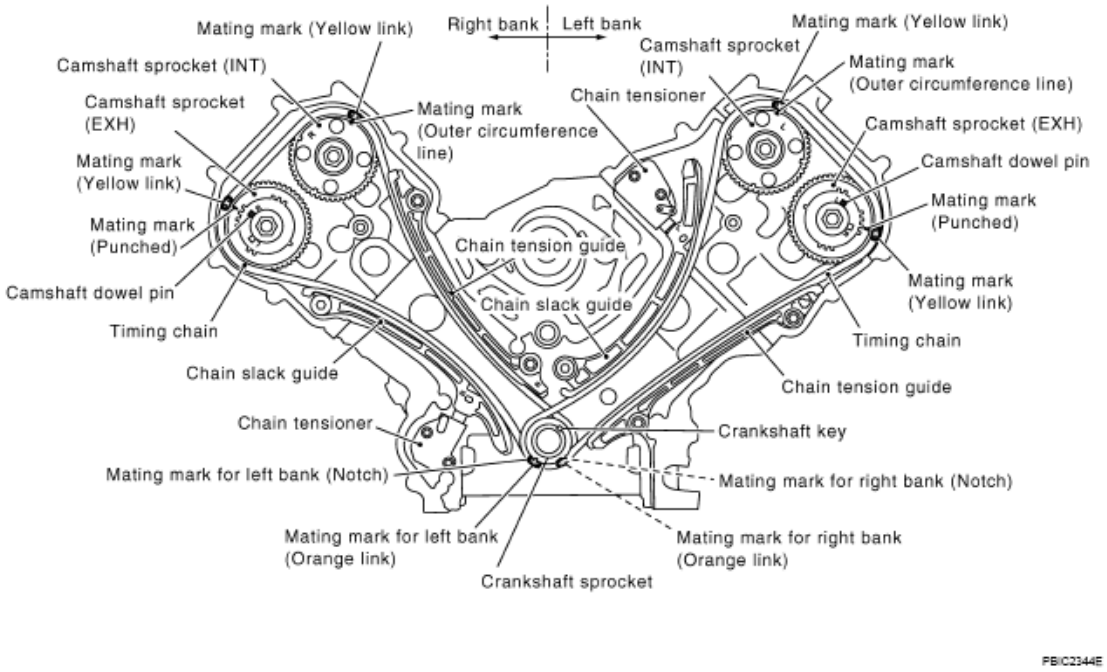


Fig. 77: Identifying Timing Chain Components
Courtesy of NISSAN MOTOR CO., U.S.A.

NOTE:

- **The above graphic shows the relationship between the mating mark on each timing chain and that on the corresponding sprocket, with the components installed.**
- **Parts with an identification mark (R or L) should be installed on the corresponding bank according to the mark.**

  Parts with an identification mark:

  - **Camshaft sprocket (INT)**
  - **Dowel pin groove of camshaft sprocket (EXH) (camshaft sprocket is same part both banks)**
  - **Chain tension guide**
  - **Chain slack guide**
- **To install timing chain and related parts, start with those on right bank. The procedure for installing parts on left bank is omitted because it is the same as that for installation on right bank.**

1. Check that crankshaft key and dowel pin of each camshaft are located as shown below. (No. 1 cylinder at compression TDC)

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

Camshaft dowel pin

: At cylinder head upper face side in each bank

Crankshaft key

: At cylinder head side of left bank

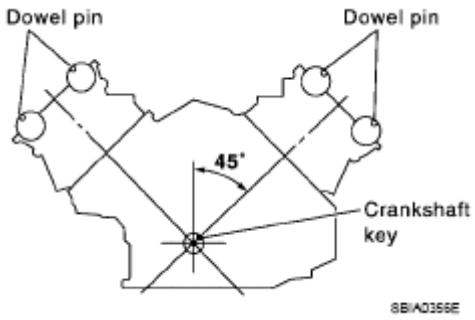


Fig. 78: Identifying Crankshaft Key And RH Bank Camshaft Dowel Pin And LH Bank Camshaft Dowel Pin
Courtesy of NISSAN MOTOR CO., U.S.A.

2. Install camshaft sprockets.
   - Install onto correct side by checking with identification mark on surface.
   - Install camshaft sprocket (EXH) by selectively using the groove of dowel pin according to the bank. (Common part used for both banks.)
   - Lock the hexagonal part of camshaft in the same procedure as for removal, and tighten mounting bolts.

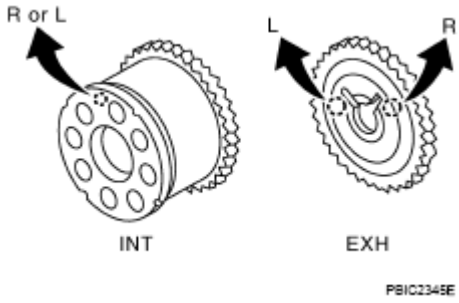


Fig. 79: Identifying Camshaft Sprockets
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Install crankshaft sprockets for both banks.
   - Install each crankshaft sprocket so that its flange side (the larger diameter side without teeth) faces in the direction shown below.

NOTE: The same parts are used but facing directions are different.

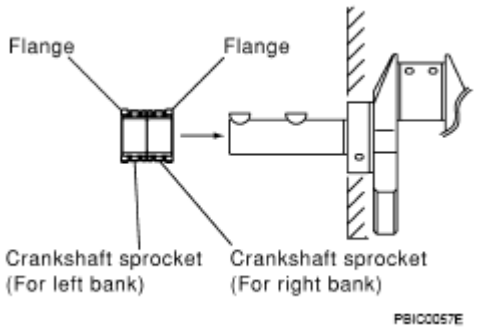


Fig. 80: Identifying Crankshaft Sprockets For Banks
Courtesy of NISSAN MOTOR CO., U.S.A.

4. Install timing chains and related parts.

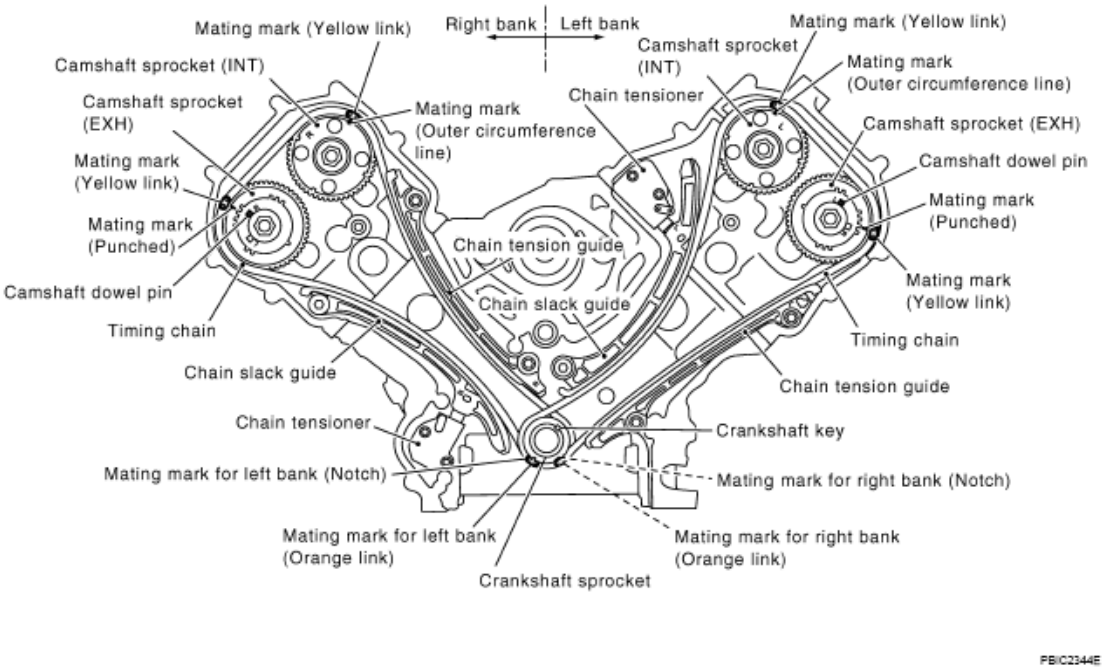


Fig. 81: Identifying Timing Chains Parts
Courtesy of NISSAN MOTOR CO., U.S.A.

- Align the mating mark on each sprocket and timing chain for installation.

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

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

- Install slack guides and tension guides onto correct side by checking with identification mark on surface.
- Install chain tensioner with plunger fixed as described in its removal.

CAUTION:
- **Before and after the installation of chain tensioner, check that the mating mark on timing chain is not out of alignment.**
- **After installing chain tensioner, remove stopper pin to release tensioner. Check tensioner is released.**
- **To avoid chain-link skipping of timing chain, never move crankshaft or camshafts until front cover is installed.**

5. Perform the same procedure as for right bank, install timing chain and related parts on left side.
6. Install oil pump. Refer to **OIL PUMP** .
7. Install oil pump drive spacer as follows:
   a. Insert oil pump drive spacer according to the directions of crankshaft key and the two flat surfaces of oil pump inner rotor.
      - If the positional relationship does not allow the insertion, rotate oil pump inner rotor with a finger to allow spacer.
   b. After confirming that the position of each part is in correct condition to allow for spacer, force fit spacer by lightly tapping with plastic hammer until it contacts and does not go further.

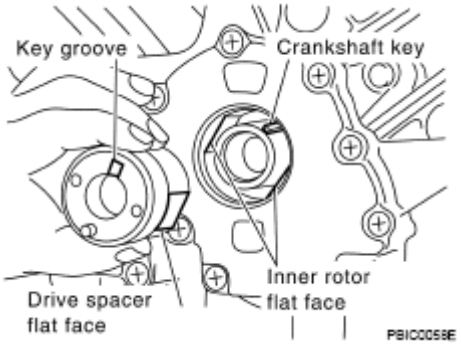


Fig. 82: Inserting Oil Pump Drive Spacer
Courtesy of NISSAN MOTOR CO., U.S.A.

8. Install front oil seal on front cover.
   - Apply new engine oil to both oil seal lip and dust seal lip.
   - Install it so that each seal lip is oriented as shown below.

CAUTION: Be careful not to scratch or make burrs on circumference of oil seal.

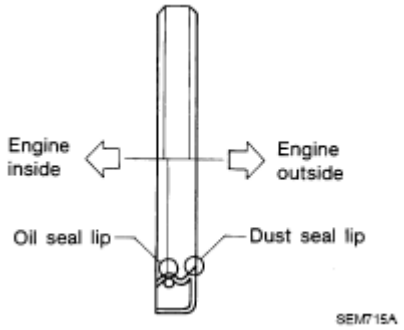


Fig. 83: Applying Engine Oil To Both Oil Seal Lip And Dust Seal Lip
Courtesy of NISSAN MOTOR CO., U.S.A.

- Using front oil seal drift (commercial service tool), press fit until the height of front oil seal is level with the mounting surface.

  Front oil seal drift

  Outer diameter: 56 mm (2.20 in)

  Inner diameter: 49 mm (1.93 in)

- Check the garter spring is in position and seal lips not inverted.

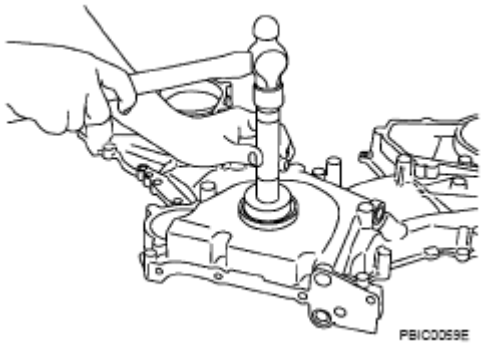


Fig. 84: Identifying Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

9. Install chain tensioner cover to front cover.
   - Apply a continuous bead of liquid gasket with tube presser (commercial service tool) to front cover as shown below.

1 : Chain tensioner cover
2 : Front cover
a : ϕ2.6 - 3.6 mm (0.102 - 0.142 in)

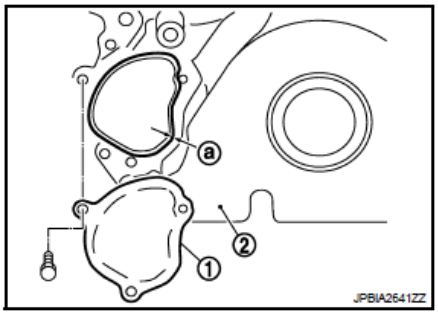


Fig. 85: Identifying Chain Tensioner Cover To Front Cover
Courtesy of NISSAN MOTOR CO., U.S.A.

Use Genuine RTV Silicone Sealant or equivalent. Refer to RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS .

10. Install front cover as follows:
    a. Install new O-rings onto cylinder heads (right bank and left bank) and cylinder block.

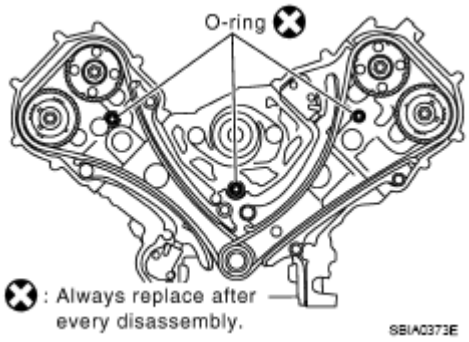


Fig. 86: Identifying O-Rings Location
Courtesy of NISSAN MOTOR CO., U.S.A.

    b. Apply a continuous bead of liquid gasket with tube presser (commercial service tool) to front cover as shown below.

Use Genuine RTV Silicone Sealant or equivalent. Refer to RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS .

    c. Check again that the mating marks on timing chain and that on each sprocket are aligned. Then, install front cover.

CAUTION: Be careful to avoid interference with the front end of oil pump drive spacer. Such interference may damage front oil seal.

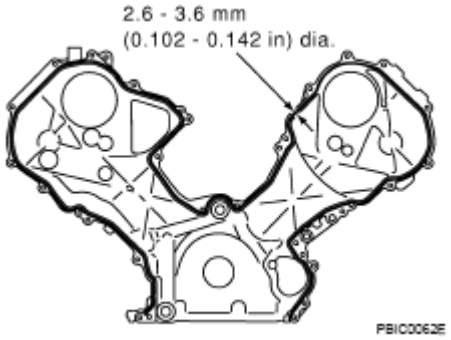


Fig. 87: Identifying Mating Marks On Timing Chain
Courtesy of NISSAN MOTOR CO., U.S.A.

d. Tighten mounting bolts in numerical order as shown below.

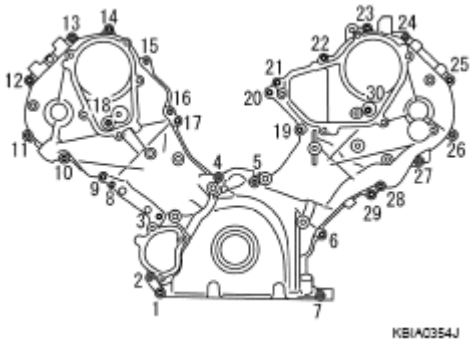


Fig. 88: Identifying Timing Chain Mounting Bolt Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

- There are four types of mounting bolts.

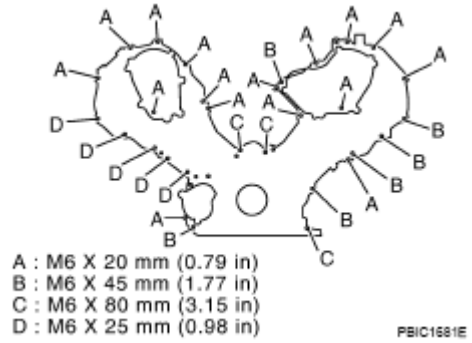


Fig. 89: Identifying Timing Chain Mounting Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

e. After all mounting bolts are tightened, retighten them in numerical order as shown below.

CAUTION: Be sure to wipe off any excessive liquid gasket leaking onto

surface mating with oil pan.

11. Install intake valve timing control cover as follows:
    a. At the back of intake valve timing control cover, install new seal rings (three for each bank) to the area to be inserted into camshaft sprocket (INT).

CAUTION: Never spread seal ring excessively to avoid breaks and deformation.

    b. Install new O-rings on front cover.

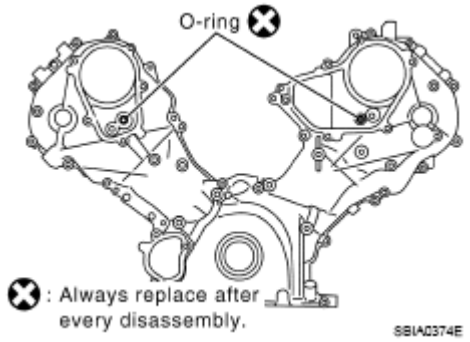


Fig. 90: Identifying O-Rings On Front Cover
Courtesy of NISSAN MOTOR CO., U.S.A.

    c. Apply a continuous bead of liquid gasket with tube presser (commercial service tool) to intake valve timing control covers as shown below.

Use Genuine RTV Silicone Sealant or equivalent. Refer to RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS .

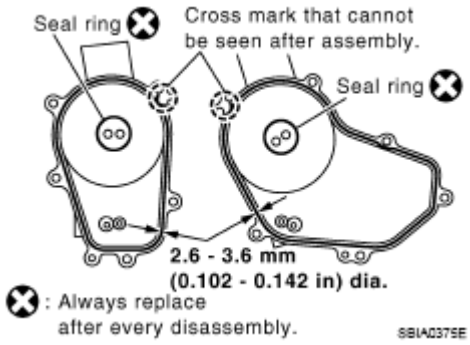


Fig. 91: Identifying Intake Valve Timing Control Covers Sealant Area
Courtesy of NISSAN MOTOR CO., U.S.A.

    d. Tighten mounting bolts in numerical order as shown below.

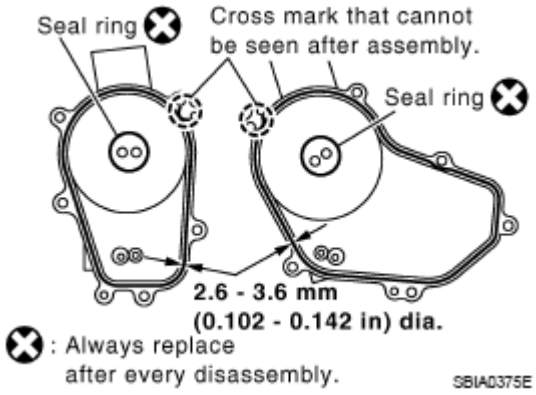


Fig. 92: Identifying Intake Valve Timing Control Cover Loosening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

12. Install intake valve timing control position sensor, intake valve timing control solenoid valve and camshaft position sensor (PHASE) to intake valve timing control cover and front cover if removed.
    - Be sure to tighten mounting bolts with flanges completely seated.
13. Install oil pan and oil strainer. Refer to **OIL PAN AND OIL STRAINER**.
14. Install crankshaft pulley as follows:
    a. Fix crankshaft with ring gear stopper [SST: - (J-45476)].
    b. Install crankshaft pulley, taking care not to damage front oil seal.
        - Install according to dowel pin of oil pump drive spacer.
        - Lightly tapping its center with plastic hammer, insert pulley.

CAUTION: Never tap pulley on the side surface where belt is installed (outer circumference).

    c. Apply engine oil onto threaded parts of crankshaft pulley bolt and seating area.
    d. Tighten crankshaft pulley bolt.

Torque Specifications: 93.1 N.m (9.5 kg-m, 69 ft-lb)

    e. Put a paint mark on crankshaft pulley aligning with angle mark on crankshaft pulley bolt.
    f. Further tighten by 90 degrees. (angle tightening)
        - Check the tightening angle by referencing to the notches. The angle between two notches is 90 degrees.

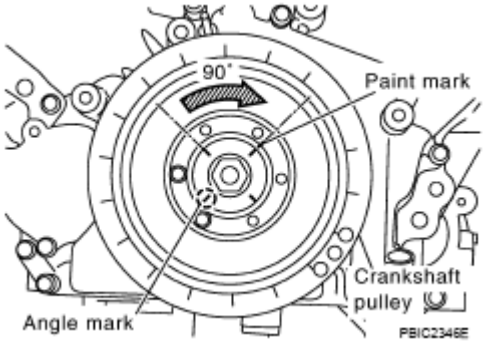


Fig. 93: Identifying Paint Mark On Crankshaft Pulley
Courtesy of NISSAN MOTOR CO., U.S.A.

15. Rotate crankshaft pulley in normal direction (clockwise when viewed from engine front) to confirm it turns smoothly.
16. 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.

NOTE: **If hydraulic pressure inside timing chain tensioner drops after removal/installation, slack in guide may generate a pounding noise during and just after engine start. However, this does not indicate an unusualness.**
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:

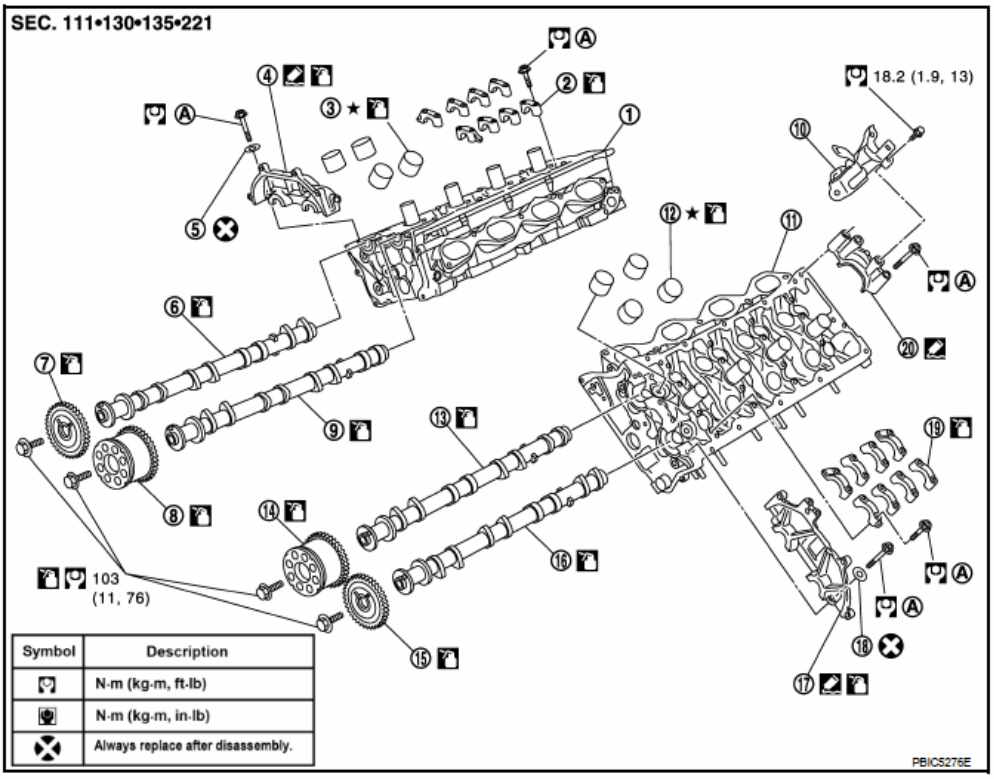
ITEM REFERENCE

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



1.	Cylinder head (right bank)	2.	Camshaft bracket (No. 2 to 5) (right bank)	3.	Valve lifter
4.	Camshaft bracket (No. 1) (right bank)	5.	Washer	6.	Camshaft (EXH) (right bank)
7.	Camshaft sprocket (EXH) (right bank)	8.	Camshaft sprocket (INT) (right bank)	9.	Camshaft (INT) (right bank)
10.	Bracket	11.	Cylinder head (left bank)	12.	Valve lifter
13.	Camshaft (INT) (left bank)	14.	Camshaft sprocket (INT) (left bank)	15.	Camshaft sprocket (EXH) (left bank)
16.	Camshaft (EXH) (left bank)	17.	Camshaft bracket (No. 1) (left bank)	18.	Washer
19.	Camshaft bracket (No. 2 to 5) (left bank)	20.	Camshaft bracket (No. 6) (left bank)		
A.	Refer to Engine Mechanical				

Fig. 94: Identifying Camshaft Components With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to **COMPONENT** for symbols above.

Removal and Installation

REMOVAL

1. Remove engine assembly from vehicle. Refer to **2WD: COMPONENT** (2WD models) or **AWD: COMPONENT** (AWD models).
2. Remove timing chain. Refer to **TIMING CHAIN**.
3. With hexagonal part of camshaft locked with wrench, loosen bolts securing camshaft sprocket to remove camshaft sprocket.

CAUTION:

- **Never loosen mounting bolts with securing anything other than the camshaft hexagonal portion or with tensioning the timing chain.**
- **After removing timing chain, never turn crankshaft and camshaft separately, or valves will strike the piston head.**

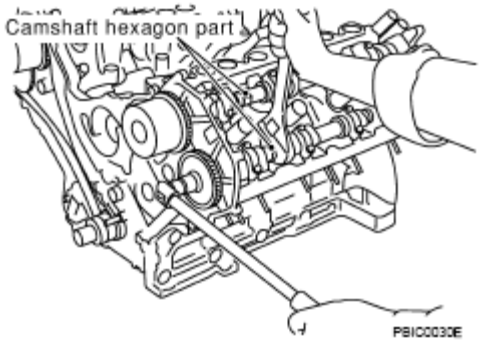


Fig. 95: Identifying Camshaft Sprocket Bolt
Courtesy of NISSAN MOTOR CO., U.S.A.

4. Remove intake and exhaust camshaft brackets.
   - Mark camshafts, camshaft brackets and bolts so placed in the same position and direction for installation.
   - Equally loosen camshaft brackets and bolts in several steps in reverse order as shown below.
   - Lightly tapping with plastic hammer, remove camshaft bracket (No. 1) and camshaft bracket (No. 6).

NOTE: **The bottom surface of each bracket will be stuck to cylinder head because of liquid gasket.**

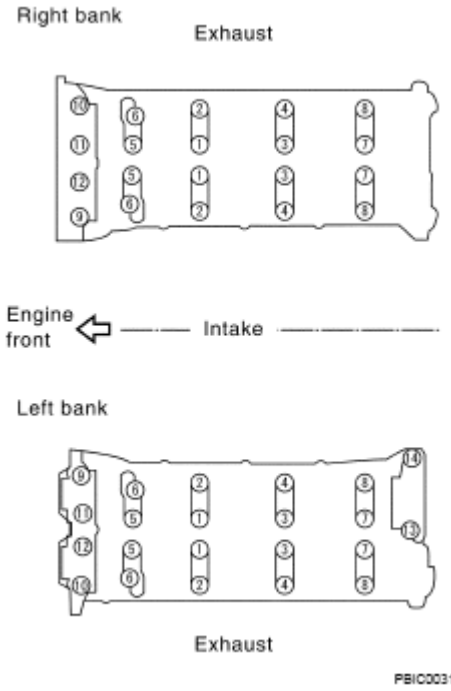


Fig. 96: Identifying Intake And Exhaust Camshaft Brackets
Courtesy of NISSAN MOTOR CO., U.S.A.

5. Remove camshaft.
6. Remove valve lifter.
    - Identify installation positions, and store them without mixing them up.

INSPECTION AFTER REMOVAL

Camshaft Runout

1. Put V-block on precise flat table, and support No. 2 and 5 journal of camshaft.

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

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

Standard:

0.02 mm (0.0008 in)

Limit:

0.05 mm (0.0020 in)

4. If it exceeds the limit, replace camshaft.

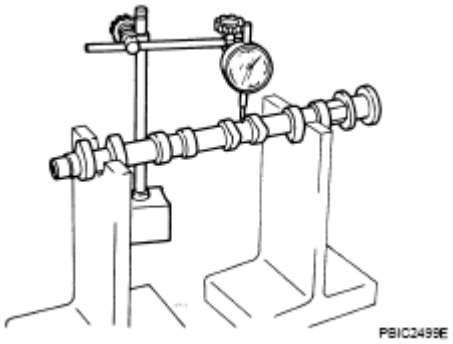


Fig. 97: Measuring Camshaft Runout On Dial Indicator
Courtesy of NISSAN MOTOR CO., U.S.A.

Camshaft Cam Height

1. Measure the camshaft cam height with micrometer.

   Standard cam height

   Intake: 44.865 - 45.055 mm (1.7663 - 1.7738 in)

   Exhaust: 43.925 - 44.115 mm (1.7293 - 1.7368 in)

   Cam wear limit

   : 0.2 mm (0.008 in)

2. If wear exceeds the limit, replace camshaft.

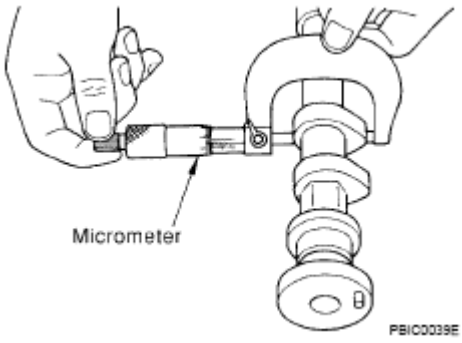


Fig. 98: Checking Camshaft Cam Height
Courtesy of NISSAN MOTOR CO., U.S.A.

Camshaft Journal Oil Clearance

CAMSHAFT JOURNAL DIAMETER

- Measure the outer diameter of camshaft journal with micrometer.

  Standard:

  No. 1: 25.938 - 25.955 mm (1.0212 - 1.0218 in)

  No. 2, 3, 4, 5: 25.953 - 25.970 mm (1.0218 - 1.0224 in)

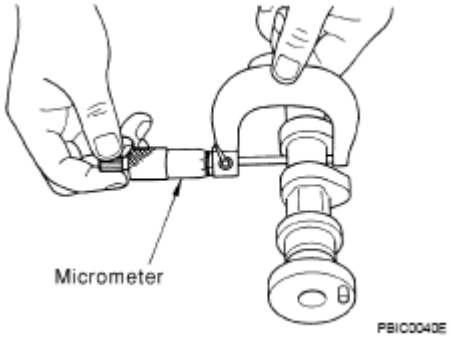


Fig. 99: Checking Outer Diameter Of Camshaft Journal
Courtesy of NISSAN MOTOR CO., U.S.A.

CAMSHAFT BRACKET INNER DIAMETER

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

  Standard:

  26.000 - 26.021 mm (1.0236 - 1.0244 in)

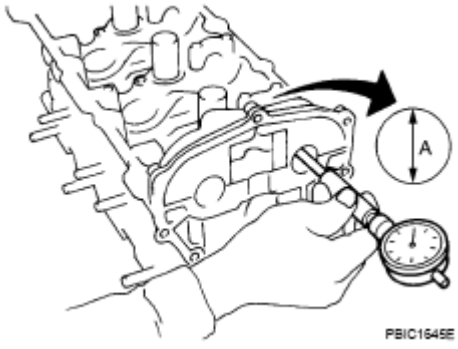


Fig. 100: Checking Inner Diameter A Of Camshaft Bracket With Bore Gauge
Courtesy of NISSAN MOTOR CO., U.S.A.

CAMSHAFT JOURNAL OIL CLEARANCE

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

  Standard:

  No. 1: 0.045 - 0.083 mm (0.0018 - 0.0033 in)

  No. 2, 3, 4, 5: 0.030 - 0.068 mm (0.0012 - 0.0027 in)

- If the calculated value out of the standard, replace either or both camshaft and cylinder head.

  NOTE: Camshaft bracket cannot be replaced as a single part, because it is machined together with cylinder head. Replace whole cylinder head assembly.

Camshaft End Play

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

  Standard:

  0.115 - 0.188 mm (0.0045 - 0.0074 in)

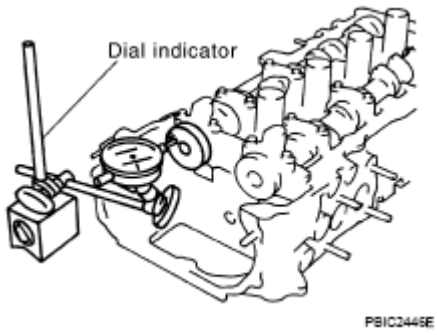


Fig. 101: Measuring Camshaft End Play
Courtesy of NISSAN MOTOR CO., U.S.A.

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

    Standard: 30.500 - 30.548 mm (1.2008 - 1.2027 in)

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

    Standard: 30.360 - 30.385 mm (1.1953 - 1.1963 in)

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

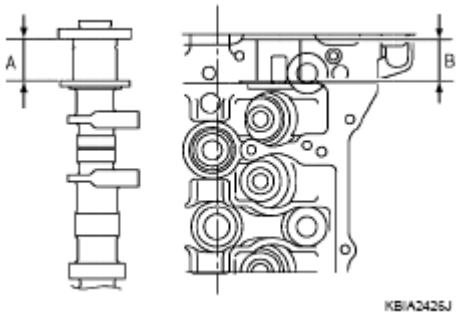


Fig. 102: Identifying Camshaft Dimension
Courtesy of NISSAN MOTOR CO., U.S.A.

Camshaft Sprocket Runout

1. Put V-block on precise flat table, and support No. 2 and 5 journal of camshaft.

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

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

   Limit: 0.15 mm (0.0059 in)

   - If it exceeds the limit, replace camshaft sprocket.

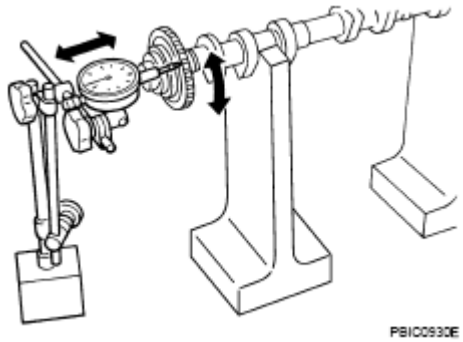


Fig. 103: Measuring Camshaft Sprocket (EXH) Runout
Courtesy of NISSAN MOTOR CO., U.S.A.

Valve Lifter

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

- If anything above is found, replace valve lifter. Refer to **VALVE CLEARANCE**.

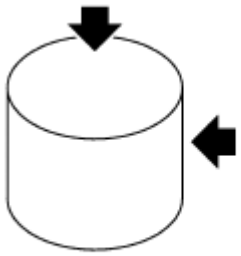


Fig. 104: Locating Valve Lifter Cracks
Courtesy of NISSAN MOTOR CO., U.S.A.

Valve Lifter Clearance

VALVE LIFTER OUTER DIAMETER

- Measure the outer diameter of valve lifter with micrometer.

  Standard: 33.977 - 33.987 mm (1.3377 - 1.3381 in)

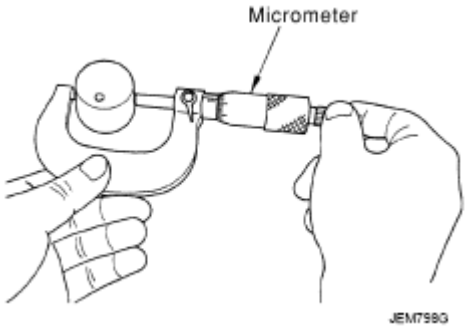


Fig. 105: Measuring Outer Diameter Of Valve Lifter
Courtesy of NISSAN MOTOR CO., U.S.A.

VALVE LIFTER HOLE DIAMETER

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

  Standard: 34.000 - 34.016 mm (1.3386 - 1.3392 in)

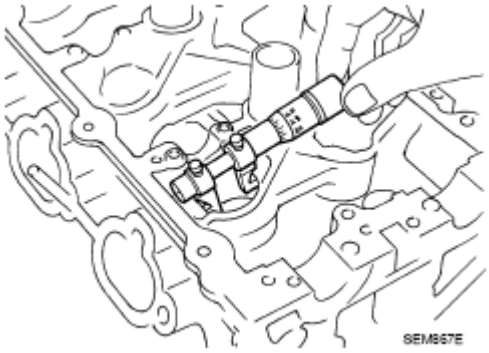


Fig. 106: Measuring Diameter Of Valve Lifter Bore Of Cylinder Head
Courtesy of NISSAN MOTOR CO., U.S.A.

VALVE LIFTER CLEARANCE

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

  Standard: 0.013 - 0.039 mm (0.0005 - 0.0015 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 valve lifters if removed.
   - Install it in the original position.
2. 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.

PAINT MARKS REFERENCE

Bank	INT/EXH	Identification rib	Paint marks		Identification mark
			M1	M2	
RH	EXH	Yes	No	White	RH
	INT	Yes	White	No	RH
LH	INT	No	White	No	LH
	EXH	No	No	White	LH

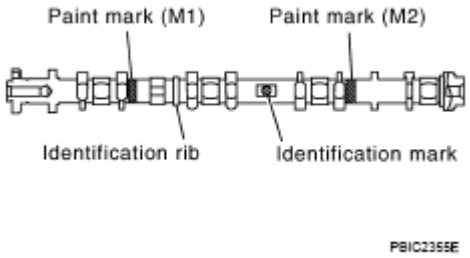


Fig. 107: Identifying Identification Marks On Camshafts
Courtesy of NISSAN MOTOR CO., U.S.A.

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

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

Camshaft dowel pin

: At cylinder head upper face side in each bank

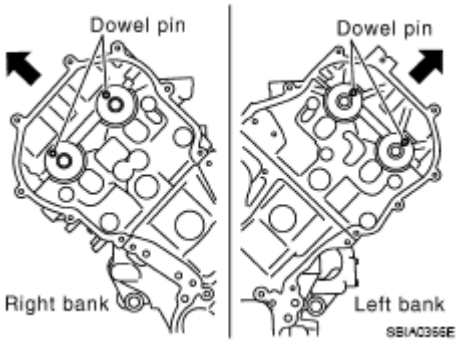


Fig. 108: Locating Camshaft Dowel Pin On Front End Face
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Install camshaft brackets.
   - Remove foreign material completely from camshaft bracket backside and from cylinder head installation face.
   - Install by referring to installation location mark on upper surface and front mark.
   - Install so that installation location mark can be correctly read when viewed from the side of left exhaust bank.

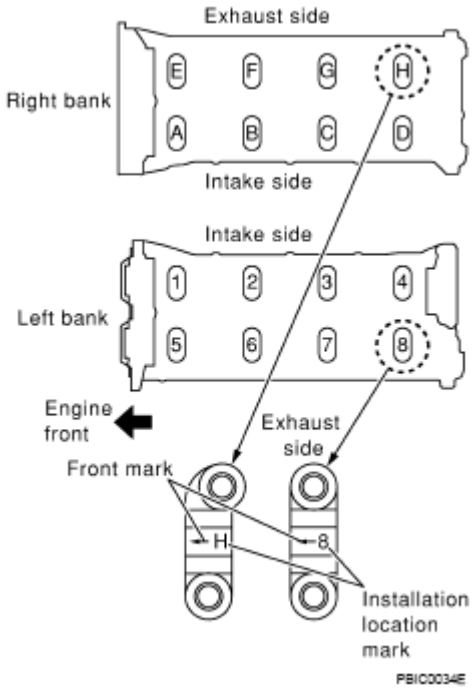


Fig. 109: Locating Installation Location Mark Of Left Exhaust Bank
Courtesy of NISSAN MOTOR CO., U.S.A.

- Apply liquid gasket to mating surface of camshaft bracket (No. 1) as shown below.

Use Genuine RTV Silicone Sealant or equivalent. Refer to RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS .

CAUTION:

- **After installation, be sure to wipe off any excessive liquid gasket leaking from part "A" and "B" (both on right and left sides).**
- **Remove completely any excess of liquid gasket inside bracket.**

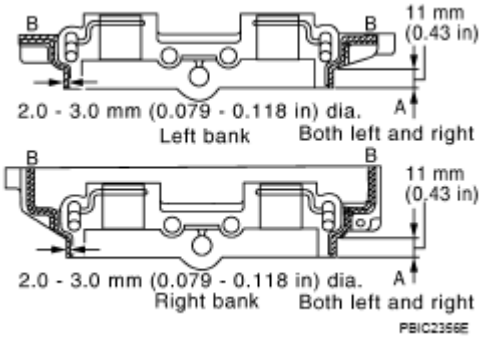


Fig. 110: Identifying Mating Surface Of Camshaft Bracket
Courtesy of NISSAN MOTOR CO., U.S.A.

- Apply liquid gasket to mating surface of camshaft bracket (No. 6) on left bank intake as shown below.

  Use Genuine RTV Silicone Sealant or equivalent. Refer to RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS .

  CAUTION:
  - **After installation, be sure to wipe off any excessive liquid gasket leaking from part "A" and "B" (both on right and left sides).**
  - **Remove completely any excess of liquid gasket inside bracket.**

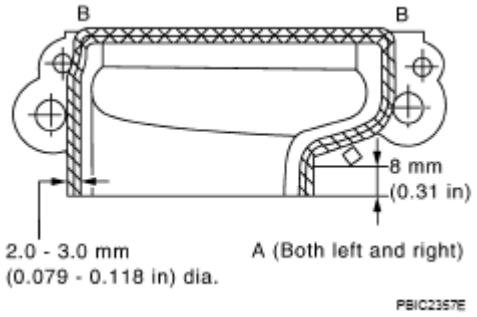


Fig. 111: Identifying Mating Surface Of Camshaft Bracket (Left Bank Intake)
Courtesy of NISSAN MOTOR CO., U.S.A.

4. Tighten camshaft bracket bolts in the following steps, in numerical order as shown below.
   a. Tighten No. 9 to 12 in numerical order as shown below.

      1.96 N.m (0.20 kg-m, 1 ft-lb)

   b. Tighten No. 1 to 8 in numerical order as shown below.

      1.96 N.m (0.20 kg-m, 1 ft-lb)

   c. Tighten No. 13 to 14 in numerical order as shown below. (left bank only)

      1.96 N.m (0.20 kg-m, 1 ft-lb)

   d. Tighten all bolts in numerical order as shown below.

      5.88 N.m (0.60 kg-m, 4 ft-lb)

   e. Tighten No. 1 to 12 in numerical order as shown below.

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

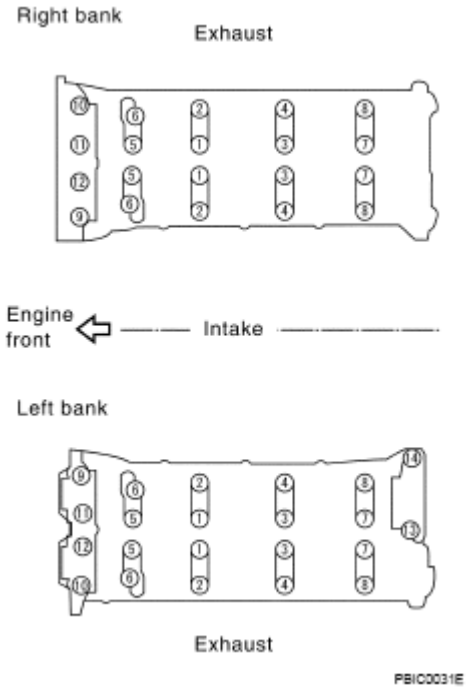


Fig. 112: Identifying Camshaft Bracket Bolt Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

f. Tighten No. 13 to 14 in numerical order as shown above. (left bank only)

31.35 N.m (3.2 kg-m, 23 ft-lb)

CAUTION: After tightening mounting bolts of camshaft brackets, be sure to wipe off excessive liquid gasket from the parts listed below.

- **Mating surface of rocker cover**
- **Mating surface of front cover**

5. Install camshaft sprockets.
   - Install by checking with identification mark on surface.
   - Install camshaft sprocket (EXH) by selectively using the groove of dowel pin according to the bank. (Common part used for both banks.)
   - Lock the hexagonal part of camshaft in the same way as for removal, and tighten mounting bolts.

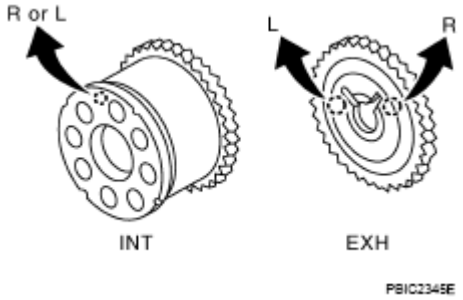


Fig. 113: Identifying Camshaft Sprockets
Courtesy of NISSAN MOTOR CO., U.S.A.

6. Check and adjust the valve clearance. Refer to **VALVE CLEARANCE**.
7. 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 and/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 DESCRIPTION .**
- **Check when the engine is cold so as to prevent burns from any splashing engine oil.**

1. Check the engine oil level. Refer to **ENGINE OIL** .
2. Perform the following procedure so as to prevent the engine from being unintentionally started while checking.
   a. Release fuel pressure. Refer to **FUEL PRESSURE CHECK** .
   b. Disconnect ignition coil and injector harness connectors.
3. Remove intake valve timing control solenoid valve. Refer to **TIMING CHAIN**.
4. Crank the engine, and then check that engine oil comes out from intake valve timing control cover oil hole. End crank after checking.

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.

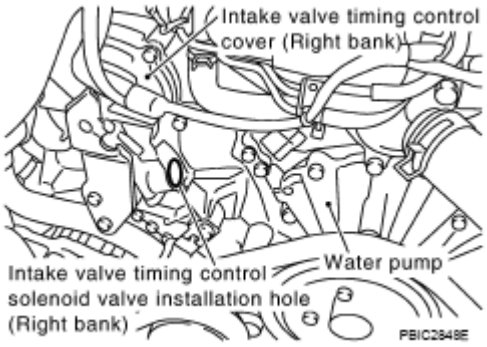


Fig. 114: Identifying Intake Valve Timing Control Cover Oil Hole
Courtesy of NISSAN MOTOR CO., U.S.A.

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

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 SYSTEM** .
6. After inspection, install removed parts.

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 guide may generate a pounding noise during and just after engine start. However, this does not indicate an unusualness. 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:

ITEM SPECIFICATION

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

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 starting, idling or causing noise), perform inspection as follows:

1. Remove rocker covers (right bank and left bank). 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 in clockwise to align TDC identification notch (without paint mark) with timing indicator on front cover.

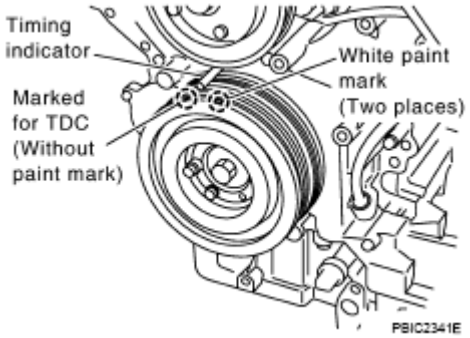


Fig. 115: Identifying TDC Identification Notch With Timing Indicator On Front Cover
Courtesy of NISSAN MOTOR CO., U.S.A.

      - Check that both intake and exhaust cam noses of No. 1 cylinder (engine front side of left bank) are located as shown below.
      - If not, turn crankshaft one revolution (360 degrees) and align as shown below.

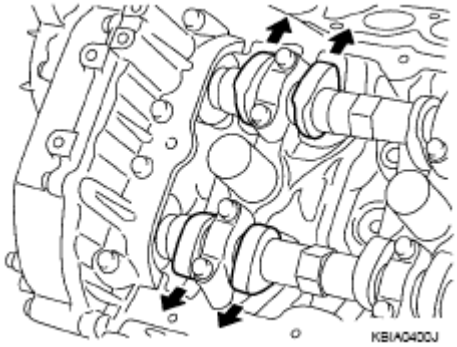


Fig. 116: Checking Intake And Exhaust Cam Lobes Of No. 1 Cylinder
Courtesy of NISSAN MOTOR CO., U.S.A.

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

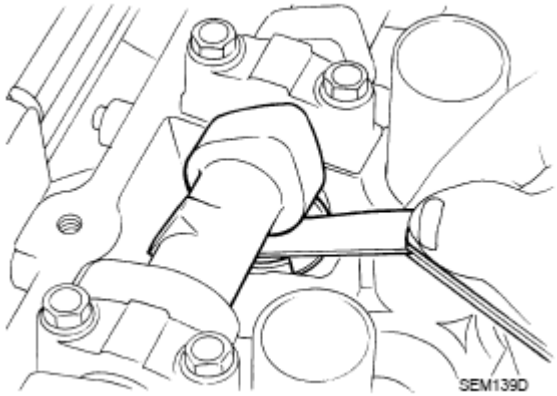


Fig. 117: Measuring Clearance Between Valve Lifter And Camshaft
Courtesy of NISSAN MOTOR CO., U.S.A.

Valve clearance:

VALVE CLEARANCE TABLE

		Unit: mm (in)
-	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 graphic, measure the valve clearances at locations marked "x" as shown in the table below (locations indicated with black arrow in graphic).

NOTE: Firing order 1-8-7-3-6-5-4-2

- No. 1 cylinder at compression TDC

CYLINDER POSITION TABLE

Measuring position (right bank)		No. 2 CYL.	No. 4 CYL.	No. 6 CYL.	No. 8 CYL.
No. 1 cylinder at compression TDC	EXH	-	-	-	x
	INT	x	x	-	-
Measuring position (left bank)		No. 1 CYL.	No. 3 CYL.	No. 5 CYL.	No. 7 CYL.
No. 1 cylinder at compression TDC	INT	x	-	x	-
	EXH	x	-	-	x

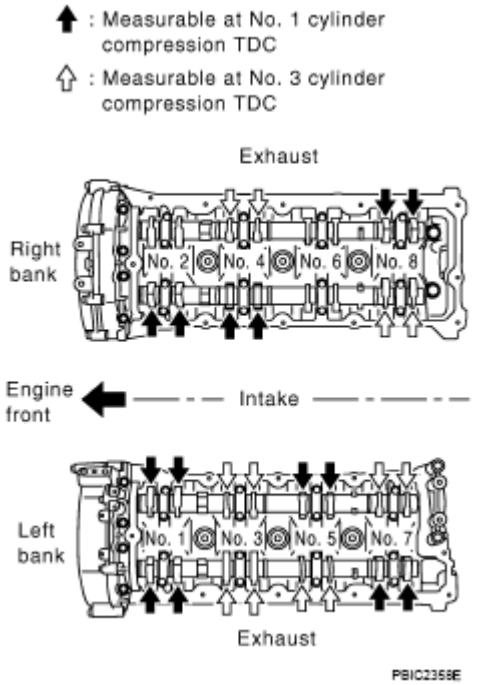


Fig. 118: Locating Valve Clearances Mark Location
Courtesy of NISSAN MOTOR CO., U.S.A.

c. Rotate crankshaft pulley clockwise (when view from engine front) by 270 degrees from the position of No. 1 cylinder compression TDC to align No. 3 cylinder at TDC of its compression stroke.

NOTE: Crankshaft pulley mounting bolt flange has a angle mark every 90

degrees. They can be used as a guide to rotation angle.

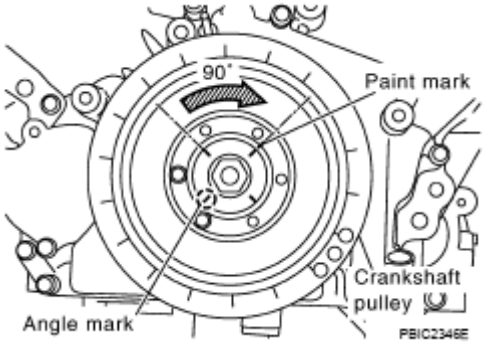


Fig. 119: Identifying Paint Mark On Crankshaft Pulley
Courtesy of NISSAN MOTOR CO., U.S.A.

- By referring to the graphic, measure the valve clearances at locations marked "x" as shown in the table below (locations indicated with white arrow in graphic).
- No. 3 cylinder at compression TDC

CYLINDER POSITION TABLE

Measuring position (right bank)		No. 2 CYL.	No. 4 CYL.	No. 6 CYL.	No. 8 CYL.
No. 3 cylinder at compression TDC	EXH	-	x	-	-
	INT	-	-	-	x
Measuring position (left bank)		No. 1 CYL.	No. 3 CYL.	No. 5 CYL.	No. 7 CYL.
No. 3 cylinder at compression TDC	INT	-	x	-	x
	EXH	-	x	x	-

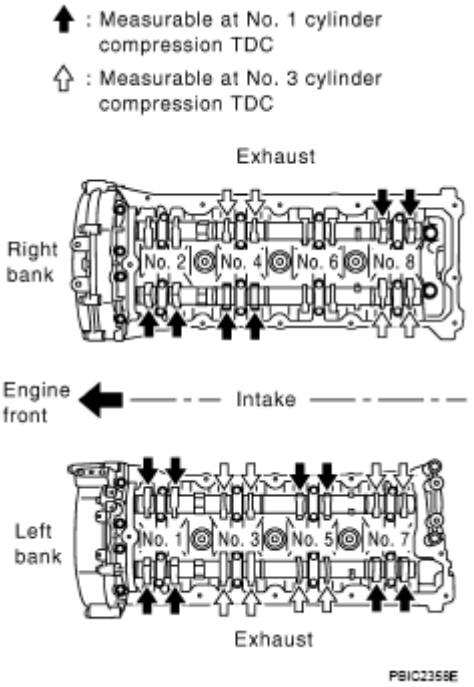


Fig. 120: Locating Valve Clearances Mark Location
Courtesy of NISSAN MOTOR CO., U.S.A.

d. Rotate crankshaft pulley clockwise (when view from engine front) by 90 degrees from the position of No. 3 cylinder compression TDC to align No. 6 cylinder at TDC of its compression stroke.

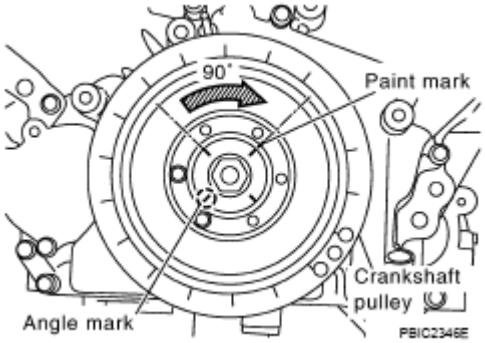


Fig. 121: Identifying Paint Mark On Crankshaft Pulley
Courtesy of NISSAN MOTOR CO., U.S.A.

- By referring to the graphic, measure the valve clearances at locations marked "x" as shown in the table below.
- No. 6 cylinder at compression TDC

CYLINDER POSITION TABLE

Measuring position (right bank)	No. 2 CYL.	No. 4 CYL.	No. 6 CYL.	No. 8 CYL.

No. 6 cylinder at compression TDC	EXH	x	-	x	-
	INT	-	-	x	-

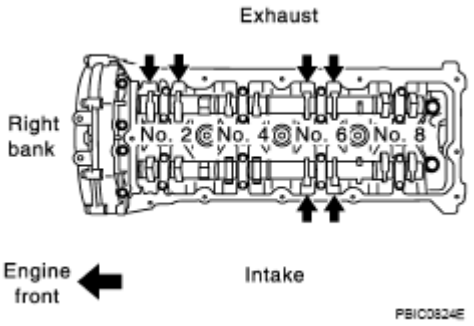


Fig. 122: Locating Valve Clearances Mark Location
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Perform adjustment if the measured value is out of the standard. Refer to **ADJUSTMENT**.

ADJUSTMENT

Perform adjustment depending on selected head thickness of valve lifter.

1. Measure the valve clearance. Refer to **VALVE CLEARANCE**.
2. Remove camshaft. Refer to **REMOVAL AND INSTALLATION**.
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.

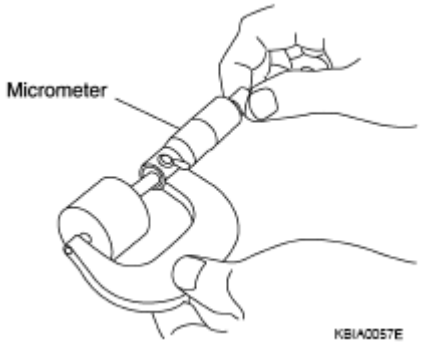


Fig. 123: Measuring Valve Clearance
Courtesy of NISSAN MOTOR CO., U.S.A.

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.

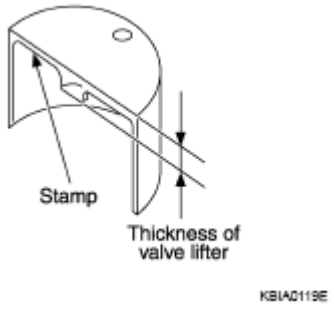


Fig. 124: Checking Thickness Of Valve Lifters
Courtesy of NISSAN MOTOR CO., U.S.A.

STAMP MARK THICKNESS TABLE

Unit: mm (in)	
Stamp mark	**Thickness**
788	7.88 (0.3102)
790	7.90 (0.3110)
.	.
.	.
840	8.40 (0.3307)

NOTE: **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 **REMOVAL AND INSTALLATION**.
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 **VALVE CLEARANCE**.
10. Install all removal parts in the reverse order of removal. Refer to **REMOVAL AND INSTALLATION**.
11. Warm up the engine, and check for unusual noise and vibration.

OIL SEAL

Removal and Installation of Valve Oil Seal

REMOVAL

1. Remove engine assembly from vehicle. Refer to **2WD: COMPONENT** (2WD models) or **AWD: COMPONENT** (AWD models).
2. Remove camshaft relating to valve oil seal to be removed. Refer to **CAMSHAFT**.
3. Remove valve lifters. Refer to **CAMSHAFT**.
   - Identify installation positions, and store them without mixing them up.
4. Turn crankshaft until the cylinder requiring new oil seals is at TDC. This will prevent valve from dropping into cylinder.
5. Remove valve collet.
   - Compress valve spring with valve spring compressor (SST), attachment (SST), and adapter (SST). Remove valve collet with magnetic hand.

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

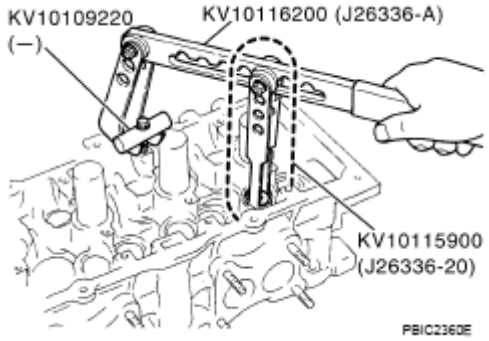


Fig. 125: Compressing Valve Spring With Valve Spring Compressor
Courtesy of NISSAN MOTOR CO., U.S.A.

6. Remove valve spring retainer and valve spring (with valve spring seat).

CAUTION: Never remove valve spring seat from valve spring.

7. Remove valve oil seal using valve oil seal puller (SST).

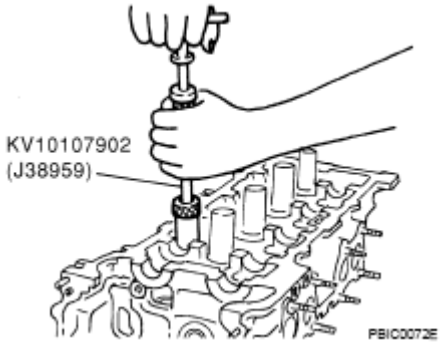


Fig. 126: Identifying Valve Oil Seal With Valve Oil Seal Puller (SST)
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

1. Apply new engine oil on new valve oil seal joint and seal lip.
2. Install valve oil seal.
   - Install with valve oil seal drift (SST) to match dimension shown below.

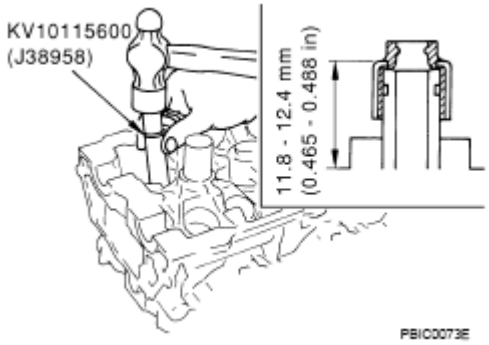


Fig. 127: Installing Valve Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Install in the reverse order of removal.

Removal and Installation of Front Oil Seal

REMOVAL

1. Remove the following parts:
   - Front engine undercover (power tool)
   - Radiator: Refer to **RADIATOR** .
   - Drive belts: Refer to **DRIVE BELTS**.
   - Rear plate cover: Refer to **OIL PAN AND OIL STRAINER**.

2. Remove crankshaft pulley as follows:
   a. Set ring gear stopper (SST).

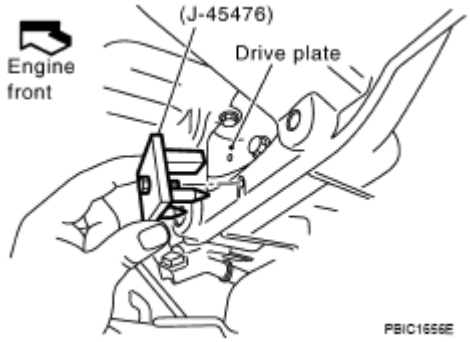


Fig. 128: Identifying Rear Plate Cover
Courtesy of NISSAN MOTOR CO., U.S.A.

   b. Loosen crankshaft pulley bolt, and then pull crankshaft pulley with both hands to remove it.

CAUTION:
- **Never remove crankshaft pulley bolt. Keep loosened crankshaft pulley bolt in place to protect removed crankshaft pulley from dropping.**
- **Never remove balance weight (inner hexagon bolt) at the front of crankshaft pulley.**

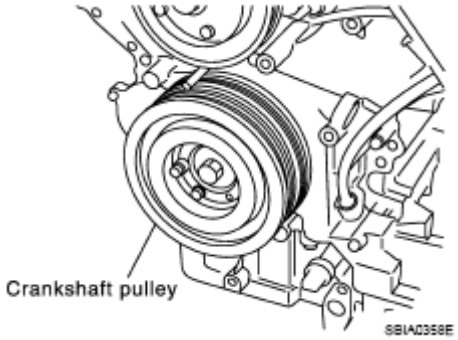


Fig. 129: Identifying Crankshaft Pulley
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Remove front oil seal using suitable tool.

CAUTION: Be careful not to damage front cover and oil pump drive spacer.

Fig. 130: Identifying Front Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

1. Apply new 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 below.

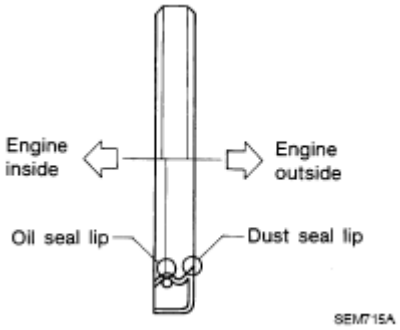


Fig. 131: Applying Engine Oil To Both Oil Seal Lip And Dust Seal Lip
Courtesy of NISSAN MOTOR CO., U.S.A.

- Using suitable drift, press fit until the height of front oil seal is level with the mounting surface.

  Suitable drift

  Outer diameter: 56 mm (2.20 in)

  Inner diameter: 49 mm (1.93 in)

- Check the garter spring is in position and seal lips not inverted.

CAUTION:
- **Be careful not to damage front cover and oil pump drive spacer.**

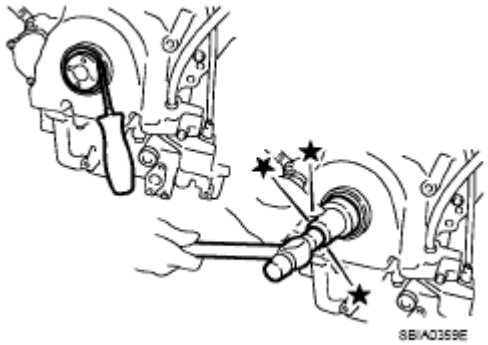


Fig. 132: Identifying Front Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

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

3. Install in the reverse order of removal.

Removal and Installation of Rear Oil Seal

REMOVAL

1. Remove transmission assembly. Refer to **TRANSMISSION ASSEMBLY** .
   a. Remove drive plate. Refer to **CYLINDER BLOCK**.
   b. Remove rear plate. Refer to **CYLINDER BLOCK**.
2. Remove rear oil seal using suitable tool.

CAUTION: Be careful not to damage crankshaft and oil seal retainer surface.

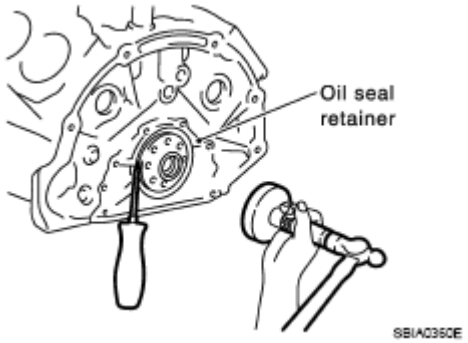


Fig. 133: Removing/Installing Rear Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

1. Apply new engine oil to both oil seal lip and dust seal lip of new rear oil seal.

2. Install rear oil seal.
   - Install rear oil seal so that each seal lip is oriented as shown below.

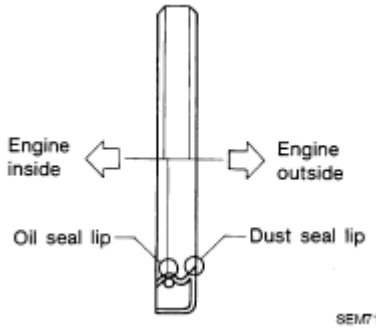


Fig. 134: Applying Engine Oil To Both Oil Seal Lip And Dust Seal Lip
Courtesy of NISSAN MOTOR CO., U.S.A.

   - Using suitable drift, press fit until the height of rear oil seal is level with the mounting surface.

     Suitable drift

     Outer diameter: 102 mm (4.02 in)

     Inner diameter: 86 mm (3.39 in)

   - Check the garter spring is in position and seal lips not inverted.

CAUTION:
- **Be careful not to damage crankshaft and rear oil seal retainer.**

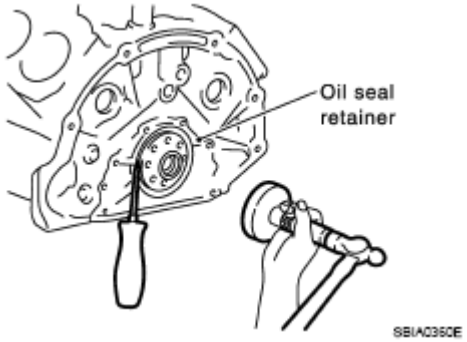


Fig. 135: Removing/Installing Rear Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

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

3. Install in the reverse order of removal.

CYLINDER HEAD

On-Vehicle Service

CHECKING COMPRESSION PRESSURE

1. Warm up engine thoroughly. Then, stop it.
2. Release fuel pressure. Refer to **FUEL PRESSURE CHECK** .
    a. Remove fuel pump fuse to avoid fuel injection during measurement.

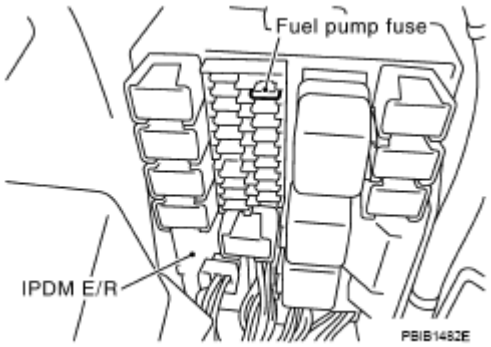


Fig. 136: Identifying Fuel Pump Fuse And IPDM E/R
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Remove engine cover with power tool. Refer to **ENGINE ROOM COVER**.
4. Remove ignition coil and spark plug from each cylinder. Refer to **COMPONENT** and **COMPONENT**.
5. Connect engine tachometer (not required in use of CONSULT-III).
6. Install compression gauge with adapter (SST or commercial service tool) onto spark plug hole.
    - Use compression gauge adapter (SST) which is required on No. 7 and 8 cylinders.

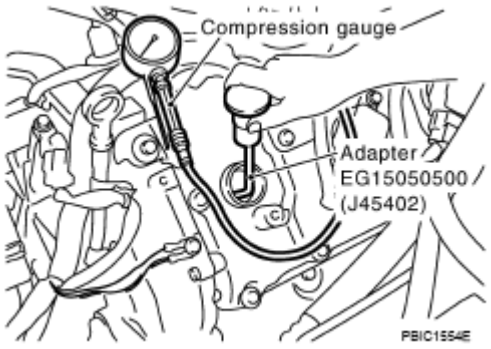


Fig. 137: Installing Compression Gauge With Adapter
Courtesy of NISSAN MOTOR CO., U.S.A.

- Use compression gauge adapter (if no SST is used) 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.

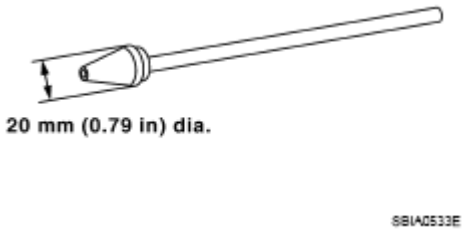


Fig. 138: Identifying Adapter Diameter
Courtesy of NISSAN MOTOR CO., U.S.A.

7. 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:

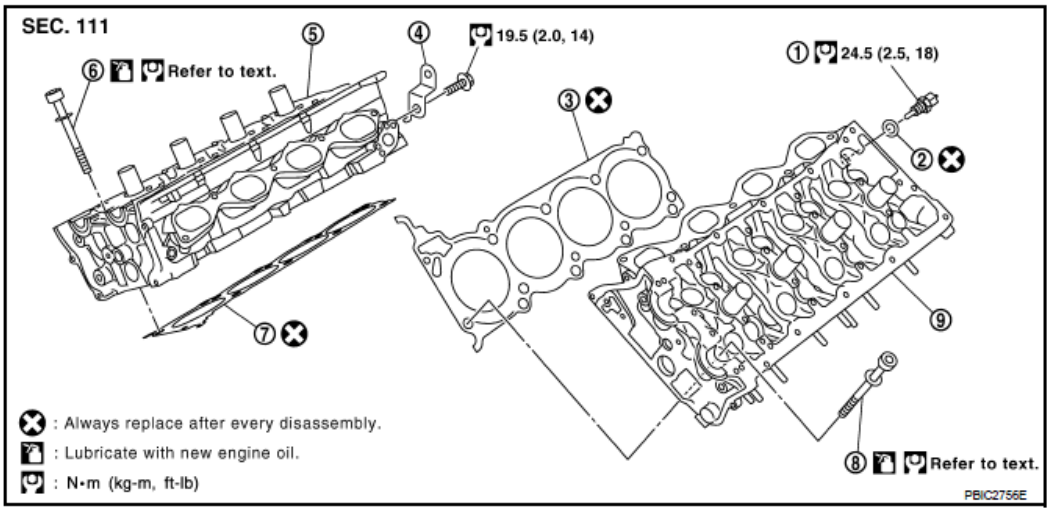
   STANDARD SPECIFICATION

Unit: kPa (kg/cm^2 , psi)/rpm		
Standard	**Minimum**	**Deferential limit between cylinders**
1,320 (13.5, 191)/300	1,130 (11.5, 164)/300	98 (1.0, 14)/300

   CAUTION: Always use a fully charged battery to obtain the 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.
8. After inspection is completed, install removed parts in the reverse order of removal.
9. Start engine, and check that engine runs smoothly.
10. Perform trouble diagnosis. If DTC appears, erase it. Refer to **TROUBLE DIAGNOSIS** .

Component



1. Engine coolant temperature sensor
2. Washer
3. Cylinder head gasket (left bank)
4. Harness bracket
5. Cylinder head (right bank)
6. Cylinder head bolt
7. Cylinder head gasket (right bank)
8. Cylinder head bolt
9. Cylinder head (left bank)

Fig. 139: Identifying Cylinder Head Components With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: Never use washer bolt together with flange bolt, when replacing cylinder head bolts, because there are two kinds of cylinder head bolts.

NOTE: Graphic is shown as an example of washer bolt.

Removal and Installation

REMOVAL

1. Remove engine assembly from vehicle. Refer to **2WD: COMPONENT** (2WD models) or **AWD: COMPONENT** (AWD models).
2. Remove exhaust manifold. Refer to **EXHAUST MANIFOLD AND THREE WAY CATALYST**.
3. Remove camshaft. Refer to **CAMSHAFT**.
4. Remove cylinder head bolts in reverse order as shown below to remove cylinder heads (right bank and left bank).

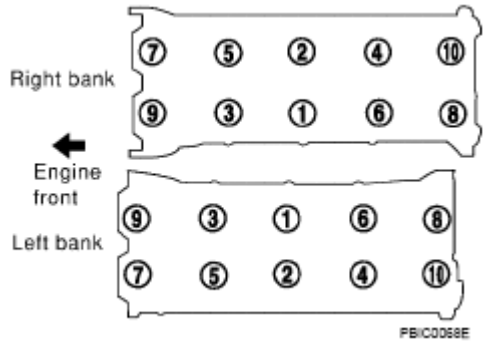


Fig. 140: Identifying Cylinder Head Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

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 "d1" and "d2" exceeds the limit, replace them with new one.

CAUTION: Never use washer bolt together with flange bolt, when replacing cylinder head bolts.

NOTE: Graphic is shown as an example of washer bolt.

Limit ("d1" - "d2"): 0.18 mm (0.0071 in)

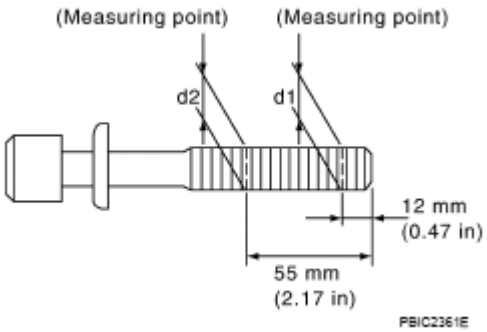


Fig. 141: Identifying Cylinder Head Bolts Outer Diameter
Courtesy of NISSAN MOTOR CO., U.S.A.

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

Cylinder Head Distortion

NOTE: When performing this inspection, cylinder block distortion should be also checking. 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.

Limit: 0.1 mm (0.004 in)

- If it exceeds the limit, replace cylinder head.

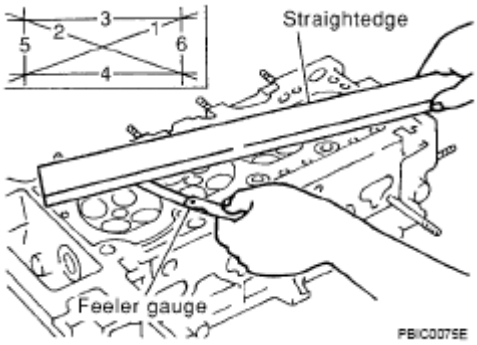


Fig. 142: Checking Cylinder Head Distortion
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

1. Install new cylinder head gasket.
2. Turn crankshaft until No. 1 piston is set at TDC.
   - Crankshaft key should line up with the left bank cylinder center line as shown below.

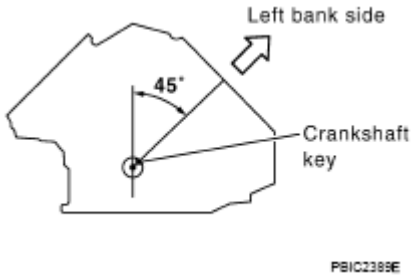


Fig. 143: Identifying Turning Angle Of Crankshaft
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Install cylinder head follow the steps below to tighten cylinder head bolts in numerical order as shown

below.

CAUTION: If cylinder head bolts are reused, check their outer diameters before installation. Refer to CYLINDER HEAD BOLTS OUTER DIAMETER.

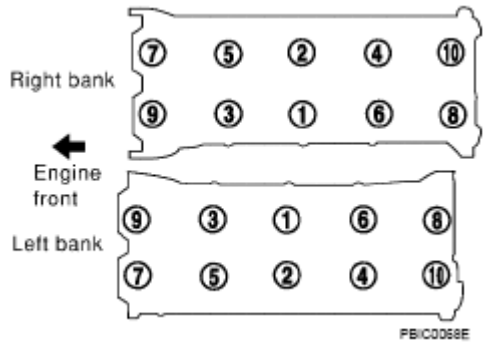


Fig. 144: Identifying Cylinder Head Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

a. Apply new engine oil to threads and seating surface of cylinder head bolts.
b. Tighten all cylinder head bolts.

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

c. Turn all cylinder head bolts 70 degrees clockwise. (angle tightening)

CAUTION: Check the tightening angle by using angle wrench (SST). Avoid judgment by visual inspection without SST.

- Check tightening angle indicated on angle wrench indicator plate.

d. Completely loosen all cylinder head bolts.

0 N.m (0 kg-m, 0 ft-lb)

CAUTION: In step "d", loosen cylinder head bolts in reverse order of that indicated below.

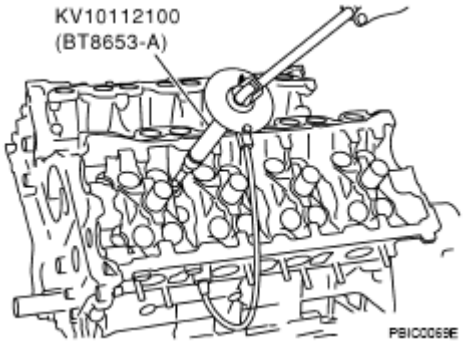


Fig. 145: Checking Tightening Angle Indicated On Angle Wrench Indicator Plate
Courtesy of NISSAN MOTOR CO., U.S.A.

e. Tighten all cylinder head bolts.

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

f. Turn all cylinder head bolts 60 degrees clockwise. (angle tightening)

CAUTION: Check the tightening angle by using angle wrench (SST). Avoid judgment by visual inspection without SST.

- Check tightening angle indicated on angle wrench indicator plate.

g. Turn all cylinder head bolts 60 degrees clockwise again. (angle tightening)

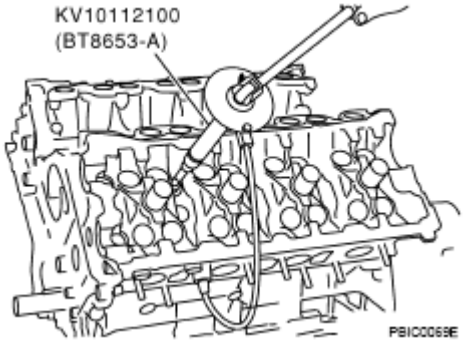
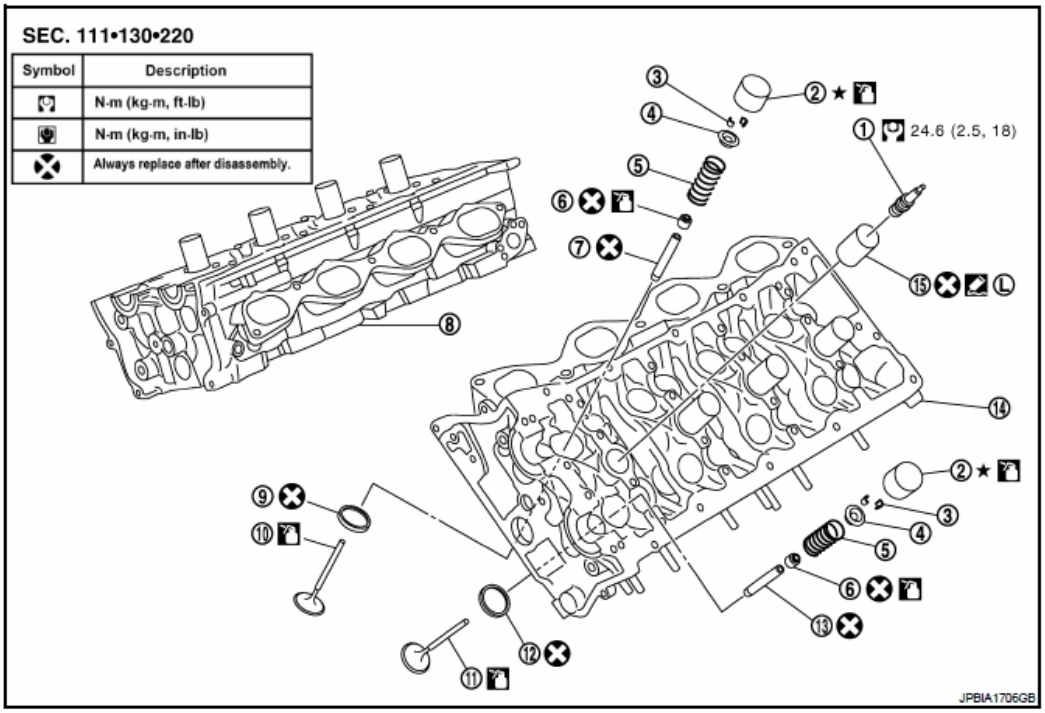


Fig. 146: Checking Tightening Angle Indicated On Angle Wrench Indicator Plate
Courtesy of NISSAN MOTOR CO., U.S.A.

4. Install in the reverse order of removal.

Disassembly and Assembly

COMPONENTS



1.	Spark plug	2.	Valve lifter	3.	Valve collet
4.	Valve spring retainer	5.	Valve spring (with valve spring seat)	6.	Valve oil seal
7.	Valve guide (INT)	8.	Cylinder head (right bank)	9.	Valve seat (INT)
10.	Valve (INT)	11.	Valve (EXH)	12.	Valve seat (EXH)
13.	Valve guide (EXH)	14.	Cylinder head (left bank)	15.	Spark plug tube

: Apply Genuine High Strength Thread Locking Sealant or equivalent.

Fig. 147: Identifying Cylinder Head Components With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to **COMPONENT** for symbols not described above.

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), attachment (SST), and adapter (SST). Remove valve collet with magnetic hand.

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

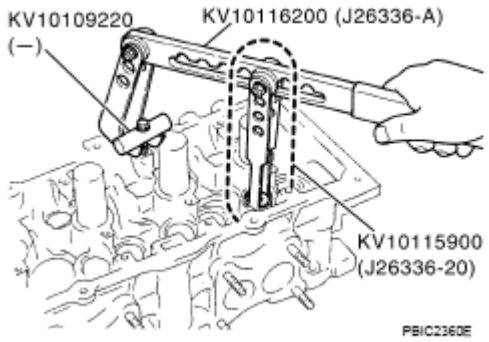


Fig. 148: Compressing Valve Spring With Valve Spring Compressor
Courtesy of NISSAN MOTOR CO., U.S.A.

4. Remove valve spring retainer and valve spring (with valve spring seat).

CAUTION: Never remove valve spring seat from valve spring.

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 seal with valve oil seal puller (SST).

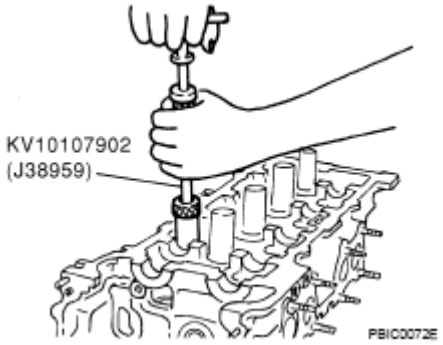


Fig. 149: Identifying Valve Oil Seal With Valve Oil Seal Puller (SST)
Courtesy of NISSAN MOTOR CO., U.S.A.

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 new valve oil seal as follows:
   a. Apply new engine oil on valve oil seal joint and seal lip.
   b. Install with valve oil seal drift (SST) to match dimension shown below.

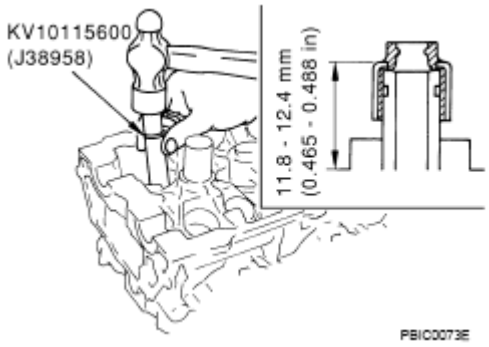


Fig. 150: Installing Valve Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

4. Install valve.
   - Install in the original position.

NOTE: Larger diameter valves are for intake side.

5. Install valve spring (with valve spring seat).
   - Install smaller pitch (valve spring seat side) to cylinder head side.

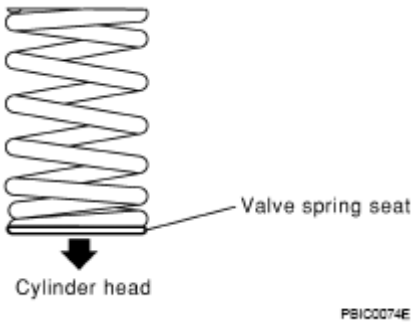


Fig. 151: Identifying Valve Spring
Courtesy of NISSAN MOTOR CO., U.S.A.

6. Install valve spring retainer.
7. Install valve collet.
   - Compress valve spring with valve spring compressor (SST), attachment (SST) and adapter (SST).

Install valve collet with magnetic hand.

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

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

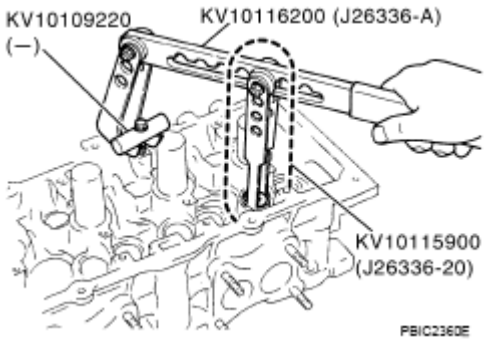


Fig. 152: Compressing Valve Spring With Valve Spring Compressor
Courtesy of NISSAN MOTOR CO., U.S.A.

8. Install valve lifter.
   - Install it in the original position.
9. Install spark plug tube.
   - Press-fit spark plug tube as follows:
   a. Remove old liquid gasket adhering to cylinder-head mounting hole.
   b. Apply sealant 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 PRODUCTS AND SEALANTS .

   c. Using drift, press-fit spark plug tube so that its height "H" is as specified below.

      Standard press-fit height "H"

      : 38.4 - 39.4 mm (1.512 - 1.551 in)

CAUTION:
- **When press-fitting, take care not to deform spark plug tube.**
- **After press-fitting, wipe off liquid gasket protruding onto cylinder head upper face.**

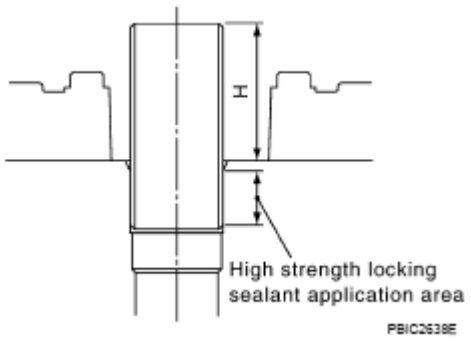


Fig. 153: Identifying High Strength Locking Sealant Application Area
Courtesy of NISSAN MOTOR CO., U.S.A.

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

Inspection After Disassembly

VALVE DIMENSIONS

- Check the dimensions of each valve. For the dimensions, refer to **STANDARD AND LIMIT**.
- If the dimensions are out of the standard, replace valve and check the valve seat contact. Refer to **VALVE SEAT CONTACT**.

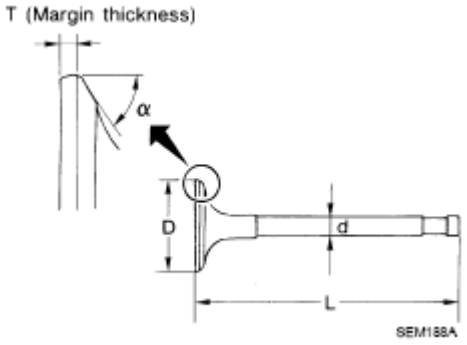


Fig. 154: Checking Dimensions Of Valve
Courtesy of NISSAN MOTOR CO., U.S.A.

VALVE GUIDE CLEARANCE

Valve Stem Diameter

Measure the diameter of valve stem with micrometer.

Standard

Intake: 5.972 - 5.980 mm (0.2351 - 0.2354 in)

Exhaust: 5.962 - 5.970 mm (0.2347 - 0.2350 in)

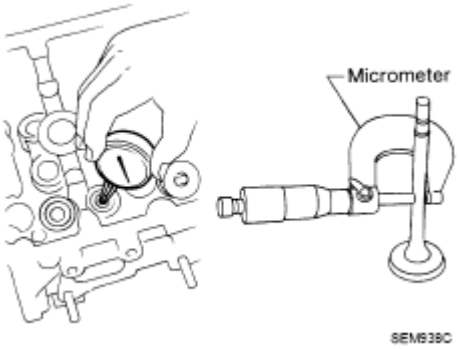


Fig. 155: Measuring Diameter Of Valve Stem With Micrometer
Courtesy of NISSAN MOTOR CO., U.S.A.

Valve Guide Inner Diameter

Measure the inner diameter of valve guide with bore gauge.

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 - 0.046 mm (0.0008 - 0.0018 in)

Exhaust: 0.030 - 0.056 mm (0.0012 - 0.0022 in)

Limit

Intake: 0.08 mm (0.0031 in)

Exhaust: 0.1 mm (0.004 in)

- If the calculated value 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 oversized [0.2 mm (0.008 in)] valve guide

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

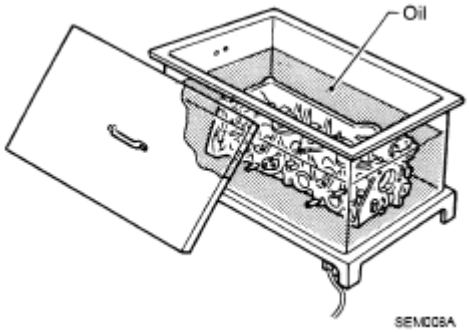


Fig. 156: Heating Cylinder Head
Courtesy of NISSAN MOTOR CO., U.S.A.

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 valve guide drift (commercial service tool).

WARNING: Cylinder head contains heat. When working, wear protective equipment to avoid getting burned.

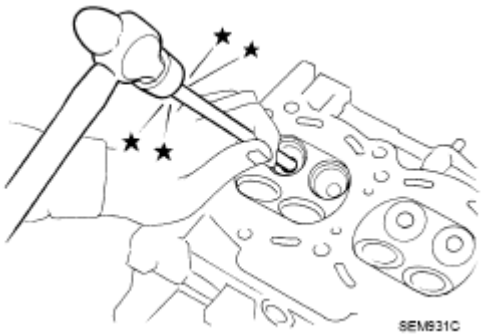


Fig. 157: Driving Out Valve Guide
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Using valve guide reamer (commercial service tool), 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)

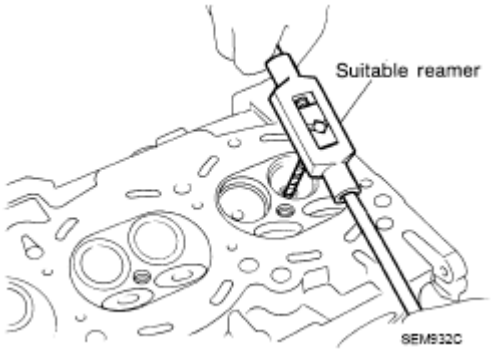


Fig. 158: Applying Reamer Finish To Valve Guide
Courtesy of NISSAN MOTOR CO., U.S.A.

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

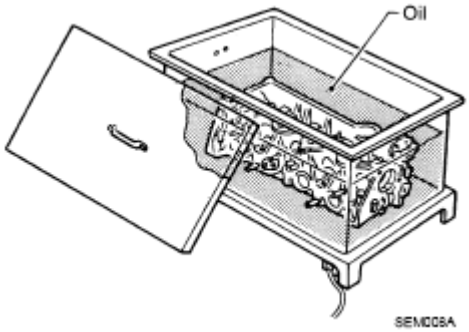


Fig. 159: Heating Cylinder Head
Courtesy of NISSAN MOTOR CO., U.S.A.

5. Using valve guide drift (commercial service tool), press valve guide from camshaft side to the dimensions as shown below.

WARNING: Cylinder head contains heat. When working, wear protective equipment to avoid getting burned.

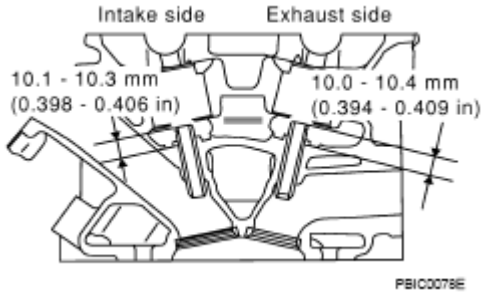


Fig. 160: Identifying Valve Guide Dimension
Courtesy of NISSAN MOTOR CO., U.S.A.

6. Using valve guide reamer (commercial service tool), apply reamer finish to valve guide.

   Standard:

   Intake and exhaust

   : 6.000 - 6.018 mm (0.2362 - 0.2369 in)

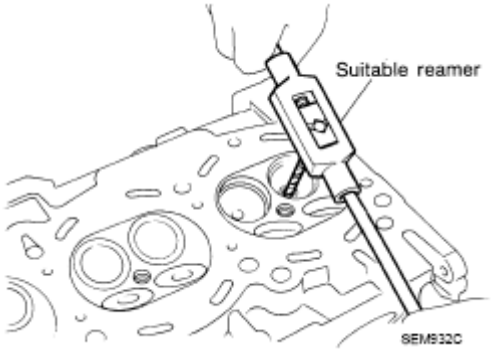


Fig. 161: Applying Reamer Finish To Valve Guide
Courtesy of NISSAN MOTOR CO., U.S.A.

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 even after the recheck, replace valve seat. Refer to **VALVE SEAT REPLACEMENT**.

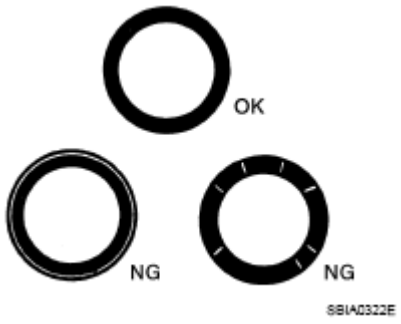


Fig. 162: Identifying Valve Seat Contact
Courtesy of NISSAN MOTOR CO., U.S.A.

VALVE SEAT REPLACEMENT

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

1. Bore out old seat until it collapses. Boring should not continue beyond the bottom face of the seat recess in 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 for service valve seat.

   Oversize [0.5 mm (0.020 in)]

   Intake: 37.500 - 37.516 mm (1.4764 - 1.4770 in)

   Exhaust: 32.700 - 32.716 mm (1.2874 - 1.2880 in)

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

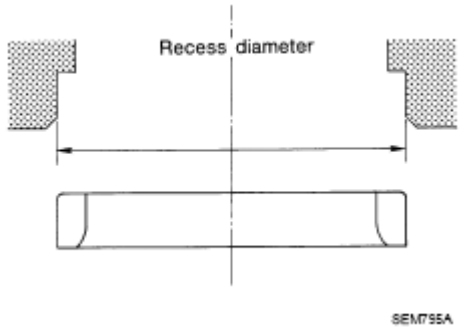


Fig. 163: Identifying Cylinder Head Recess Diameter
Courtesy of NISSAN MOTOR CO., U.S.A.

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

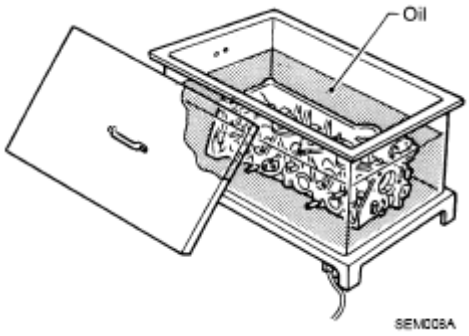


Fig. 164: Heating Cylinder Head
Courtesy of NISSAN MOTOR CO., U.S.A.

4. Provide valve seats cooled well with dry ice. Force fit valve seat into cylinder head.

WARNING: Cylinder head contains heat. When working, wear protective equipment to avoid getting burned.

CAUTION: Avoid directly touching cold valve seats.

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.

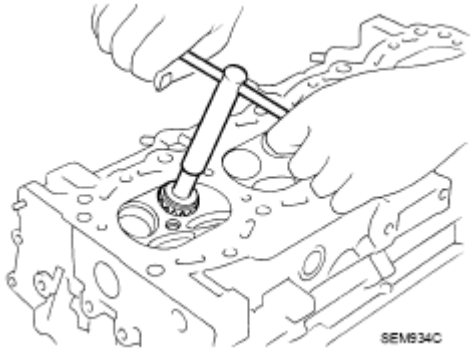


Fig. 165: Cutting Valve Seat
Courtesy of NISSAN MOTOR CO., U.S.A.

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

  Limit: 2.0 mm (0.079 in)

- If it exceeds the limit, replace valve spring.

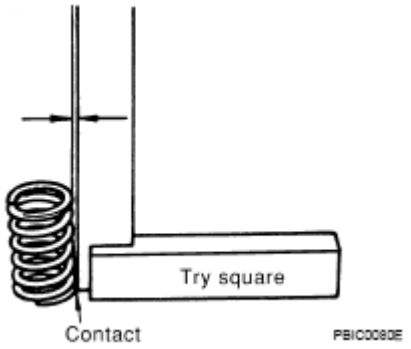


Fig. 166: Measuring Clearance Between Top Of Valve Spring And Try Square
Courtesy of NISSAN MOTOR CO., U.S.A.

VALVE SPRING DIMENSIONS AND VALVE SPRING PRESSURE LOAD

- Check valve spring pressure at the specified spring height.

  Standard:

  Intake and exhaust

  Free height

  : 46.35 - 46.85 mm (1.8248 - 1.8445 in)

  Installation height

  : 33.8 mm (1.331 in)

  Installation load

  : 165 - 189 N (16.8 - 19.3 kg, 37 - 42 lb)

  Height during valve open

  : 24.4 mm (0.961 in)

  Load with valve open

  : 290 - 330 N (29.6 - 33.7 kg, 65 - 74 lb)

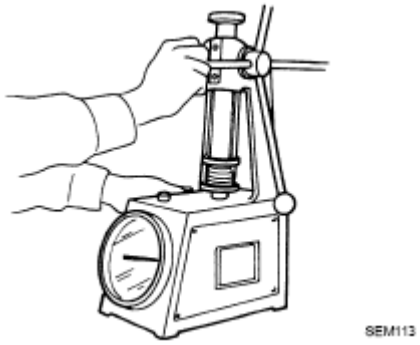


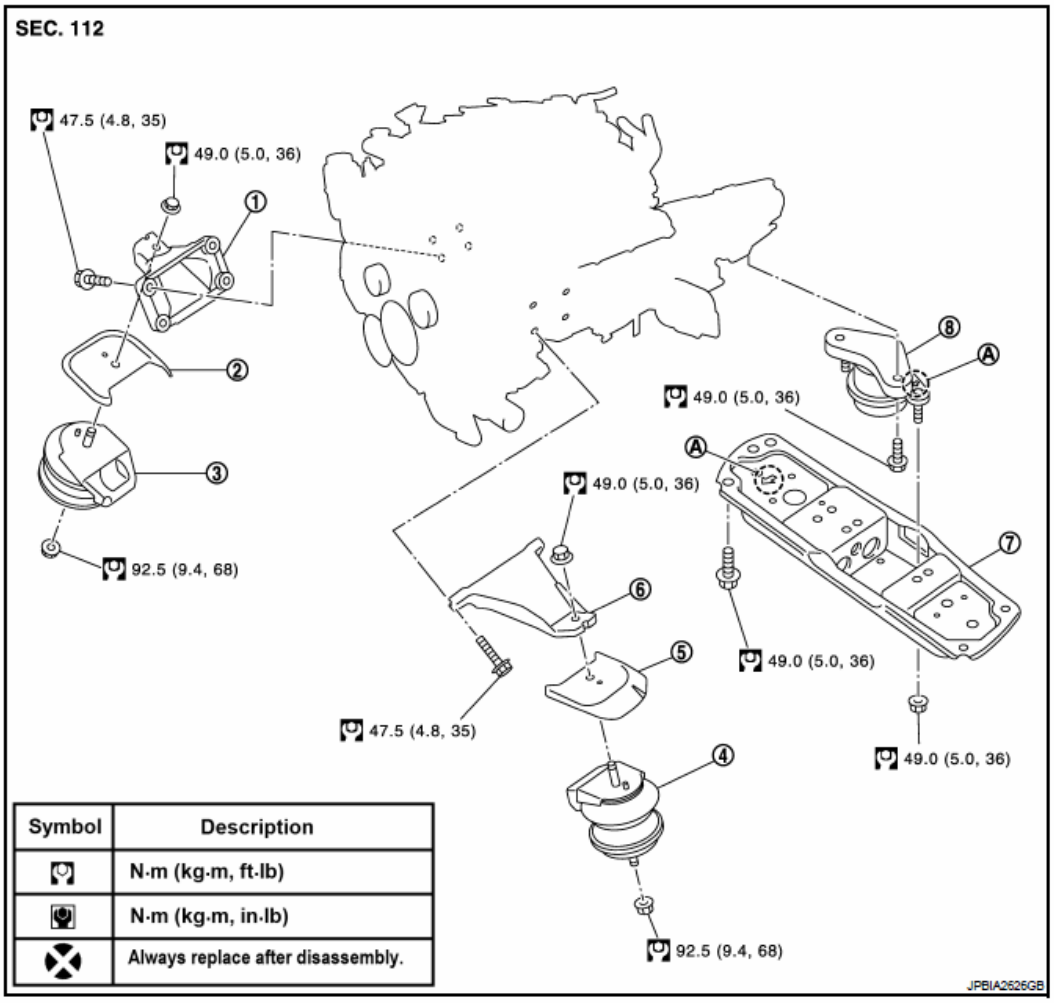
Fig. 167: Checking Valve Spring Dimensions And Valve Spring Pressure Load
Courtesy of NISSAN MOTOR CO., U.S.A.

- If the installation load or load with valve open is out of the standard, replace valve spring.

ENGINE ASSEMBLY

2WD

2WD: Component



1. Engine mounting bracket (RH)
2. Heat insulator (RH)
3. Engine mounting insulator (RH)
4. Engine mounting insulator (LH)
5. Heat insulator (LH)
6. Engine mounting bracket (LH)
7. Rear engine mounting member
8. Engine mounting insulator (rear)

A. Front mark

Fig. 168: Identifying Engine Assembly Components With Torque Specifications (2WD)
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to **COMPONENT** for symbols above.

2WD: Removal and Installation

WARNING:

- **Situate 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 applicable 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 service information.**
- **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 the 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 from vehicle downward. Then separate the engine from the transmission.

Preparation

1. Release fuel pressure. Refer to **FUEL PRESSURE CHECK** .
2. Drain engine coolant from radiator. Refer to **CHANGING ENGINE COOLANT** .

CAUTION:

- **Perform this step when engine is cold.**
- **Never spill engine coolant on drive belts.**

3. Disconnect both battery cables. Refer to **BATTERY** .
4. Remove crankshaft position sensor (POS) from transmission. Refer to **COMPONENT**.

CAUTION:

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

5. Remove the following parts:
   - Front and rear engine undercover (power tool)
   - Air duct (inlet), air duct and air cleaner case assembly: Refer to **AIR CLEANER AND AIR DUCT**.

- Front road wheels and tires (power tool)

Engine Room LH

1. Disconnect heater hoses, and install plugs to avoid leakage of engine coolant. Refer to **COMPONENT** .
2. Disconnect wire bonding from exhaust manifold cover to vehicle.
3. Disconnect vacuum hose between vehicle and engine and set it aside.
4. Discharge refrigerant from A/C circuit. Refer to **REFRIGERANT LINES** .
5. Remove A/C piping from A/C compressor, and temporarily fasten it on vehicle with a rope. Refer to **REFRIGERANT LINES** .

Engine Room RH

1. Disconnect fuel feed hose and EVAP hose. Refer to **FUEL INJECTOR AND FUEL TUBE**.

CAUTION: Fit plugs onto disconnected hose to prevent fuel leakage.

2. Disconnect ground cable [between vehicle and cylinder head (right bank)].
3. Disconnect vacuum hose between vehicle and engine and set it aside.
4. Disconnect reservoir tank of power steering oil pump from engine, and move it aside for easier work.

CAUTION: When temporarily securing, keep 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, dash side finisher, and glove box. Refer to **BODY SIDE TRIM** and **INSTRUMENT PANEL ASSEMBLY** .
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 **EXHAUST SYSTEM** .
3. Remove exhaust front tube with power tool. Refer to **EXHAUST SYSTEM** .
4. Disconnect steering lower joint at power steering gear assembly side, and release steering lower shaft. Refer to **STEERING COLUMN** .
5. Separate steering outer sockets from steering knuckle. Refer to **POWER STEERING GEAR AND LINKAGE** .
6. Remove A/T control rod at control device assembly side. Then temporarily secure it on transmission, so that it does not sag. Refer to **SHIFT CONTROL SYSTEM** .
7. Remove rear plate cover from oil pan. Then remove bolts fixing drive plate to torque converter. Refer to **OIL PAN AND OIL STRAINER** and **TRANSMISSION ASSEMBLY** .
8. Remove transmission joint bolts which pierce at oil pan lower rear side. Refer to **COMPONENT**.
9. Remove lower ends of left and right strut from transverse link. Refer to **COMPONENT** .
10. Remove transverse link mounting bolts at knuckle side. Refer to **COMPONENT** .
11. Remove front stabilizer at transverse link side. Refer to **COMPONENT** .
12. Remove rear propeller shaft. Refer to **COMPONENT** .

Removal Work

1. Use manual lift table caddy (commercial service tool) or equivalently rigid tool such as transmission jack. Securely support bottom of suspension member and transmission assembly.

CAUTION: Put a piece of wood or something similar as the supporting surface, secure a completely stable condition.

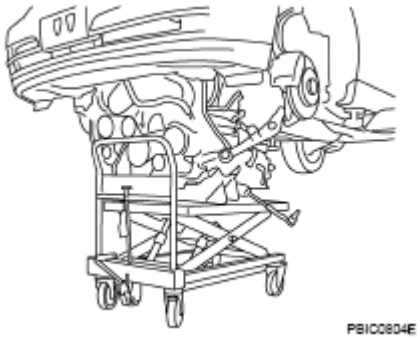


Fig. 169: Identifying Manual Lift Table Caddy (Commercial Service Tool)
Courtesy of NISSAN MOTOR CO., U.S.A.

2. Remove engine rear member mounting bolts.
3. Remove front suspension member mounting nuts and bolts with power tool. Refer to **COMPONENT** .
4. Carefully lower jack, or raise lift to remove engine, transmission and front suspension member assembly.

When performing work, observe the following caution:

CAUTION:

- **Confirm there is no interference with 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 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 (left bank) and front of cylinder head (right bank).

   Slinger bolts:

   33.4 N.m (3.4 kg-m, 25 ft-lb)

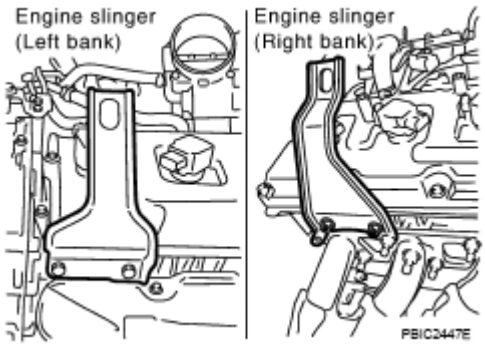


Fig. 170: Identifying Engine Slingers Into Front Of Cylinder Head (Left/Right Bank)
Courtesy of NISSAN MOTOR CO., U.S.A.

2. Remove engine mounting insulators (RH and LH) under side nut with power tool.
3. Lift with hoist and separate engine and transmission assembly from front suspension member.

CAUTION: Avoid damage to and oil/grease smearing or spills onto engine mounting insulator.

4. Remove alternator. Refer to **REMOVAL AND INSTALLATION** .
5. Remove starter motor. Refer to **REMOVAL AND INSTALLATION** .
6. Separate engine from transmission assembly. Refer to **TRANSMISSION ASSEMBLY** .
7. Remove engine mounting insulators (RH and LH) and brackets (RH and LH) from engine with power tool.
8. Remove rear engine mounting member and engine mounting insulator (rear) from transmission.

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 graphic in **2WD: COMPONENT**.
- When installing engine mounting brackets (RH and LH) on cylinder block, tighten two upper bolts (shown as "A" below) first. Then tighten two lower bolts (shown as "B" below).

NOTE: Graphic shows left bank.

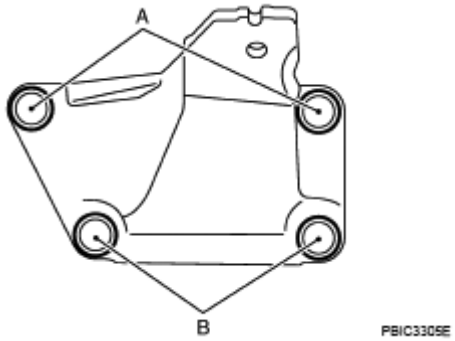


Fig. 171: Identifying Engine Mounting Insulator
Courtesy of NISSAN MOTOR CO., U.S.A.

INSPECTION AFTER INSTALLATION

Inspection for Leakage

The following are procedure 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:

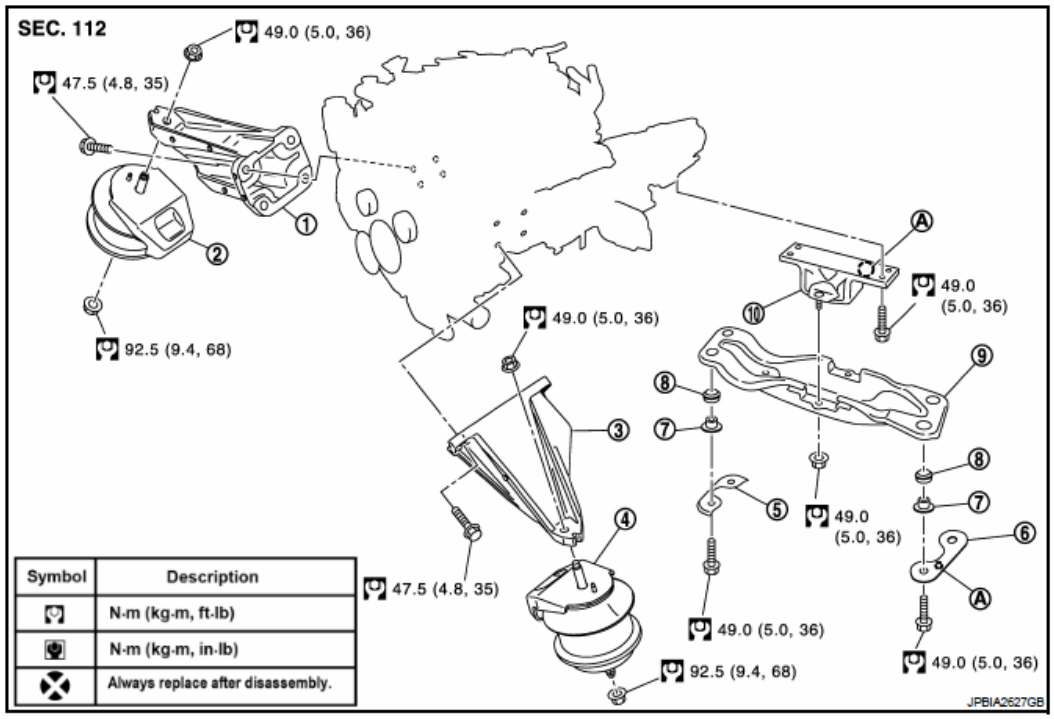
ITEM SPECIFICATION

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



1. Engine mounting bracket (RH)
2. Engine mounting insulator (RH)
3. Engine mounting bracket (LH)
4. Engine mounting insulator (LH)
5. Plate (RH)
6. Plate (LH)
7. Spacer
8. Pad
9. Rear engine mounting member
10. Engine mounting insulator (rear)
A. Front mark

Fig. 172: Identifying Engine Mounting Bracket With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to **COMPONENT** for symbols above.

AWD: Removal and Installation

WARNING:

- **Situate 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 applicable 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 mechanical 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 the 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, and front final drive with front suspension member from vehicle downward. Then separate the engine from the transmission.

Preparation

1. Release fuel pressure. Refer to **FUEL PRESSURE CHECK** .
2. Drain engine coolant from radiator. Refer to **CHANGING ENGINE COOLANT** .

CAUTION:

- **Perform this step when engine is cold.**
- **Never spill engine coolant on drive belts.**

3. Disconnect both battery cables. Refer to **BATTERY** .
4. Remove crankshaft position sensor (POS) from transmission. Refer to **COMPONENT**.

CAUTION:

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

5. Remove the following parts:
   - Front and rear engine undercover (power tool)
   - Air duct (inlet), air duct and air cleaner case assembly: Refer to **AIR CLEANER AND AIR DUCT**.
   - Front road wheels and tires (power tool)
   - Front cross bar: Refer to **COMPONENT** .

Engine Room LH

1. Disconnect heater hoses, and install plugs to avoid leakage of engine coolant. Refer to **COMPONENT** .
2. Disconnect wire bonding from exhaust manifold cover to vehicle.
3. Disconnect vacuum hose between vehicle and engine and set it aside.
4. Discharge refrigerant from A/C circuit. Refer to **REFRIGERANT LINES** .
5. Remove A/C piping from A/C compressor, and temporarily fasten it on vehicle with a rope. Refer to **REFRIGERANT LINES** .

Engine Room RH

1. Disconnect fuel feed hose and EVAP hose. Refer to **FUEL INJECTOR AND FUEL TUBE**.

CAUTION: Fit plugs onto disconnected hose to prevent fuel leakage.

2. Disconnect ground cable (between vehicle and right bank cylinder head).
3. Disconnect vacuum hose between vehicle and engine and set it aside.
4. Disconnect reservoir tank of power steering oil pump from engine, and move it aside for easier work.

CAUTION: When temporarily securing, keep 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, dash side finisher, and glove box. Refer to **BODY SIDE TRIM** and **INSTRUMENT PANEL ASSEMBLY** .
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 **EXHAUST SYSTEM** .
3. Remove exhaust front tube with power tool. Refer to **EXHAUST SYSTEM** .
4. Disconnect steering lower joint at power steering gear assembly side, and release steering lower shaft. Refer to **STEERING COLUMN** .
5. Separate steering outer sockets from steering knuckle. Refer to **POWER STEERING GEAR AND LINKAGE** .
6. Remove A/T control rod at control device assembly side. Then temporarily secure it on transmission, so that it does not sag. Refer to **SHIFT CONTROL SYSTEM** .
7. Remove rear plate cover from oil pan. Then remove bolts fixing drive plate to torque converter. Refer to **OIL PAN AND OIL STRAINER** and **TRANSMISSION ASSEMBLY** .
8. Remove bolts fixing the transmission assembly to lower rear side of oil pan. Refer to **COMPONENT**.
9. Remove lower ends of left and right strut from transverse link. Refer to **COMPONENT** .
10. Remove transverse link mounting bolts at knuckle side. Refer to **COMPONENT** .
11. Remove front stabilizer at transverse link side. Refer to **COMPONENT** .
12. Remove rear propeller shaft. Refer to **COMPONENT** .
13. Remove front drive shaft (both side). Refer to **REMOVAL AND INSTALLATION** .

Removal Work

1. Use manual lift table caddy (commercial service tool) or equivalently rigid tool such as transmission jack. Securely support bottom of suspension member and transmission assembly.

CAUTION: Put a piece of wood or something similar as the supporting surface, secure a completely stable condition.

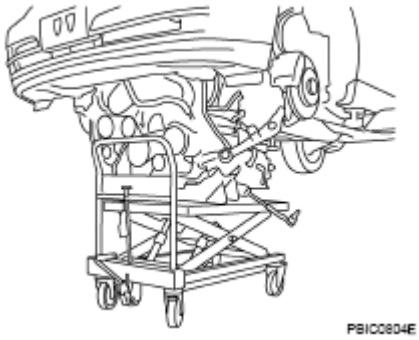


Fig. 173: Identifying Manual Lift Table Caddy (Commercial Service Tool)
Courtesy of NISSAN MOTOR CO., U.S.A.

2. Remove engine rear member mounting bolts.
3. Remove front suspension member mounting nuts and bolts with power tool. Refer to **COMPONENT** .
4. Carefully lower jack, or raise lift to remove engine, transmission and front suspension member assembly. When performing work, observe the following caution:

CAUTION:
- **Confirm there is no interference with 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 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 (left bank) and front of cylinder head (right bank).

   Slinger bolts:

   33.4 N.m (3.4 kg-m, 25 ft-lb)

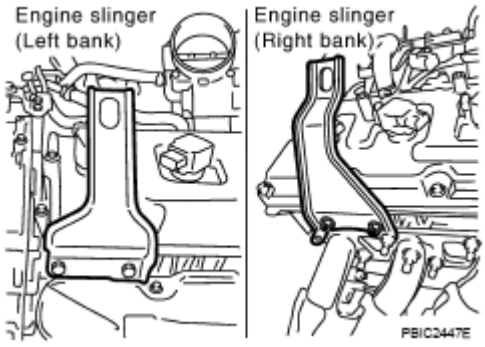


Fig. 174: Identifying Engine Slingers Into Front Of Cylinder Head (Left/Right Bank)
Courtesy of NISSAN MOTOR CO., U.S.A.

2. Remove engine mounting insulators (RH and LH) under side nut with power tool.
3. Lift with hoist and separate engine, transmission assembly, the transfer assembly and the front final drive assembly from front suspension member.

CAUTION: Avoid damage to and oil/grease smearing or spills onto engine mounting insulator.

4. Remove alternator. Refer to **REMOVAL AND INSTALLATION** .
5. Remove starter motor. Refer to **DISASSEMBLY AND ASSEMBLY** .
6. Remove front propeller shaft from the front final drive assembly. Refer to **COMPONENT** .
7. Separate engine from transmission assembly. Refer to **TRANSMISSION ASSEMBLY** .
8. Remove the front final drive assembly from oil pan. Refer to **REMOVAL AND INSTALLATION (VK45DE)** .
9. Remove engine mounting insulators (RH and LH) and brackets (RH and LH) from engine with power tool.
10. Remove rear engine mounting member and engine mounting insulator (rear) from transmission.

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 graphic in **AWD: COMPONENT**.
- When installing engine mounting brackets (RH and LH) on cylinder block, tighten two upper bolts (shown as "A" below) first. Then tighten two lower bolts (shown as "B" below).

NOTE: Graphic shows left bank.

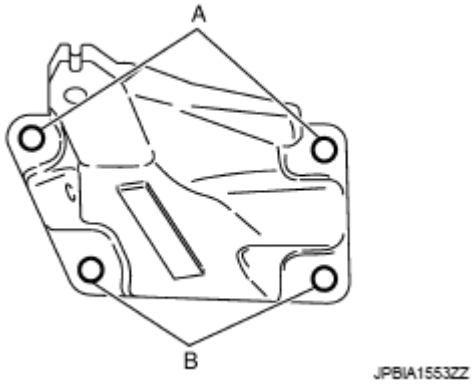


Fig. 175: Identifying Engine Mounting Brackets On Cylinder Block
Courtesy of NISSAN MOTOR CO., U.S.A.

INSPECTION AFTER INSTALLATION

Inspection for Leakage

The following are procedure 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:

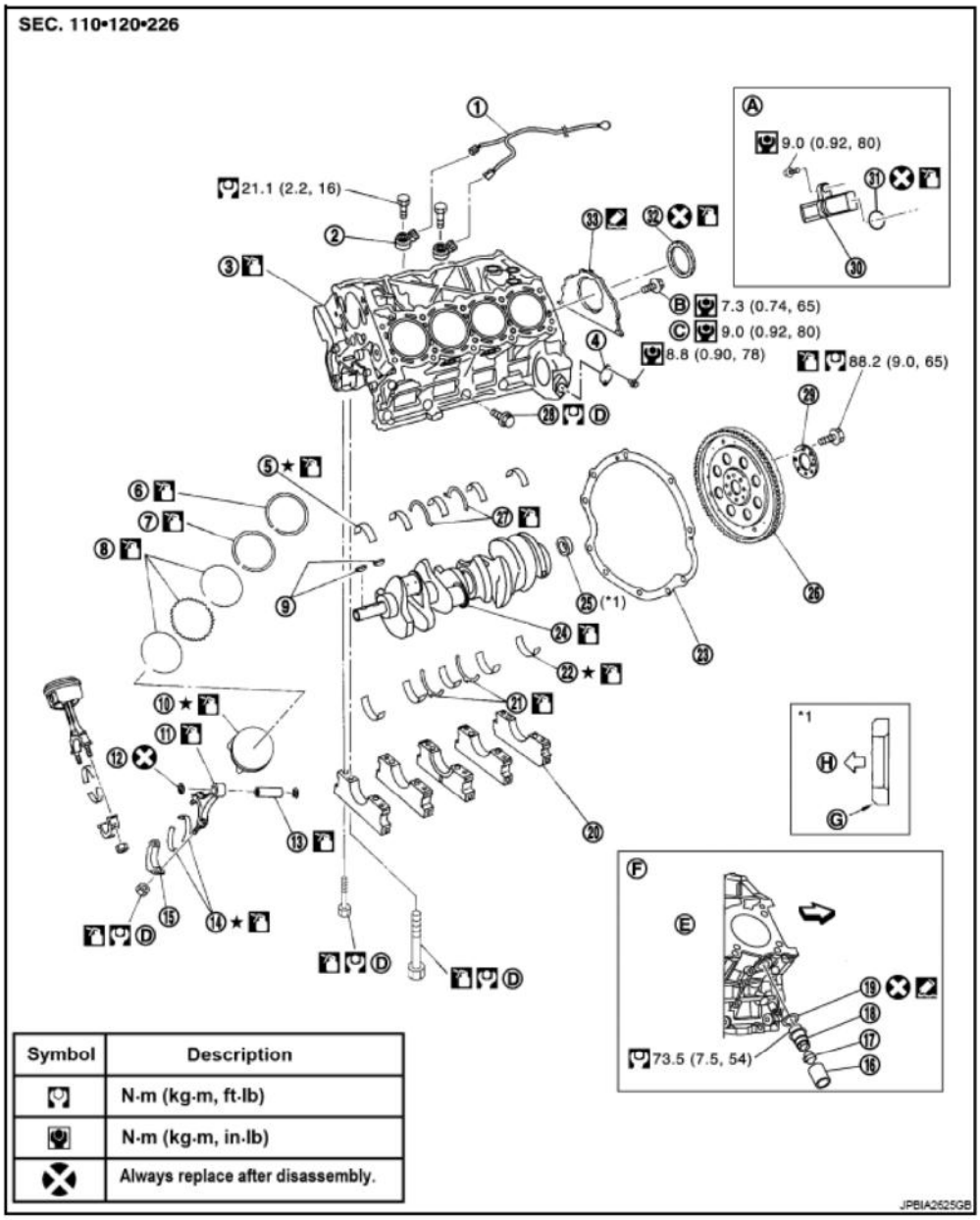
ITEM SPECIFICATION

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



1. Knock sensor sub harness
2. Knock sensor
3. Cylinder block
4. Cover
5. Main bearing (upper)
6. Top ring
7. Second ring
8. Oil ring
9. Crankshaft key
10. Piston
11. Connecting rod
12. Snap ring
13. Piston pin
14. Connecting rod bearing
15. Connecting rod bearing cap
16. Cylinder block heater protector
17. Connector cap
18. Cylinder block heater
19. Gasket
20. Main bearing cap
21. Thrust bearing (lower)
22. Main bearing (lower)
23. Rear plate
24. Crankshaft
25. Pilot converter
26. Drive plate
27. Thrust bearing (upper)
28. Side bolt
29. Reinforcement plate
30. Crankshaft position sensor (POS)
31. O-ring
32. Rear oil seal
33. Rear oil seal retainer
A. Reference: Installed on transmission
B. Washer bolt
C. Flange bolt
D. Refer to Engine Mechanical
E. left bank
F. Cylinder block heater (for Canada)
G. Chamfered
H. Crankshaft side
⇦ : Engine front

Fig. 176: Identifying Cylinder Block Components With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

- Refer to **RELATION BETWEEN ILLUSTRATIONS AND DESCRIPTIONS** for symbols above.

Disassembly and Assembly

DISASSEMBLY

NOTE: Explained here is how to disassemble with engine stand supporting transmission surface. When using different type of engine stand, note with difference in steps and etc.

1. Remove engine assembly from vehicle, and separate front suspension member, transmission from engine. Refer to **2WD: COMPONENT** (2WD models) or **AWD: COMPONENT** (AWD models).
2. Remove the parts that may restrict installation of engine to widely use engine stand.

NOTE: The procedure is described assuming that you use widely use engine holding the surface, to which transmission is installed.

a. Remove drive plate.
   - Holding ring gear with ring gear stopper (SST).
   - Loosen mounting bolts diagonally order.

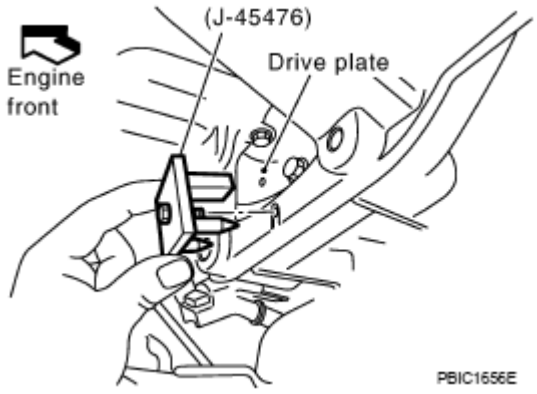


Fig. 177: Removing Drive Plate
Courtesy of NISSAN MOTOR CO., U.S.A.

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.**

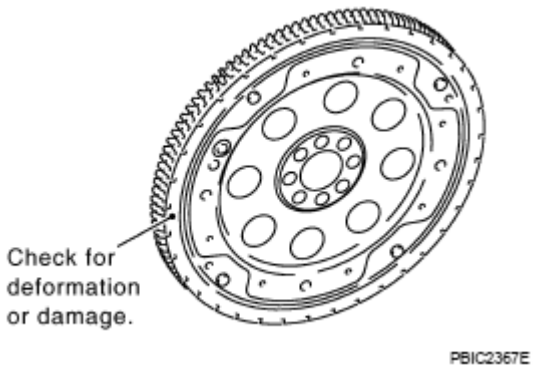


Fig. 178: Identifying Drive Plate
Courtesy of NISSAN MOTOR CO., U.S.A.

b. Remove rear plate.

3. Lift engine with hoist to install it onto widely use engine stand.

CAUTION: Use engine stand that has a load capacity [approximately 240 kg (529 lb) or more] large enough for supporting the engine weight.

- If the load capacity of stand is not adequate, remove the following parts beforehand to reduce the potential risk of overturning stand.
  - Intake manifolds (upper and lower): Refer to **COMPONENT**.
  - Exhaust manifold and three way catalyst: Refer to **EXHAUST MANIFOLD AND THREE WAY CATALYST**.
  - Fuel tube and fuel injector assembly: Refer to **FUEL INJECTOR AND FUEL TUBE**.
  - Ignition coil: Refer to **IGNITION COIL**.
  - Rocker cover: Refer to **ROCKER COVER**.
  - Other removable brackets

NOTE: The graphic shows an example of widely use engine stand that can hold mating surface of transmission with drive plate and rear plate removed.

CAUTION: Before removing the hanging chains, check the engine stand is stable and there is no risk of overturning.

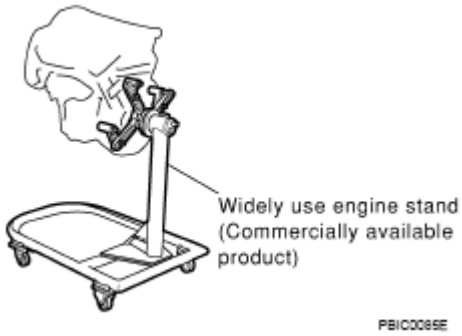


Fig. 179: Identifying Engine Stand
Courtesy of NISSAN MOTOR CO., U.S.A.

4. Drain engine oil. Refer to **CHANGING ENGINE OIL** .
5. Drain engine coolant from inside engine by removing water drain plugs (B) as shown below.

A : Plug
C : Plug (except for Canada models)
: Block heater (for Canada models)
D : Plug

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

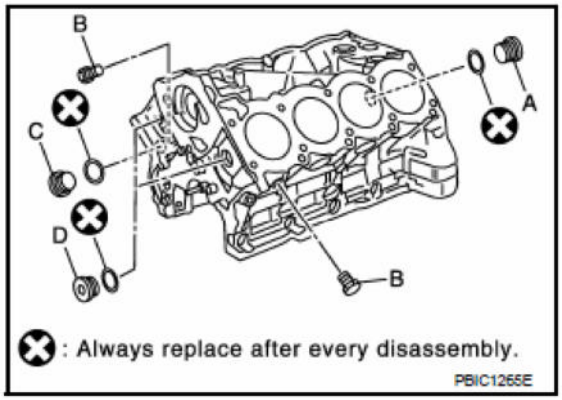


Fig. 180: Identifying Water Drain Plugs
Courtesy of NISSAN MOTOR CO., U.S.A.

6. Remove oil pan and oil strainer. Refer to **OIL PAN AND OIL STRAINER**.
7. Remove crankshaft pulley as follows:
   a. Lock crankshaft with a hammer handle or similar tool to loosen crankshaft bolt.
   b. Pull crankshaft pulley with both hands to remove it.

CAUTION:

- **Never remove crankshaft pulley bolt. Keep loosened crankshaft pulley bolt in place to protect removed crankshaft pulley from dropping.**
- **Never remove balance weight (inner hexagon bolt) at the front of crankshaft pulley.**

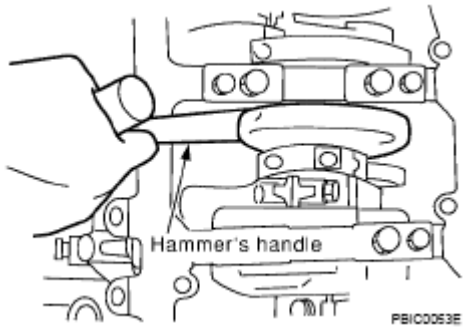


Fig. 181: Identifying Crankshaft Pulley Bolts Using Hammer
Courtesy of NISSAN MOTOR CO., U.S.A.

8. Remove the following parts and related parts (The parts listed in step 3 are not included here).
   - Front cover and timing chain: Refer to **TIMING CHAIN**.
   - Camshaft: Refer to **CAMSHAFT**.
   - Cylinder head: Refer to **COMPONENT**.
9. Remove knock sensor.

CAUTION: Carefully handle sensor, avoiding shocks.

10. 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.

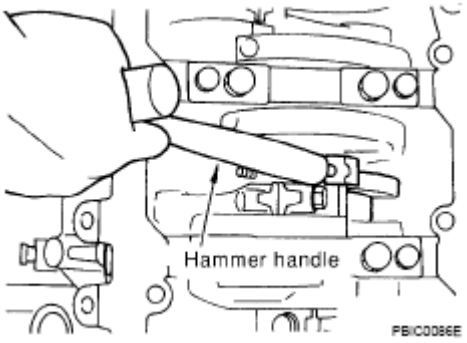


Fig. 182: Pushing Connecting Rod Assembly Out To Cylinder Head
Courtesy of NISSAN MOTOR CO., U.S.A.

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

CAUTION: Identify installation positions, and store them without mixing them up.

12. Remove piston rings from piston.
    - Before removing the piston rings, check the piston ring side clearance. Refer to **INSPECTION AFTER DISASSEMBLY**.
    - Use piston ring expander (commercial service tool).

CAUTION:
- **When removing piston rings, be careful not to damage piston.**
- **Be careful not to damage piston rings by expanding them excessively.**

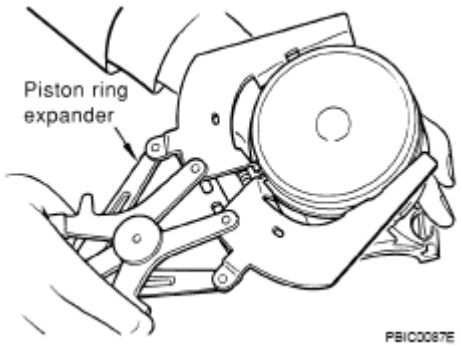


Fig. 183: Identifying Piston Rings Expander
Courtesy of NISSAN MOTOR CO., U.S.A.

13. Remove piston from connecting rod as follows:
    a. Using snap ring pliers, remove the snap rings.

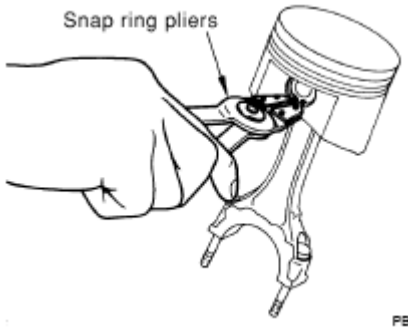


Fig. 184: Identifying Snap Ring Into Front Of Piston Pin-Groove
Courtesy of NISSAN MOTOR CO., U.S.A.

b. Heat piston to 60 to 70°C (140 to 158°F) with industrial use drier or equivalent.

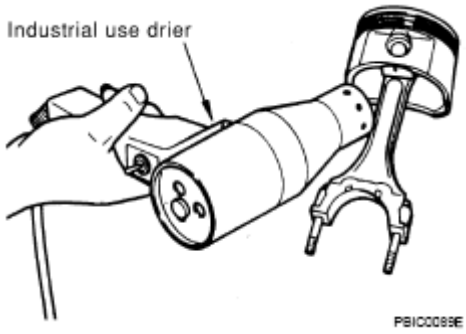


Fig. 185: Heating Piston
Courtesy of NISSAN MOTOR CO., U.S.A.

c. Push out piston pin with stick of outer diameter approximately 20 mm (0.79 in).

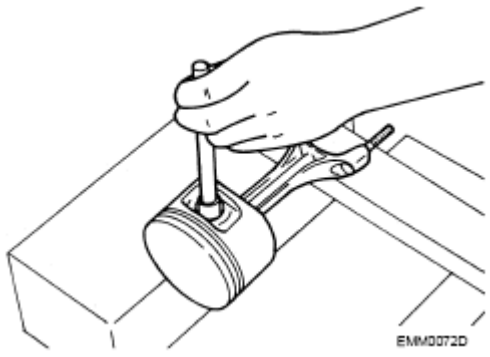


Fig. 186: Pushing Out Piston Pin
Courtesy of NISSAN MOTOR CO., U.S.A.

14. Remove rear oil seal retainer from cylinder block.
    - Insert screwdriver or similar tool between rear end of crankshaft counter weight and rear oil seal retainer, and separate liquid gasket to remove.

CAUTION: Be careful not to damage the mating surfaces.

15. Using screwdriver or similar tool, and lever off rear oil seal from rear oil seal retainer.
16. Remove main bearing cap as follows:
    - Before loosening main bearing cap bolts, measure the crankshaft end play. Refer to **INSPECTION AFTER DISASSEMBLY**.
    - Loosen main bearing cap bolts in several different steps.

    a. Remove cover attached to the rear left side of cylinder block (next to the starter motor housing).

    NOTE: Bolts (No. 27 shown below) are installed on the inside of cover.

    b. Loosen side bolts (M10) starting from 30 to 21 to remove.
    c. Loosen main bearing cap sub bolts (M9) starting from 20 to 11 to remove.
    d. Loosen main bearing cap bolts (M12) starting from 10 to 1 to remove.

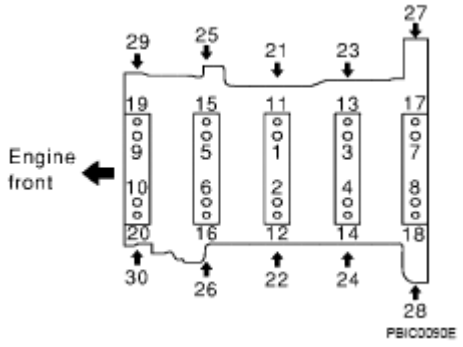


Fig. 187: Identifying Main Bearing Caps
Courtesy of NISSAN MOTOR CO., U.S.A.

e. Using main bearing cap remover (SST), remove main bearing cap.

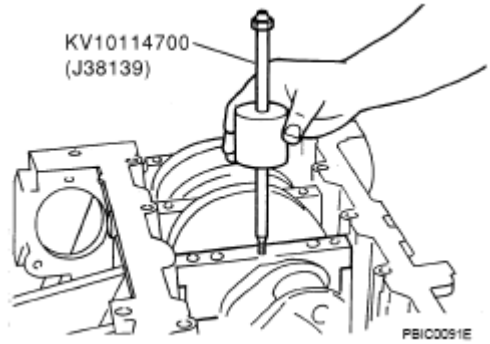


Fig. 188: Using SST To Remove Main Bearing Cap
Courtesy of NISSAN MOTOR CO., U.S.A.

17. Remove crankshaft.
18. Remove main bearings and thrust bearings from cylinder block and main bearing caps.

CAUTION: Identify installation positions, and store them without mixing them up.

19. If pilot converter must be removed, remove it from the rear end of the crankshaft using pilot bushing puller (SST).

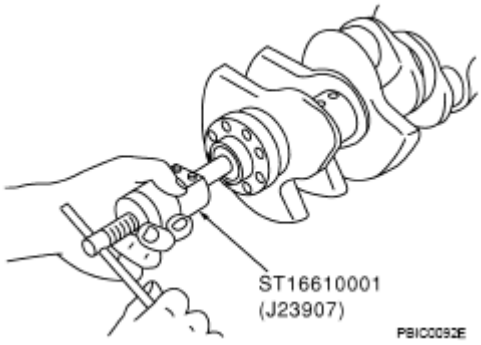


Fig. 189: Using SST To Remove Rear End Of Crankshaft
Courtesy of NISSAN MOTOR CO., U.S.A.

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 the cylinder block. (Only screwed-type plugs are shown below.)
   - Apply sealant to the thread of each plug "A" and "D".

     Use genuine high strength thread locking sealant or equivalent. Refer to RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS .

   - Apply sealant to the thread of each plug "B" and "C".

     Use Anaerobic Liquid Gasket or equivalent. Refer to RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS .

NOTE: For Canada models, "C" shown below is not plug but block heater. Refer to COMPONENT.

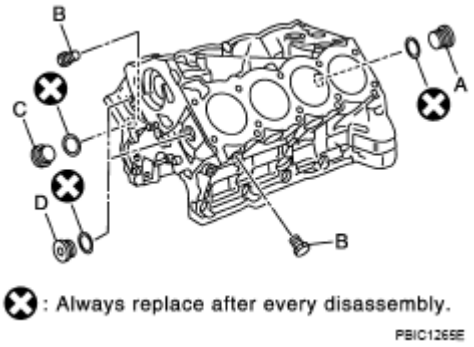


Fig. 190: Identifying Cylinder Block And Plugs
Courtesy of NISSAN MOTOR CO., U.S.A.

- Replace copper washers with new ones.
- Tighten each plug as specified below.

TIGHTENING TORQUE SPECIFICATION

Part	Washer	Tightening torque
A	Yes	53.9 N.m (5.5 kg-m, 40 ft-lb)
B	No	19.6 N.m (2.0 kg-m, 14 ft-lb)
C	Yes	62.7 N.m (6.4 kg-m, 46 ft-lb)
D	Yes	62.7 N.m (6.4 kg-m, 46 ft-lb)

3. Install main bearings and thrust bearings as follows:
   a. Remove dust, dirt and oil on the bearing mating surfaces of cylinder block and main bearing caps.
   b. Install thrust bearings to the both sides of the No. 3 journal housing on cylinder block and main bearing cap.
      - Install thrust bearings with the oil groove facing the crankshaft arm (outside).
      - Install thrust bearing with a protrusion on one end on cylinder block, and thrust bearing with a protrusion at center on main bearing cap. Align each protrusion with mating notch.

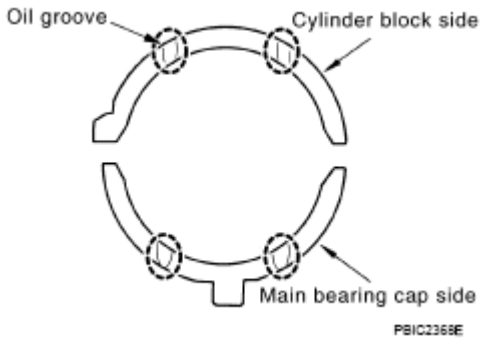


Fig. 191: Identifying Cylinder Block And Main Bearing Cap Side
Courtesy of NISSAN MOTOR CO., U.S.A.

c. Install main bearings paying attention to the direction.
   - Main bearing with oil hole and groove goes on cylinder block. The one without them goes on main bearing cap.
   - 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 main bearing caps.
   - Ensure the oil holes on cylinder block and those on the corresponding bearing are aligned.

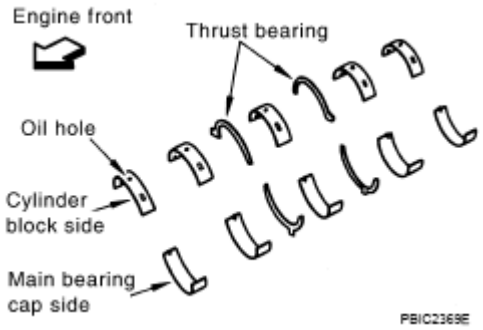


Fig. 192: Identifying Main Bearing Cap Side And Thrust Bearing
Courtesy of NISSAN MOTOR CO., U.S.A.

4. Install pilot converter to crankshaft, if removed.
   - With drift [outer diameter: approximately 35 mm (1.38 in)], press-fit as far as it will go.

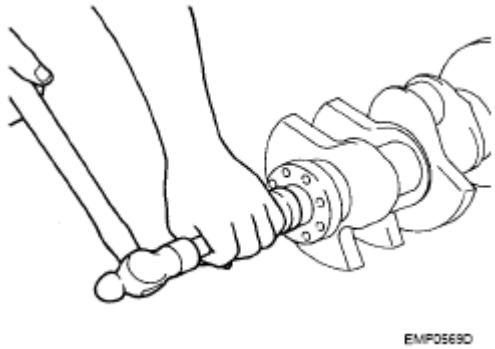


Fig. 193: Identifying Crankshaft To Cylinder Block
Courtesy of NISSAN MOTOR CO., U.S.A.

   - Press-fit pilot converter with its chamfering side facing crankshaft as shown below.
   - It is possible to remove pilot converter without hoisting engine with engine stand.

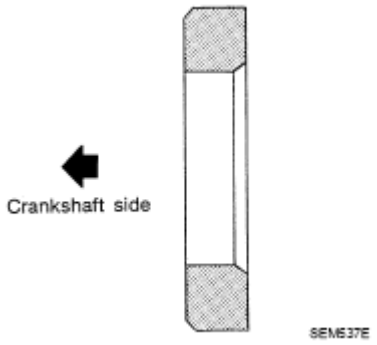


Fig. 194: Identifying Pilot Converter Chamfer Face
Courtesy of NISSAN MOTOR CO., U.S.A.

5. Install crankshaft to cylinder block.
   - While turning crankshaft by hand, check it turns smoothly.
6. Install main bearing caps.
   - Align the identification number to the journal position to install.
   - Install the upper side of the identification number facing the front of engine. (The number shall be read correctly from the rear of engine.)
   - Using plastic hammer or similar tool, tap them lightly to seat them on the installation position.

NOTE: Main bearing cap cannot be replaced as a single parts, because it is machined together with cylinder block.

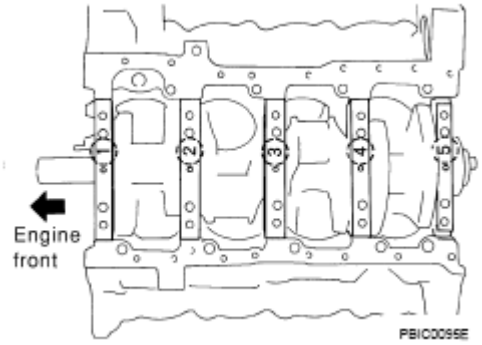


Fig. 195: Identifying Main Bearing Caps Identification Number
Courtesy of NISSAN MOTOR CO., U.S.A.

7. Install each main bearing cap bolt as follows:
   a. Apply new engine oil to threads and seating surface of main bearing cap bolts, and tighten all bolts temporarily.
   b. Tighten main bearing cap bolt (M12) in order of 1 to 10.

39.2 N.m (4.0 kg-m, 29 ft-lb)

c. Tighten main bearing cap sub bolt (M9) in order of 11 to 20.

29.4 N.m (3.0 kg-m, 22 ft-lb)

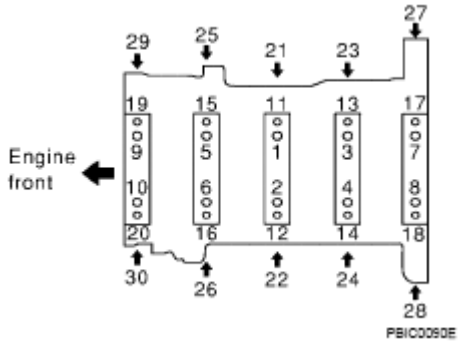


Fig. 196: Identifying Main Bearing Caps
Courtesy of NISSAN MOTOR CO., U.S.A.

d. Tighten main bearing cap bolt (M12) to 40 degrees clockwise in order of 1 to 10. (angle tightening)

CAUTION: Use angle wrench (SST) to check tightening angle in step "d" and "e". Never make judgment by visual inspection.

e. Tighten main bearing cap sub bolt (M9) to 30 degrees clockwise in order of 11 to 20. (angle tightening)

CAUTION: Use angle wrench (SST) to check tightening angle in step "d" and "e". Never make judgment by visual inspection.

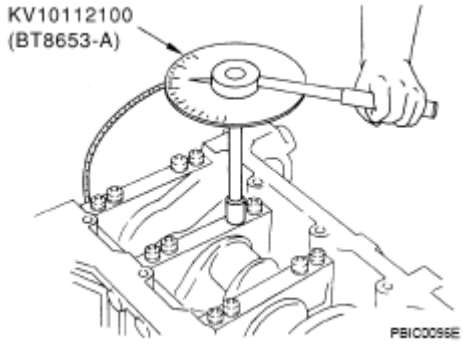


Fig. 197: Checking Tighten Angle Of Main Bearing Cap Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

f. Tighten side bolt (M10) in order of 21 to 30.

49.0 N.m (5.0 kg-m, 36 ft-lb)

- After installing main bearing cap bolts, check that crankshaft can be rotated smoothly.
- Check the crankshaft end play. Refer to **INSPECTION AFTER DISASSEMBLY**.

g. Install cover of cylinder block rear left side (next to the starter motor housing).

8. Install new rear oil seal on rear oil seal retainer.
   - Install new rear oil seal so that each seal lip is oriented as shown below.

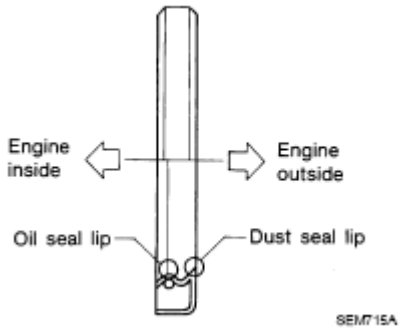


Fig. 198: Applying Engine Oil To Both Oil Seal Lip And Dust Seal Lip
Courtesy of NISSAN MOTOR CO., U.S.A.

   - Install rear oil seal to rear oil seal retainer with rear oil seal drift (commercial service tool).

     Rear oil seal drift

     Outer diameter: 102 mm (4.02 in)

     Inner diameter: 86 mm (3.39 in)

   - Tap until flattened with front edge of rear oil seal retainer. Do not damage or scratch outer circumference of oil seal.
   - Check the garter spring is in position and seal lips not inverted.

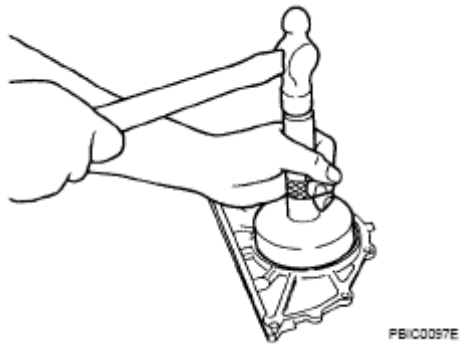


Fig. 199: Fitting Rear Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

9. Install rear oil seal retainer.

- Apply new engine oil to both oil seal lip and dust seal lip.
- Apply a continuous bead of liquid gasket with tube presser (commercial service tool) to rear oil seal retainer as shown below.

Use Genuine RTV Silicone Sealant or equivalent. Refer to RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS .

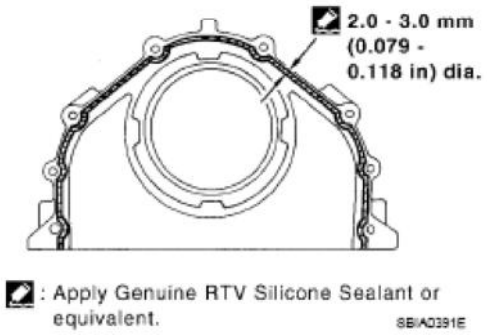


Fig. 200: Applying Liquid Gasket Thoroughly To Rear Oil Seal Retainer
Courtesy of NISSAN MOTOR CO., U.S.A.

10. Install piston to connecting rod.
    a. Using snap ring pliers, install new snap ring to the groove of the 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 oil holes and the cylinder No. on connecting rod are positioned as shown below.
    c. Using snap ring pliers, install new snap rings to the groove of the piston front side.
        - Insert it fully into groove to install.
        - After installing, check that connecting rod moves smoothly.

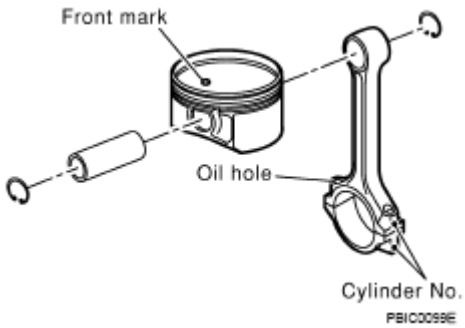


Fig. 201: Identifying Piston Pin Snap Ring Into Front Of Piston
Courtesy of NISSAN MOTOR CO., U.S.A.

11. Using piston ring expander (commercial service tool), 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.**

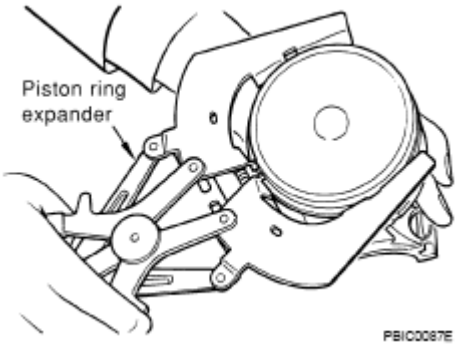


Fig. 202: Identifying Piston Rings Expander
Courtesy of NISSAN MOTOR CO., U.S.A.

- Position each ring with the gap as shown below, referring to the piston front mark.
- Install top ring and second ring with the stamped surface facing upward.

Stamped mark

Top ring: R

Second ring: 2 R

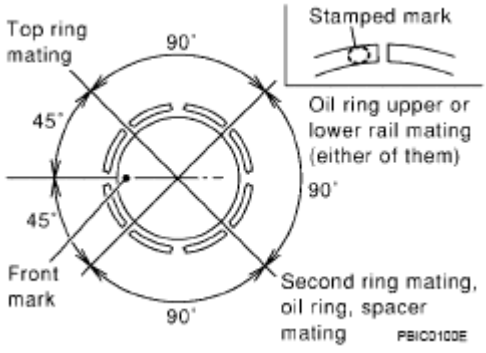


Fig. 203: Identifying Piston Ring Gap
Courtesy of NISSAN MOTOR CO., U.S.A.

12. 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 the connecting rod bearing stopper protrusion with the cutout of connecting rod and connecting rod bearing cap to install.
- Ensure the oil holes on connecting rod and that on the corresponding bearing are aligned.

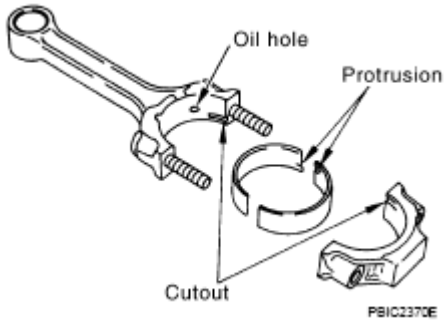


Fig. 204: Identifying Connecting Rod And Corresponding Bearing
Courtesy of NISSAN MOTOR CO., U.S.A.

13. Install piston and connecting rod assembly to crankshaft.
    - Position the 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 No. 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)], install piston with the front mark on the piston head facing the front of engine.

CAUTION: Be careful not to damage cylinder wall and crankshaft pin, resulting from an interference of the connecting rod big end.

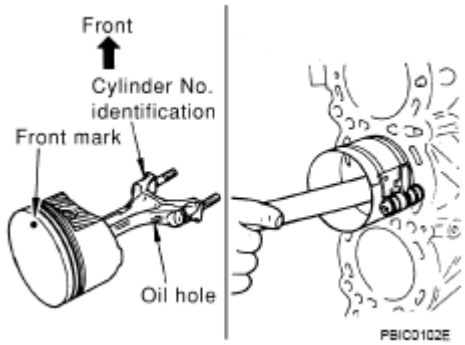


Fig. 205: Identifying Piston And Connecting Rod
Courtesy of NISSAN MOTOR CO., U.S.A.

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

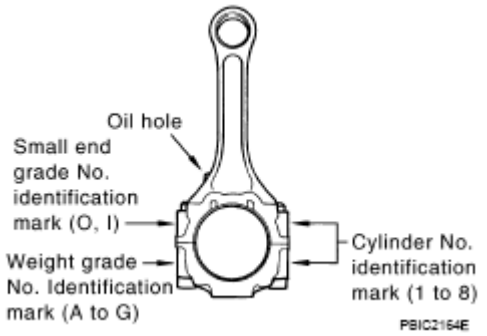


Fig. 206: Identifying Cylinder Number Marks On Connecting Rod
Courtesy of NISSAN MOTOR CO., U.S.A.

15. Tighten connecting rod nuts as follows:
    a. Apply new engine oil to the threads and seats of connecting rod bolts and nuts.
    b. Tighten connecting rod nuts.

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

    c. Then tighten all connecting rod nuts 60 degrees clockwise. (angle tightening)

       CAUTION: Use angle wrench (SST) to check tightening angle. Never make judgment by visual inspection.

       - After tightening connecting rod nuts, check that crankshaft rotates smoothly.
       - Check the connecting rod side clearance. Refer to **INSPECTION AFTER DISASSEMBLY**.

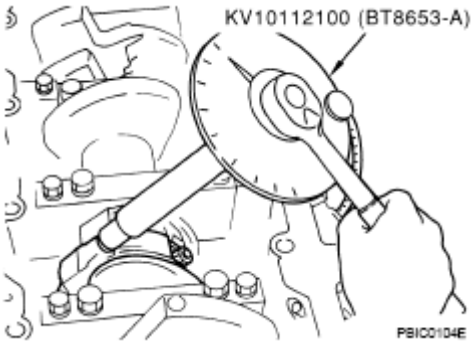


Fig. 207: Checking Connecting Rod Side Clearance
Courtesy of NISSAN MOTOR CO., U.S.A.

16. Install knock sensor.
    - Install it with its connector facing the rear of engine.
    - Install the sub-harness with its shorter branch line to the left bank.

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.**

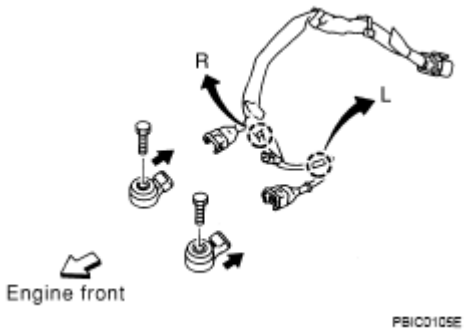


Fig. 208: Identifying Knock Sensor
Courtesy of NISSAN MOTOR CO., U.S.A.

17. Note the following, and 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 guide pin and drive plate side guide pin hole.

CAUTION: If these are not aligned correctly, engine runs roughly and "MIL" turns on.

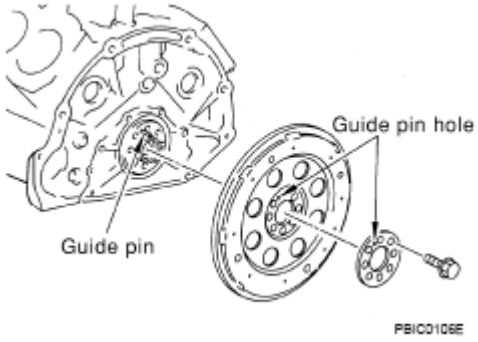


Fig. 209: Identifying Crankshaft Side Guide Pin And Drive Plate Side Guide Pin Hole
Courtesy of NISSAN MOTOR CO., U.S.A.

- Install drive plate, reinforcement plate and pilot converter (if not installed in step 4) as shown below.
- Face chamfered or rounded edge side to crankshaft.
- Holding ring gear with ring gear stopper [SST: - (J-45476)].
- Tighten mounting bolts crosswise over several times.
- When install pilot converter, using drift [outer diameter: approximately 35 mm (1.38 in)]. Press-fit as far as it will go.

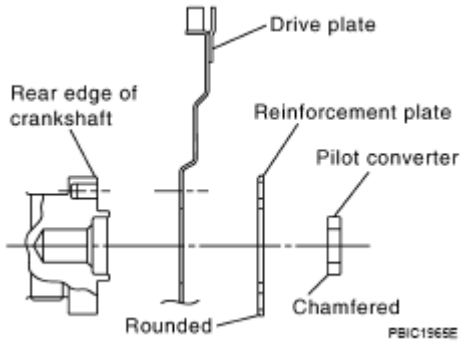


Fig. 210: Identifying Drive Plate, Reinforcement Plate And Pilot Converter
Courtesy of NISSAN MOTOR CO., U.S.A.

How to Select Piston and Bearing

DESCRIPTION

ITEM DESCRIPTION

Selection points	Selection parts	Selection items	Selection methods
Between cylinder block and 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 and 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 and 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 and 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 the rear upper side between cylinder block banks, and select piston of the same grade.

NOTE: Piston is available with piston pin as a set for the service part. (Only "0" grade piston pin is available.)

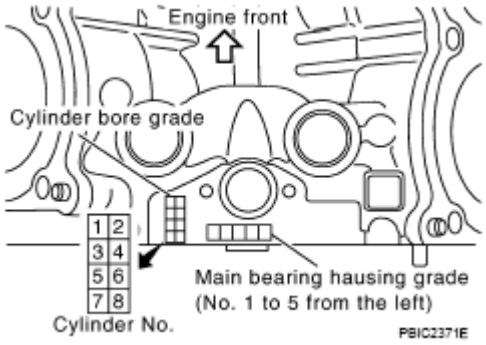


Fig. 211: Identifying Main Bearing Housing Grade
Courtesy of NISSAN MOTOR CO., U.S.A.

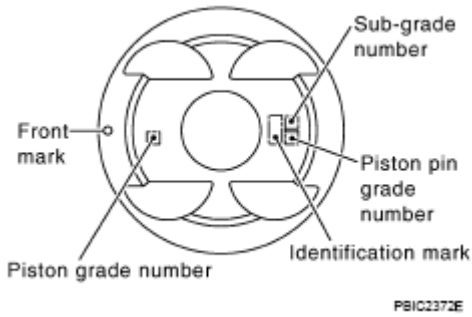


Fig. 212: Identifying Piston Pin Grade Number
Courtesy of NISSAN MOTOR CO., U.S.A.

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 the "Cylinder bore inner diameter" of the "Piston Selection Table". Select piston of the same grade.

Piston Selection Table

GRADE REFERENCE

Unit: mm (in)

Grade	1	2 (or no mark)	3
Cylinder bore inner diameter	93.000 - 93.010 (3.6614 - 3.6618)	93.010 - 93.020 (3.6618 - 3.6622)	93.020 - 93.030 (3.6622 - 3.6626)
Piston skirt diameter	92.980 - 92.990 (3.6606 - 3.6610)	92.990 - 93.000 (3.6610 - 3.6614)	93.000 - 93.010 (3.6614 - 3.6618)

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

Check pin diameter grade ("0", "1" or "2") on front of crankshaft, and select connecting rod bearing of the same grade.

NOTE: There is no grading for connecting rod big end diameter.

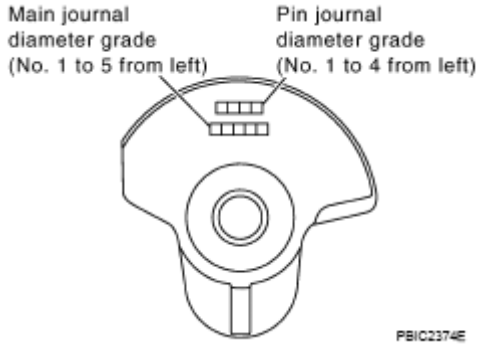


Fig. 213: Identifying Main Journal Diameter Grade

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

When Crankshaft and Connecting Rod are Reused

1. Measure the connecting rod big end diameter. Refer to **INSPECTION AFTER DISASSEMBLY**.
2. Check that the connecting rod big end diameter is within the standard value.
3. Measure the crankshaft pin journal diameter. Refer to **INSPECTION AFTER DISASSEMBLY**.
4. Determine the grade of crankshaft pin diameter grade by corresponding to the measured dimension in "Crankshaft pin journal diameter" column of "Connecting Rod Bearing Selection Table".
5. Select connecting rod bearing of the same grade.

Connecting Rod Bearing Selection Table

CONNECTING ROD BIG END DIAMETER TABLE

	Unit: mm (in)
Connecting rod big end diameter	55.000 - 55.013 (2.1654 - 2.1659)

CRANKSHAFT REFERENCE

				Unit: mm (in)
Crankshaft		**Connecting rod bearing**		
Crankshaft pin journal diameter	**Grade (Mark)**	**Dimension (Bearing thickness range)**	**Bearing grade No.**	**Color**
51.968 - 51.974 (2.0460 - 2.0462)	0	1.500 - 1.503 (0.0591 - 0.0592)	STD 0	No color
51.962 - 51.968 (2.0457 - 2.0460)	1	1.503 - 1.506 (0.0592 - 0.0593)	STD 1	Brown
51.956 - 51.962 (2.0455 - 2.0457)	2	1.506 - 1.509 (0.0593 - 0.0594)	STD 2	Green

Under Size 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 [1.5 mm (0.059 in)].

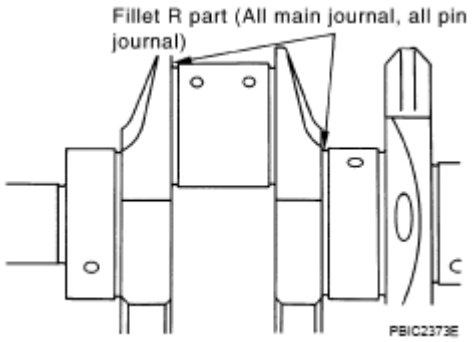


Fig. 214: Identifying Crankshaft Main Journal
Courtesy of NISSAN MOTOR CO., U.S.A.

Bearing undersize table

THICKNESS TABLE

	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 main bearing housing grade on rear upper side between cylinder block banks.

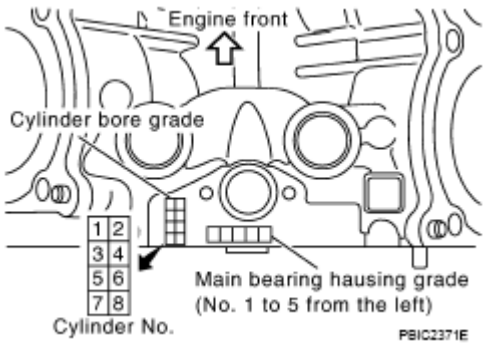


Fig. 215: Identifying Main Bearing Housing Grade
Courtesy of NISSAN MOTOR CO., U.S.A.

2. "Main Bearing Selection Table" columns correspond to main journal diameter grade on front side of crankshaft.

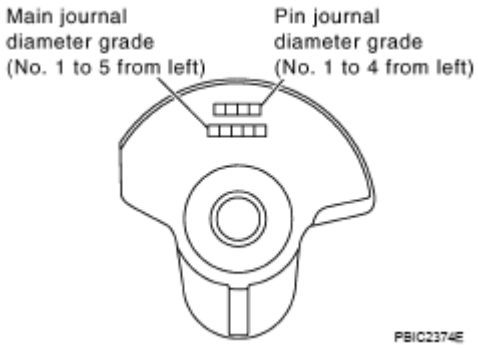


Fig. 216: Identifying Main Journal Diameter Grade
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Select main bearing grade at the point where selected row and column meat in "Main Bearing Selection Table".

CAUTION:
- **Initial clearance for No. 1, 5 journal and No. 2, 3, 4 journal is different. Use two different selection table for each part.**
- **No. 1, 5 journal and No. 2, 3, 4 journal have the same signs but different measures. Never confuse.**

4. Apply sign at crossing in above step 3 to "Main Bearing Grade Table".

NOTE:
- **"Main Bearing Grade Table" applies to all journals.**
- **Service parts is available as a set of both upper and lower.**

When Cylinder Block and Crankshaft Are Reused

1. Measure the cylinder block main bearing housing inner diameter and the 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. Follow step 3 and later in "When New Cylinder Block and Crankshaft are Used".

Main Bearing Selection Table (No. 1 and 5 Journal)

Crankshaft main journal diameter / Cylinder block main bearing housing inner diameter		I.D. mark	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	V	W	X	Y	1	2
I.D. mark	Axle diameter Unit: mm (in)	Hole diameter Unit: mm (in)	68.944 - 68.945 (2.7143 - 2.7144)	68.945 - 68.946 (2.7144 - 2.7144)	68.946 - 68.947 (2.7144 - 2.7144)	68.947 - 68.948 (2.7144 - 2.7145)	68.948 - 68.949 (2.7145 - 2.7145)	68.949 - 68.950 (2.7145 - 2.7146)	68.950 - 68.951 (2.7146 - 2.7146)	68.951 - 68.952 (2.7146 - 2.7146)	68.952 - 68.953 (2.7146 - 2.7147)	68.953 - 68.954 (2.7147 - 2.7147)	68.954 - 68.955 (2.7147 - 2.7148)	68.955 - 68.956 (2.7148 - 2.7148)	68.956 - 68.957 (2.7148 - 2.7148)	68.957 - 68.958 (2.7148 - 2.7149)	68.958 - 68.959 (2.7149 - 2.7149)	68.959 - 68.960 (2.7149 - 2.7150)	68.960 - 68.961 (2.7150 - 2.7150)	68.961 - 68.962 (2.7150 - 2.7150)	68.962 - 68.963 (2.7150 - 2.7151)	68.963 - 68.964 (2.7151 - 2.7151)	68.964 - 68.965 (2.7151 - 2.7152)	68.965 - 68.966 (2.7152 - 2.7152)	68.966 - 68.967 (2.7152 - 2.7152)	68.967 - 68.968 (2.7152 - 2.7153)
G	63.964 - 63.963 (2.5183 - 2.5182)		1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5
H	63.963 - 63.962 (2.5182 - 2.5182)		1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5
J	63.962 - 63.961 (2.5182 - 2.5181)		12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5
K	63.961 - 63.960 (2.5181 - 2.5181)		12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56
L	63.960 - 63.959 (2.5181 - 2.5181)		12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56
M	63.959 - 63.958 (2.5181 - 2.5180)		2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56
N	63.958 - 63.957 (2.5180 - 2.5180)		2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6
P	63.957 - 63.956 (2.5180 - 2.5179)		2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6
R	63.956 - 63.955 (2.5179 - 2.5179)		23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6
S	63.955 - 63.954 (2.5179 - 2.5179)		23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67
T	63.954 - 63.953 (2.5179 - 2.5178)		23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67
U	63.953 - 63.952 (2.5178 - 2.5178)		3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67
V	63.952 - 63.951 (2.5178 - 2.5178)		3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7
W	63.951 - 63.950 (2.5178 - 2.5177)		3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7
X	63.950 - 63.949 (2.5177 - 2.5177)		34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7
Y	63.949 - 63.948 (2.5177 - 2.5176)		34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7	78
1	63.948 - 63.947 (2.5176 - 2.5176)		34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7	78	78
2	63.947 - 63.946 (2.5176 - 2.5176)		4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7	78	78	78
3	63.946 - 63.945 (2.5176 - 2.5175)		4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7	78	78	78	8
4	63.945 - 63.944 (2.5175 - 2.5175)		4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7	78	78	78	8	8
5	63.944 - 63.943 (2.5175 - 2.5174)		45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7	78	78	78	8	8	8
6	63.943 - 63.942 (2.5174 - 2.5174)		45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7	78	78	78	8	8	8	8
7	63.942 - 63.941 (2.5174 - 2.5174)		45	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7	78	78	78	8	8	8	8	8
9	63.941 - 63.940 (2.5174 - 2.5173)		5	5	5	56	56	56	6	6	6	67	67	67	7	7	7	78	78	78	8	8	8	8	8	8

PBIC2375E

Fig. 217: Main Bearing Selection Table
Courtesy of NISSAN MOTOR CO., U.S.A.

Main Bearing Selection Table (No. 2, 3 and 4 Journal)

Crankshaft main journal diameter: I.D. mark	Crankshaft main journal diameter: Axle diameter Unit: mm (in)	Cylinder block main bearing housing inner diameter: I.D. mark	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	V	W	X	Y	1	2
		Hole diameter Unit: mm (in)	68.944 - 68.945 (2.7143 - 2.7144)	68.945 - 68.946 (2.7144 - 2.7144)	68.946 - 68.947 (2.7144 - 2.7144)	68.947 - 68.948 (2.7144 - 2.7145)	68.948 - 68.949 (2.7145 - 2.7145)	68.949 - 68.950 (2.7145 - 2.7146)	68.950 - 68.951 (2.7146 - 2.7146)	68.951 - 68.952 (2.7146 - 2.7146)	68.952 - 68.953 (2.7146 - 2.7147)	68.953 - 68.954 (2.7147 - 2.7147)	68.954 - 68.955 (2.7147 - 2.7148)	68.955 - 68.956 (2.7148 - 2.7148)	68.956 - 68.957 (2.7148 - 2.7148)	68.957 - 68.958 (2.7148 - 2.7149)	68.958 - 68.959 (2.7149 - 2.7149)	68.959 - 68.960 (2.7149 - 2.7150)	68.960 - 68.961 (2.7150 - 2.7150)	68.961 - 68.962 (2.7150 - 2.7150)	68.962 - 68.963 (2.7150 - 2.7151)	68.963 - 68.964 (2.7151 - 2.7151)	68.964 - 68.965 (2.7151 - 2.7152)	68.965 - 68.966 (2.7152 - 2.7152)	68.966 - 68.967 (2.7152 - 2.7152)	68.967 - 68.968 (2.7152 - 2.7153)
A	63.964 - 63.963 (2.5183 - 2.5182)		0	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	
B	63.963 - 63.962 (2.5182 - 2.5182)		0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	
C	63.962 - 63.961 (2.5182 - 2.5181)		01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	
D	63.961 - 63.960 (2.5181 - 2.5181)		01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	
E	63.960 - 63.959 (2.5181 - 2.5181)		01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	
F	63.959 - 63.958 (2.5181 - 2.5180)		1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	
G	63.958 - 63.957 (2.5180 - 2.5180)		1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	
H	63.957 - 63.956 (2.5180 - 2.5179)		1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	
J	63.956 - 63.955 (2.5179 - 2.5179)		12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	
K	63.955 - 63.954 (2.5179 - 2.5179)		12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	
L	63.954 - 63.953 (2.5179 - 2.5178)		12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	
M	63.953 - 63.952 (2.5178 - 2.5178)		2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	
N	63.952 - 63.951 (2.5178 - 2.5178)		2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	
P	63.951 - 63.950 (2.5178 - 2.5177)		2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	
R	63.950 - 63.949 (2.5177 - 2.5177)		23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	
S	63.949 - 63.948 (2.5177 - 2.5176)		23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	
T	63.948 - 63.947 (2.5176 - 2.5176)		23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	
U	63.947 - 63.946 (2.5176 - 2.5176)		3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	
V	63.946 - 63.945 (2.5176 - 2.5175)		3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	
W	63.945 - 63.944 (2.5175 - 2.5175)		3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7	
X	63.944 - 63.943 (2.5175 - 2.5174)		34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7	
Y	63.943 - 63.942 (2.5174 - 2.5174)		34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7	78	
1	63.942 - 63.941 (2.5174 - 2.5174)		34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7	78	78	
2	63.941 - 63.940 (2.5174 - 2.5173)		4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7	78	78	78	

PBIC2376E

Fig. 218: Main Bearing Selection Table
Courtesy of NISSAN MOTOR CO., U.S.A.

Main Bearing Grade Table (All Journals)

MAIN BEARING GRADE TABLE

Unit: mm (in)

Grade number	Thickness	Identification color	Remarks
0	2.483 - 2.486 (0.0978 - 0.0979)	Black	
1	2.486 - 2.489 (0.0979 - 0.0980)	Brown	
2	2.489 - 2.492 (0.0980 - 0.0981)	Green	

3		2.492 - 2.495 (0.0981 - 0.0982)	Yellow	Grade and color are the same for upper and lower bearings.
4		2.495 - 2.498 (0.0982 - 0.0983)	Blue	
5		2.498 - 2.501 (0.0983 - 0.0985)	Pink	
6		2.501 - 2.504 (0.0985 - 0.0986)	Purple	
7		2.504 - 2.507 (0.0986 - 0.0987)	White	
8		2.507 - 2.510 (0.0987 - 0.0988)	Red	
01	UPR	2.483 - 2.486 (0.0978 - 0.0979)	Black	Grade and color are different for upper and lower bearings.
	LWR	2.486 - 2.489 (0.0979 - 0.0980)	Brown	
12	UPR	2.486 - 2.489 (0.0979 - 0.0980)	Brown	
	LWR	2.489 - 2.492 (0.0980 - 0.0981)	Green	
23	UPR	2.489 - 2.492 (0.0980 - 0.0981)	Green	
	LWR	2.492 - 2.495 (0.0981 - 0.0982)	Yellow	
34	UPR	2.492 - 2.495 (0.0981 - 0.0982)	Yellow	
	LWR	2.495 - 2.498 (0.0982 - 0.0983)	Blue	
45	UPR	2.495 - 2.498 (0.0982 - 0.0983)	Blue	
	LWR	2.498 - 2.501 (0.0983 - 0.0985)	Pink	
56	UPR	2.498 - 2.501 (0.0983 - 0.0985)	Pink	
	LWR	2.501 - 2.504 (0.0985 - 0.0986)	Purple	
67	UPR	2.501 - 2.504 (0.0985 - 0.0986)	Purple	
	LWR	2.504 - 2.507 (0.0986 - 0.0987)	White	
78	UPR	2.504 - 2.507 (0.0986 - 0.0987)	White	
	LWR	2.507 - 2.510 (0.0987 - 0.0988)	Red	

Use 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 [1.5 mm (0.059 in)].

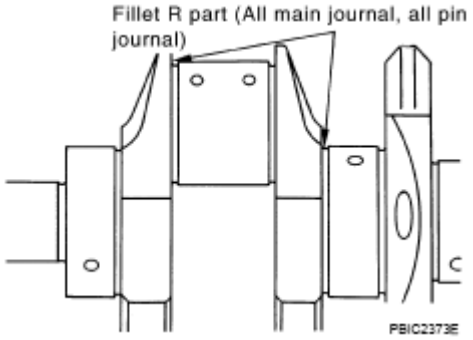


Fig. 219: Identifying Crankshaft Main Journal
Courtesy of NISSAN MOTOR CO., U.S.A.

Bearing undersize table

THICKNESS TABLE

Unit: mm (in)	
Size	**Thickness**
US 0.25 (0.0098)	2.618 - 2.626 (0.1031 - 0.1034)

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)

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

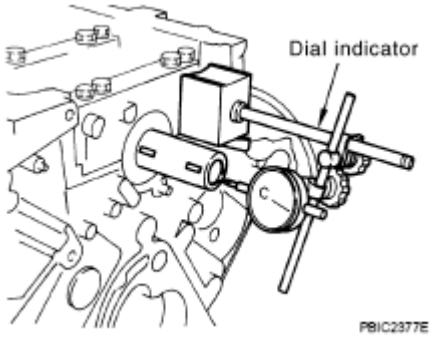


Fig. 220: Measuring Clearance Between Thrust Bearings And Crankshaft Arm
Courtesy of NISSAN MOTOR CO., U.S.A.

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)

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

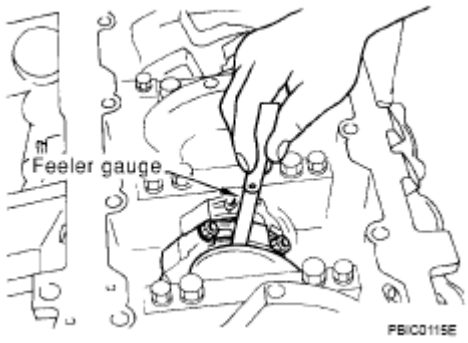


Fig. 221: Measuring Connecting Rod Side Clearance
Courtesy of NISSAN MOTOR CO., U.S.A.

PISTON TO PISTON PIN OIL CLEARANCE

Piston Pin Hole Diameter

Measure the inner diameter of piston pin hole with inside micrometer.

Standard: 21.993 - 22.005 mm (0.8659 - 0.8663 in)

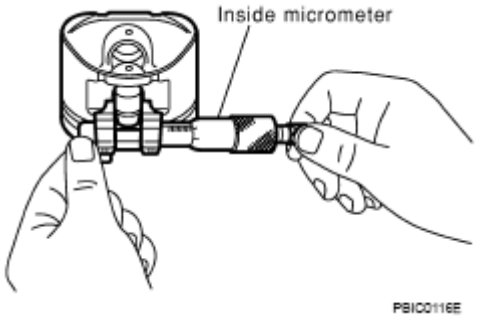


Fig. 222: Measuring Inner Diameter Of Piston Pin Hole
Courtesy of NISSAN MOTOR CO., U.S.A.

Piston Pin Outer Diameter

Measure the outer diameter of piston pin with micrometer.

Standard: 21.989 - 22.001 mm (0.8657 - 0.8662 in)

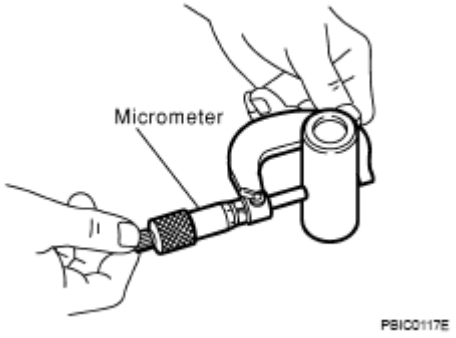


Fig. 223: Measuring Outer Diameter Of Piston Pin With Micrometer
Courtesy of NISSAN MOTOR CO., U.S.A.

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 and piston ring groove with feeler gauge.

  Standard:

  Top ring: 0.045 - 0.080 mm (0.0018 - 0.0031 in)

  2nd ring: 0.030 - 0.070 mm (0.0012 - 0.0028 in)

  Oil ring: 0.065 - 0.135 mm (0.0026 - 0.0053 in)

  Limit:

  Top ring: 0.11 mm (0.0043 in)

  2nd ring: 0.10 mm (0.0039 in)

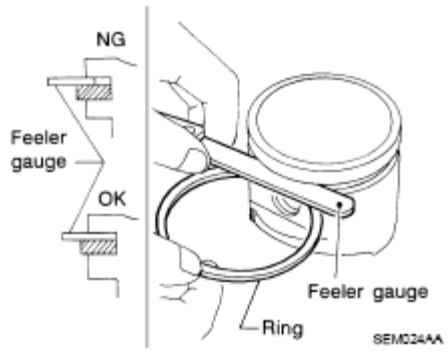


Fig. 224: Measuring Side Clearance Of Piston Ring And Piston Ring Groove
Courtesy of NISSAN MOTOR CO., U.S.A.

- 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 the cylinder bore inner diameter is within the specification. Refer to **CYLINDER BORE INNER DIAMETER**.
- Lubricate with new engine oil to piston and piston ring, and then insert piston ring until middle of cylinder with piston, and measure the piston ring end gap with feeler gauge.

  Standard:

  Top ring: 0.22 - 0.32 mm (0.0087 - 0.0126 in)

  2nd ring: 0.22 - 0.32 mm (0.0087 - 0.0126 in)

Oil ring: 0.20 - 0.50 mm (0.0079 - 0.0197 in)

Limit:

Top ring: 0.56 mm (0.0220 in)

2nd ring: 0.56 mm (0.0220 in)

Oil ring: 0.96 mm (0.0378 in)

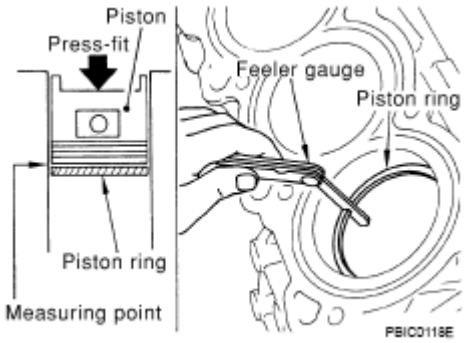


Fig. 225: Checking Piston Ring End Gap
Courtesy of NISSAN MOTOR CO., U.S.A.

- 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.

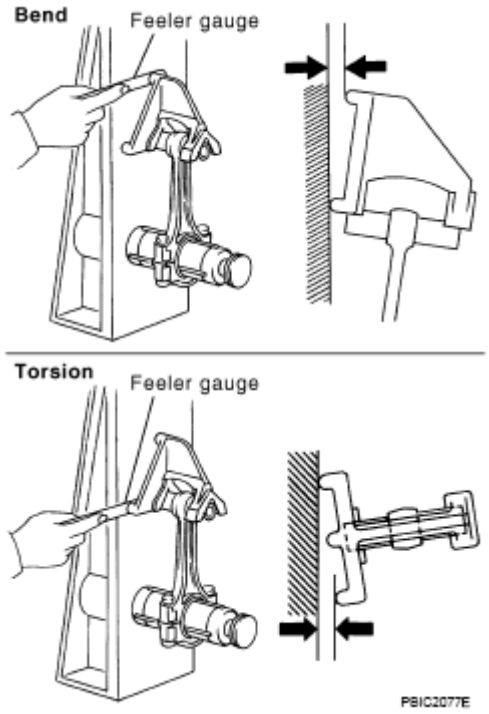


Fig. 226: Checking Connecting Rod Bend And Torsion
Courtesy of NISSAN MOTOR CO., U.S.A.

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 **DISASSEMBLY AND ASSEMBLY** for the tightening procedure.
- Measure the inner diameter of connecting rod big end with inside micrometer.

  Standard: 55.000 - 55.013 mm (2.1654 - 2.1659 in)

- If out of the standard, replace connecting rod assembly.

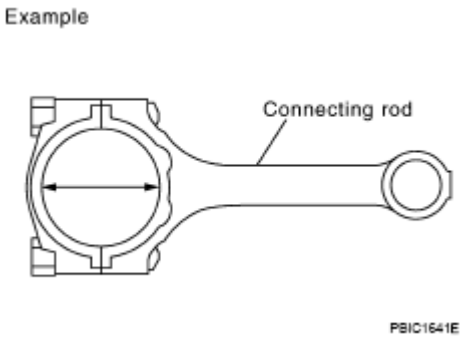


Fig. 227: Measuring Inner Diameter Of Connecting Rod Big End With Inside Micrometer
Courtesy of NISSAN MOTOR CO., U.S.A.

CONNECTING ROD BUSHING OIL CLEARANCE

Connecting Rod Bushing Inner Diameter

Measure the inner diameter of connecting rod bushing with inside micrometer.

Standard: 22.000 - 22.012 mm (0.8661 - 0.8666 in)

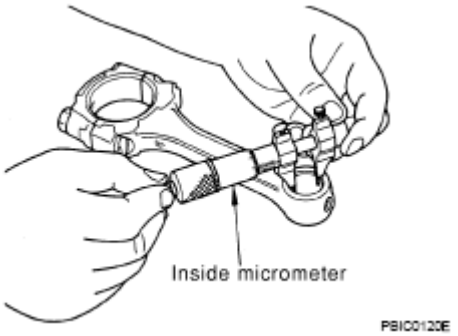


Fig. 228: Measuring Inner Diameter Of Connecting Rod Bushing With Inside Micrometer
Courtesy of NISSAN MOTOR CO., U.S.A.

Piston Pin Outer Diameter

Measure the outer diameter of piston pin with micrometer.

Standard: 21.989 - 22.001 mm (0.8657 - 0.8662 in)

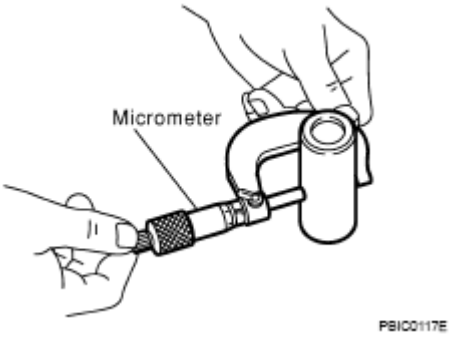


Fig. 229: Measuring Outer Diameter Of Piston Pin With Micrometer
Courtesy of NISSAN MOTOR CO., U.S.A.

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 calculated 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.

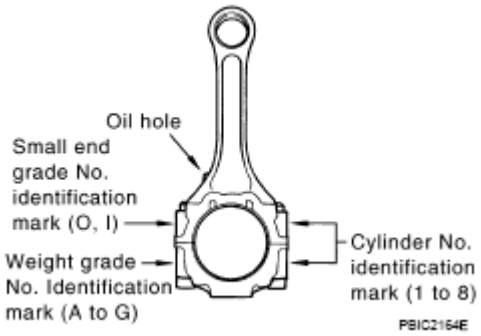


Fig. 230: Identifying Cylinder Number Marks On Connecting Rod
Courtesy of NISSAN MOTOR CO., U.S.A.

Factory installed parts grading:

- Service parts apply only to grade "0".

GRADE REFERENCE

		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		

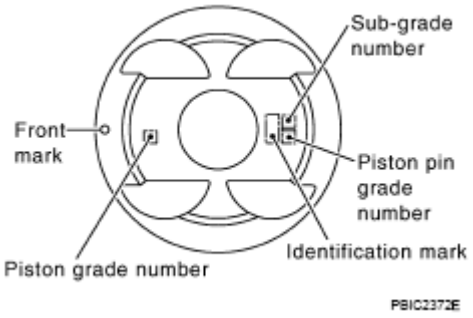


Fig. 231: Identifying Piston Pin Grade Number
Courtesy of NISSAN MOTOR CO., U.S.A.

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 with straightedge and feeler gauge.

Limit: 0.1 mm (0.004 in)

- If it exceeds the limit, replace cylinder block.

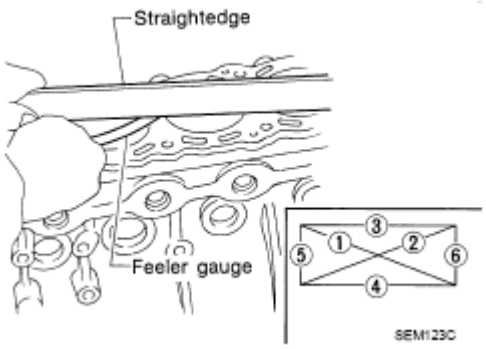


Fig. 232: Checking Distortion Of Cylinder Block Upper Face
Courtesy of NISSAN MOTOR CO., U.S.A.

MAIN BEARING HOUSING INNER DIAMETER

- Install main bearing caps and main bearing without installing main bearings, and tighten main bearing cap bolts to the specified torque. Refer to **DISASSEMBLY AND ASSEMBLY** for the tightening procedure.
- Measure the inner diameter of main bearing housing with bore gauge.

Standard: 68.944 - 68.968 mm (2.7143 - 2.7153 in)

- If out of the standard, replace cylinder block and main bearing caps as assembly.

NOTE: Cylinder block cannot be replaced as a single part, because it is machined together with main bearing caps.

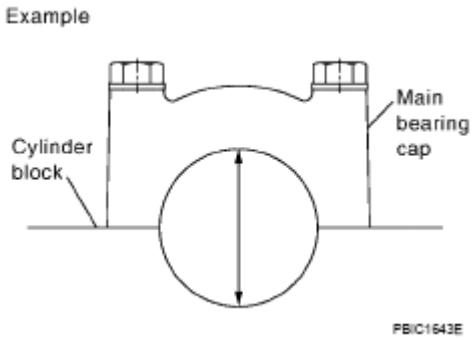


Fig. 233: Measuring Cylinder Bore Diameter
Courtesy of NISSAN MOTOR CO., U.S.A.

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. ("X" and "Y" directions at "A", "B" and "C") ("X" is in longitudinal direction of engine)

  Standard inner diameter:

  93.000 - 93.030 mm (3.6614 - 3.6626 in)

  Wear limit:

  0.2 mm (0.008 in)

  Out-of-round (Difference between "X" and "Y"):

  0.015 mm (0.0006 in)

  Taper limit (Difference between "A" and "C"):

  0.01 mm (0.0004 in)

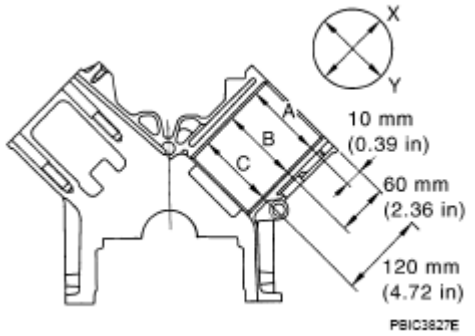


Fig. 234: Identifying Cylinder Dimension

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 oversize pistons for all cylinders with oversize piston rings.

Oversize (O/S): 0.2 mm (0.008 in)

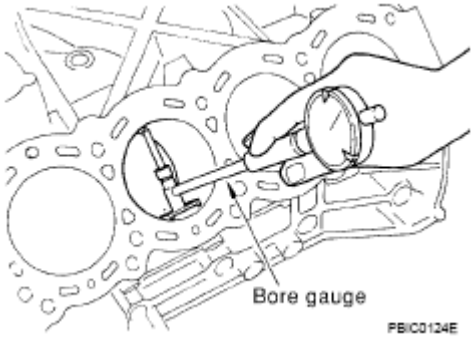


Fig. 235: Identifying Bore Gauge
Courtesy of NISSAN MOTOR CO., U.S.A.

Piston Skirt Diameter

- Measure the outer diameter of piston skirt with micrometer.

Standard

: 92.980 - 93.010 mm (3.6606 - 3.6618 in)

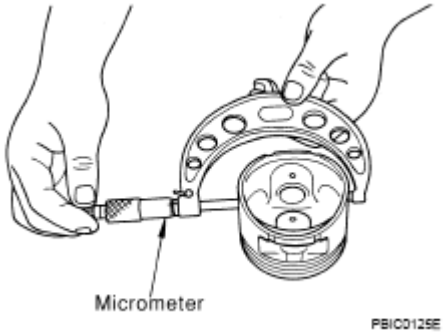


Fig. 236: Checking Outer Diameter Of Piston
Courtesy of NISSAN MOTOR CO., U.S.A.

- Measure point "H" (Distance from the top): 42 mm (1.65 in)

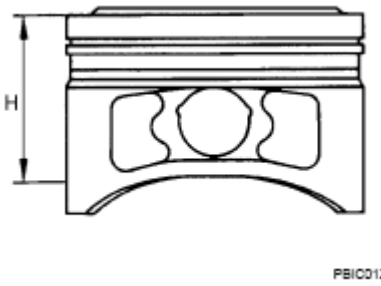


Fig. 237: Measuring Piston Point H
Courtesy of NISSAN MOTOR CO., U.S.A.

Piston to Cylinder Bore Clearance

Calculate by piston skirt diameter and cylinder bore inner diameter (direction "Y", position "B").

(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 the calculated value exceeds the limit, replace piston and piston pin assembly. Refer to **HOW TO SELECT PISTON AND BEARING**.

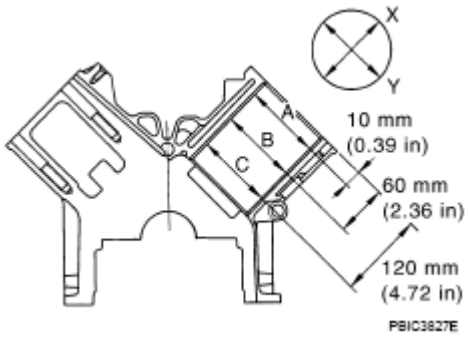


Fig. 238: Identifying Cylinder Dimension
Courtesy of NISSAN MOTOR CO., U.S.A.

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 main bearing caps and main bearing, 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: 63.940 - 63.964 mm (2.5173 - 2.5183 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.

  Standard: 51.956 - 51.974 mm (2.0455 - 2.0462 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**.

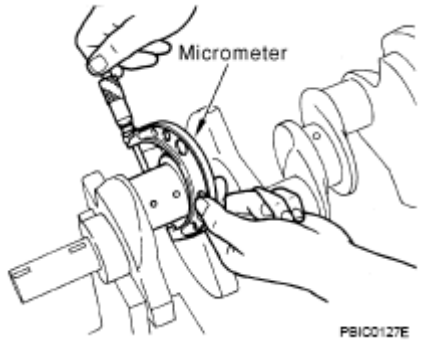


Fig. 239: Checking Outer Diameter Of Crankshaft Pin Journal With Micrometer
Courtesy of NISSAN MOTOR CO., U.S.A.

CRANKSHAFT OUT-OF-ROUND AND TAPER

- Measure the dimensions at four different points as shown below on each main journal and pin journal with micrometer.
- Out-of-round is indicated by the difference in the dimensions between "X" and "Y" at "A" and "B".
- Taper is indicated by the difference in the dimensions between "A" and "B" at "X" and "Y".

Limit:

Out-of-round (Difference between "X" and "Y")

: 0.015 mm (0.0006 in)

Taper (Difference between "A" and "B")

: 0.010 mm (0.0004 in)

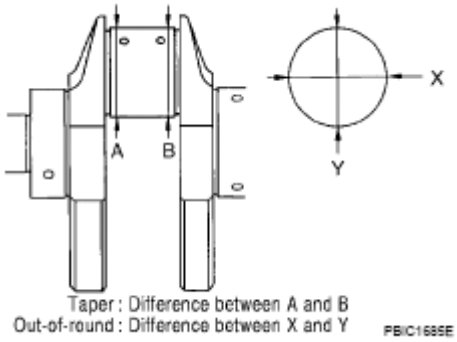


Fig. 240: Measuring Dimensions Four Different Points
Courtesy of NISSAN MOTOR CO., U.S.A.

- 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)

- If it exceeds the limit, replace crankshaft.

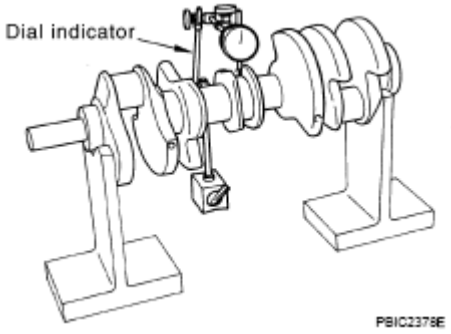


Fig. 241: Identifying Quick Connector Cap To Quick Connector Connection
Courtesy of NISSAN MOTOR CO., U.S.A.

CONNECTING ROD BEARING OIL CLEARANCE

Method by Calculation

- Install connecting rod bearings to connecting rod and cap, and tighten connecting rod bolts to the specified torque. Refer to **DISASSEMBLY AND ASSEMBLY** 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)

  Standard: 0.020 - 0.045 mm (0.0008 - 0.0018 in) (actual clearance)

  Limit: 0.055 mm (0.0022 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 **DISASSEMBLY AND ASSEMBLY** 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.

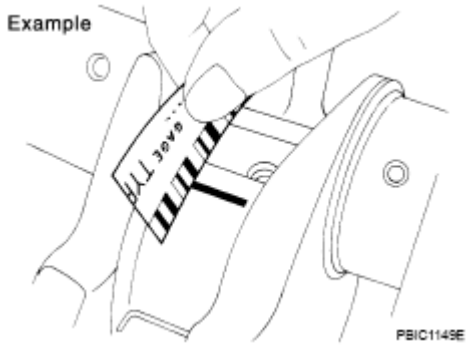


Fig. 242: Measuring Plastigage Width
Courtesy of NISSAN MOTOR CO., U.S.A.

MAIN BEARING OIL CLEARANCE

Method by Calculation

- Install main bearings to cylinder block and main bearing caps, and tighten main bearing cap bolts with main bearing to the specified torque. Refer to **DISASSEMBLY AND ASSEMBLY** for the tightening procedure.
- Measure the inner diameter of main bearing with bore gauge.

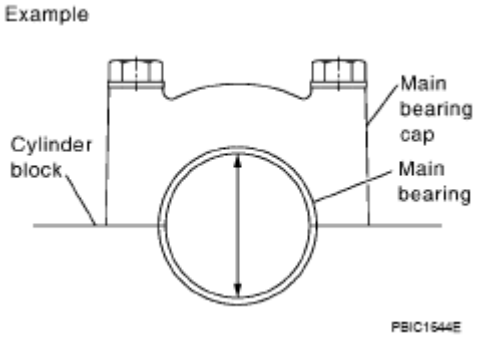


Fig. 243: Checking Main Bearing Oil Clearance
Courtesy of NISSAN MOTOR CO., U.S.A.

(Bearing clearance) = (Main bearing inner diameter) - (Crankshaft main journal diameter)

Standard

No. 1 and 5 journal: 0.001 - 0.011 mm (0.00004 - 0.0004 in)

No. 2, 3 and 4 journal: 0.007 - 0.017 mm (0.0003 - 0.0007 in)

Limit

No. 1 and 5 journal: 0.021 mm (0.0008 in)

No. 2, 3 and 4 journal: 0.027 mm (0.0011 in)

- If the calculated value 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 main bearing caps, and tighten main bearing bolts with main bearing to the specified torque. Refer to **DISASSEMBLY AND ASSEMBLY** for the tightening procedure.

CAUTION: Never rotate crankshaft.

- Remove main bearing caps 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 Method by Calculation.

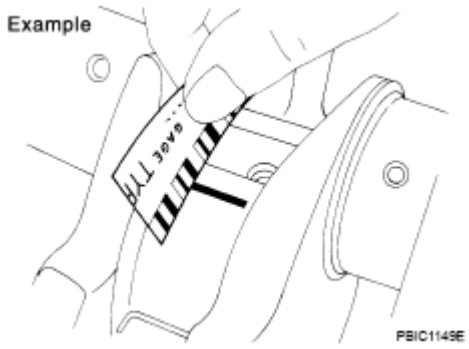


Fig. 244: Measuring Plastigage Width
Courtesy of NISSAN MOTOR CO., U.S.A.

CRUSH HEIGHT OF MAIN BEARING

- When main bearing cap is removed after being tightened to the specified torque with main bearings installed, the tip end of bearing must protrude. Refer to **DISASSEMBLY AND ASSEMBLY** for the tightening procedure.

  Standard: There must be crush height .

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

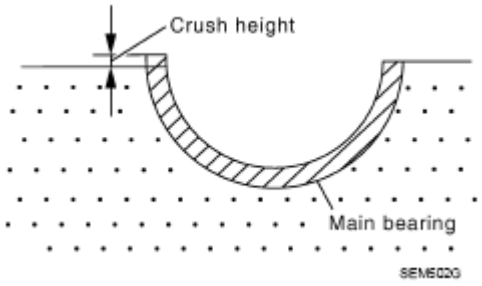


Fig. 245: Identifying Crush Height Of Main Bearing
Courtesy of NISSAN MOTOR CO., U.S.A.

CRUSH HEIGHT OF CONNECTING ROD BEARING

- When connecting rod bearing cap is removed after being tightened to the specified torque with connecting rod bearings installed, the tip end of bearing must protrude. Refer to **DISASSEMBLY AND ASSEMBLY** for the tightening procedure.

  Standard: There must be crush height .

- If the standard is not met, replace connecting rod bearings.

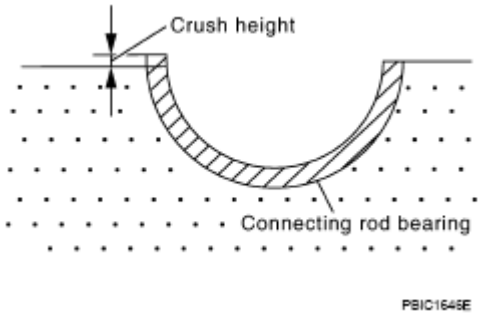


Fig. 246: Identifying Crush Height Of Connecting Rod Bearing
Courtesy of NISSAN MOTOR CO., U.S.A.

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.

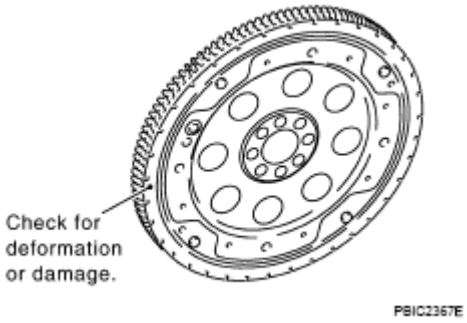


Fig. 247: Identifying Drive Plate
Courtesy of NISSAN MOTOR CO., U.S.A.

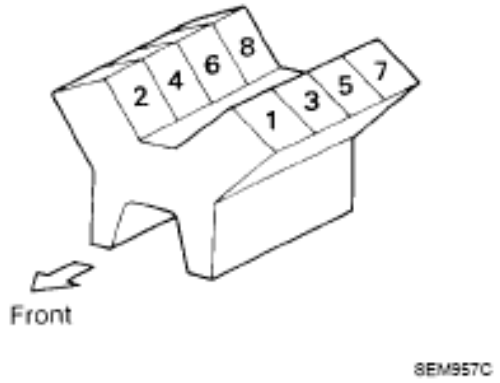
SERVICE DATA AND SPECIFICATIONS (SDS)

Standard and Limit

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Cylinder arrangement	V-8

Displacement cm^3 (cu in)		4,494 (274.22)
Bore and stroke mm (in)		93 x 82.7 (3.66 x 3.256)
Valve arrangement		DOHC
Firing order		1-8-7-3-6-5-4-2
Number of piston rings	Compression	2
	Oil	1
Number of main bearings		5
Compression ratio		10.5
Compression pressure kPa (kg/cm^2 , psi)/300 RPM	Standard	1,320 (13.5, 191)
	Minimum	1,130 (11.5, 164)
	Differential limit between cylinders	98 (1.0, 14)
Cylinder number		
Valve timing		

Unit: degree

a	b	c	d	e	f
228	240	-2	62	4	44

DRIVE BELTS

DRIVE BELTS SPECIFICATION

Tension of drive belts	Auto adjustment by auto tensioner

INTAKE MANIFOLD AND EXHAUST MANIFOLD

INTAKE MANIFOLD AND EXHAUST MANIFOLD SPECIFICATION

Unit: mm (in)

Items		Limit
Surface distortion	Intake manifold (upper)	0.1 (0.004)
	Intake manifold (lower)	0.1 (0.004)
	Exhaust manifold	0.3 (0.012)

SPARK PLUG

SPARK PLUG SPECIFICATION

Unit: mm (in)

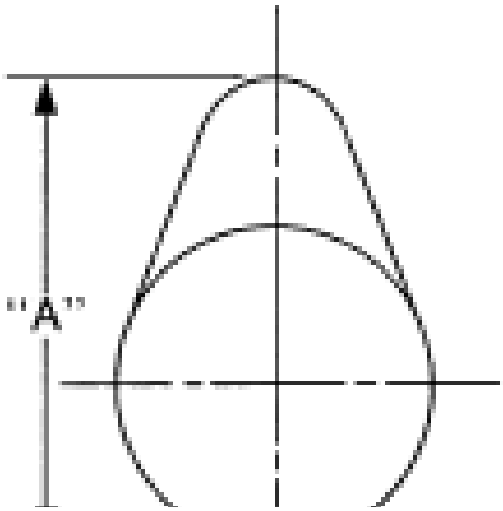
Make	NGK
Standard type	PLFR5A-11
Hot type	PLFR4A-11
Cold type	PLFR6A-11
Gap (Nominal)	1.1 (0.043)

CAMSHAFT AND CAMSHAFT BEARING

CAMSHAFT AND CAMSHAFT BEARING SPECIFICATION

Unit: mm (in)

Items		Standard	Limit
Camshaft journal oil clearance	No. 1	0.045 - 0.083 (0.0018 - 0.0033)	-
	No. 2, 3, 4, 5	0.030 - 0.068 (0.0012 - 0.0027)	-
Camshaft journal diameter	No. 1	25.938 - 25.955 (1.0212 - 1.0218)	-
	No. 2, 3, 4, 5	25.953 - 25.970 (1.0218 - 1.0224)	-
Camshaft bracket inner diameter		26.000 - 26.021 (1.0236 - 1.0244)	-
Camshaft end play		0.115 - 0.188 (0.0045 - 0.0074)	-
Cam height "A"	Intake	44.865 - 45.055 (1.7663 - 1.7738)	0.2 (0.008)
	Exhaust	43.925 - 44.115 (1.7293 - 1.7368)	0.2 (0.008)
Camshaft runout (TIR[1])		0.02 (0.0008)	0.05 (0.0020)
Camshaft sprocket runout (TIR[1])		-	0.15 (0.0059)



(1) Total indicator reading

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)

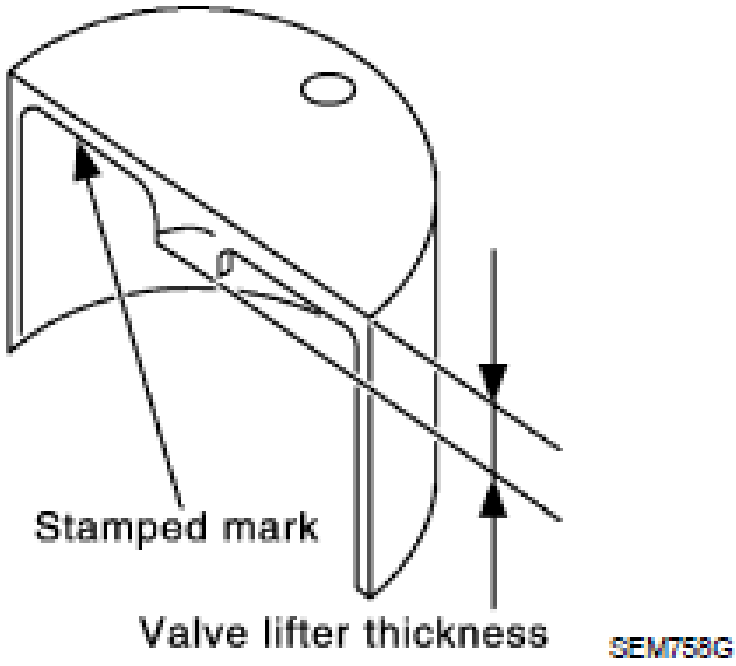
AVAILABLE VALVE LIFTER

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)



VALVE LIFTER

VALVE LIFTER SPECIFICATION

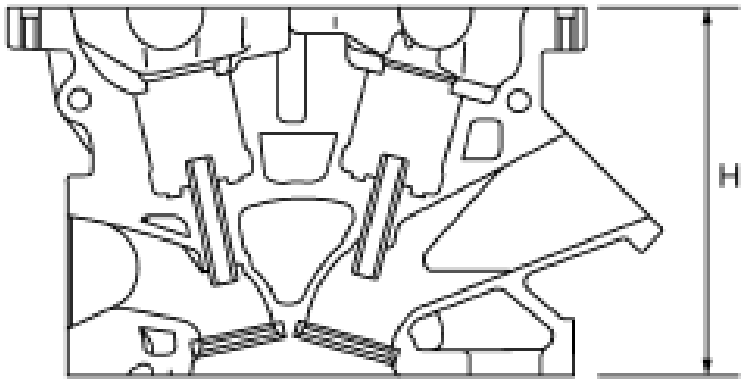
Items	Standard
Valve lifter outer diameter	33.977 - 33.987 (1.3377 - 1.3381)
Valve lifter hole diameter	34.000 - 34.016 (1.3386 - 1.3392)
Valve lifter clearance	0.013 - 0.039 (0.0005 - 0.0015)

CYLINDER HEAD

CYLINDER HEAD SPECIFICATION

Unit: mm (in)

Items	Standard	Limit
Surface distortion	Less than 0.03 (0.0012)	0.1 (0.004)



Nominal cylinder head height:
H = 126.4 mm (4.98 in)

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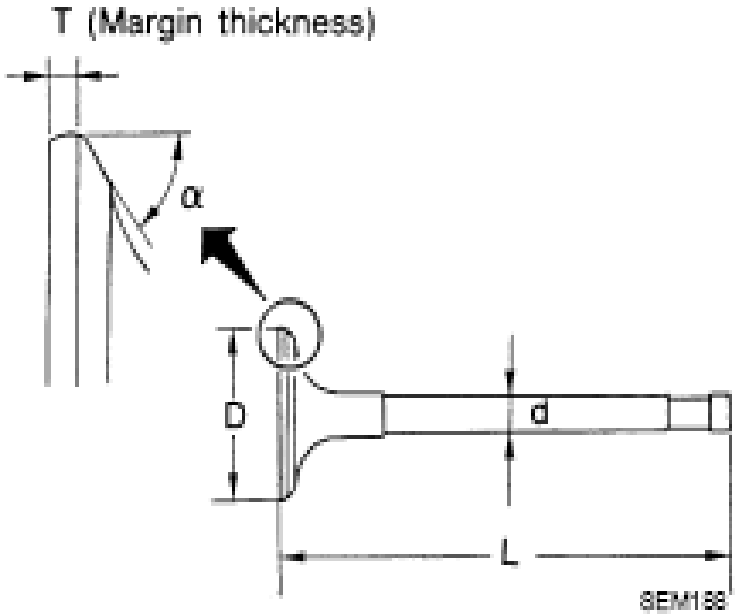
VALVE DIMENSIONS

VALVE DIMENSIONS TABLE

Unit: mm (in)

Items		Standard
Valve head diameter "D"	Intake	36.0 - 36.3 (1.417 - 1.429)
	Exhaust	31.2 - 31.5 (1.228 - 1.240)
Valve length "L"	Intake	96.57 (3.8020)
	Exhaust	94.50 (3.7205)
Valve stem diameter "d"	Intake	5.972 - 5.980 (0.2351 - 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	1.15 - 1.45 (0.0453 - 0.0571)
	Exhaust	1.85 - 2.15 (0.0728 - 0.0846)

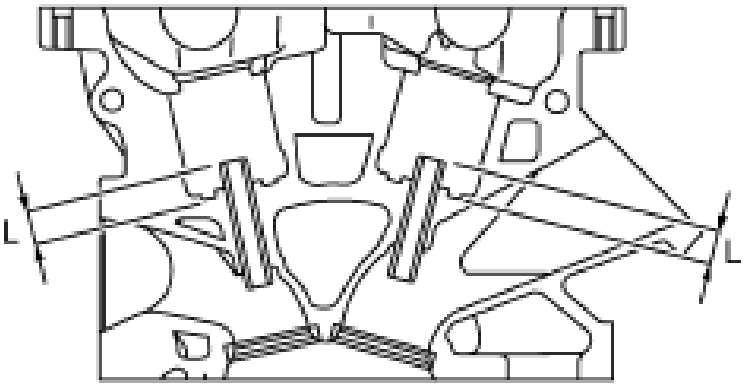


VALVE GUIDE

VALVE GUIDE SPECIFICATION

Unit: mm (in)

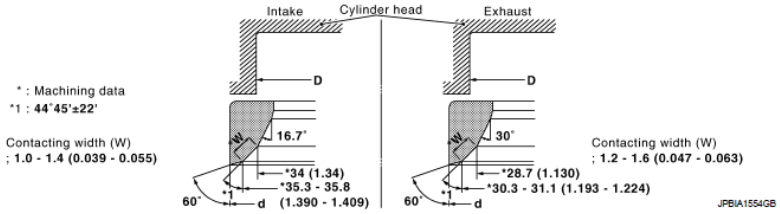
Items		Standard	Oversize (Service) [0.2 (0.008)]
Valve guide	Outer diameter	10.023 - 10.034 (0.3946 - 0.3950)	10.223 - 10.234 (0.4025 - 0.4029)
	Inner diameter (Finished size)	6.000 - 6.018 (0.2362 - 0.2369)	
Cylinder head valve guide hole diameter		9.975 - 9.996 (0.3927 - 0.3935)	10.175 - 10.196 (0.4006 - 0.4014)
Interference fit of valve guide		0.027 - 0.059 (0.0011 - 0.0023)	
Items		Standard	Limit
Valve guide clearance	Intake	0.020 - 0.046 (0.0008 - 0.0018)	0.08 (0.0031)
	Exhaust	0.030 - 0.056 (0.0012 - 0.0022)	0.1 (0.004)
Projection length "L"	Intake	10.1 - 10.3 (0.398 - 0.406)	-
	Exhaust	10.0 - 10.4 (0.394 - 0.409)	-



VALVE SEAT

VALVE SEAT SPECIFICATION

Unit: mm (in)



Items		Standard	Oversize (Service) [0.5 (0.020)]
Cylinder head seat recess diameter "D"	Intake	37.000 - 37.016 (1.4567 - 1.4573)	37.500 - 37.516 (1.4764 - 1.4770)
	Exhaust	32.200 - 32.216 (1.2677 - 1.2683)	32.700 - 32.716 (1.2874 - 1.2880)
Valve seat interference fit	Intake	0.081 - 0.113 (0.0032 - 0.0044)	
	Exhaust	0.064 - 0.096 (0.0025 - 0.0038)	
Valve seat outer diameter "d"	Intake	37.097 - 37.113 (1.4605 - 1.4611)	37.597 - 37.613 (1.4802 - 1.4808)
	Exhaust	32.280 - 32.296 (1.2709 - 1.2715)	32.780 - 32.796 (1.2905 - 1.2912)

VALVE SPRING

VALVE SPRING SPECIFICATION

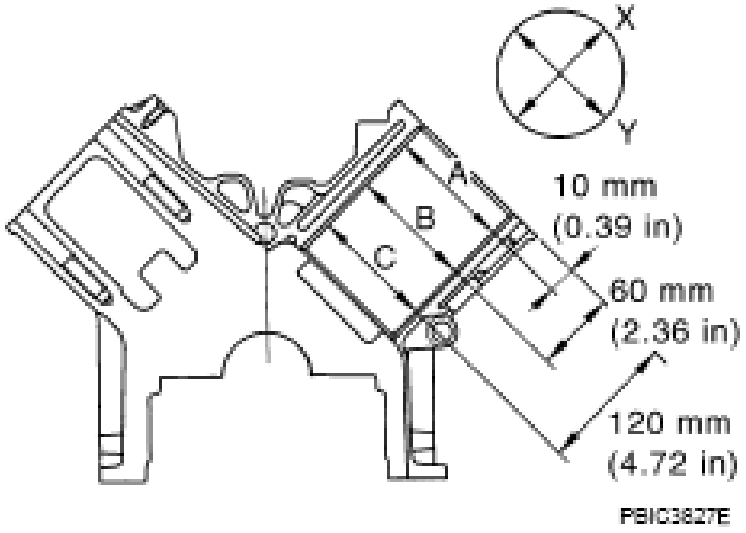
Free height mm (in)		46.35 - 46.85 (1.8248 - 1.8445)
Pressure N (kg, lb) at height mm	Installation	165 - 189 (16.8 - 19.3, 37 - 42) at 33.8 (1.331)

(in)	Valve open	290 - 330 (29.6 - 33.7, 65 - 74) at 24.4 (0.961)
Out-of-square mm (in)	Limit	2.0 (0.079)

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		68.944 - 68.968 (2.7143 - 2.7153)
Cylinder bore inner diameter	Standard	Grade No. 1	93.000 - 93.010 (3.6614 - 3.6618)
		Grade No. 2	93.010 - 93.020 (3.6618 - 3.6622)
		Grade No. 3	93.020 - 93.030 (3.6622 - 3.6626)
	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")			0.01 (0.0004)
		Grade No. A	68.944 - 68.945 (2.7143 - 2.7144)
		Grade No. B	68.945 - 68.946 (2.7144 - 2.7144)
		Grade No. C	68.946 - 68.947 (2.7144 - 2.7144)

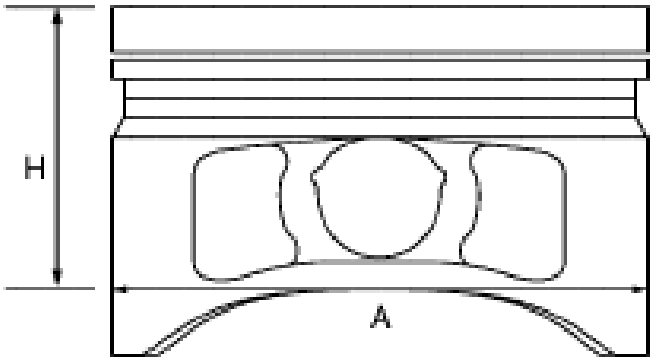
Main bearing housing inner diameter (Without bearing)	Grade No. D	68.947 - 68.948 (2.7144 - 2.7145)
	Grade No. E	68.948 - 68.949 (2.7145 - 2.7145)
	Grade No. F	68.949 - 68.950 (2.7145 - 2.7146)
	Grade No. G	68.950 - 68.951 (2.7146 - 2.7146)
	Grade No. H	68.951 - 68.952 (2.7146 - 2.7146)
	Grade No. J	68.952 - 68.953 (2.7146 - 2.7147)
	Grade No. K	68.953 - 68.954 (2.7147 - 2.7147)
	Grade No. L	68.954 - 68.955 (2.7147 - 2.7148)
	Grade No. M	68.955 - 68.956 (2.7148 - 2.7148)
	Grade No. N	68.956 - 68.957 (2.7148 - 2.7148)
	Grade No. P	68.957 - 68.958 (2.7148 - 2.7149)
	Grade No. R	68.958 - 68.959 (2.7149 - 2.7149)
	Grade No. S	68.959 - 68.960 (2.7149 - 2.7150)
	Grade No. T	68.960 - 68.961 (2.7150 - 2.7150)
	Grade No. U	R68.961 - 68.962 (2.7150 - 2.7150)
	Grade No. V	68.962 - 68.963 (2.7150 - 2.7151)
	Grade No. W	68.963 - 68.964 (2.7151 - 2.7151)
	Grade No. X	68.964 - 68.965 (2.7151 - 2.7152)
	Grade No. Y	68.965 - 68.966 (2.7152 - 2.7152)
	Grade No. 1	68.966 - 68.967 (2.7152 - 2.7152)
	Grade No. 2	68.967 - 68.968 (2.7152 - 2.7153)
Difference in inner diameter between cylinders	Standard	Less than 0.03 (0.0012)

PISTON, PISTON RING AND PISTON PIN

AVAILABLE PISTON

PISTON SPECIFICATION

Unit: mm (in)



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Items		Standard	Oversize (Service) [0.2 (0.008)]
Piston skirt diameter "A"	Grade No. 1	92.980 - 92.990 (3.6606 - 3.6610)	-
	Grade No. 2	92.990 - 93.000 (3.6610 - 3.6614)	-
	Grade No. 3	93.000 - 93.010 (3.6614 - 3.6618)	-
	Service	-	93.180 - 93.210 (3.6685 - 3.6697)
"H" dimension		42 (1.65)	
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	Standard	0.010 - 0.030 (0.0004 - 0.0012)	
	Limit	0.08 (0.0031)	

PISTON RING

PISTON RING SPECIFICATION

Unit: mm (in)

Items		Standard	Limit
Side clearance	Top	0.045 - 0.080 (0.0018 - 0.0031)	0.11 (0.0043)
	2nd	0.030 - 0.070 (0.0012 - 0.0028)	0.10 (0.0039)

	Oil ring	0.065 - 0.135 (0.0026 - 0.0053)	-
End gap	Top	0.22 - 0.32 (0.0087 - 0.0126)	0.56 (0.0220)
	2nd	0.22 - 0.32 (0.0087 - 0.0126)	0.56 (0.0220)
	Oil (rail ring)	0.20 - 0.50 (0.0079 - 0.0197)	0.96 (0.0378)

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)

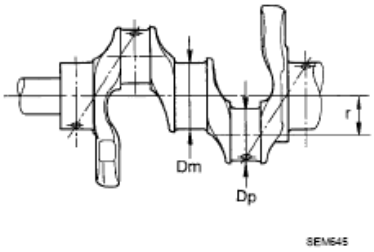
Items		Standard	Limit
Center distance		146.95 - 147.05 (5.79 - 5.79)	-
Bend [per 100 (3.94)]		-	0.15 (0.0059)
Torsion [per 100 (3.94)]		-	0.30 (0.0118)
Connecting rod bushing inner diameter(1)	Grade No. 0	22.000 - 22.006 (0.8661 - 0.8664)	-
	Grade No. 1	22.006 - 22.012 (0.8664 - 0.8666)	-
Connecting rod big end diameter (without bearing)		55.000 - 55.013 (2.1654 - 2.1659)	-
Side clearance		0.20 - 0.35 (0.0079 - 0.0138)	0.40 (0.0157)

(1) After installing in connecting rod

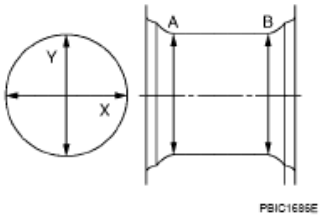
CRANKSHAFT

CRANKSHAFT SPECIFICATION

Unit: mm (in)



Out-of-round : Diffenrence between X and Y.
Taper : Diffenrence between A and B.



Main journal diameter "Dm" (No. 1 and 5 journal)		Grade No. G	63.963 - 63.964 (2.5182 - 2.5183)
		Grade No. H	63.962 - 63.963 (2.5182 - 2.5182)
		Grade No. J	63.961 - 63.962 (2.5181 - 2.5182)
		Grade No. K	63.960 - 63.961 (2.5181 - 2.5181)
		Grade No. L	63.959 - 63.960 (2.5181 - 2.5181)
		Grade No. M	63.958 - 63.959 (2.5180 - 2.5181)
		Grade No. N	63.957 - 63.958 (2.5180 - 2.5180)
		Grade No. P	63.956 - 63.957 (2.5179 - 2.5180)
		Grade No. R	63.955 - 63.956 (2.5179 - 2.5179)
		Grade No. S	63.954 - 63.955 (2.5179 - 2.5179)
		Grade No. T	63.953 - 63.954 (2.5178 - 2.5179)
		Grade No. U	63.952 - 63.953 (2.5178 - 2.5178)
		Grade No. V	63.951 - 63.952 (2.5178 - 2.5178)
		Grade No. W	63.950 - 63.951 (2.5177 - 2.5178)
		Grade No. X	63.949 - 63.950 (2.5177 - 2.5177)
		Grade No. Y	63.948 - 63.949 (2.5176 - 2.5177)
		Grade No. 1	63.947 - 63.948 (2.5176 - 2.5176)
		Grade No. 2	63.946 - 63.947 (2.5176 -

			2.5176)
		Grade No. 3	63.945 - 63.946 (2.5175 - 2.5176)
		Grade No. 4	63.944 - 63.945 (2.5175 - 2.5175)
		Grade No. 5	63.943 - 63.944 (2.5174 - 2.5175)
		Grade No. 6	63.942 - 63.943 (2.5174 - 2.5174)
		Grade No. 7	63.941 - 63.942 (2.5174 - 2.5174)
		Grade No. 9	63.940 - 63.941 (2.5173 - 2.5174)
Main journal diameter "Dm" (No. 2, 3 and 4 journal)		Grade No. A	63.963 - 63.964 (2.5182 - 2.5183)
		Grade No. B	63.962 - 63.963 (2.5182 - 2.5182)
		Grade No. C	63.961 - 63.962 (2.5181 - 2.5182)
		Grade No. D	63.960 - 63.961 (2.5181 - 2.5181)
		Grade No. E	63.959 - 63.960 (2.5181 - 2.5181)
		Grade No. F	63.958 - 63.959 (2.5180 - 2.5181)
		Grade No. G	63.957 - 63.958 (2.5180 - 2.5180)
		Grade No. H	63.956 - 63.957 (2.5179 - 2.5180)
		Grade No. J	63.955 - 63.956 (2.5179 - 2.5179)
		Grade No. K	63.954 - 63.955 (2.5179 - 2.5179)
		Grade No. L	63.953 - 63.954 (2.5178 - 2.5179)
		Grade No. M	63.952 - 63.953 (2.5178 - 2.5178)
		Grade No. N	63.951 - 63.952 (2.5178 - 2.5178)
		Grade No. P	63.950 - 63.951 (2.5177 - 2.5178)
		Grade No. R	63.949 - 63.950 (2.5177 - 2.5177)
		Grade No. S	63.948 - 63.949 (2.5176 - 2.5177)

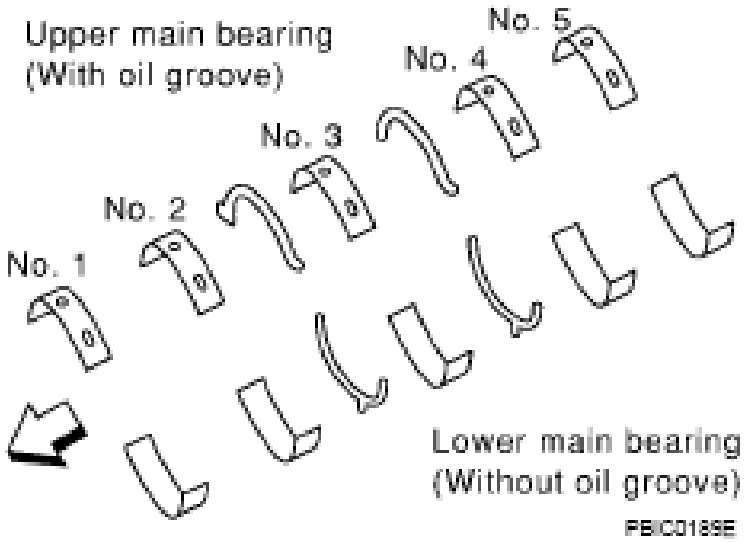
	Standard	Grade No. T	63.947 - 63.948 (2.5176 - 2.5176)
		Grade No. U	63.946 - 63.947 (2.5176 - 2.5176)
		Grade No. V	63.945 - 63.946 (2.5175 - 2.5176)
		Grade No. W	63.944 - 63.945 (2.5175 - 2.5175)
		Grade No. X	63.943 - 63.944 (2.5174 - 2.5175)
		Grade No. Y	63.942 - 63.943 (2.5174 - 2.5174)
		Grade No. 1	63.941 - 63.942 (2.5174 - 2.5174)
		Grade No. 2	63.940 - 63.941 (2.5173 - 2.5174)
Pin journal diameter "Dp"	Grade No. 0		51.968 - 51.974 (2.0460 - 2.0462)
	Grade No. 1		51.962 - 51.968 (2.0457 - 2.0460)
	Grade No. 2		51.956 - 51.962 (2.0455 - 2.0457)
Center distance "r"			41.31 - 41.39 (1.6264 - 1.6295)
Out-of-round (Difference between "X" and "Y")	Limit		0.015 (0.0006)
Taper (Difference between "A" and "B")	Limit		0.010 (0.0004)
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		Thickness	Identification color	Remarks
0		2.483 - 2.486 (0.0978 - 0.0979)	Black	Grade and color are the same for upper and lower bearings.
1		2.486 - 2.489 (0.0979 - 0.0980)	Brown	
2		2.489 - 2.492 (0.0980 - 0.0981)	Green	
3		2.492 - 2.495 (0.0981 - 0.0982)	Yellow	
4		2.495 - 2.498 (0.0982 - 0.0983)	Blue	
5		2.498 - 2.501 (0.0983 - 0.0985)	Pink	
6		2.501 - 2.504 (0.0985 - 0.0986)	Purple	
7		2.504 - 2.507 (0.0986 - 0.0987)	White	
8		2.507 - 2.510 (0.0987 - 0.0988)	Red	
01	UPR	2.483 - 2.486 (0.0978 - 0.0979)	Black	
	LWR	2.486 - 2.489 (0.0979 - 0.0980)	Brown	
12	UPR	2.486 - 2.489 (0.0979 - 0.0980)	Brown	
	LWR	2.489 - 2.492 (0.0980 - 0.0981)	Green	
	UPR	2.489 - 2.492 (0.0980 - 0.0981)	Green	

23	LWR	2.492 - 2.495 (0.0981 - 0.0982)	Yellow	Grade and color are different for upper and lower bearings.
34	UPR	2.492 - 2.495 (0.0981 - 0.0982)	Yellow	
	LWR	2.495 - 2.498 (0.0982 - 0.0983)	Blue	
45	UPR	2.495 - 2.498 (0.0982 - 0.0983)	Blue	
	LWR	2.498 - 2.501 (0.0983 - 0.0985)	Pink	
56	UPR	2.498 - 2.501 (0.0983 - 0.0985)	Pink	
	LWR	2.501 - 2.504 (0.0985 - 0.0986)	Purple	
67	UPR	2.501 - 2.504 (0.0985 - 0.0986)	Purple	
	LWR	2.504 - 2.507 (0.0986 - 0.0987)	White	
78	UPR	2.504 - 2.507 (0.0986 - 0.0987)	White	
	LWR	2.507 - 2.510 (0.0987 - 0.0988)	Red	

UNDERSIZE

THICKNESS TABLE

Unit: mm (in)

Undersize	Thickness	Main journal diameter
0.25 (0.0098)	2.618 - 2.626 (0.1031 - 0.1034)	Grind so that bearing clearance is the specified value.

MAIN BEARING OIL CLEARANCE

MAIN BEARING OIL CLEARANCE REFERENCE

Unit: mm (in)

Main bearing oil clearance	Standard	No. 1 and 5	0.001 - 0.011 (0.00004 - 0.0004)
		No. 2, 3 and 4	0.007 - 0.017 (0.0003 - 0.0007)
	Limit	No. 1 and 5	0.021 (0.0008)
		No. 2, 3 and 4	0.027 (0.0011)

CONNECTING ROD BEARING

CONNECTING ROD BEARING THICKNESS TABLE

Unit: mm (in)

Grade number	Thickness	Identification color (mark)
0	1.500 - 1.503 (0.0591 - 0.0592)	No color
1	1.503 - 1.506 (0.0592 - 0.0593)	Brown
2	1.506 - 1.509 (0.0593 - 0.0594)	Green

UNDERSIZE

PIN JOURNAL DIAMETER THICKNESS TABLE

Unit: mm (in)

Undersize	Thickness	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

STANDARD SPECIFICATION

Unit: mm (in)

Connecting rod bearing oil clearance	Standard	0.020 - 0.045 (0.0008 - 0.0018)
	Limit	0.055 (0.0022)

