2008 ENGINE

Engine Mechanical (VQ35DE) - FX35 - FX45

PRECAUTIONS

PRECAUTIONS NECESSARY FOR STEERING WHEEL ROTATION AFTER BATTERY DISCONNECT

NOTE:

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

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

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

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

OPERATION PROCEDURE

1. Connect both battery cables.

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

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

PRECAUTIONS FOR DRAIN ENGINE COOLANT AND ENGINE OIL

Drain engine coolant and engine oil when the engine is cooled.

PRECAUTIONS FOR DISCONNECTING FUEL PIPING

- Before starting work, make sure 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.

PRECAUTIONS 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 a tape or equivalent, if necessary, to seal out foreign materials.
- Mark and arrange disassembly parts in an organized way for easy troubleshooting and re-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 in the step.

PRECAUTIONS FOR INSPECTION, REPAIR AND REPLACEMENT

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

PRECAUTIONS 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.
- Dowel pins are used for several parts alignment. When replacing and reassembling parts with dowel pins, make sure that dowel pins are installed in the original position.
- Thoroughly wash, clean, and air-blow each part. Carefully check engine oil or engine coolant passages for any restriction and blockage.
- Avoid damaging sliding or mating surfaces. Completely remove foreign materials such as cloth lint or dust. Before assembly, oil sliding surfaces well.
- Release air within route when refilling after draining engine coolant.
- After repairing, start the engine and increase engine speed to check engine coolant, fuel, engine oil, and exhaust gases for leakage.

PRECAUTIONS FOR ANGLE TIGHTENING

- Use the 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 bolts
  - Crankshaft pulley bolt (No the angle wrench is required as 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.

PRECAUTIONS FOR LIQUID GASKET

REMOVAL OF LIQUID GASKET SEALING

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

CAUTION: Be careful not to damage the mating surfaces.

- Tap the seal cutter to insert it, and then slide it by tapping on the side as shown in the figure.
- In areas where the seal cutter is difficult to use, use a plastic hammer to lightly tap the parts, to remove it.

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

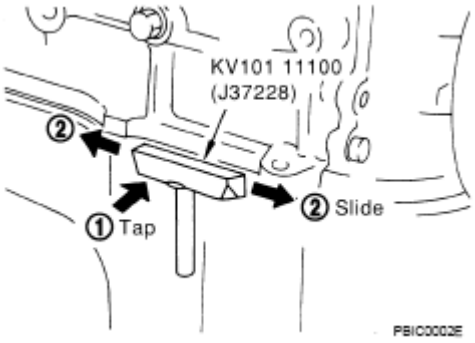


Fig. 1: Locating Liquid Gasket Sealing
Courtesy of NISSAN MOTOR CO., U.S.A.

LIQUID GASKET APPLICATION PROCEDURE

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

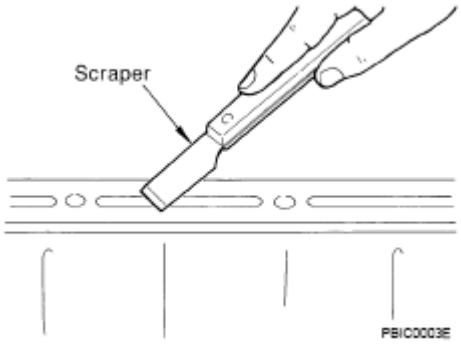


Fig. 2: Removing Old Gasket Material With Scraper
Courtesy of NISSAN MOTOR CO., U.S.A.

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.
3. Attach liquid gasket tube to the tube presser [SST: WS39930000 (-)].

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

4. Apply liquid gasket without breaks to the specified location with the specified dimensions.

- If there is a groove for liquid gasket application, apply liquid gasket to the groove.

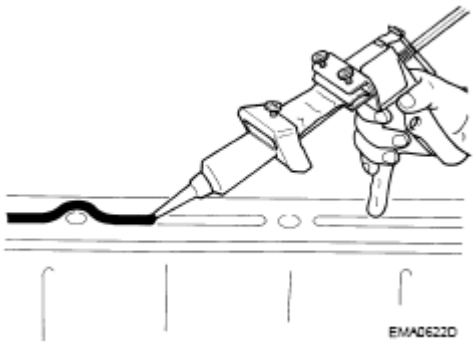


Fig. 3: Applying Liquid Gasket
Courtesy of NISSAN MOTOR CO., U.S.A.

- As for bolt holes, normally apply liquid gasket inside the holes. Occasionally, it should be applied outside the holes.

  Make sure to read the text of this article.

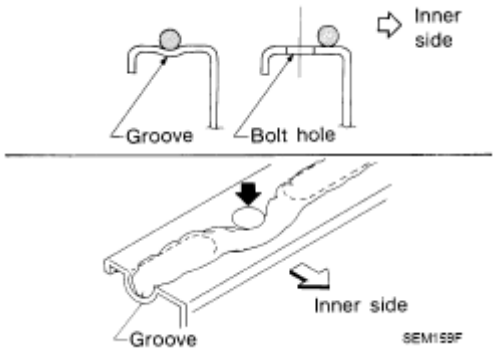


Fig. 4: Identifying Properly Applied Liquid Gasket
Courtesy of NISSAN MOTOR CO., U.S.A.

- Within five minutes of liquid gasket application, install the mating component.
- If liquid gasket protrudes, wipe it off immediately.
- Do not retighten mounting bolts or nuts after the installation.
- After 30 minutes or more have passed from the installation, fill engine oil and engine coolant.

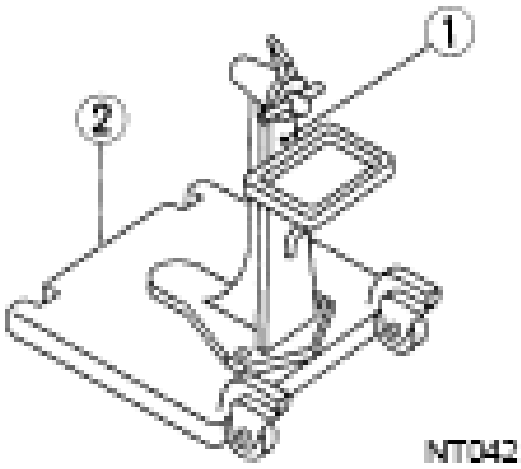
CAUTION: If there are specific instructions in this article, observe them.

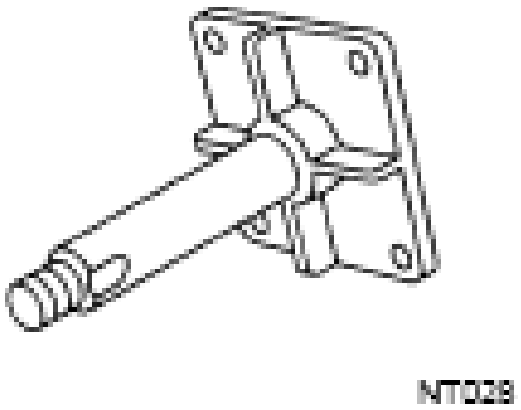
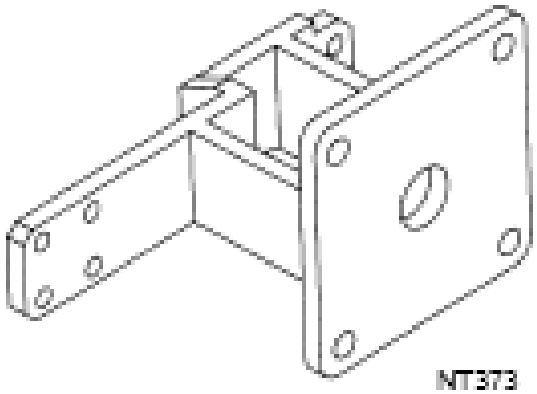
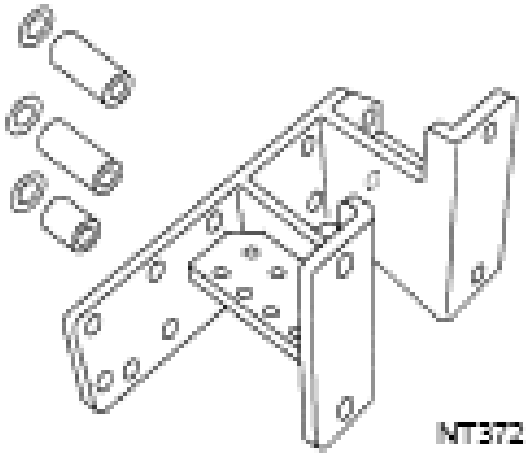
PREPARATION

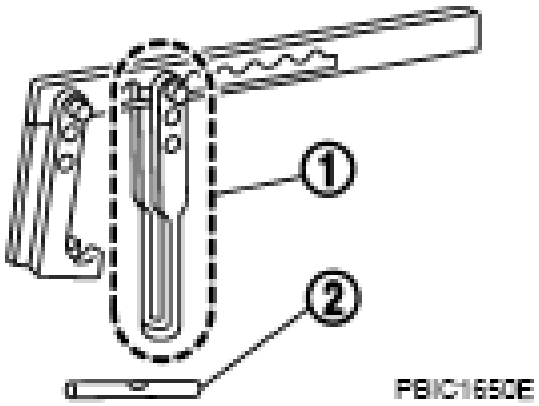
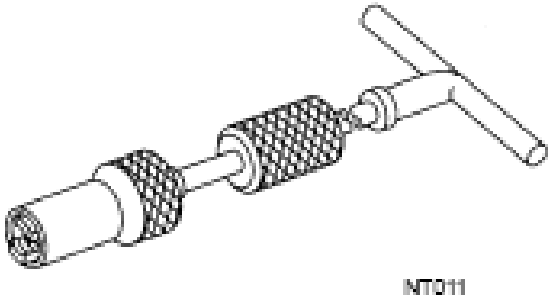
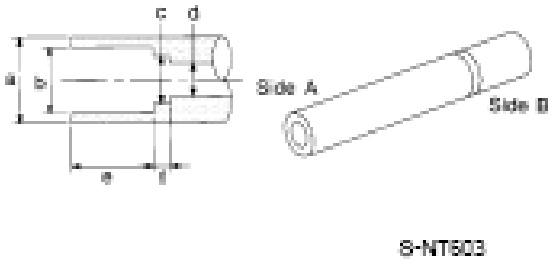
SPECIAL SERVICE TOOLS

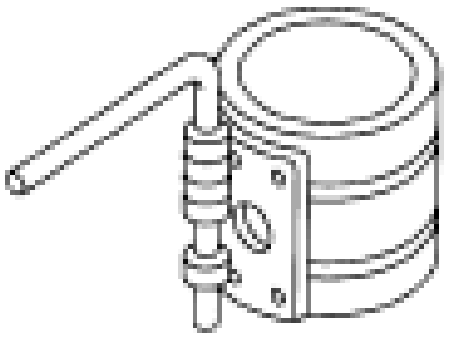
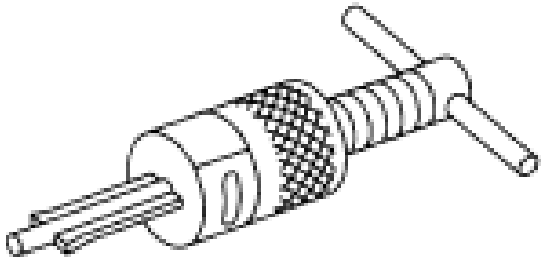
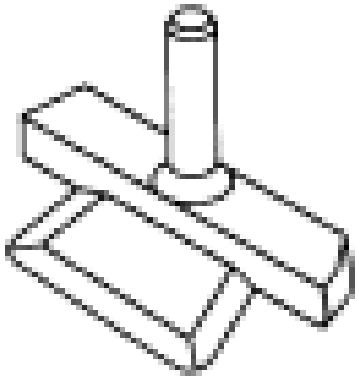
The actual shapes of Kent-Moore tools may differ from those of special service tools illustrated here.

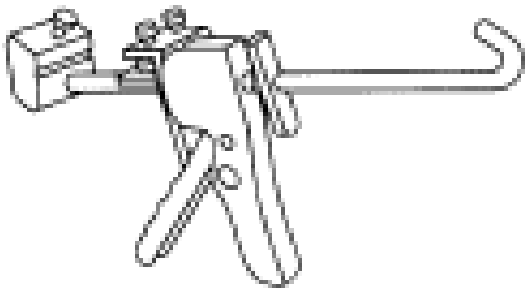
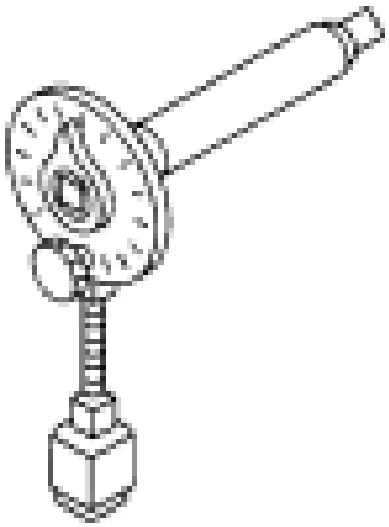
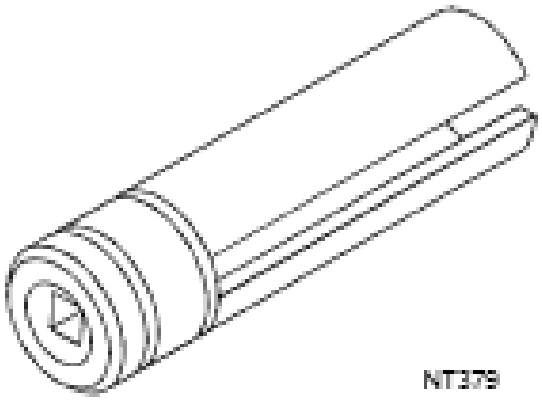
SPECIAL SERVICE TOOLS SPECIFICATION

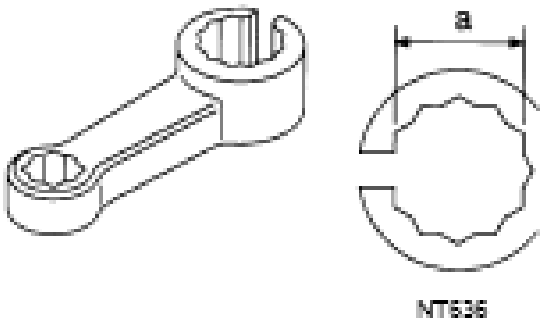
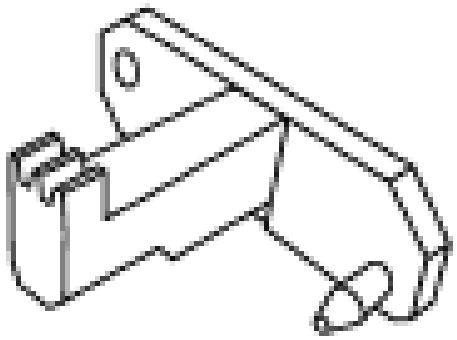
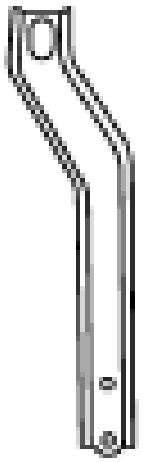
Tool number (Kent-Moore No.) Tool name		Description
ST0501S000 (-) Engine stand assembly 1. ST05011000 (-) Engine stand 2. ST05012000 (-) Base		Disassembling and assembling the engine

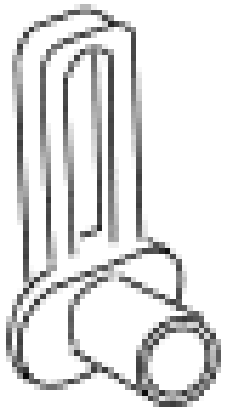
KV10106500 (-) Engine stand shaft	 NT028	
KV10117000 (J41262) Engine sub-attachment	 NT373	KV10117000 has been replaced with KV10117001 (KV10117000 is no longer in production, but it is usable).
KV10117001 (-) Engine sub-attachment	 NT372	Installing on cylinder block
KV10116200 (J26336-A) Valve spring compressor 1. KV10115900 (J26336-20) Attachment 2. KV10109220 (-)		Disassembling valve mechanism Part (1) is a component of KV10116200 (J26336-A), but Part (2) is not so.

Adapter		
KV10107902 (J38959) Valve oil seal puller		Replacing valve oil seal
KV10115600 (J-38958) Valve oil seal drift		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 (J8037) Piston ring compressor		Installing piston assembly into cylinder bore

	 NT044	
ST16610001 (J23907) Pilot bushing puller	 NT045	Removing pilot converter
KV10111100 (J37228) Seal cutter	 NT046	Removing oil pan (lower and upper), front and rear timing chain case, etc.
WS39930000 (-) Tube presser		Pressing the tube of liquid gasket

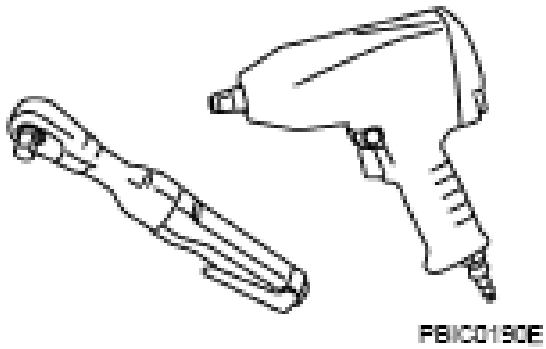
	 NT052	
KV10112100 (BT8653-A) Angle wrench	 NT014	Tightening bolts for connecting rod bearing cap, cylinder head, etc. in angle
KV10117100 (J3647-A) Heated oxygen sensor wrench	 NT379	Loosening or tightening heated oxygen sensor 2 **For 22 mm (0.87 in) width hexagon nut**
KV10114400 (J38365) Heated oxygen sensor wrench		Loosening or tightening air fuel ratio sensor 1 a. **22 mm (0.87 in)**

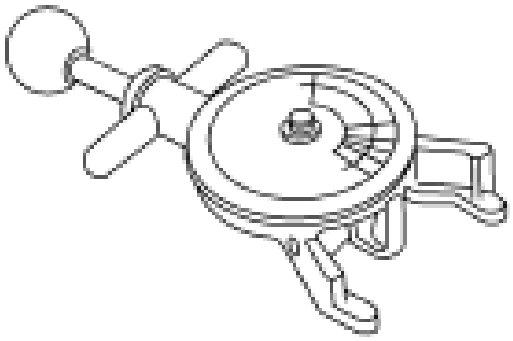
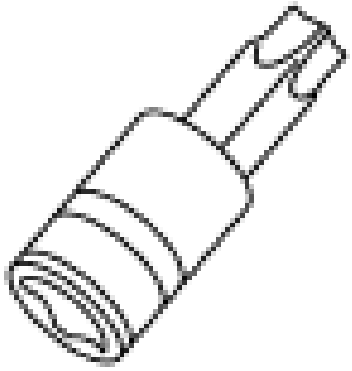
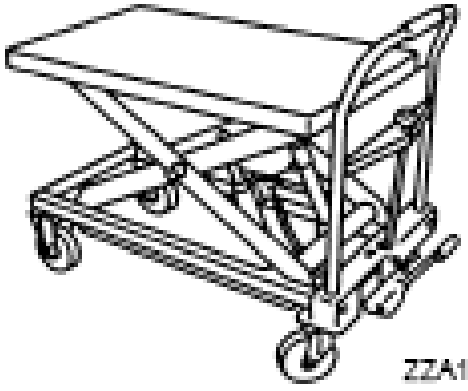
	 NT636	
KV10117700 (J44716) Ring gear stopper	 NT822	Removing and installing crankshaft pulley
10006 31U00 (-) Engine rear slinger	 SBIA0530E	Removing and installing oil pan (upper) for on vehicle service
- (J-45488) Quick connector release		Removing fuel tube quick connectors in engine room

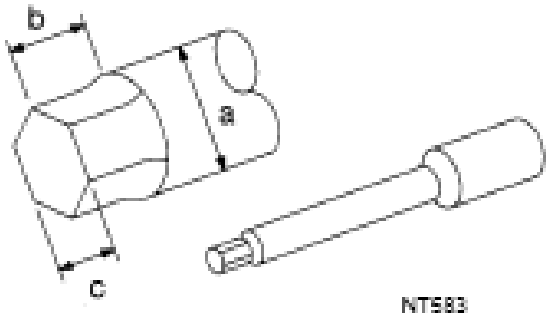
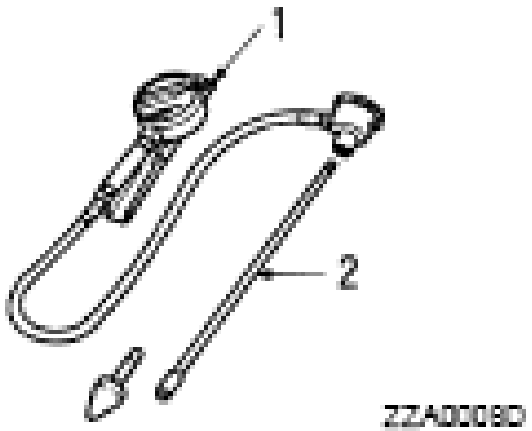
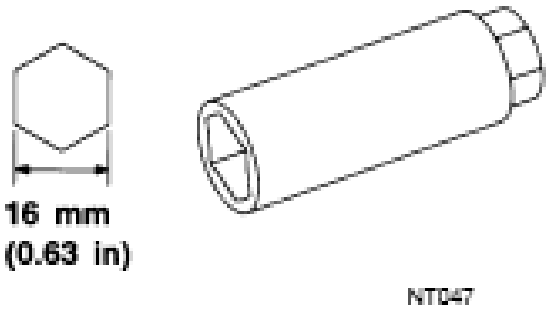
	 FBIC0188E	

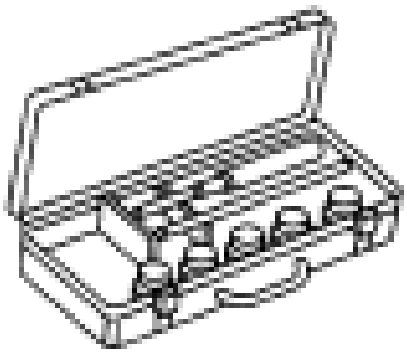
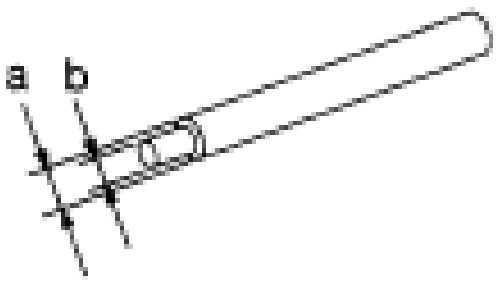
COMMERCIAL SERVICE TOOLS

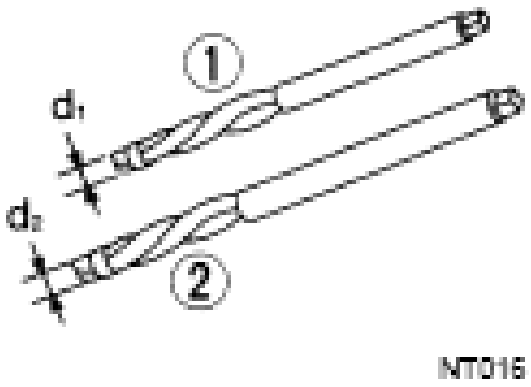
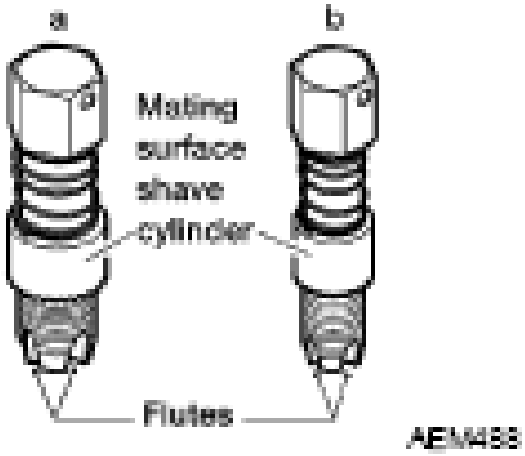
COMMERCIAL SERVICE TOOLS SPECIFICATION

(Kent-Moore No.) Tool number		Description
WS39930000 (-) Tube presser		Pressing the tube of liquid gasket
(-) Power tool	 FBIC0190E	Loosening nuts and bolts
(BT3373-F) Belt tension gauge		Checking drive belt tension

	 AMA126	
(-) TORX socket	 PBIC1113E	Removing and installing flywheel **Size: T55**
(-) Manual lift table caddy	 ZZA1210D	Removing and installing engine
(J24239-01) Cylinder head bolt wrench		Loosening and tightening cylinder head bolt, and used with the angle wrench [SST: KV10112100 (BT8653-A)] a. **13 (0.51) dia.** b. **12 (0.47)**

		c. **10 (0.39)** Unit: mm (in)
(-) 1. Compression tester 2. Adapter		Checking compression pressure
(-) Spark plug wrench		Removing and installing spark plug
(-) Valve seat cutter set		Finishing valve seat dimensions

	 NT048	
(-) Piston ring expander	 NT030	Removing and installing piston ring
(-) Valve guide drift	 NT015	Removing and installing valve guide **Intake and Exhaust:** a. **9.5 mm (0.374 in) dia.** b. **5.5 mm (0.217 in) dia.**
(-) Valve guide reamer		1. Reaming valve guide inner hole 2. Reaming hole for oversize valve guide **Intake and Exhaust: d1 :**

		**6.0 mm (0.236 in) dia. d2 : 10.2 mm (0.402 in) dia.**
(J-43897-18) (J-43897-12) Oxygen sensor thread cleaner		Reconditioning the exhaust system threads before installing a new air fuel ratio sensor and heated oxygen sensor (Use with anti-seize lubricant shown below.) a. **J-43897-18 [18 mm (0.71 in) dia.] for zirconia heated oxygen sensor and air fuel ratio sensor** b. **J-43897-12 [12 mm (0.47 in) dia.] for titania heated oxygen sensor**
(-) Anti-seize lubricant (Permatex 133AR or equivalent meeting MIL specification MIL-A-907)		Lubricating oxygen sensor thread cleaning tool when reconditioning exhaust system threads

NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING

NVH TROUBLESHOOTING - ENGINE NOISE

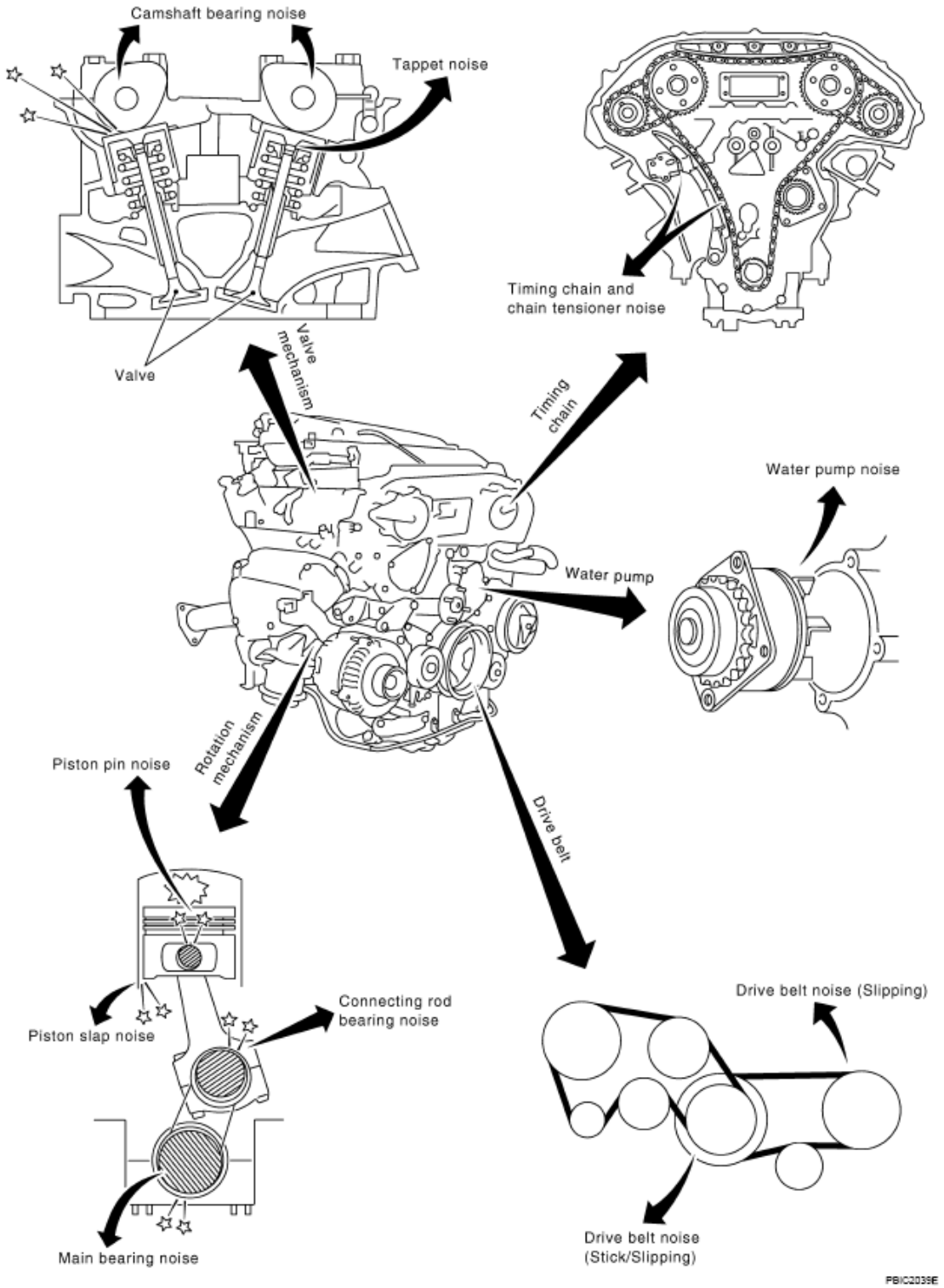


Fig. 5: Identifying NVH Troubleshooting - Engine Noise Locations
Courtesy of NISSAN MOTOR CO., U.S.A.

USE THE CHART BELOW TO HELP YOU FIND THE CAUSE OF THE SYMPTOM

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

If necessary, repair or replace these parts.

NVH TROUBLESHOOTING SYMPTOM CHART

Location of noise	Type of noise	Operating condition of engine						Source of noise	Check item
		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
	Rattle	C	A	-	A	B	C	Camshaft bearing noise	Camshaft runout Camshaft journal oil clearance
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
	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
									Connecting rod bushing

	Knock	A	B	C	B	B	B	Connecting rod bearing noise	oil clearance Connecting rod bearing oil clearance
	Knock	A	B	-	A	B	C	Main bearing noise	Main bearing oil clearance Crankshaft runout
Front of engine Timing chain case	Tapping or ticking	A	A	-	B	B	B	Timing chain and timing chain tensioner noise	Timing chain cracks and wear Timing chain tensioner operation
Front of engine	Squeaking or fizzing	A	B	-	B	-	C	Drive belts (Sticking or slipping)	Drive belts deflection
	Creaking	A	B	A	B	A	B	Drive belts (Slipping)	Idler pulley bearing operation
	Squall Creak	A	B	-	B	A	B	Water pump noise	Water pump operation
A: Closely related B: Related C: Sometimes related -: Not related									

DRIVE BELTS

CHECKING DRIVE BELTS

WARNING: Be sure to perform when engine is stopped.

1. Inspect belts for cracks, fraying, wear and oil. If necessary, replace.
2. Inspect drive belt deflection or tension at a point on belt midway between pulleys.
    1. Power steering oil pump
    2. Alternator
    3. Idler pulley
    4. Crankshaft pulley
    5. A/C compressor

- Inspection should be done only when engine is cold, or over 30 minutes after engine is stopped.

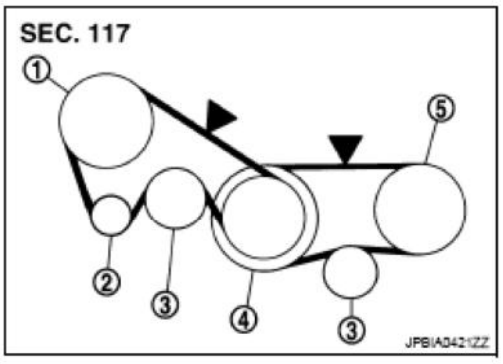


Fig. 6: Drive Belt Tension And Pulleys
Courtesy of NISSAN MOTOR CO., U.S.A.

- Measure the belt tension with belt tension gauge (Commercial service tool: BT3373-F or equivalent) at points marked ? shown in the figure.
- When measuring the deflection, apply 98 N (10 kg, 22 lb) at the ? marked point.
- Adjust if the belt deflection exceeds the limit or if the belt tension is not within specifications.

CAUTION:

- **When checking the belt deflection or the tension immediately after installation, first adjust it to the specified value. Then, after turning crankshaft two turns or more, re-adjust to the specified value to avoid variation in deflection between pulleys.**
- **Tighten idler pulley lock nut by hand and measure the deflection or the tension without looseness.**

Belt Deflection and Tension

BELT DEFLECTION AND TENSION

Items	Deflection adjustment		Unit: mm (in)	Tension adjustment(1)		Unit: N (kg, lb)
	Used belt		New belt	Used belt		New belt
	Limit	After adjustment		Limit	After adjustment	
Alternator and power steering oil pump belt	7 (0.28)	4 - 5 (0.16 - 0.20)	3.5 - 4.5 (0.138 - 0.177)	294 (30, 66)	730 - 818 (74.5 - 83.4, 164 - 184)	838 - 926 (85.5 - 94.5, 188 - 208)
A/C compressor belt	12 (0.47)	9 - 10 (0.35 - 0.39)	8 - 9 (0.31 - 0.35)	196 (20, 44)	348 - 436 (35.5 - 44.5, 78 - 98)	470 - 559 (47.9 - 57.0, 106 - 126)
Applied pushing force	98 N (10 kg, 22 lb)			-		

(1) If belt tension gauge cannot be installed at check points shown, check drive belt tension at different

location on belt.

TENSION ADJUSTMENT

TENSION ADJUSTMENT

Portion	Belt tightening method for adjustment
Alternator and power steering oil pump belt	Adjusting bolt on idler pulley
A/C compressor belt	Adjusting bolt on idler pulley

CAUTION:

- **When belt is replaced with a new one, adjust it to value for "New belt" to accommodate for insufficient adaptability with pulley grooves.**
- **When deflection or tension of belt being used exceeds "Limit", adjust it to value for "After adjustment".**
- **When checking belt deflection or tension immediately after installation, first adjust it to the specified value. Then, after turning crankshaft two turns or more, re-adjust to the specified value to avoid variation in deflection between pulleys.**
- **When installing belt, make sure that it is correctly engaged with pulley grooves.**
- **Keep engine oil, working fluid and engine coolant away from belt and pulley grooves.**
- **Do not twist or bend belt excessively.**

ALTERNATOR AND POWER STEERING OIL PUMP BELT

1. Remove front engine undercover with power tool.
    1. Alternator and power steering oil pump belt
    2. A/C compressor belt
    3. Power steering oil pump
    4. Idler pulley
    5. Alternator
    6. Crankshaft pulley
    7. A/C compressor

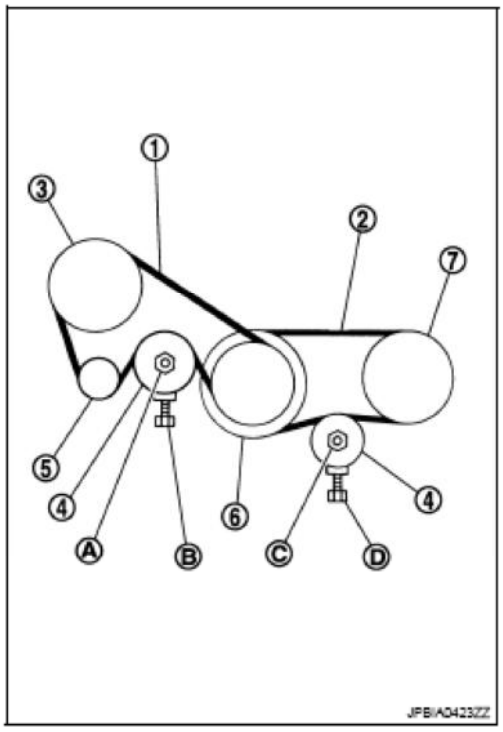


Fig. 7: Identifying Alternator And Power Steering Oil Pump Belt Tension
Courtesy of NISSAN MOTOR CO., U.S.A.

2. Loosen idler pulley lock nut (A) and adjust tension by turning adjusting bolt (B).
   - For the specified belt tension, refer to "**CHECKING DRIVE BELTS**".
3. Tighten nut (A).

: 34.8 N.m (3.5 kg-m, 26 ft-lb)

A/C COMPRESSOR BELT

1. Remove front engine undercover with power tool.
2. Loosen idler pulley lock nut (C) and adjust tension by turning adjusting bolt (D).
   - For the specified belt tension, refer to "**CHECKING DRIVE BELTS**".
3. Tighten nut (C).

: 34.8 N.m (3.5 kg-m, 26 ft-lb)

REMOVAL AND INSTALLATION

REMOVAL

1. Remove front engine undercover with power tool.
2. Remove alternator and power steering oil pump belt. Refer to "**ALTERNATOR AND POWER STEERING OIL PUMP BELT**".

3. Remove A/C compressor belt. Refer to "**A/C COMPRESSOR BELT**".

CAUTION: Grease is applied to idler pulley adjusting bolt. Be careful to keep grease away from belt.

INSTALLATION

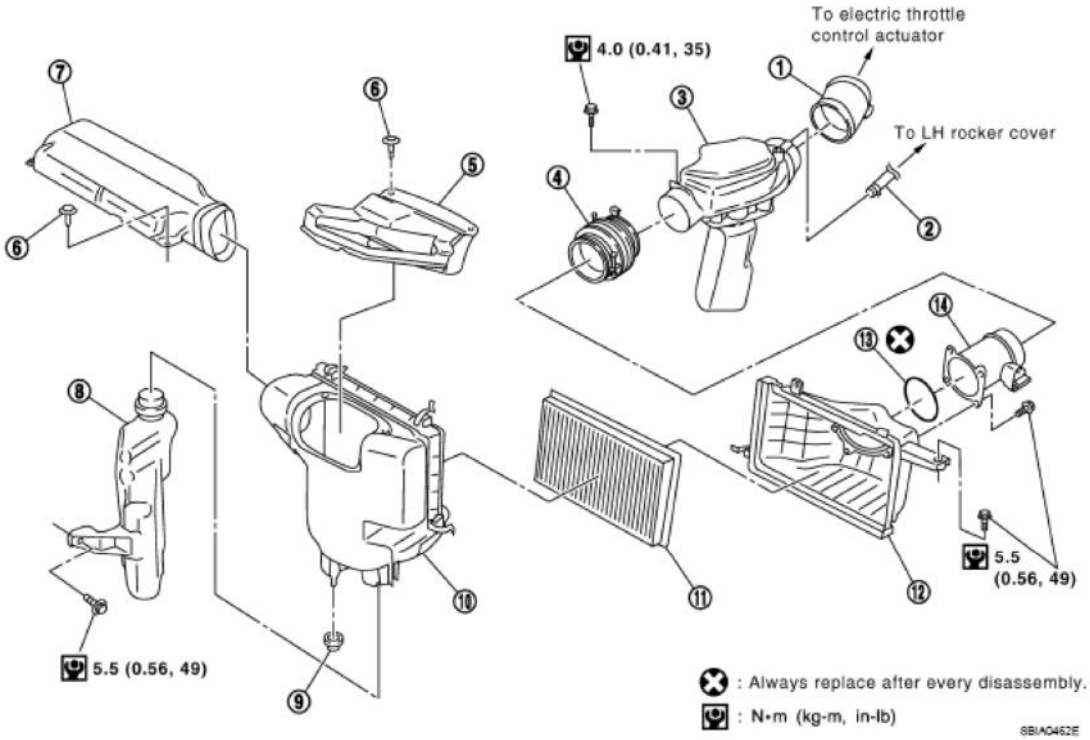
1. Install belts to pulley in reverse order of removal.

CAUTION:
- **Make sure drive belt is correctly engaged with pulley groove.**
- **Make sure that for engine oil and engine coolant do not adhere to belt and each pulley grooves.**

2. Adjust belt tension. Refer to "**TENSION ADJUSTMENT**".
3. Tighten each adjusting bolt and nut to the specified torque.
4. Make sure that tension of each belt is within the standard. Refer to "**CHECKING DRIVE BELTS**".

AIR CLEANER AND AIR DUCT

COMPONENTS



1. Air hose
2. PCV hose
3. Air duct
4. Air hose
5. Power duct
6. Clip
7. Air duct (inlet)
8. Resonator
9. Grommet
10. Air cleaner case
11. Air cleaner filter
12. Air cleaner case
13. O-ring
14. Mass air flow sensor

Fig. 8: Identifying Air Cleaner And Air Duct Components With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

REMOVAL AND INSTALLATION

REMOVAL

1. Remove engine cover with power tool. Refer to "**INTAKE MANIFOLD COLLECTOR**".
   - This work is unnecessary when parts located forward of mass air flow sensor are removed/installed.
2. Remove air duct (inlet) and power duct.
3. Disconnect mass air flow sensor harness connector.
4. Disconnect PCV hose.
5. Remove air cleaner case/mass air flow sensor and air duct disconnecting their joints.
   - Add marks as necessary for easier installation.
6. Remove mass air flow sensor from air cleaner case.

CAUTION: Handle mass air flow sensor with the following cares.

- **Do not shock it.**

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

7. Remove resonator in fender, lifting left fender protector.

INSPECTION AFTER REMOVAL

Inspect air hoses for cracks or tear.

- If anything found replace air hose.

INSTALLATION

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

- Align marks. Attach each joint. Screw clamps firmly.
- To position air cleaner case, refer to "**CHANGING AIR CLEANER FILTER**".

CHANGING AIR CLEANER FILTER

INSPECTION

Check status (fouling, damage, etc.) of air cleaner filter at power duct hole.

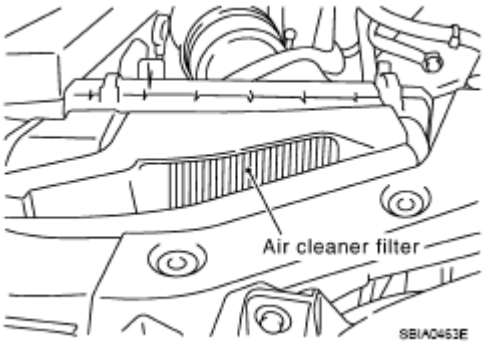


Fig. 9: Identifying Air Cleaner Filter
Courtesy of NISSAN MOTOR CO., U.S.A.

REMOVAL

Removal in the order below.

1. Remove air duct (inlet) from air cleaner case.
2. Disconnect harness connector from mass air flow sensor.
3. Loosen clamp bolts of air hose.
4. Remove mounting bolts for air cleaner case. Remove air cleaner case/mass air flow sensor/air hose

assembly.

5. Unhook clips and open air cleaner case, and remove air cleaner filter.

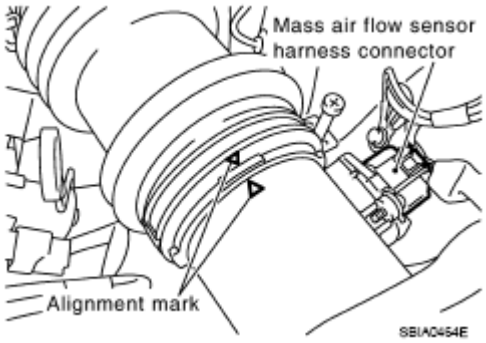


Fig. 10: Identifying Air Flow Sensor And Harness Connector
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

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

- If grommet at bottom of air cleaner case comes off together with air cleaner case, fix it to vehicle before installation.
- Look at internal bottom face through power duct hole, and position air cleaner case with resonator upper end circle and air cleaner case round hole aligned. Then push air cleaner case straight down.
- At this time, check by hand if protrusion at bottom of air cleaner case has been inserted into grommet on vehicle side.
- Clip power duct with bulge on reverse side of lower end engaged with air cleaner case.

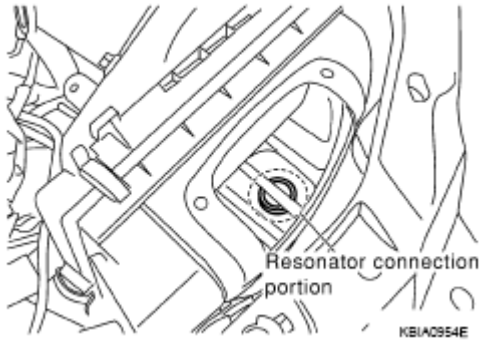
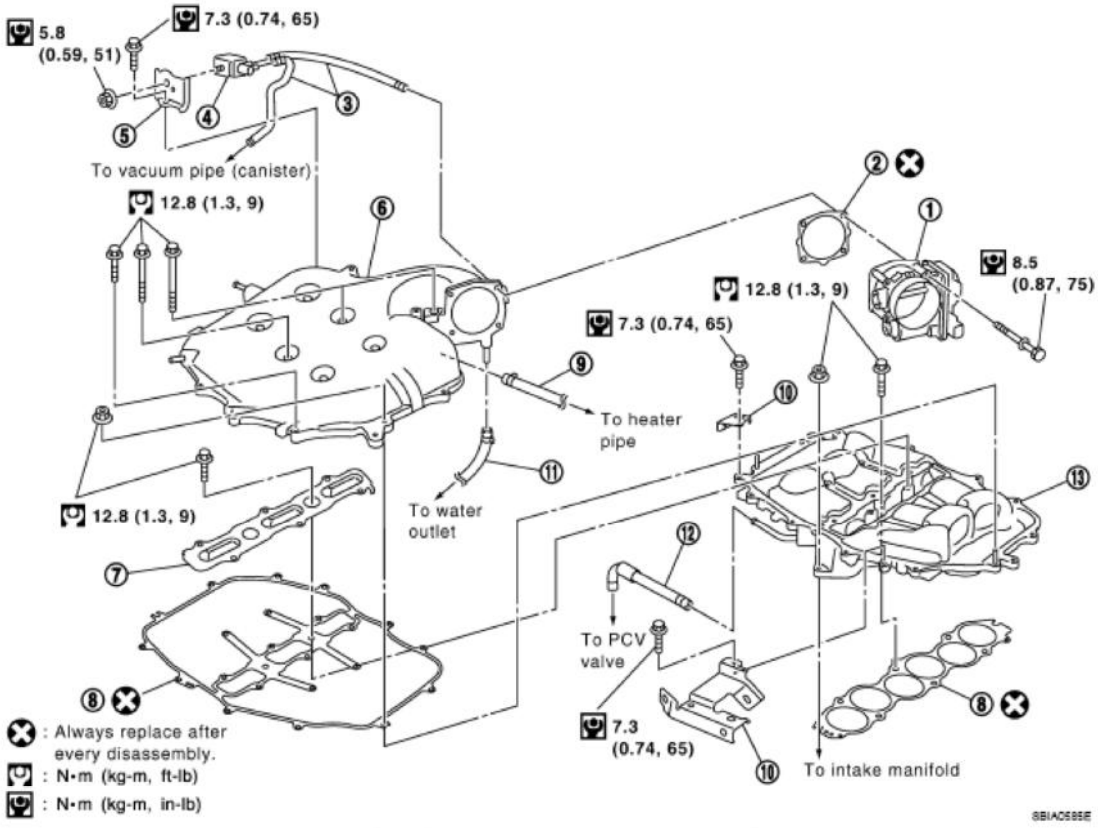


Fig. 11: Identifying Resonator Connection Portion
Courtesy of NISSAN MOTOR CO., U.S.A.

INTAKE MANIFOLD COLLECTOR

COMPONENTS



1. Electric throttle control actuator	2. Gasket	3. Vacuum hose
4. EVAP canister purge volume control solenoid valve	5. Bracket	6. Intake manifold collector (upper)
7. Intake manifold collector cover	8. Gasket	9. Water hose
10. Bracket	11. Water hose	12. PCV hose
13. Intake manifold collector (lower)		

Fig. 12: Identifying Intake Manifold Collector Components With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

REMOVAL AND INSTALLATION

REMOVAL

WARNING:

- **To avoid the danger of being scalded, never drain engine coolant when the engine is hot.**
- **Gasket for intake manifold collector (upper) is secured together with mounting bolt for intake manifold collector (lower). Thus, even when only gasket for upper side is replaced, gasket for lower side must be also replaced.**

1. Remove engine cover with power tool.

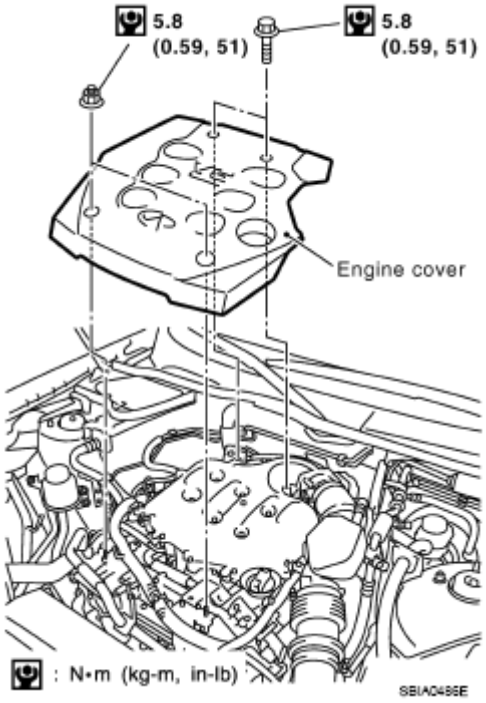


Fig. 13: Identifying Engine Cover With Power Tool With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

2. Disconnect water hoses from intake manifold collector (upper), attach blind plug to prevent engine coolant leakage.

CAUTION:
- **Perform this step when the engine is cold.**
- **Do not spill engine coolant on drive belts.**

3. Remove air cleaner case and air duct. Refer to "**AIR CLEANER AND AIR DUCT**".
4. Remove electric throttle control actuator as the following:
   a. Disconnect harness connector.
   b. Loosen mounting bolts in reverse order as shown in the figure.

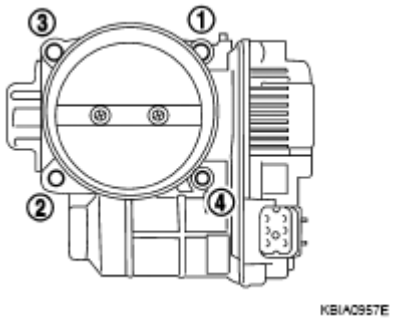


Fig. 14: Identifying Electric Throttle Control Actuator

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

CAUTION:
- **Handle carefully to avoid any shock to electric throttle control actuator.**
- **Do not disassemble.**

5. Remove fuel sub-tube mounting bolt to disconnect from rear of intake manifold collector (lower). Refer to "**FUEL INJECTOR AND FUEL TUBE**".
6. Disconnect vacuum hose and water hose from intake manifold collector (upper).
7. Remove EVAP canister purge volume control solenoid valve bracket mounting bolt from intake manifold collector (upper).
8. Loosen mounting bolts in reverse order of illustration to remove intake manifold collector (upper) with power tool.

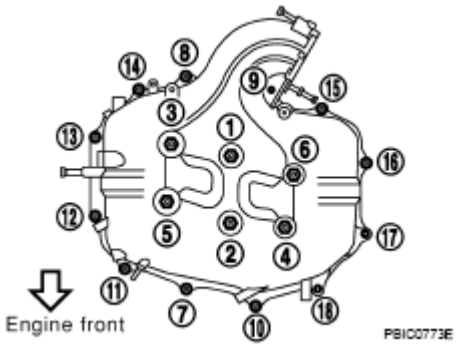


Fig. 15: Identifying Intake Manifold Collector And Mounting Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

9. Remove PCV hose [between intake manifold collector (lower) and rocker cover (right bank)].
10. Loosen mounting bolts in reverse order as shown in the figure, and remove intake manifold collector cover, gasket, intake manifold collector (lower) and gasket with power tool.

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

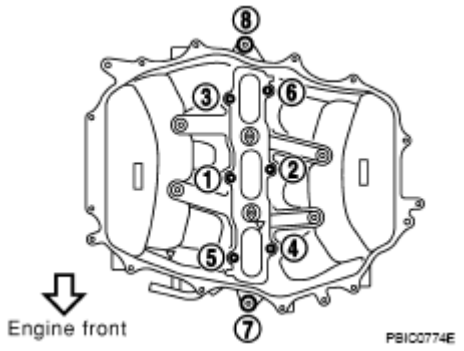


Fig. 16: Identifying Intake Manifold Collector (Lower) And Gasket
Courtesy of NISSAN MOTOR CO., U.S.A.

INSPECTION AFTER REMOVAL

Surface Distortion

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

  Limit : 0.1 mm (0.004 in)

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

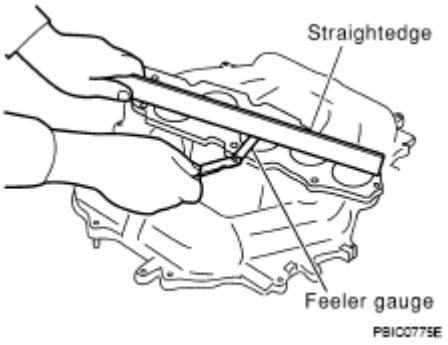


Fig. 17: Checking Surface Distortion Intake Manifold Collector (Upper And Lower) Mating Surfaces
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

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

Part Installation Direction

Referring to front marks, install parts shown in figure.

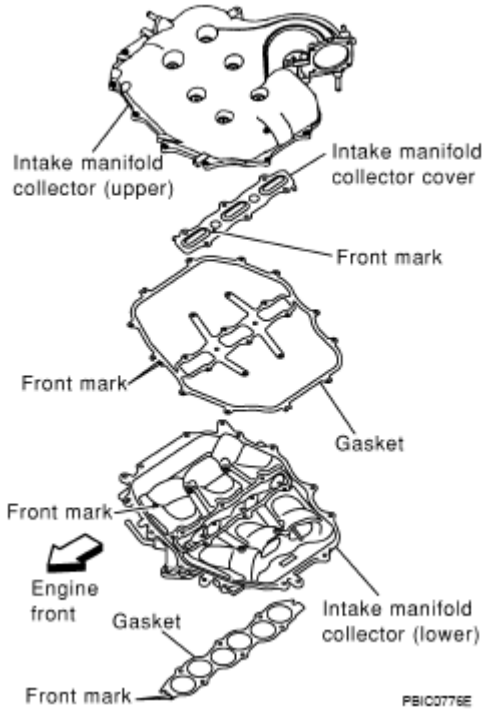


Fig. 18: Identifying Intake Manifold Collector (Lower) And Gasket
Courtesy of NISSAN MOTOR CO., U.S.A.

Intake Manifold Collector (Lower)

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

NOTE: Tighten mounting bolts to secure gasket (lower), intake manifold collector (lower), gasket (upper), and intake manifold collector cover.

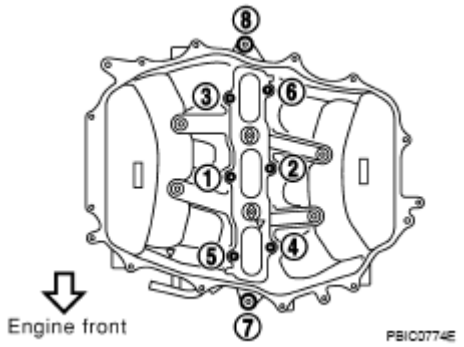


Fig. 19: Identifying Intake Manifold Collector (Lower) And Gasket
Courtesy of NISSAN MOTOR CO., U.S.A.

Intake Manifold Collector (Upper)

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

: 5.9 N.m (0.6 kg-m, 52 in-lb)

- Shank length under bolt head varies with bolt location. Install mounting bolts while referring to numbers shown below and in the figure. (Bolt length does not include pilot portion.)

  Bolt

  M6 x 25 mm (0.98 in) : 7, 8, 10, 11, 13, 14, 15, 16, 18

  M6 x 45 mm (1.77 in) : 2, 4, 5

  M6 x 60 mm (2.36 in) : 1, 3, 6, 9

  M6 Nut : 12, 17

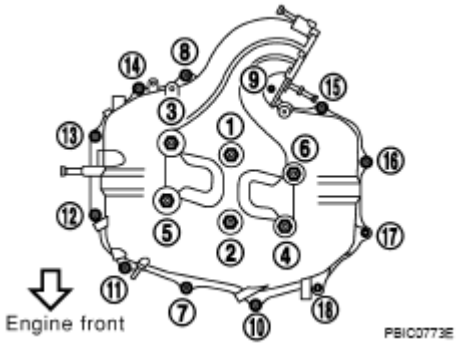


Fig. 20: Identifying Intake Manifold Collector And Mounting Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

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

Water Hose

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

Electric Throttle Control Actuator

- Install gasket with positioning no-protrusion surface upward or downward.
- Tighten in numerical order as shown in the figure.
- 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** ".

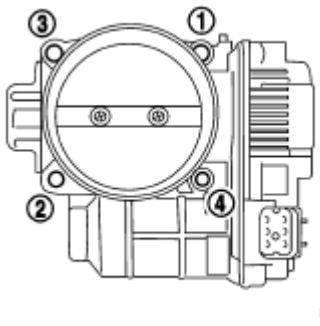


Fig. 21: Identifying Electric Throttle Control Actuator
Courtesy of NISSAN MOTOR CO., U.S.A.

INTAKE MANIFOLD

COMPONENTS

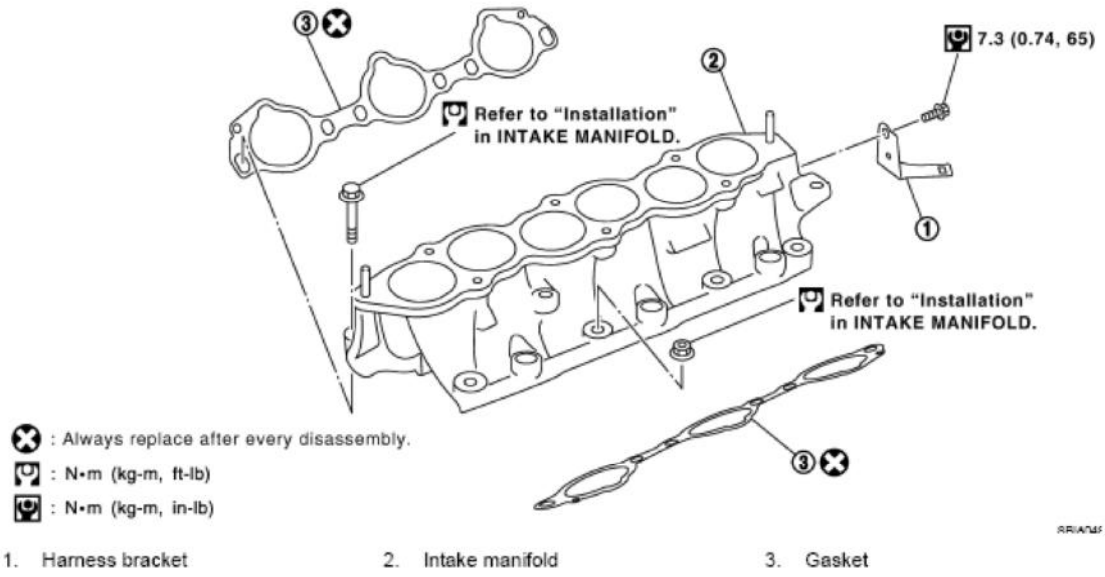


Fig. 22: Identifying Intake Manifold Components With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

REMOVAL AND INSTALLATION

REMOVAL

1. Release fuel pressure. Refer to "**FUEL PRESSURE RELEASE** ".
2. Remove intake manifold collectors (upper and lower). Refer to "**INTAKE MANIFOLD COLLECTOR**".
3. Remove fuel tube and fuel injector assembly. Refer to "**FUEL INJECTOR AND FUEL TUBE**".
4. Loosen mounting bolts and nuts in reverse order as shown in the figure to remove intake manifold with power tool.

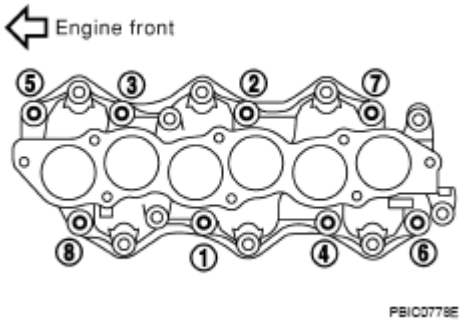


Fig. 23: Identifying Intake Manifold And Mounting Bolts And Nuts
Courtesy of NISSAN MOTOR CO., U.S.A.

5. Remove gaskets.

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

INSPECTION AFTER REMOVAL

Surface Distortion

- Check the surface distortion of the intake manifold mating surface with a straightedge and a feeler gauge.

  Limit : 0.1 mm (0.004 in)

- If it exceeds the limit, replace intake manifold.

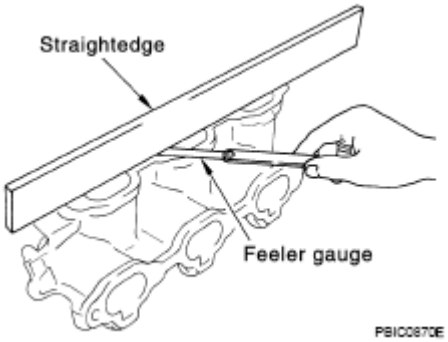


Fig. 24: Checking Surface Distortion
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

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

Intake Manifold

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

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

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

1st step:

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

2nd step and after:

: 29.0 N.m (3.0 kg-m, 21 ft-lb)

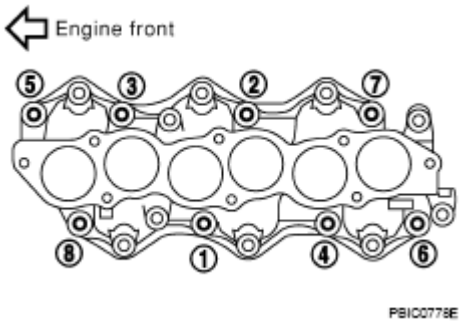
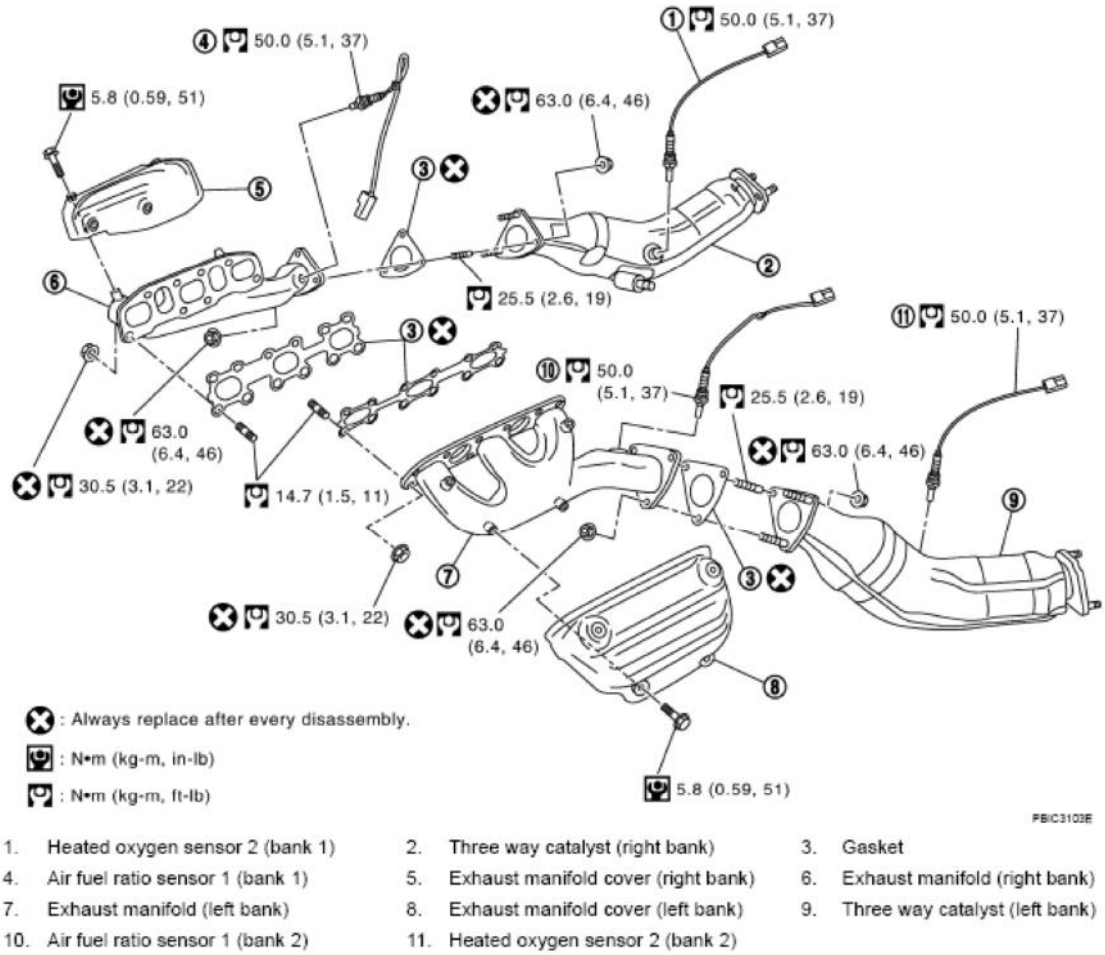


Fig. 25: Identifying Intake Manifold Mounting Bolts And Nuts
Courtesy of NISSAN MOTOR CO., U.S.A.

EXHAUST MANIFOLD AND THREE WAY CATALYST

COMPONENTS



1. Heated oxygen sensor 2 (bank 1)
2. Three way catalyst (right bank)
3. Gasket
4. Air fuel ratio sensor 1 (bank 1)
5. Exhaust manifold cover (right bank)
6. Exhaust manifold (right bank)
7. Exhaust manifold (left bank)
8. Exhaust manifold cover (left bank)
9. Three way catalyst (left bank)
10. Air fuel ratio sensor 1 (bank 2)
11. Heated oxygen sensor 2 (bank 2)

Fig. 26: Identifying Exhaust Manifold And Three Way Catalyst Components With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

REMOVAL AND INSTALLATION

REMOVAL

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

1. Remove engine cover with power tool. Refer to "**INTAKE MANIFOLD COLLECTOR**".
2. Drain engine coolant. Refer to "**CHANGING ENGINE COOLANT** ".

CAUTION:
- **Perform this step when the engine is cold.**
- **Do not spill engine coolant on drive belts.**

3. Remove air cleaner case and air duct. Refer to "**AIR CLEANER AND AIR DUCT**".

4. Remove front and rear engine undercover and front cross bar with power tool.
5. Disconnect heated oxygen sensors 2 (bank 1 and bank 2) harness connectors.
6. Using the heated oxygen sensor wrench (SST), remove heated oxygen sensors 2 (bank 1 and bank 2).

CAUTION:

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

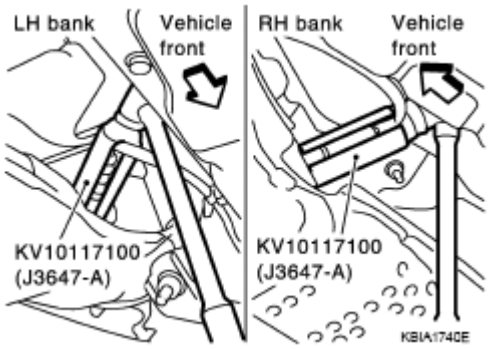


Fig. 27: Identifying Heated Oxygen Sensor (Bank 1 And Bank 2) Harness Connectors
Courtesy of NISSAN MOTOR CO., U.S.A.

7. Remove exhaust mounting bracket between three way catalysts (right and left bank) and transmission. Refer to "**EXHAUST SYSTEM** ".
8. Remove three way catalysts (right and left bank).
9. Disconnect air fuel ratio sensor 1 (bank 1 and bank 2) harness connectors and remove harness clip.
10. Using the heated oxygen sensor wrench (SST), remove air fuel ratio sensor 1 (bank 1 and bank 2).

CAUTION:

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

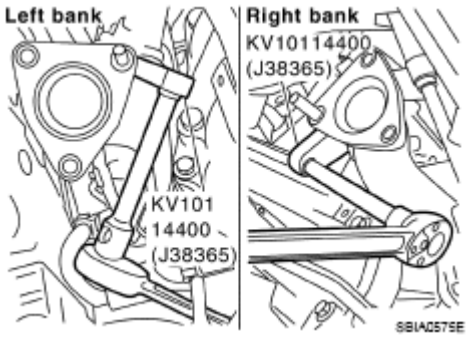


Fig. 28: Identifying Air Fuel Ratio Sensor 1 (Bank 1 And Bank 2) Harness Connectors
Courtesy of NISSAN MOTOR CO., U.S.A.

11. Remove water pipe and heater pipe on both right and left side. Refer to "**WATER OUTLET AND WATER PIPING** ".
12. Remove exhaust manifold cover (right and left bank).
13. Loosen mounting nuts in the reverse order as shown in the figure to remove exhaust manifold with power tool.

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

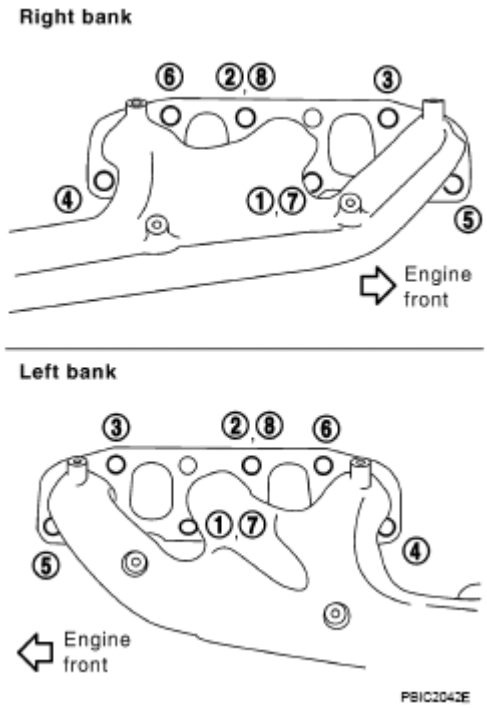


Fig. 29: Identifying Exhaust Manifold Nuts Loosening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

14. Remove gaskets.

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

INSPECTION AFTER REMOVAL

Surface Distortion

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

Limit : 0.3 mm (0.012 in)

- If it exceeds the limit, replace exhaust manifold.

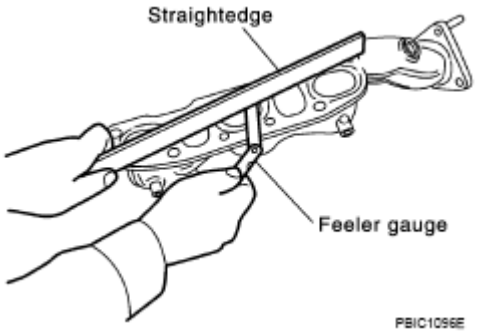


Fig. 30: Checking Surface Distortion Of Exhaust Manifold Mating Surface
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

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

Exhaust Manifold Gasket

- Install exhaust manifold gasket in direction shown in the figure. (Follow same procedure for both banks.)

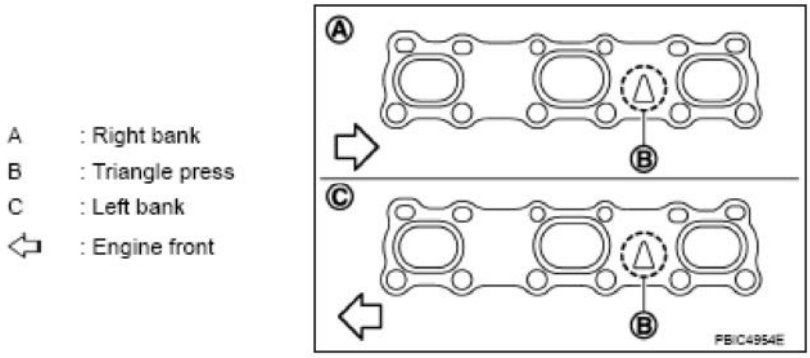


Fig. 31: Identifying Exhaust Manifold Gasket
Courtesy of NISSAN MOTOR CO., U.S.A.

Exhaust Manifold

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

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

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

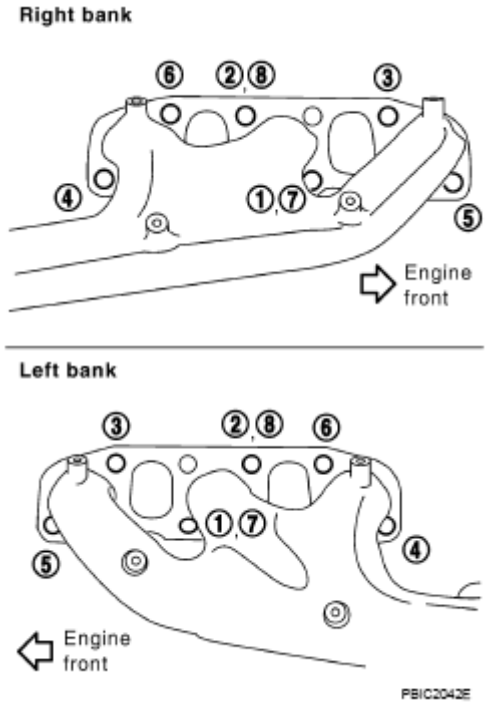


Fig. 32: Identifying Exhaust Manifold
Courtesy of NISSAN MOTOR CO., U.S.A.

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

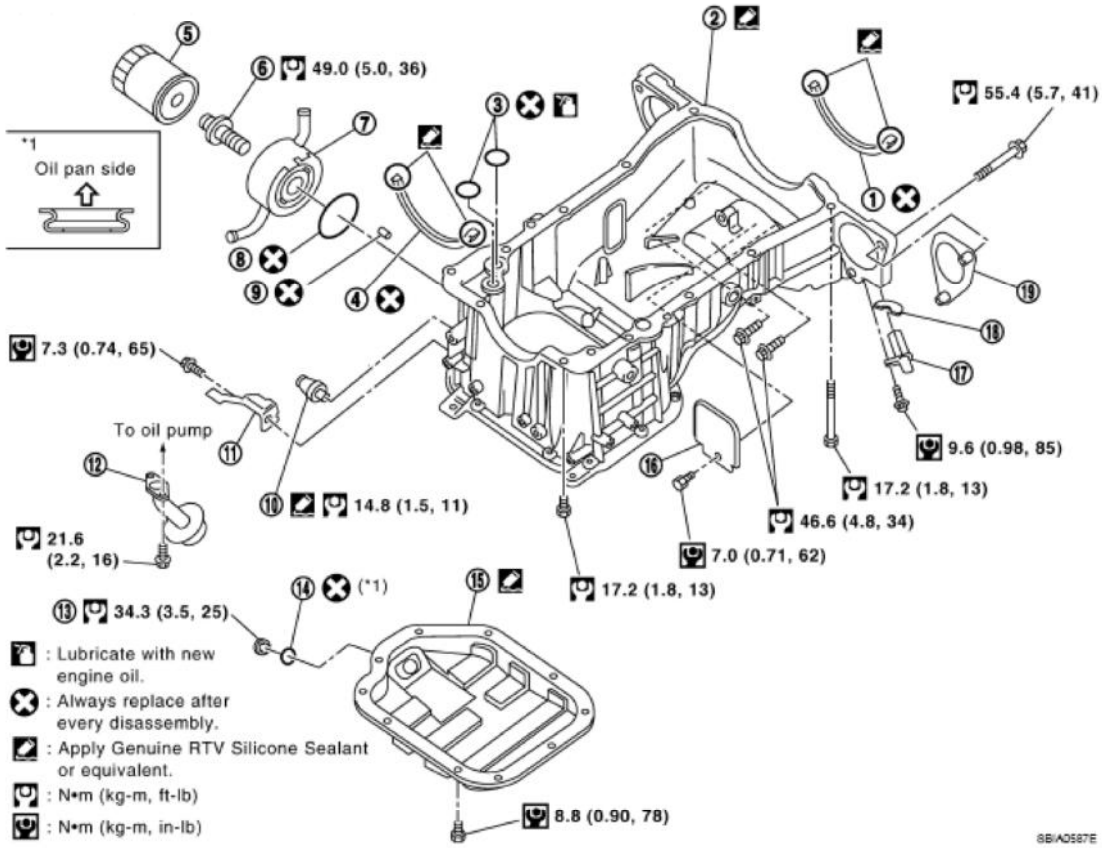
Air Fuel Ratio Sensor 1 and Heated Oxygen Sensor 2

CAUTION:

- **Before installing a new air fuel ratio sensor 1 and new heated oxygen sensor 2, clean exhaust system threads using heated oxygen sensor thread cleaner tool (Commercial Service Tool: J-43897-18 or J-43897-12) and apply anti-seize lubricant.**
- **Do not over torque air fuel ratio sensor 1 and heated oxygen sensor 2. Doing so may cause damage to air fuel ratio sensor 1 and heated oxygen sensor 2, resulting in the "MIL" coming on.**

OIL PAN AND OIL STRAINER

COMPONENTS (2WD MODELS)



1. Oil pan gasket (rear)
2. Oil pan (upper)
3. O-ring
4. Oil pan gasket (front)
5. Oil filter
6. Connector bolt
7. Oil cooler
8. O-ring
9. Relief valve
10. Oil pressure switch
11. Bracket
12. Oil strainer
13. Drain plug
14. Drain plug washer
15. Oil pan (lower)
16. Rear plate cover
17. Crankshaft position sensor (POS)
18. Seal rubber
19. Rear cover plate

Fig. 33: Identifying Oil Pan And Oil Strainer Components With Torque Specifications (2WD Models)
Courtesy of NISSAN MOTOR CO., U.S.A.

REMOVAL AND INSTALLATION (2WD MODELS)

REMOVAL

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

NOTE: To remove oil pan (lower) only, take step 5, then step 20. Removal of step 1, hood assembly (step 2) and step 4 are unnecessary.

1. Remove front tire.
2. Remove hood assembly. Refer to "**HOOD** ".

3. Remove front and rear engine undercover with power tool.
4. Remove front cross bar with power tool. "**FRONT SUSPENSION ASSEMBLY** ".
5. Drain engine oil. Refer to "**CHANGING ENGINE OIL** ".

CAUTION:
- **Perform this step when the engine is cold.**
- **Do not spill engine oil on drive belts.**

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

CAUTION:
- **Perform this step when the engine is cold.**
- **Do not spill engine coolant on drive belts.**

7. Remove engine cover with power tool. Refer to "**INTAKE MANIFOLD COLLECTOR**".
8. Remove air hose from air duct to mass air flow sensor side and electric throttle control actuator side. Refer to "**AIR CLEANER AND AIR DUCT**".
9. Removal engine rear lower slinger, and install engine rear slinger [SST: 10006 31U00 (-)] to sling engine assembly for positioning. Refer to "**SPECIAL SERVICE TOOLS**".

   Slinger bolts:

   : 28.0 N.m (2.9 kg-m, 21 ft-lb)

10. Remove front suspension member. Refer to "**FRONT SUSPENSION MEMBER** ".
11. Remove drive belts. Refer to "**DRIVE BELTS**".
12. Remove alternator stay. Refer to "**CHARGING SYSTEM** ".
13. Remove starter motor. Refer to "**STARTING SYSTEM** ".
14. Remove idler pulley and bracket assembly. Refer to "**TIMING CHAIN**".
15. Disconnect oil cooler water hoses, and remove oil cooler water pipe mounting bolt. Refer to "**OIL COOLER** ".
16. Disconnect A/T fluid cooler hoses, and remove A/T fluid cooler tube. Refer to "**TRANSMISSION ASSEMBLY** ".
17. Remove crankshaft position sensor (POS).

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

18. Remove oil filter, as necessary. Refer to "**OIL FILTER** ".

19. Remove oil cooler, as necessary. Refer to "**OIL COOLER** ".
20. Remove oil pan (lower) as follows:
    a. Loosen mounting bolts in reverse order as shown in the figure to remove.

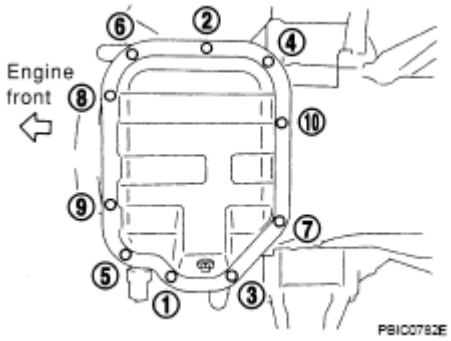


Fig. 34: Loosening And Tightening Oil Pan Mounting Bolts In Sequence (Lower)
Courtesy of NISSAN MOTOR CO., U.S.A.

    b. Insert the seal cutter (SST) between oil pan (upper) and oil pan (lower).

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

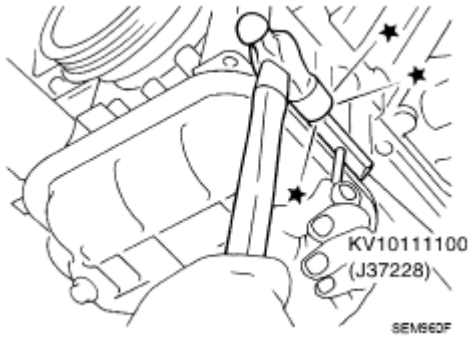


Fig. 35: Inserting Seal Cutter (SST) Between Oil Pan (Upper) And Oil Pan (Lower)
Courtesy of NISSAN MOTOR CO., U.S.A.

    c. Slide the seal cutter by tapping on the side of tool with a hammer. Remove oil pan (lower).
21. Remove oil strainer.
22. Remove transmission joint bolts which pierce oil pan (upper). Refer to "**TRANSMISSION ASSEMBLY** ".
23. Remove rear cover plate.
24. Loosen mounting bolts in the reverse order as shown in the figure with power tool to remove.
    - Insert the seal cutter [SST: KV10111100 (J37228)] between oil pan (upper) and cylinder block.

Slide seal cutter by tapping on the side of tool with a hammer. Remove oil pan (upper).

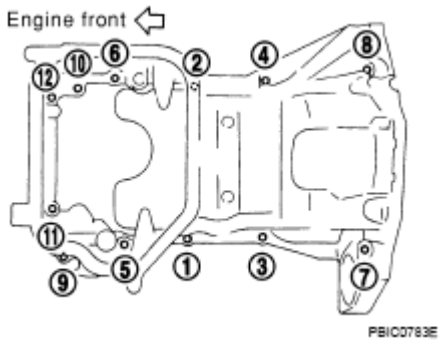


Fig. 36: Identifying Oil Pan Bolts Loosening Sequence (Upper)
Courtesy of NISSAN MOTOR CO., U.S.A.

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

25. Remove O-rings from bottom of cylinder block and oil pump.

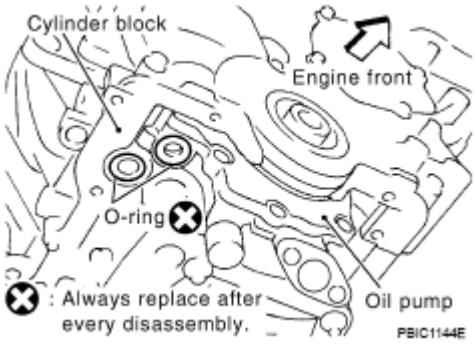


Fig. 37: Identifying New O-Rings On Bottom Of Cylinder Block
Courtesy of NISSAN MOTOR CO., U.S.A.

26. Remove oil pan gaskets.

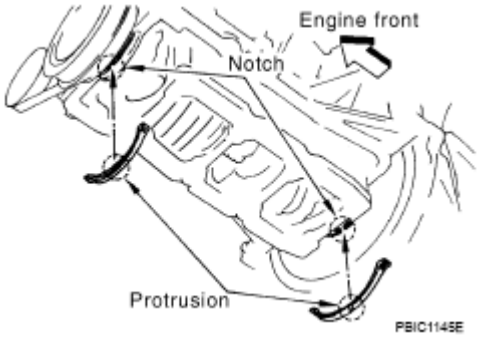


Fig. 38: Identifying Oil Pan Gasket
Courtesy of NISSAN MOTOR CO., U.S.A.

INSPECTION AFTER REMOVAL

Clean oil strainer if any object attached.

INSTALLATION

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

CAUTION: Do not scratch or damage the mating surfaces when cleaning off old liquid gasket.

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

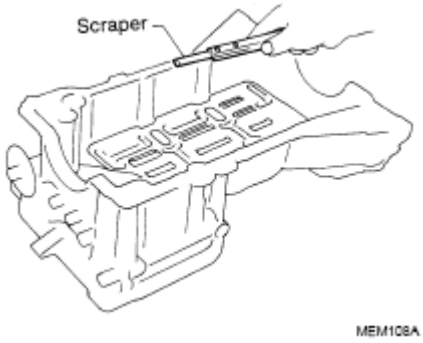


Fig. 39: Removing Gasket Using Scraper
Courtesy of NISSAN MOTOR CO., U.S.A.

   b. Install new oil pan gaskets.
      - Apply liquid gasket to oil pan gaskets as shown in the figure. **Use Genuine RTV Silicone Sealant or equivalent.** Refer to "**RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS** ".

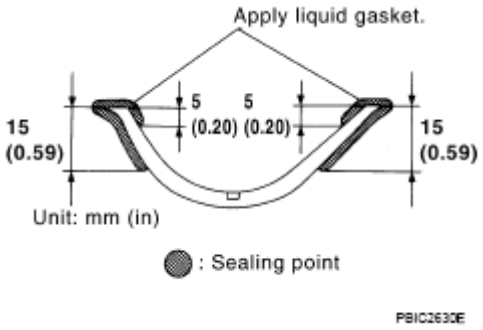


Fig. 40: Applying Liquid Gasket To Oil Pan Gasket
Courtesy of NISSAN MOTOR CO., U.S.A.

- To install, align protrusion of oil pan gasket with notches of front timing chain case and rear oil seal retainer.
- Install oil pan gasket with smaller arc to front timing chain case side.

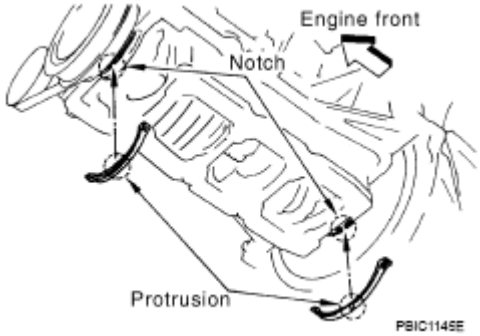


Fig. 41: Aligning Protrusion Of Oil Pan Gasket With Notches
Courtesy of NISSAN MOTOR CO., U.S.A.

c. Install new O-rings on the bottom of cylinder block and oil pump.

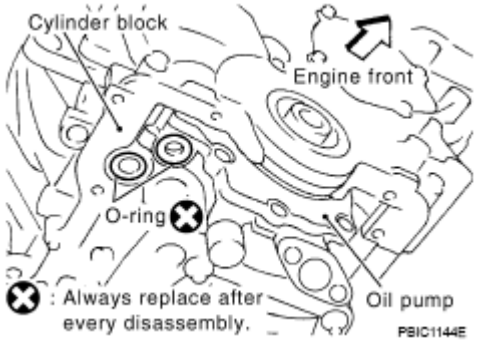


Fig. 42: Identifying New O-Rings On Bottom Of Cylinder Block
Courtesy of NISSAN MOTOR CO., U.S.A.

d. Apply a continuous bead of liquid gasket with the tube presser [SST: WS39930000 (-)] to the

cylinder block mating surface of oil pan (upper) to a limited portion as shown in the figure. **Use Genuine RTV Silicone Sealant or equivalent.** Refer to "**RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS** ".

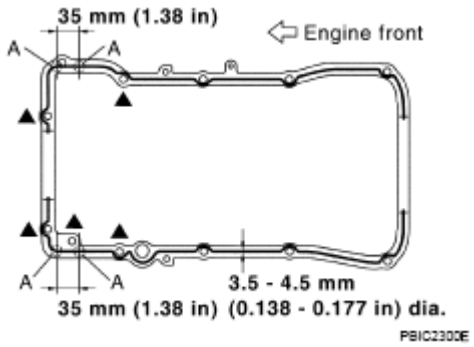


Fig. 43: Applying Continuous Bead Of Liquid Gasket To Cylinder Block Mating Surface
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION:
- **For bolt holes with ? marks (5 locations), apply liquid gasket outside the holes.**
- **Apply a bead of 4.5 to 5.5 mm (0.177 to 0.217 in) in diameter to area "A".**
- **Attaching should be done within 5 minutes after coating.**

e. Install oil pan (upper).

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

- Tighten mounting bolts in numerical order as shown in the figure.
- There are two types of mounting bolts. Refer to the following for locating bolts.

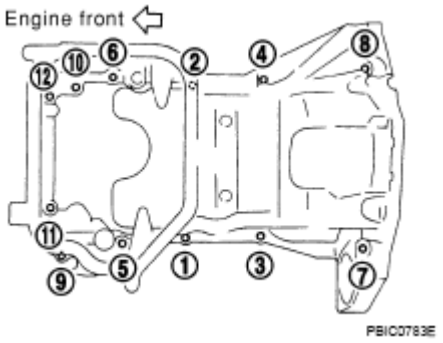


Fig. 44: Loosening And Tightening Oil Pan Mounting Bolts In Sequence (Upper)
Courtesy of NISSAN MOTOR CO., U.S.A.

M8 x 100 mm (3.94 in) : 5, 7, 8, 11

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

f. Tighten transmission joint bolts. Refer to "**TRANSMISSION ASSEMBLY** ".

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

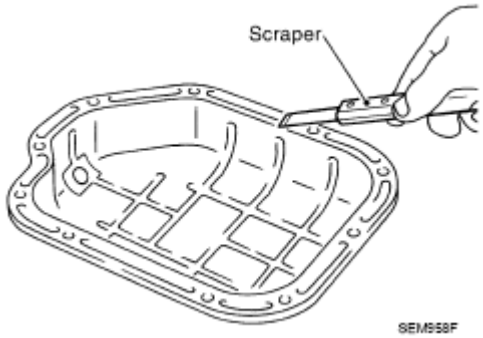


Fig. 45: Removing Liquid Gasket From Mating Surfaces Using Scraper
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: Do not scratch or damage the mating surfaces when cleaning off old liquid gasket.

   b. Apply a continuous bead of liquid gasket with the tube presser [SST: WS39930000 (-)] to the oil pan (lower) as shown in the figure.

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

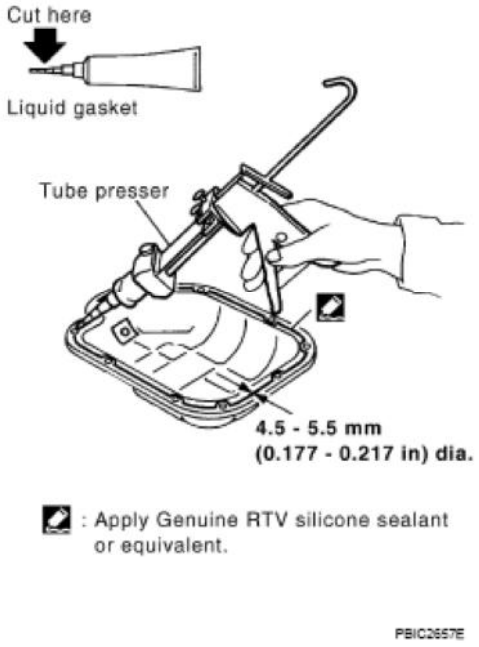


Fig. 46: Applying Continuous Bead Of Liquid Gasket To Oil Pan (Lower)
Courtesy of NISSAN MOTOR CO., U.S.A.

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

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

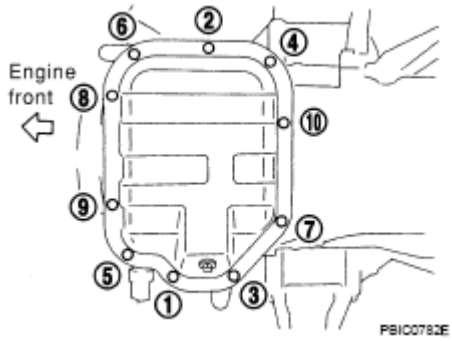


Fig. 47: Loosening And Tightening Oil Pan Mounting Bolts In Sequence (Lower)
Courtesy of NISSAN MOTOR CO., U.S.A.

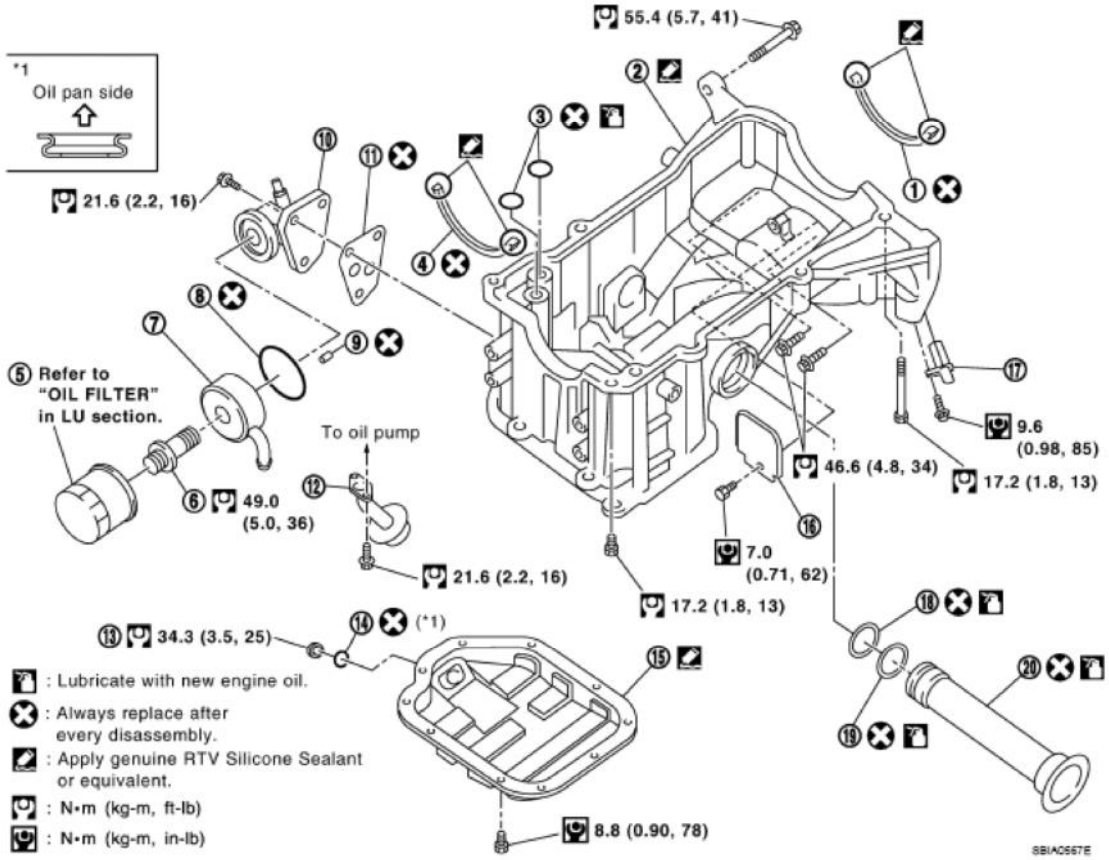
4. Install oil pan drain plug.
   - Refer to **COMPONENTS (2WD MODELS)** for installation direction of drain plug washer.
5. Install in the reverse order of removal after this step.

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

INSPECTION AFTER INSTALLATION

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

COMPONENTS (AWD MODELS)



1. Oil pan gasket (rear)	2. Oil pan (upper)	3. O-ring
4. Oil pan gasket (front)	5. Oil filter	6. Connector bolt
7. Oil cooler	8. O-ring	9. Relief valve
10. Oil filter bracket	11. Oil filter bracket gasket	12. Oil strainer
13. Drain plug	14. Drain plug washer	15. Oil pan (lower)
16. Rear plate cover	17. Crankshaft position sensor (POS)	18 O-ring (small)
19. O-ring (large)	20. Axle pipe	

Fig. 48: Exploded View Of Oil Pan Components With Torque Specifications (AWD Models)
Courtesy of NISSAN MOTOR CO., U.S.A.

REMOVAL AND INSTALLATION (AWD MODELS)

REMOVAL

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

NOTE: To remove oil pan (lower) only, take step 5, then step 24. Removal of step 1, hood assembly (step 2) and step 4 are unnecessary.

1. Remove front tire.
2. Remove hood assembly. Refer to "**HOOD** ".
3. Remove front and rear engine undercover with power tool.
4. Remove front cross bar with power tool. Refer to "**FRONT SUSPENSION ASSEMBLY** ".
5. Drain engine oil. Refer to "**CHANGING ENGINE OIL** ".

   CAUTION:
   - **Perform this step when the engine is cold.**
   - **Do not spill engine oil on drive belts.**

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

   CAUTION:
   - **Perform this step when the engine is cold.**
   - **Do not spill engine coolant on drive belts.**

7. Remove engine cover with power tool. Refer to "**INTAKE MANIFOLD COLLECTOR**".
8. Remove air hose from air duct to mass air flow sensor side and electric throttle control actuator side. Refer to "**AIR CLEANER AND AIR DUCT**".
9. Remove drive belts. Refer to "**DRIVE BELTS**".
10. Remove front drive shaft (LH and RH) and side shaft. Refer to "**FRONT DRIVE SHAFT** ".
11. Remove side shaft. Refer to "**FRONT FINAL DRIVE ASSEMBLY** ".
12. Removal engine rear lower slinger, and install engine rear slinger [SST: 10006 31U00 (-)] to sling engine assembly for positioning. Refer to "**SPECIAL SERVICE TOOLS**".

    Slinger bolts:

    : 28.0 N.m (2.9 kg-m, 21 ft-lb)

13. Remove front suspension member. Refer to "**FRONT SUSPENSION MEMBER** ".
14. Remove engine mounting bracket, engine mounting bracket (lower) and insulator. Refer to "**ENGINE ASSEMBLY**".
15. Remove front propeller shaft. Refer to "**FRONT PROPELLER SHAFT** ".
16. Remove oil filter and oil filter bracket. Refer to "**OIL FILTER BRACKET (AWD)** ".
17. Remove alternator stay. Refer to "**CHARGING SYSTEM** ".

18. Remove idler pulley and bracket. Refer to "**DRIVE BELTS**".
19. Disconnect oil cooler water hoses, and remove oil cooler water pipe mounting bolt. Refer to "**OIL COOLER** ".
20. Disconnect A/T fluid cooler hoses, and remove A/T fluid cooler tube. Refer to "**TRANSMISSION ASSEMBLY** ".
21. Remove front final drive assembly. Refer to "**FRONT FINAL DRIVE ASSEMBLY** ".
22. Remove starter motor. Refer to "**STARTING SYSTEM** ".
23. Remove crankshaft position sensor (POS).

CAUTION:

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

24. Remove oil pan (lower) as follows:
    a. Loosen mounting bolts in reverse order as shown in the figure to remove.

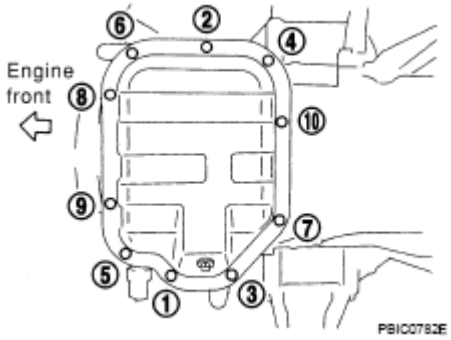


Fig. 49: Loosening And Tightening Oil Pan Mounting Bolts In Sequence (Lower)
Courtesy of NISSAN MOTOR CO., U.S.A.

    b. Insert the seal cutter (SST) between oil pan (upper) and oil pan (lower).

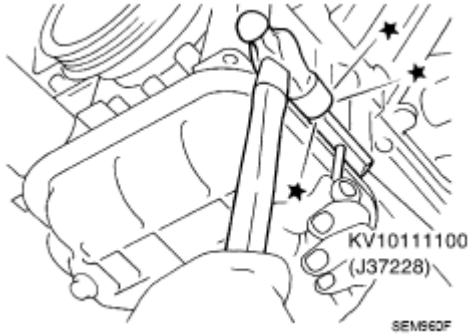


Fig. 50: Inserting Seal Cutter (SST) Between Oil Pan (Upper) And Oil Pan (Lower)
Courtesy of NISSAN MOTOR CO., U.S.A.

c. Slide the seal cutter by tapping on the side of tool with a hammer. Remove oil pan (lower).

CAUTION:
- **Be careful not to damage the mating surface.**
- **Do not insert flat-bladed screwdriver, this will damage the mating surface.**

25. Remove oil strainer.
26. Remove transmission joint bolts which pierce oil pan (upper). Refer to "**TRANSMISSION ASSEMBLY**".
27. Loosen mounting bolts in the reverse order as shown in the figure with power tool to remove.
    - Insert the seal cutter [SST: KV10111100 (J37228)] between oil pan (upper) and cylinder block. Slide seal cutter by tapping on the side of tool with a hammer. Remove oil pan (upper).

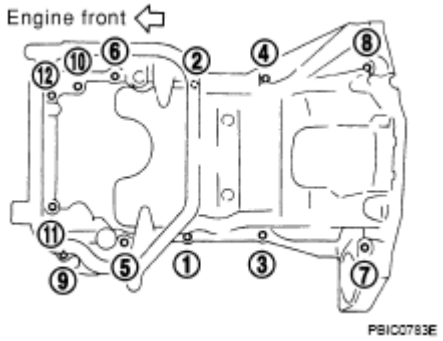


Fig. 51: Loosening And Tightening Oil Pan Mounting Bolts In Sequence (Upper)
Courtesy of NISSAN MOTOR CO., U.S.A.

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

28. Remove O-rings from bottom of cylinder block and oil pump.

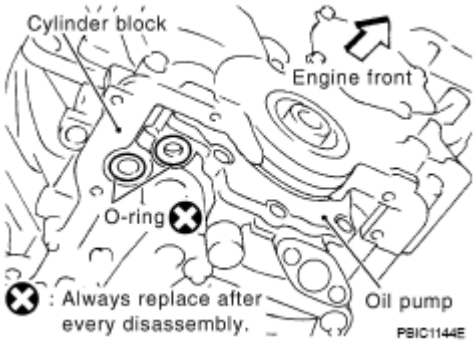


Fig. 52: Identifying New O-Rings On Bottom Of Cylinder Block
Courtesy of NISSAN MOTOR CO., U.S.A.

29. Remove oil pan gaskets.

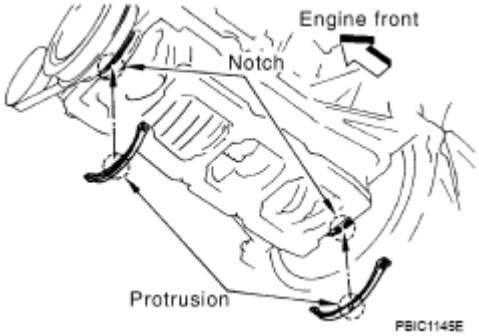


Fig. 53: Identifying Oil Pan Gasket
Courtesy of NISSAN MOTOR CO., U.S.A.

30. Remove axle pipe, as necessary.

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

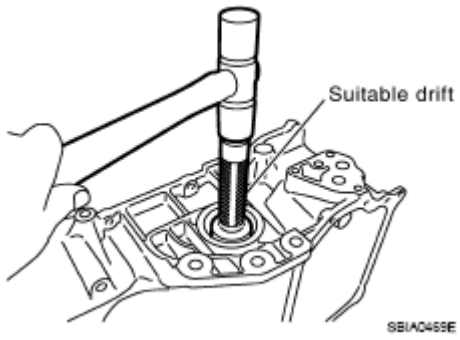


Fig. 54: Removing Axle Pipe From Oil Pan
Courtesy of NISSAN MOTOR CO., U.S.A.

INSPECTION AFTER REMOVAL

Clean oil strainer if any object attached.

INSTALLATION

1. Install axle pipe to oil pan, if removed.
   - Lubricate O-ring groove of axle pipe, O-ring, and O-ring joint of oil pan with new engine oil.

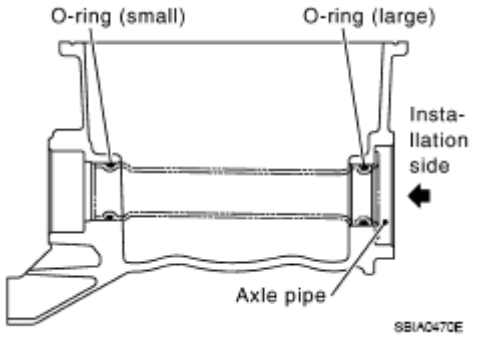


Fig. 55: Identifying O-Ring Groove Of Axle Pipe
Courtesy of NISSAN MOTOR CO., U.S.A.

ITEMS CHART

	Unit: mm (in)
Item	**O-ring inner diameter**
Final drive side (right side)	32 (1.26)
Axle pipe flange side (left side)	34 (1.34)

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

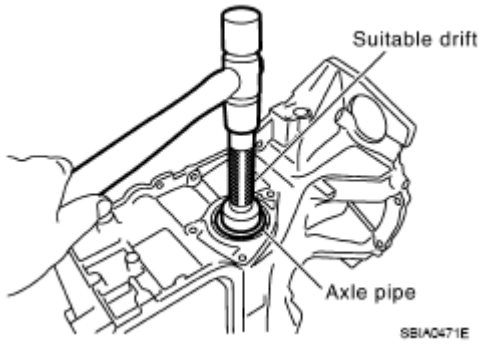


Fig. 56: Installing Axle Pipe To Oil Pan
Courtesy of NISSAN MOTOR CO., U.S.A.

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

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

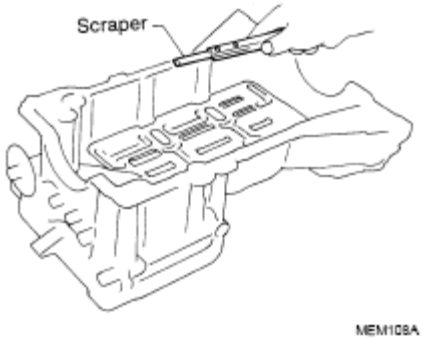


Fig. 57: Identifying Oil Liquid Gasket From Bolt Holes And Threads
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: Do not scratch or damage the mating surfaces when cleaning off old liquid gasket.

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

   b. Install new oil pan gaskets.
      - Apply liquid gasket to oil pan gaskets as shown in the figure.

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

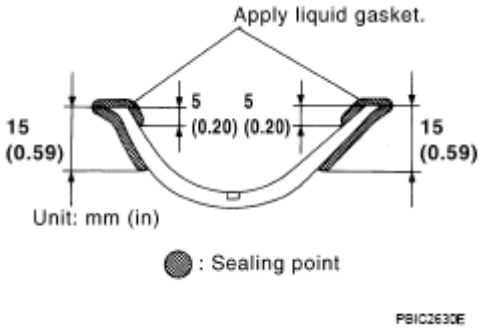


Fig. 58: Applying Liquid Gasket To Oil Pan Gasket
Courtesy of NISSAN MOTOR CO., U.S.A.

      - To install, align protrusion of oil pan gasket with notches of front timing chain case and rear oil seal retainer.
      - Install oil pan gasket with smaller arc to front timing chain case side.

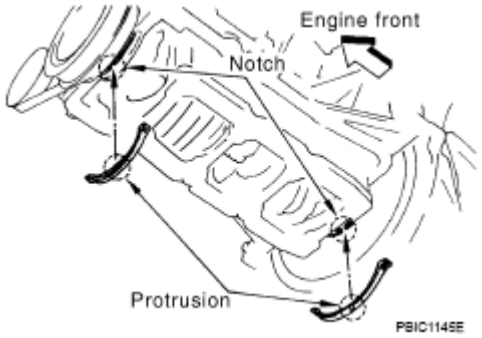


Fig. 59: Identifying Oil Pan Gasket
Courtesy of NISSAN MOTOR CO., U.S.A.

c. Install new O-rings on the bottom of cylinder block and oil pump.

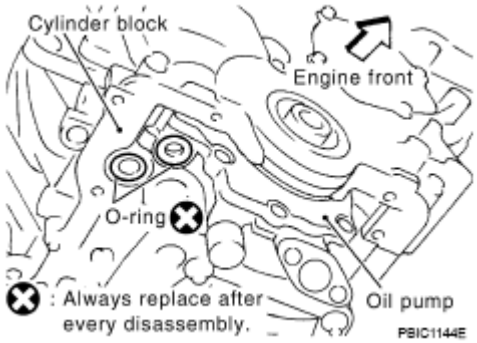


Fig. 60: Identifying New O-Rings On Bottom Of Cylinder Block
Courtesy of NISSAN MOTOR CO., U.S.A.

d. Apply a continuous bead of liquid gasket with the tube presser [SST: WS39930000 (-)] to the cylinder block mating surface of oil pan (upper) to a limited portion as shown in the figure.

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

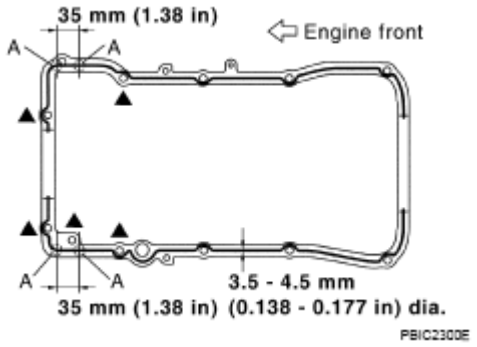


Fig. 61: Applying Continuous Bead Of Liquid Gasket
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION:

- **For bolt holes with ? marks (5 locations), apply liquid gasket outside the holes.**
- **Apply a bead of 4.5 to 5.5 mm (0.177 to 0.217 in) in diameter to area "A".**
- **Attaching should be done within 5 minutes after coating.**

e. Install oil pan (upper).

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

- Tighten mounting bolts in numerical order as shown in the figure.
- There are two types of mounting bolts. Refer to the following for locating bolts.

M8 x 100 mm (3.94 in) : 5, 7, 8, 11

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

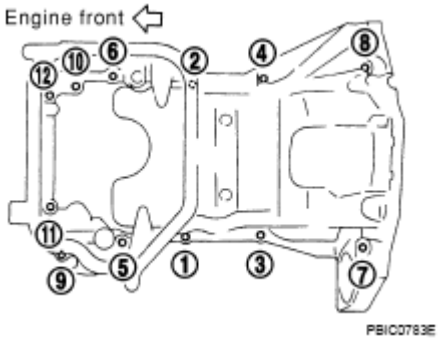


Fig. 62: Loosening And Tightening Oil Pan Mounting Bolts In Sequence (Upper)
Courtesy of NISSAN MOTOR CO., U.S.A.

f. Tighten transmission joint bolts. Refer to "**TRANSMISSION ASSEMBLY** ".

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

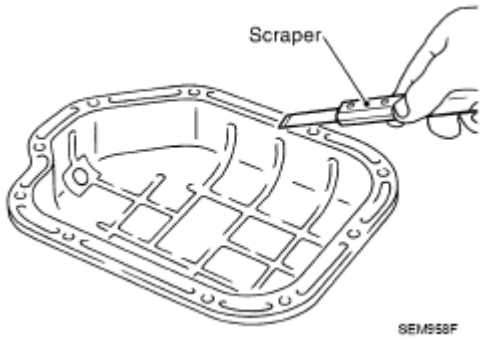


Fig. 63: Removing Liquid Gasket From Mating Surfaces Using Scraper
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: Do not scratch or damage the mating surfaces when cleaning off old liquid gasket.

b. Apply a continuous bead of liquid gasket with the tube presser [SST: WS39930000 (-)] to the oil pan (lower) as shown in the figure.

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

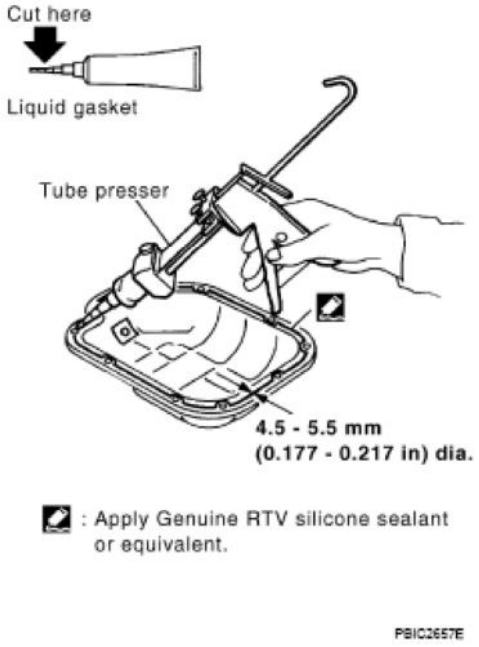


Fig. 64: Applying Continuous Bead Of Liquid Gasket To Oil Pan (Lower)
Courtesy of NISSAN MOTOR CO., U.S.A.

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

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

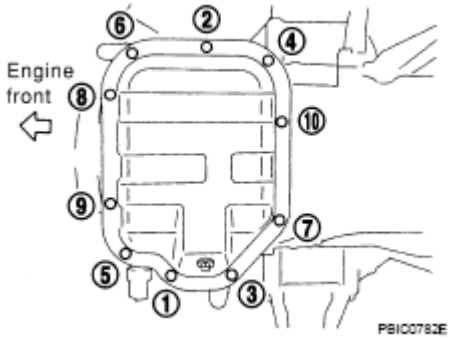


Fig. 65: Loosening And Tightening Oil Pan Mounting Bolts In Sequence (Lower)
Courtesy of NISSAN MOTOR CO., U.S.A.

5. Install oil pan drain plug.
   - Refer to **COMPONENTS (AWD MODELS)** for installation direction of drain plug washer.
6. Install in the reverse order of removal after this step.

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

INSPECTION AFTER INSTALLATION

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

IGNITION COIL

COMPONENTS

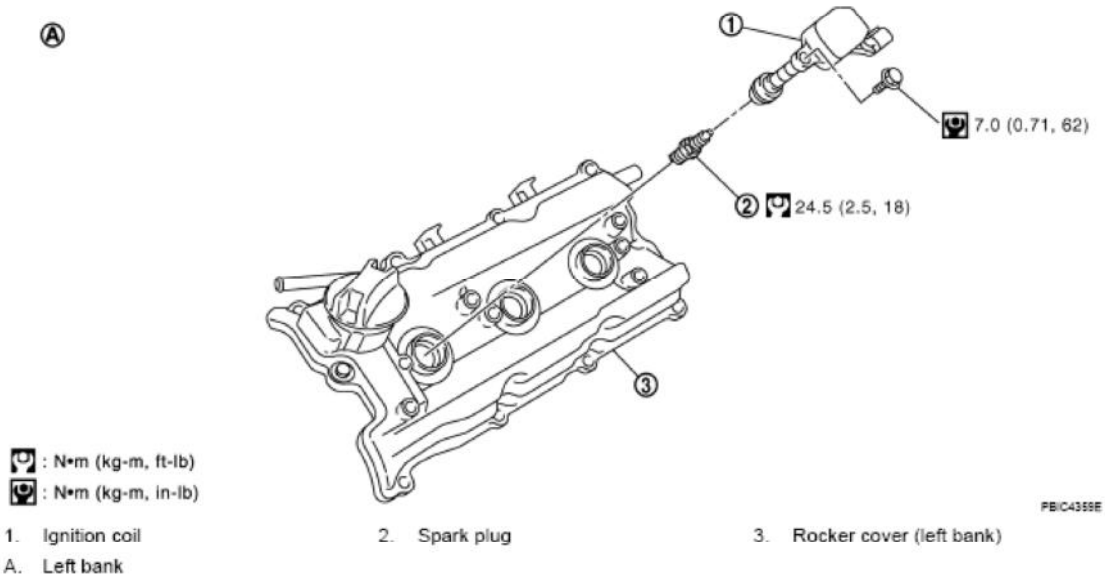


Fig. 66: Identifying Ignition Coil Components With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

REMOVAL AND INSTALLATION

REMOVAL

1. Remove engine cover with power tool. Refer to "**INTAKE MANIFOLD COLLECTOR**".
2. Remove air duct (At the left bank side, remove ignition coil). Refer to "**AIR CLEANER AND AIR DUCT**".
3. Move aside harness, harness bracket, and hoses located above ignition coil.
4. Disconnect harness connector from ignition coil.
5. Remove ignition coil.

CAUTION: Do not shock it.

INSTALLATION

Installation is the reverse order of removal.

SPARK PLUG (PLATINUM-TIPPED TYPE)

COMPONENTS

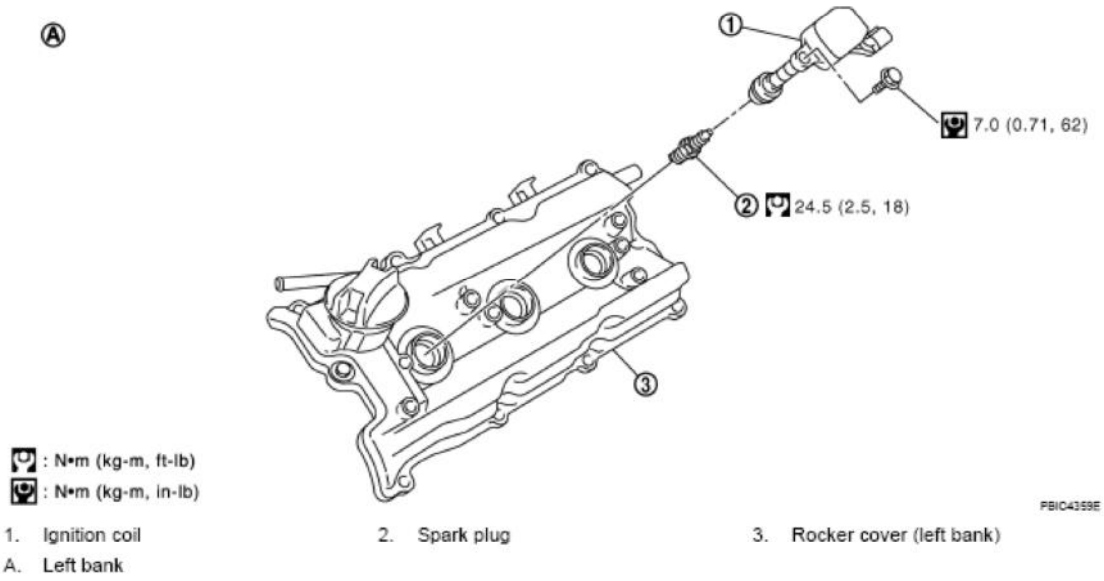


Fig. 67: Identifying Spark Plug Components With Torque Specifications (Platinum-Tipped Type)
Courtesy of NISSAN MOTOR CO., U.S.A.

REMOVAL AND INSTALLATION

REMOVAL

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

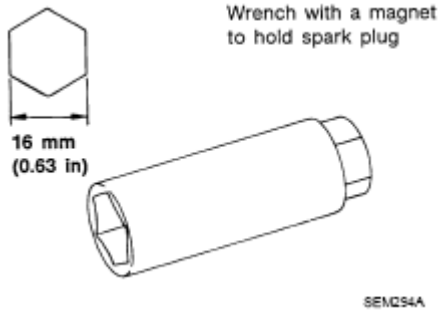


Fig. 68: Identifying Park Plug Tool
Courtesy of NISSAN MOTOR CO., U.S.A.

INSPECTION AFTER REMOVAL

Use the standard type spark plug for normal condition.

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

- Frequent engine starts
- Low ambient temperatures

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

- Extended highway driving
- Frequent high engine revolution

SPARK PLUG STANDARD TYPE

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

Gap (Nominal) : 1.1 mm (0.043 in)

CAUTION:

- **Do not drop or shock spark plug.**
- **Do not use a 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

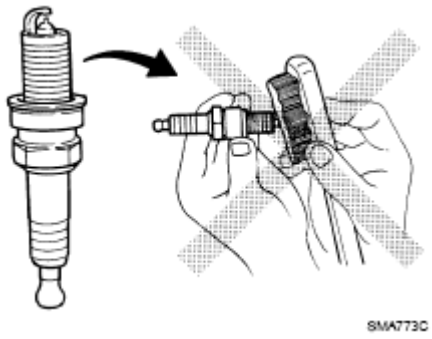


Fig. 69: Precaution For Cleaning Spark Plugs
Courtesy of NISSAN MOTOR CO., U.S.A.

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

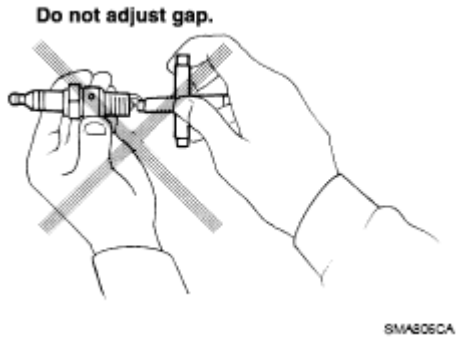


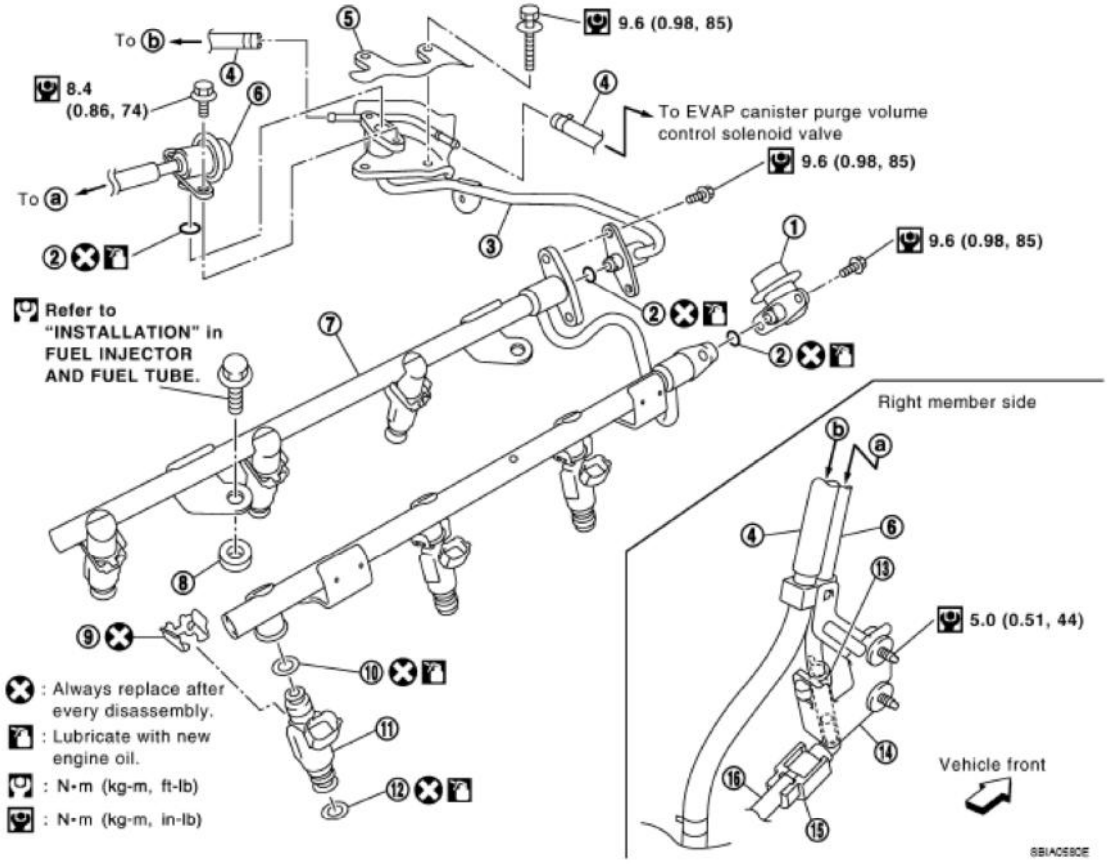
Fig. 70: Precaution - Spark Plug Gap Adjustment
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

Installation is the reverse order of removal.

FUEL INJECTOR AND FUEL TUBE

COMPONENTS



1. Fuel damper
2. O-ring
3. Fuel sub-tube
4. EVAP hose
5. Intake manifold collector (lower)
6. Fuel feed hose (with damper)
7. Fuel tube
8. Spacer
9. Clip
10. O-ring (blue)
11. Fuel injector
12. O-ring (brown)
13. Hose clamp
14. Bracket
15. Quick connector cap
16. Centralized under-floor piping

Fig. 71: Identifying Fuel Injector And Fuel Tube Components With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: Do not remove or disassemble parts unless instructed as shown in Fig. 71.

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 CO_2 fire extinguisher.**
- **Do not smoke while servicing fuel system. Keep open flames and sparks away from the work area.**

- **To avoid the danger of being scalded, do not drain engine coolant when the engine is hot.**

1. Remove engine cover with power tool. Refer to "**INTAKE MANIFOLD COLLECTOR**".
2. Release fuel pressure. Refer to "**FUEL PRESSURE RELEASE** ".
3. Drain engine coolant, or when water hoses are disconnected, attach plug to prevent engine coolant leakage. Refer to "**CHANGING ENGINE COOLANT** " and "**INTAKE MANIFOLD COLLECTOR**".

CAUTION: Perform this step when the engine is cold.

4. Remove fuel feed hose (with damper) from fuel sub-tube.

NOTE: There is no fuel return route.

CAUTION:

- **While hoses are disconnected, plug them to prevent fuel from draining.**
- **Do not separate damper and hose.**

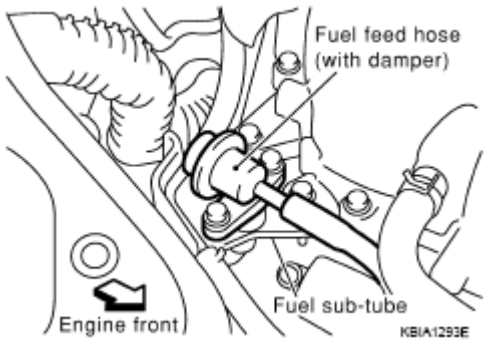


Fig. 72: Identifying Fuel Feed Hose (With Damper) From Fuel Sub-Tube
Courtesy of NISSAN MOTOR CO., U.S.A.

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

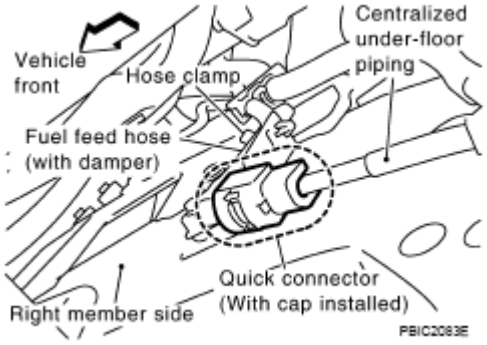


Fig. 73: Identifying Fuel Feed Hose (With Damper) From Bracket Hose Clamp
Courtesy of NISSAN MOTOR CO., U.S.A.

c. Disconnect quick connector from centralized under-floor piping as follows:

CAUTION: Disconnect quick connector by using quick connector release [SST: -(J-45488)], not by picking out retainer tabs.

i. With the sleeve side of quick connector release facing quick connector, install quick connector release onto centralized under-floor piping.
ii. Insert quick connector release into quick connector until sleeve contacts and goes no further. Hold quick connector release on that position.

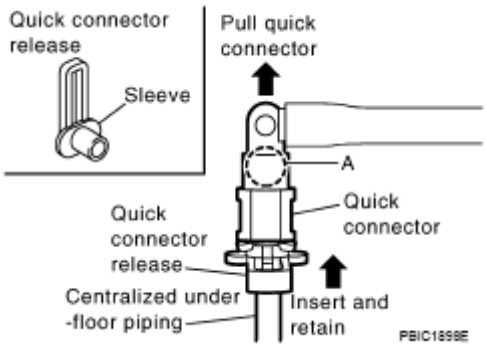


Fig. 74: Identifying Quick Connector
Courtesy of NISSAN MOTOR CO., U.S.A.

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 centralized under-floor piping.

CAUTION:
- **Pull quick connector holding "A" position as shown in the figure.**

- **Do not pull with lateral force applied. O-ring inside quick connector may be damaged.**
- **Prepare container and cloth beforehand as fuel will leak out.**
- **Avoid fire and sparks.**
- **Keep parts away from heat source. Especially, be careful when welding is performed around them.**
- **Do not expose parts to battery electrolyte or other acids.**
- **Do not bend or twist connection between quick connector and fuel feed hose (with damper) during installation/removal.**
- **To keep clean the connecting portion and to avoid damage and foreign materials, cover them completely with plastic bags or something similar.**

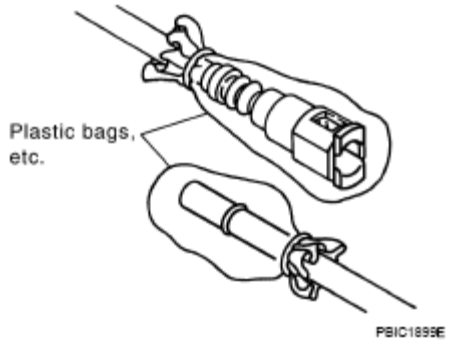


Fig. 75: Covering Connecting Portion With Plastic Bags
Courtesy of NISSAN MOTOR CO., U.S.A.

6. Remove intake manifold collectors (upper and lower). Refer to "**INTAKE MANIFOLD COLLECTOR**".
7. Disconnect harness connector from fuel injector.
8. Loosen mounting bolts in reverse order as shown in the figure, and remove fuel tube and fuel injector assembly.

CAUTION: Do not tilt it, or remaining fuel in pipes may flow out from pipes.

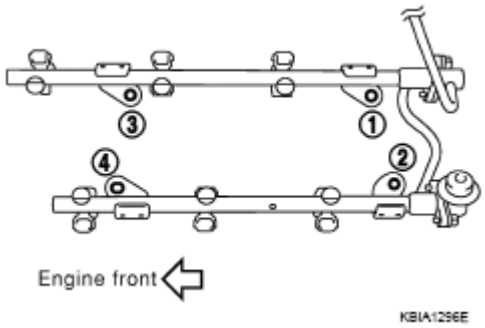


Fig. 76: Identifying Loosening/Tightening Sequence Of Fuel Tube And Fuel Injector Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

9. Remove spacers on intake manifold.
10. Remove fuel injector from fuel tube as follows:
    a. Open and remove clip.
    b. Remove fuel injector from fuel tube by pulling straight.

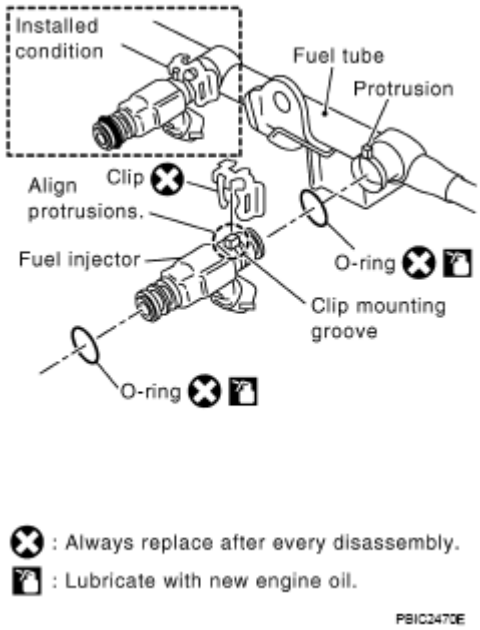


Fig. 77: Identifying Fuel Injector From Fuel Tube
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION:
- **Be careful with remaining fuel that may go out from fuel tube.**
- **Be careful not to damage injector nozzles during removal.**
- **Do not bump or drop fuel injector.**
- **Do not disassemble fuel injector.**

11. Remove fuel sub-tube and fuel damper.

INSTALLATION

1. Install fuel damper and fuel sub-tube.
   - When handling new O-rings, be careful of the following caution:

CAUTION:

- **Handle O-ring with bare hands. Do not wear gloves.**
- **Lubricate O-ring with new engine oil.**
- **Do not clean O-ring with solvent.**
- **Make sure 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, do not insert it quickly into fuel tube.**
- **Insert new O-ring straight into fuel tube. Do not decenter or twist it.**

   - Insert fuel damper and fuel sub-tube straight into fuel tube.
   - Tighten mounting bolts evenly in turn.
   - After tightening mounting bolts, make sure that there is no gap between flange and fuel tube.
2. Install new O-rings to fuel injector, paying attention to the following.

CAUTION:

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

  Fuel tube side : Blue

  Nozzle side : Brown

- **Handle O-ring with bare hands. Do not wear gloves.**
- **Lubricate O-ring with new engine oil.**
- **Do not clean O-ring with solvent.**
- **Make sure 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, do not insert it quickly into fuel tube.**
- **Insert O-ring straight into fuel injector. Do not decenter or twist it.**

3. Install fuel injector to fuel tube as follows:

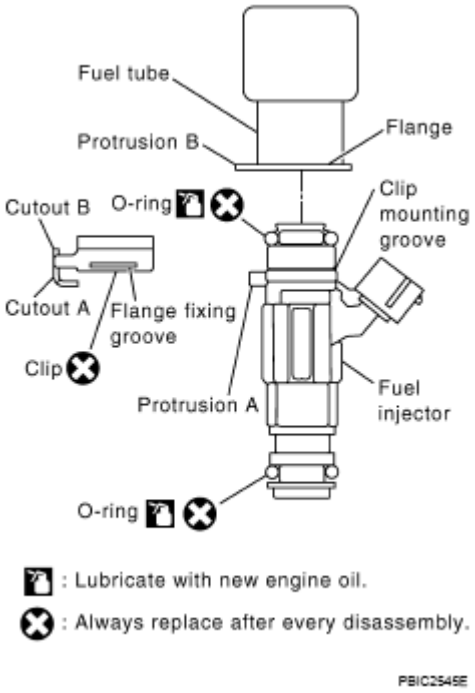


Fig. 78: Identifying Fuel Injector
Courtesy of NISSAN MOTOR CO., U.S.A.

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:
- **Do not 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.
   - Make sure that fuel tube flange is securely fixed in flange fixing groove on clip.

c. Make sure that installation is complete by checking that fuel injector does not rotate or come off.
   - Make sure that protrusions of fuel injectors are aligned with cutouts of clips after installation.

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

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

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

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

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

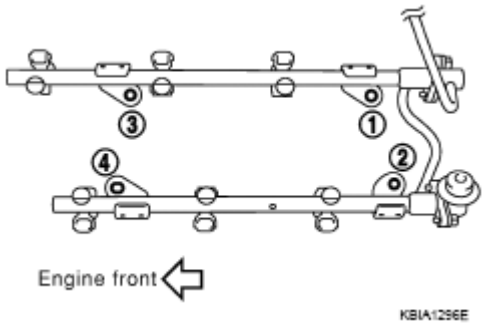


Fig. 79: Identifying Loosening/Tightening Sequence Of Fuel Tube And Fuel Injector Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

6. Connect injector sub-harness.
7. Install intake manifold collectors (upper and lower). Refer to "**INTAKE MANIFOLD COLLECTOR**".
8. Install fuel sub-tube on rear end of intake manifold collector (lower).
9. Connect fuel feed hose (with damper).
   - Handling procedure of O-ring is the same as that of fuel damper and fuel sub-tube.
   - Insert fuel damper straight into fuel sub-tube.
   - Tighten mounting bolts evenly in turn.
   - After tightening mounting bolts, make sure that there is no gap between flange and fuel sub-tube.
10. Connect quick connector between fuel feed hose (with damper) and centralized under-floor piping connection as follows:
    a. Make sure no foreign substances are deposited in and around centralized under-floor piping and quick connector, and no damage on them.
    b. Thinly apply new engine oil around centralized under-floor piping from tip end to spool end.
    c. Align center to insert quick connector straightly into centralized under-floor piping.
       - Insert quick connector to centralized under-floor piping until top spool is completely inside quick connector, and 2nd level spool exposes right below quick connector.

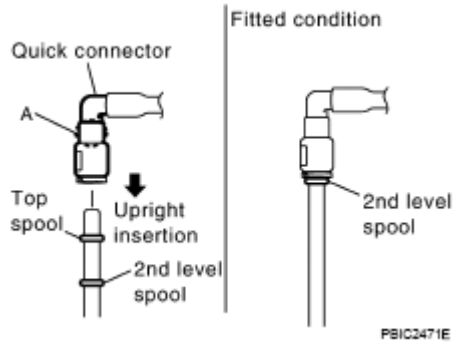


Fig. 80: Aligning Center To Insert Quick Connector
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION:
- **Hold "A" position as shown in the figure when inserting centralized under-floor piping 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.**

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

e. Install quick connector cap to quick connector connection.

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

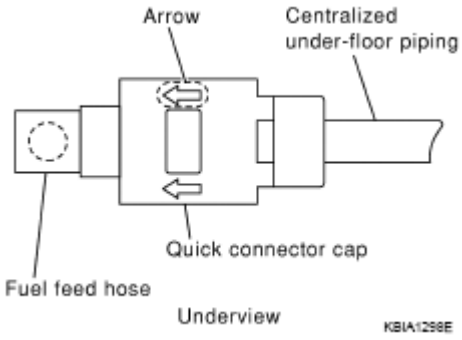


Fig. 81: Identifying Quick Connector Cap
Courtesy of NISSAN MOTOR CO., U.S.A.

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

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

INSPECTION AFTER INSTALLATION

Check on Fuel Leakage

1. Turn ignition switch "ON" (with the engine stopped). With fuel pressure applied to fuel piping, make sure there are no fuel leaks at connection points.

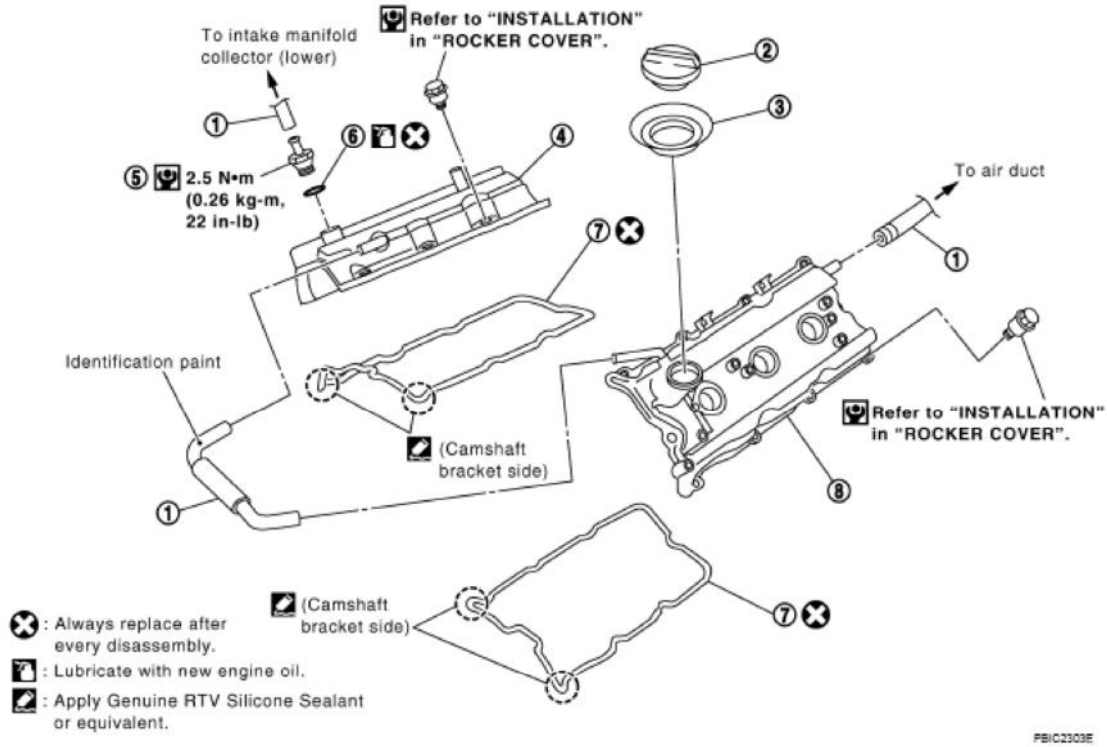
NOTE: Use mirrors for checking at points out of clear sight.

2. Start the engine. With engine speed increased, make sure again that there are no fuel leaks at connection points.

CAUTION: Do not touch the engine immediately after stopped, as the engine becomes extremely hot.

ROCKER COVER

COMPONENTS



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

Fig. 82: Identifying Rocker Cover Components With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

REMOVAL AND INSTALLATION

REMOVAL

1. Remove engine cover with power tool. Refer to "**INTAKE MANIFOLD COLLECTOR**".
2. Release the fuel pressure. Refer to "**FUEL PRESSURE RELEASE** ".
3. Drain engine coolant, or when water hoses are disconnected, attach plug to prevent engine coolant leakage. Refer to "**CHANGING ENGINE COOLANT** " and "**INTAKE MANIFOLD COLLECTOR**".

CAUTION: Perform this step when the engine is cold.

4. Remove intake manifold collectors (upper and lower). Refer to "**INTAKE MANIFOLD COLLECTOR**".
5. Separate engine harness removing their brackets from rocker covers.
6. Remove ignition coil. Refer to "**IGNITION COIL**".
7. Remove PCV hoses from rocker covers.
8. Remove PCV valve and O-ring from rocker cover (right bank), if necessary.
9. Remove oil filler cap and oil catcher from rocker cover (left bank), if necessary.
10. Loosen mounting bolts with power tool in reverse order as shown in the figure.

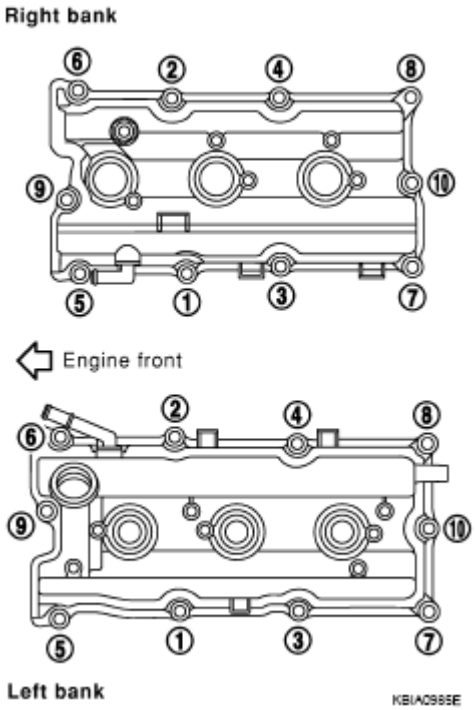


Fig. 83: Identifying Rocker Cover Mounting Bolts In Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

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

CAUTION: Do not scratch or damage the mating surface when cleaning off old liquid gasket.

INSTALLATION

1. Apply liquid gasket with the tube presser [SST: WS39930000 (-)] to joint part among rocker cover,

cylinder head and camshaft bracket (No. 1) as follows:

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

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

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

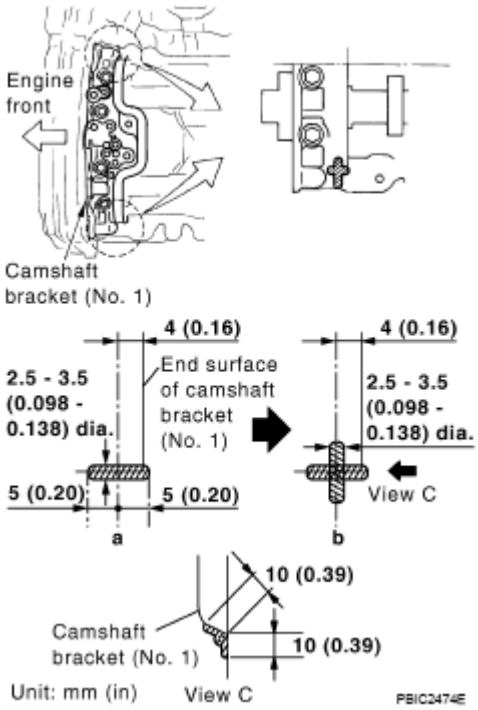


Fig. 84: Applying Liquid Gasket
Courtesy of NISSAN MOTOR CO., U.S.A.

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

1st step : 1.96 N.m (0.20 kg-m, 17 in-lb)

2nd step : 8.33 N.m (0.85 kg-m, 74 in-lb)

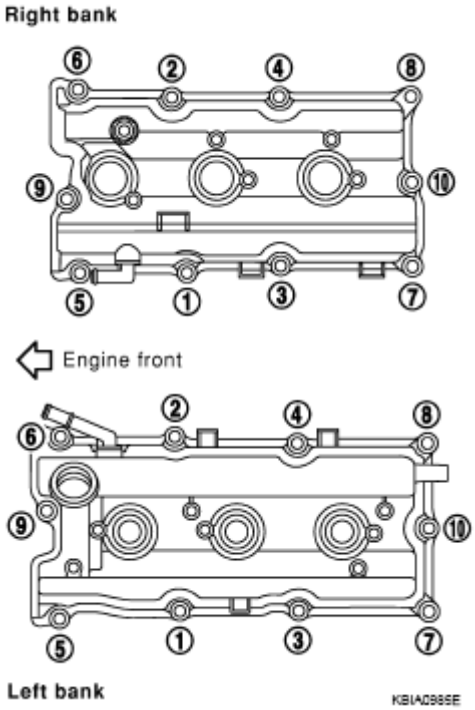


Fig. 85: Identifying Rocker Cover Mounting Bolts In Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

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

FRONT TIMING CHAIN CASE

REMOVAL AND INSTALLATION

NOTE:

- **This service information describes removal/installation procedure of front timing chain case and timing chain related parts without removing oil pan (upper) on the vehicle.**
- **When oil pan (upper) needs to be removed or installed, or when rear timing chain case is removed or installed, remove oil pans (upper and lower) first. Then remove front timing chain case, timing chain related parts, and rear timing chain case in this order, and install in reverse order of removal. Refer to "TIMING CHAIN".**

- **Refer to "TIMING CHAIN" for component parts location.**

REMOVAL

1. Disconnect negative battery terminal. Refer to "**BATTERY** ".
2. Remove engine cover with power tool. Refer to "**INTAKE MANIFOLD COLLECTOR**".
3. Remove air cleaner case assembly. Refer to "**AIR CLEANER AND AIR DUCT**".
4. Remove front and rear engine undercover with power tool.
5. Release the fuel pressure. Refer to "**FUEL PRESSURE RELEASE** ".
6. Drain engine oil. Refer to "**CHANGING ENGINE OIL** ".

CAUTION:
- **Perform this step when the engine is cold.**
- **Do not spill engine oil on drive belts.**

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

CAUTION:
- **Perform this step when the engine is cold.**
- **Do not spill engine coolant on drive belts.**

8. Separate engine harnesses removing their brackets from front timing chain case.
9. Remove drive belts. Refer to "**DRIVE BELTS**".
10. Remove intake manifold collectors (upper and lower). Refer to "**INTAKE MANIFOLD COLLECTOR**".
11. Remove power steering oil pump from bracket with piping connected, and temporarily secure it aside. Refer to "**POWER STEERING OIL PUMP** ".
12. Remove power steering oil pump bracket. Refer to "**POWER STEERING OIL PUMP** ".
13. Remove alternator. Refer to "**CHARGING SYSTEM** ".
14. Remove water bypass hose, water hose clamp and idler pulley bracket from front timing chain case.
15. Remove intake valve timing control covers.
    - Loosen mounting bolts in reverse order as shown in the figure.

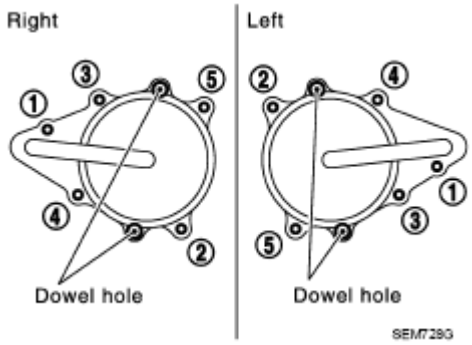


Fig. 86: Identifying Dowel Pins On Chain Case With Holes
Courtesy of NISSAN MOTOR CO., U.S.A.

- Use the seal cutter [SST: KV10111100 (J37228)] to cut liquid gasket for removal.

CAUTION: Shaft is internally jointed with camshaft sprocket (INT) center hole. When removing, keep it horizontal until it is completely disconnected.

16. Remove collared O-ring from front timing chain case (left and right side).

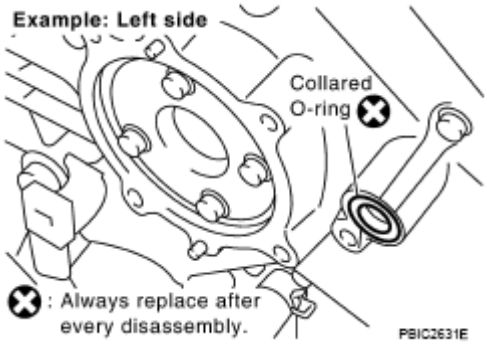


Fig. 87: Identifying Collared O-Rings
Courtesy of NISSAN MOTOR CO., U.S.A.

17. Remove rocker covers (right and left banks). Refer to "**ROCKER COVER**".

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

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

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

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

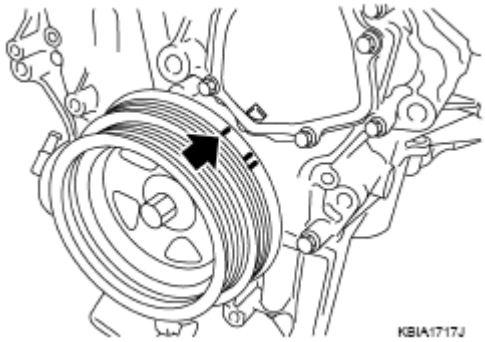


Fig. 88: Aligning Timing Mark With Timing Indicator
Courtesy of NISSAN MOTOR CO., U.S.A.

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

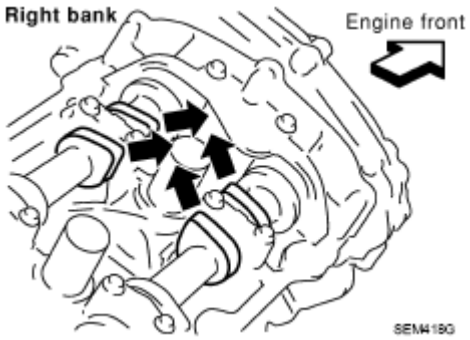


Fig. 89: Identifying Camshaft
Courtesy of NISSAN MOTOR CO., U.S.A.

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

19. Remove crankshaft pulley as follows:
    a. Remove rear cover plate (2WD) or starter motor (AWD) and set ring gear stopper (SST). Refer to "**OIL PAN AND OIL STRAINER**" (2WD) or "**STARTING SYSTEM** " (AWD).
    b. Loosen crankshaft pulley bolt and locate bolt seating surface as 10 mm (0.39 in) from its original position.

CAUTION: Do not remove crankshaft pulley bolt as it will be used as a supporting point for suitable puller.

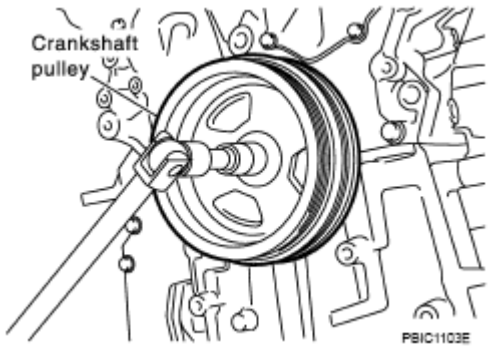


Fig. 90: Identifying Crankshaft Pulley Bolt

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

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

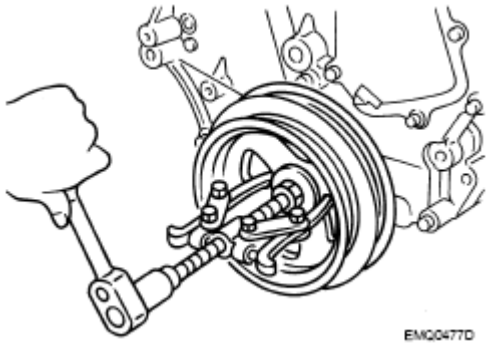


Fig. 91: Pulling Crankshaft Pulley
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: Do not put suitable puller tab on crankshaft pulley periphery, as this will damage internal damper.

20. Remove oil pan (lower). Refer to "**OIL PAN AND OIL STRAINER**".
21. Loosen two mounting bolts in front of oil pan (upper) with power tool in reverse order shown in figure.

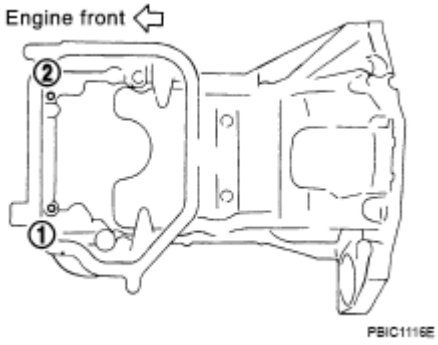


Fig. 92: Identifying Two Mounting Bolts In Front Of Oil Pan (Upper)
Courtesy of NISSAN MOTOR CO., U.S.A.

22. Remove front timing chain case as follows:
    a. Loosen mounting bolts with power tool in reverse order as shown in the figure.

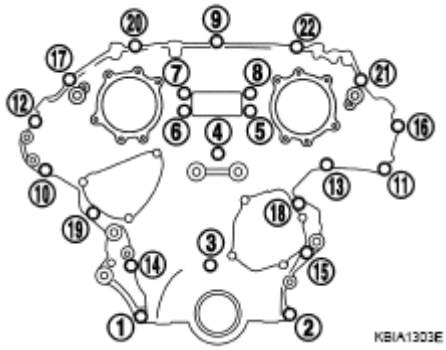


Fig. 93: Identifying Loosening And Tightening Front Timing Chain Case Bolts In Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

b. Insert suitable tool into the notch at the top of front timing chain case as shown (1).
c. Pry off case by moving a tool as shown (2).

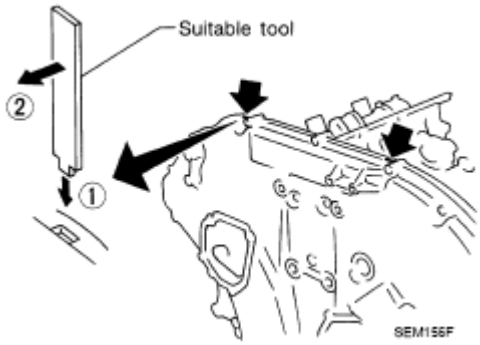


Fig. 94: Removing Front Timing Chain Case Using Suitable Tool
Courtesy of NISSAN MOTOR CO., U.S.A.

- Use the seal cutter [SST: KV10111100 (J37228)] to cut liquid gasket for removal.

CAUTION:
- **Do not use a screwdrivers or something similar.**
- **After removal, handle front timing chain case carefully so it does not tilt, cant, or warp under a load.**

23. Remove O-rings from rear timing chain case.

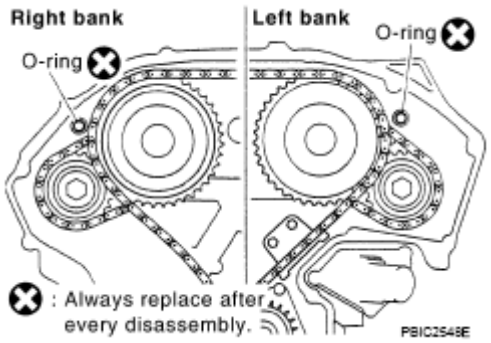


Fig. 95: Identifying O-Rings On Rear Timing Chain Case
Courtesy of NISSAN MOTOR CO., U.S.A.

24. Remove oil pan gasket (front). Refer to "**OIL PAN AND OIL STRAINER**".
25. Remove water pump cover and chain tensioner cover from front timing chain case, if necessary.
    - Use the seal cutter [SST: KV10111100 (J37228)] to cut liquid gasket for removal.
26. Remove front oil seal from front timing chain case using a suitable tool.
    - Use a screwdriver for removal.

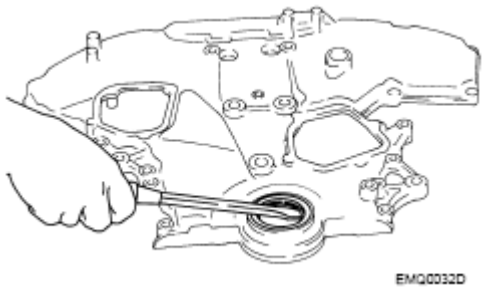


Fig. 96: Identifying Front Oil Seal From Front Timing Chain Case
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: Exercise care not to damage front timing chain case.

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

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

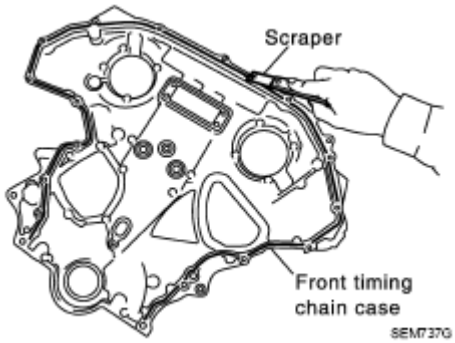


Fig. 97: Removing Liquid Gasket Using Scraper
Courtesy of NISSAN MOTOR CO., U.S.A.

- Remove old liquid gasket from bolt hole and thread.

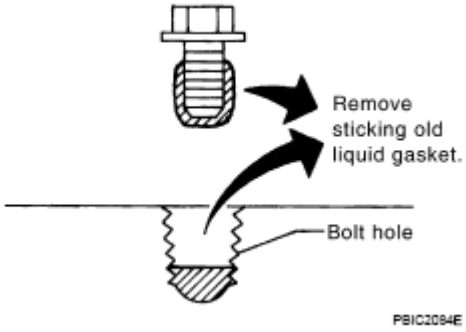


Fig. 98: Identifying Old Liquid Gasket From Bolt Hole And Threads
Courtesy of NISSAN MOTOR CO., U.S.A.

29. Use a scraper to remove all traces of liquid gasket from water pump cover, chain tensioner cover and intake valve timing control covers.

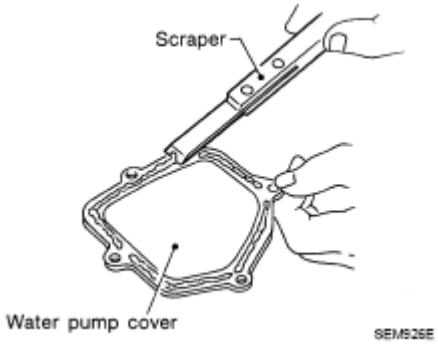


Fig. 99: Removing Liquid Gasket Using Scraper
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

1. Install timing chain and related parts. Refer to "**TIMING CHAIN**".
2. Hammer dowel pins (right and left) into front timing chain case up to a point close to taper in order to shorten protrusion length.

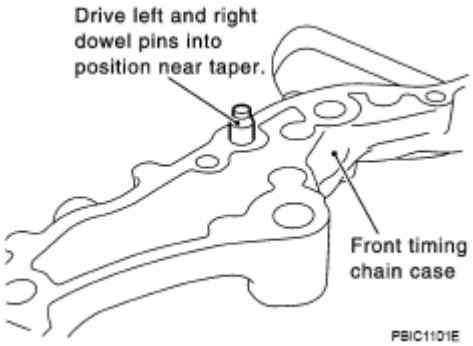


Fig. 100: Identifying Dowel Pins (Right And Left) Into Front Timing Chain
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Install front oil seal on front timing chain case.
   - Apply new engine oil to the oil seal lip and dust seal lip.
   - Install it so that each seal lip is oriented as shown in the figure.

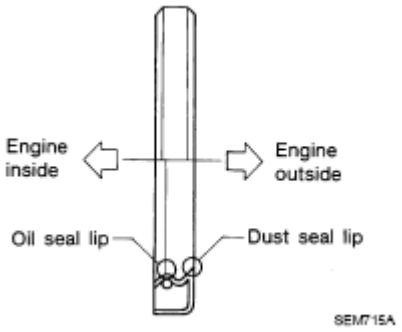


Fig. 101: Identifying Engine Oil To Both Oil Seal Lip And Dust Seal Lip
Courtesy of NISSAN MOTOR CO., U.S.A.

   - Using a suitable drift [outer diameter: 60 mm (2.36 in)], pressfit oil seal until it becomes flush with front timing chain case end face.
   - Make sure the garter spring is in position and seal lip is not inverted.

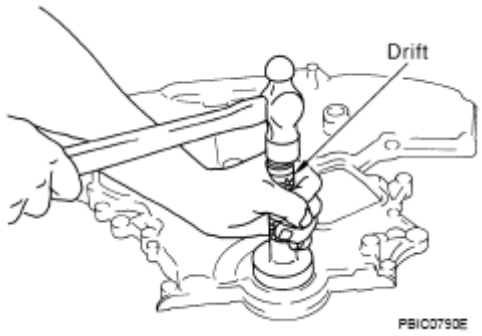


Fig. 102: Identifying Drift
Courtesy of NISSAN MOTOR CO., U.S.A.

4. Install water pump cover and chain tensioner cover to front timing chain case.
   - Apply a continuous bead of liquid gasket with the tube presser [SST: WS39930000 (-)] to front timing chain case as shown in the figure.

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

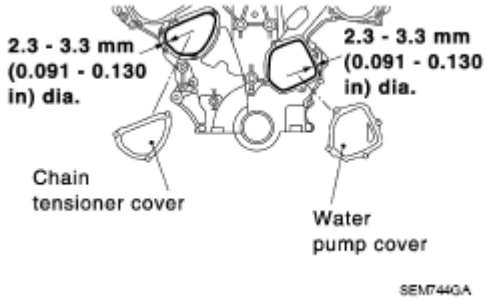


Fig. 103: Applying Bead Of Liquid Gasket With Tube Presser To Front Timing Chain Case
Courtesy of NISSAN MOTOR CO., U.S.A.

5. Install front timing chain case as follows:
   a. Apply a continuous bead of liquid gasket with the tube presser [SST: WS39930000 (-)] to front timing chain case back side as shown in the figure.

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

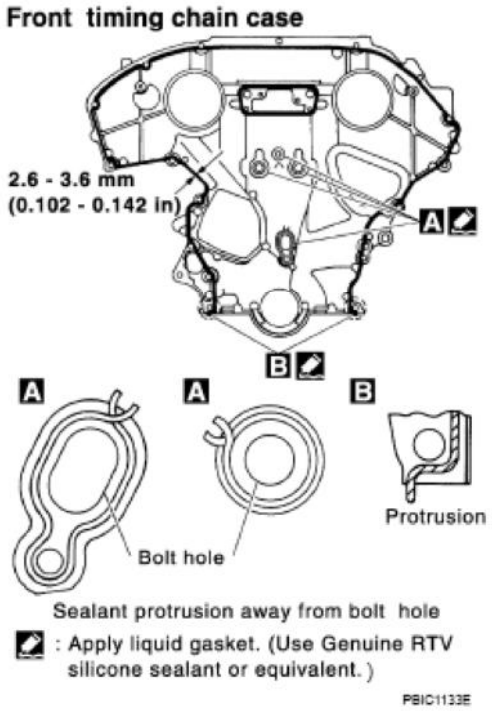


Fig. 104: Identifying Front Timing Chain Case
Courtesy of NISSAN MOTOR CO., U.S.A.

b. Install new oil pan gasket (front).
   - Apply liquid gasket to oil pan gasket (front) as shown in the figure.

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

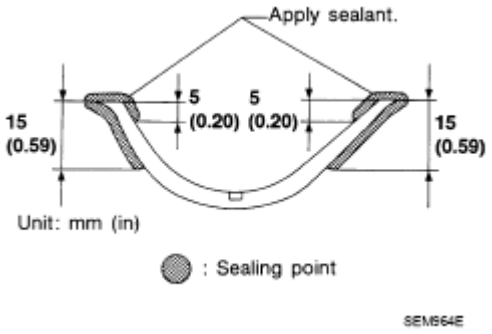


Fig. 105: Applying Liquid Gasket To Oil Pan Gasket (Front)
Courtesy of NISSAN MOTOR CO., U.S.A.

- Align notch of front timing chain case with protrusion of oil pan gasket.

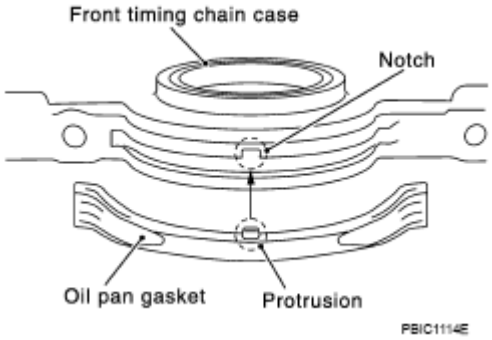


Fig. 106: Aligning Notch Of Front Timing Chain Case With Protrusion Of Oil Pan Gasket
Courtesy of NISSAN MOTOR CO., U.S.A.

- Apply liquid gasket with the tube presser [SST: WS39930000 (-)] to top surface of oil pan (upper) as shown in the figure.

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

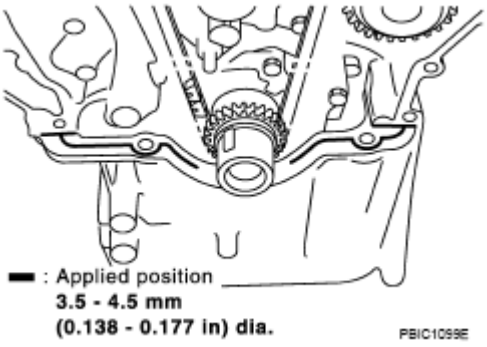


Fig. 107: Applying Liquid Gasket To Top Surface Of Oil Pan (Upper)
Courtesy of NISSAN MOTOR CO., U.S.A.

c. Install new O-rings on rear timing chain case.

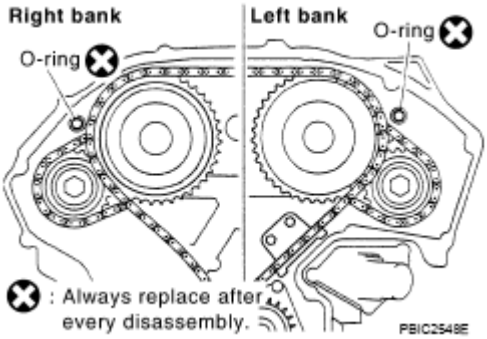


Fig. 108: Identifying New O-Rings On Rear Timing Chain Case

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

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

CAUTION: Be careful that oil pan gasket is in place.

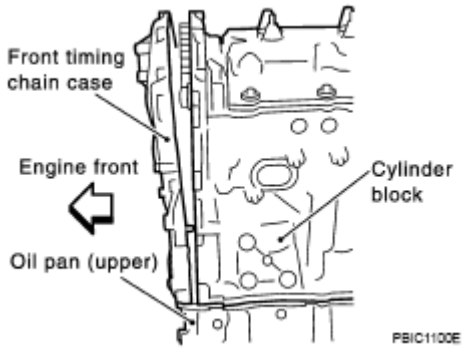


Fig. 109: Identifying Front Timing Chain Case
Courtesy of NISSAN MOTOR CO., U.S.A.

   ii. Since front timing chain case is offset for difference of bolt holes, tighten bolts temporarily with holding front timing chain case from front and top as shown in the figure.

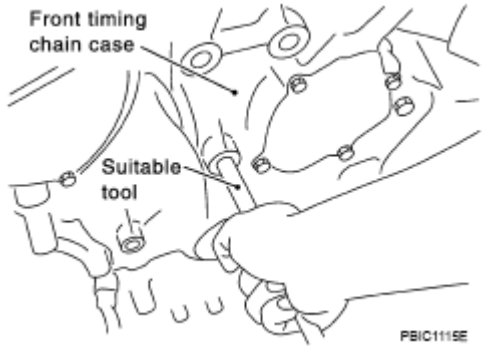


Fig. 110: Tightening Timing Case Bolts Temporarily
Courtesy of NISSAN MOTOR CO., U.S.A.

For bolt length and positions, refer to the step e.

   iii. Same as the step ii, insert dowel pin with holding front timing chain case from front and top completely.

e. Tighten mounting bolts to the specified torque in numerical order as shown in the figure.
   - There are two type of mounting bolts. Refer to the following for locating bolts.

M8 bolts : 1, 2

: 28.4 N.m (2.9 kg-m, 21 ft-lb)

M6 bolts : Except the above

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

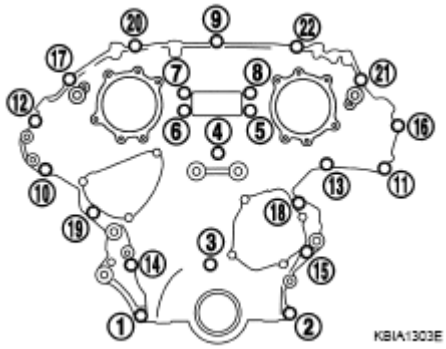


Fig. 111: Identifying Loosening And Tightening Front Timing Chain Case Bolts In Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

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

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

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

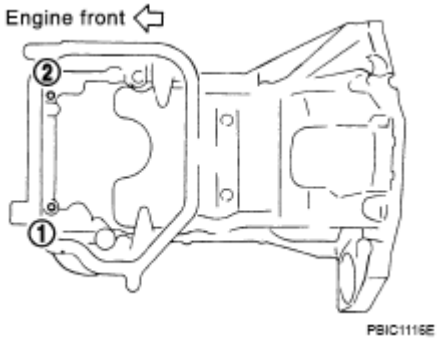


Fig. 112: Identifying Two Mounting Bolts In Front Of Oil Pan (Upper)
Courtesy of NISSAN MOTOR CO., U.S.A.

7. Install oil pan (lower). Refer to "**OIL PAN AND OIL STRAINER**".
8. Install intake valve timing control covers as follows:
   a. Install new seal rings in shaft grooves.
   b. Apply a continuous bead of liquid gasket with the tube presser [SST: WS39930000 (-)] to intake valve timing control covers as shown in the figure.

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

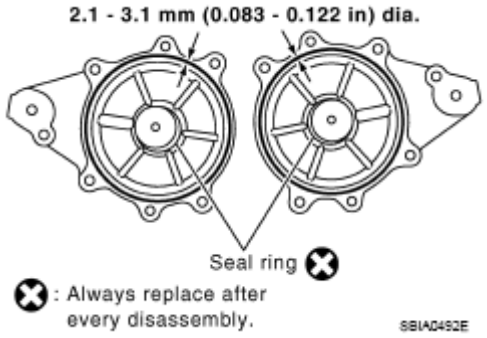


Fig. 113: Identifying Bead Of Liquid Gasket With Tube Presser To Intake Valve Timing Control Covers
Courtesy of NISSAN MOTOR CO., U.S.A.

c. Install new collared O-rings in front timing chain case oil hole (left and right sides).

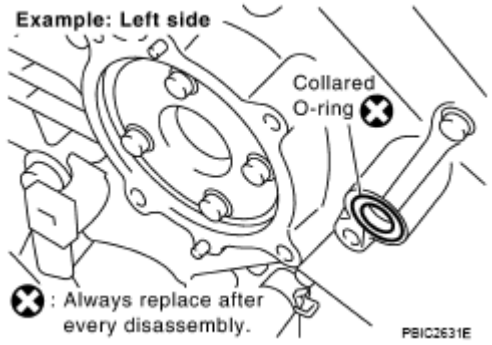


Fig. 114: Identifying Collared O-Rings
Courtesy of NISSAN MOTOR CO., U.S.A.

d. Being careful not to move seal ring from the installation groove, align dowel pins on front timing chain case with the holes to install intake valve timing control covers.
e. Tighten mounting bolts in numerical order as shown in the figure.

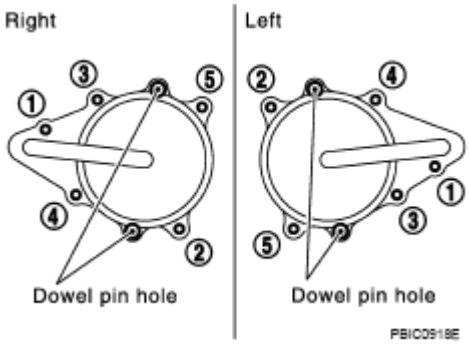


Fig. 115: Identifying Mounting Bolts In Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

9. Install crankshaft pulley as follows:
   a. Fix crankshaft using the ring gear stopper [SST: KV10117700 (J44716)].
   b. Install crankshaft pulley, taking care not to damage front oil seal.
      - When press-fitting crankshaft pulley with plastic hammer, tap on its center portion (not circumference).
   c. Tighten crankshaft pulley bolt.

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

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

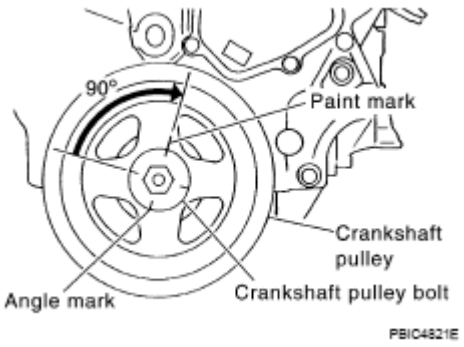


Fig. 116: Tightening Crankshaft Pulley Bolt An Additional 90°
Courtesy of NISSAN MOTOR CO., U.S.A.

10. Rotate crankshaft pulley in normal direction (clockwise when viewed from front) to confirm it turns smoothly.
11. For the following operations, perform steps in the reverse order of removal.

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

INSPECTION AFTER INSTALLATION

Inspection for Leaks

The followings are procedures for checking fluids leak, lubricates leak.

- 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 CHEMICAL PRODUCTS AND SEALANTS** ".

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

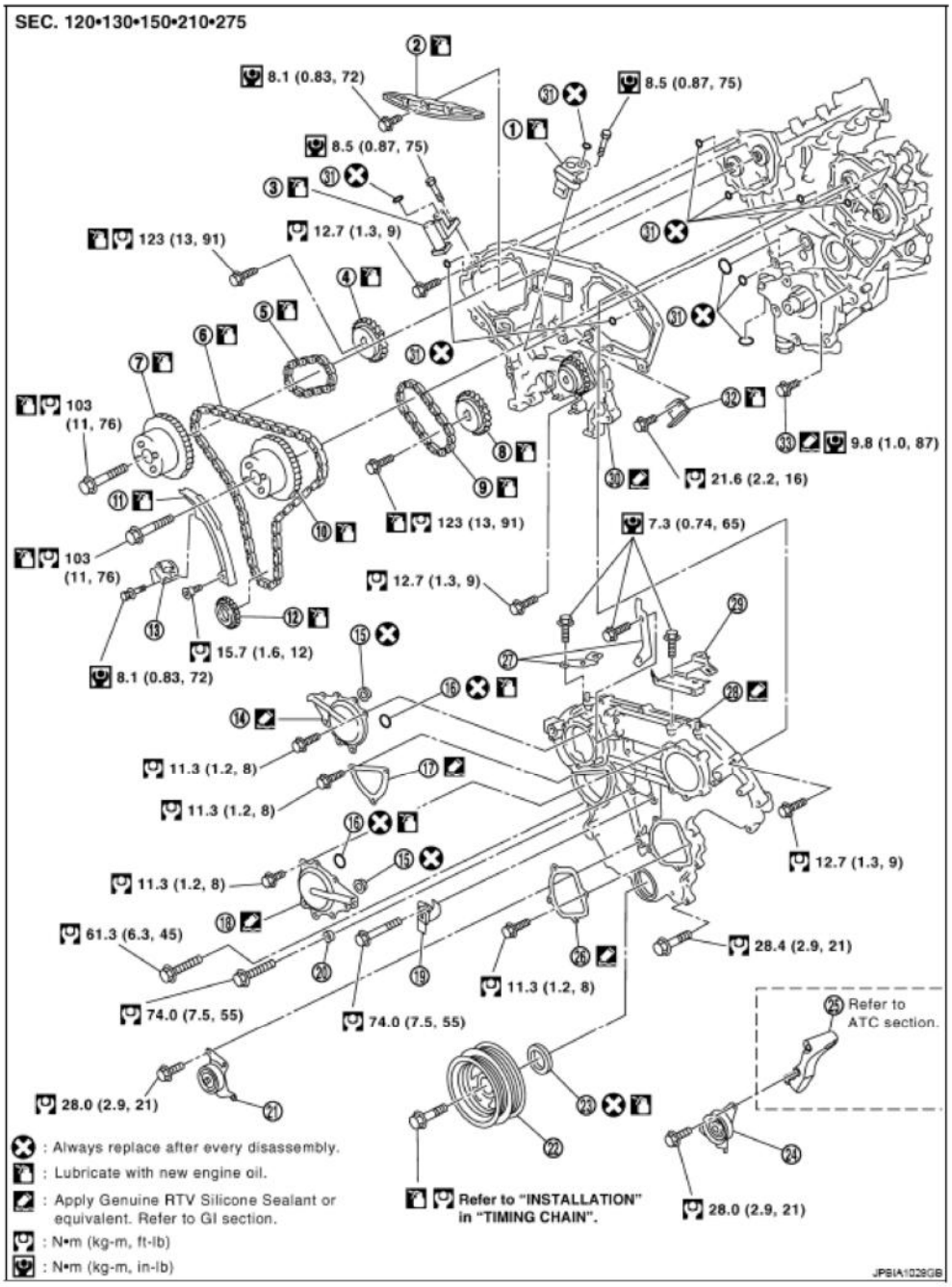
- Warm up engine thoroughly to make sure there is no leakage of fuel, or any oil/fluids including engine oil and engine coolant.
- Bleed air from lines and hoses of applicable lines, such as in cooling system.
- After cooling down engine, again check oil/fluid levels including engine oil and engine coolant.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

SUMMARY OF INSPECTION ITEMS

Item	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
(1) Transmission/transaxle/CVT fluid. power steering fluid, brake fluid, etc.			

TIMING CHAIN

COMPONENTS



1. Timing chain tensioner (secondary)
2. Internal chain guide
3. Timing chain tensioner (secondary)
4. Camshaft sprocket (EXH)
5. Timing chain (secondary)
6. Timing chain (primary)
7. Camshaft sprocket (INT)
8. Camshaft sprocket (EXH)
9. Timing chain (secondary)
10. Camshaft sprocket (INT)
11. Slack guide
12. Crankshaft sprocket
13. Timing chain tensioner (primary)
14. Intake valve timing control cover
15. Collared O-ring
16. O-ring
17. Chain tensioner cover
18. Intake valve timing control cover
19. Water hose clamp
20. Spacer
21. Idler pulley
22. Crankshaft pulley
23. Front oil seal
24. Idler pulley
25. A/C compressor bracket
26. Water pump cover
27. Bracket
28. Front timing chain case
29. Bracket
30. Rear timing chain case
31. O-ring
32. Tension guide
33. Water drain plug (front side)

Fig. 117: Identifying Timing Chain Components With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

REMOVAL AND INSTALLATION

NOTE:

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

REMOVAL

1. Remove front tire.
2. Disconnect negative battery terminal.
3. Remove engine cover with power tool. Refer to "**INTAKE MANIFOLD COLLECTOR**".
4. Remove air cleaner case assembly. Refer to "**AIR CLEANER AND AIR DUCT**".
5. Remove front and rear engine undercover with power tool.
6. Release the fuel pressure. Refer to "**FUEL PRESSURE RELEASE** ".
7. Drain engine coolant from radiator. Refer to "**CHANGING ENGINE COOLANT** ".

CAUTION:

- **Perform this step when the engine is cold.**
- **Do not spill engine coolant on drive belts.**

8. Drain engine oil. Refer to "**CHANGING ENGINE OIL** ".

CAUTION:

- **Perform this step when the engine is cold.**
- **Do not spill engine oil on drive belts.**

9. Remove engine harnesses.
10. Remove intake manifold collectors (upper and lower). Refer to "**INTAKE MANIFOLD COLLECTOR**".
11. Remove radiator cooling fan assembly. Refer to "**COOLING FAN** ".
12. Remove drive belts. Refer to "**DRIVE BELTS**".
13. Remove A/C compressor from bracket with piping connected, and temporarily secure it aside. Refer to "**COMPONENTS** ".
14. Remove power steering oil pump from bracket with piping connected, and temporarily secure it aside. Refer to "**POWER STEERING OIL PUMP** ".
15. Remove power steering oil pump bracket. Refer to "**POWER STEERING OIL PUMP** ".
16. Remove alternator. Refer to "**CHARGING SYSTEM** ".

17. Remove water bypass hose, water hose clamp and idler pulley bracket from front timing chain case.
18. Remove intake valve timing control covers.
    - Loosen mounting bolts in reverse order as shown in the figure.

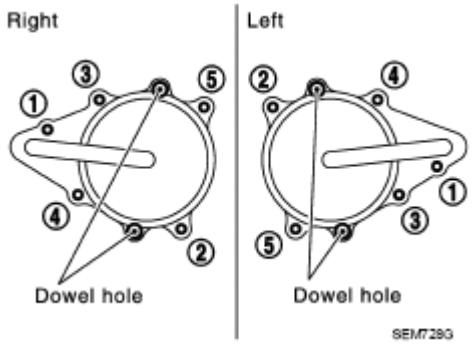


Fig. 118: Identifying Dowel Pins On Chain Case With Holes
Courtesy of NISSAN MOTOR CO., U.S.A.

- Use the seal cutter [SST: KV10111100 (J37228)] to cut liquid gasket for removal.

CAUTION: Shaft is internally jointed with camshaft sprocket (INT) center hole. When removing, keep it horizontal until it is completely disconnected.

19. Remove collared O-ring from front timing chain case (left and right side).

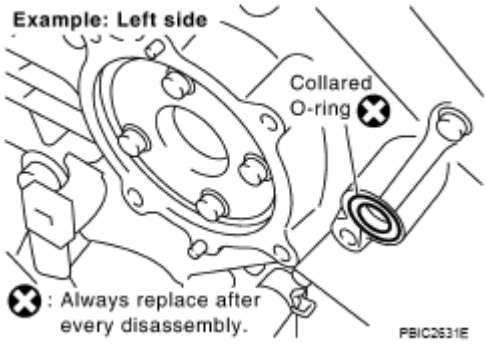


Fig. 119: Identifying Collared O-Rings
Courtesy of NISSAN MOTOR CO., U.S.A.

20. Remove rocker covers (right and left). Refer to "**ROCKER COVER**".
21. Remove oil pans (lower and upper). Refer to "**OIL PAN AND OIL STRAINER**".
22. Obtain No. 1 cylinder at TDC of its compression stroke as follows:
    a. Rotate crankshaft pulley clockwise to align timing mark (grooved line without color) with timing indicator.

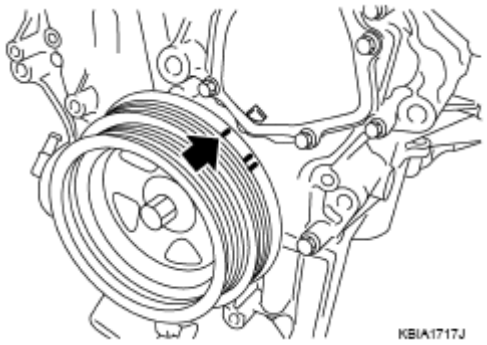


Fig. 120: Aligning Timing Mark With Timing Indicator
Courtesy of NISSAN MOTOR CO., U.S.A.

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

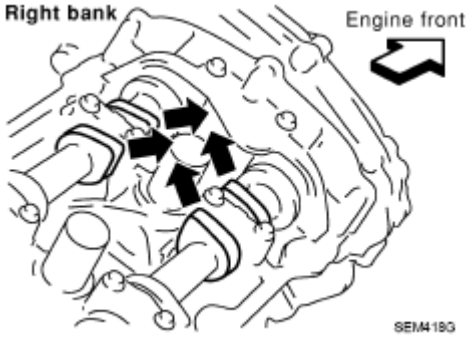


Fig. 121: Identifying Camshaft
Courtesy of NISSAN MOTOR CO., U.S.A.

23. Remove crankshaft pulley as follows:
    a. Remove rear cover plate (2WD) or starter motor (AWD) and set the ring gear stopper (SST). Refer to "**OIL PAN AND OIL STRAINER**" (2WD) or "**STARTING SYSTEM** " (AWD).
    b. Loosen crankshaft pulley bolt and rotate bolt seating surface at 10 mm (0.39 in) from its original position.

CAUTION: Do not remove crankshaft pulley bolt as it will be used as a supporting point for suitable puller.

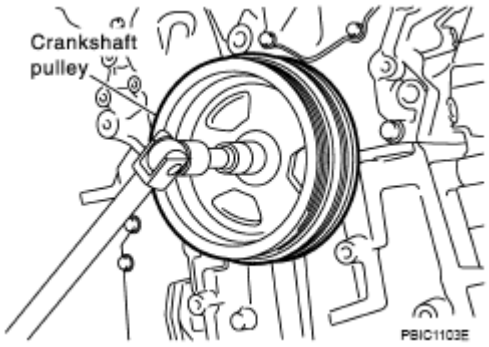


Fig. 122: Identifying Crankshaft Pulley Bolt
Courtesy of NISSAN MOTOR CO., U.S.A.

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

CAUTION: Do not put suitable puller tab on crankshaft pulley periphery, as this will damage internal damper.

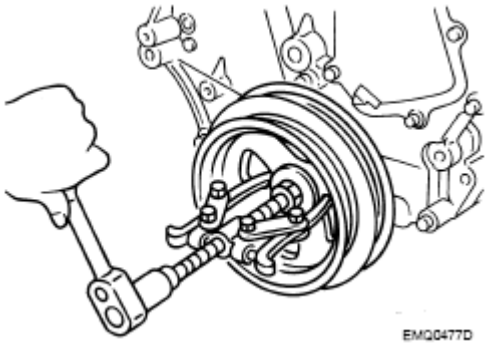


Fig. 123: Pulling Crankshaft Pulley
Courtesy of NISSAN MOTOR CO., U.S.A.

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

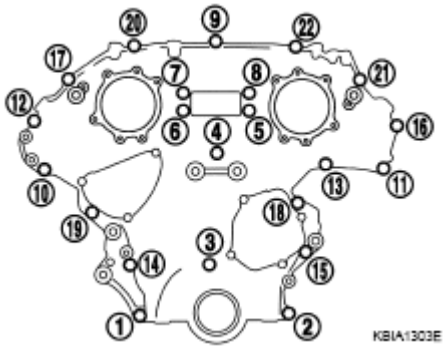


Fig. 124: Identifying Loosening And Tightening Front Timing Chain Case Bolts In Sequence

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

b. Insert a suitable tool into the notch at the top of front timing chain case as shown (1).
c. Pry off case by moving the tool as shown (2).

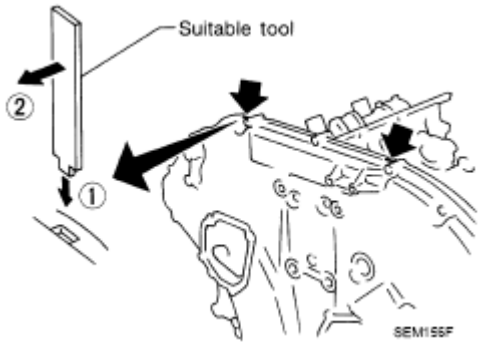


Fig. 125: Removing Front Timing Chain Case Using Suitable Tool
Courtesy of NISSAN MOTOR CO., U.S.A.

- Use the seal cutter [SST: KV10111100 (J37228)] to cut liquid gasket for removal.

CAUTION:
- **Do not use a screwdriver or something similar.**
- **After removal, handle front timing chain case carefully so it does not tilt, cant, or warp under a load.**

25. Remove O-rings from rear timing chain case.

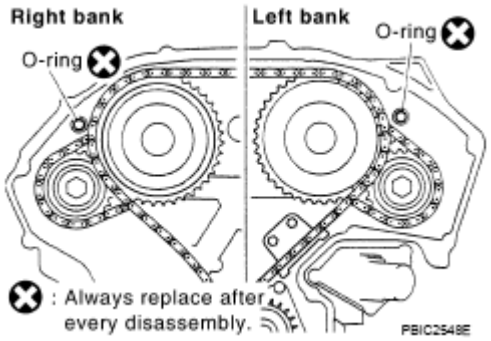


Fig. 126: Identifying New O-Rings On Rear Timing Chain Case
Courtesy of NISSAN MOTOR CO., U.S.A.

26. Remove water pump cover and chain tensioner cover from front timing chain case, if necessary.
    - Use the seal cutter [SST: KV10111100 (J37228)] to cut liquid gasket for removal.
27. Remove front oil seal from front timing chain case using a suitable tool.
    - Use a screwdriver for removal.

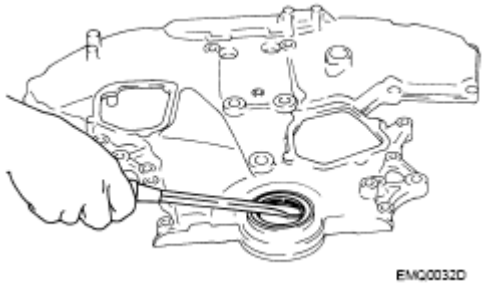


Fig. 127: Identifying Front Oil Seal From Front Timing Chain Case
Courtesy of NISSAN MOTOR CO., U.S.A.

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

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

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

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

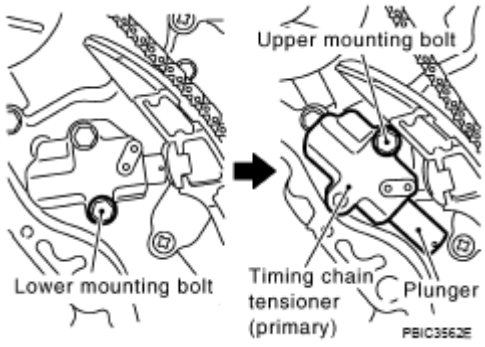


Fig. 128: Identifying Timing Chain Tensioner - Primary
Courtesy of NISSAN MOTOR CO., U.S.A.

29. Remove internal chain guide, tension guide and slack guide.

NOTE: Tension guide can be removed after removing timing chain (primary).

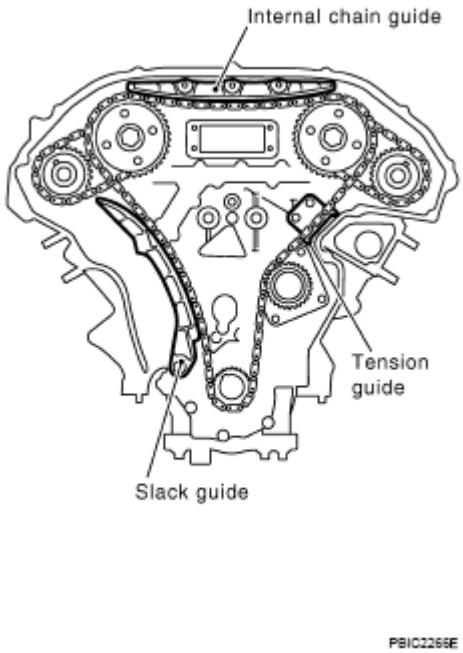


Fig. 129: Identifying Internal Chain Guide, Tension Guide And Slack Guide
Courtesy of NISSAN MOTOR CO., U.S.A.

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

CAUTION: After removing timing chain (primary), do not turn crankshaft and camshaft separately, or valves will strike the piston heads.

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

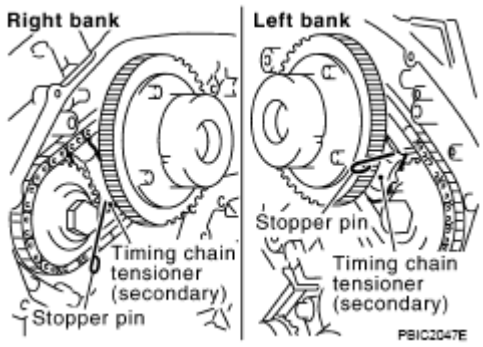


Fig. 130: Identifying Timing Chain And Crankshaft Sprocket (Secondary)
Courtesy of NISSAN MOTOR CO., U.S.A.

NOTE:

- **Use approximately 0.5 mm (0.020 in) dia. hard metal pin as a stopper pin.**

- **For removal of timing chain tensioner (secondary), refer to "CAMSHAFT". [Removing camshaft bracket (No. 1) is required.]**

b. Remove camshaft sprocket (INT and EXH) mounting bolts.
- Secure the hexagonal portion of camshaft using a wrench to loosen mounting bolts.

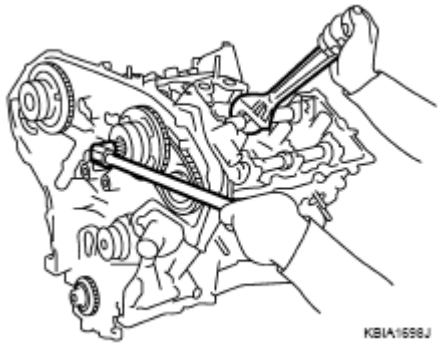


Fig. 131: Loosening And Tightening Camshaft Sprocket Mounting Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: Do not loosen the mounting bolts with securing anything other than the camshaft hexagonal portion or with tensioning the timing chain.

c. Remove timing chain (secondary) together with camshaft sprockets.
- Turn camshaft slightly to secure slackness of timing chain on timing chain tensioner (secondary) side.
- Insert 0.5 mm (0.020 in)-thick metal or resin plate between timing chain and timing chain tensioner plunger (guide). Remove timing chain (secondary) together with camshaft sprockets with timing chain loose from guide groove.

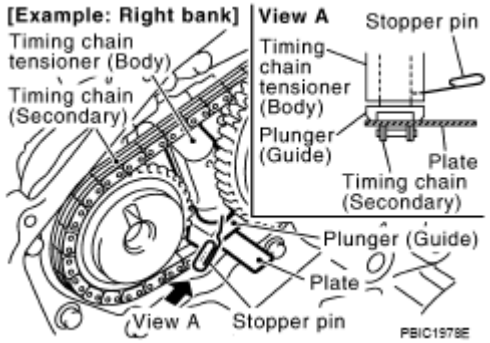


Fig. 132: Identifying Timing Chain (Secondary)
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: Be careful of plunger coming-off when removing timing chain

(secondary). This is because plunger of timing chain tensioner (secondary) moves during operation, leading to coming-off of fixed stopper pin.

NOTE: **Camshaft sprocket (INT) is two-for-one structure of primary and secondary sprockets.**

- When handling camshaft sprocket (INT), be careful of the following caution:

CAUTION:
- **Handle carefully to avoid any shock to camshaft sprocket.**
- **Do not disassemble. (Do not loosen bolts "A" as shown in the figure).**

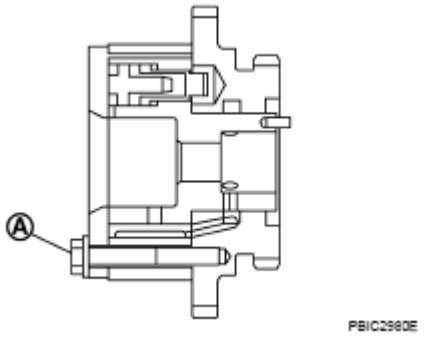


Fig. 133: Identifying Bolt
Courtesy of NISSAN MOTOR CO., U.S.A.

32. Remove rear timing chain case as follows:
    a. Loosen and remove mounting bolts in reverse order as shown in the figure.

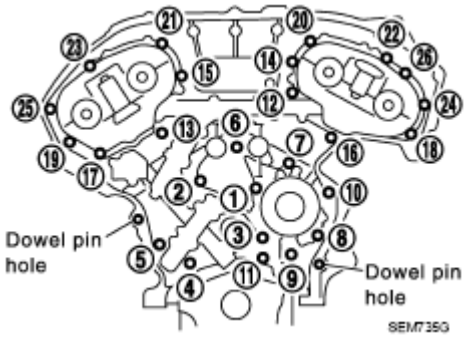


Fig. 134: Removal/Installation Of Rear Timing Chain Case Mounting Bolts In Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

    b. Cut liquid gasket using the seal cutter [SST: KV10111100 (J37228)] and remove rear timing chain case.

CAUTION:

- **Do not remove plate metal cover of oil passage.**
- **After removal, handle rear timing chain case carefully so it does not tilt, cant, or warp under a load.**

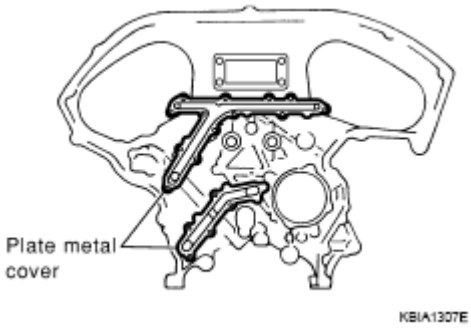


Fig. 135: Identifying Plate Metal Cover
Courtesy of NISSAN MOTOR CO., U.S.A.

33. Remove O-rings from cylinder head.

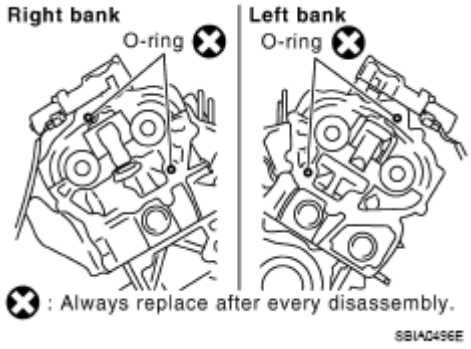


Fig. 136: Identifying New O-Rings To Cylinder Head
Courtesy of NISSAN MOTOR CO., U.S.A.

34. Remove O-rings from cylinder block.

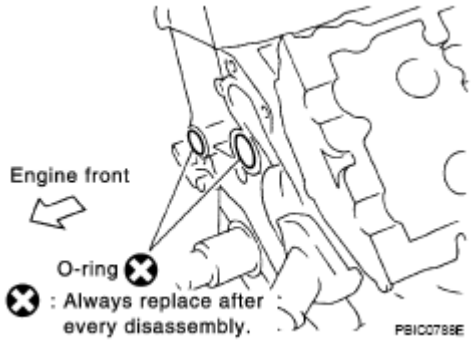


Fig. 137: Identifying New O-Rings Onto Cylinder Block

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

35. Remove timing chain tensioners (secondary) from cylinder head as follows, if necessary.
    a. Remove camshaft brackets (No. 1). Refer to "**REMOVAL**".
    b. Remove timing chain tensioners (secondary) with a stopper pin attached.
36. Use a scraper to remove all traces of liquid gasket from front and rear timing chain cases, and opposite mating surfaces.

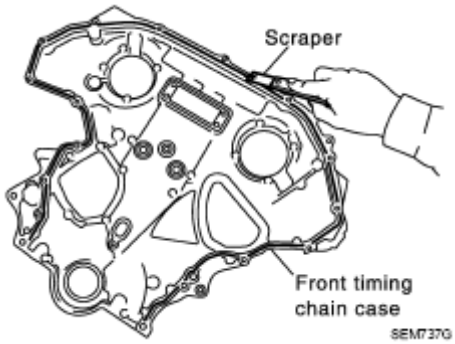


Fig. 138: Removing Liquid Gasket From Front And Rear Timing Chain Cases Using Scraper
Courtesy of NISSAN MOTOR CO., U.S.A.

- Remove old liquid gasket from the bolt hole and thread.

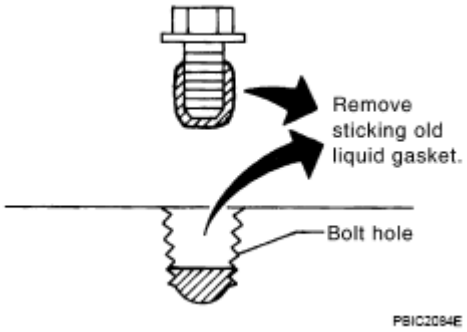


Fig. 139: Identifying Old Liquid Gasket From Bolt Hole
Courtesy of NISSAN MOTOR CO., U.S.A.

37. Use a scraper to remove all traces of liquid gasket from water pump cover, chain tensioner cover and intake valve timing control covers.

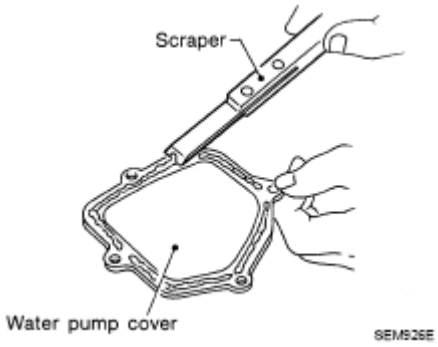


Fig. 140: Removing Liquid Gasket Using Scraper
Courtesy of NISSAN MOTOR CO., U.S.A.

INSPECTION AFTER REMOVAL

Timing Chain

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

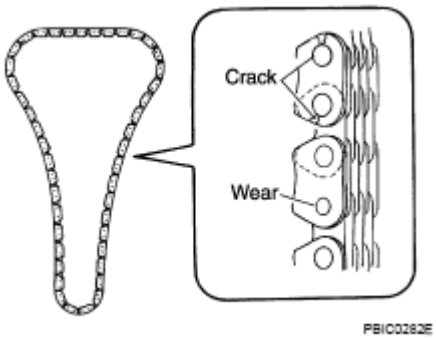


Fig. 141: Identifying Cracks And Any Excessive Wear At Link Plates
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

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

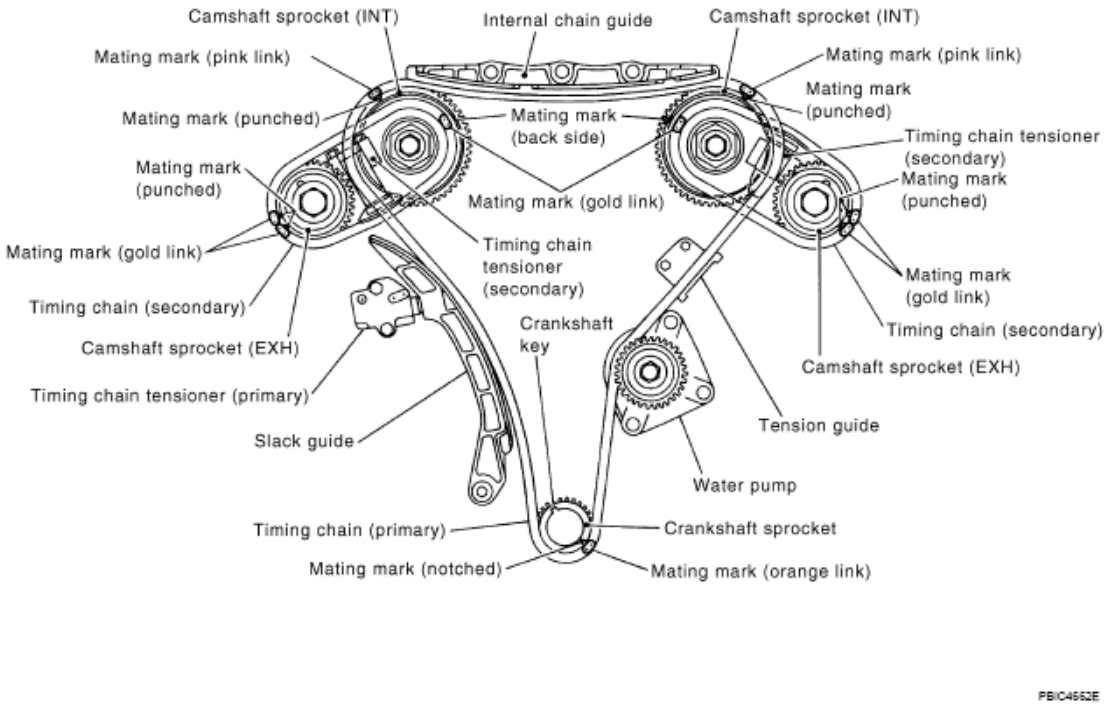


Fig. 142: Identifying Timing Chain On Corresponding Sprocket Components
Courtesy of NISSAN MOTOR CO., U.S.A.

1. Install timing chain tensioners (secondary) to cylinder head as follows if removed. Refer to "**INSTALLATION**".
   a. Install timing chain tensioners (secondary) with a stopper pin attached and new O-rings.
   b. Install camshaft brackets (No. 1). Refer to "**INSTALLATION**".
2. Install rear timing chain case as follows:
   a. Install new O-rings onto cylinder block.

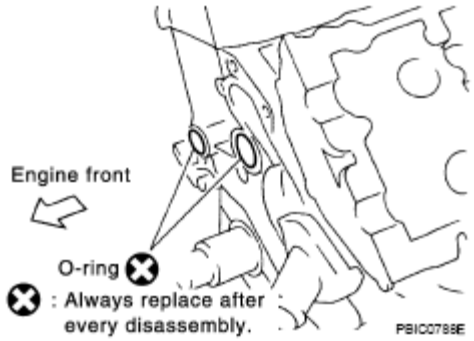


Fig. 143: Identifying New O-Rings Onto Cylinder Block
Courtesy of NISSAN MOTOR CO., U.S.A.

   b. Install new O-rings to cylinder head.

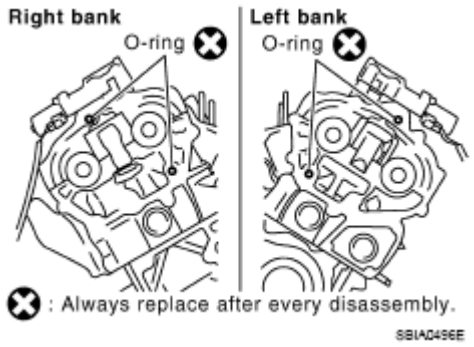


Fig. 144: Identifying New O-Rings To Cylinder Head
Courtesy of NISSAN MOTOR CO., U.S.A.

c. Apply liquid gasket with the tube presser [SST: WS39930000 (-)] to rear timing chain case back side as shown in the figure.

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

CAUTION:

- **For "A" in the figure, completely wipe out liquid gasket exte portion touching at engine coolant.**
- **Apply liquid gasket on installation position of water pump a head very completely.**

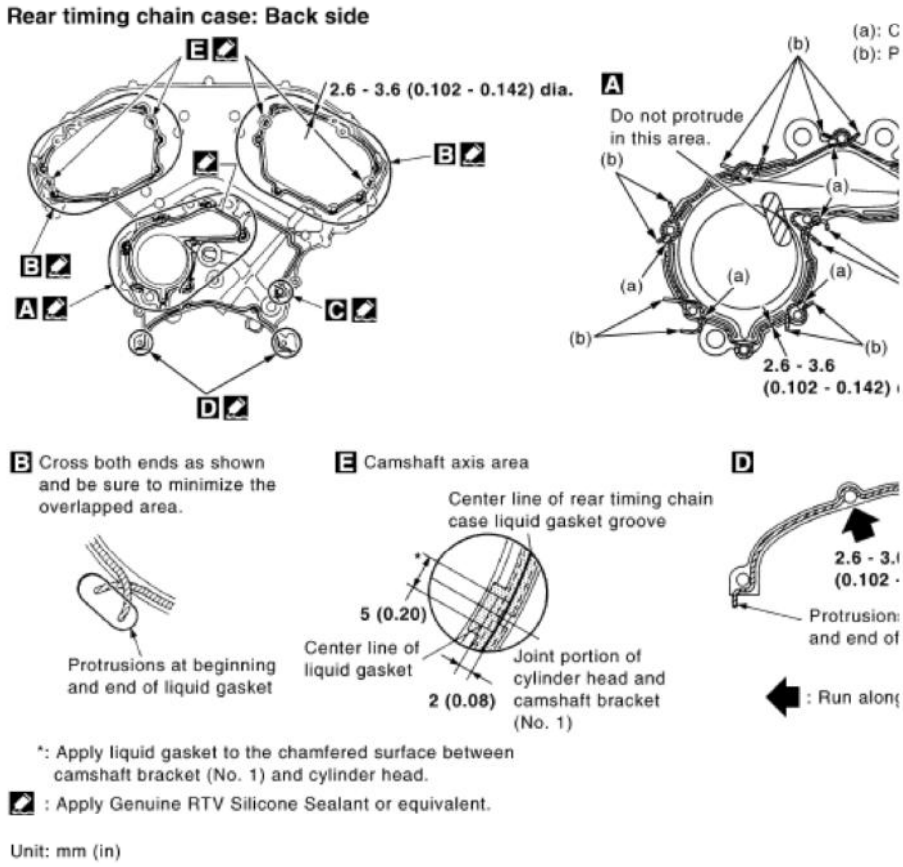


Fig. 145: Identifying Liquid Gasket Applying Areas
Courtesy of NISSAN MOTOR CO., U.S.A.

d. Align rear timing chain case and water pump assembly with dowel pins (right and left) on cylinder block and install rear timing chain case.
   - Make sure O-rings stay in place during installation to cylinder block and cylinder head.
e. Tighten mounting bolts in numerical order as shown in the figure.

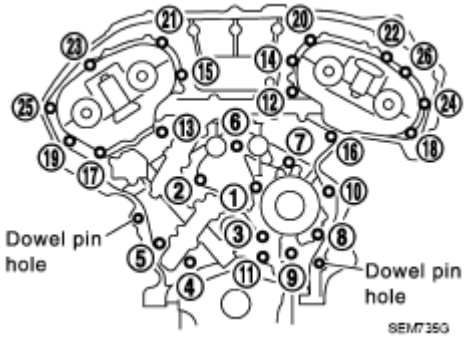


Fig. 146: Removal/Installation Of Rear Timing Chain Case Mounting Bolts In Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

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

Bolt length: Bolt position

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

16 mm (0.63 in) : Except the above

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

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

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

Standard

Rear timing chain case to cylinder block:

-0.24 to 0.14 mm (-0.009 to 0.006 in)

- If not within the standard, repeat the installation procedure.

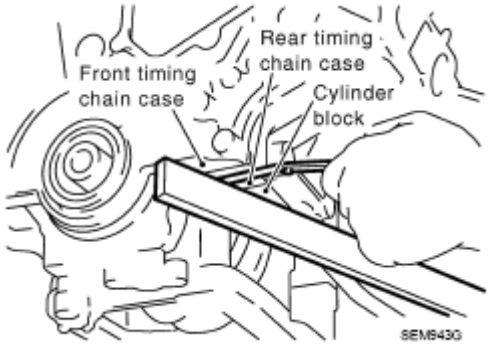


Fig. 147: Checking Surface Height
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Install water pump with new O-rings. Refer to "**WATER PUMP** ".
4. Make sure that dowel pin hole, dowel pin and crankshaft key are located as shown in the figure. (No. 1 cylinder at compression TDC)

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

Camshaft dowel pin hole (intake side) : At cylinder head upper face side in each bank.

Camshaft dowel pin (exhaust side) : At cylinder head upper face side in each bank.

Crankshaft key : At cylinder head side of right bank.

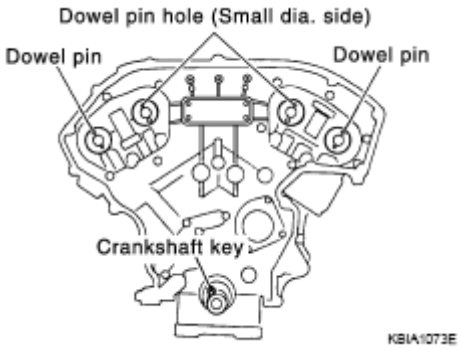


Fig. 148: Identifying Camshaft Dowel Pin Hole Position
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: Hole on small dia. side must be used for intake side dowel pin hole. Do not misidentify (ignore big dia. side).

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

CAUTION: Mating marks between timing chain and sprockets slip easily. Confirm all mating mark positions repeatedly during the installation process.

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

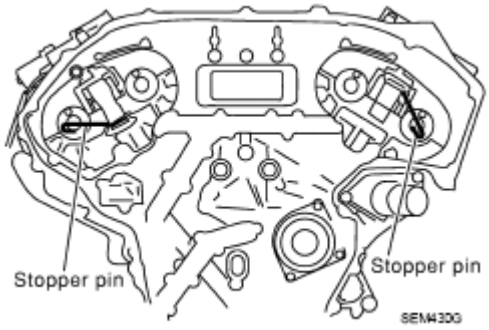


Fig. 149: Identifying Stopper Pin
Courtesy of NISSAN MOTOR CO., U.S.A.

b. Install timing chains (secondary) and camshaft sprockets.
   - Align the mating marks on timing chain (secondary) (gold link) with the ones on intake and

exhaust camshaft sprockets (punched), and install them.

NOTE:

- **Mating marks for intake camshaft sprocket are on the back side of camshaft sprocket (secondary).**
- **There are two types of mating marks, circle and oval types. They should be used for the right and left banks, respectively.**

Right bank : Use circle type.

Left bank : Use oval type.

Example: Right bank (Rear view)

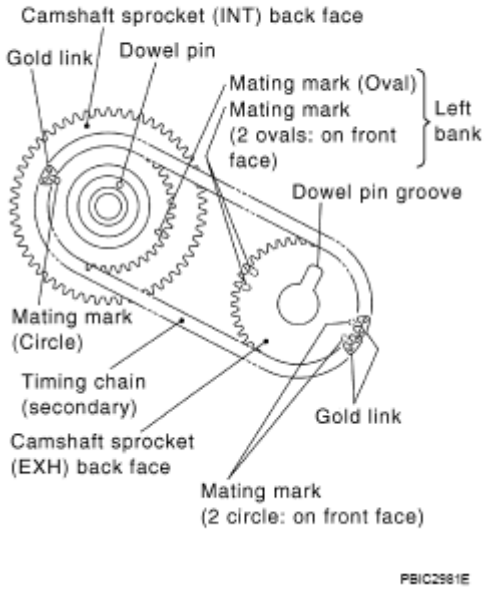


Fig. 150: Identifying Timing Chains (Secondary) And Camshaft Sprockets
Courtesy of NISSAN MOTOR CO., U.S.A.

- Align dowel pin and pin hole on camshafts with the groove and dowel pin on sprockets, and install them.
- On the intake side, align pin hole on the small diameter side of the camshaft front end with dowel pin on the back side of camshaft sprocket, and install them.
- On the exhaust side, align dowel pin on camshaft front end with pin groove on camshaft sprocket, and install them.
- In case that positions of each mating mark and each dowel pin are not fit on mating parts, make fine adjustment to the position holding the hexagonal portion on camshaft with wrench or equivalent.
- Mounting bolts for camshaft sprockets must be tightened in the next step. Tightening them

by hand is enough to prevent the dislocation of dowel pins.

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

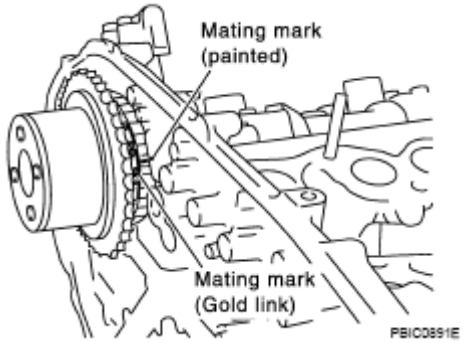


Fig. 151: Identifying Mating Marks
Courtesy of NISSAN MOTOR CO., U.S.A.

c. After confirming the mating marks are aligned, tighten camshaft sprocket mounting bolts.
   - Secure camshaft using a wrench at the hexagonal portion to tighten mounting bolts.

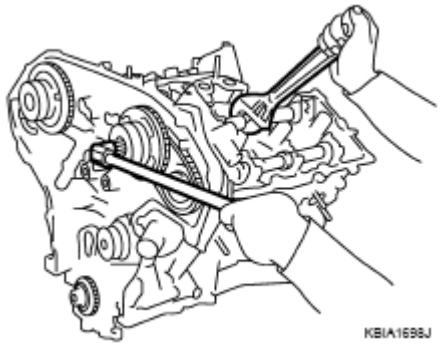


Fig. 152: Loosening And Tightening Camshaft Sprocket Mounting Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

d. Pull stopper pins out from timing chain tensioners (secondary).

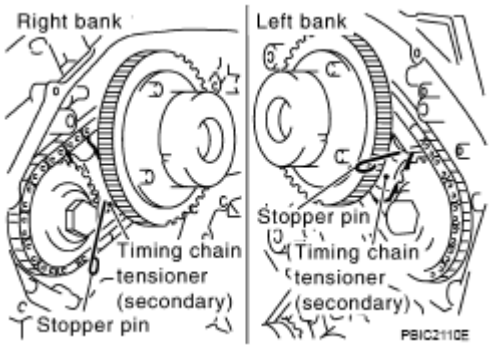


Fig. 153: Locating Stopper Pins
Courtesy of NISSAN MOTOR CO., U.S.A.

6. Install tension guide.
7. Install timing chain (primary) as follows:
   a. Install crankshaft sprocket.
      - Make sure the mating marks on crankshaft sprocket face the front of the engine.

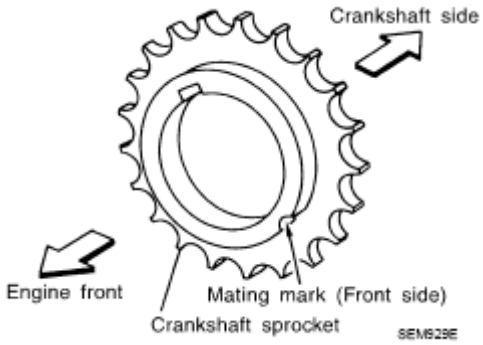


Fig. 154: Identifying Crankshaft Sprocket
Courtesy of NISSAN MOTOR CO., U.S.A.

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

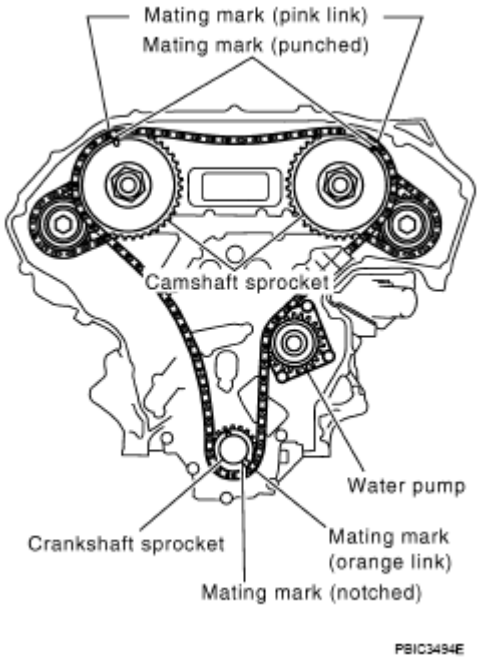


Fig. 155: Identifying Timing Chain (Primary)
Courtesy of NISSAN MOTOR CO., U.S.A.

8. Install internal chain guide, slack guide and timing chain tensioner (primary).

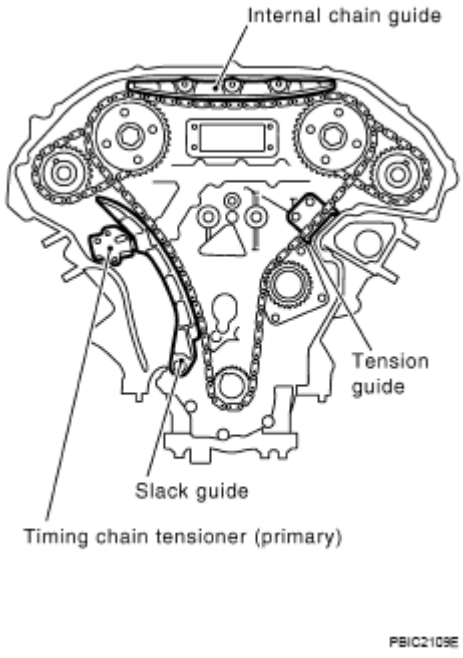


Fig. 156: Identifying Internal Chain Guide
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: Do not overtighten slack guide mounting bolts. It is normal for a gap

to exist under the bolt seats when mounting bolts are tightened to the specification.

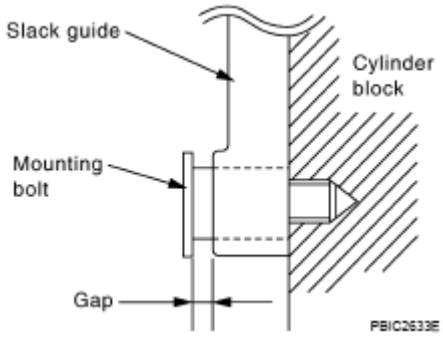


Fig. 157: Identifying Clearance Between Mounting Bolt And Slack Guide
Courtesy of NISSAN MOTOR CO., U.S.A.

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

NOTE: Plunger stopper tab and lever are synchronized.

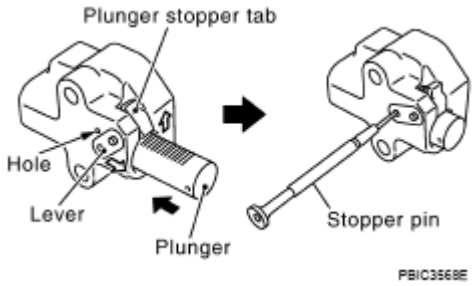


Fig. 158: Locating Plunger Stopper Tap
Courtesy of NISSAN MOTOR CO., U.S.A.

   b. Push plunger into the inside of tensioner body.
   c. Hold plunger in the fully compressed position by engaging plunger stopper tab with the tip of ratchet.
   d. To secure lever, insert stopper pin through hole of lever into tensioner body hole.
      - The lever parts and the tab are synchronized. Therefore, the plunger will be secured under this condition.

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

   e. Install timing chain tensioner (primary).

- Remove any dirt and foreign materials completely from the back and the mounting surfaces of timing chain tensioner (primary).

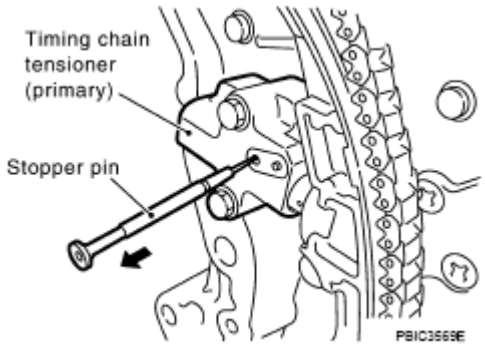


Fig. 159: Identifying Timing Chain Tensioner - Primary
Courtesy of NISSAN MOTOR CO., U.S.A.

f. Pull out stopper pin after installing, and then release plunger.

10. Make sure again that the mating marks on sprockets and timing chain have not slipped out of alignment.
11. Install new O-rings on rear timing chain case.

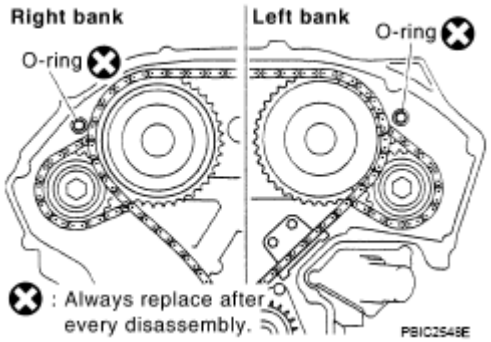


Fig. 160: Identifying New O-Rings On Rear Timing Chain Case
Courtesy of NISSAN MOTOR CO., U.S.A.

12. Install new front oil seal on front timing chain case.
    - Apply new engine oil to both oil seal lip and dust seal lip.
    - Install it so that each seal lip is oriented as shown in the figure.

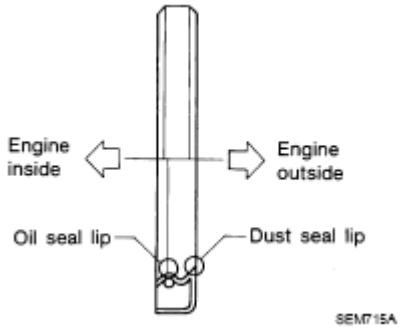


Fig. 161: Identifying Engine Oil To Both Oil Seal Lip And Dust Seal Lip
Courtesy of NISSAN MOTOR CO., U.S.A.

- Using a suitable drift [outer diameter: 60 mm (2.36 in)], pressfit oil seal until it becomes flush with front timing chain case end face.
- Make sure the garter spring is in position and seal lip is not inverted.

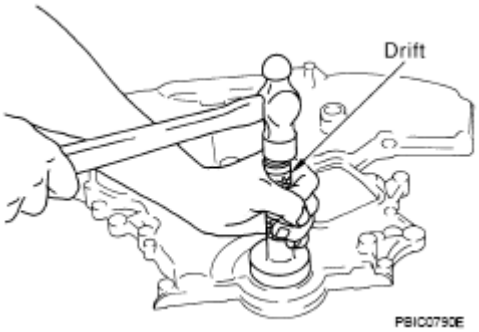


Fig. 162: Pressing Fit Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

13. Install water pump cover and chain tensioner cover to front timing chain case.
    - Apply a continuous bead of liquid gasket with the tube presser [SST: WS39930000 (-)] to front timing chain case as shown in the figure.

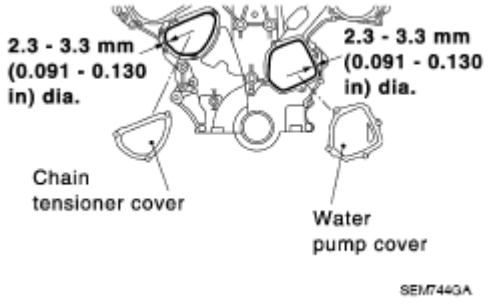


Fig. 163: Identifying Liquid Gasket With Tube Presser To Front Timing Chain Case
Courtesy of NISSAN MOTOR CO., U.S.A.

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

14. Install front timing chain case as follows:
    a. Apply a continuous bead of liquid gasket with the tube presser [SST: WS39930000 (-)] to front timing chain case back side as shown in the figure.

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

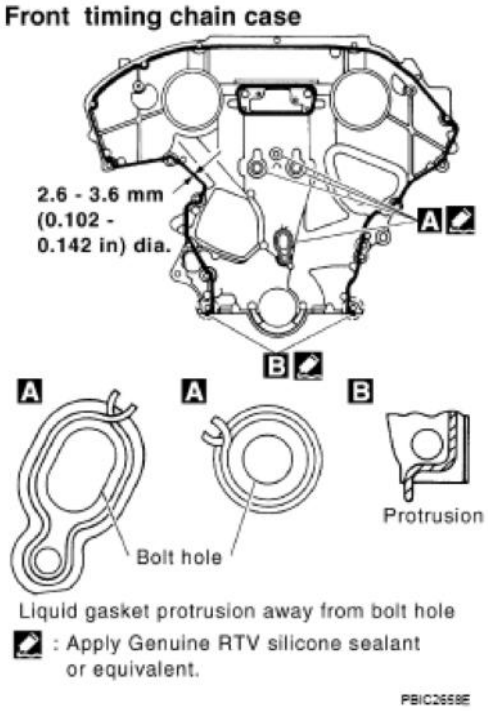


Fig. 164: Identifying Front Timing Chain Case
Courtesy of NISSAN MOTOR CO., U.S.A.

    b. Install front timing chain case as to fit its dowel pin hole together dowel pin on rear timing chain case.
    c. Tighten mounting bolts to the specified torque in numerical order as shown in the figure.

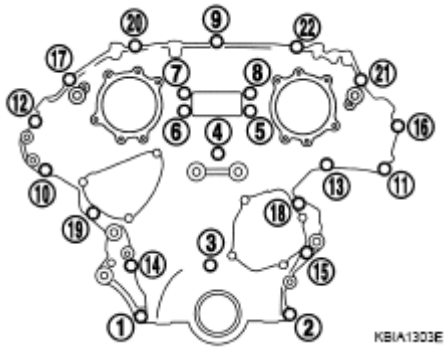


Fig. 165: Identifying Loosening And Tightening Front Timing Chain Case Bolts In Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

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

M8 bolts : 1, 2

: 28.4 N.m (2.9 kg-m, 21 ft-lb)

M6 bolts : Except the above

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

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

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

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

Standard

Front timing chain case to rear timing chain case:

-0.14 to 0.14 mm (-0.006 to 0.006 in)

- If not within the standard, repeat the installation procedure.

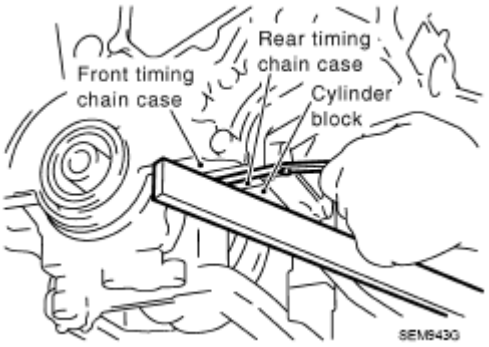


Fig. 166: Checking Surface Height
Courtesy of NISSAN MOTOR CO., U.S.A.

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

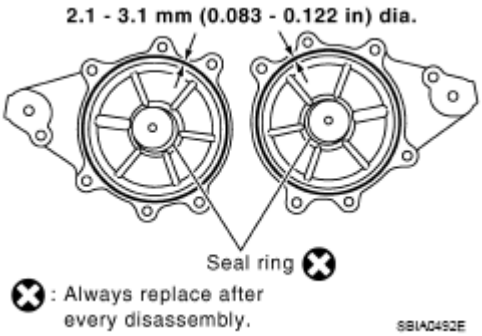


Fig. 167: Identifying Seal Rings In Shaft Grooves
Courtesy of NISSAN MOTOR CO., U.S.A.

    b. Apply a continuous bead of liquid gasket with the tube presser [SST: WS39930000 (-)] to intake valve timing control covers as shown in the figure.

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

    c. Install new collared O-rings in front timing chain case oil hole (left and right sides).

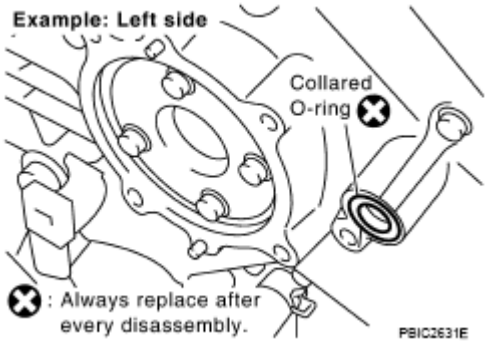


Fig. 168: Identifying Collared O-Rings
Courtesy of NISSAN MOTOR CO., U.S.A.

d. Being careful not to move seal ring from the installation groove, align dowel pins on front timing chain case with holes to install intake valve timing control covers.
e. Tighten mounting bolts in numerical order as shown in the figure.

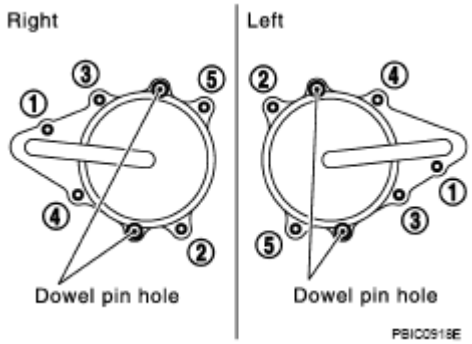


Fig. 169: Identifying Mounting Bolts In Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

16. Install oil pans (upper and lower). Refer to "**OIL PAN AND OIL STRAINER**".
17. Install rocker covers (right and left banks). Refer to "**ROCKER COVER**".
18. Install crankshaft pulley as follows:
    a. Fix crankshaft using the ring gear stopper [SST: KV10117700 (J44716)].
    b. Install crankshaft pulley, taking care not to damage front oil seal.
        - When press-fitting crankshaft pulley with plastic hammer, tap on its center portion (not circumference).
    c. Tighten crankshaft pulley bolt.

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

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

degrees.

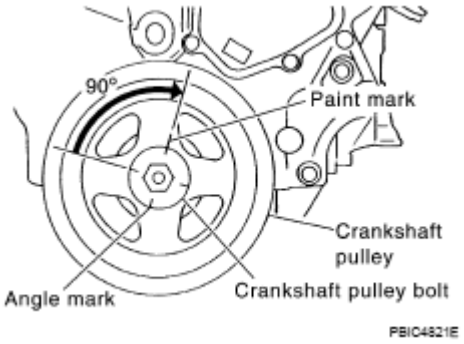


Fig. 170: Tightening Crankshaft Pulley Bolt An Additional 90°
Courtesy of NISSAN MOTOR CO., U.S.A.

19. Rotate crankshaft pulley in normal direction (clockwise when viewed from front) to confirm it turns smoothly.
20. For the following operations, perform steps in the reverse order of removal.

INSPECTION AFTER INSTALLATION

Inspection for Leaks

The following are procedures for checking fluids leak, lubricates leak.

- 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 CHEMICAL PRODUCTS AND SEALANTS** ".
- 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 chain tensioner drops after removal/installation, slack in guide may generate a pounding noise during and just after the engine start. However, this does not indicate an unusualness. Noise will stop after hydraulic pressure rises.

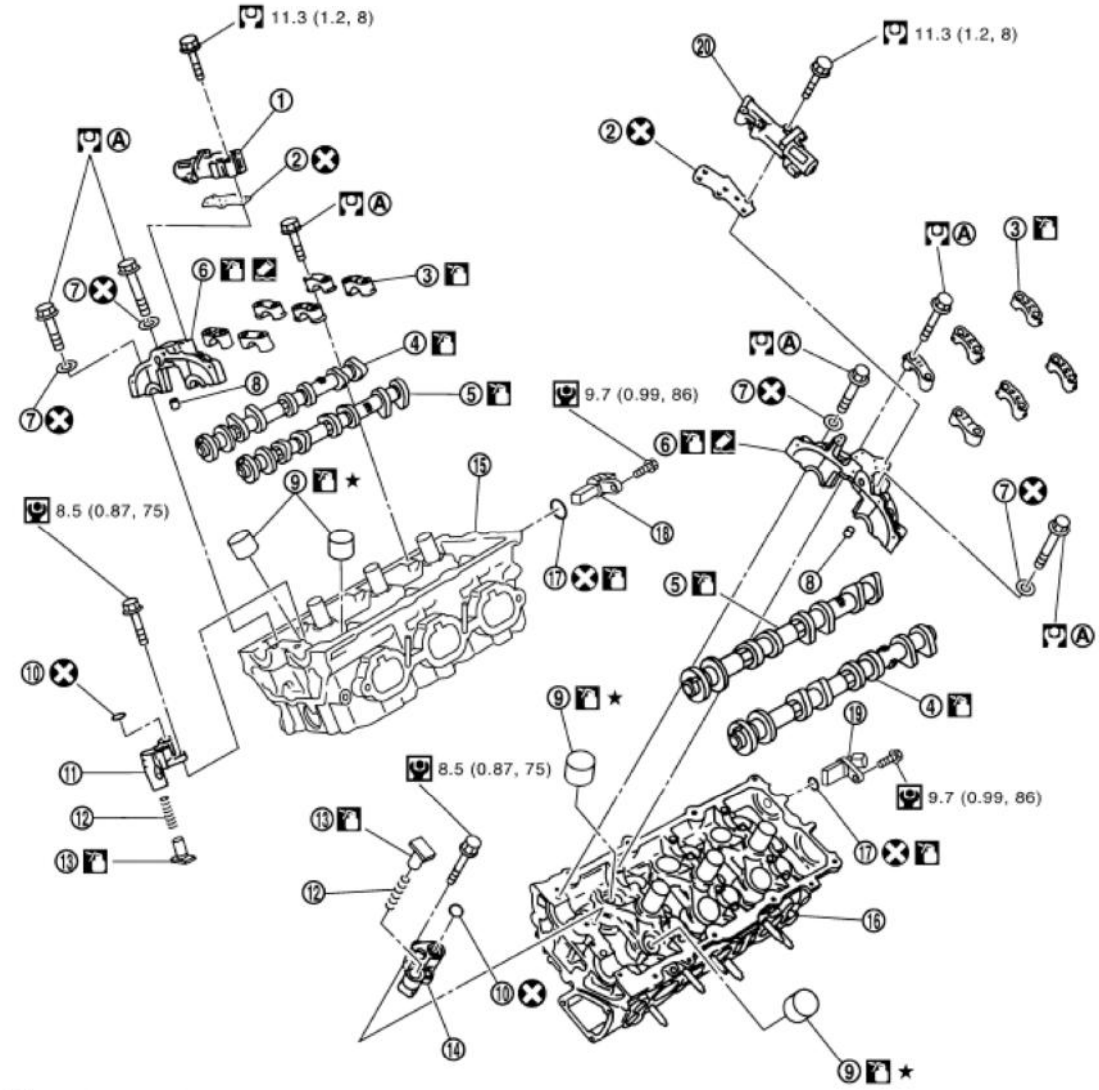
- Warm up engine thoroughly to make sure there is no leakage of fuel, or any oil/fluids including engine oil and engine coolant.
- Bleed air from lines and hoses of applicable lines, such as in cooling system.
- After cooling down engine, again check oil/fluid levels including engine oil and engine coolant.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

SUMMARY OF INSPECTION ITEMS

Item	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
(1) Transmission/transaxle/CVT fluid. power steering fluid, brake fluid, etc.			

CAMSHAFT

COMPONENTS



: N•m (kg-m, in-lb)
: N•m (kg-m, ft-lb)

FBIC4684E

1.	Intake valve timing control solenoid valve (right bank)	2.	Gasket	3.	Camshaft bracket (No. 2 to 4)
4.	Camshaft (EXH)	5.	Camshaft (INT)	6.	Camshaft bracket (No. 1)
7.	Seal washer	8.	Dowel pin	9.	Valve lifter
10.	O-ring	11.	Timing chain tensioner (secondary) (right bank)	12.	Spring
13.	Plunger	14.	Timing chain tensioner (secondary) (left bank)	15.	Cylinder head (right bank)
16.	Cylinder head (left bank)	17.	O-ring	18.	Camshaft position sensor (PHASE) (right bank)
19.	Camshaft position sensor (PHASE) (left bank)	20.	Intake valve timing control solenoid valve (left bank)		

A. Refer to VALVE LIFTER CLEARANCE in Camshaft

Fig. 171: Identifying Exploded View Of Camshaft Components With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

REMOVAL AND INSTALLATION

REMOVAL

1. Remove front timing chain case, camshaft sprocket, timing chain and rear timing chain case. Refer to "**TIMING CHAIN**".
2. Remove camshaft position sensor (PHASE) (right and left banks) from cylinder head back side.

CAUTION:

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

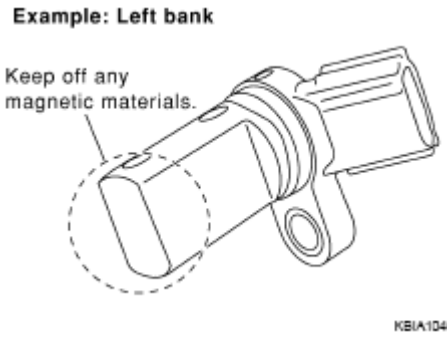


Fig. 172: Identifying Camshaft Position Sensor
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Remove intake valve timing control solenoid valves.
   - Discard intake valve timing control solenoid valve gaskets and use new gaskets for installation.

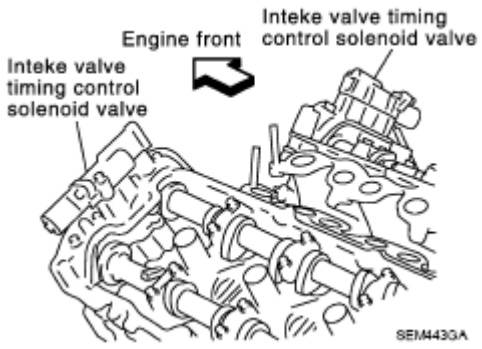


Fig. 173: Identifying Intake Valve Timing Control Solenoid Valves
Courtesy of NISSAN MOTOR CO., U.S.A.

4. Remove camshaft brackets.
   - Mark camshafts, camshaft brackets and bolts so they are placed in the same position and direction for installation.

- Equally loosen camshaft bracket bolts in several steps in reverse order as shown in the figure.

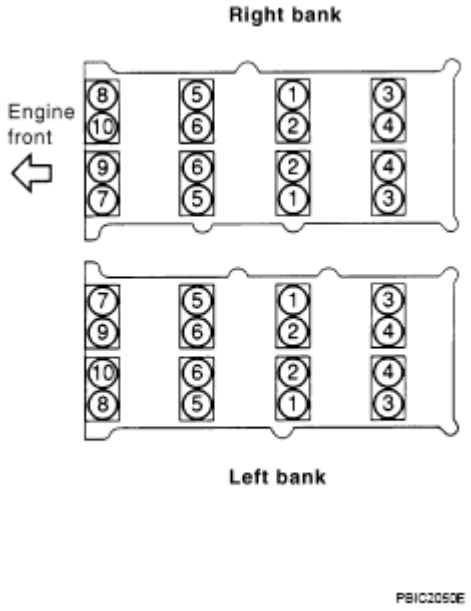


Fig. 174: Identifying Loosening And Tightening Of Camshaft Bracket Bolts In Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

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

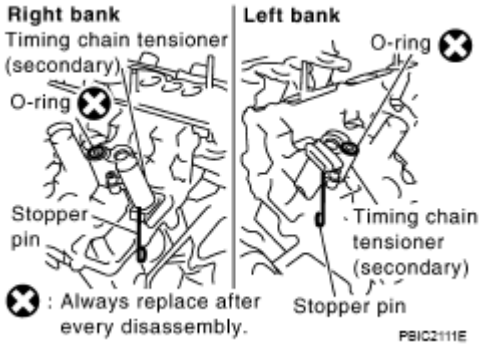


Fig. 175: Identifying Timing Chain Tensioner
Courtesy of NISSAN MOTOR CO., U.S.A.

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

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

INSPECTION AFTER REMOVAL

Camshaft Runout

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

CAUTION: Do not support No. 1 journal (on the side of camshaft sprocket) because it has a different diameter from the other three locations.

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

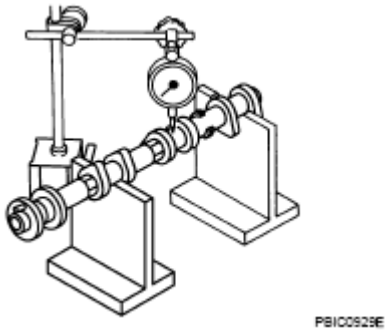


Fig. 176: Identifying Camshaft Runout
Courtesy of NISSAN MOTOR CO., U.S.A.

Standard : Less than 0.02 mm (0.0008 in)

Limit : 0.05 mm (0.0020 in)

4. If it exceeds the limit, replace camshaft.

Camshaft Cam Height

1. Measure the camshaft cam height with a micrometer.

Standard cam height (intake and exhaust) : 44.865 - 45.055 mm (1.7663 - 1.7738 in)

Cam wear limit : 0.2 mm (0.008 in)

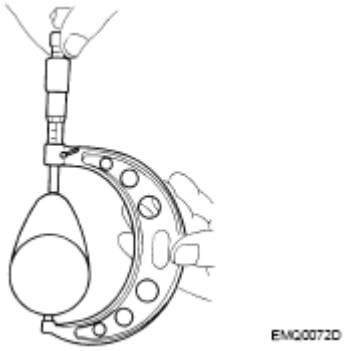


Fig. 177: Identifying Camshaft Cam Height
Courtesy of NISSAN MOTOR CO., U.S.A.

2. If wear exceeds the limit, replace camshaft.

Camshaft Journal Oil Clearance

CAMSHAFT JOURNAL DIAMETER

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

Standard:

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

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

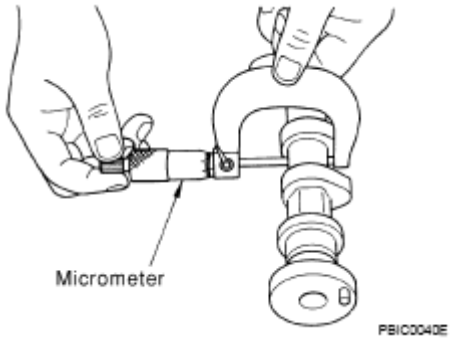


Fig. 178: Measuring Outer Diameter Of Camshaft Journal
Courtesy of NISSAN MOTOR CO., U.S.A.

CAMSHAFT BRACKET INNER DIAMETER

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

Standard:

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

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

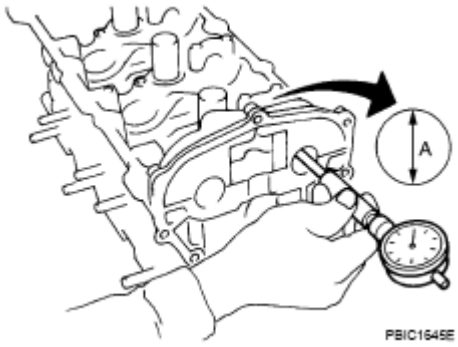


Fig. 179: Measuring Inner Diameter A Of Camshaft Bracket With Bore Gauge
Courtesy of NISSAN MOTOR CO., U.S.A.

CAMSHAFT JOURNAL OIL CLEARANCE

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

  Standard:

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

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

  Limit : 0.15 mm (0.0059 in)

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

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

Camshaft End Play

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

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

  Limit : 0.24 mm (0.0094 in)

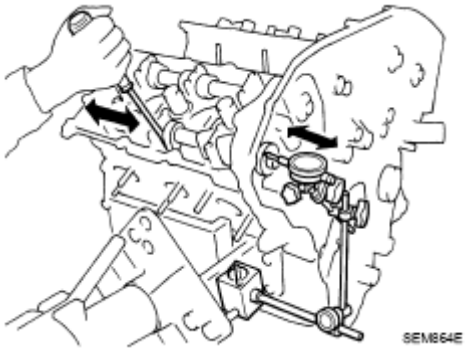


Fig. 180: Measuring End Play Of Dial Indicator
Courtesy of NISSAN MOTOR CO., U.S.A.

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

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

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

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

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

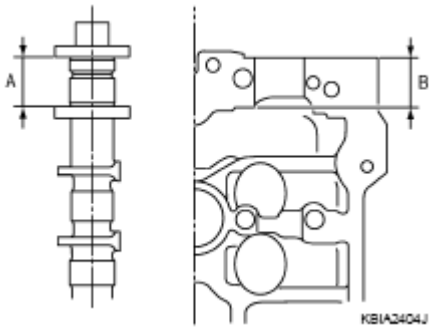


Fig. 181: Measuring Dimensions "A" And "B"
Courtesy of NISSAN MOTOR CO., U.S.A.

Camshaft Sprocket Runout

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

   CAUTION: Do not support No. 1 journal (on the side of camshaft sprocket) because it has a different diameter from the other three locations.

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

Limit : 0.15 mm (0.0059 in)

- If it exceeds the limit, replace camshaft sprocket.

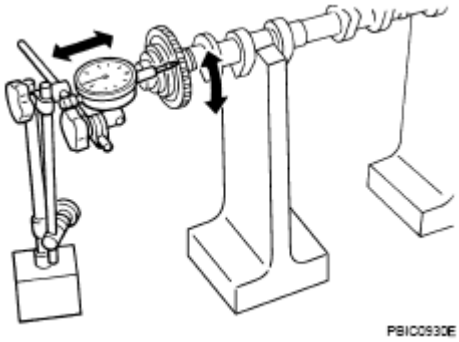


Fig. 182: Checking Camshaft Sprocket Runout
Courtesy of NISSAN MOTOR CO., U.S.A.

Valve Lifter

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

- If anything above is found, replace valve lifter. Refer to "**AVAILABLE VALVE LIFTER**".

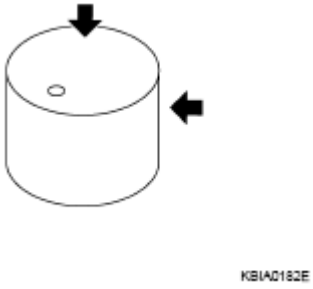


Fig. 183: Checking Surface Of Valve Lifter
Courtesy of NISSAN MOTOR CO., U.S.A.

Valve Lifter Clearance

VALVE LIFTER OUTER DIAMETER

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

Standard (Intake and exhaust) : 33.977 - 33.987 mm (1.3377 - 1.3381 in)

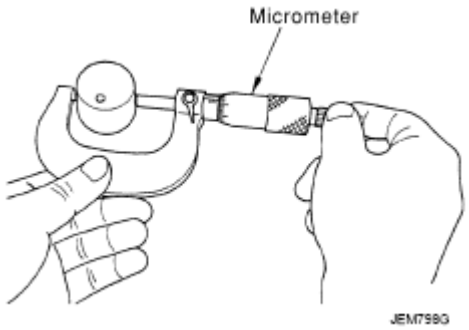


Fig. 184: Checking Outer Diameter Of Valve Lifter
Courtesy of NISSAN MOTOR CO., U.S.A.

VALVE LIFTER HOLE DIAMETER

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

Standard (Intake and exhaust) : 34.000 - 34.016 mm (1.3386 - 1.3392 in)

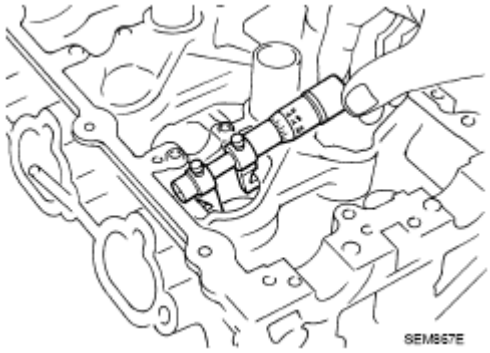


Fig. 185: Checking Diameter Of Valve Lifter Bore Of Cylinder Head
Courtesy of NISSAN MOTOR CO., U.S.A.

VALVE LIFTER CLEARANCE

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

  Standard (Intake and exhaust) : 0.013 - 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 timing chain tensioners (secondary) on both sides of cylinder head.
   - Install timing chain tensioner with its stopper pin attached.
   - Install timing chain tensioner with sliding part facing downward on right-side cylinder head, and with sliding part facing upward on left-side cylinder head.

- Install new O-ring as shown in the figure.

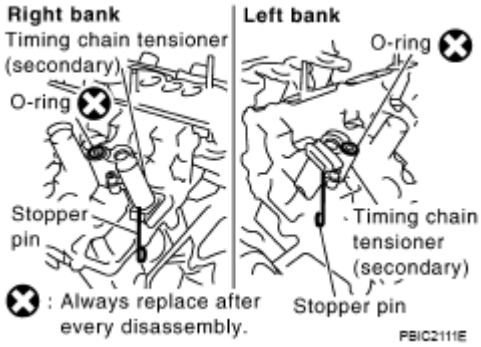


Fig. 186: Identifying O-Ring
Courtesy of NISSAN MOTOR CO., U.S.A.

2. Install valve lifter.
   - Install it in the original position.
3. Install camshafts.
   - Install camshaft with dowel pin attached to its front end face on the exhaust side.

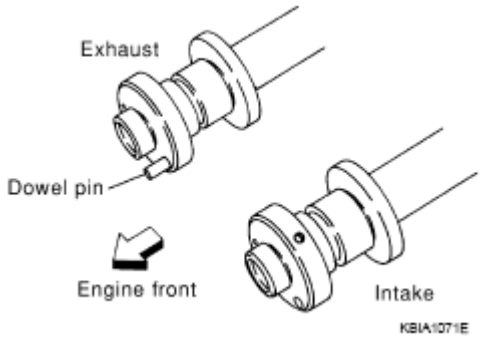


Fig. 187: Identifying Camshaft With Dowel Pin
Courtesy of NISSAN MOTOR CO., U.S.A.

- 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 AND IDENTIFICATION MARKS

Bank	INT/EXH	Dowel pin	Paint marks		Identification mark
			M1	M2	
RH	INT	No	Pink	No	RE
	EXH	Yes	No	Orange	RE
LH	INT	No	Pink	No	LH
	EXH	Yes	No	Orange	LH

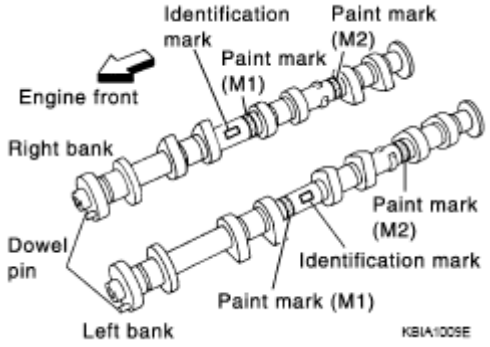


Fig. 188: Identifying Identification Marks On Cam Shaft
Courtesy of NISSAN MOTOR CO., U.S.A.

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

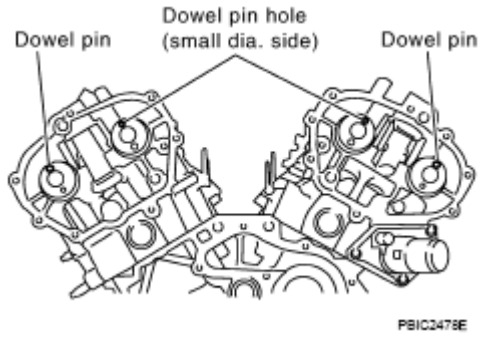


Fig. 189: Identifying Camshaft Dowel Pin Hole
Courtesy of NISSAN MOTOR CO., U.S.A.

NOTE:

- **Large and small pin holes are located on front end face of camshaft (INT), at intervals of 180 degrees. Face small dia. side pin hole upward (in cylinder head upper face direction).**
- **Though camshaft does not stop at the portion as shown in the figure, for the placement of cam nose, it is generally accepted camshaft is placed for the same direction of the figure.**

4. Install camshaft brackets.
   - Remove foreign material completely from camshaft bracket backside and from cylinder head installation face.
   - Install camshaft bracket in original position and direction as shown in figure.

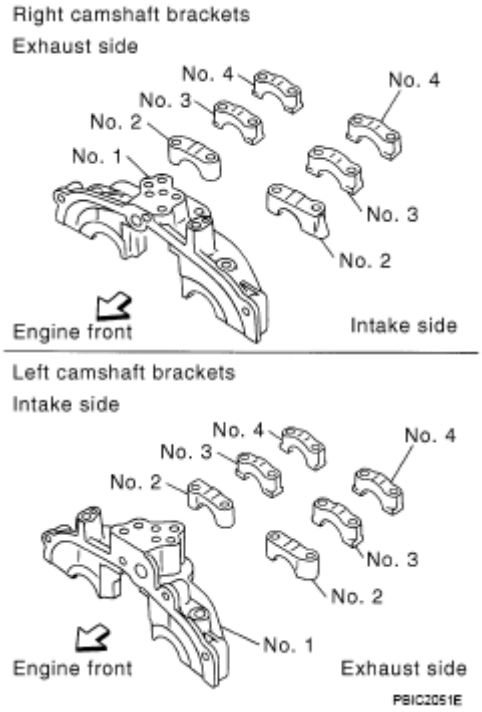


Fig. 190: Identifying Camshaft Brackets
Courtesy of NISSAN MOTOR CO., U.S.A.

- Install camshaft brackets (No. 2 to 4) aligning the stamp marks as shown in the figure.

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

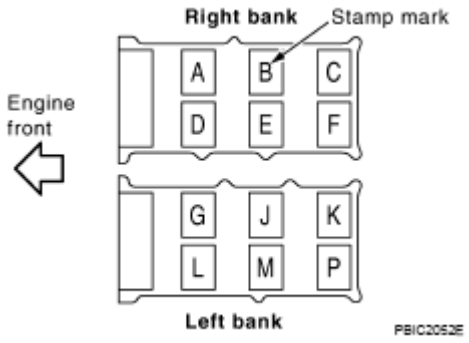


Fig. 191: Identifying Stamp Marks
Courtesy of NISSAN MOTOR CO., U.S.A.

- Apply liquid gasket to mating surface of camshaft bracket (No. 1) as shown on both right and left banks.

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

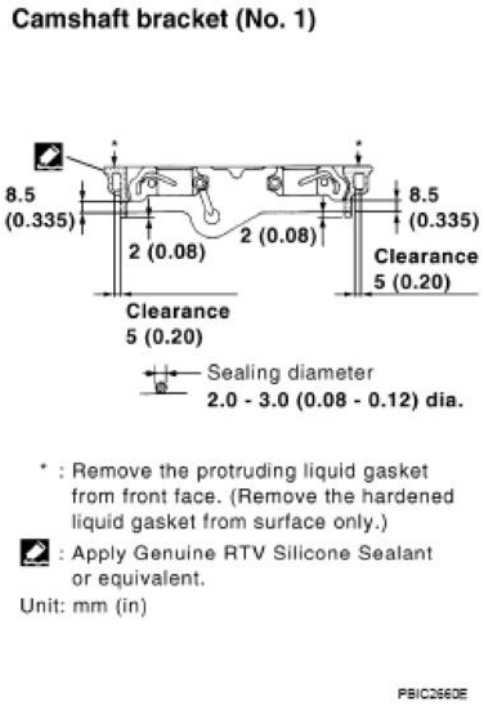


Fig. 192: Identifying Liquid Gasket To Mating Surface Of Camshaft Bracket
Courtesy of NISSAN MOTOR CO., U.S.A.

5. Tighten camshaft bracket bolts in the following steps, in numerical order as shown.

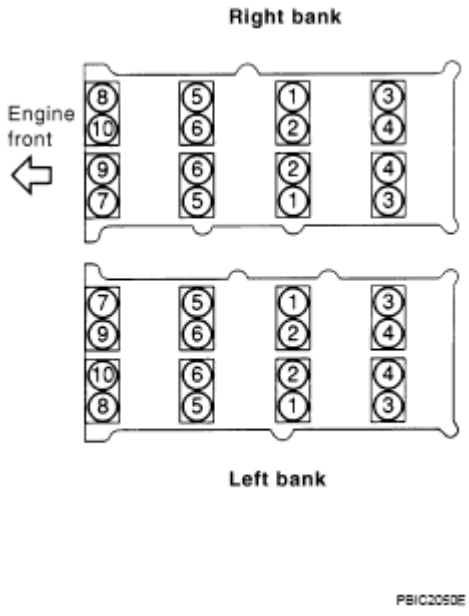


Fig. 193: Identifying Loosening And Tightening Of Camshaft Bracket Bolts In Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

a. Tighten No. 7 to 10 in numerical order as shown.

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

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

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

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

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

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

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

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

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

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

Standard : -0.14 to 0.14 mm (-0.006 to 0.006 in)

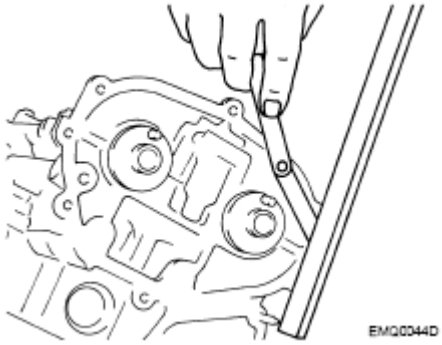


Fig. 194: Measuring Between Front End Faces Of No 1 Camshaft Bracket And Cylinder Head
Courtesy of NISSAN MOTOR CO., U.S.A.

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

7. Inspect and adjust the valve clearance. Refer to "**VALVE CLEARANCE**".
8. Install in the reverse order of removal after this step.

INSPECTION AFTER INSTALLATION

Inspection of Camshaft Sprocket (INT) Oil Groove

CAUTION:

- **Perform this inspection only when DTC P0011 or P0021 are detected in self-diagnostic results of CONSULT-III and it is directed according to inspection procedure of EC service information. Refer to "SELF-DIAG RESULTS MODE ".**
- **Check when engine ins 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 RELEASE** ".
   b. Disconnect ignition coil and injector harness connectors.
3. Remove intake valve timing control solenoid valve. Refer to "**CAMSHAFT**".
4. Crank the engine, and then make sure that engine oil comes out from camshaft bracket (No. 1) oil hole. End crank after checking.

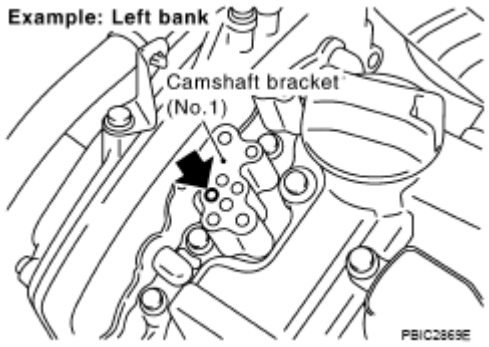


Fig. 195: Identifying Camshaft Bracket No. 1
Courtesy of NISSAN MOTOR CO., U.S.A.

WARNING: Be careful not to touch rotating parts (drive belts, 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. Do not allow engine oil to get on rubber components such as drive belt or engine mount insulators. Immediately wipe off any splashed engine oil.

- Clean oil groove between oil strainer and intake valve timing control solenoid valve if engine oil does not come out from camshaft bracket (No. 1) 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 for Leaks

The following are procedures for checking fluids leak, lubricates leak.

- Before starting engine, check oil/fluid levels including engine coolant and engine oil. If less than required quantity, fill to the specified level. Refer to "**RECOMMENDED FLUIDS AND LUBRICANTS** ".
- Use procedure below to check for fuel leakage.
  - Turn ignition switch "ON" (with engine stopped). With fuel pressure applied to fuel piping, check for fuel leakage at connection points.
  - Start engine. With engine speed increased, check again for fuel leakage at connection points.
- Run engine to check for unusual noise and vibration.

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

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

SUMMARY OF INSPECTION ITEMS

Item	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
(1) Transmission/transaxle/CVT fluid. power steering fluid, brake fluid, etc.			

VALVE CLEARANCE

INSPECTION

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

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

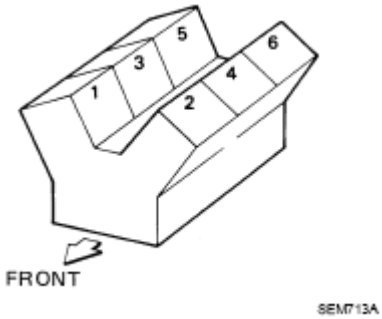


Fig. 196: Identifying Cylinder Block
Courtesy of NISSAN MOTOR CO., U.S.A.

1. Remove rocker covers (right 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 clockwise to align timing mark (grooved line without color) with timing indicator.

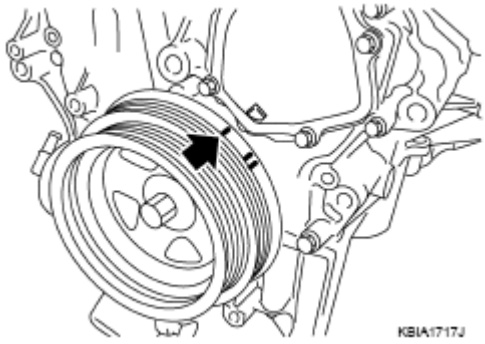


Fig. 197: Aligning Timing Mark With Timing Indicator
Courtesy of NISSAN MOTOR CO., U.S.A.

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

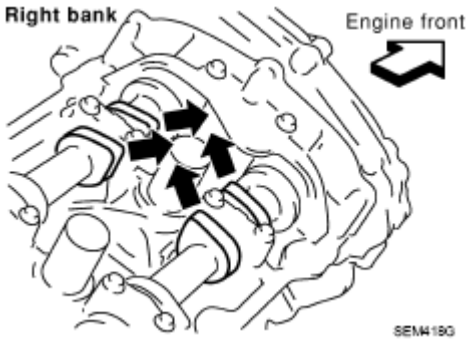


Fig. 198: Identifying Camshaft
Courtesy of NISSAN MOTOR CO., U.S.A.

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

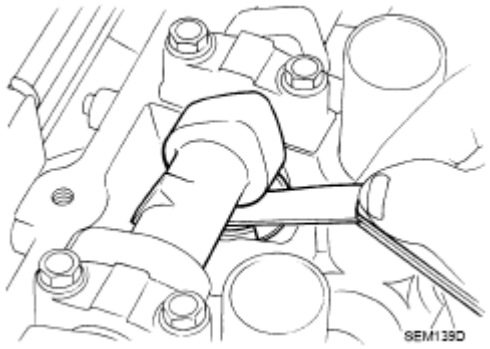


Fig. 199: Checking Clearance Between Valve Lifter And Camshaft
Courtesy of NISSAN MOTOR CO., U.S.A.

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)		

- By referring to the figure, measure the valve clearances at locations marked "x" as shown in the table below (locations indicated in the figure).
- No. 1 cylinder at compression TDC

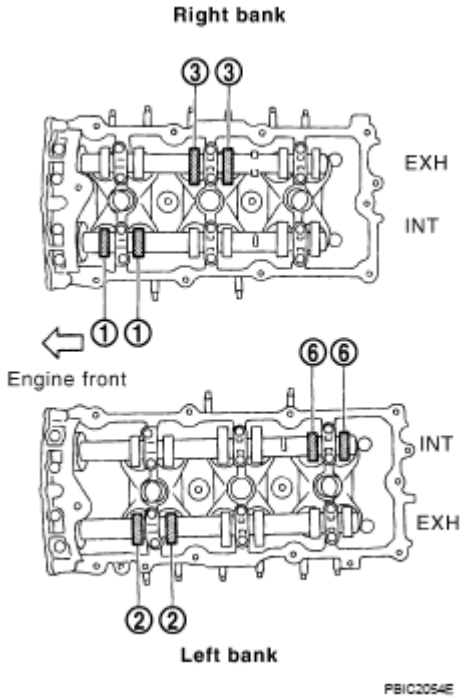


Fig. 200: Identifying Marks For Measuring Valve Clearances
Courtesy of NISSAN MOTOR CO., U.S.A.

MEASURING POSITION SPECIFICATIONS

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

c. Rotate crankshaft by 240 degrees clockwise (when viewed from engine front) to align No. 3 cylinder at TDC of its compression stroke.

NOTE:

- **To align cylinder No.3 with the compression top dead center, place matching marks (A) on the crankshaft pulley (1) side and on the cylinder block side at a point 240° counterclockwise from the compression top dead center using the hex head of the crankshaft pulley bolt as a guide.**

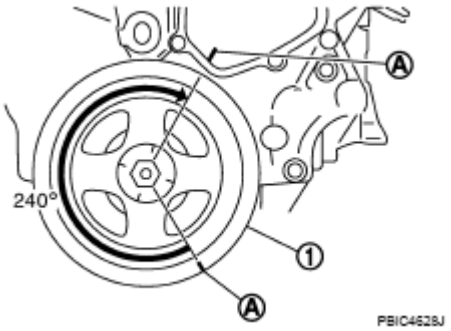


Fig. 201: Identifying Matching Marks On Crankshaft Pulley
Courtesy of NISSAN MOTOR CO., U.S.A.

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

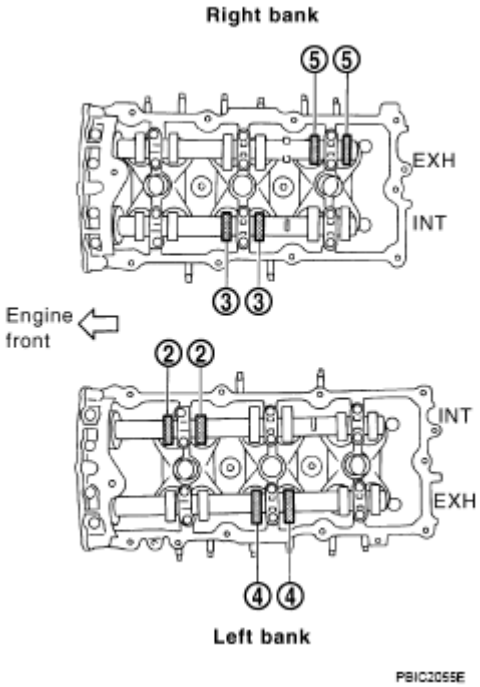


Fig. 202: Identifying Valve Clearance Measuring Location
Courtesy of NISSAN MOTOR CO., U.S.A.

MEASURING POSITION SPECIFICATIONS

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

No. 3 cylinder at compression TDC	INT	x		
	EXH		x	

d. Rotate crankshaft by 240 degrees clockwise (when viewed from engine front) to align No. 5 cylinder at TDC of compression stroke.

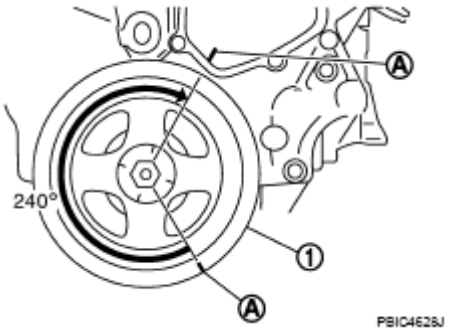


Fig. 203: Identifying Matching Marks On Crankshaft Pulley
Courtesy of NISSAN MOTOR CO., U.S.A.

NOTE:

- **To align cylinder No.5 with the compression top dead center, place matching marks (A) on the crankshaft pulley (1) side and on the cylinder block side at a point 240° counterclockwise from the compression top dead center using the hex head of the crankshaft pulley bolt as a guide.**
- **By referring to the figure, measure the valve clearances at locations marked "x" as shown in the table below (locations indicated in the figure).**
- **No. 5 cylinder at compression TDC**

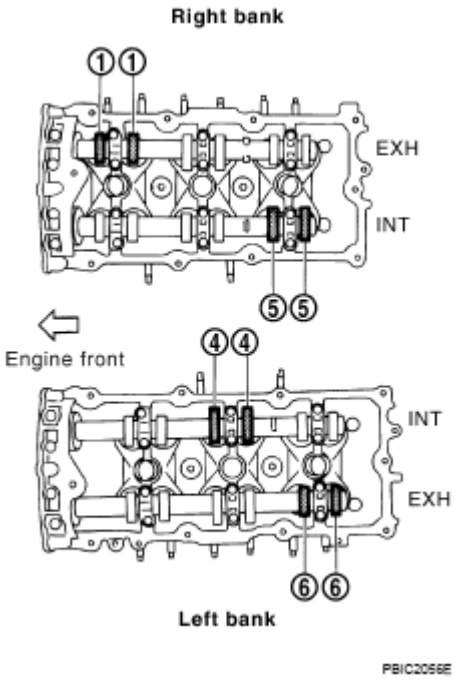


Fig. 204: Identifying Angle And Paint Mark
Courtesy of NISSAN MOTOR CO., U.S.A.

MEASURING POSITION SPECIFICATIONS

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

3. For measured value are out of the standard, perform adjustment. Refer to "**ADJUSTMENT**".

ADJUSTMENT

- Perform adjustment depending on selected head thickness of valve lifter.

1. Measure the valve clearance. Refer to "**INSPECTION**".
2. Remove camshaft. Refer to "**REMOVAL**".
3. Remove valve lifters at the locations that are out of the standard.
4. Measure the center thickness of the removed valve lifters with a micrometer.

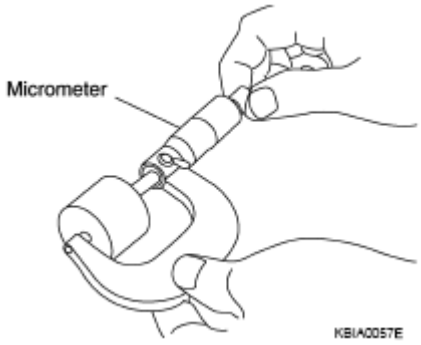


Fig. 205: Checking Center Thickness Of Removed Valve Lifters With Micrometer
Courtesy of NISSAN MOTOR CO., U.S.A.

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).

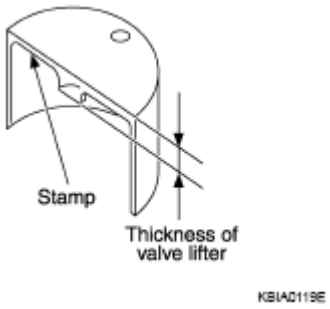


Fig. 206: Identifying Thickness Of Valve Lifters
Courtesy of NISSAN MOTOR CO., U.S.A.

THICKNESS SPECIFICATION

Stamp mark		Thickness
INT	EXH	
788U	788R	7.88 mm
790U	790R	7.90 mm
.	.	.
.	.	.
840U	840R	8.40 mm

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 "**AVAILABLE VALVE LIFTER**".

CAUTION: Install identification letter at the end, "U" and "R", at each of proper positions. (Be careful of misinstallation between intake and exhaust)

6. Install selected valve lifter.
7. Install camshaft. Refer to "**INSTALLATION**".
8. Manually turn crankshaft pulley a few turns.
9. Make sure that the valve clearances for cold engine are within the specifications by referring to the specified values. Refer to "**INSPECTION**".
10. Install all removal parts in the reverse order of removal. Refer to "**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 camshaft relating to valve oil seal to be removed. Refer to "**CAMSHAFT**".
2. Remove valve lifters. Refer to "**CAMSHAFT**".
3. Turn crankshaft until the cylinder requiring new oil seals is at TDC. This will prevent valve from dropping into cylinder.
4. Remove valve collet.
   - Compress valve spring with the valve spring compressor, the attachment, the adapter (SST). Remove valve collet with a magnet hand.

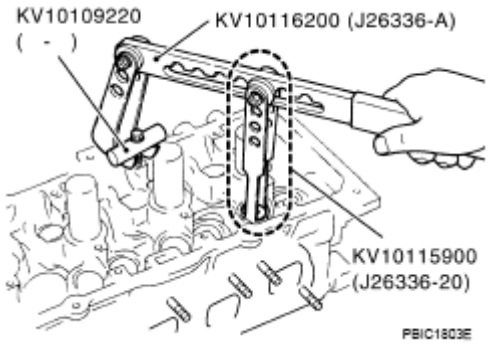


Fig. 207: Compressing Valve Spring With Valve Spring Compressor
Courtesy of NISSAN MOTOR CO., U.S.A.

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

5. Remove valve spring retainer, and valve spring.
6. Remove valve oil seal using the valve oil seal puller (SST).

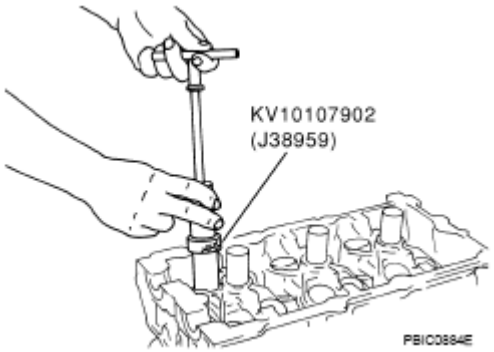


Fig. 208: Identifying Valve Oil Seal Using Valve Oil Seal Puller
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

1. Apply new engine oil on new valve oil seal joint and seal lip.
2. Using the valve oil seal drift (SST), press fit valve seal to height "H" shown in figure.

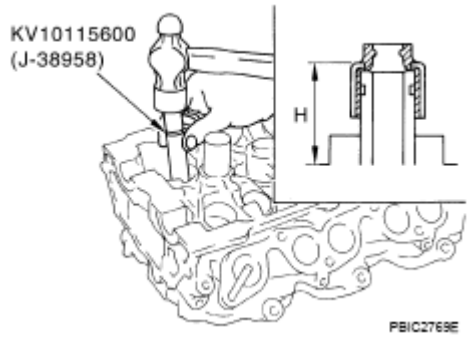


Fig. 209: Identifying Valve Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

NOTE: Dimension "H": Height measured before valve spring seat installation

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

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

REMOVAL AND INSTALLATION OF FRONT OIL SEAL

REMOVAL

1. Remove the following parts:
   - Undercover
   - Drive belts; Refer to "**DRIVE BELTS**".
   - Crankshaft pulley; Refer to "**TIMING CHAIN**".
2. Remove front oil seal using a suitable tool.

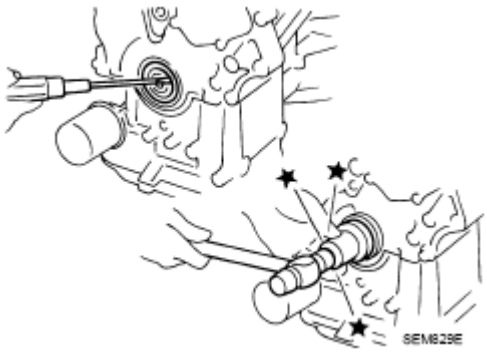


Fig. 210: Removal/Installation Of Front Oil Seal Using Suitable Tool
Courtesy of NISSAN MOTOR CO., U.S.A.

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

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 in the figure.

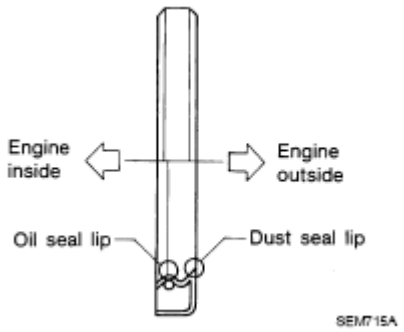


Fig. 211: Identifying Engine Oil To Both Oil Seal Lip And Dust Seal Lip
Courtesy of NISSAN MOTOR CO., U.S.A.

   - Using a suitable drift, press-fit until the height of front oil seal is level with the mounting surface.
     - Suitable drift: outer diameter 60 mm (2.36 in), inner diameter 50 mm (1.97 in).
   - Make sure the garter spring is in position and seal lips not inverted

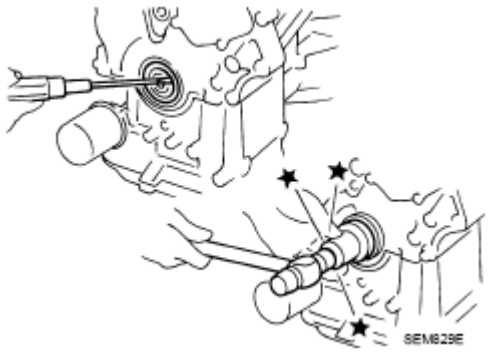


Fig. 212: Removal/Installation Of Front Oil Seal Using Suitable Tool
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION:
- **Be careful not to damage front timing chain case and crankshaft.**
- **Press-fit straight and avoid causing burrs or tilting oil seal.**

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

REMOVAL AND INSTALLATION OF REAR OIL SEAL

REMOVAL

1. Remove oil pan (upper). Refer to "**OIL PAN AND OIL STRAINER**".
2. Remove transmission assembly. Refer to "**TRANSMISSION ASSEMBLY** ".
3. Remove drive plate. Refer to "**CYLINDER BLOCK**".
4. Use a seal cutter (SST) to cut away liquid gasket and remove rear oil seal retainer.

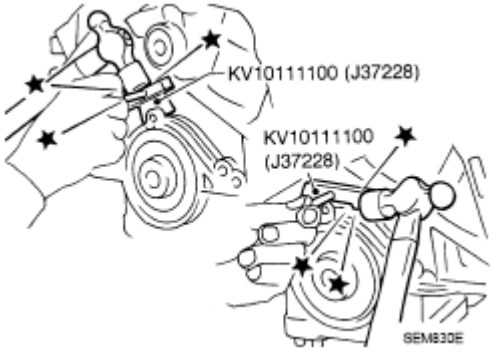


Fig. 213: Removing Rear Oil Seal Retainer
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: Be careful not to damage mounting surface.

NOTE: Regard both rear oil seal and retainer as an assembly.

INSTALLATION

1. Remove old liquid gasket on mating surfaces of cylinder block and oil pan (upper) using a scraper.
2. Apply new engine oil to both oil seal lip and dust seal lip of new rear oil seal retainer.
3. Apply a continuous bead of liquid gasket with the tube presser [SST: WS39930000 (-)] to rear oil seal retainer as shown in the figure.

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

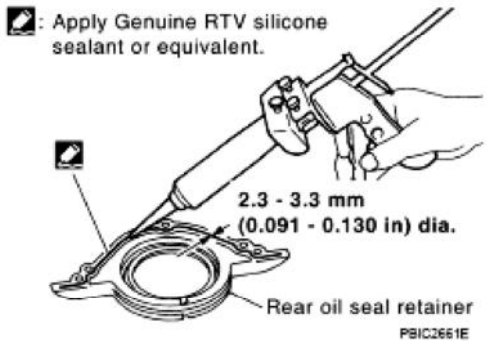


Fig. 214: Applying Bead Of Liquid Gasket With Tube Presser To Rear Oil Seal Retainer

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

- Assembly should be done within 5 minutes after coating.

4. Install rear oil seal retainer to cylinder block. Refer to "**CYLINDER BLOCK**".
   - Make sure the garter spring is in position and seal lips not inverted.
5. Install in the reverse order of removal after this step.

CYLINDER HEAD

ON-VEHICLE SERVICE

CHECKING COMPRESSION PRESSURE

1. Warm up engine thoroughly. Then, stop it.
2. Release fuel pressure. Refer to "**FUEL PRESSURE RELEASE** ".
3. Disconnect fuel pump fuse to avoid fuel injection during measurement.

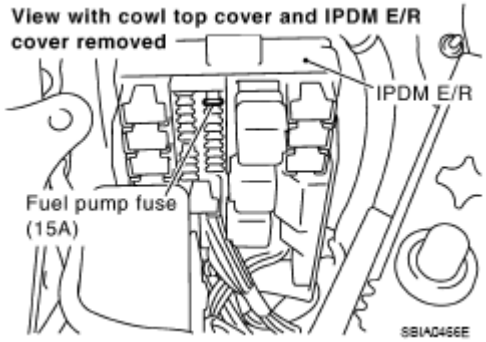


Fig. 215: Identifying Fuel Pump Fuse To Avoid Fuel Injection
Courtesy of NISSAN MOTOR CO., U.S.A.

4. Remove engine cover with power tool. Refer to "**INTAKE MANIFOLD COLLECTOR**".
5. Remove ignition coil and spark plug from each cylinder. Refer to "**IGNITION COIL**" and "**SPARK PLUG (PLATINUM-TIPPED TYPE)**".
6. Connect engine tachometer (not required in use of CONSULT-III).
7. Install compression gauge with an adapter (commercial service tool) onto spark plug hole.

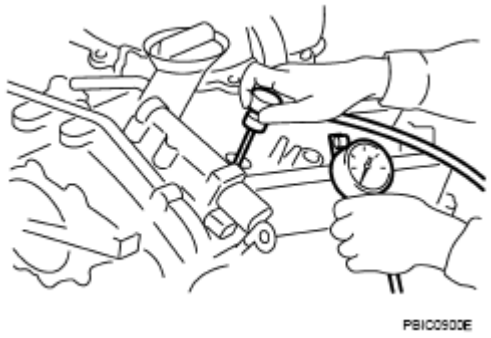


Fig. 216: Identifying Compression Tester With Adapter Onto Spark Plug Hole
Courtesy of NISSAN MOTOR CO., U.S.A.

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

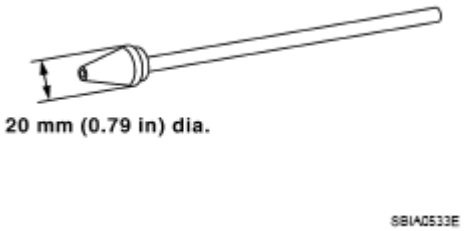


Fig. 217: Identifying Adapter Diameter
Courtesy of NISSAN MOTOR CO., U.S.A.

8. Turn ignition switch to "START" for cranking. When the gauge pointer stabilizes, read the compression pressure and the engine rpm. Perform these steps to check each cylinder.

COMPRESSION PRESSURE SPECIFICATION

		Unit: kPa (kg/cm^2 , psi) /rpm
Standard	**Minimum**	**Deference limit between cylinders**
1,275 (13.0, 185) / 300	981 (10.0, 142) / 300	98 (1.0, 14) / 300

CAUTION: Always use a fully changed battery to obtain the specified engine speed.

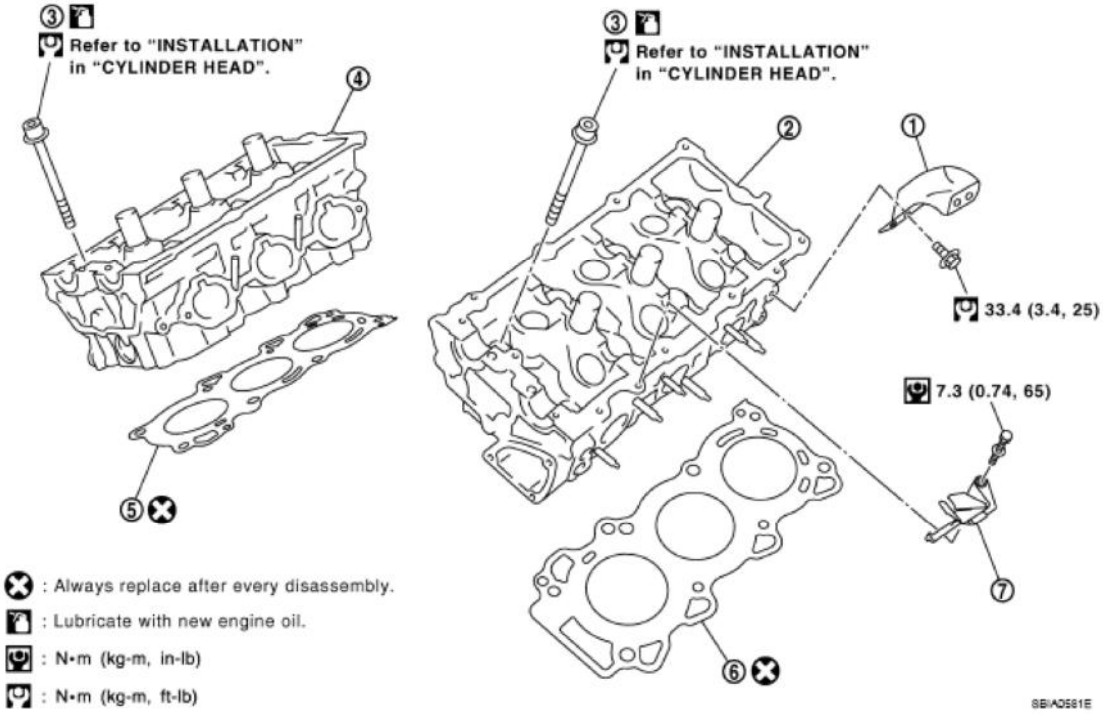
- If the engine speed is out of the specified range, check battery liquid for proper gravity. Check the engine speed again with normal battery gravity.
- If compression pressure is below minimum value, check valve clearances and parts associated with combustion chamber (valve, valve seat, piston, piston ring, cylinder bore, cylinder head, cylinder head gasket). After the checking, measure compression pressure again.
- If some cylinder has low compression pressure, pour small amount of engine oil into the spark plug hole of the cylinder to re-check it for compression.

- If the added engine oil improves the compression, piston rings may be worn out or damaged. Check piston rings and replace if necessary.
- If the compression pressure remains at low level despite the addition of engine oil, valves may be malfunctioning. Check valves for damage. Replace valve or valve seat accordingly.

- If two adjacent cylinders have respectively low compression pressure and their compression remains low even after the addition of engine oil, cylinder head gaskets are leaking. In such a case, replace cylinder head gaskets.

9. After inspection is completed, install removed parts.
10. Start the engine, and make sure that the engine runs smoothly.
11. Perform trouble diagnosis. If DTC appears, erase it. Refer to "**TROUBLE DIAGNOSIS** ".

COMPONENTS



1. Engine rear lower slinger
2. Cylinder head (left bank)
3. Cylinder head bolt
4. Cylinder head (right bank)
5. Cylinder head gasket (right bank)
6. Cylinder head gasket (left bank)
7. Oil level gauge guide

Fig. 218: Identifying Cylinder Head Gaskets Components With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

REMOVAL AND INSTALLATION

REMOVAL

1. Remove camshaft. Refer to "**CAMSHAFT**".

NOTE: It is also possible to perform the following steps 2 and 3 just before removing camshaft.

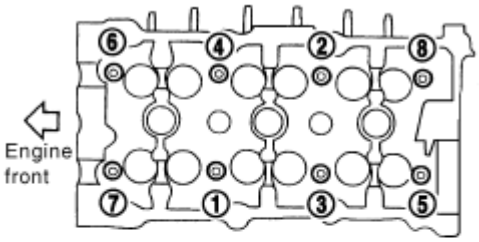
2. Temporarily fit front suspension member to support engine. Refer to "**FRONT SUSPENSION MEMBER** ".

CAUTION: Temporary fitting means the status that engine is adequately stable though the hoist is released from hanging.

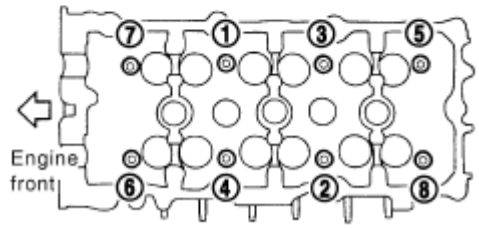
NOTE: At the time of the start of this procedure front suspension member is removed, and cylinder head is hanged by hoist with the engine slinger installed.

3. Release the hoist from hanging, then remove the engine slinger.
4. Remove the following parts:
   - Fuel tube and fuel injector assembly; Refer to "**FUEL INJECTOR AND FUEL TUBE**".
   - Intake manifold; Refer to "**INTAKE MANIFOLD**".
   - Exhaust manifold; Refer to "**EXHAUST MANIFOLD AND THREE WAY CATALYST**".
   - Water inlet and thermostat assembly; Refer to "**WATER INLET AND THERMOSTAT ASSEMBLY** ".
   - Water outlet, water pipe and heater pipe; Refer to "**WATER OUTLET AND WATER PIPING** ".
5. Remove cylinder head bolts in reverse order as shown in the figure with cylinder head bolt wrench (commercial service tool) and power tool to remove cylinder heads (right and left banks).

Right bank



Left bank



PBIC2057E

Fig. 219: Identifying Cylinder Head Bolts Loosening And Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

6. 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.

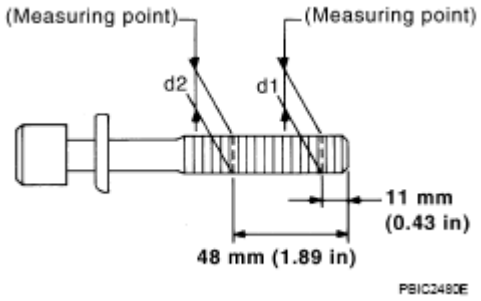


Fig. 220: Identifying Cylinder Head Bolts Diameter
Courtesy of NISSAN MOTOR CO., U.S.A.

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

- 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 "CYLINDER BLOCK DISTORTION".

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

CAUTION: Do not 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)

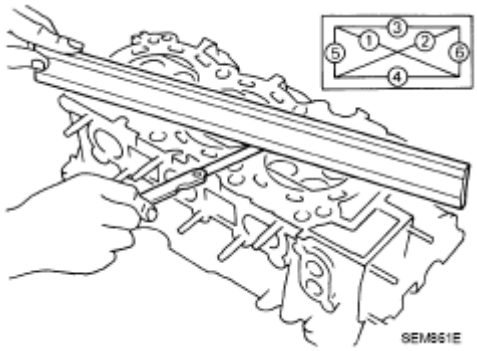


Fig. 221: Measuring Cylinder Head Distortion
Courtesy of NISSAN MOTOR CO., U.S.A.

- If it exceeds the limit, replace cylinder head.

INSTALLATION

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

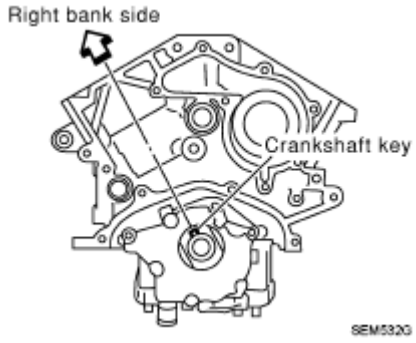


Fig. 222: Identifying Crankshaft Key
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Install cylinder head follow the steps below to tighten cylinder head bolts in numerical order as shown in the figure with cylinder head bolts wrench (commercial service tool).

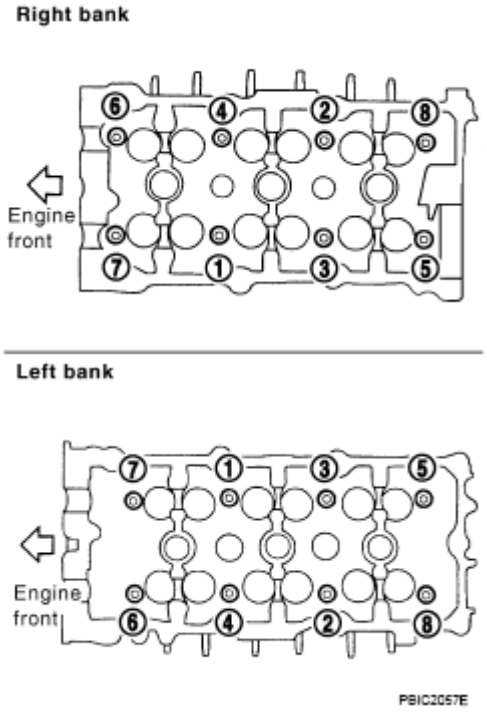


Fig. 223: Identifying Cylinder Head Bolts Loosening And Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: If cylinder head bolts re-used, check their outer diameters before installation. Refer to "CYLINDER HEAD BOLTS OUTER DIAMETER".

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

: 98.1 N.m (10 kg-m, 72 ft-lb)

c. Completely loosen all cylinder head bolts.

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

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

d. Tighten all cylinder head bolts.

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

e. Turn all cylinder head bolts 90 degrees clockwise (angle tightening).

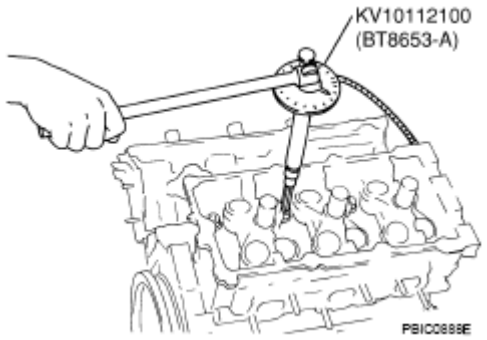


Fig. 224: Identifying Tightening Angle
Courtesy of NISSAN MOTOR CO., U.S.A.

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

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

f. Turn all cylinder head bolts 90 degrees clockwise again (angle tightening).

4. After installing cylinder head, measure distance between front end faces of cylinder block and cylinder head (left and right banks).

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

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

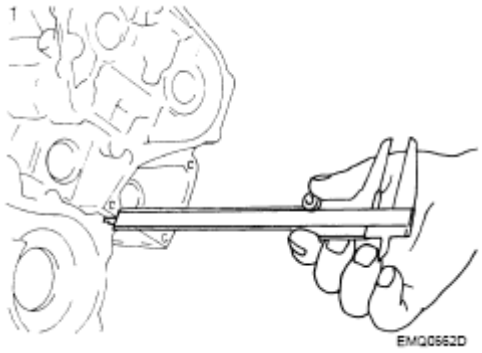


Fig. 225: Checking Distance Between Front End Faces Of Cylinder Block And Cylinder Head (Left And Right Banks)
Courtesy of NISSAN MOTOR CO., U.S.A.

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

INSPECTION AFTER INSTALLATION

Inspection for Leaks

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

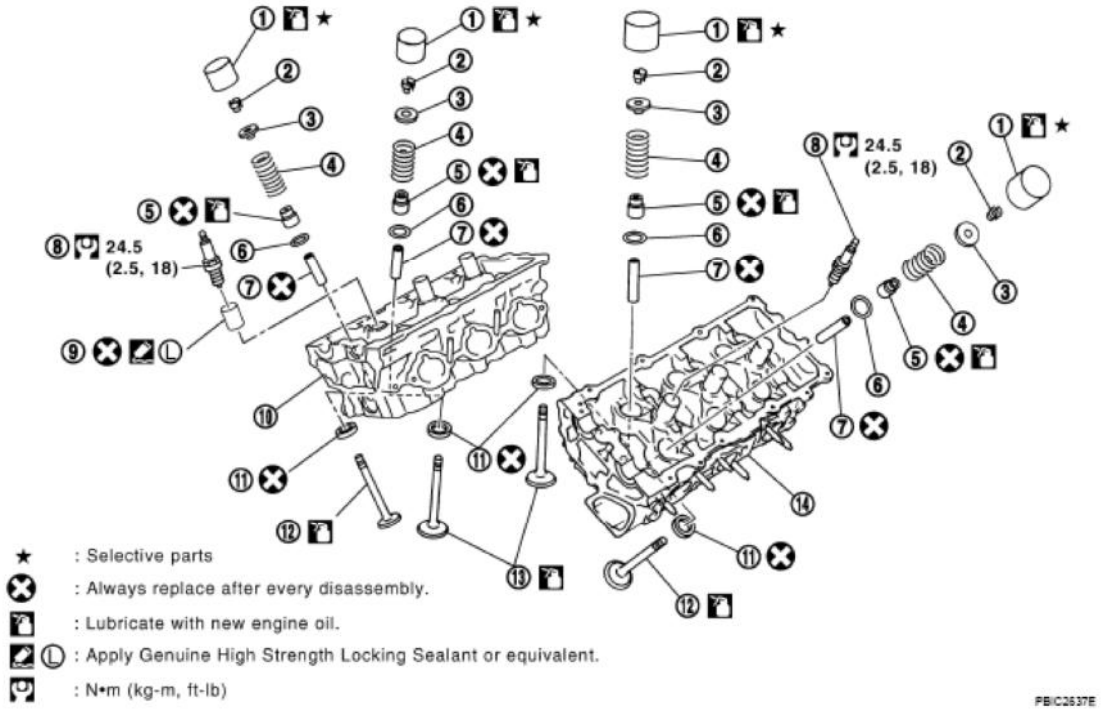
- Before starting engine, check oil/fluid levels including engine coolant and engine oil. If less than required quantity, fill to the specified level. Refer to "**RECOMMENDED FLUIDS AND LUBRICANTS** ".
- Use procedure below to check for fuel leakage.
  - Turn ignition switch "ON" (with engine stopped). 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 make sure 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 INSPECTION ITEMS

Item	Before starting engine	Engine running	After engine stopped
Engine coolant	Level	Leakage	Level
Engine oil	Level	Leakage	Level
Other oils and fluid(1)	Level	Leakage	Level
Fuel	Leakage	Leakage	Leakage
Exhaust gases	-	Leakage	-

(1) Transmission/transaxle/CVT fluid. power steering fluid, brake fluid, etc.

DISASSEMBLY AND ASSEMBLY



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

Fig. 226: Identifying Exploded View Of Cylinder Head Components With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

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 the valve spring compressor, the attachment and the adapter (SST). Remove valve collet with a magnet hand.

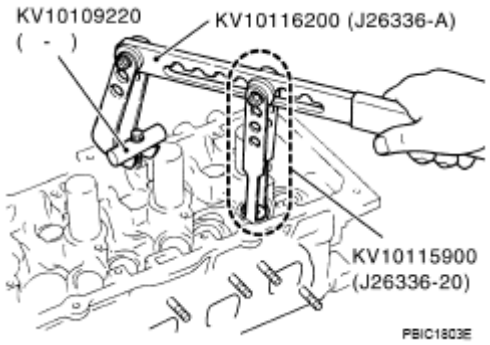


Fig. 227: Compressing Valve Spring With Valve Spring Compressor
Courtesy of NISSAN MOTOR CO., U.S.A.

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

4. Remove valve spring retainer, valve spring and valve spring seat.
5. Push valve stem to combustion chamber side, and remove valve.
   - Identify installation positions, and store them without mixing them up.
6. Remove valve oil seal using the valve oil seal puller (SST).

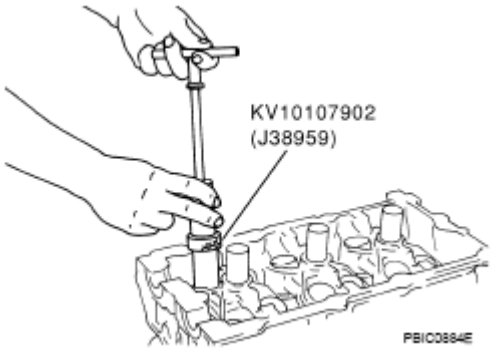


Fig. 228: Removing Valve Oil Seal Using Valve Oil Seal Puller
Courtesy of NISSAN MOTOR CO., U.S.A.

7. If valve seat must be replaced, refer to "**VALVE SEAT REPLACEMENT**".
8. If valve guide must be replaced, refer to "**VALVE GUIDE REPLACEMENT**".
9. Remove spark plug tube, as necessary.

- Using a 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. Do not remove it unless absolutely necessary.**

ASSEMBLY

1. When valve guide is removed, install it. Refer to "**VALVE GUIDE REPLACEMENT**".
2. When valve seat is removed, install it. Refer to "**VALVE SEAT REPLACEMENT**".
3. Install new valve oil seals as follows:
   a. Apply new engine oil on valve oil seal joint and seal lip.
   b. Install with the valve oil seal drift (SST) to match dimension in the figure.

Height "H" (Without valve spring seat installed)

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

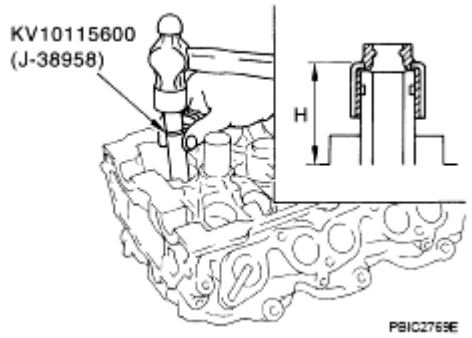


Fig. 229: Installing Valve Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

4. Install valve spring seat.
5. Install valve.
   - Larger diameter valves are for intake side.

NOTE: Larger diameter valves are for intake side.

6. Install valve spring (uneven pitch type).
   - Install narrow pitch end (paint mark) to cylinder head side (valve spring seat side).
   - Intake side and exhaust side valve springs are different. Install them referring to the following paint mark collar.

Paint mark collar

Intake and Exhaust : Blue

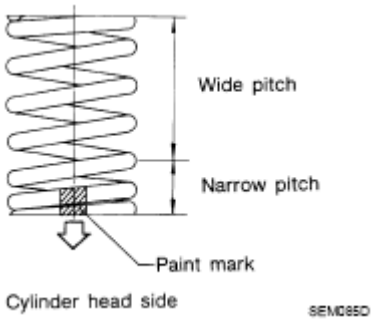


Fig. 230: Identifying Paint Mark
Courtesy of NISSAN MOTOR CO., U.S.A.

7. Install valve spring retainer.
8. Install valve collet.
   - Compress valve spring with the valve spring compressor, the attachment and the adapter (SST). Install valve collet with a magnet hand.

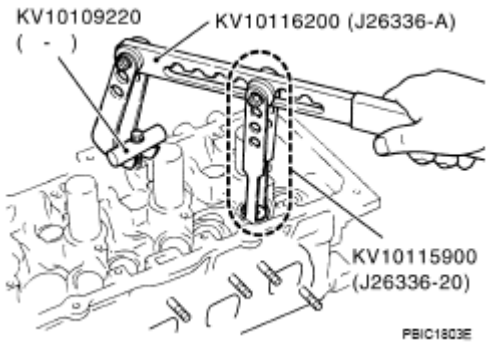


Fig. 231: Compressing Valve Spring With Valve Spring Compressor
Courtesy of NISSAN MOTOR CO., U.S.A.

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

   - Tap valve stem edge lightly with plastic hammer after installation to check its installed condition.
9. Install valve lifter.
   - Install it in the original position.
10. Install spark plug tube.
   - Press-fit spark plug tube as follows:
   a. Remove old liquid gasket adhering to cylinder head mounting hole.
   b. Apply sealant to area within approximately 12 mm (0.47 in) from edge of spark plug tube press-fit side.

Use Genuine High Strength 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 in the figure.

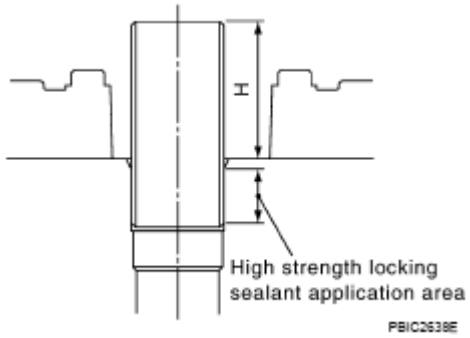


Fig. 232: Identifying High Strength Locking Sealant Application Area
Courtesy of NISSAN MOTOR CO., U.S.A.

Standard press-fit height "H":

38.1 - 39.1 mm (1.500 - 1.539 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.**

11. 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 "**VALVE DIMENSIONS**".
- If dimensions are out of the standard, replace valve and check valve seat contact. Refer to "**VALVE SEAT CONTACT**".

VALVE GUIDE CLEARANCE

Valve Stem Diameter

Measure the diameter of valve stem with micrometer.

Standard

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

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

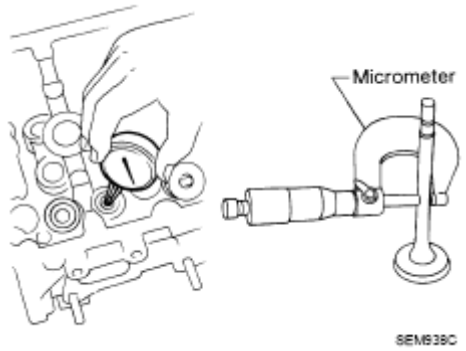


Fig. 233: Measuring Diameter Of Valve Stem With Micrometer
Courtesy of NISSAN MOTOR CO., U.S.A.

Valve Guide Inner Diameter

Measure the inner diameter of valve guide with an inside micrometer.

Standard

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

Valve Guide Clearance

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

Valve guide clearance:

Standard

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

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

Limit

Intake : 0.08 mm (0.0031 in)

Exhaust : 0.10 mm (0.0039 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.

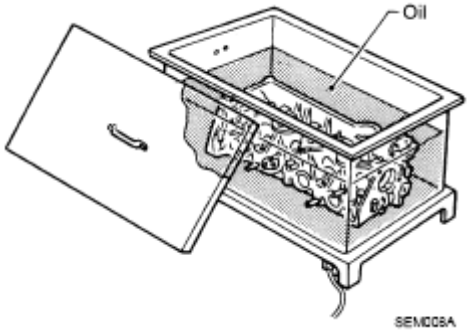


Fig. 234: Heating Cylinder Head
Courtesy of NISSAN MOTOR CO., U.S.A.

2. Drive out valve guide with a press [under a 20 kN (2 ton, 2.2 US ton, 2.0 lmp ton) pressure] or a hammer and the valve guide drift (commercial service tool).

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

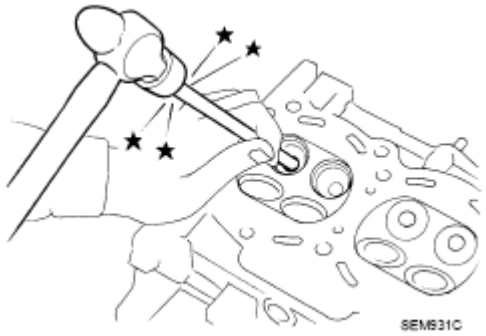


Fig. 235: Driving Out Valve Guide
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Using the 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)

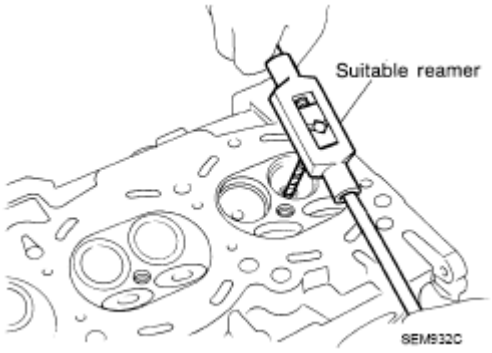


Fig. 236: Reaming Cylinder Head Valve Guide
Courtesy of NISSAN MOTOR CO., U.S.A.

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

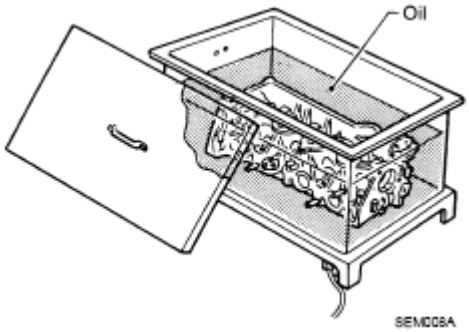


Fig. 237: Heating Cylinder Head
Courtesy of NISSAN MOTOR CO., U.S.A.

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

Projection "L"

Intake and exhaust : 12.6 - 12.8 mm (0.496 - 0.504 in)

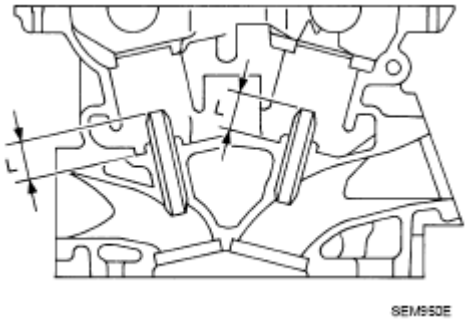


Fig. 238: Identifying Dimensions For Pressing Valve Guide From Camshaft Side
Courtesy of NISSAN MOTOR CO., U.S.A.

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

6. Using the 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)

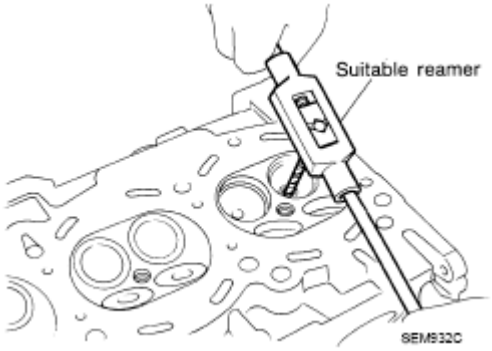


Fig. 239: Reaming Cylinder Head Valve Guide
Courtesy of NISSAN MOTOR CO., U.S.A.

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 re-check, replace valve seat. Refer to "**VALVE SEAT REPLACEMENT**".

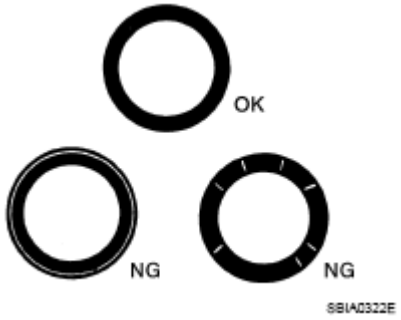


Fig. 240: Identifying Valve Seat Contact
Courtesy of NISSAN MOTOR CO., U.S.A.

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 "**VALVE SEAT**".

   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 : 38.500 - 38.516 mm (1.5157 - 1.5164 in)

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

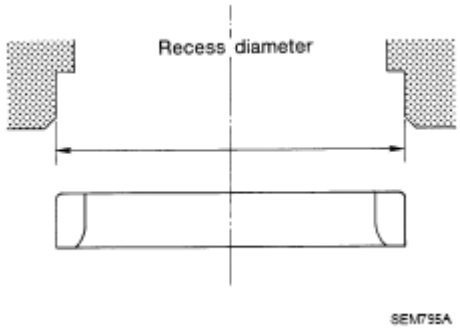


Fig. 241: Identifying Cylinder Head Recess Diameter
Courtesy of NISSAN MOTOR CO., U.S.A.

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

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

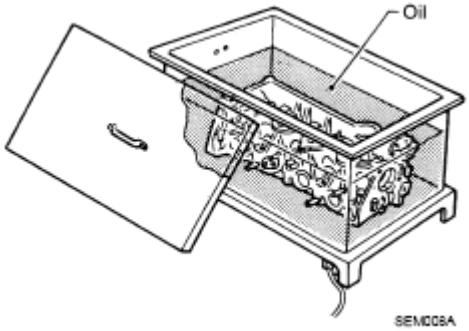


Fig. 242: Heating Cylinder Head
Courtesy of NISSAN MOTOR CO., U.S.A.

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 the valve seat cutter set (commercial service tool) or valve seat grinder, finish seat to the specified dimensions. Refer to "**VALVE SEAT**".

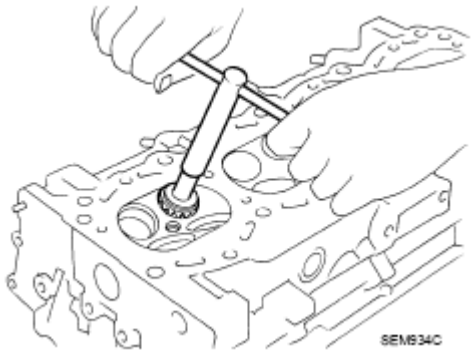


Fig. 243: Cutting Valve Seat
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: When using the 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.

6. Using compound, grind to adjust valve fitting.
7. Check again for normal contact. Refer to "**VALVE SEAT CONTACT**".

VALVE SPRING SQUARENESS

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

  Limit : 2.1 mm (0.083 in)

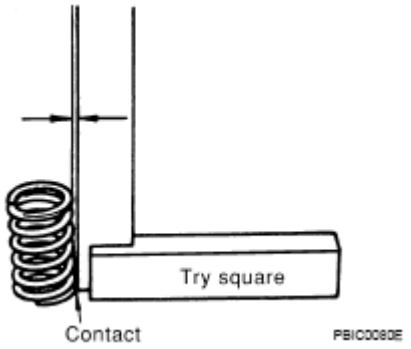


Fig. 244: Checking Maximum Clearance Between Top Face Of Spring And Try Square
Courtesy of NISSAN MOTOR CO., U.S.A.

- If it exceeds the limit, replace valve spring.

VALVE SPRING DIMENSIONS AND VALVE SPRING PRESSURE LOAD

- Check the valve spring pressure at specified spring height.

  Standard:

  Intake and exhaust

  Free height : 47.07 mm (1.8531 in)

  Installation height : 37.0 mm (1.457 in)

  Installation load : 166 - 188 N (16.9 - 19.2 kg, 37 - 42 lb)

  Height during valve open : 27.2 mm (1.071 in)

  Load with valve open : 373 - 421 N (38.0 - 42.9 kg, 84 - 95 lb)

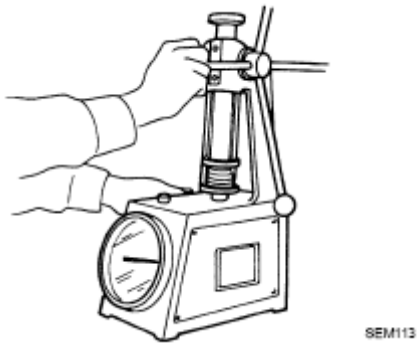
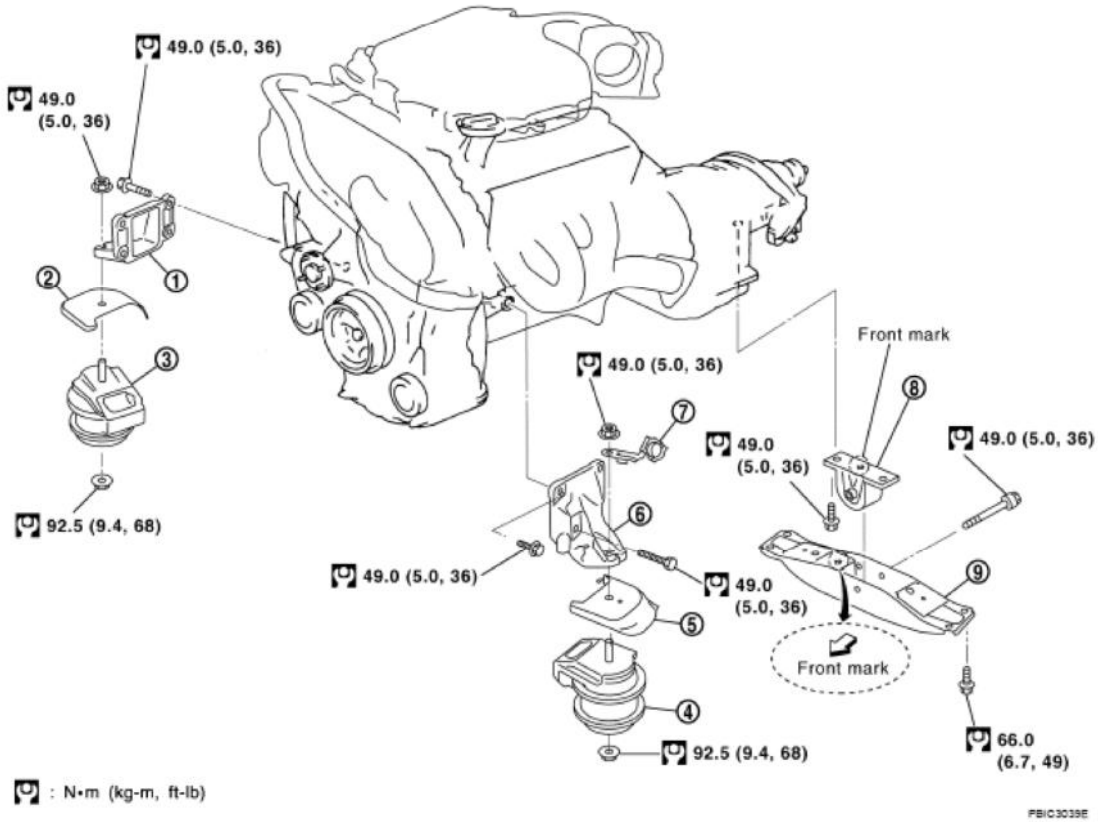


Fig. 245: Checking Valve Spring Dimensions And Valve Spring Pressure Load
Courtesy of NISSAN MOTOR CO., U.S.A.

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

ENGINE ASSEMBLY

COMPONENTS (2WD MODELS)



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. Harness bracket
8. Engine mounting insulator (rear)
9. Rear engine mounting member

Fig. 246: Identifying Engine Assembly Components With Torque Specifications (2WD Models)
Courtesy of NISSAN MOTOR CO., U.S.A.

REMOVAL AND INSTALLATION (2WD MODELS)

WARNING:

- **Situate the vehicle on a flat and solid surface.**
- **Place chocks at front and back of rear wheels.**
- **For engines not equipped with engine slingers, attach proper slingers and bolts described in PARTS CATALOG .**

CAUTION:

- **Always be careful to work safely, avoid forceful or uninstructed operations.**

- **Do not start working until exhaust system and engine coolant are cool enough.**
- **If items or work required are not covered by the engine article, refer to the applicable 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 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 ".**

REMOVAL

Outline

At first, remove the engine and the transmission assembly with front suspension member downward. Then separate the engine from transmission.

Preparation

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

CAUTION:
- **Perform this step when engine is cold.**
- **Do not spill engine coolant on drive belts.**

3. Disconnect both battery terminals. Refer to "**BATTERY** ".
4. Remove the following parts:
   - Engine cover; Refer to "**INTAKE MANIFOLD COLLECTOR**".
   - Front road wheel and tires
   - Front and rear engine undercover
   - Front cross bar; Refer to "**FRONT SUSPENSION MEMBER** ".
   - Cowl top cover (right); Refer to "**COWL TOP** ".
   - Air duct and air cleaner case assembly; "**AIR CLEANER AND AIR DUCT**".
5. Discharge refrigerant from A/C circuit. Refer to "**REFRIGERANT LINES** ".
6. Remove radiator hoses (upper and lower). Refer to "**RADIATOR** ".

Engine Room

1. Disconnect heater hose from vehicle-side, and fit a plug onto hose end to prevent engine coolant leak.
2. Disconnect grounding cable (between vehicle to left bank cylinder head).

3. Disconnect battery positive cable harness at vehicle side and temporarily fasten it on engine.
4. Disconnect A/C piping from A/C compressor, and temporarily fasten it on vehicle with a rope. Refer to "**REFRIGERANT LINES** ".
5. Disconnect engine room harness connectors shown in the figure.

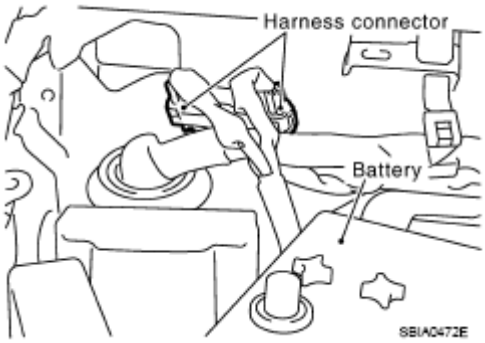


Fig. 247: Identifying Battery And Harness Connector
Courtesy of NISSAN MOTOR CO., U.S.A.

6. Disconnect two body ground cables.
7. Disconnect brake booster vacuum hose.
8. Disconnect fuel feed hose (with damper) and EVAP hose. Refer to "**FUEL INJECTOR AND FUEL TUBE**"

CAUTION: Fit plugs onto disconnected hoses to prevent fuel leak.

9. Remove reservoir tank of power steering oil pump and piping from vehicle, and temporarily secure them on engine. Refer to "**POWER STEERING OIL PUMP** ".

CAUTION: When temporarily securing, keep the reservoir tank upright to avoid a fluid leak.

Passenger Room Side

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.

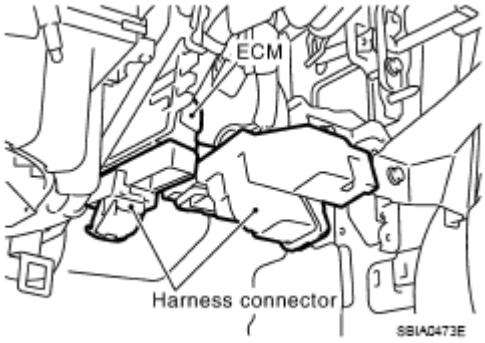


Fig. 248: Identifying Engine Room Harness Connectors (TCM And ECM)
Courtesy of NISSAN MOTOR CO., U.S.A.

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. Remove exhaust front tube and center muffler. Refer to "**EXHAUST SYSTEM** ".
3. Disconnect steering lower joint at power steering gear assembly side, and release steering lower shaft. Refer to "**STEERING COLUMN** ".
4. Remove tunnel stay. Refer to "**REAR SUSPENSION ASSEMBLY** ".
5. Remove rear propeller shaft. Refer to "**REAR PROPELLER SHAFT** ".
   - After disconnection, plug the opening on transmission assembly side.
6. Disengage A/T control rod at control device assembly side. Then, temporarily secure it on the transmission assembly, so that it does not sag. Refer to "**SHIFT CONTROL SYSTEM** ".
7. Remove rear plate from oil pan (upper). 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 (upper) lower rear side. Refer to "**TRANSMISSION ASSEMBLY** ".
9. Remove front stabilizer. Refer to "**STABILIZER BAR** ".
10. Separate steering outer sockets from steering knuckle. Refer to "**POWER STEERING GEAR AND LINKAGE** ".
11. Separate transverse links from suspension member and vehicle body. Refer to "**TRANSVERSE LINK** ".

Removal Work

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

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

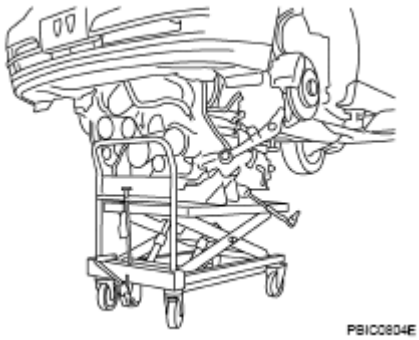


Fig. 249: Supporting Bottom Of Suspension And Transmission Assembly
Courtesy of NISSAN MOTOR CO., U.S.A.

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

CAUTION:
- **Confirm there is no interference with the vehicle.**
- **Make sure that all connection points have been disconnected.**
- **Keep in mind the center of vehicle gravity changes. If necessary, use jack(s) to support the vehicle at rear jacking point(s) to prevent it from falling it off the lift.**

Separation Work

1. Install engine slingers into front of cylinder head (right bank) and rear of cylinder head (left bank).

Slinger bolts:

: 28.0 N.m (2.9 kg-m, 21 ft-lb)

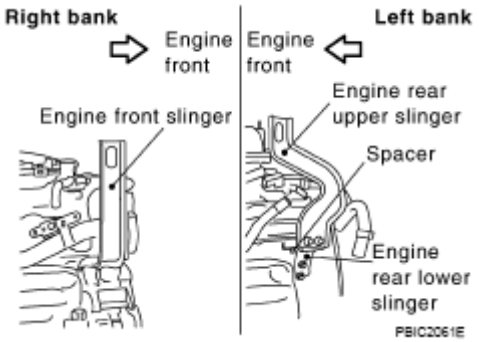


Fig. 250: Identifying Engine Slingers Into Front Of Cylinder Head (Right Bank) And Rear Cylinder Head (Left Bank)
Courtesy of NISSAN MOTOR CO., U.S.A.

- To protect rocker cover against damage caused by tilting of engine slinger, insert spacer between cylinder head and engine rear lower slinger, in direction shown in the figure.

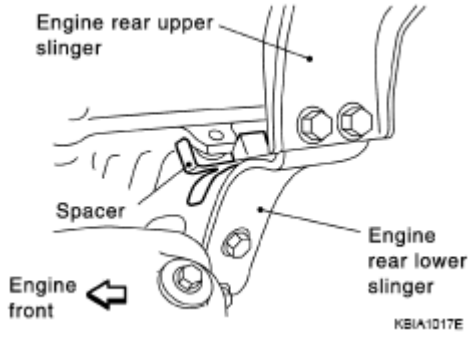


Fig. 251: Inserting Spacer Between Cylinder Head And Engine Rear Lower Slinger
Courtesy of NISSAN MOTOR CO., U.S.A.

NOTE: Spacer is a component part of engine rear upper slinger assembly.

2. Remove power steering oil pump from engine side. Refer to "**POWER STEERING OIL PUMP** ".
3. Remove engine mounting insulators (RH and LH) under side nuts with power tool.
4. Lift with hoist and separate the engine and the transmission assembly from front suspension member.

CAUTION:
- **Before and during this lifting, always make sure that any harnesses are left connected.**
- **Avoid damage to and oil/grease smearing or spills onto engine mounting insulator.**

5. Remove alternator. Refer to "**CHARGING SYSTEM** ".
6. Remove starter motor. Refer to "**STARTING SYSTEM** ".
7. Separate the engine from the transmission assembly. Refer to "**TRANSMISSION ASSEMBLY** ".

8. Remove each engine mounting insulator and each engine mounting bracket from the engine with power tool.
9. Remove rear engine mounting member and engine mounting insulator (rear) from the transmission assembly.

INSTALLATION

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

- Do not allow engine mounting insulator to be damage and careful no oil gets on it.
- For a location with a positioning pin, insert it securely into hole of mating part.
- For a part with a specified installation orientation, refer to component figure in "**COMPONENTS (2WD MODELS)**".
- When installing engine mounting bracket (RH and LH) on cylinder block, tighten two upper bolts (shown as "A" in the figure) first. Then tighten two lower bolts (shown as "B" in the figure).

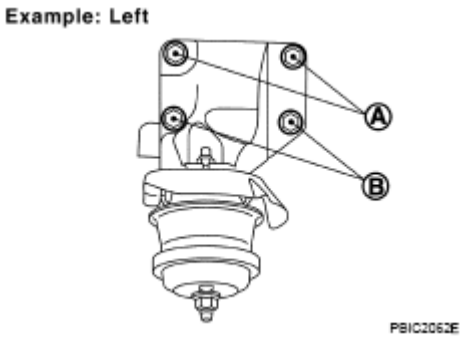


Fig. 252: Identifying Engine Mounting Brackets
Courtesy of NISSAN MOTOR CO., U.S.A.

- Make sure all engine mounting insulators are seated properly, then tighten mounting nuts.
- Tighten rear engine mounting member bolts in numerical order as shown in the figure.

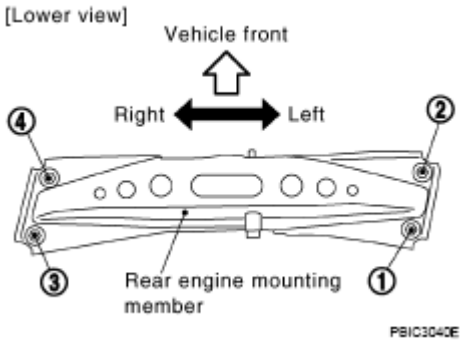


Fig. 253: Identifying Rear Engine Mounting Member Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

INSPECTION AFTER INSTALLATION

Inspection for Leaks

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

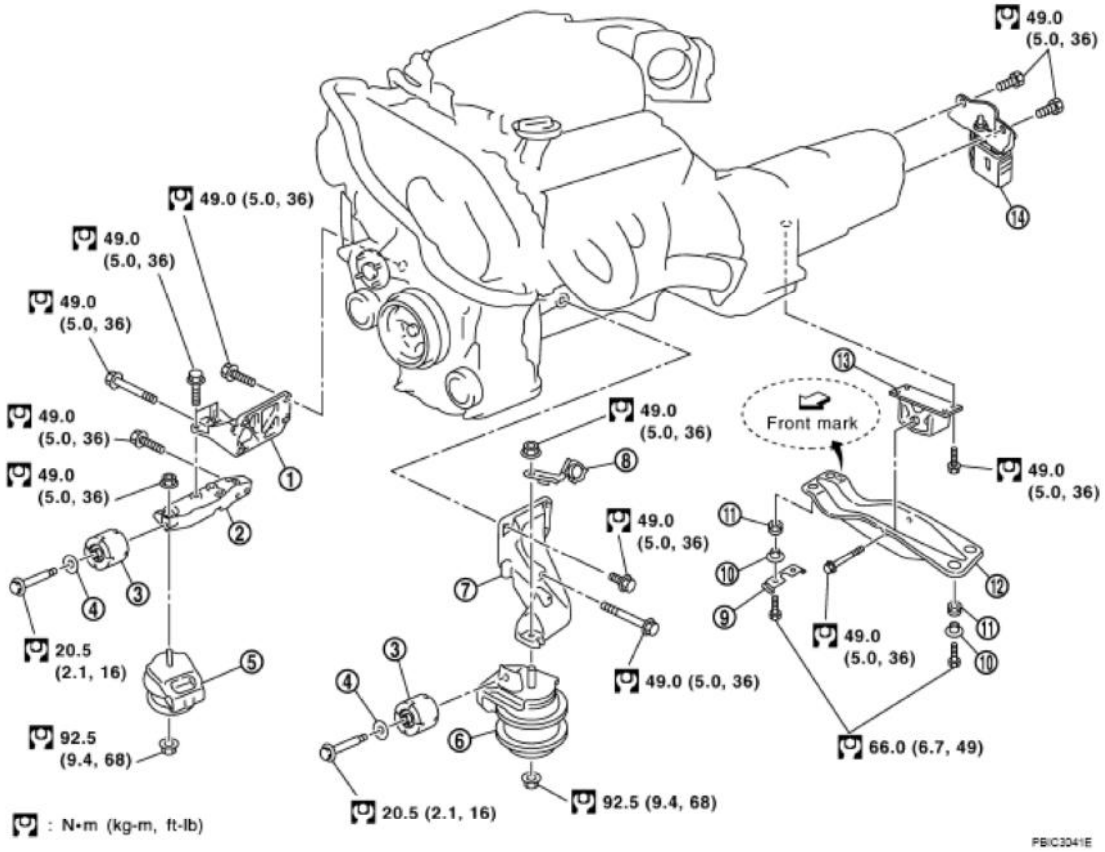
- Before starting engine, check oil/fluid levels including engine coolant and engine oil. If less than required quantity, fill to the specified level. Refer to "**RECOMMENDED FLUIDS AND LUBRICANTS** ".
- Use procedure below to check for fuel leakage.
  - Turn ignition switch "ON" (with engine stopped). 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 make sure 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 INSPECTION ITEMS

Item	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.

COMPONENTS (AWD MODELS)



1. Engine mounting bracket (RH)	2. Engine mounting bracket (RH) (Lower)	3. Dynamic damper
4. Washer	5. Engine mounting insulator (RH)	6. Engine mounting insulator (LH)
7. Engine mounting bracket (LH)	8. Harness bracket	9. Heat insulator
10. Caller	11. Rubber bush	12. Rear engine mounting member
13. Engine mounting insulator (rear)	14. Dynamic damper	

Fig. 254: Identifying Engine Assembly Components With Torque Specifications (AWD Models)
Courtesy of NISSAN MOTOR CO., U.S.A.

REMOVAL AND INSTALLATION (AWD MODELS)

WARNING:

- **Situate the vehicle on a flat and solid surface.**
- **Place chocks at front and back of rear wheels.**
- **For engines not equipped with engine slingers, attach proper slingers and bolts described in PARTS CATALOG.**

CAUTION:

- **Always be careful to work safely, avoid forceful or uninstructed operations.**
- **Do not start working until exhaust system and engine coolant are cool enough.**
- **If items or work required are not covered by the engine article, refer to the applicable 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 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 ".**

REMOVAL

Outline

At first, remove the engine, the transmission assembly, the transfer assembly and the front final drive assembly with front suspension member downward. Then separate the engine, the transmission assembly, the transfer and the front final drive assembly.

Preparation

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

CAUTION:
- **Perform this step when engine is cold.**
- **Do not spill engine coolant on drive belts.**

3. Disconnect both battery terminals. Refer to "**BATTERY** ".
4. Remove the following parts:
   - Engine cover; Refer to "**INTAKE MANIFOLD COLLECTOR**".
   - Front road wheel and tires
   - Front and rear engine undercover
   - Front cross bar; Refer to "**FRONT SUSPENSION MEMBER** ".
   - Cowl top cover (right); Refer to "**COWL TOP** ".
   - Air duct and air cleaner case assembly; "**AIR CLEANER AND AIR DUCT**".
5. Discharge refrigerant from A/C circuit. Refer to "**REFRIGERANT LINES** ".
6. Remove radiator hoses (upper and lower). Refer to "**RADIATOR** ".

Engine Room

1. Disconnect heater hose from vehicle-side, and fit a plug onto hose end to prevent engine coolant leak.
2. Disconnect grounding cable (between vehicle to left bank cylinder head).
3. Disconnect battery positive cable harness at vehicle side and temporarily fasten it on engine.
4. Disconnect A/C piping from A/C compressor, and temporarily fasten it on vehicle with a rope. Refer to "**REFRIGERANT LINES** ".

5. Disconnect engine room harness connectors shown in the figure.

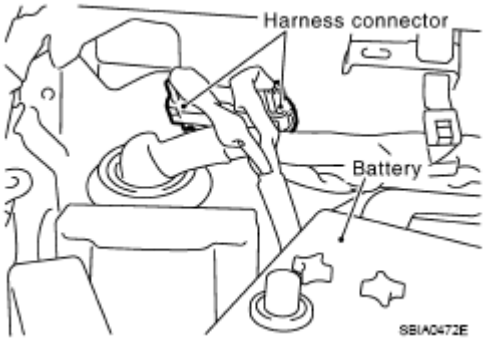


Fig. 255: Identifying Battery And Harness Connector
Courtesy of NISSAN MOTOR CO., U.S.A.

6. Disconnect two body ground cables.
7. Disconnect brake booster vacuum hose.
8. Disconnect fuel feed hose (with damper) and EVAP hose. Refer to "**FUEL INJECTOR AND FUEL TUBE**"

CAUTION: Fit plugs onto disconnected hoses to prevent fuel leak.

9. Remove reservoir tank of power steering oil pump and piping from vehicle, and temporarily secure them on engine. Refer to "**POWER STEERING OIL PUMP** ".

CAUTION: When temporarily securing, keep the reservoir tank upright to avoid a fluid leak.

Passenger Room Side

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.

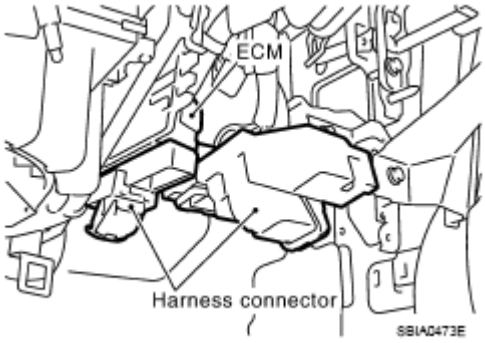


Fig. 256: Identifying Engine Room Harness Connectors (TCM And ECM)
Courtesy of NISSAN MOTOR CO., U.S.A.

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. Remove exhaust front tube and center muffler. Refer to "**EXHAUST SYSTEM** ".
3. Disconnect steering lower joint at power steering gear assembly side, and release steering lower shaft. Refer to "**STEERING COLUMN** ".
4. Remove tunnel stay. Refer to "**REAR SUSPENSION ASSEMBLY** ".
5. Remove rear propeller shaft. Refer to "**REAR PROPELLER SHAFT** ".
6. Remove front drive shaft (both side). Refer to "**FRONT DRIVE SHAFT** ".
7. Disconnect harness connector from transmission assembly and transfer assembly.
8. Disengage A/T control rod at control device assembly side. Then, temporarily secure it on the transmission assembly, so that it does not sag. Refer to "**SHIFT CONTROL SYSTEM** ".
9. Remove rear plate from oil pan (upper). Then remove bolts fixing drive plate to torque converter. Refer to "**OIL PAN AND OIL STRAINER**" and "**TRANSMISSION ASSEMBLY** ".
10. Remove bolts fixing the transmission assembly to lower rear side of oil pan (upper). Refer to "**TRANSMISSION ASSEMBLY** ".
11. Remove front stabilizer. Refer to "**STABILIZER BAR** ".
12. Separate steering outer sockets from steering knuckle. Refer to "**POWER STEERING GEAR AND LINKAGE** ".
13. Separate transverse links from suspension member and vehicle body. Refer to "**TRANSVERSE LINK** ".

Removal Work

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

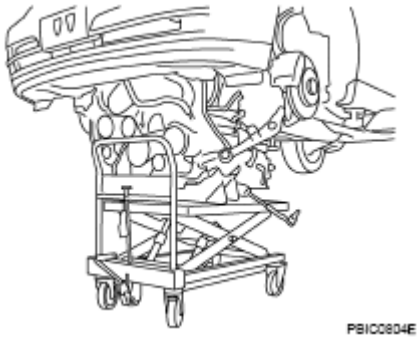


Fig. 257: Supporting Bottom Of Suspension And Transmission Assembly
Courtesy of NISSAN MOTOR CO., U.S.A.

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

2. Remove rear engine mounting member bolts.
3. Remove front suspension member mounting nuts. Refer to "**FRONT SUSPENSION ASSEMBLY** ".
4. Carefully lower jack, or raise lift to remove the engine, transmission assembly, transfer, front final drive assembly and front suspension member. When performing work, observe the following caution:

CAUTION:
- **Confirm there is no interference with the vehicle.**
- **Make sure that all connection points have been disconnected.**
- **Keep in mind the center of the vehicle gravity changes. If necessary, use jack(s) to support the vehicle at rear jacking point(s) to prevent it from falling it off the lift.**

Separation Work

1. Install engine slingers into front of cylinder head (right bank) and rear of cylinder head (left bank).

Slinger bolts:

: 28.0 N.m (2.9 kg-m, 21 ft-lb)

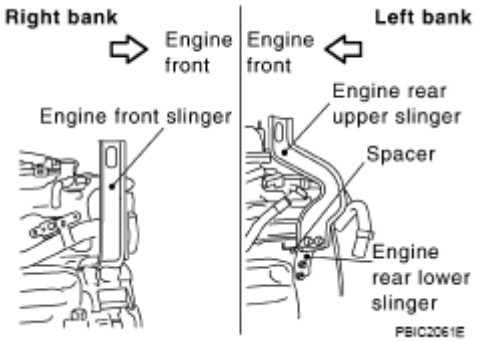


Fig. 258: Identifying Engine Slingers Into Front Of Cylinder Head (Right Bank) And Rear Cylinder Head (Left Bank)
Courtesy of NISSAN MOTOR CO., U.S.A.

- To protect rocker cover against damage caused by tilting of engine slinger, insert spacer between cylinder head and engine rear lower slinger, in direction shown in the figure.

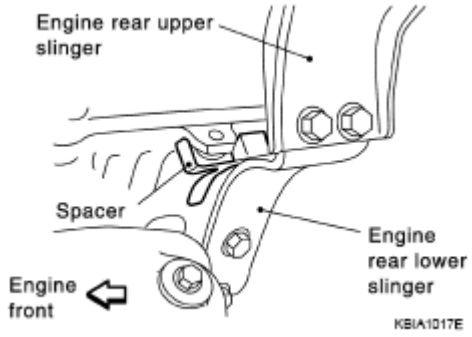


Fig. 259: Identifying Spacer Between Cylinder Head And Engine Rear Lower Slinger
Courtesy of NISSAN MOTOR CO., U.S.A.

NOTE: Spacer is a component part of engine rear upper slinger assembly.

2. Remove power steering oil pump from engine side. Refer to "**POWER STEERING OIL PUMP** ".
3. Remove engine mounting insulators (RH and LH) under side nuts with power tool.
4. Lift with hoist and separate the engine, the transmission assembly, the transfer assembly and the front final drive assembly from front suspension member.

CAUTION:
- **Before and during this lifting, always check if any harnesses are left connected.**
- **Avoid damage to and oil/grease smearing or spills onto engine mounting insulator.**

5. Remove alternator. Refer to "**CHARGING SYSTEM** ".
6. Remove starter motor. Refer to "**STARTING SYSTEM** ".

7. Remove front propeller shaft from the front final drive assembly side. Refer to "**FRONT PROPELLER SHAFT** ".
8. Separate the engine from the transmission assembly. Refer to "**TRANSMISSION ASSEMBLY** ".
9. Remove the front final drive assembly from oil pan (upper). Refer to "**FRONT FINAL DRIVE ASSEMBLY** ".
10. Remove each engine mounting insulator and each engine mounting bracket from the engine with power tool.
11. Remove rear engine mounting member and engine mounting insulator (rear) from the transmission assembly.
12. Remove dynamic damper from the transfer assembly.

INSTALLATION

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

- Do not allow engine mounting insulator to be damage and careful no engine oil gets on it.
- For a location with a positioning pin, insert it securely into hole of mating part.
- For a part with a specified installation orientation, refer to component figure in "**COMPONENTS (AWD MODELS)**".
- When installing engine mounting bracket (RH and LH) on cylinder block, tighten two upper bolts (shown as "A" in the figure) first. Then tighten two lower bolts (shown as "B" in the figure).
- Install engine mounting bracket (RH) (lower) as follows:
  - Temporarily tighten mounting bolts (shown as "C", "D" and "E" in the figure).

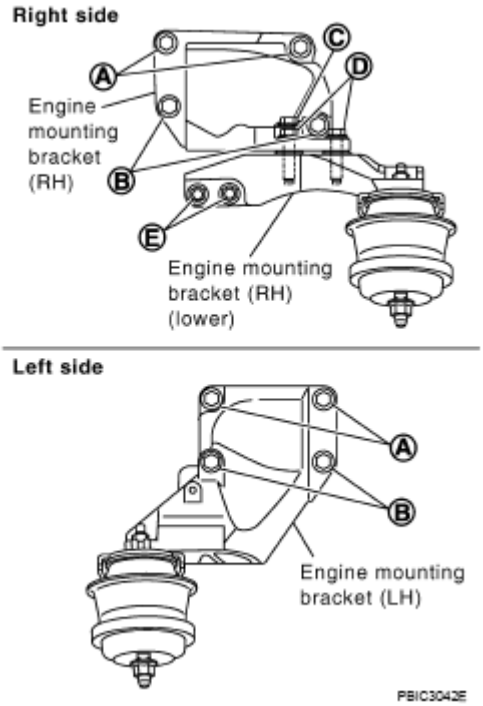


Fig. 260: Identifying Engine Mounting Bracket
Courtesy of NISSAN MOTOR CO., U.S.A.

  - Tighten mounting bolts to the specified torque with following mounting surfaces touched.
  - Engine mounting bracket (RH) to engine mounting bracket (RH) (lower) (shown as "C" and "D" in figure).
  - Front final drive to engine mounting bracket (RH) (lower) (shown as "E" in figure).
- Make sure all engine mounting insulators are seated properly, then tighten mounting nuts.

INSPECTION AFTER INSTALLATION

Inspection for Leaks

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

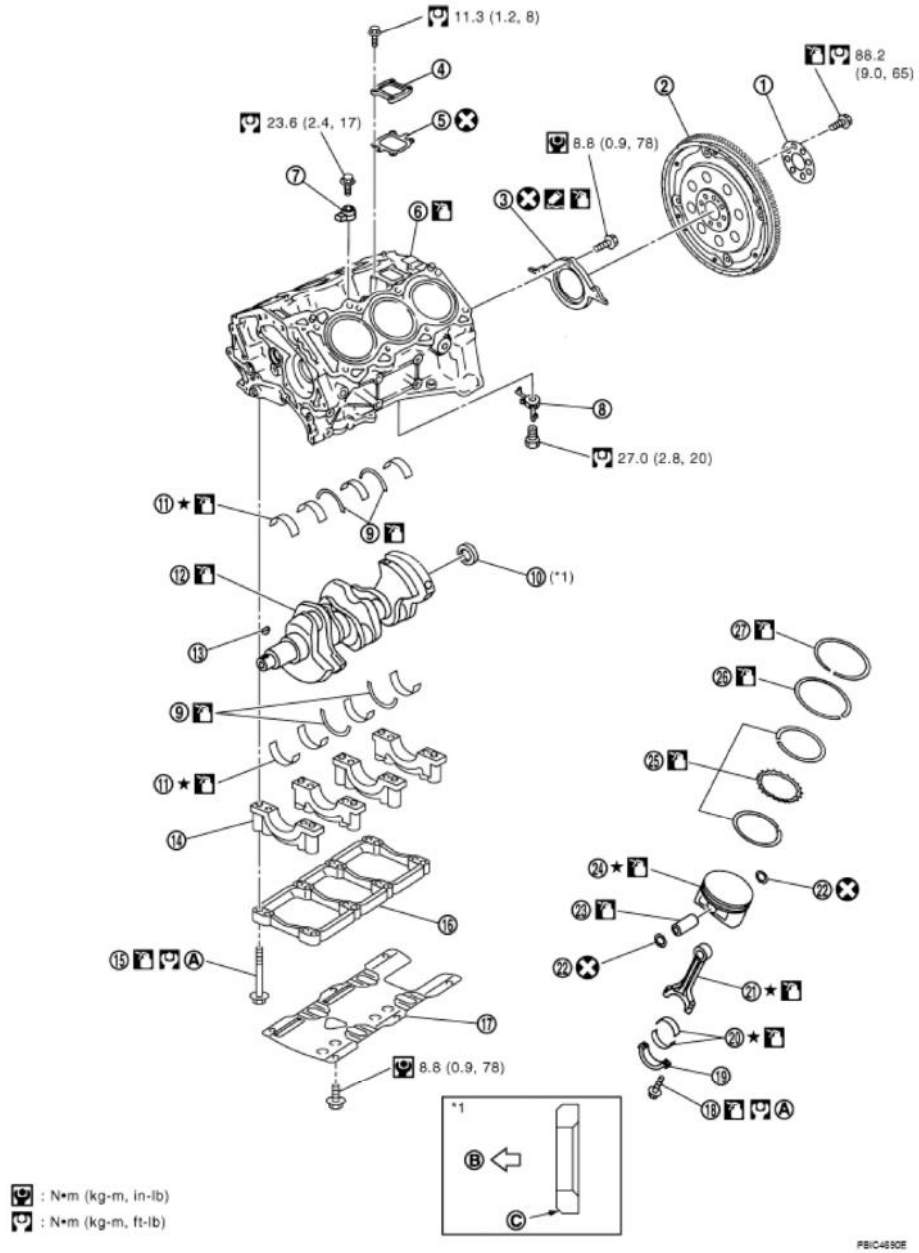
- Before starting engine, check oil/fluid levels including engine coolant and engine oil. If less than required quantity, fill to the specified level. Refer to "**RECOMMENDED FLUIDS AND LUBRICANTS** ".
- Use procedure below to check for fuel leakage.
  - Turn ignition switch "ON" (with engine stopped). 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 make sure 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 INSPECTION ITEMS

Item	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

COMPONENTS



1. Reinforcement plate	2. Drive plate	3. Rear oil seal retainer
4. Cover	5. Gasket	6. Cylinder block
7. Knock sensor	8. Oil jet	9. Thrust bearing
10. Pilot converter	11. Main bearing	12. Crankshaft
13. Crankshaft key	14. Main bearing cap	15. Main bearing cap bolt
16. Main bearing beam	17. Baffle plate (2WD models)	18. Connecting rod bolt
19. Connecting rod bearing cap	20. Connecting rod bearing	21. Connecting rod
22. Snap ring	23. Piston pin	24. Piston
25. Oil ring	26. Second ring	27. Top ring
A. Refer to Assembly in Cylinder Block	B. Crankshaft side	C. Chamfered

Fig. 261: Identifying Cylinder Block Components With Torque Specifications (1 Of 2)
Courtesy of NISSAN MOTOR CO., U.S.A.

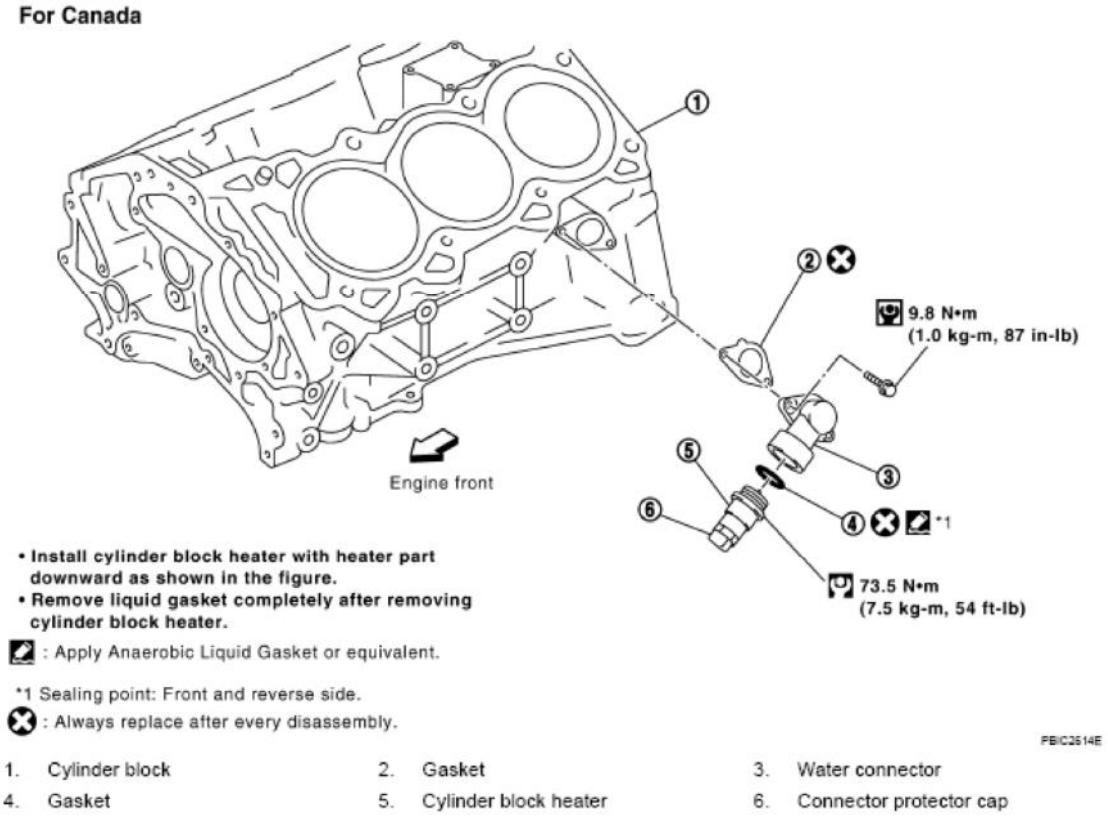


Fig. 262: Identifying Cylinder Block Components With Torque Specifications (2 Of 2)
Courtesy of NISSAN MOTOR CO., U.S.A.

DISASSEMBLY AND ASSEMBLY

DISASSEMBLY

1. Remove the engine assembly from the vehicle, and separate transmission assembly, transfer assembly (AWD models), front final drive assembly (AWD models) and front suspension member from the engine. Refer to "**ENGINE ASSEMBLY**".
2. Remove exhaust manifold. Refer to "**EXHAUST MANIFOLD AND THREE WAY CATALYST**".
3. Install engine sub-attachment with engine stand shaft (SST) to right side of cylinder block.
    - Use a spacer to the engine rear side.

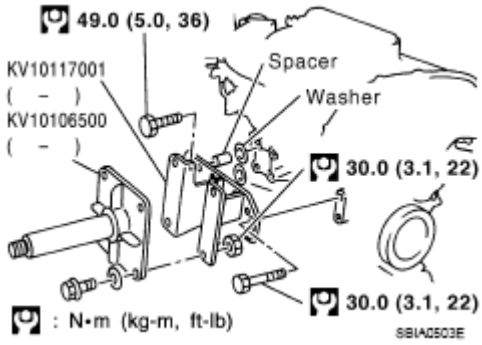


Fig. 263: Identifying Sub-Attachment With Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

4. Lift the engine, and mount it onto engine stand (SST).

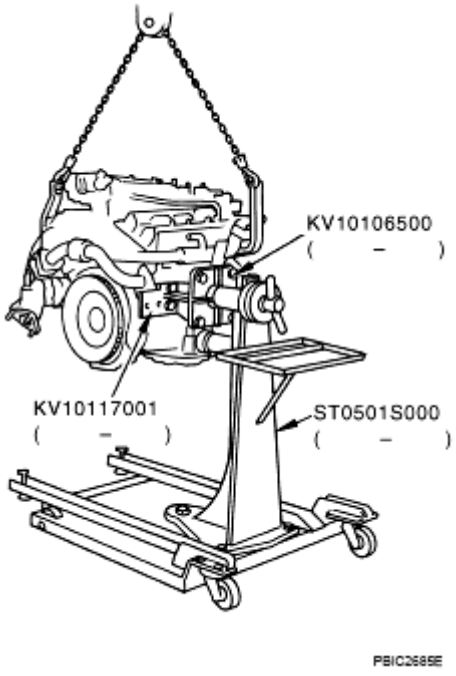


Fig. 264: Lifting Engine
Courtesy of NISSAN MOTOR CO., U.S.A.

- A widely use engine stand can be used.

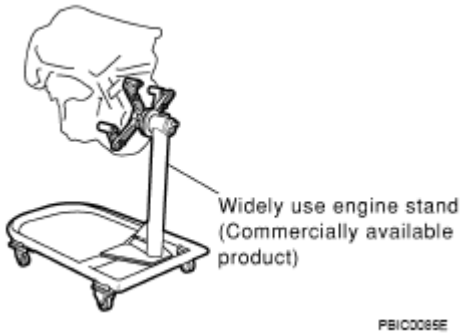


Fig. 265: Identifying Engine Stand
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: Use an engine stand that has a load capacity [approximately 220 kg (485 lb) or more] large enough for supporting the engine weight.

NOTE: This example is an engine stand for holding at transmission mounting side with drive plate removed.

5. Drain engine oil. Refer to "**CHANGING ENGINE OIL** ".
6. Drain engine coolant by removing water drain plugs from cylinder block both sides at "B" and "C" and cylinder block front side at "A" as shown in the figure.

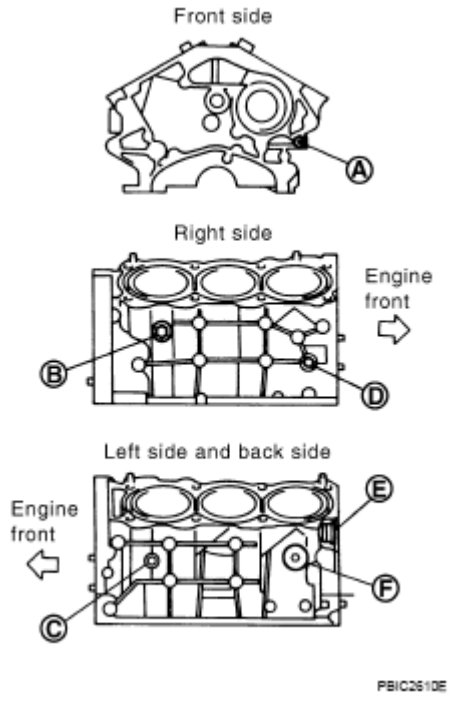


Fig. 266: Identifying Cylinder Block Plug
Courtesy of NISSAN MOTOR CO., U.S.A.

7. Remove drive plate with power tool. Fix crankshaft with a ring gear stopper [SST: KV1011770 (J44716)], and remove mounting bolts.
   - Loosen mounting bolts in diagonal order.

CAUTION:
- **Do not 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.**

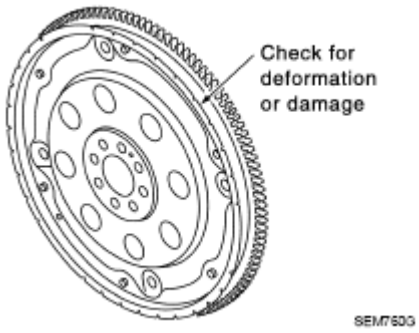


Fig. 267: Checking Drive Plate And Signal Plate For Deformation Or Cracks
Courtesy of NISSAN MOTOR CO., U.S.A.

8. Remove the following parts:
   - Intake manifold collector: Refer to "**INTAKE MANIFOLD COLLECTOR**".
   - Intake manifold: Refer to "**INTAKE MANIFOLD**".
   - Oil pans (lower and upper): Refer to "**OIL PAN AND OIL STRAINER**".
   - Front and rear timing chain case: Refer to "**TIMING CHAIN**".
   - Cylinder head: Refer to "**CYLINDER HEAD**".
9. Remove knock sensor.

CAUTION: Carefully handle sensor avoiding shocks.

10. Remove pilot converter using the pilot bushing puller (SST) as necessary.

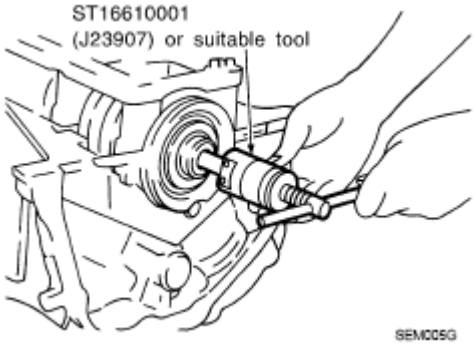


Fig. 268: Identifying Pilot Bushing
Courtesy of NISSAN MOTOR CO., U.S.A.

11. Remove rear oil seal retainer.
    - Remove by inserting a screwdriver between main bearing cap and rear oil seal retainer.

CAUTION: If rear oil seal retainer is removed, replace it with new one.

NOTE: Regard both rear oil seal and retainer as an assembly.

12. Remove baffle plate from main bearing beam (2WD models).
13. Remove piston and connecting rod assembly with the following procedure:
    - Before removing piston and connecting rod assembly, check the connecting rod side clearance. Refer to "**CONNECTING ROD SIDE CLEARANCE**".

CAUTION: Be careful not to drop connecting rod bearing, and to scratch the surface.

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

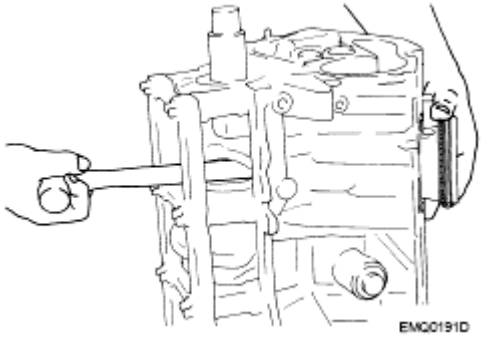


Fig. 269: Pushing Piston And Connecting Rod Assembly Out To Cylinder Head Side
Courtesy of NISSAN MOTOR CO., U.S.A.

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

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

CAUTION:
- **Be careful not to drop connecting rod bearing, and to scratch the surface.**
- **Identify installation positions, and store them without mixing them up.**

15. Remove piston rings form piston.
    - Before removing piston rings, check the piston ring side clearance. Refer to "**PISTON RING SIDE CLEARANCE**".
    - Use a piston ring expander (commercial service tool).

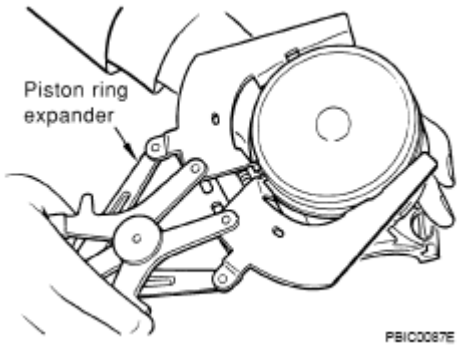


Fig. 270: Identifying Piston Ring Expander
Courtesy of NISSAN MOTOR CO., U.S.A.

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

excessively.

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

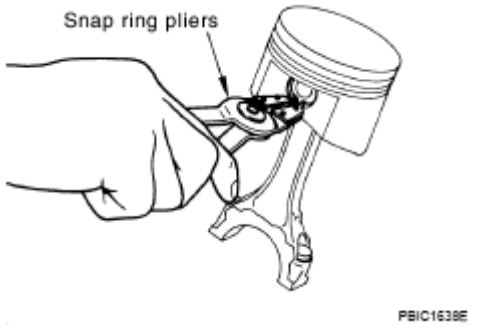


Fig. 271: Identifying Snap Ring Pliers
Courtesy of NISSAN MOTOR CO., U.S.A.

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

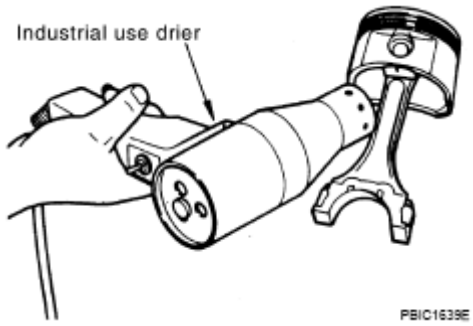


Fig. 272: Applying Heat To Piston
Courtesy of NISSAN MOTOR CO., U.S.A.

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

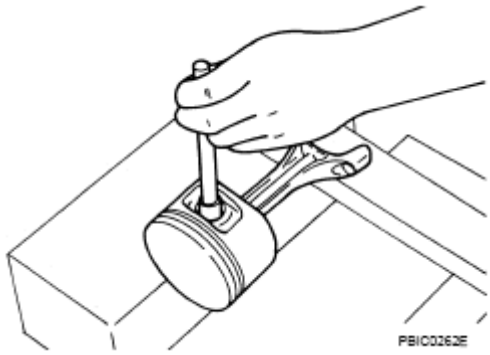


Fig. 273: Pushing Out Piston Pin

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

17. Remove main bearing cap bolts.

NOTE: Use TORX socket (size E14).

- **Before loosening main bearing cap bolts, measure the crankshaft end play. Refer to "CRANKSHAFT END PLAY".**
- **Loosen main bearing cap bolts in the reverse order shown in the figure in several different steps.**

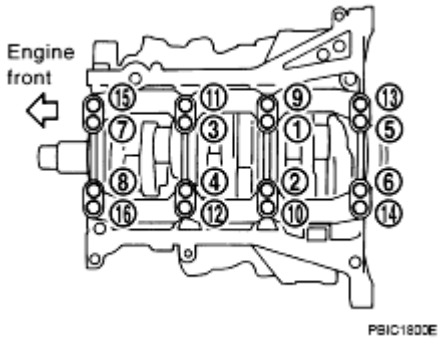


Fig. 274: Identifying Main Bearing Cap Bolts In Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

18. Remove main bearing beam.

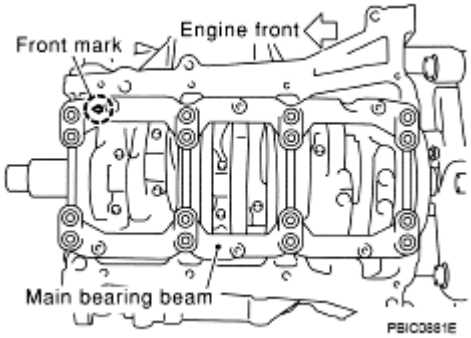


Fig. 275: Identifying Main Bearing Beam
Courtesy of NISSAN MOTOR CO., U.S.A.

19. Remove main bearing caps.

CAUTION: Be careful not to drop main bearing, and to scratch the surface.

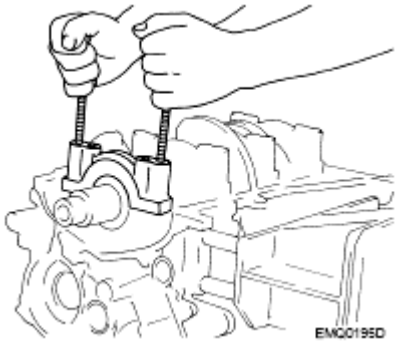


Fig. 276: Identifying Main Bearing Cap
Courtesy of NISSAN MOTOR CO., U.S.A.

- Using main bearing cap bolts, remove main bearing cap while shaking it back-and-forth.

20. Remove crankshaft.
21. Remove main bearings and thrust bearings from cylinder block and main bearing caps.

CAUTION:
- **Be careful not to drop main bearing, and to scratch the surface.**
- **Identify installation positions, and store them without mixing them up.**

22. Remove oil jet.

ASSEMBLY

1. Fully air-blow engine coolant and engine oil passages in cylinder block, cylinder bore and crankcase to remove any foreign material.

CAUTION: Use a goggles to protect your eye.

2. Install each plug to cylinder block as shown in the figure.

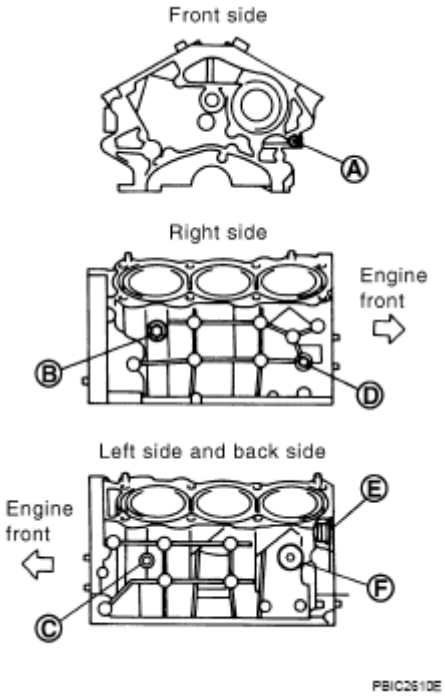


Fig. 277: Identifying Cylinder Block Plug
Courtesy of NISSAN MOTOR CO., U.S.A.

- Apply sealant to the thread of water drain plugs "A", "B" and "C".

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

- Apply sealant to the thread of plugs "D" and "E".

  Use Genuine High Strength Thread Locking Sealant or equivalent. Refer to "**RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS** ".

- Apply sealant to the thread of plug "F".

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

  NOTE: For Canada, "F" in the figure is not plug but block heater. Refer to "COMPONENTS".

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

TIGHTENING TORQUE SPECIFICATION

Part	Washer	Tightening torque

A	No	9.8 N.m (1.0 kg-m, 87 in-lb)
B	No	19.6 N.m (2.0 kg-m, 14 ft-lb)
C	No	19.6 N.m (2.0 kg-m, 14 ft-lb)
D	Yes	12.3 N.m (1.3 kg-m, 9 ft-lb)
E	Yes	62 N.m (6.3 kg-m, 46 ft-lb)
F	Yes	62 N.m (6.3 kg-m, 46 ft-lb)

3. Install oil jet.
   - Insert oil jet dowel pin into cylinder block dowel pin hole, and tighten mounting bolts.

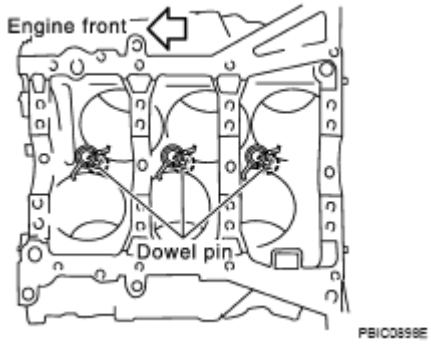


Fig. 278: Identifying Dowel Pin
Courtesy of NISSAN MOTOR CO., U.S.A.

4. Install main bearings and thrust bearings as follows:

CAUTION: Be careful not to drop main bearing, and to scratch the surface.

   a. Remove dust, dirt, and engine oil on 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 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.

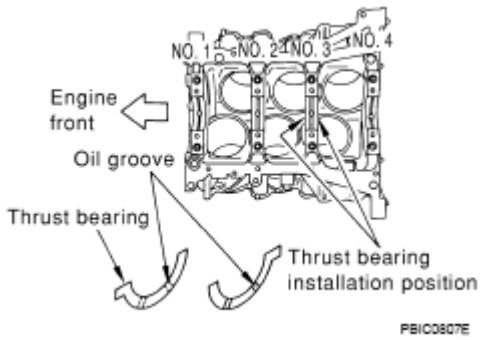


Fig. 279: Identifying Thrust Bearings Installation Position
Courtesy of NISSAN MOTOR CO., U.S.A.

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.

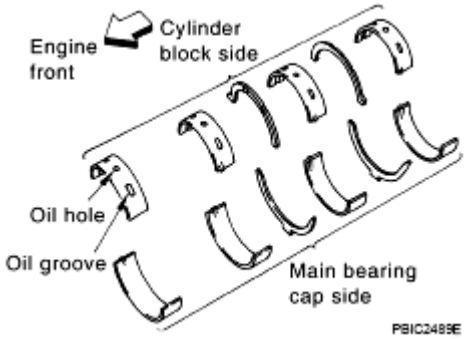


Fig. 280: Identifying Main Bearings
Courtesy of NISSAN MOTOR CO., U.S.A.

5. Install crankshaft to cylinder block.
   - While turning crankshaft by hand, check that it turns smoothly.
6. Install main bearing cap.
   - Main bearing caps are identified by identification mark cast on them. For installation, face front mark to front side.

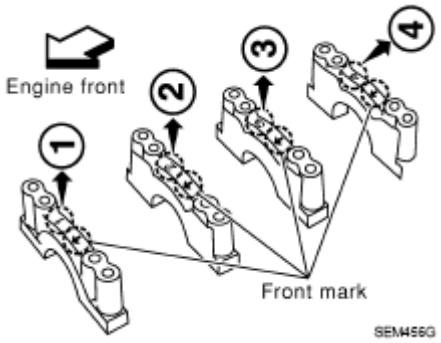


Fig. 281: Identifying Bearing Cap Identification Mark Cast
Courtesy of NISSAN MOTOR CO., U.S.A.

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

7. Install main bearing beam.
   - Install main bearing beam with front mark facing downward (oil pan side).
   - Install main bearing beam with front mark facing front of the engine.

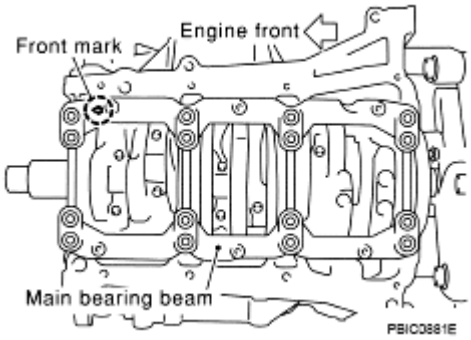


Fig. 282: Identifying Main Bearing Beam
Courtesy of NISSAN MOTOR CO., U.S.A.

8. Install main bearing cap bolts in numerical order as shown in the figure as follows:

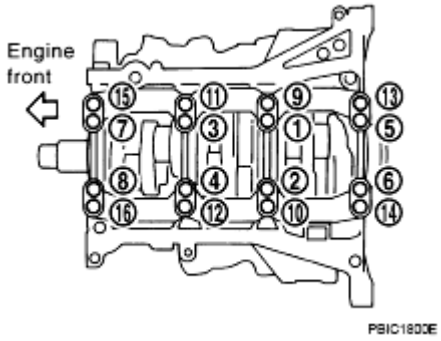


Fig. 283: Identifying Main Bearing Cap Bolts In Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

a. Inspect the outer diameter of main bearing cap bolt. Refer to "**MAIN BEARING CAP BOLT OUTER DIAMETER**".
b. Apply new engine oil to threads and seat surfaces of main bearing cap bolts.
c. Tighten main bearing cap bolts in several different steps.

: 35.3 N.m (3.6 kg-m, 26 ft-lb)

d. Turn all main bearing cap bolts 90 degrees clockwise (Angle tightening).

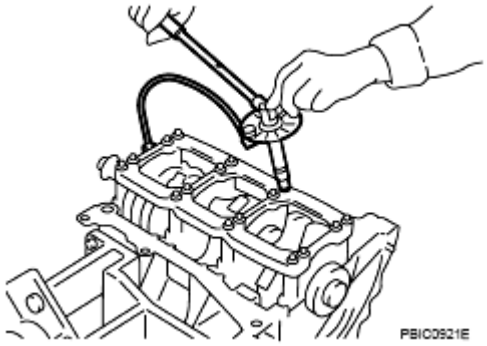


Fig. 284: Checking Tightening Angle
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: Use the angle wrench [SST: KV10112100 (BT8653-A)] to check tightening angle. Do not make judgment by visual inspection.

- After installing main bearing cap bolts, make sure that crankshaft can be rotated smoothly by hand.
- Check the crankshaft end play. Refer to "**CRANKSHAFT END PLAY**".

9. Install piston to connecting rod as follows:
   a. Using a snap ring pliers, install new snap ring to the groove of piston rear side.
      - Insert it fully into groove to install.
   b. Install piston to connecting rod.
      - Using an industrial use drier or similar tool, heat piston until piston pin can be pushed in by hand without excess force [approx. 60 to 70°C (140 to 158°F)]. From the front to the rear, insert piston pin into piston and connecting rod.
      - Assemble so that the front mark on the piston head and the cylinder number on connecting rod are positioned as shown in the figure.

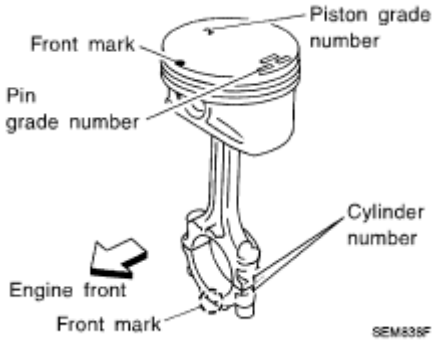


Fig. 285: Identifying Cylinder Number And Piston Grade Number
Courtesy of NISSAN MOTOR CO., U.S.A.

c. Install new snap ring to the groove of the piston front side.
- Insert it fully into groove to install.
- After installing, make sure that connecting rod moves smoothly.

10. Using a piston ring expander (commercial service tool), install piston rings.

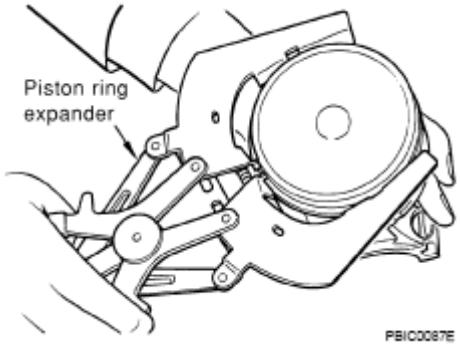


Fig. 286: Identifying Piston Ring Expander
Courtesy of NISSAN MOTOR CO., U.S.A.

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

- If there is stamped mark on ring, mount it with marked side up.

NOTE: **If there is no stamp on ring, no specific orientation is required for installation.**

Stamped mark:

Top ring : -

Second ring : "R"

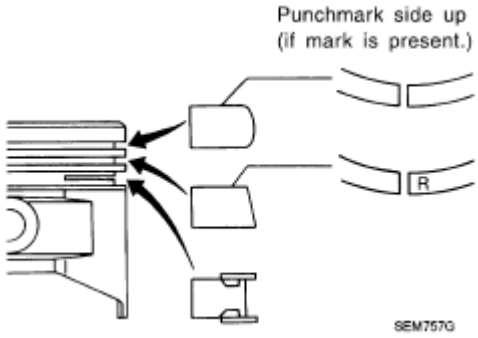


Fig. 287: Identifying Piston Rings Stamped Mark
Courtesy of NISSAN MOTOR CO., U.S.A.

- Position each ring with the gap as shown in the figure referring to the piston front mark.

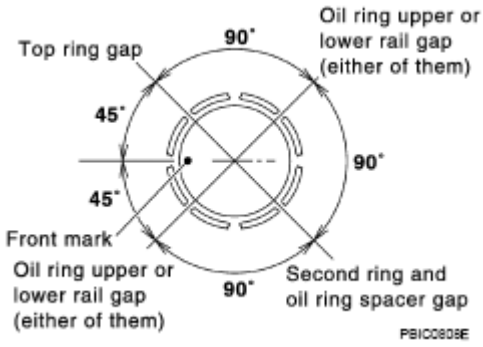


Fig. 288: Identifying Gap For Positioning Ring
Courtesy of NISSAN MOTOR CO., U.S.A.

- Check the piston ring side clearance. Refer to "**PISTON RING SIDE CLEARANCE**".

11. Install connecting rod bearings to connecting rod and connecting rod bearing cap.

CAUTION: Be careful not to drop connecting rod bearing, and to scratch the surface.

- Before installing connecting rod bearings, apply engine oil to the bearing surface (inside). Do not apply engine oil to the back surface, but thoroughly clean it.
- When installing, align connecting rod bearing stopper protrusion with cutout of connecting rods and connecting rod bearing caps to install.
- Ensure the oil hole on connecting rod and that on the corresponding bearing are aligned.

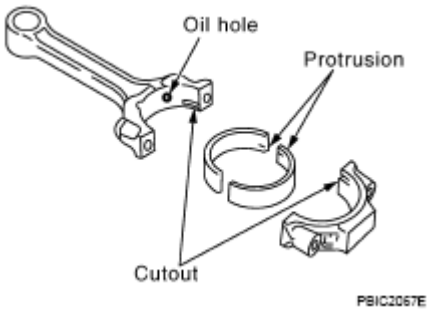


Fig. 289: Identifying Rod Bearing Stopper Protrusion And Rod Bearing Caps Cutout
Courtesy of NISSAN MOTOR CO., U.S.A.

12. Install piston and connecting rod assembly to crankshaft.
    - Position crankshaft pin corresponding to connecting rod to be installed onto the bottom dead center.
    - Apply engine oil sufficiently to the cylinder bore, piston and crankshaft pin journal.
    - Match the cylinder position with the cylinder number on connecting rod to install.
    - Be sure that front mark on piston crown is facing front of engine.
    - Using a piston ring compressor (SST) or suitable tool, install piston with the front mark on the piston crown facing the front of the engine.

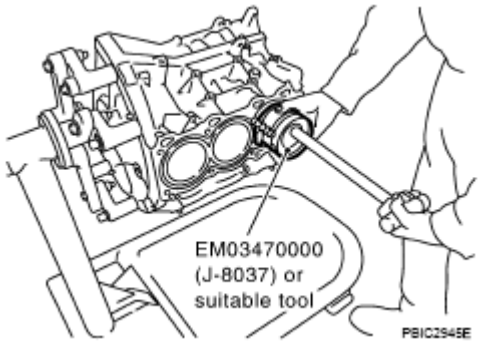


Fig. 290: Installing Piston And Connecting Rod Assembly To Crankshaft
Courtesy of NISSAN MOTOR CO., U.S.A.

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

13. Install connecting rod bearing cap.
    - Match the stamped cylinder number marks on connecting rod with those on connecting rod bearing cap to install.
    - Be sure that front mark on connecting rod bearing cap is facing front of the engine.

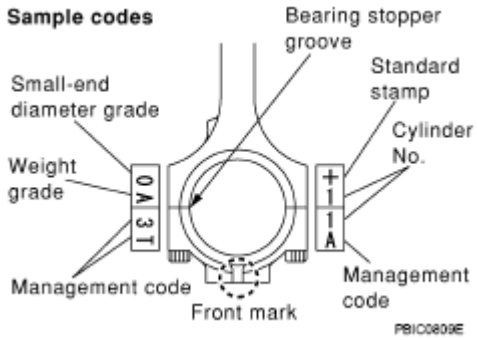


Fig. 291: Identifying Connecting Rod Sample Codes
Courtesy of NISSAN MOTOR CO., U.S.A.

14. Tighten connecting rod bolt as follows:
    a. Inspect the outer diameter of connecting rod bolt. Refer to "**CONNECTING ROD BOLT OUTER DIAMETER**".
    b. Apply engine oil to the threads and seats of connecting rod bolts.
    c. Tighten connecting rod bolts.

       : 19.6 N.m (2.0 kg-m, 14 ft-lb)

    d. Then tighten all connecting rod bolts 90 degrees clockwise (Angle tightening).

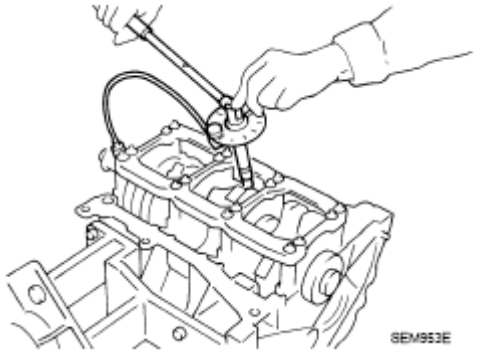


Fig. 292: Tightening Connecting Rod Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: Always use the angle wrench [SST: KV10112100 (BT8653-A)]. Avoid tightening based on visual check alone.

- After tightening connecting rod bolts, make sure that crankshaft rotates smoothly.
- Check the connecting rod side clearance. Refer to "**CONNECTING ROD SIDE CLEARANCE**".

15. Install baffle plate to main bearing beam (2WD models).
16. Install new rear oil seal retainer to cylinder block.
    - Apply new engine oil to both oil seal lip and dust seal lip.

- Apply a continuous bead of liquid gasket with the tube presser [SST: WS39930000 (-)] to rear oil seal retainer as shown in the figure.

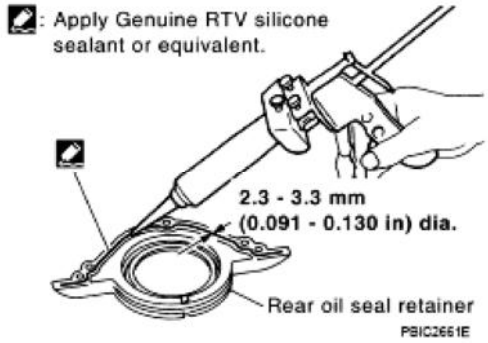


Fig. 293: Applying Continuous Bead Of Liquid Gasket To Rear Oil Seal Retainer
Courtesy of NISSAN MOTOR CO., U.S.A.

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

CAUTION:
- **Replace with a new parts.**
- **Attaching should be done within 5 minutes after coating.**
- **Make sure the garter spring is in position and seal lips not inverted.**

NOTE: Regard both rear oil seal and retainer as an assembly.

17. Install pilot converter.
    - With a drift [outer diameter: approx. 33 mm (1.30 in)], press-fit as far as it will go.

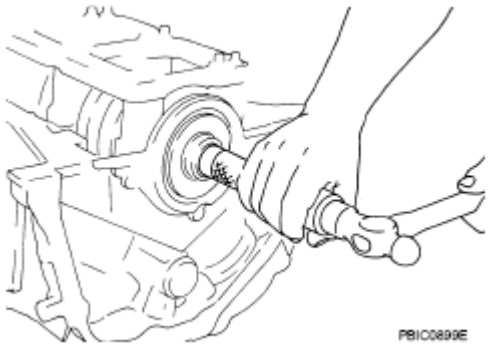


Fig. 294: Installing Pilot Bushing Or Pilot Converter
Courtesy of NISSAN MOTOR CO., U.S.A.

- Press-fit pilot converter with its chamfer facing crankshaft as shown in the figure.

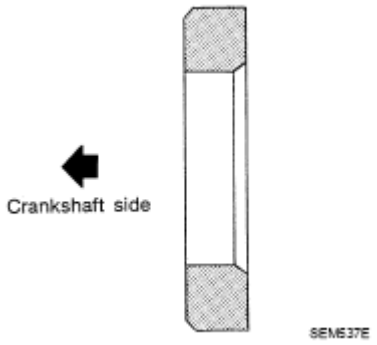


Fig. 295: Identifying Pilot Converter Chamfer Face
Courtesy of NISSAN MOTOR CO., U.S.A.

18. Install knock sensor.
    - Install knock sensor so that connector faces front of the engine.
    - After installing knock sensor, connect harness connector, and lay it out to rear of the engine.

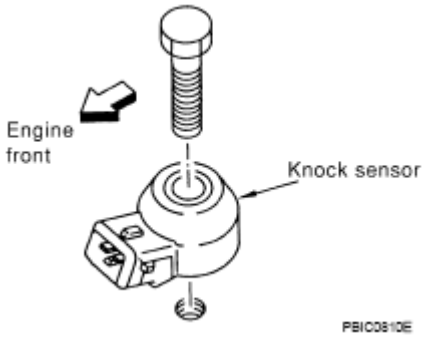


Fig. 296: Identifying Knock Sensor
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION:
- **Do not tighten mounting bolts while holding connector.**
- **If any impact by dropping is applied to knock sensor, replace it with new one.**

NOTE:
- **Make sure that there is no foreign material on the cylinder block mating surface and the back surface of knock sensor.**
- **Make sure that knock sensor does not interfere with other parts.**

19. Note the following, assemble in the reverse order of disassembly after this step.

    Drive plate

    - When installing drive plate to crankshaft, be sure to correctly align crankshaft side guide pin and drive plate side guide pin hole.

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

- Install drive plate and reinforcement plate as shown in the figure.

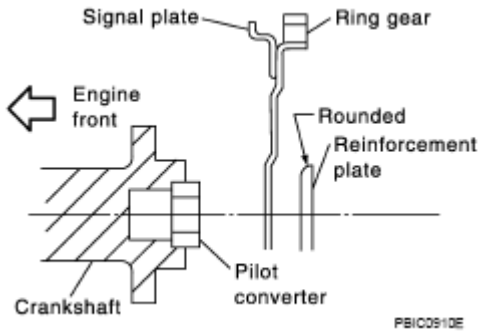


Fig. 297: Identifying Drive Plate And Reinforcement Plate
Courtesy of NISSAN MOTOR CO., U.S.A.

- Holding ring gear with the ring gear stopper [SST: KV10117700 (J44716)].
- Tighten the mounting bolts crosswise over several times.

CAUTION: Make sure that dowel pin is installed at the rear end of crankshaft.

HOW TO SELECT PISTON AND BEARING

DESCRIPTION

PISTON SELECTION CHART

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 grade (piston skirt diameter)	Piston grade = cylinder bore grade (inner diameter of bore)

	piston pin as assembly.)		
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 rear side of cylinder block, 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.)

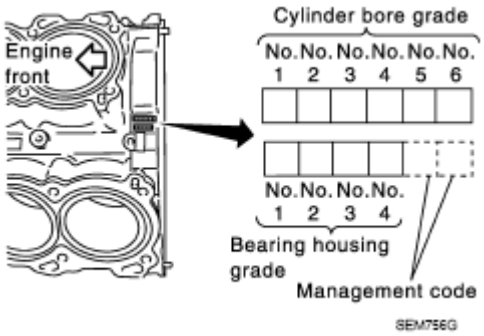


Fig. 298: Identifying Cylinder Bore Grade (1, 2 Or 3) On Rear Side Of Cylinder Block
Courtesy of NISSAN MOTOR CO., U.S.A.

When Cylinder Block is Reused

1. Measure the cylinder bore inner diameter. Refer to "**CYLINDER BORE INNER DIAMETER**".
2. Determine the bore grade by comparing the measurement with the values under the cylinder bore inner diameter of the "Piston Selection Table".

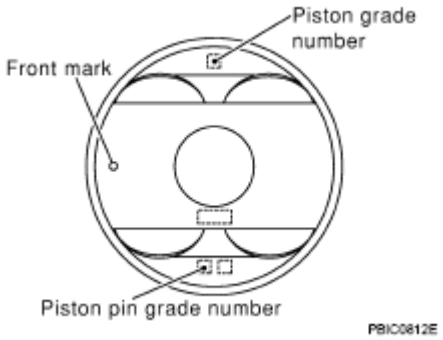


Fig. 299: Identifying Front Marks On Piston
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Select piston of the same grade.

Piston Selection Table

PISTON SELECTION CHART

			Unit: mm (in)
Grade	**1**	**2 (or no mark)**	**3**
Cylinder bore inner diameter	95.500 - 95.510 (3.7598 - 3.7602)	95.510 - 95.520 (3.7602 - 3.7606)	95.520 - 95.530 (3.7606 - 3.7610)
Piston skirt diameter	95.480 - 95.490 (3.7590 - 3.7594)	95.490 - 95.500 (3.7594 - 3.7598)	95.500 - 95.510 (3.7598 - 3.7602)

NOTE:

- **Piston is available together with piston pin as assembly.**
- **Piston pin (piston pin hole) grade is provided only for the parts installed at the plant. For service parts, no piston pin grades can be selected. (Only "0" grade is available.)**
- **No second grade mark is available on piston.**

HOW TO SELECT CONNECTING ROD BEARING

When New Connecting Rod and Crankshaft are Used

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.

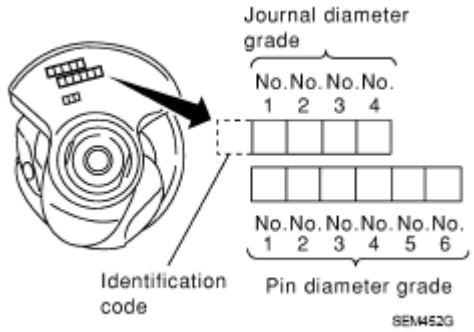


Fig. 300: Identifying Pin Diameter Grade
Courtesy of NISSAN MOTOR CO., U.S.A.

When Crankshaft and Connecting Rod are Reused

1. Measure the connecting rod big end diameter. Refer to "**CONNECTING ROD BIG END DIAMETER**".
2. Make sure that the connecting rod big end diameter is within the standard value.
3. Measure the crankshaft pin journal diameter. Refer to "**CRANKSHAFT PIN JOURNAL DIAMETER**".
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

PISTON SELECTION CHART

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

CONNECTING ROD BEARING SPECIFICATION

				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	Black
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

Undersize Bearings Usage Guide

- When the specified connecting rod bearing oil clearance is not obtained with standard size connecting rod

bearings, use undersize (US) bearings.

- When using undersize (US) bearing, measure the connecting rod bearing inner diameter with bearing installed, and grind crankshaft pin so that the connecting rod bearing oil clearance satisfies the standard.

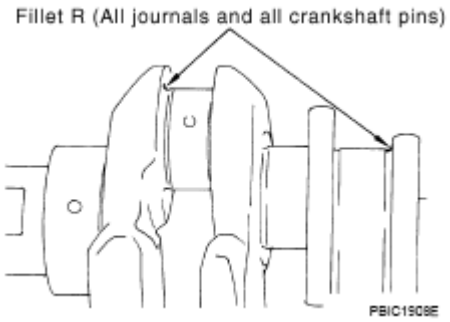


Fig. 301: Identifying Crankshaft Journals
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: In grinding crankshaft pin to use undersize bearings, keep the fillet R [1.5 - 1.7 mm (0.059 - 0.067 in)].

THICKNESS SPECIFICATION

	Unit: mm (in)
Size	**Thickness**
US 0.25 (0.0098)	1.626 - 1.634 (0.0640 - 0.0643)

HOW TO SELECT MAIN BEARING

When New Cylinder Block and Crankshaft are Used

1. "Main Bearing Selection Table" rows correspond to bearing housing grade on rear left side of cylinder block.

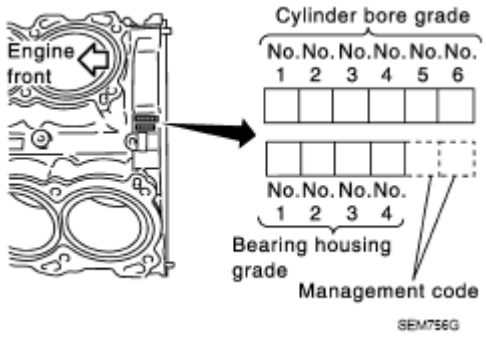


Fig. 302: Checking Cylinder Bore Grade (1, 2 Or 3) On Rear Side Of Cylinder Block
Courtesy of NISSAN MOTOR CO., U.S.A.

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

crankshaft.

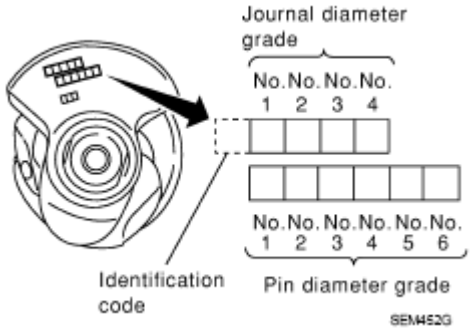


Fig. 303: Applying Journal Diameter Grade Stamped On Crankshaft Front Side To Column
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Select main bearing grade at the point where selected row and column meet in "**Main Bearing Selection Table**".

When Cylinder Block and Crankshaft are Reused

1. Measure cylinder block main bearing housing inner diameter and crankshaft main journal diameter. Refer to "**MAIN BEARING HOUSING INNER DIAMETER**" and "**CRANKSHAFT MAIN JOURNAL DIAMETER**".
2. Correspond the measured dimension in "Cylinder block main bearing housing inner diameter" row of "**Main Bearing Selection Table**".
3. Correspond the measured dimension in "Crankshaft main journal diameter" column of "**Main Bearing Selection Table**".
4. Select main bearing grade at the point where selected row and column meet in following selection table.

Main Bearing Selection Table

Cylinder block main bearing housing inner diameter Unit: mm (in) / Crankshaft main journal diameter Unit: mm (in)		Mark	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	V	W	X	Y	4	7
		Hole diameter	63.993 - 63.994 (2.5194 - 2.5194)	63.994 - 63.995 (2.5194 - 2.5195)	63.995 - 63.996 (2.5195 - 2.5195)	63.996 - 63.997 (2.5195 - 2.5196)	63.997 - 63.998 (2.5196 - 2.5196)	63.998 - 63.999 (2.5196 - 2.5196)	63.999 - 64.000 (2.5196 - 2.5197)	64.000 - 64.001 (2.5197 - 2.5197)	64.001 - 64.002 (2.5197 - 2.5198)	64.002 - 64.003 (2.5198 - 2.5198)	64.003 - 64.004 (2.5198 - 2.5198)	64.004 - 64.005 (2.5198 - 2.5199)	64.005 - 64.006 (2.5199 - 2.5199)	64.006 - 64.007 (2.5199 - 2.5200)	64.007 - 64.008 (2.5200 - 2.5200)	64.008 - 64.009 (2.5200 - 2.5200)	64.009 - 64.010 (2.5200 - 2.5201)	64.010 - 64.011 (2.5201 - 2.5201)	64.011 - 64.012 (2.5201 - 2.5202)	64.012 - 64.013 (2.5202 - 2.5202)	64.013 - 64.014 (2.5202 - 2.5202)	64.014 - 64.015 (2.5202 - 2.5203)	64.015 - 64.016 (2.5203 - 2.5203)	64.016 - 64.017 (2.5203 - 2.5203)
Mark	Axle diameter																									
A	59.975 - 59.974 (2.3612 - 2.3612)		0	0	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34
B	59.974 - 59.973 (2.3612 - 2.3611)		0	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4
C	59.973 - 59.972 (2.3611 - 2.3611)		0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4
D	59.972 - 59.971 (2.3611 - 2.3611)		01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4
E	59.971 - 59.970 (2.3611 - 2.3610)		01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45
F	59.970 - 59.969 (2.3610 - 2.3610)		01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45
G	59.969 - 59.968 (2.3610 - 2.3609)		1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45
H	59.968 - 59.967 (2.3609 - 2.3609)		1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5
J	59.967 - 59.966 (2.3609 - 2.3609)		1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5
K	59.966 - 59.965 (2.3909 - 2.3608)		12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5
L	59.965 - 59.964 (2.3608 - 2.3608)		12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56
M	59.964 - 59.963 (2.3608 - 2.3607)		12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56
N	59.963 - 59.962 (2.3607 - 2.3607)		2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56
P	59.962 - 59.961 (2.3607 - 2.3607)		2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6
R	59.961 - 59.960 (2.3607 - 2.3606)		2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6
S	59.960 - 59.959 (2.3606 - 2.3606)		23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6
T	59.959 - 59.958 (2.3606 - 2.3605)		23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67
U	59.958 - 59.957 (2.3605 - 2.3605)		23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67
V	59.957 - 59.956 (2.3605 - 2.3605)		3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67
W	59.956 - 59.955 (2.3605 - 2.3604)		3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7
X	59.955 - 59.954 (2.3604 - 2.3604)		3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7
Y	59.954 - 59.953 (2.3604 - 2.3603)		34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7
4	59.953 - 59.952 (2.3603 - 2.3603)		34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7	7
7	59.952 - 59.951 (2.3603 - 2.3603)		34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7	7	7

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Fig. 304: Identifying Main Bearing Selection Table
Courtesy of NISSAN MOTOR CO., U.S.A.

Main Bearing Grade Table (All Journals)

MAIN BEARING GRADE CHART (ALL JOURNALS)

Unit: mm (in)

Grade number	Thickness	Width	Identification color	Remarks
0	2.000 - 2.003 (0.0787 - 0.0789)		Black	
1	2.003 - 2.006 (0.0789 - 0.0790)		Brown	
2	2.006 - 2.009 (0.0790 - 0.0791)		Green	

3		2.009 - 2.012 (0.0791 - 0.0792)	19.9 - 20.1 (0.783 - 0.791)	Yellow	Grade and color are the same for upper and lower bearings.
4		2.012 - 2.015 (0.0792 - 0.0793)		Blue	
5		2.015 - 2.018 (0.0793 - 0.0794)		Pink	
6		2.018 - 2.021 (0.0794 - 0.0796)		Purple	
7		2.021 - 2.024 (0.0796 - 0.0797)		White	
01	UPR	2.003 - 2.006 (0.0789 - 0.0790)		Brown	Grade and color are different for upper and lower bearings.
	LWR	2.000 - 2.003 (0.0787 - 0.0789)		Black	
12	UPR	2.006 - 2.009 (0.0790 - 0.0791)		Green	
	LWR	2.003 - 2.006 (0.0789 - 0.0790)		Brown	
23	UPR	2.009 - 2.012 (0.0791 - 0.0792)		Yellow	
	LWR	2.006 - 2.009 (0.0790 - 0.0791)		Green	
34	UPR	2.012 - 2.015 (0.0792 - 0.0793)		Blue	
	LWR	2.009 - 2.012 (0.0791 - 0.0792)		Yellow	
45	UPR	2.015 - 2.018 (0.0793 - 0.0794)		Pink	
	LWR	2.012 - 2.015 (0.0792 - 0.0793)		Blue	
56	UPR	2.018 - 2.021 (0.0794 - 0.0796)		Purple	
	LWR	2.015 - 2.018 (0.0793 - 0.0794)		Pink	
67	UPR	2.021 - 2.024 (0.0796 - 0.0797)		White	
	LWR	2.018 - 2.021 (0.0794 - 0.0796)		Purple	

Undersize Bearing Usage Guide

- When the specified main bearing oil clearance is not obtained with standard size main bearings, use underside (US) bearing.
- When using undersize (US) bearing, measure the main bearing inner diameter with bearing installed, and grind main journal so that the main bearing oil clearance satisfies the standard.

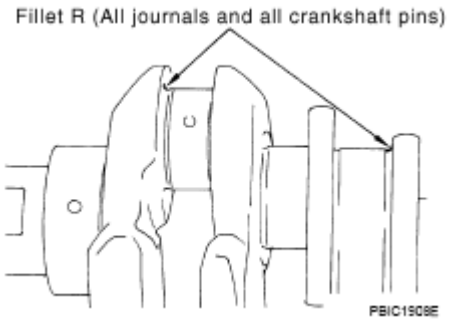


Fig. 305: Identifying Crankshaft Journals
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: In grinding crankshaft main journal to use undersize bearings, keep the fillet R [1.5 - 1.7 mm (0.059 - 0.067 in)].

Bearing undersize table

THICKNESS SPECIFICATION

	Unit: mm (in)
Size	**Thickness**
US 0.25 (0.0098)	2.132 - 2.140 (0.0839 - 0.0843)

INSPECTION AFTER DISASSEMBLY

CRANKSHAFT END PLAY

- Measure the clearance between thrust bearings and crankshaft arm when crankshaft is moved fully forward or backward with a dial indicator.

  Standard : 0.10 - 0.25 mm (0.0039 - 0.0098 in)

  Limit : 0.30 mm (0.0118 in)

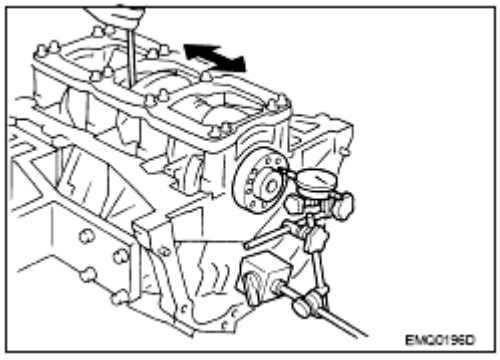


Fig. 306: Checking Crankshaft End Play

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

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

CONNECTING ROD SIDE CLEARANCE

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

  Standard : 0.20 - 0.35 mm (0.008 - 0.014 in)

  Limit : 0.40 mm (0.016 in)

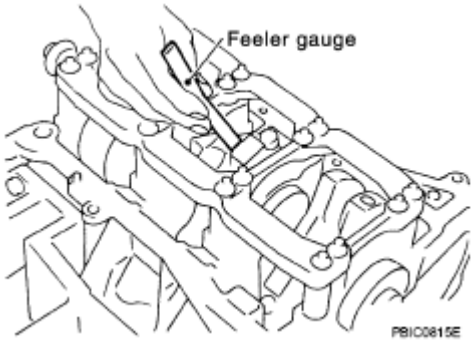


Fig. 307: Measuring Side Clearance Between Connecting Rod And Crankshaft Arm
Courtesy of NISSAN MOTOR CO., U.S.A.

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

PISTON TO PISTON PIN OIL CLEARANCE

Piston Pin Hole Diameter

Measure the inner diameter of piston pin hole with an inside micrometer.

Standard : 21.993 - 22.005 mm (0.8659 - 0.8663 in)

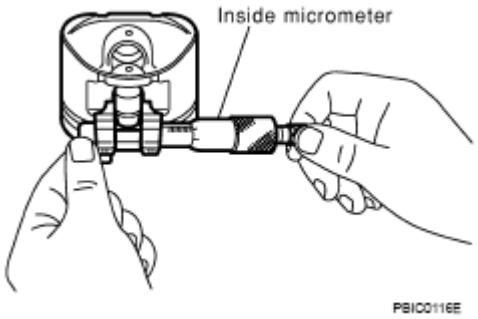


Fig. 308: Measuring Inner Diameter Of Piston Pin Hole
Courtesy of NISSAN MOTOR CO., U.S.A.

Piston Pin Outer Diameter

Measure the outer diameter of piston pin with a micrometer.

Standard : 21.989 - 22.001 mm (0.8657 - 0.8662 in)

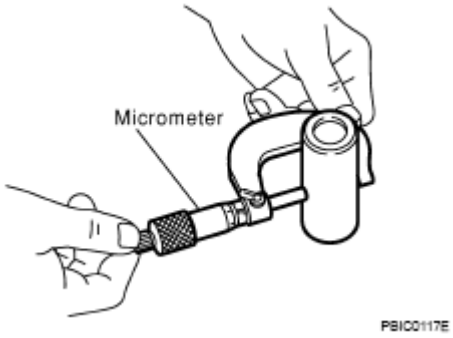


Fig. 309: Measuring Outer Diameter Of Piston Pin With Micrometer
Courtesy of NISSAN MOTOR CO., U.S.A.

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**".

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 a feeler gauge.

  Standard:

  Top ring : 0.045 - 0.080 mm (0.002 - 0.003 in)

  2nd ring : 0.030 - 0.070 mm (0.001 - 0.003 in)

Oil ring : 0.065 - 0.135 mm (0.003 - 0.005 in)

Limit:

Top ring : 0.11 mm (0.004 in)

2nd ring : 0.10 mm (0.004 in)

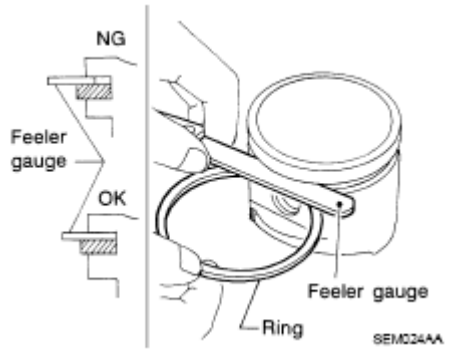


Fig. 310: Measuring Side Clearance Of Piston Ring And Piston Ring Groove
Courtesy of NISSAN MOTOR CO., U.S.A.

- 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

- Make sure 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 a feeler gauge.

Standard:

Top ring : 0.23 - 0.33 mm (0.009 - 0.013 in)

2nd ring : 0.33 - 0.48 mm (0.013 - 0.019 in)

Oil ring : 0.20 - 0.50 mm (0.008 - 0.020 in)

Limit:

Top ring : 0.54 mm (0.021 in)

2nd ring : 0.80 mm (0.031 in)

Oil ring : 0.95 mm (0.037 in)

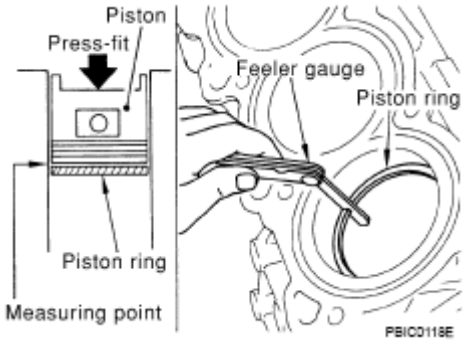


Fig. 311: Checking Piston Ring End Gap
Courtesy of NISSAN MOTOR CO., U.S.A.

- If the measured value exceeds the limit, replace piston ring, and measure again. If it still exceeds the limit, re-bore cylinder and use oversize piston and piston rings.

CONNECTING ROD BEND AND TORSION

- Check with a connecting rod aligner.

  Bend:

  Limit : 0.15 mm (0.006 in) per 100 mm (3.94 in) length

  Torsion:

  Limit : 0.30 mm (0.012 in) per 100 mm (3.94 in) length

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

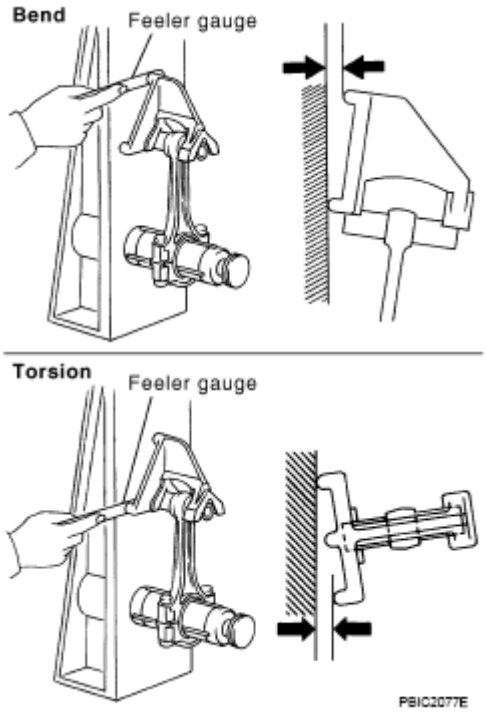


Fig. 312: Checking Connecting Rod Bend And Torsion
Courtesy of NISSAN MOTOR CO., U.S.A.

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 "**ASSEMBLY**" for the tightening procedure.
- Measure the inner diameter of connecting rod big end with an inside micrometer.

  Standard : 55.000 - 55.013 mm (2.1654 - 2.1659 in)

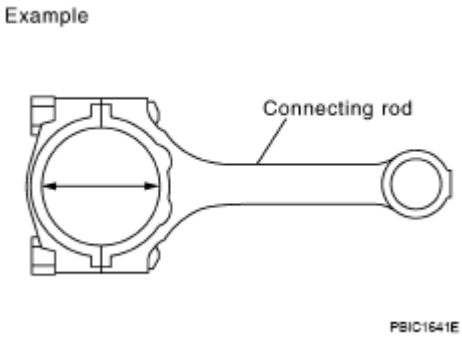


Fig. 313: Identifying Inner Diameter Of Connecting Rod Big End
Courtesy of NISSAN MOTOR CO., U.S.A.

- If out of the standard, replace connecting rod assembly.

CONNECTING ROD BUSHING OIL CLEARANCE

Connecting Rod Bushing Inner Diameter

Measure the inner diameter of connecting rod bushing with an inside micrometer.

Standard : 22.000 - 22.012 mm (0.8661 - 0.8666 in)

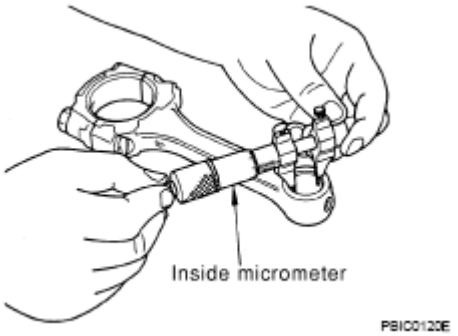


Fig. 314: Measuring Inner Diameter Of Connecting Rod Bushing With Inside Micrometer
Courtesy of NISSAN MOTOR CO., U.S.A.

Piston Pin Outer Diameter

Measure the outer diameter of piston pin with a micrometer.

Standard : 21.989 - 22.001 mm (0.8657 - 0.8662 in)

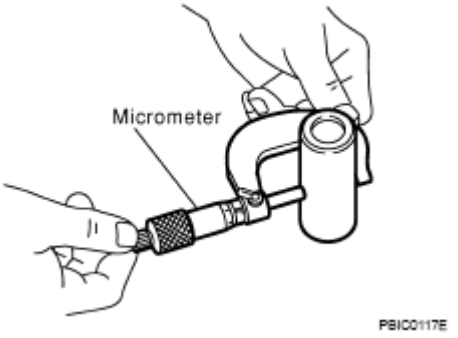


Fig. 315: Measuring Outer Diameter Of Piston Pin With Micrometer
Courtesy of NISSAN MOTOR CO., U.S.A.

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**".
- If replacing connecting rod assembly, refer to "**CONNECTING ROD BEARING OIL CLEARANCE**" to select the connecting rod bearing.

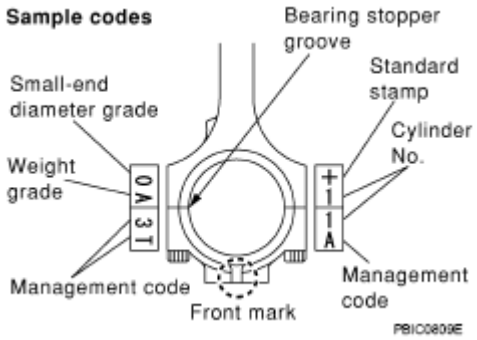


Fig. 316: Identifying Connecting Rod Sample Codes
Courtesy of NISSAN MOTOR CO., U.S.A.

Factory installed parts grading

- Service parts apply only to grade "0".

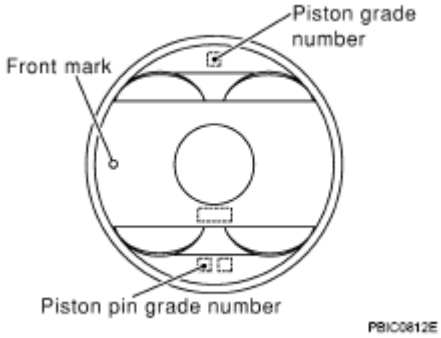


Fig. 317: Identifying Front Marks On Piston
Courtesy of NISSAN MOTOR CO., U.S.A.

CONNECTING ROD BUSHING INNER DIAMETER SPECIFICATIONS

		Unit: mm (in)
Grade	**0**	**1**
Connecting rod bushing inner diameter (1)	22.000 - 22.006 (0.8661 - 0.8664)	22.006 - 22.012 (0.8664 - 0.8666)
Piston pin hole diameter	21.993 - 21.999 (0.8659 - 0.8661)	21.999 - 22. 005 (0.8661 - 0.8663)
Piston pin outer diameter	21.989 - 21.995 (0.8657 - 0.8659)	21.995 - 22.001 (0.8659 - 0.8662)
(1) After installing in connecting rod		

CYLINDER BLOCK DISTORTION

- Using a 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 a straightedge and a feeler gauge.

Limit : 0.1 mm (0.004 in)

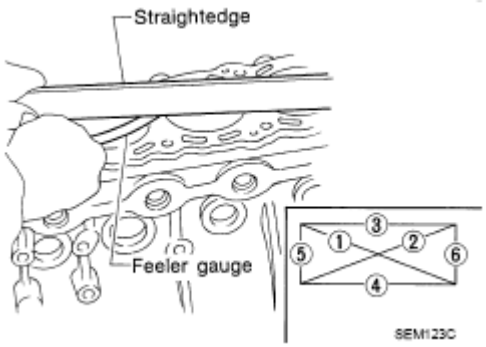


Fig. 318: Checking Distortion Of Cylinder Block Upper Face
Courtesy of NISSAN MOTOR CO., U.S.A.

- If it exceeds the limit, replace cylinder block.

MAIN BEARING HOUSING INNER DIAMETER

- Install main bearing caps and main bearing beam without installing main bearings, and tighten main bearing cap bolts to the specified torque. Refer to "**ASSEMBLY**" for the tightening procedure.

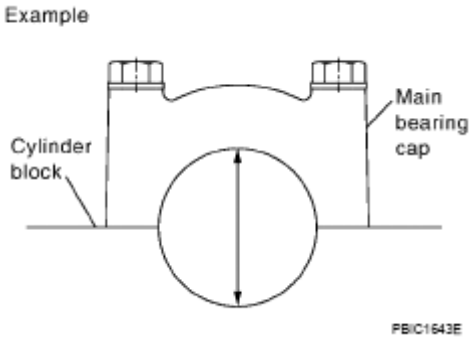


Fig. 319: Identifying Main Bearing Cap And Cylinder Block
Courtesy of NISSAN MOTOR CO., U.S.A.

- Measure the inner diameter of main bearing housing with a bore gauge.

  Standard : 63.993 - 64.017 mm (2.5194 - 2.5203 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.

PISTON TO CYLINDER BORE CLEARANCE

Cylinder Bore inner Diameter

- Using a 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") ("Y" is in longitudinal direction of engine)

  Standard inner diameter: 95.500 - 95.530 mm (3.7598 - 3.7610 in)

  Wear limit: 0.20 mm (0.0079 in)

  Out-of-round (Difference between "X" and "Y"): Limit: 0.015 mm (0.0006 in)

  Taper (Difference between "A" and "C"): Limit: 0.010 mm (0.0004 in)

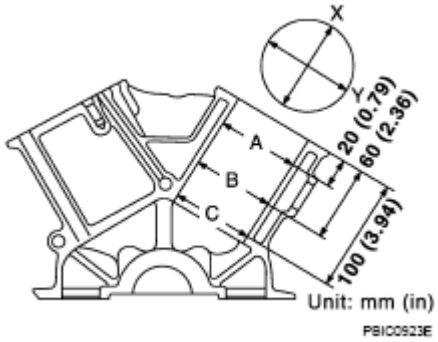


Fig. 320: Identifying Cylinder Bore Inner Diameter Dimensions
Courtesy of NISSAN MOTOR CO., U.S.A.

- If the measured value exceeds the limit, or if there are scratches and/or seizure on the cylinder inner wall, hone or re-bore the inner wall.

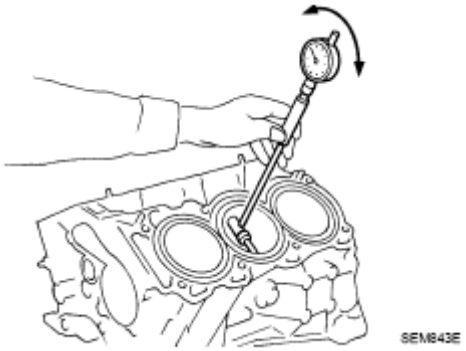


Fig. 321: Checking Clearance Of Piston-To-Cylinder Bore
Courtesy of NISSAN MOTOR CO., U.S.A.

- Oversize piston is provided. When using oversize piston, re-bore 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 (OS) : 0.2 mm (0.008 in)

Piston Skirt Diameter

Measure the outer diameter of piston skirt with a micrometer.

Measure point : Distance from the top 41.0 mm (1.614 in)

Standard : 95.480 - 95.510 mm (3.7590 - 3.7602 in)

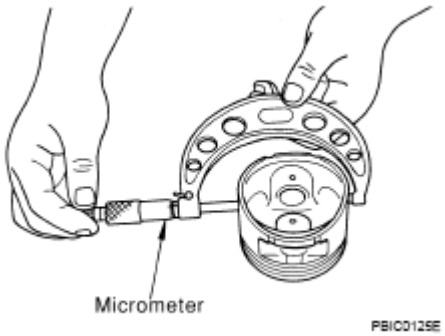


Fig. 322: Measuring Outer Diameter Of Piston
Courtesy of NISSAN MOTOR CO., U.S.A.

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**".

Re-boring Cylinder Bore

1. Cylinder bore size is determined by adding piston to cylinder bore clearance to piston skirt diameter.

   Re-bored size calculation: D = A + B - C

   where,

   D: Bored diameter

   A: Piston skirt diameter as measured

   B: Piston to cylinder bore clearance (standard value)

   C: Honing allowance 0.02 mm (0.0008 in)

2. Install main bearing caps and main bearing beam, 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 a micrometer.

  Standard : 59.951 - 59.975 mm (2.3603 - 2.3612 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 a 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**".

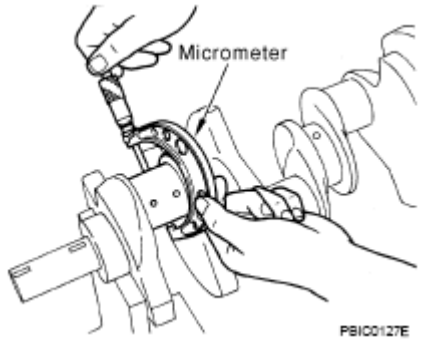


Fig. 323: Checking Outer Diameter Of Crankshaft Pin Journal With Micrometer
Courtesy of NISSAN MOTOR CO., U.S.A.

CRANKSHAFT OUT-OF-ROUND AND TAPER

- Measure the dimensions at four different points as shown in the figure on each main journal and pin journal with a 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") : 0.002 mm (0.0001 in)

  Taper (Difference between "A" and "B") : 0.002 mm (0.0001 in)

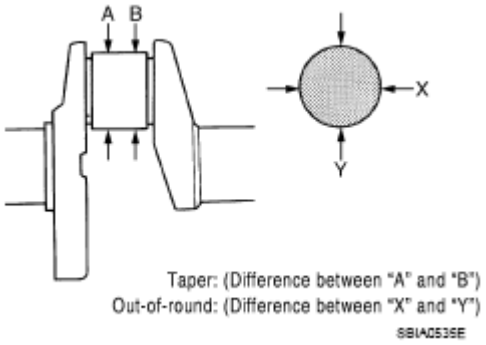


Fig. 324: Identifying Crank Shaft Taper And Out Of Round Dimensions
Courtesy of NISSAN MOTOR CO., U.S.A.

- 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 a dial indicator straight up on the No. 3 journal.
- While rotating crankshaft, read the movement of the pointer on a 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.

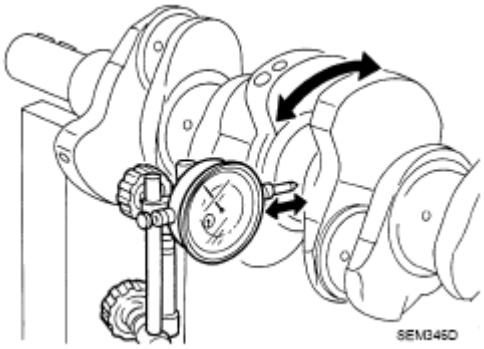


Fig. 325: Checking Crankshaft Runout
Courtesy of NISSAN MOTOR CO., U.S.A.

CONNECTING ROD BEARING OIL CLEARANCE

Method by Calculation

- Install connecting rod bearings to connecting rod and connecting rod cap, and tighten connecting rod bolts to the specified torque. Refer to "**ASSEMBLY**" for the tightening procedure.
- Measure the inner diameter of connecting rod bearing with an inside micrometer.

  (Oil clearance) = (Connecting rod bearing inner diameter) - (Crankshaft pin journal diameter)

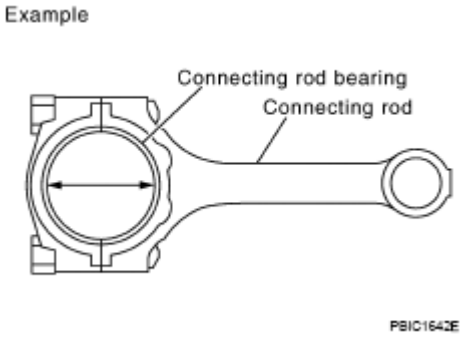


Fig. 326: Identifying Rod Bearing Oil Clearance
Courtesy of NISSAN MOTOR CO., U.S.A.

Standard : 0.034 - 0.059 mm (0.0013 - 0.0023 in) (actual clearance)

Limit : 0.070 mm (0.0028 in)

- If the calculated value exceeds the limit, select proper connecting rod bearing according to connecting rod big end diameter and crankshaft pin journal diameter to obtain the specified bearing oil clearance. Refer to "**HOW TO SELECT CONNECTING ROD BEARING**".

Method of Using Plastigage

- Remove oil and dust on crankshaft pin journal and the surfaces of each bearing completely.
- Cut a plastigage slightly shorter than the bearing width, and place it in crankshaft axial direction, avoiding oil holes.
- Install connecting rod bearings to connecting rod and connecting rod bearing cap, and tighten connecting rod bolts to the specified torque. Refer to "**ASSEMBLY**" for the tightening procedure.

CAUTION: Do not rotate crankshaft.

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

NOTE: The procedure when the measured value exceeds the limit is same as that described in the "METHOD BY CALCULATION".

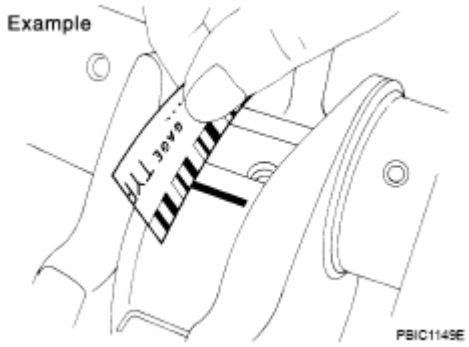


Fig. 327: Measuring Plastigage Width
Courtesy of NISSAN MOTOR CO., U.S.A.

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 beam to the specified torque. Refer to "**ASSEMBLY**" for the tightening procedure.

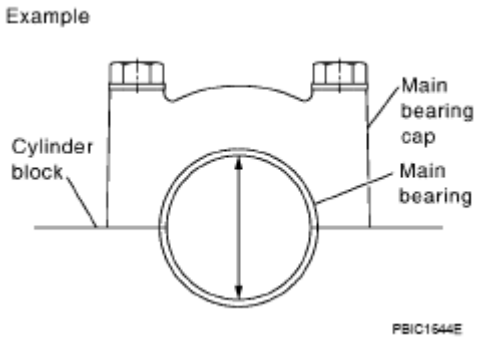


Fig. 328: Identifying Cylinder Block, Main Bearing And Main Bearing Caps
Courtesy of NISSAN MOTOR CO., U.S.A.

- Measure the inner diameter of main bearing with a bore gauge.

  (Oil clearance) = (Main bearing inner diameter) - (Crankshaft main journal diameter)

  Standard : 0.035 - 0.045 mm (0.0014 - 0.0018 in) (actual clearance)

  Limit : 0.065 mm (0.0026 in)

- 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 MAIN BEARING**".

Method of Using Plastigage

- Remove engine oil and dust on crankshaft journal and the surfaces of each bearing completely.
- Cut a plastigage slightly shorter than the bearing width, and place it in crankshaft axial direction, avoiding oil holes.
- Install main bearing to cylinder block and main bearing cap, and tighten main bearing bolts with main bearing beam to the specified torque. Refer to "**ASSEMBLY**" for the tightening procedure.

CAUTION: Never rotate crankshaft.

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

NOTE: The procedure when the measured value exceeds the limit is same as that described in the "METHOD BY CALCULATION".

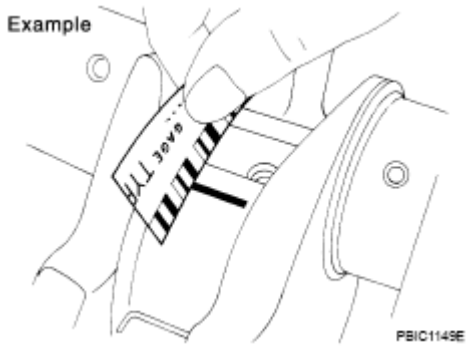


Fig. 329: Measuring Plastigage Width
Courtesy of NISSAN MOTOR CO., U.S.A.

MAIN BEARING CRUSH HEIGHT

- 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 "**ASSEMBLY**" for the tightening procedure.

  Standard : There must be crush height.

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

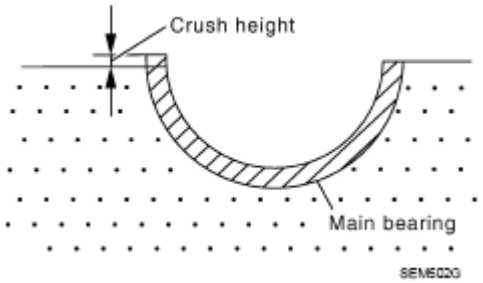


Fig. 330: Identifying Crush Height Of Main Bearing
Courtesy of NISSAN MOTOR CO., U.S.A.

CONNECTING ROD BEARING CRUSH HEIGHT

- 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 "**ASSEMBLY**" for the tightening procedure.

  Standard : There must be crush height.

- If the standard is not met, replace connecting rod bearings.

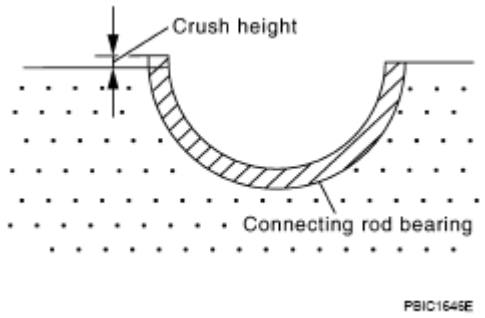


Fig. 331: Identifying Crush Height Of Connecting Rod Bearing
Courtesy of NISSAN MOTOR CO., U.S.A.

MAIN BEARING CAP BOLT OUTER DIAMETER

- Measure the outer diameters ("d1 ", "d2 ") at two positions as shown in the figure.
- If reduction appears in "A" range, regard it as "d2 ".

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

- If it exceeds the limit (large difference in dimensions), replace main bearing cap bolt with new one.

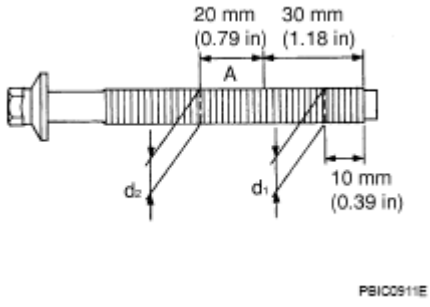


Fig. 332: Identifying Lower Cylinder Block Bolt Outer Diameter
Courtesy of NISSAN MOTOR CO., U.S.A.

CONNECTING ROD BOLT OUTER DIAMETER

- Measure the outer diameter "d" at position shown in the figure.
- If the reduction appears in a position other than "d", regard it as "d".

  Standard : 7.90 - 8.00 mm (0.3110 - 0.3150 in)

  Limit : 7.75 mm (0.3051 in)

- When "d" exceeds the limit (when it becomes thinner), replace connecting rod bolt with new one.

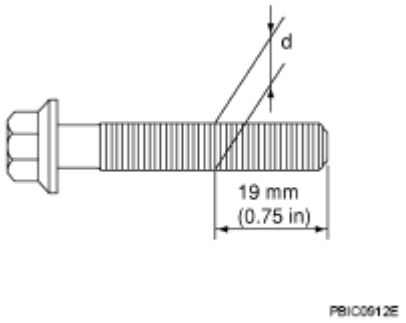


Fig. 333: Identifying Connecting Rod Bolt Outer Diameter
Courtesy of NISSAN MOTOR CO., U.S.A.

DRIVE PLATE

- Check drive plate and signal plate for deformation or damage.

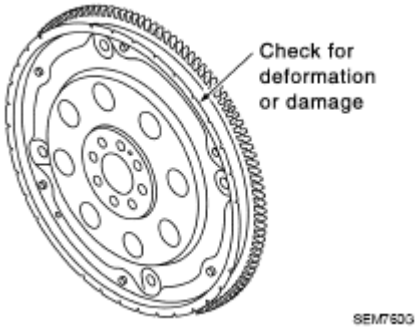


Fig. 334: Identifying Drive Plate And Signal Plate For Deformation Or Cracks
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION:
- **Do not disassemble drive plate.**
- **Do not 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.

OIL JET

- Check nozzle for deformation and damage.
- Blow compressed air from nozzle, and check for clogs.
- If it is not satisfied, clean or replace oil jet.

OIL JET RELIEF VALVE

- Using a clean plastic stick, press check valve in oil jet relief valve. Make sure that valve moves smoothly with proper reaction force.
- If it is not satisfied, replace oil jet relief valve.

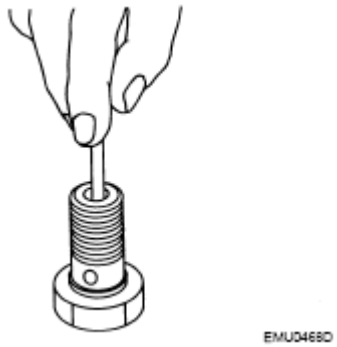


Fig. 335: Checking Oil Jet Relief Valve

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

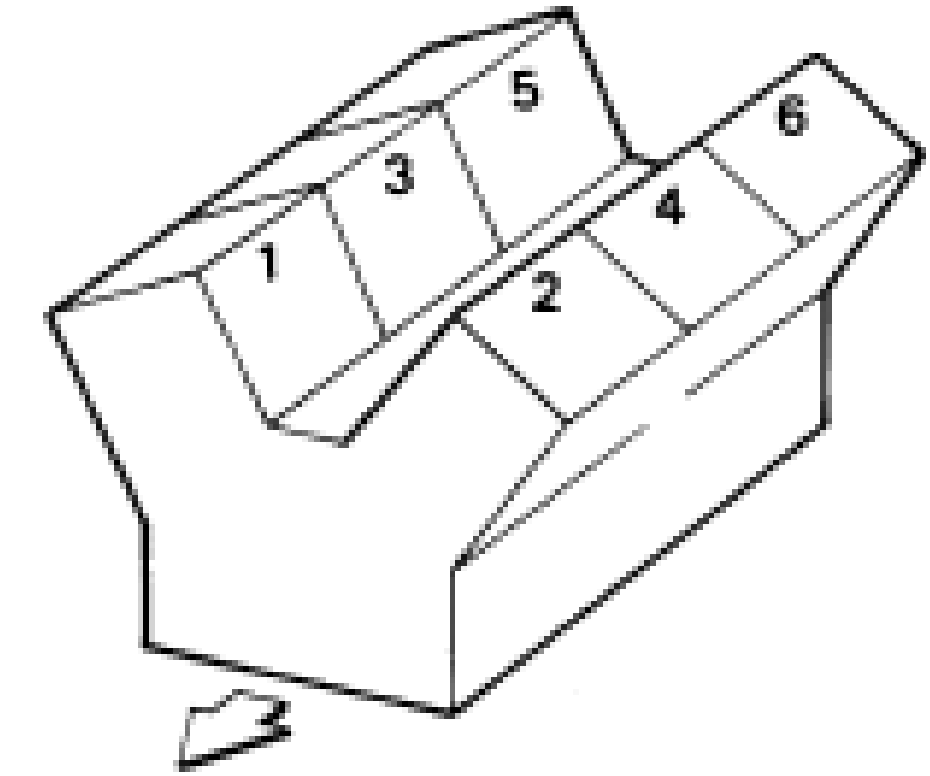
SERVICE DATA AND SPECIFICATIONS (SDS)

STANDARD AND LIMIT

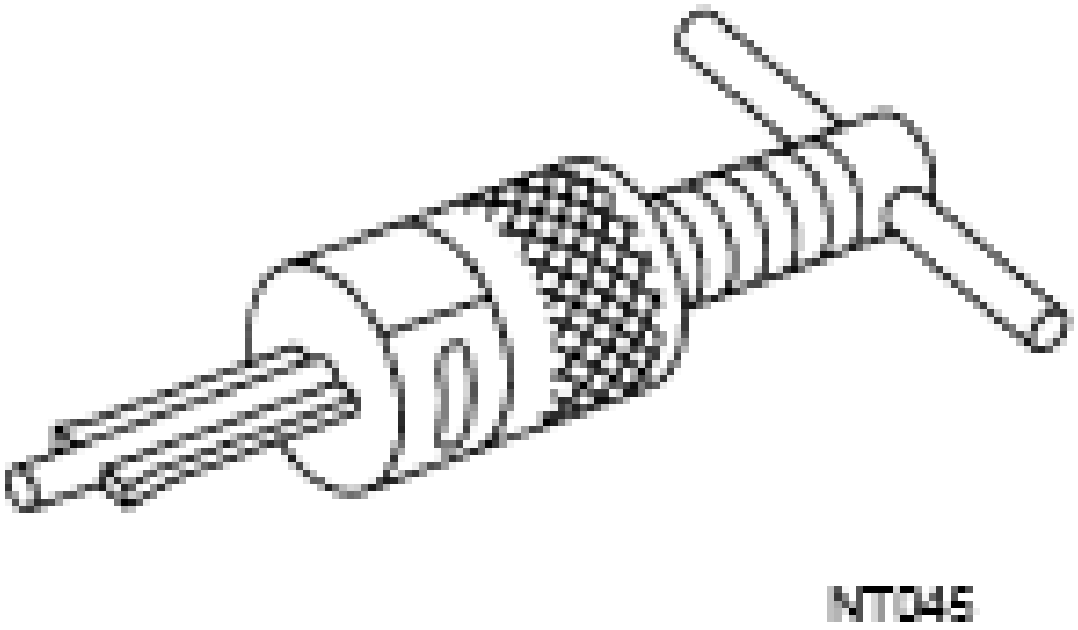
GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Cylinder arrangement		**V-6**
Displacement cm^3 (cu in)		3,498 (213.45)
Bore and stroke mm (in)		95.5 x 81.4 (3.760 x 3.205)
Valve arrangement		DOHC
Firing order		1-2-3-4-5-6
Number of piston rings	Compression	2
	Oil	1
Number of main bearings		4
Compression ratio		10.3
Compression pressure kPa (kg/cm^2, psi)/300 rpm	Standard	1,275 (13.0, 185)
	Minimum	981 (10.0, 142)
	Differential limit between cylinders	98 (1.0, 14)
Cylinder number		



Valve timing (Intake valve timing control - "OFF")



VALVE TIMING SPECIFICATION

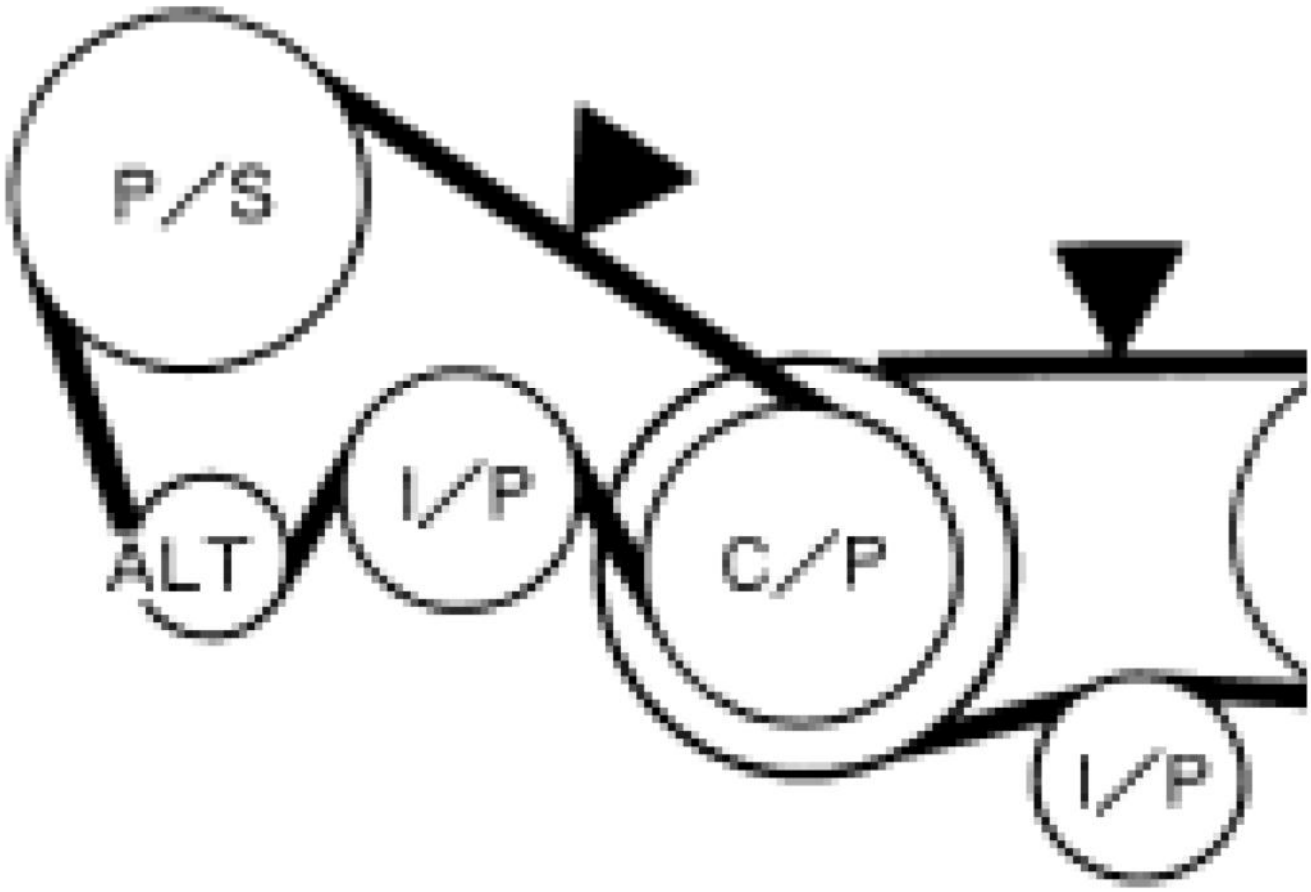
Unit: degree

a	b	c	d	e	f
240	238	-6	64	8	52

DRIVE BELT

DRIVE BELT SPECIFICATION

	Deflection adjustment		Unit: mm (in)	Tension adjustment(1)	
	Used belt		New belt	Used belt	
	Limit	After adjustment		Limit	After adju
Alternator and power steering oil pump belt	7 (0.28)	7 - 8 (0.28 - 0.31)	6 - 7 (0.24 - 0.28)	294 (30, 66)	730 - 818 83.4, 164
A/C compressor belt	12 (0.47)	9 - 10 (0.35 - 0.39)	8 - 9 (0.31 - 0.35)	196 (20, 44)	348 - 436 44.5, 78
Applied pushing force	98 N (10 kg, 22 lb)				-



(1) If belt tension gauge cannot be installed at check points shown, check drive belt tension at different location

INTAKE MANIFOLD COLLECTOR, INTAKE MANIFOLD AND EXHAUST MANIFOLD

INTAKE MANIFOLD COLLECTOR AND EXHAUST MANIFOLD SPECIFICATION

Unit: mm (in)

Items		Limit
Surface distortion	Intake manifold collector (upper)	0.1 (0.004)
	Intake manifold collector (lower)	0.1 (0.004)
	Intake manifold	0.1 (0.004)
	Exhaust manifold	0.3 (0.012)

SPARK PLUG

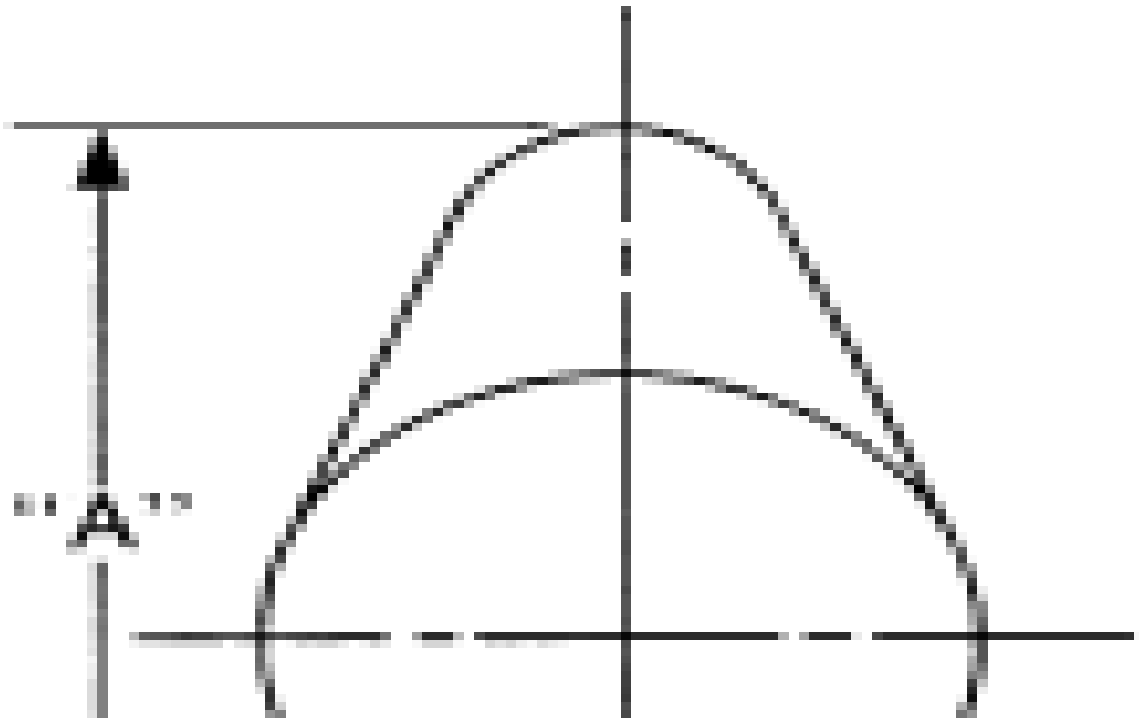
SPARK PLUG STANDARD TYPE SPECIFICATION

Make	NGK
Standard type	PLFR5A-11
Hot type	PLFR4A-11
Cold type	PLFR6A-11
Gap (Nominal)	1.1 mm (0.043 in)

CAMSHAFT AND CAMSHAFT BEARING

CAMSHAFT AND CAMSHAFT BEARING SPECIFICATION

Items		Standard	
Camshaft journal oil clearance	No. 1	0.045 - 0.086 (0.0018 - 0.0034)	
	No. 2, 3, 4	0.035 - 0.076 (0.0014 - 0.0030)	
Camshaft bracket inner diameter	No. 1	26.000 - 26.021 (1.0236 - 1.0244)	
	No. 2, 3, 4	23.500 - 23.521 (0.9252 - 0.9260)	
Camshaft journal diameter	No. 1	25.935 - 25.955 (1.0211 - 1.0218)	
	No. 2, 3, 4	23.445 - 23.465 (0.9230 - 0.9238)	
Camshaft end play		0.115 - 0.188 (0.0045 - 0.0074)	
Camshaft cam height "A"	Intake and exhaust	44.865 - 45.055 (1.7663 - 1.7738)	
Camshaft runout [TIR(2)]		Less than 0.02 mm (0.0008)	
Camshaft sprocket runout [TIR(2)]		-	



(1) Cam wear limit

(2) Total indicator reading

Valve Lifter

VALVE LIFTER SPECIFICATION

Unit: mm (in)

Items		Standard

Valve lifter outer diameter	Identification (stamped) mark "R" or "U"	33.977 - 33.987 (1.3377 - 1.3381)
	Identification (stamped) mark "V"	33.980 - 33.990 (1.3378 - 1.3382)
Valve lifter hole diameter		34.000 - 34.016 (1.3386 - 1.3392)
Valve lifter clearance	Identification (stamped) mark "R" or "U"	0.013 - 0.039 (0.0005 - 0.0015)
	Identification (stamped) mark "V"	0.010 - 0.036 (0.0004 - 0.0014)

Valve Clearance

VALVE CLEARANCE SPECIFICATION

Unit: mm (in)

Items	Cold	Hot(1) (reference data)
Intake	0.26 - 0.34 (0.010 - 0.013)	0.304 - 0.416 (0.012 - 0.016)
Exhaust	0.29 - 0.37 (0.011 - 0.015)	0.308 - 0.432 (0.012 - 0.017)

(1) Approximately 80°C (176°F)

Available Valve Lifter

AVAILABLE VALVE LIFTER SPECIFICATION

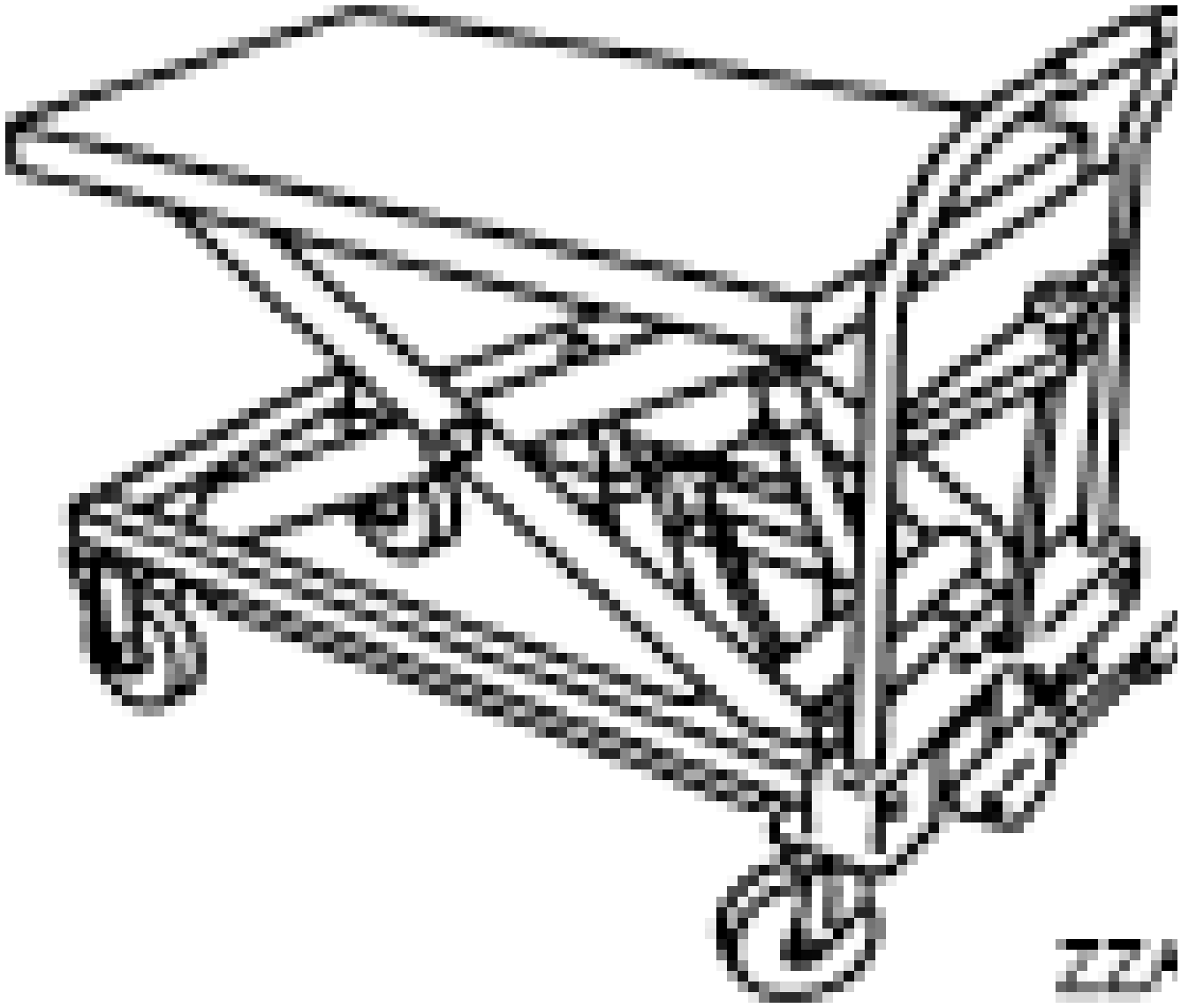
Identification (stamped) mark		
Intake	Exhaust	
788U	788R	7
790U	790R	7
792U	792R	7
794U	794R	7
796U	796R	7
798U	798R	7
800U	800R	8
802U	802R	8
804U	804R	8
806U	806R	8
808U	808R	8
810U	810R	8
812U	812R	8
814U	814R	8
816U	816R	8
818U	818R	8
820U	820R	8
822U	822R	8

824U	824R	8
826U	826R	8
828U	828R	8
830U	830R	8
832U	832R	8
834U	834R	8
836U	836R	8
838U	838R	8
840U	840R	8

CYLINDER HEAD

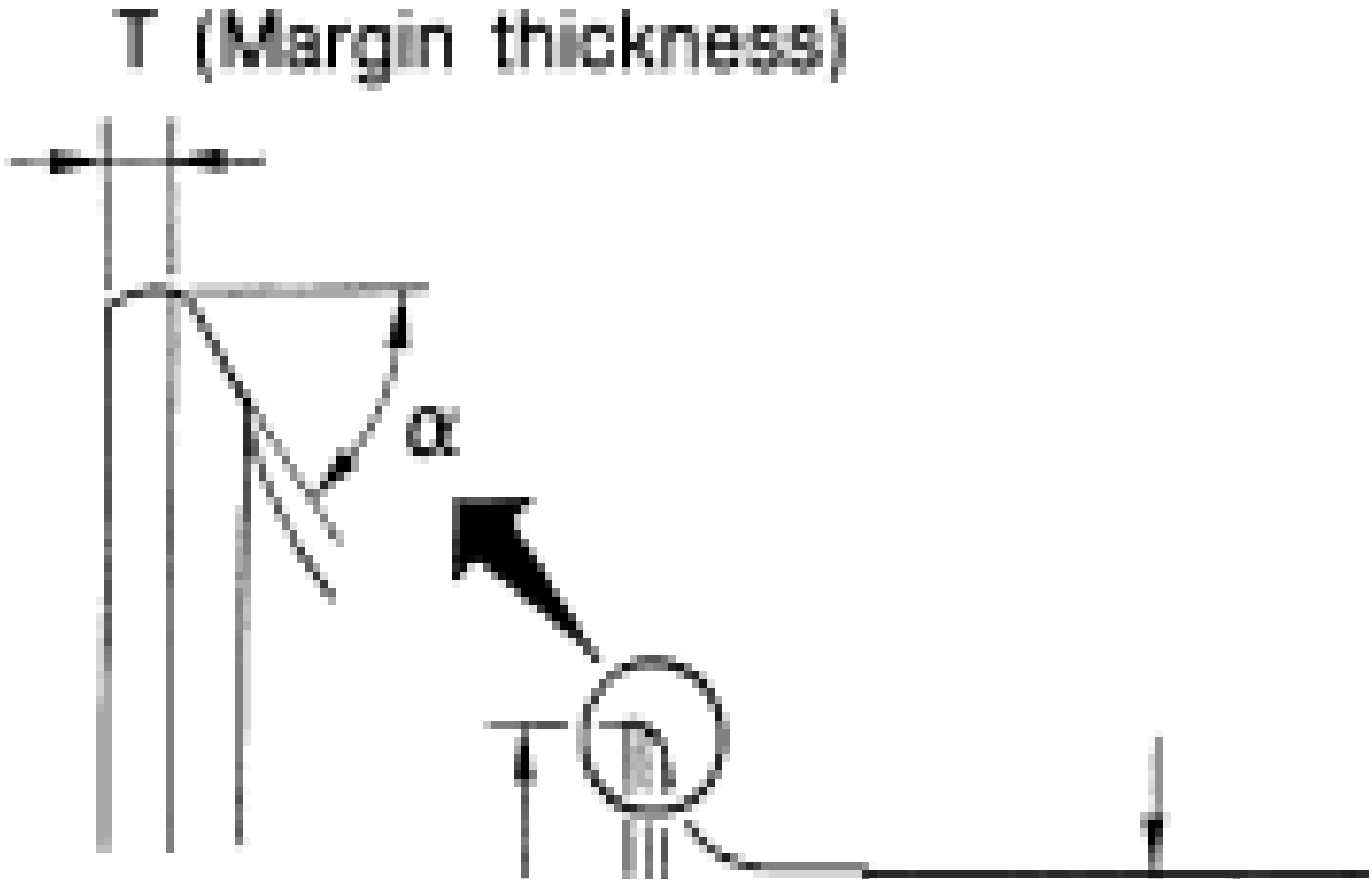
CYLINDER HEAD SPECIFICATION

Items	Standard	
Head surface distortion	Less than 0.03 (0.0012)	
Normal cylinder head height "H"	126.3 - 126.5 (4.97 - 4.98)	



Valve Dimensions

VALVE DIMENSIONS

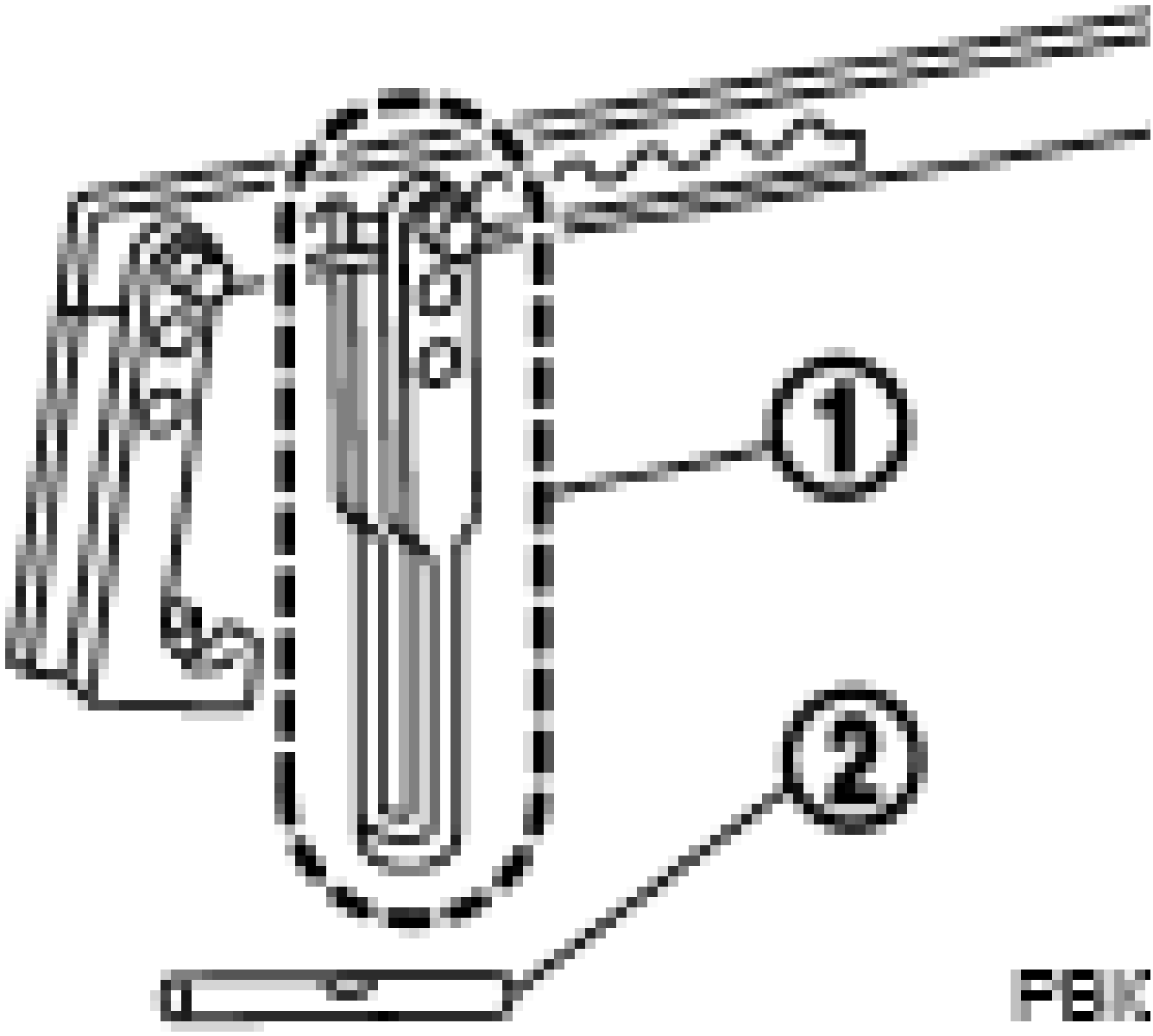


Valve head diameter "D"	Intake	37.0 - 3
	Exhaust	31.2 - 3
Valve length "L"	Intake	96
	Exhaust	93
	Intake	5.965 - 5.9

Valve stem diameter "d"	Exhaust	5.955 - 5.9
Valve seat angle "a"	Intake	45
	Exhaust	
Valve margin "T"	Intake	
	Exhaust	
Valve margin "T" limit		
Valve stem end surface grinding limit		

Valve Guide

VALVE GUIDE SPECIFICATION



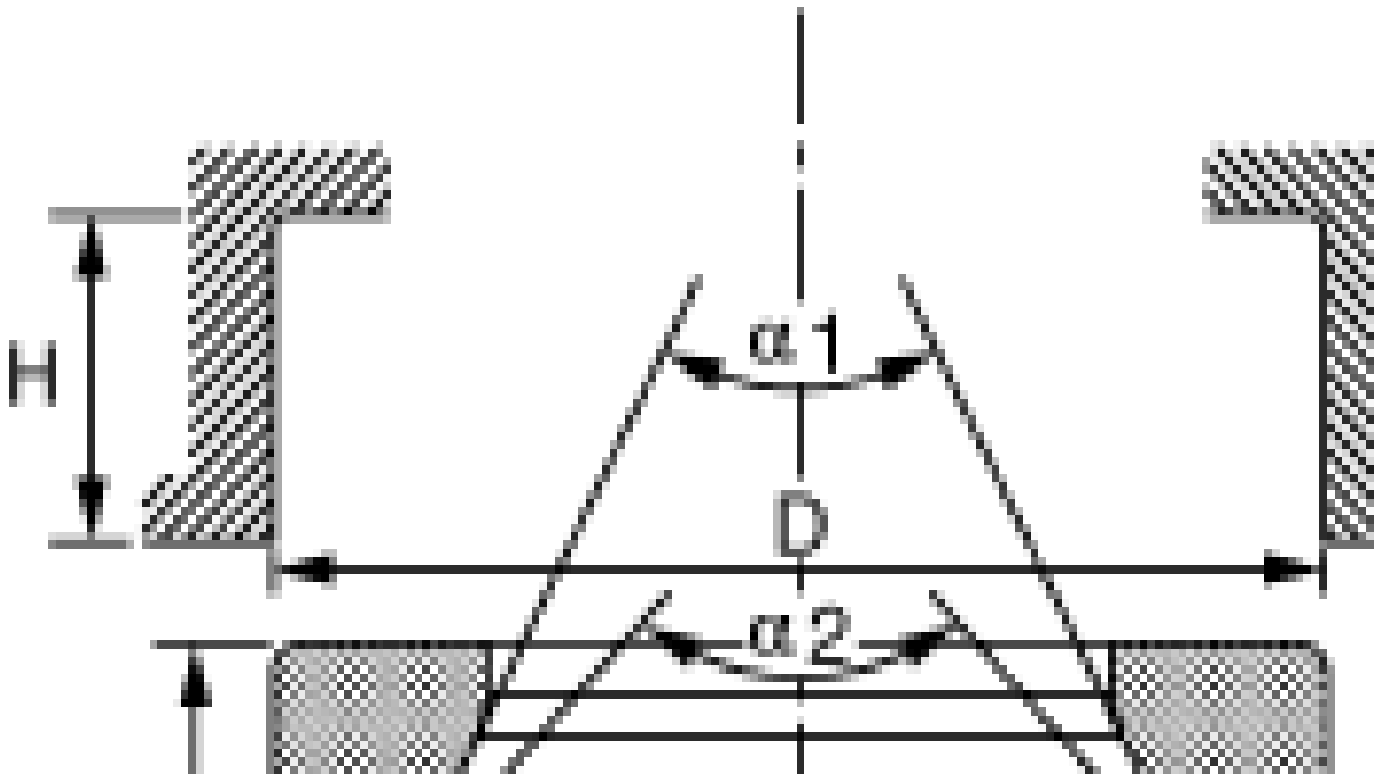
Items		Standard	Over
Valve guide	Outer diameter	10.023 - 10.034 (0.3946 - 0.3950)	10.22
	Inner diameter (Finished size)	6.000 - 6.018 (0.2362	
Cylinder head valve guide hole diameter		9.975 - 9.996 (0.3927 - 0.3935)	10.17
Interference fit of valve guide		0.027 - 0.059 (0.0011	

Items		Standard	
Valve guide clearance	Intake	0.020 - 0.053 (0.0008 - 0.0021)	

	Exhaust	0.030 - 0.063 (0.0012 - 0.0025)	
Projection length "L"		12.6 - 12.8 (0.496 -	

Valve Seat

VALVE SEAT SPECIFICATION



Items		Standard	Ove
Cylinder head seat recess diameter "D"	Intake	38.000 - 38.016 (1.4961 - 1.4967)	38.50
	Exhaust	32.200 - 32.216 (1.2677 - 1.2683)	32.70
	Intake	38.097 - 38.113 (1.4999 - 1.5005)	38.59

Valve seat outer diameter "d"	Exhaust	32.280 - 32.296 (1.2709 - 1.2715)	32.78
Valve seat interference fit	Intake	0.081 - 0.113 (0.0032	
	Exhaust	0.064 - 0.096 (0.0025	
Diameter "d1"(1)	Intake	35 (1.38)	
	Exhaust	28.7 (1.130)	
Diameter "d2"(2)	Intake	36.6 - 36.8 (1.441 -	
	Exhaust	30.6 - 30.8 (1.205 -	
Angle "a1"	Intake	60°	
	Exhaust	60°	
Angle "a2"	Intake	88°45' - 90°15	
	Exhaust	88°45' - 90°15	
Angle "a3"	Intake	120°	
	Exhaust	120°	
Contacting width "W"(3)	Intake	1.09 - 1.31 (0.0429 -	
	Exhaust	1.29 - 1.51 (0.0508 -	
Height "h"	Intake	5.9 - 6.0 (0.232 - 0.236)	5.0
	Exhaust	5.9 - 6.0 (0.232 - 0.236)	4.9
Depth "H"		6.0 (0.236)	

(1) Diameter made by intersection point of conic angles "a1" and "a2"

(2) Diameter made by intersection point of conic angles "a2" and "a3"

(3) Machining data

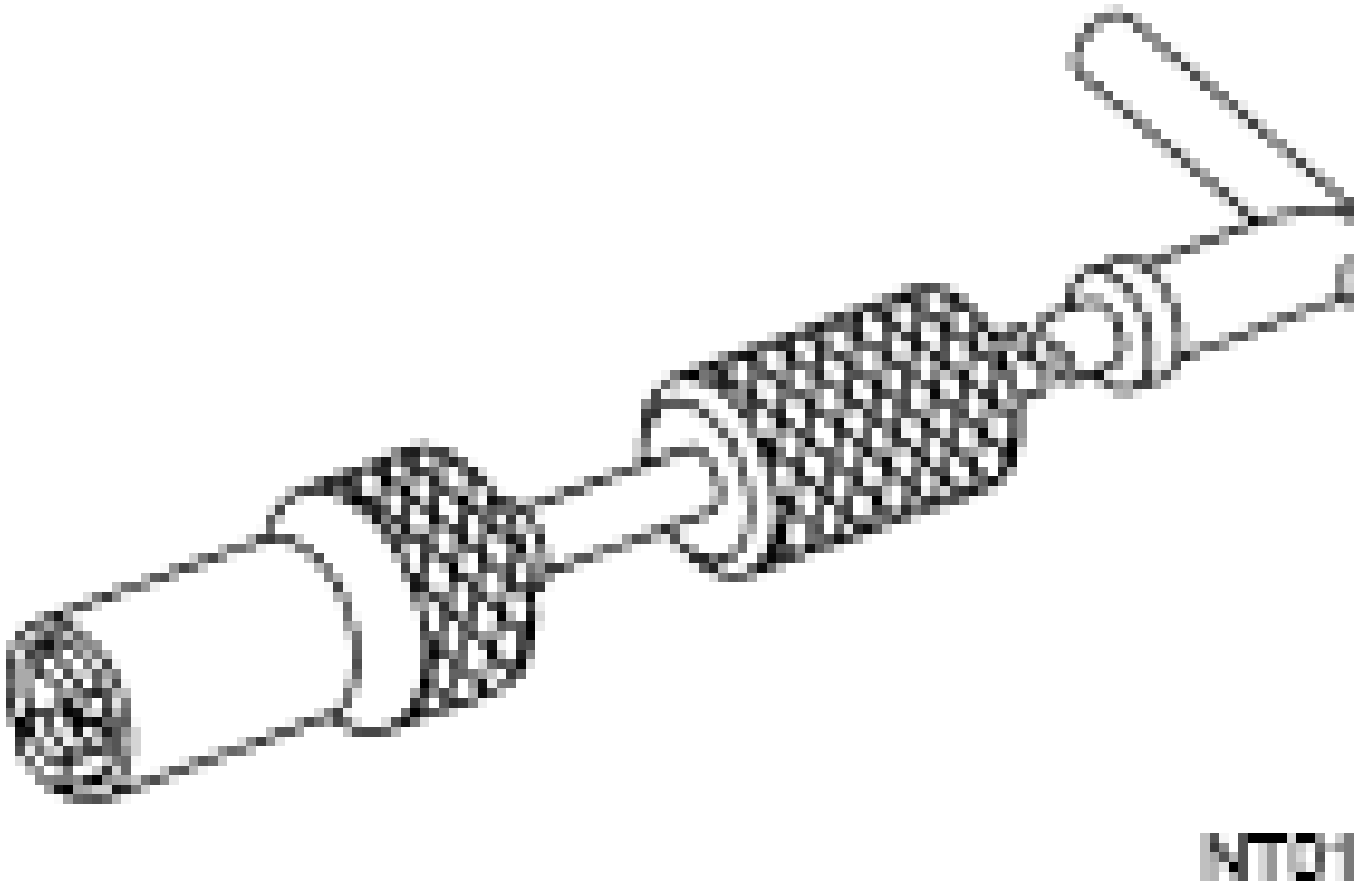
Valve Spring

VALVE SPRING SPECIFICATION

Free height mm (in)		**47.07 (1.8531)**
Pressure N (kg, lb) at height mm (in)	Installation	166 - 188 (16.9 - 19.2, 37 - 42) at 37.0 (1.457)
	Valve open	373 - 421 (38.0 - 42.9, 84 - 95) at 27.2 (1.071)
Out-of-square mm (in)	Limit	2.1 (0.083)

CYLINDER BLOCK

CYLINDER BLOCK SPECIFICATION



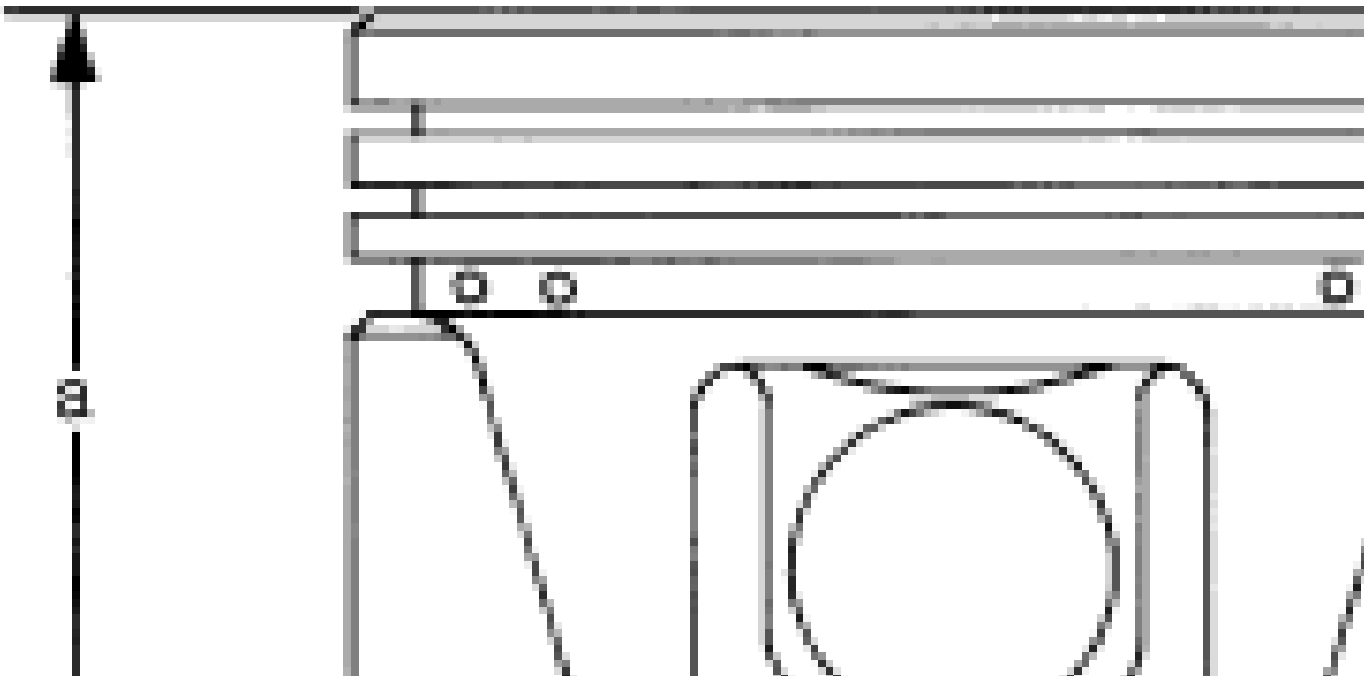
Surface flatness		Standard		Les
		Limit		
Main bearing housing inner diameter		Standard		63.993 -
Cylinder bore	Inner diameter	Standard	Grade No. 1	95.500 -
			Grade No. 2	95.510 -
			Grade No. 3	95.520 -
		Wear limit		
Out-of-round (Difference between "X" and "Y")		Limit		
Taper (Difference between "A" and "C")				
			Grade No. A	63.993 -
			Grade No. B	63.994 -
			Grade No. C	63.995 -
			Grade No. D	63.996 -
			Grade No. E	63.997 -
			Grade No. F	63.998 -
			Grade No. G	63.999 -
			Grade No. H	64.000 -

Main journal inner diameter grade (Without bearing)		Grade No. J	64.001 -
		Grade No. K	64.002 -
		Grade No. L	64.003 -
		Grade No. M	64.004 -
		Grade No. N	64.005 -
		Grade No. P	64.006 -
		Grade No. R	64.007 -
		Grade No. S	64.008 -
		Grade No. T	64.009 -
		Grade No. U	64.010 -
		Grade No. V	64.011 -
		Grade No. W	64.012 -
		Grade No. X	64.013 -
		Grade No. Y	64.014 -
		Grade No. 4	64.015 -
		Grade No. 7	64.016 -
Difference in inner diameter between cylinders	Standard		Less

PISTON, PISTON RING AND PISTON PIN

Available Piston

AVAILABLE PISTON SPECIFICATION



Items		Standard	Over
Piston skirt diameter "A"	Grade No. 1	95.480 - 95.490 (3.7590 - 3.7594)	
	Grade No. 2	95.490 - 95.500 (3.7594 - 3.7598)	
	Grade No. 3	95.500 - 95.510 (3.7598 - 3.7602)	
	Service	-	95.68

Items	Standard
"a" dimension	41.0 (1.614)

Piston pin hole diameter	Grade No. 0	21.993 - 21.999 (0.8659 - 0.8661)	
	Grade No. 1	21.999 - 22.005 (0.8661 - 0.8663)	
Piston to cylinder bore clearance		0.010 - 0.030 (0.0004 - 0.0012)	

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)	0.1 (0.004)
	Oil ring	0.065 - 0.135 (0.0026 - 0.0053)	-
End gap	Top	0.23 - 0.33 (0.0091 - 0.0130)	0.54 (0.0213)
	2nd	0.33 - 0.48 (0.0130 - 0.0189)	0.80 (0.0315)
	Oil (rail ring)	0.20 - 0.50 (0.0079 - 0.0197)	0.95 (0.0374)

Piston Pin

PISTON PIN SPECIFICATION

Unit: mm (in)

Items		Standard	Limit
Piston pin outer diameter	Grade No. 0	21.989 - 21.995 (0.8657 - 0.8659)	-
	Grade No. 1	21.995 - 22.001 (0.8659 - 0.8662)	-
Piston to piston pin oil clearance		0.002 - 0.006 (0.0001 - 0.0002)	-
Connecting rod bushing oil clearance		0.005 - 0.017 (0.0002 - 0.0007)	0.030 (0.0012)

CONNECTING ROD

CONNECTING ROD SPECIFICATION

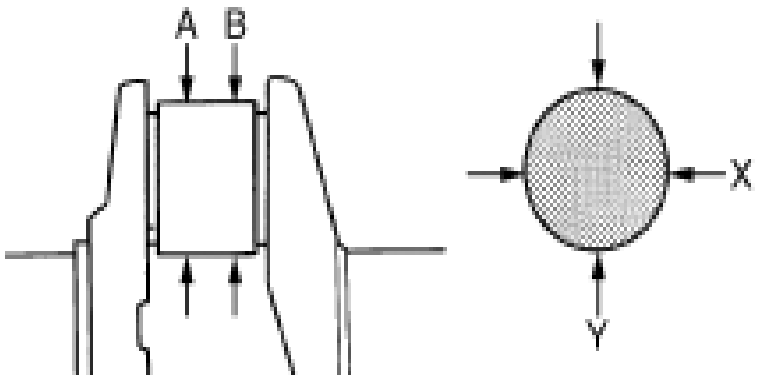
Unit: mm (in)

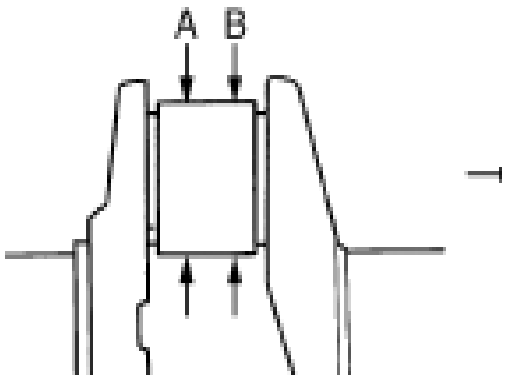
Items	Standard	Limit
Center distance	144.15 - 144.25 (5.68 - 5.68)	-
Bend [per 100 (3.94)]	-	0.15 (0.0059)

Torsion [per 100 (3.94)]		-	0.30 (0.0118)
Connecting rod bushing inner diameter(1)	Grade No. 0	22.000 - 22.006 (0.8661 - 0.8664)	-
	Grade No. 1	22.006 - 22.012 (0.8664 - 0.8666)	-
Connecting rod big end diameter (Without bearing)		55.000 - 55.013 (2.1654 - 2.1659)	-
Side clearance		0.20 - 0.35 (0.008 - 0.014)	0.40 (0.016)
(1) After installing in connecting rod			

CRANKSHAFT

CRANKSHAFT SPECIFICATION





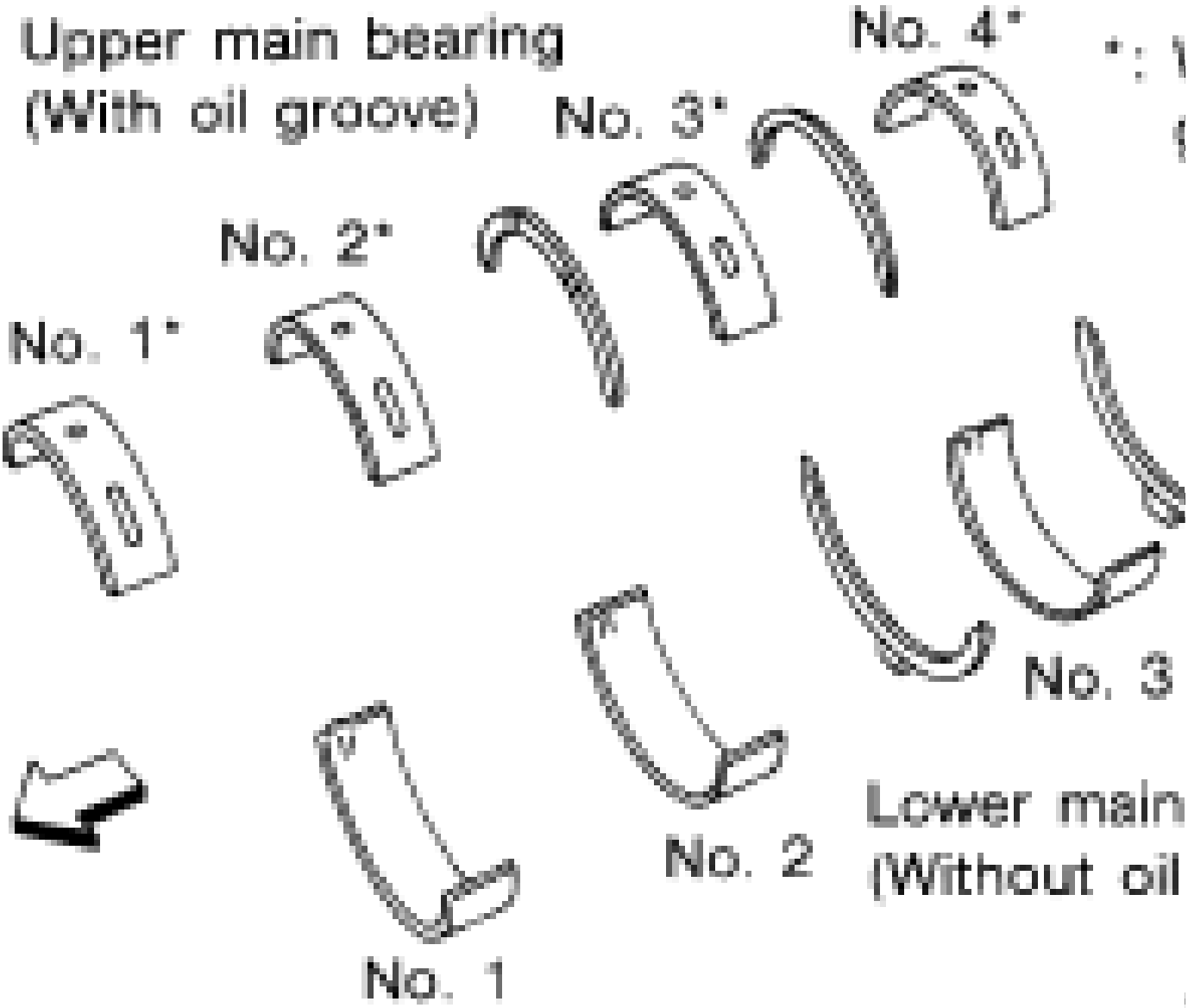
Grade No. A	59.97
Grade No. B	59.97
Grade No. C	59.97
Grade No. D	59.97
Grade No. E	59.97
Grade No. F	59.96
Grade No. G	59.96
Grade No. H	59.96
Grade No. J	59.96
Grade No. K	59.96
Grade No. L	59.96

Main journal diameter. "Dm" grade	Standard	Grade No. M	59.96
		Grade No. N	59.96
		Grade No. P	59.96
		Grade No. R	59.96
		Grade No. S	59.95
		Grade No. T	59.95
		Grade No. U	59.95
		Grade No. V	59.95
		Grade No. W	59.95
		Grade No. X	59.95
		Grade No. Y	59.95
		Grade No. 4	59.95
		Grade No. 7	59.95
Pin journal diameter. "Dp"	Standard	Grade No. 0	51.96
		Grade No. 1	51.96
		Grade No. 2	51.95
Center distance "r"			40.6
Taper (Difference between "A" and "B")	Limit		
Out-of-round (Difference between "X" and "Y")			
Crankshaft runout [TIR(1)]	Standard		
	Limit		
Crankshaft end play	Standard		0.1
	Limit		

(1) Total indicator reading

MAIN BEARING

MAIN BEARING SPECIFICATION



Grade number	UPR/LWR	Thickness	Width	Identification co
0	-	2.000 - 2.003 (0.0787 - 0.0789)		Black
1	-	2.003 - 2.006 (0.0789 - 0.0790)		Brown
2	-	2.006 - 2.009 (0.0790 - 0.0791)		Green
3	-	2.009 - 2.012 (0.0791 - 0.0792)		Yellow
4	-	2.012 - 2.015 (0.0792 - 0.0793)		Blue
5	-	2.015 - 2.018 (0.0793 - 0.0794)		Pink
6	-	2.018 - 2.021 (0.0794 - 0.0796)		Purple
7	-	2.021 - 2.024 (0.0796 - 0.0797)		White

01	UPR	2.003 - 2.006 (0.0789 - 0.0790)	19.9 - 20.1 (0.783 - 0.791)	Brown
	LWR	2.000 - 2.003 (0.0787 - 0.0789)		Black
12	UPR	2.006 - 2.009 (0.0790 - 0.0791)		Green
	LWR	2.003 - 2.006 (0.0789 - 0.0790)		Brown
23	UPR	2.009 - 2.012 (0.0791 - 0.0792)		Yellow
	LWR	2.006 - 2.009 (0.0790 - 0.0791)		Green
34	UPR	2.012 - 2.015 (0.0792 - 0.0793)		Blue
	LWR	2.009 - 2.012 (0.0791 - 0.0792)		Yellow
45	UPR	2.015 - 2.018 (0.0793 - 0.0794)		Pink
	LWR	2.012 - 2.015 (0.0792 - 0.0793)		Blue
56	UPR	2.018 - 2.021 (0.0794 - 0.0796)		Purple
	LWR	2.015 - 2.018 (0.0793 - 0.0794)		Pink
67	UPR	2.021 - 2.024 (0.0796 - 0.0797)		White
	LWR	2.018 - 2.021 (0.0794 - 0.0796)		Purple

Undersize

THICKNESS SPECIFICATION

Unit: mm (in)

Items	Thickness	Main journal diameter
0.25 (0.0098)	2.132 - 2.140 (0.0839 - 0.0843)	Grind so that bearing clearance is the specified value.

Main Bearing Oil Clearance

MAIN BEARING OIL CLEARANCE SPECIFICATION

Unit: mm (in)

Items	Standard	Limit
Main bearing oil clearance	0.035 - 0.045 (0.0014 - 0.0018)(1)	0.065 (0.0026)

(1) Actual clearance

CONNECTING ROD BEARING

CONNECTING ROD BEARING SPECIFICATION

Grade number	Thickness mm (in)	Identification color (mark)
0	1.500 - 1.503 (0.0591 - 0.0592)	Black
1	1.503 - 1.506 (0.0592 - 0.0593)	Brown
2	1.506 - 1.509 (0.0593 - 0.0594)	Green

Undersize

THICKNESS SPECIFICATION

Unit: mm (in)

Items	Thickness	Crank pin journal diameter
0.25 (0.0098)	1.626 - 1.634 (0.0640 - 0.0643)	Grind so that bearing clearance is the specified value.

Connecting Rod Bearing Oil Clearance

CONNECTING ROD BEARING OIL CLEARANCE SPECIFICATION

Unit: mm (in)

Items	Standard	Limit
Connecting rod bearing oil clearance	0.034 - 0.059 (0.0013 - 0.0023)(1)	0.070 (0.0028)
(1) Actual clearance		