# SECTION EM
# ENGINE MECHANICAL



## CONTENTS

### QR25DE

# PRECAUTION

## PRECAUTIONS

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

INFOID:0000000000990260

The Supplemental Restraint System such as “AIR BAG” and “SEAT BELT PRE-TENSIONER”, used along with a front seat belt, helps to reduce the risk or severity of injury to the driver and front passenger for certain types of collision. Information necessary to service the system safely is included in the SRS and SB section of this Service Manual.

**WARNING:**

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

### Precaution for Draining Coolant

INFOID:0000000000990261

- Drain coolant when engine is cooled.

### Precaution for Disconnecting Fuel Piping

INFOID:0000000000990262

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

### Precaution for Removal and Disassembly

INFOID:0000000000990263

- When instructed to use special service tools, use the specified tools. Always be careful to work safely, avoid forceful operations.
- Use maximum care to avoid damage to mating or sliding surfaces.
- Cover openings of engine system with tape or equivalent, if necessary, to seal out foreign materials.
- Mark and arrange disassembly parts in an organized way for easy troubleshooting and assembly.
- When loosening nuts and bolts, as a basic rule, start with the one furthest outside, then the one diagonally opposite, and so on. If the order of loosening is specified, follow the specifications.

### Precaution for Inspection, Repair and Replacement

INFOID:0000000000990264

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

### Precaution for Assembly and Installation

INFOID:0000000000990265

- Use torque wrench to tighten bolts or nuts.
- When tightening nuts and bolts, as a basic rule, equally tighten in several different steps starting with the ones in center, then ones on inside and outside diagonally in this order. If the order of tightening is specified, follow the specifications.
- Always replace the old with a new gasket, packing, oil seal or O-ring.
- Thoroughly wash, clean, and air-blow each part. Carefully check oil or coolant passages for any restriction and blockage.
- Avoid damaging sliding or mating surfaces. Completely remove foreign materials such as cloth lint or dust. Before assembly, oil sliding surfaces well.
- Bleed the air trapped within the system after draining the coolant.
- Before starting engine, apply fuel pressure to fuel lines with turning ignition switch ON (with engine stopped). Then make sure that there are no leaks at fuel line connections.

- After repairing, start engine and increase engine speed to check coolant, fuel, oil, and exhaust systems for leakage or rattles.

## Parts Requiring Angular Tightening

INFOID:0000000000990266

- Use an angle wrench for the final tightening of the following engine parts.
- Cylinder head bolts
- Lower cylinder block bolts
- Connecting rod cap bolts
- Crankshaft pulley bolt (No angle wrench is required as the bolt flange is provided with notches for angular tightening)
- Do not use a torque value for final tightening.
- The torque value for these parts are for a preliminary step.
- Ensure thread and seat surfaces are clean and coated with engine oil.

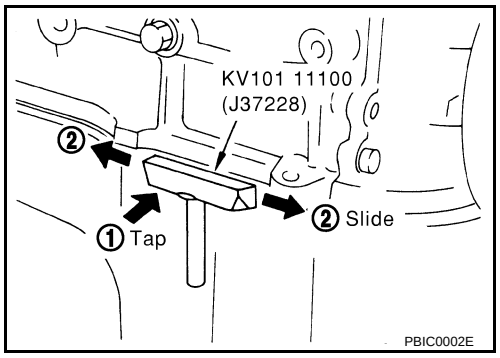
## Precaution for Liquid Gasket

INFOID:0000000000990267

### REMOVAL OF LIQUID GASKET SEALING

- After removing the bolts and nuts, separate the mating surface and remove the sealant using Tool.

**Tool number : KV10111100 (J-37228)**



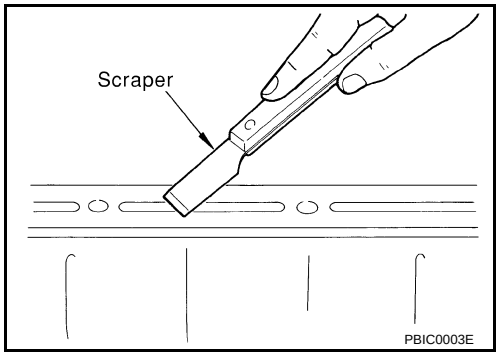

**CAUTION:**
**Be careful not to damage the mating surfaces.**

- In areas where the cutter is difficult to use, use a plastic hammer to lightly tap (1) the cutter where the RTV Silicone Sealant is applied. Use a plastic hammer to slide the cutter (2) by tapping on the side.

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

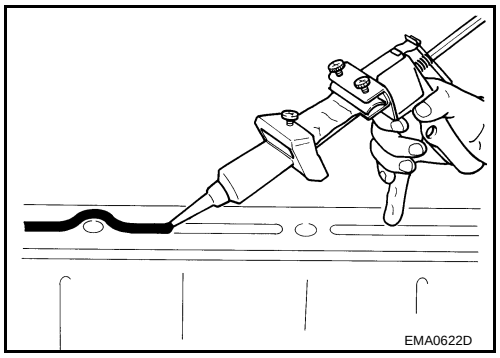
### LIQUID GASKET APPLICATION PROCEDURE

1. Using a scraper, remove the old Silicone RTV Sealant adhering to the gasket application surface and the mating surface.
   - Remove the sealant completely from the groove of the gasket application surface, mounting bolts, and bolt holes.
2. Thoroughly clean the gasket application surface and the mating surface and remove adhering moisture, grease and foreign materials.
3. Attach the sealant tube to the tube presser.
   **Use Genuine Silicone RTV Sealant or equivalent. Refer to GI-15, "Recommended Chemical Products and Sealants".**



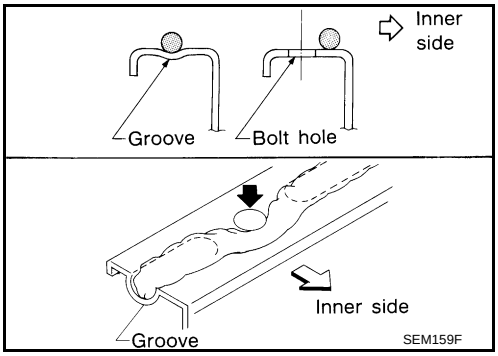

4. Apply the sealant using Tool without breaks to the specified location.

**Tube presser WS39930000 ( – )**




- If there is a groove for the sealant application, apply the sealant to the groove.
- As for the bolt holes, normally apply the sealant inside the holes. If specified, it should be applied outside the holes. Make sure to read the text of this manual.
- Within five minutes of the sealant application, install the mating component.
- If the sealant protrudes, wipe it off immediately.
- Do not retighten after the installation.

- After 30 minutes or more have passed from the installation, fill the engine with the specified oil and coolant. Refer to MA-11, "Fluids and Lubricants".




**CAUTION:**
**Follow all specific instructions in this manual.**

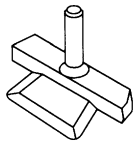
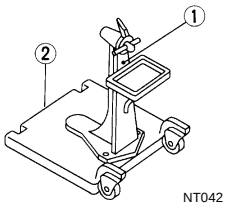
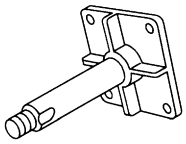
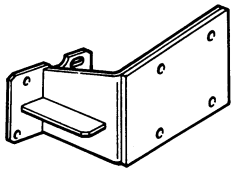
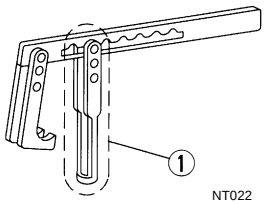
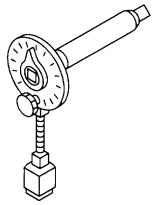
# PREPARATION

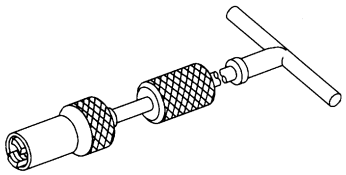
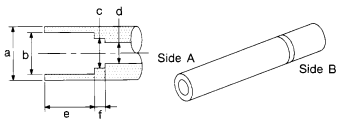
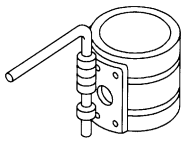
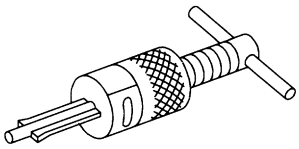
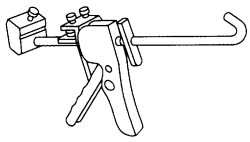
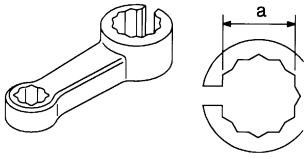
## PREPARATION

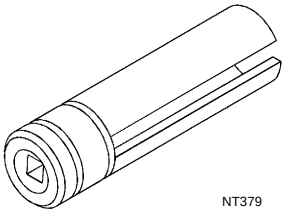
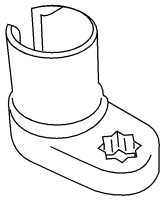
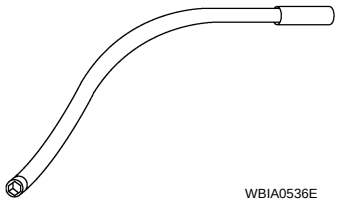
### Special Service Tool

INFOID:0000000000990268

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

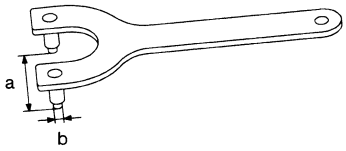
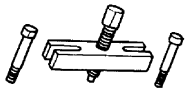
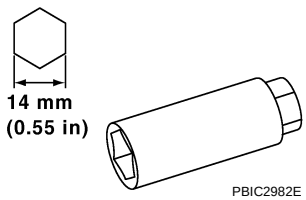
| Tool number (Kent-Moore No.) Tool name | | Description |
|---|---|---|
| KV10111100<br>(J-37228)<br>Seal cutter |  <br>S-NT046 | Removing steel oil pan and rear timing chain case |
| ST0501S000<br>Engine stand assembly<br>1. ST05011000<br>( — )<br>Engine stand<br>2. ST05012000<br>( — )<br>Base |  <br>NT042 | Disassembling and assembling |
| KV10106500<br>( — )<br>Engine stand shaft |  <br>NT028 | |
| KV10115300<br>( — )<br>Engine sub-attachment |  <br>ZZA1078D | |
| KV10116200<br>(J-26336-B)<br>Valve spring compressor<br>1. KV10115900<br>(J-26336-20)<br>Attachment |  <br>NT022 | Disassembling valve mechanism |
| KV10112100<br>(BT-8653-A)<br>Angle wrench |  <br>S-NT014 | Tightening bolts for bearing cap, cylinder head, etc. |

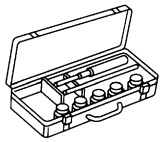
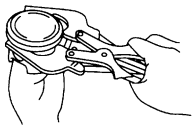
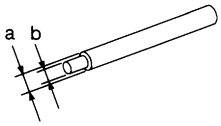
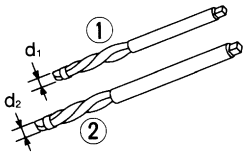
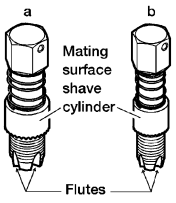
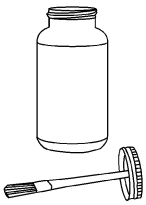
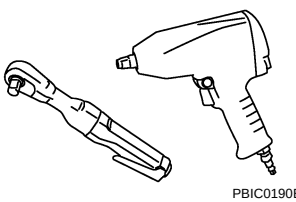
| Tool number (Kent-Moore No.) Tool name | Description |
|---|---|
| KV10107902 (J-38959) Valve oil seal puller  S-NT011 | Removing valve oil seal |
| KV10115600 (J-38958) Valve oil seal drift   S-NT603 | Installing valve oil seal<br>**Use side A.**<br>**a: 20 (0.79) dia.** **d: 8 (0.31) dia.**<br>**b: 13 (0.51) dia.** **e: 10.7 (0.421) dia.**<br>**c: 10.3 (0.406) dia.** **f: 5 (0.20) dia.**<br>Unit: mm (in) |
| EM03470000 (J-8037) Piston ring compressor  S-NT044 | Installing piston assembly into cylinder bore |
| ST16610001 (J-23907) Pilot bushing puller  S-NT045 | Removing crankshaft pilot bushing |
| WS39930000 ( — ) Tube presser  S-NT052 | Pressing the tube of liquid gasket |
| 16441 6N210 (J-45488) Quick connector release  PBIC0198E | Removing fuel tube quick connectors in engine room<br>(Available in SEC. 164 of PARTS CATALOG: Part No. 16441 6N210) |
| KV10114400 (J-38365) Heated oxygen sensor wrench   NT636 | Loosening or tightening rear heated oxygen sensor<br>**a: 22 mm (0.87 in)** |

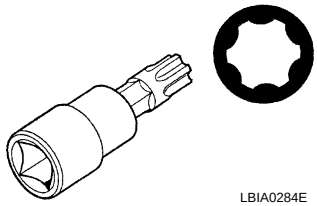
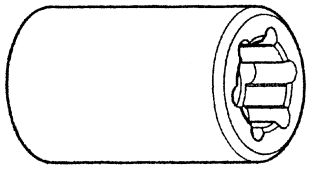
| Tool number (Kent-Moore No.) Tool name | Description |
|---|---|
| KV10117100 (J-36471-A) Heated oxygen sensor wrench  NT379 | Loosening or tightening heated oxygen sensor **For 22 mm (0.87 in) hexagon nut** |
| — (J-44626) Air fuel ratio (A/F) sensor wrench  LEM054 | Loosening or tightening air fuel ratio (A/F) sensor 1 |
| — (J-46535) Drive belt tension releaser  WBIA0536E | Releasing drive belt tension |

## Commercial Service Tool

INFOID:0000000000990269

| Tool number (Kent-Moore No.) Tool name | Description |
|---|---|
| Pulley holder   NT628 | Crankshaft pulley removing and installing **a: 68 mm (2.68 in) dia.** **b: 8 mm (0.31 in) dia.** |
| Crank puller  ZZA0010D | Crankshaft pulley removing |
| Spark plug wrench   PBIC2982E | Removing and installing spark plug |

| Tool number (Kent-Moore No.) Tool name | Description |
|---|---|
| Valve seat cutter set  S-NT048 | Finishing valve seat dimensions |
| Piston ring expander  S-NT030 | Removing and installing piston ring |
| Valve guide drift   S-NT015 | Removing and installing valve guide<br>**Intake & Exhaust:**<br>**a: 9.5 mm (0.374 in) dia.**<br>**b: 5.5 mm (0.217 in) dia.** |
| Valve guide reamer   S-NT016 | 1: Reaming valve guide inner hole<br>2: Reaming hole for oversize valve guide<br>**Intake & Exhaust:**<br>**d1: 6.0 mm (0.236 in) dia.**<br>**d2: 10.2 mm (0.402 in) dia.** |
| (J-43897-18)<br>(J-43897-12)<br>Oxygen sensor thread cleaner   AEM488 | Reconditioning the exhaust system threads before installing a new heated oxygen sensor (Use with anti-seize lubricant shown below.)<br>**a: J-43897-18 [18 mm (0.71 in) dia.] for zirconia heated oxygen sensor**<br>**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)  AEM489 | Lubricating oxygen sensor thread cleaning tool when reconditioning exhaust system threads |
| Power tool  PBIC0190E | Loosening bolts and nuts |

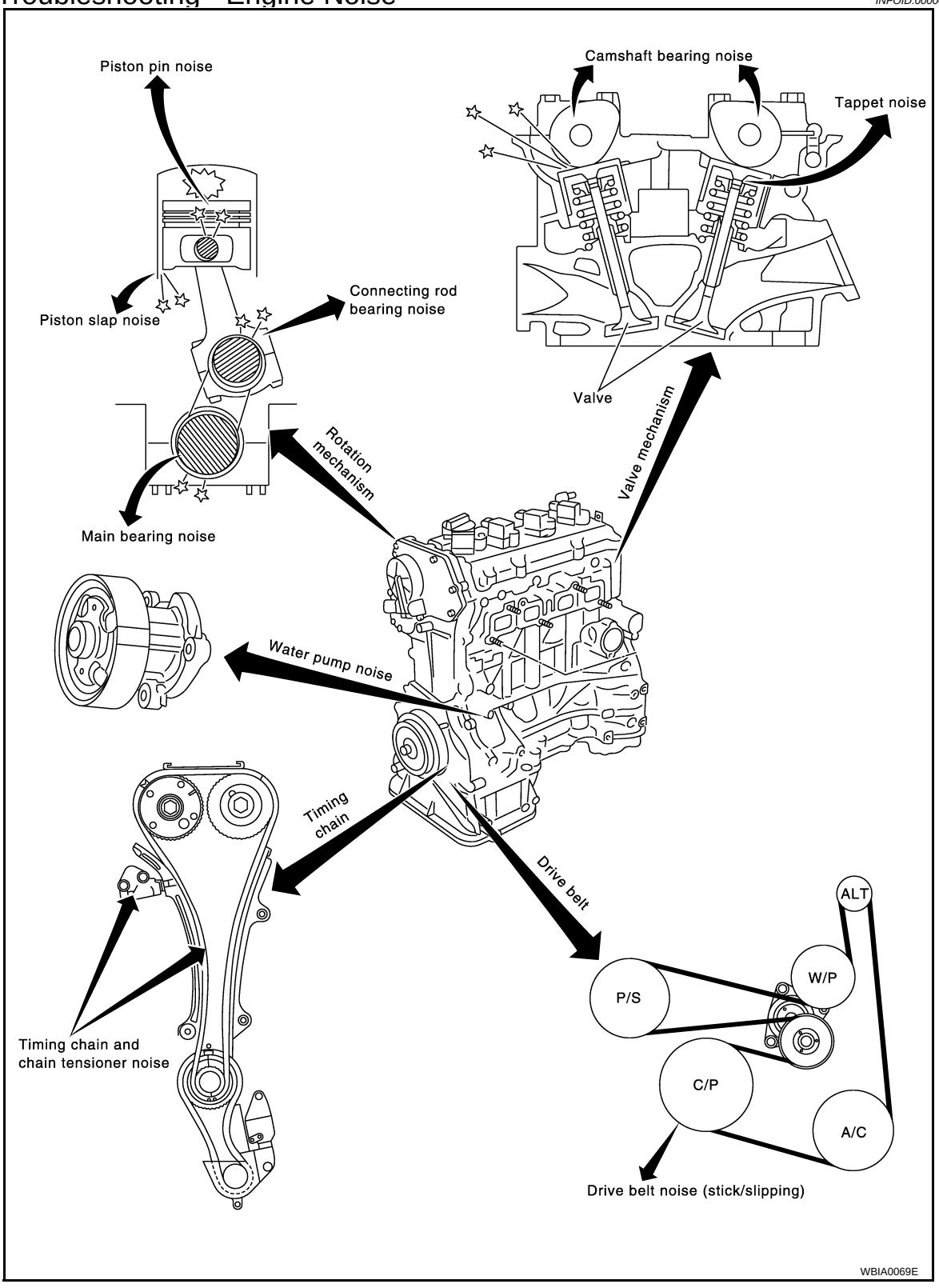
| Tool number<br>(Kent-Moore No.)<br>Tool name | Description |
|---|---|
| TP55 Torx® plus Bit<br>  <br>LBIA0284E | Removing and installing M/T flywheel bolts |
| E20 Torx® Socket<br>(J-45816)<br>  <br>LBIA0285E | Removing and installing A/T drive plate bolts |

# FUNCTION DIAGNOSIS

## NOISE, VIBRATION, AND HARSHNESS (NVH) TROUBLESHOOTING

### NVH Troubleshooting - Engine Noise

INFOID:0000000000990270




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

INFOID:0000000000990271

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

If necessary, repair or replace these parts.

| Location of noise | Type of noise | Operating condition of engine | | | | | | Source of noise | Check item | Reference page |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Before warm-up | After warm-up | When starting | When idling | When racing | While driving | | | |
| Top of engine Rocker cover Cylinder head | Ticking or clicking | C | A | — | A | B | — | Tappet noise | Valve clearance | EM-48 |
| | Rattle | C | A | — | A | B | C | Camshaft bearing noise | Camshaft journal clearance<br>Camshaft runout | EM-40<br>EM-40 |
| Crankshaft pulley Cylinder block (Side of engine) Oil pan | Slap or knock | — | A | — | B | B | — | Piston pin noise | Piston and piston pin clearance<br>Connecting rod bushing clearance | EM-84<br>EM-84 |
| | Slap or rap | A | — | — | B | B | A | Piston slap noise | Piston-to-bore clearance<br>Piston ring side clearance<br>Piston ring end gap<br>Connecting rod bend and torsion | EM-84<br>EM-84<br>EM-84<br>EM-84 |
| | Knock | A | B | C | B | B | B | Connecting rod bearing noise | Connecting rod bushing clearance (Small end)<br>Connecting rod bearing clearance (Big end) | EM-84<br>EM-84 |
| | Knock | A | B | — | A | B | C | Main bearing noise | Main bearing oil clearance<br>Crankshaft runout | EM-84<br>EM-84 |
| Front of engine Timing chain cover | Tapping or ticking | A | A | — | B | B | B | Timing chain and chain tensioner noise | Timing chain cracks and wear<br>Timing chain tensioner operation | EM-51 |
| Front of engine | Squeaking or fizzing | A | B | — | B | — | B | Drive belts (Sticking or slipping) | Drive belts deflection | EM-16 |
| | Creaking | A | B | A | B | A | B | Drive belts (Slipping) | Idler pulley bearing operation | |
| | Squall Creak | A | B | — | B | A | B | Water pump noise | Water pump operation | CO-18 |

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

# ON-VEHICLE MAINTENANCE

## SPARK PLUG

### Removal and Installation

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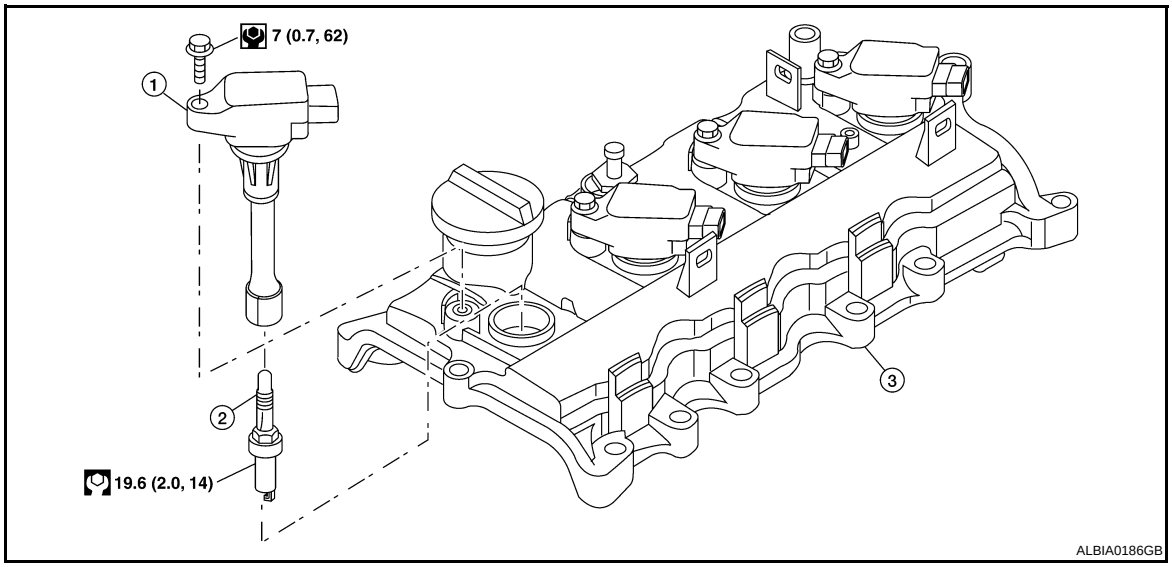
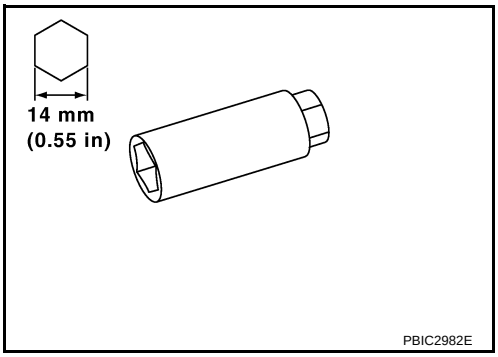



1. Ignition coil
2. Spark plug
3. Rocker cover

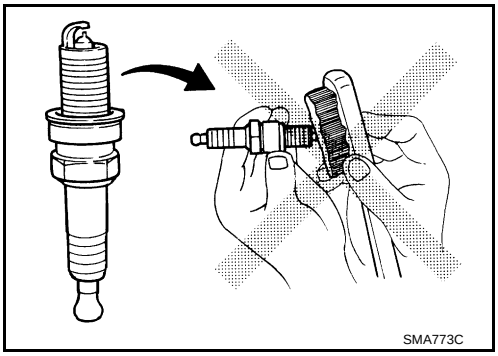
REMOVAL

1. Remove the ignition coil. Refer to EM-34, "Removal and Installation".
2. Remove the spark plug with a suitable spark plug wrench.




INSPECTION AFTER REMOVAL

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

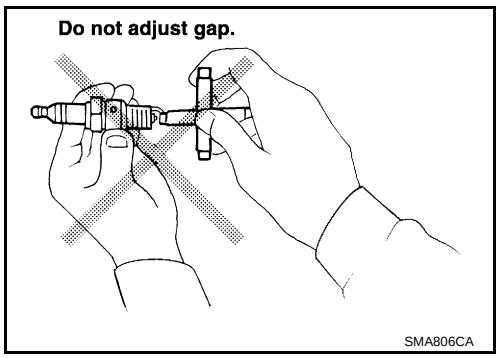



- If plug is covered with carbon, a spark plug cleaner may be used.

**Cleaner air pressure : less than 588 kPa (6 kg/cm$^2$, 85 psi)**
**Cleaning time : less than 20 seconds**

- Checking and adjusting plug gap is not required between change intervals. If the gap is out of specification, replace the spark plug.

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




## INSTALLATION

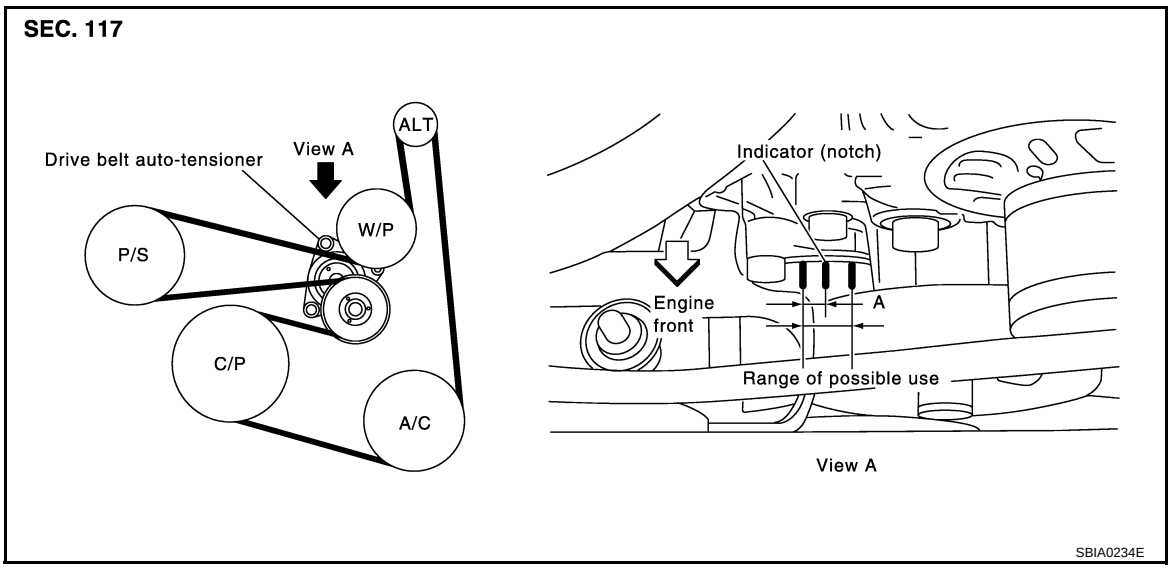
Installation is in the reverse order of removal.

| | |
|---|---|
| Temperature range | NGK |
| Standard type | DILKAR6A-11 |
| Gap (nominal) | 1.1 mm (0.043 in) |

# DRIVE BELTS

## Checking Drive Belts

INFOID:0000000000990273




**WARNING:**
**Inspect the drive belt only when the engine is stopped.**
**NOTE:**
**On vehicles not equipped with A/C, there is an idler pulley in the position for the drive belt routing.**

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

  **NOTE:**
  - Check the drive belt auto-tensioner indicator (notch) when the engine is cold.
  - When the new drive belt is installed, the range should be “A” as shown.
  - Visually check entire belt for wear, damage or cracks.
  - If the indicator is out of allowable use range or belt is damaged, replace the belt.

## Tension Adjustment

INFOID:0000000000990274

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

## Removal and Installation

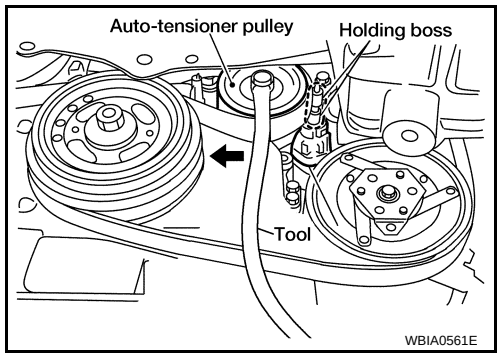
INFOID:0000000000990275

### REMOVAL

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

   **Tool number : — (J-46535)**

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




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

- Leave tensioner pulley arm locked until belt is installed again.

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

### INSTALLATION

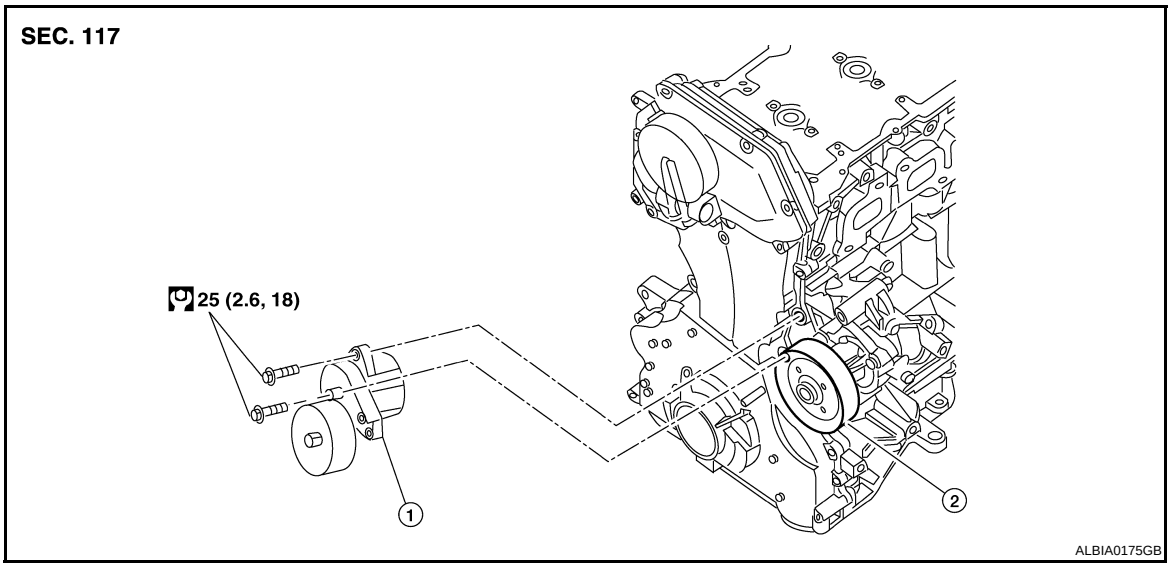
1. Hook the auxiliary drive belt onto all of the pulleys except for the water pump pulley. Hook the drive belt onto water pump pulley last.

**CAUTION:**
**Confirm belts are completely set on the pulleys.**

2. Release tensioner, and apply tensions to belt.
   **CAUTION:**
   - **Avoid placing hand in a location where pinching may occur if the holding tool accidentally comes off.**
   - **Do not loosen the auto-tensioner pulley bolt. (Don't turn it counterclockwise. If turned counter-clockwise, the complete auto-tensioner must be replaced as a unit, including pulley.**
3. Turn crankshaft pulley clockwise several times to equalize tension between each pulley.
4. Confirm tensions of belt at indicator is within the allowable use range. Refer to EM-16, "Checking Drive Belts".

## Removal and Installation of Drive Belt Auto-tensioner

INFOID:0000000000990276




1. Drive belt auto-tensioner
2. Water pump pulley

### REMOVAL

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

1. Remove the front RH engine cover.
2. Remove the drive belt EM-16, "Removal and Installation".
   - Insert a rod approximately 6 mm (0.24 in) in diameter through the rear of tensioner into the retaining boss to lock tensioner pulley.
3. Remove the generator. Refer to CHG-21, "Removal and Installation".
4. Remove the drive belt auto-tensioner, with power tool.

**CAUTION:**
**Do not loosen the auto-tensioner pulley bolt. (Don't turn it counterclockwise. If turned counterclockwise, the complete auto-tensioner must be replaced as a unit, including pulley.**

### INSTALLATION

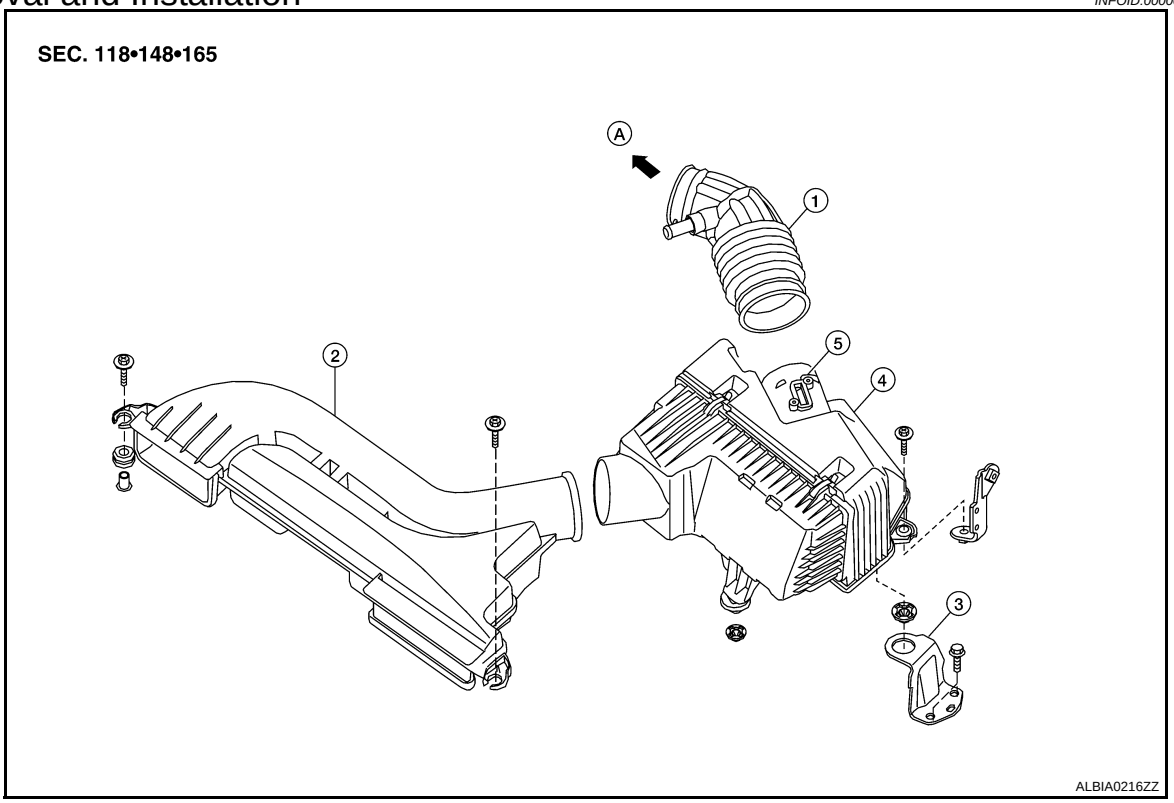
Installation is in the reverse order of removal.

**CAUTION:**
- **If there is damage greater than peeled paint, replace drive belt auto-tensioner units**
- **Install the drive belt auto-tensioner carefully so not to damage the water pump pulley.**
- **Do not swap the pulley between the new and old auto-tensioner units**

# AIR CLEANER FILTER

## Removal and Installation

INFOID:0000000000990277




1. Air duct hose
2. Front air duct
3. Air cleaner mounting bracket
4. Air cleaner assembly
5. Mass air flow sensor
A. To electronic throttle control actuator

### CHANGING THE AIR CLEANER ELEMENT

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

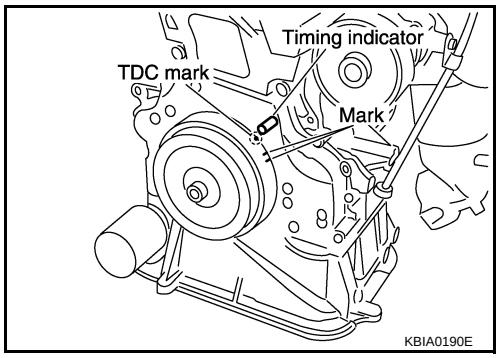
# CAMSHAFT VALVE CLEARANCE

## Camshaft valve clearence

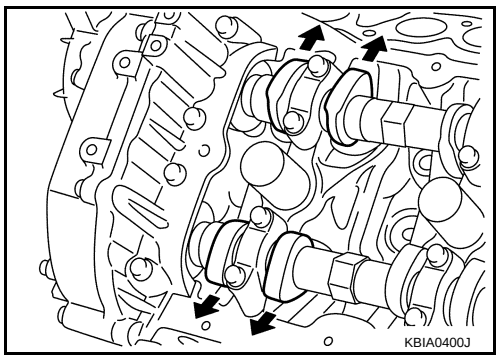
INFOID:0000000000990278

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

1. Warm up the engine, then stop it.
2. Remove front RH engine under cover using power tool.
3. Remove the rocker cover using power tool.
   Refer to EM-38, "Removal and Installation".
4. Turn crankshaft pulley in normal direction (clockwise when viewed from front) to align TDC identification mark (without paint mark) with timing indicator.

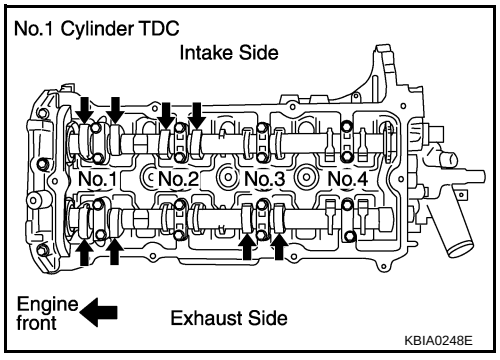



5. At this time, check that the both intake and exhaust cam lobes of No. 1 cylinder face outside.
   - If they do not face outside, turn crankshaft pulley once more.

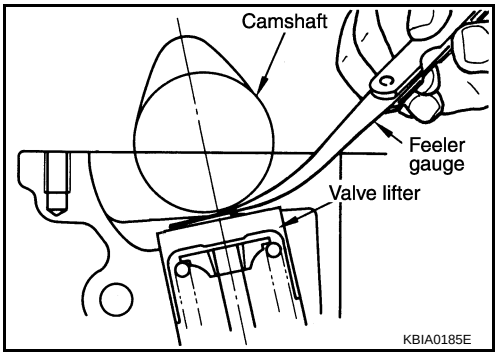



6. By referring to the figure (locations indicated with black arrow), measure valve clearances with a feeler gauge at locations marked X as shown in the table below.
   - No.1 cylinder compression TDC.

| Cylinder | No.1 | | No.2 | | No.3 | | No.4 | |
|---|---|---|---|---|---|---|---|---|
| Valve | INT | EXH | INT | EXH | INT | EXH | INT | EXH |
| Measurable | × | × | × | | | x | | |



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




**Valve clearance standard:**

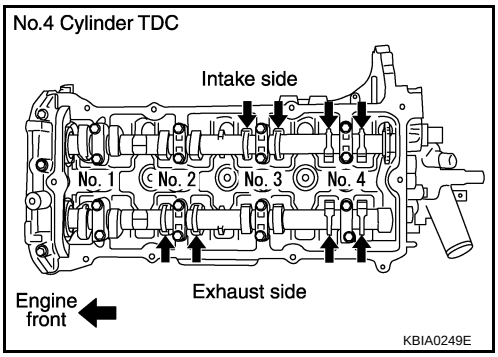
| | | |
|---|---|---|
| **Cold** | **Intake** | **: 0.24 - 0.32 mm (0.009 - 0.013 in)** |
| | **Exhaust** | **: 0.26 - 0.34 mm (0.010 - 0.013 in)** |
| **Hot*** | **Intake** | **: 0.32 - 0.40 mm (0.013 - 0.016 in)** |
| | **Exhaust** | **: 0.33 - 0.41 mm (0.013 - 0.016 in)** |

*Reference data at approximately 80°C (176°F)

**CAUTION:**

**If inspection was carried out with cold engine, check that values with fully warmed up engine are still within specifications.**

7. Turn crankshaft one complete revolution (360°) and align mark on crankshaft pulley with pointer.
8. By referring to the figure (locations indicated with black arrow), measure valve clearances with a feeler gauge at locations marked X as shown in the table below.
   - No.4 cylinder compression TDC.



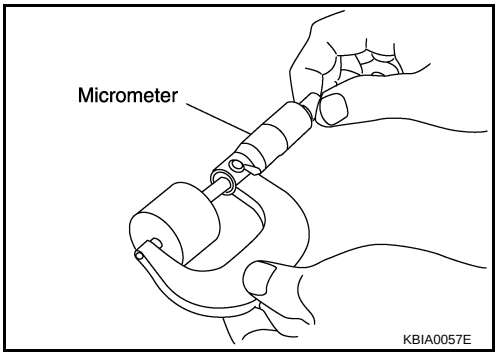

| Cylinder | No.1 | | No.2 | | No.3 | | No.4 | |
|---|---|---|---|---|---|---|---|---|
| Valve | INT | EXH | INT | EXH | INT | EXH | INT | EXH |
| Measurable | | | | x | × | | x | × |

9. If out of specifications, adjust as follows.

ADJUSTMENT

- Perform adjustment depending on selected head thickness of valve lifter.
- The specified valve lifter thickness is the dimension at normal temperatures. Ignore dimensional differences caused by temperature. Use the specifications for hot engine condition to adjust.

1. Remove camshaft. Refer to EM-40, "Removal and Installation".
2. Remove the valve lifters at the locations that are outside the standard.
3. Measure the center thickness of the removed valve lifters with a micrometer.




4. Use the equation below to calculate valve lifter thickness for replacement.
   - Valve lifter thickness calculation.

   t = t1 + (C1 - C2)

   t = Thickness of replacement valve lifter.
   t1 = Thickness of removed valve lifter.
   C1 = Measured valve clearance.
   C2 = Standard valve clearance.