MURANO OVERVIEW


Z50iA001

Murano represents NISSAN's first entry into the rapidly expanding crossover SUV segment. Murano features dramatic styling and advanced technology. Murano employs the FF-L (front-engine, front-drive) platform. Murano is equipped with the AWD (all wheel drive) system and 3.5-liter DOHC V6, derived from the award-winning VQ series engine for some models.

Standard features on Murano SE AWD include:

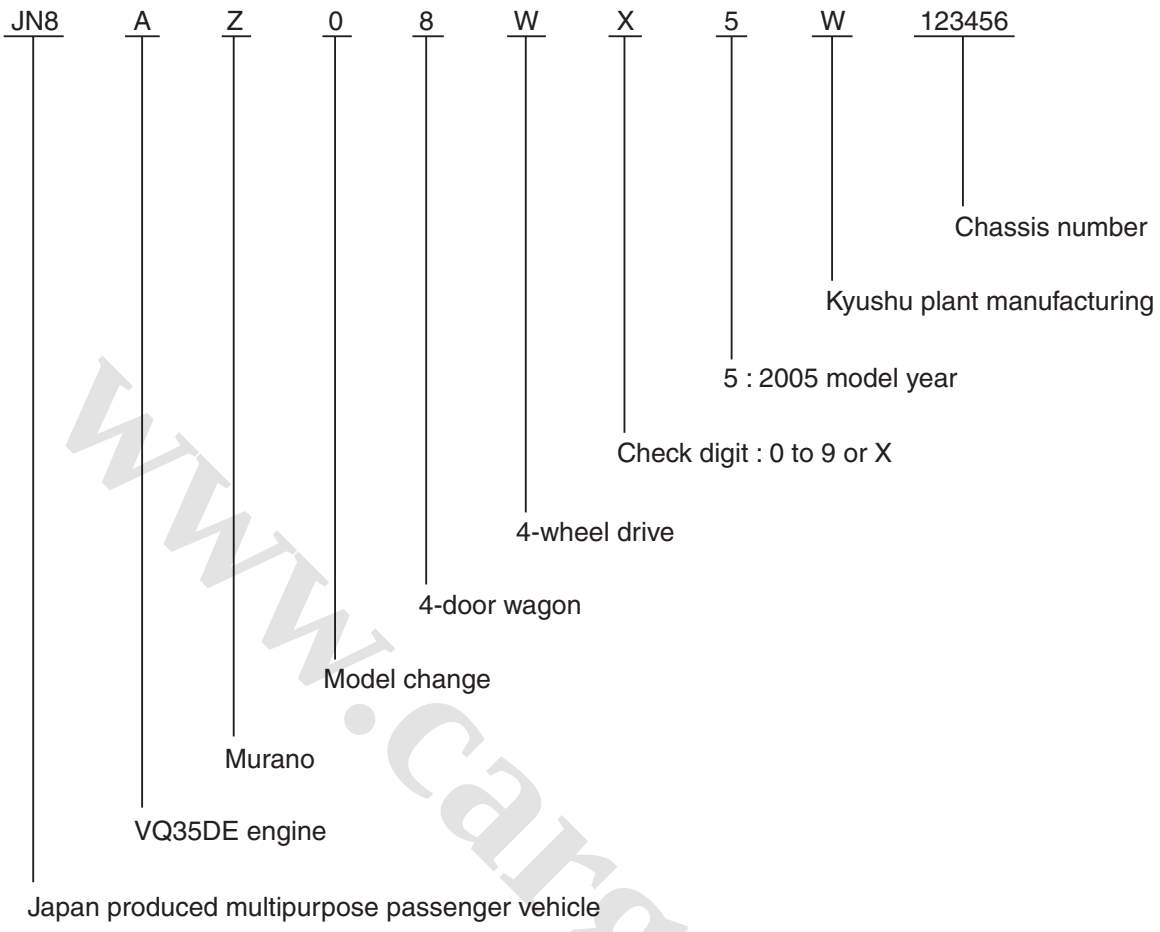
- All-new, sculpted exterior with distinctive, contemporary design guided by a sculpture in motion theme
- Wraparound surface construction with an architectural front grille, upswept D-pillars, sloping hoodline, and steeply raked windshield
- Lightweight rear cargo door
- Automatic on/off headlamp
- Chrome exhaust tip finishers
- 3.5-liter DOHC 24-valve V6 engine
- NISSAN Vehicle Immobilizer System (NVIS/NATS)
- Electronic drive-by-wire system
- Independent strut front suspension
- Independent multi-link rear suspension
- Front and rear stabilizer bars
- Power-assisted 4-wheel vented disc brakes
- 4-wheel Anti-lock Braking System (ABS)
- Brake Assist (BA)
- Electronic Brake force Distribution (EBD)
- Unibody construction engine cradle
- Sculpted front and rear seats
- Reclining rear seatbacks with 60/40 split fold-down feature and rear cargo area release
- 3-spoke leather steering wheel with controls for audio and cruise control
- Cruise control with steering-wheel-mounted controls
- ATC (digital Automatic Temperature Control) with dual-zone climate control
- Multi-functional center console
- Power windows with auto-down/up for driver's and front-passenger's windows
- Power door locks with selective unlocking

- Remote keyless entry
- VSS (Vehicle Security System)
- Information monitor with 5.8-inch LCD display
- 3-point seat belts for all seating positions
- Driver and front passenger air bags (SRS)
- Driver and front passenger side-impact air bags (SRS)
- Roof-mounted curtain side-impact air bags (SRS)
- Front seat active head restraints
- LATCH (Lower Anchors and Tether for CHildren) system
- Sport-tuned suspension (firmer front/rear springs, firmer struts/shock absorbers)
- 6-spoke design aluminum-alloy wheels
- Dark silver-colored lower bumpers
- HID (High Intensity Discharge) xenon headlamps
- Manual headlamp levelizer
- Conventional size spare tire
- Sunroof (option)
- Adjustable pedals
- Roof-mounted luggage rack rails (option)
- Bose audio system with AM/FM/cassette/in-dash 6-disc CD changer
- 2-position memory seat (option)
- Leather seats
- 4-way power passenger's seat

VIN (Vehicle Identification Number) structure

VIN plate for GCC

The VIN plate is located at the bottom LH of the windshield.



Z50iA002

Identification plate

The identification plate is located at the bottom of the B-pillar (on the driver's side). The information includes the VIN.

Chassis number

The chassis number is stamped under the passenger's seat as shown (the same as VIN).

Tire placard

The cold tire pressure is on the tire placard affixed to the driver's door center pillar.

Air conditioner specification label

The air conditioner specification label is affixed inside the hood.

Dimensions

Overall length mm (in)		4765 (187.6)
Overall width mm (in)		1880 (74.02)
Overall height mm (in)	Without roof rack rail	1689 (66.50)
	With roof rack rail	1709 (67.28)
Tread width mm (in)	Front	1630 (64.17)
	Rear	1630 (64.17)
Wheelbase mm (in)		2825 (111.2)
Minimum ground clearance mm (in)		180
Coefficient of drag (Cd)		0.39
Cargo height		850
Step-in height mm (in)	Front	457 (17.99)
	Rear	462 (18.19)
Angle of approach (degrees)		28.0˚
Angle of departure (degrees)		26.0˚

Z50iA004

Weights/capacities/EPA

Weights — Unit: kg (lb)

Curb	1795 (3958)
GVW	2292 (5055)

Capacities — Unit: ℓ (Imp qt)

Fuel tank	82 (72-1/8)
Engine oil (with filter)	4.0 (3-1/2)
Engine coolant (with reservoir)	9.2 (8-1/8)

Towing — Unit: kg (lb)

Trailer	1588 (3502)
Tongue	150 (331)

Z50iA005

Vehicle lift points

Caution

- The vehicle's center of gravity can change due to the removal of the main components (engine, transaxle, suspension, etc.). Support a jack-up point on the rear side with a transmission jack or equivalent.
- Since the vehicle's center of gravity changes when removing the main parts on the rear end (rear axle, suspension, etc.), support a jack-up point on the front end with a transmission jack or equivalent.

Vehicle hoist and safety stand

Warning

- Park the vehicle on a level surface when using the jack. Make sure to avoid damaging pipes, tubes, etc. that are under the vehicle.
- Never get under the vehicle while it is supported only by the jack. Always use safety stands when you must get under the vehicle.
- Place wheel chocks at both the front and back of the wheels on the ground.

2-pole lift

Warning

- When lifting the vehicle, open the lift arms as wide as possible and ensure that the front and rear of the vehicle are well balanced.
- When setting the lift arm, do not allow the arm to contact the brake tubes, brake cable, fuel lines or sill spoiler.

On-board lift

Warning

When lifting the vehicle, using the on-board lift, you should insert an approximately 100 mm height spacer between the lift board and urethane pad. Otherwise the lift board may interfere with the front suspension member stay.

NOTES

VQ35DE ENGINE

[Outline]
Murano is equipped with a 3.5-liter DOHC 24-valve V6 engine. This engine is derived from the NISSAN VQ engine series, which has been awarded as one of the Ten Best Engines by Auto World magazine for seven consecutive years. The advanced Murano V6 engine includes a continuously variable intake valve timing control system, noiseless timing chain for silent operation, structurally reinforced aluminum engine block and an electronically controlled drive-by-wire throttle system. It also features a modular engine design, microfinished crank journals and cam lobes, and molybdenum-coated lightweight pistons.

General specifications

Displacement cc (cu in)	3498 (213.45)
Bore and stroke mm (in)	95.5 x 81.4 (3.76 x 3.205)
Compression ratio	10.3
Maximum power kW(hp)/rpm	170 (231)/5600
Maximum torque N·m (kg-m, lb-ft)/rpm	333 (34.0, 75)/2800
Maximum engine speed rpm	6600
Induction system	Sequential multi-point fuel injection
Valve train	DOHC 4 valves per cylinder with Continuously Variable intake Valve Timing Control System (CVTCS)
Intake system	NISSAN Induction Control System (NICS)
Recommended fuel*	Unleaded premium
Emissions system	Three-way catalyst

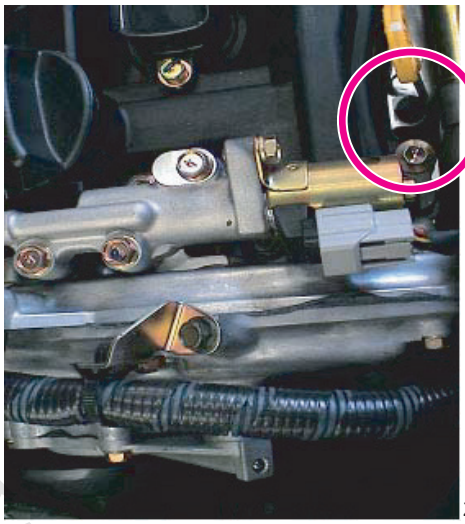
Z50iB020

*: • Premium gasoline is recommended for peak horsepower, torque and fuel economy.
• Lower fuel grades can be used, but the power and fuel economy will be lower.

Oil level gauge guide

[Construction]
The oil level gauge guide is equipped at the entrance of the cylinder head oil level gauge bore.

[Service point]
The guide makes it easy to insert the gauge.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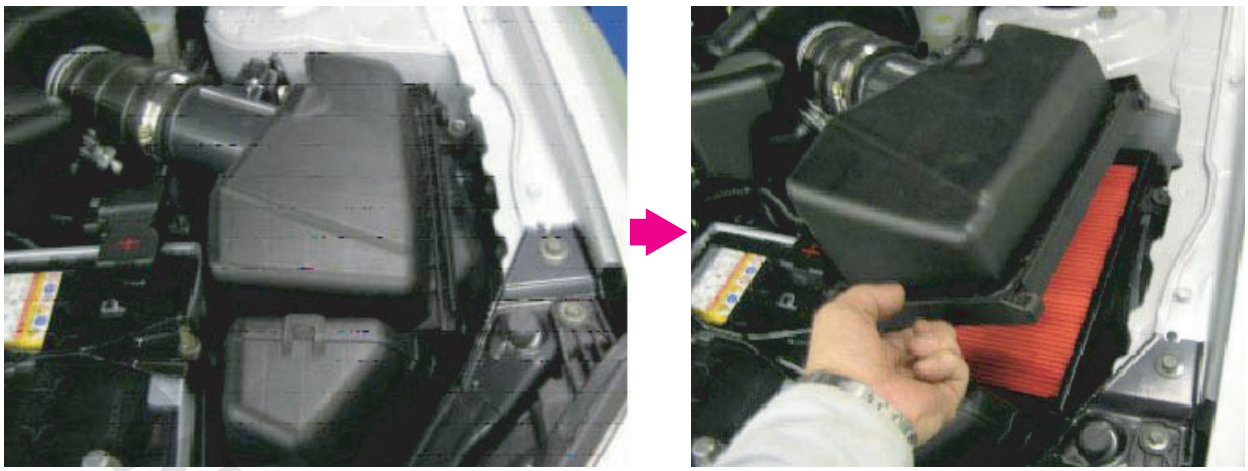
Air cleaner

[Construction]
The air cleaner cover can be easily opened by releasing the two clips.



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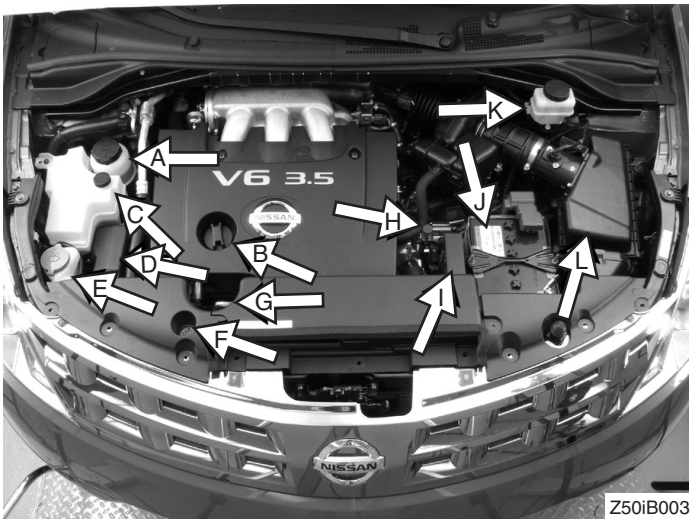
Engine component parts location

[Outline]



A: Power steering fluid reservoir
B: Engine oil filler cap
C: Engine coolant reservoir
D: IPDM E/R and fuses
E: Windshield washer fluid reservoir
F: Radiator filler cap
G: Engine oil dipstick
H: A/T dipstick
I: Fuse/fusible link holder
J: Battery/fusible links
K: Brake fluid reservoir
L: Air cleaner
ABS control unit (passenger side under the cowl top, not pictured)

Drive belts

- Murano's VQ35DE engine uses two drive belts.
  - » One drives the alternator and A/C compressor.
  - » The second drives the power steering pump.

Engine mounts

- Murano AWD models employ electronically controlled, liquid-filled front and rear engine mounts.
- To further control NVH, a damper has been installed on the front suspension member.

Engine lubrication system

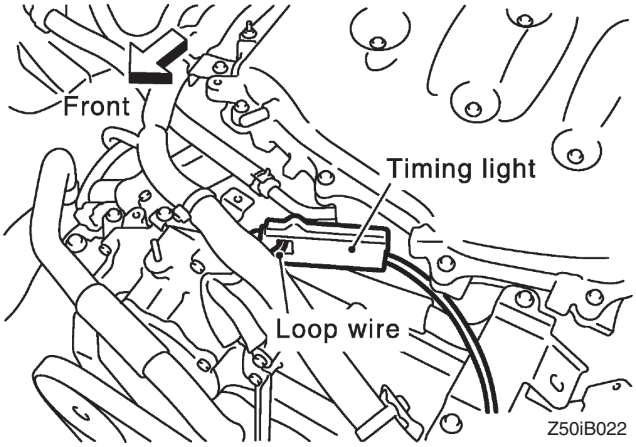
- The engine oil cooler is located between the oil pan and oil filter.
- Oil capacity (approximate)

  - » With oil filter change: 4 liters (3-1/2 Imp qt)
  - » Without oil filter change: 3.7 liters (3-1/4 Imp qt)

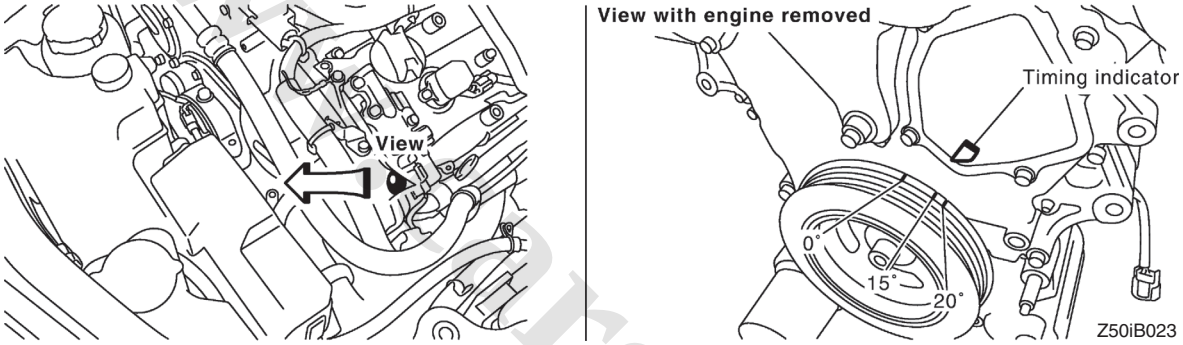
[Service point]
The refill capacity depends on the oil temperature and drain time. Always use the dipstick to determine that the proper amount of oil is in the engine.

Ignition timing

[Service point]
The ignition timing is adjusted as follows.
1. Attach a timing light to the loop wire as shown.



2. Check the ignition timing using a timing light.



15±5º BTDC (700 rpm ±50 rpm)
On the neutral or parking range of the CVT lever position.

Idle speed/ignition timing/idle mixture ratio adjustment

[Service point]

Preparation

1. Make sure that the following parts are in good condition.
   - Battery
   - Ignition system
   - Engine oil and coolant levels
   - Fuses
   - ECM harness connector
   - Vacuum hoses
   - Air intake system
   - Air tightness/leakage (oil filler cap, oil level gauge, etc.)
   - Fuel pressure
   - Engine compression
   - Throttle valve
   - Evaporative emission system
2. Make sure that the air conditioner is OFF.
3. Make sure that the shift lever is in the N position.
4. When measuring the CO percentage, insert the probe more than 40 cm (15.7 in) into the tail pipe.
5. Make sure that the headlamp, heater blower and rear window defogger are turned off.
6. Keep the front wheels set to the straight ahead position.

Engine cooling system

[Service point]
- To drain the engine coolant
  - » Remove the engine undercover with a power tool.
  - » Open the radiator drain plug at the bottom of the radiator and remove the radiator cap.
  - » Drain engine coolant from both sides of the cylinder block for draining all of the engine coolant in the system.
  - » The engine coolant capacity is 9.2 liters (8-1/8 Imp qt).
- Radiator
  - » New one-touch mounts facilitate the removal and installation of the radiator (refer to ESM Section CO for the procedure).
- Thermostat
  - » The Murano thermostat has an expanded water inlet for improved operation (refer to ESM Section CO for more information).

Cooling system specifications

[Outline]
- Thermostat operating temperature

Valve opening temperature	Valve closing temperature
80.5 - 83.5°C (177 - 182˚F)	77°C (171°F) or higher

Z50iB024

- Water pump
  - » There is a new procedure for removal with the silent timing chain (refer to ESM Section CO). The o-ring installed closest to the timing chain is identified by white paint.

WATER PUMP

PFP:21020

Removal and Installation

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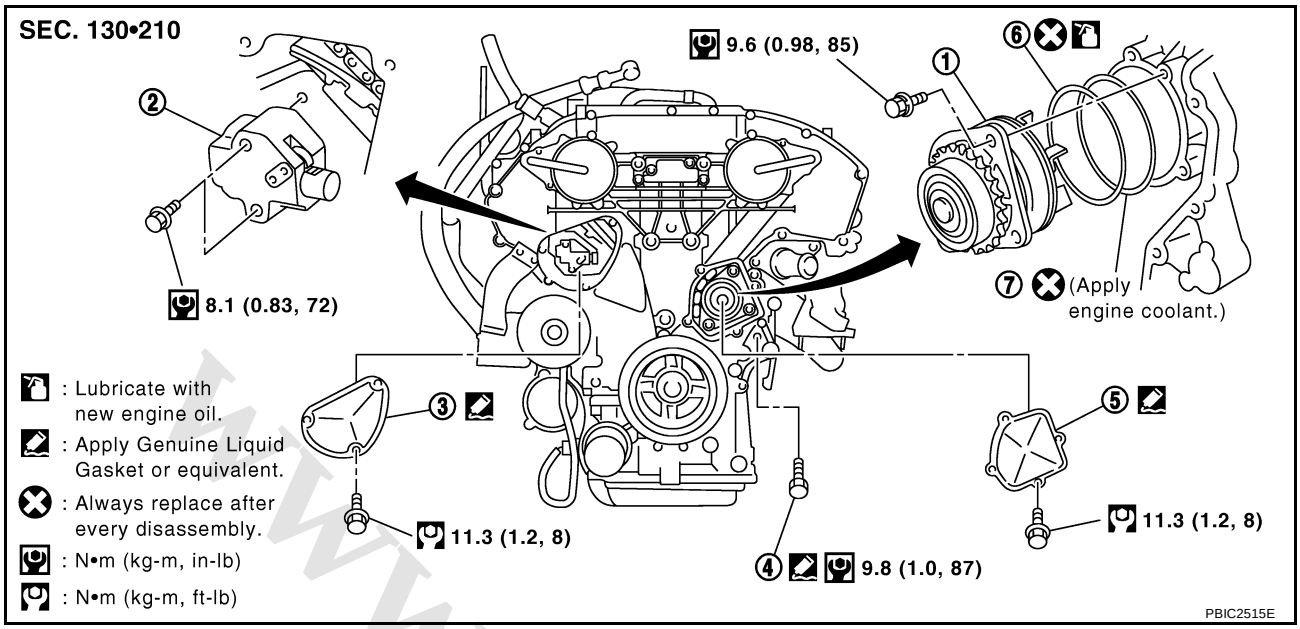


1. Water pump
2. Timing chain tensioner (primary)
3. Chain tensioner cover
4. Water drain plug (front)
5. Water pump cover
6. O-ring
7. O-ring

CAUTION:

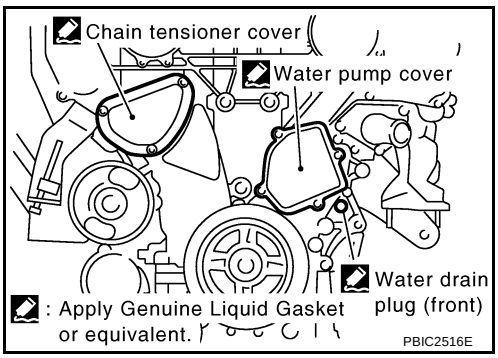
- **When removing water pump assembly, be careful not to get engine coolant on drive belt.**
- **Water pump cannot be disassembled and should be replaced as a unit.**
- **After installing water pump, connect hose and clamp securely, then check for leaks using the radiator cap tester (commercial service tool) and the radiator cap tester adapter [SST: EG17650301].**

REMOVAL

1. Remove engine cover. Refer to EM-16, "INTAKE MANIFOLD COLLECTOR" .
2. Remove air duct (inlet) and radiator cover grills (right and left sides). Refer to EM-14, "AIR CLEANER AND AIR DUCT" .
3. Remove undercover and splash guard (RH).
4. Drain engine coolant from radiator. Refer to CO-9, "Changing Engine Coolant" .

   CAUTION:
   - **Perform this step when the engine is cold.**
   - **Do not spill engine coolant on drive belts.**
5. Remove drive belts. Refer to EM-11, "DRIVE BELTS" .
6. Remove reservoir tank of radiator. Refer to CO-13, "RADIATOR" .
7. Remove reservoir tank of power steering oil pump with piping connected, and move it to aside. Refer to PS-35, "HYDRAULIC LINE" .
8. Support oil pan (lower) bottom with transmission jack.
9. Remove RH engine mounting insulator and RH engine mounting bracket. Refer to EM-104, "ENGINE ASSEMBLY" .

10. Remove water drain plug (front) on water pump side of cylinder block to drain engine coolant from engine inside.

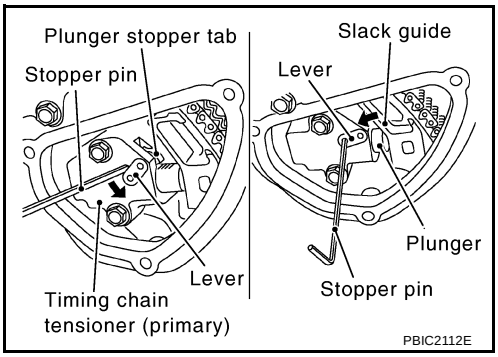


11. Remove chain tensioner cover and water pump cover from front timing chain case.
    - Use the seal cutter [SST: KV10111100] to cut liquid gasket for removal.
12. Remove idler pulley and bracket. Refer to EM-58, "TIMING CHAIN" .
13. Remove timing chain tensioner (primary) as follows:

a. Pull lever down and release plunger stopper tab.
   - Plunger stopper tab can be pushed up to release (coaxial structure with lever).

b. Insert stopper pin into tensioner body hole to hold lever, and keep tab released.

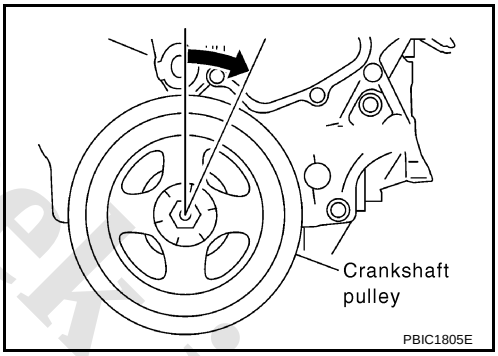
   NOTE:
   An allen wrench [2.5 mm (0.098 in)] is used for the stopper pin as an example.



c. Insert plunger into tensioner body by pressing slack guide.

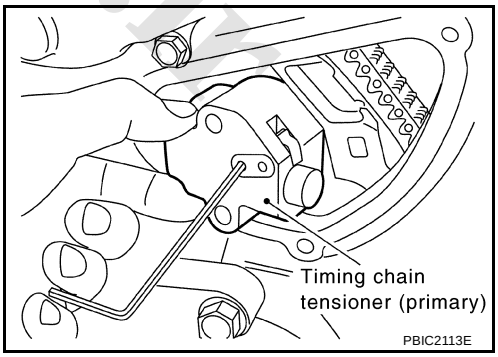
d. Keep slack guide pressed and hold plunger in by pushing stopper pin through the lever hole and tensioner body hole.

e. Turn crankshaft pulley clockwise so that timing chain on the timing chain tensioner (primary) side is loose.



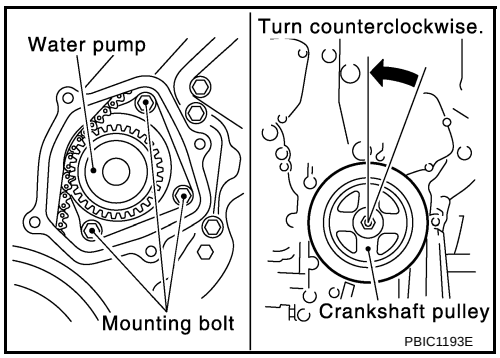
f. Remove mounting bolts and remove timing chain tensioner (primary).

   CAUTION:
   Be careful not to drop mounting bolts inside timing chain case.



14. Remove water pump as follows:

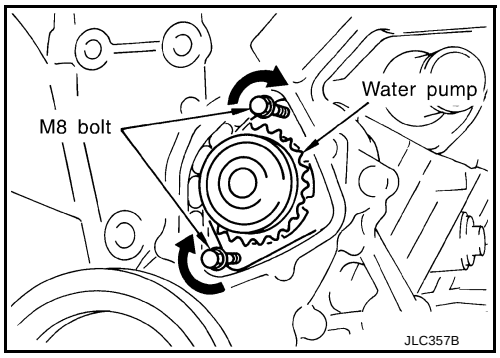
a. Remove three water pump mounting bolts. Secure a gap between water pump gear and timing chain, by turning crankshaft pulley counterclockwise until timing chain looseness on water pump sprocket becomes maximum.



b. Screw M8 bolts [pitch: 1.25 mm (0.049 in) length: approx. 50 mm (1.97 in)] into water pumps upper and lower mounting bolt holes until they reach timing chain case. Then, alternately tighten each bolt for a half turn, and pull out water pump.

CAUTION:

- **Pull straight out while preventing vane from contacting socket in installation area.**
- **Remove water pump without causing sprocket to contact timing chain.**



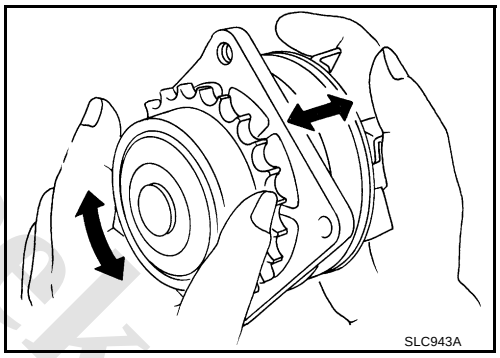
c. Remove M8 bolts and O-rings from water pump.

CAUTION:

Do not disassemble water pump.

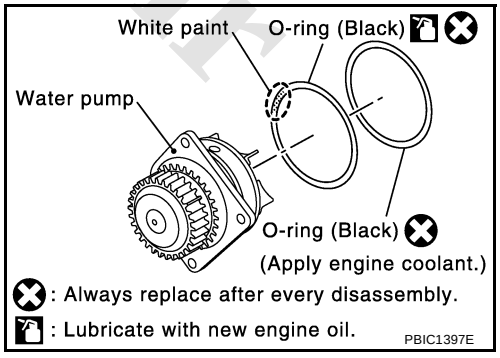
INSPECTION AFTER REMOVAL

- Check for badly rusted or corroded water pump body assembly.
- Check for rough operation due to excessive end play.
- If anything is found, replace water pump.

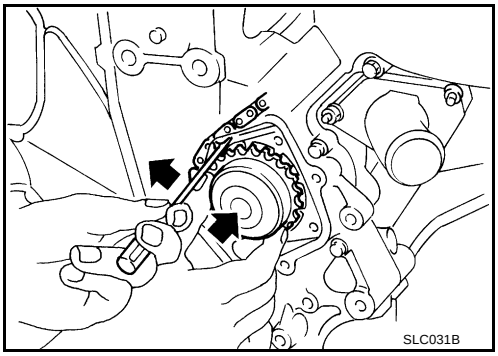


INSTALLATION

1. Install new O-rings to water pump.
   - Apply engine oil and engine coolant to O-rings as shown in the figure.
   - Locate O-ring with white paint mark to engine front side.



2. Install water pump.



CAUTION:
Do not allow cylinder block to nip O-rings when installing water pump.

- Check that timing chain and water pump sprocket are engaged.
- Insert water pump by tightening mounting bolts alternately and evenly.

3. Install timing chain tensioner (primary) as follows:

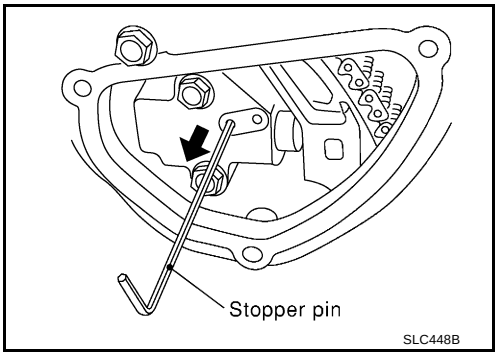
a. Remove dust and foreign material completely from backside of timing chain tensioner (primary) and from installation area of rear timing chain case.

b. Turn crankshaft pulley clockwise so that timing chain on the timing chain tensioner (primary) side is loose.

c. Install timing chain tensioner (primary) with its stopper pin attached.

CAUTION:
Be careful not to drop mounting bolts inside timing chain case.

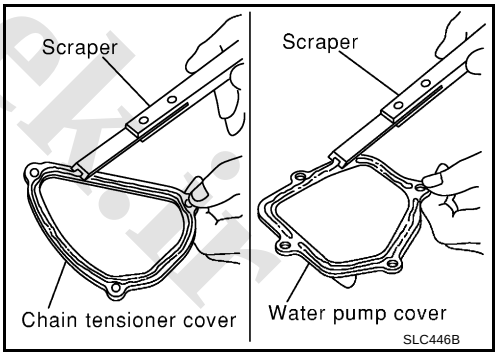
d. Remove stopper pin.



e. Make sure again that timing chain and water pump sprocket are engaged.

4. Install chain tensioner cover and water pump cover as follows:

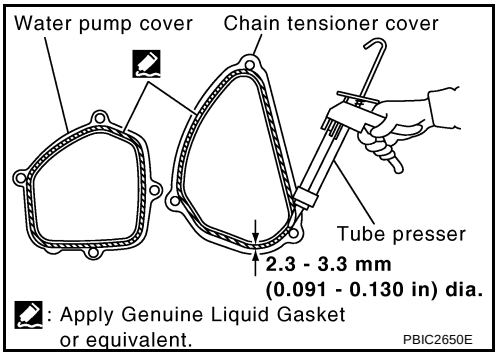
a. Before installing, remove all traces of old liquid gasket from mating surface of water pump cover and chain tensioner cover using scraper. Also remove traces of old liquid gasket from the mating surface of front timing chain case.



b. Apply a continuous bead of liquid gasket with the tube presser [SST: WS39930000] to mating surface of chain tensioner cover and water pump cover.
Use Genuine Liquid Gasket or equivalent.

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

c. Tighten mounting bolts.



5. Install water drain plug (front) on water pump side of cylinder block.

- Apply liquid gasket to the thread of water drain plug (front).
  Use Genuine Liquid Gasket or equivalent.

6. Install in the reverse order of removal after this step.
   - **After starting the engine, let idle for three minutes, then rev engine up to 3,000 rpm under no load to purge air from the high-pressure chamber of chain tensioner. Engine may produce a rattling noise. This indicates that air still remains in the chamber and is not a matter of concern.**

INSPECTION AFTER INSTALLATION

- Check for leaks of engine coolant using the radiator cap tester adapter [SST: EG17650301] and the radiator cap tester (commercial service tool). Refer to CO-9, "LEAK CHECK" .
- Start and warm up the engine. Visually make sure that there is no leaks of engine coolant.

WATER INLET AND THERMOSTAT ASSEMBLY

PFP:21200

Removal and Installation

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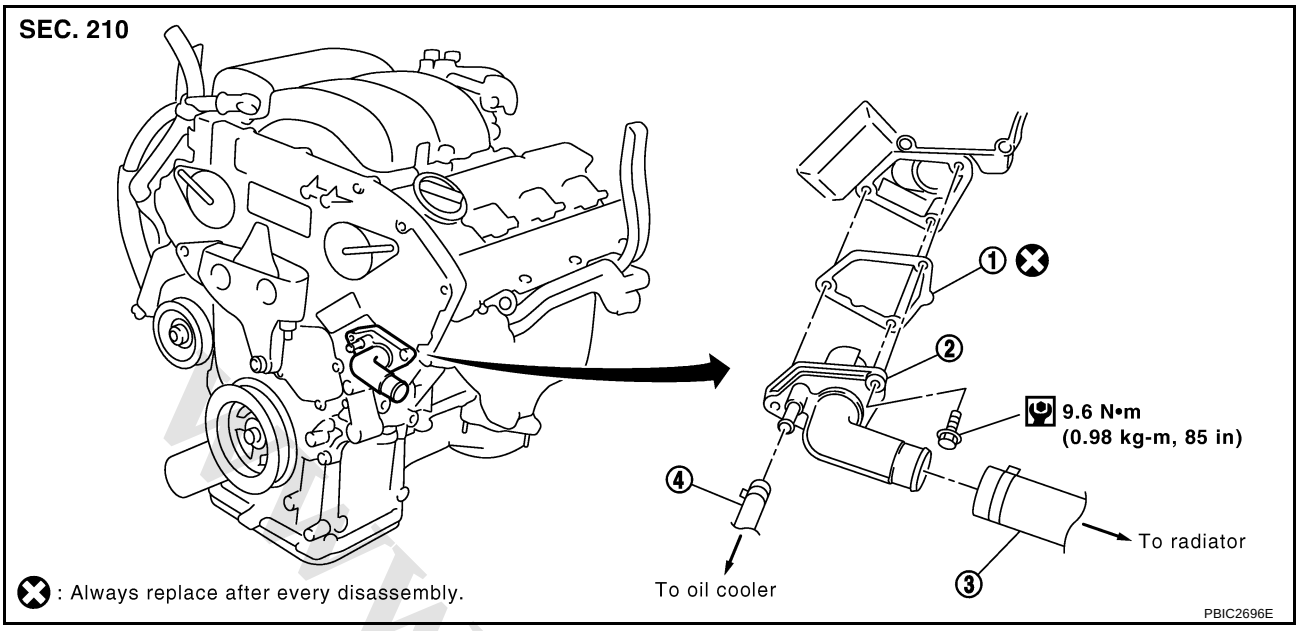


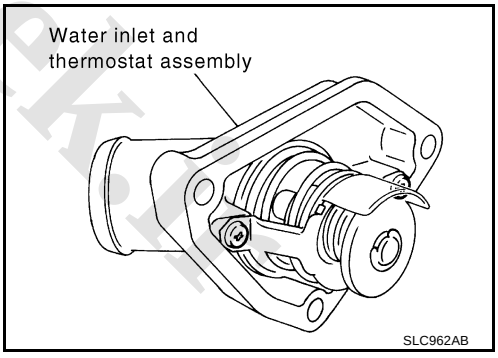
1. Gasket
2. Water inlet and thermostat assembly
3. Radiator hose (lower)
4. Water hose

REMOVAL

1. Drain engine coolant from radiator drain plug at the bottom of radiator, and from water drain plug at the front of cylinder block. Refer to CO-9, "Changing Engine Coolant" and CO-22, "WATER PUMP" .

   CAUTION:
   - **Perform this step when the engine is cold.**
   - **Do not spill engine coolant on drive belts.**
2. Remove reservoir tank of radiator, and move it aside.
3. Disconnect radiator hose (lower) and oil cooler water hose from water inlet and thermostat assembly.
4. Remove water inlet and thermostat assembly.

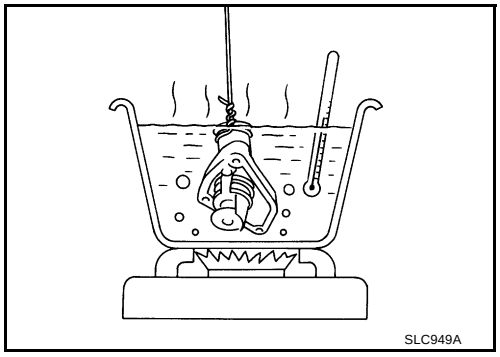
   CAUTION:
   Do not disassemble water inlet and thermostat assembly. Replace them as a unit, if necessary.



INSPECTION AFTER REMOVAL

1. Check valve seating condition at ordinary room temperatures. It should seat tightly.
2. Check valve operation.

Thermostat	Standard
Valve opening temperature	80.5 - 83.5°C (177 - 182°F)
Maximum valve lift	8.6 mm / 95°C (0.339 in / 203°F)
Valve closing temperature	77°C (171°F)



- If the malfunctioning condition, when valve seating at ordinary room temperature, or measured values are out of the standard, replace water inlet and thermostat assembly.

INSTALLATION

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

- **Be careful not to spill engine coolant over engine room. Use rag to absorb engine coolant.**

INSPECTION AFTER INSTALLATION

- Check for leaks of engine coolant using the radiator cap tester adapter [SST: EG17650301] and the radiator cap tester (commercial service tool). Refer to CO-9, "LEAK CHECK" .
- Start and warm up the engine. Visually make sure that there is no leaks of engine coolant.

Air cleaner, air duct and air flow meter

Caution

- Remove air duct (inlet), air cleaner case/MAF sensor assembly disconnecting their joints (add marks as necessary for easier installation).
- Remove MAF sensor from air cleaner case.
- Murano's MAF is a new type.
- Handle MAF sensor with care.
- Do not shock it, disassemble it, or touch its sensor.
- To change the air cleaner element
  - » Release two clips and lift up the air cleaner filter cover.
  - » Remove air cleaner filter.

1. ECCS OUTLINE

1) What's ECCS?

ECCS is the original abbreviation for Electronic Concentrated engine Control System and used to be the symbol of the improved system of the electronic controlled engine management system of its first generation (EGI or EFI).
ECCS accurately controls fuel injection quantity, idle engine speed and ignition timing for every engine condition.
In order to perform such accurate controls, ECCS requires various information to come from the sensors as input signals. Then the system determines the appropriate value among the programmed data and sends output signals to the respective actuators.

2) Purpose of ECCS Development

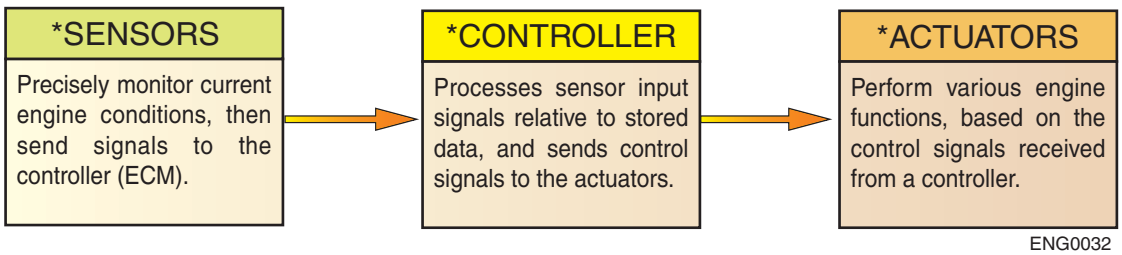
- Improve engine performance
- Improve fuel consumption
- Reduce air pollution
- Improve drivability
- Improve startability in cold condition

3) ECCS Flow System

Although particular components vary from model to model, basically, the ECCS monitors and controls these 3 primary systems to maintain the maximum engine performance.

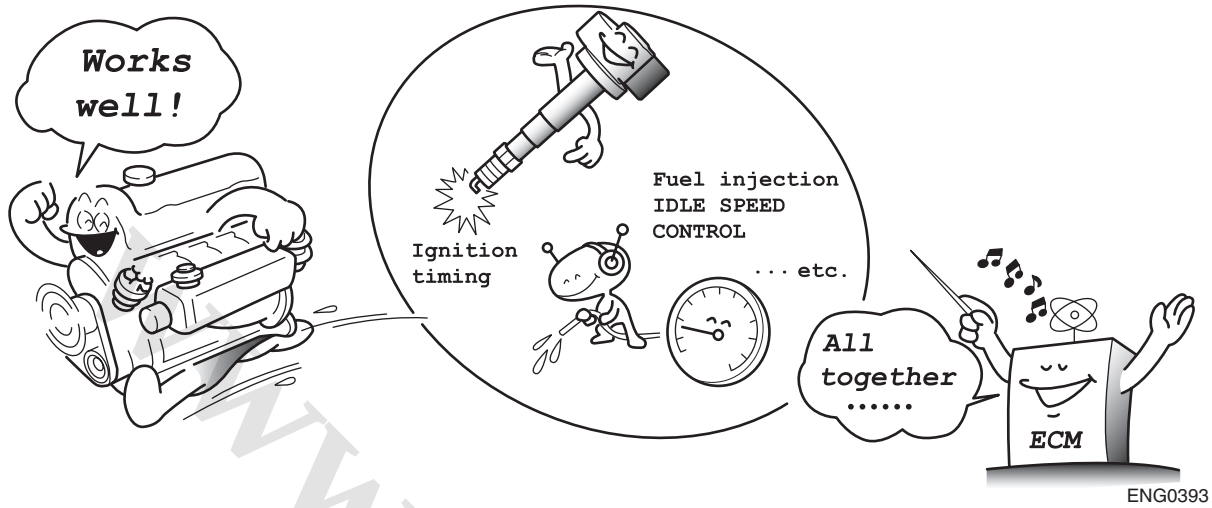
- Fuel flow system
- Air flow system
- Electronic flow (ignition) system

Constant adjustments are made to maintain a specified relationship between these systems. Understanding this relationship will allow you to more easily break down the overall engine operations into smaller segments. In doing so, you can more systematically target and/or eliminate them as part of the cause of any malfunctions. Brief descriptions of each system are found on the following pages. To maintain the operational relationship described above, the ECCS uses three basic types of components such as sensors, controllers and actuators.



2. ECCS SYSTEM CONFIGURATION

ECCS is capable of controlling a number of functions. It is also capable of providing more delicate and more sophisticated control for the various engine operating conditions.
The following functions are controlled by ECCS.



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1) Fuel Injection Control

Based on the quantity of intake air (air mass), the fuel injection control system determines the fuel injection quantity corresponding to the engine conditions.
For example, the optimum fuel injection quantity is determined by the coolant temperature at the time when the engine is operating. After idling, the air-fuel mixture ratio is properly controlled by a learning function.

2) Ignition Timing Control

Reads data from the program matrix stored in ECM and determines the optimum ignition timing based on the engine speed and the intake air quantity.

3) Fuel Pump Control

Controls the power supply to the fuel pump according to the engine conditions.
It includes a system that controls the power supply voltage value in order to reduce the pump noise and the power consumption.

4) Idle Speed Control

Receives signals from various sensors and adjusts the engine to the optimum idle speed corresponding to the engine conditions.

5) Pressure Regulator Control

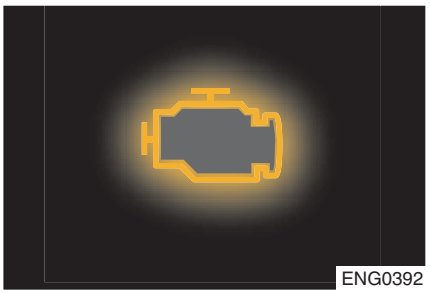
Increases the fuel pressure temporarily when starting an engine that has a high coolant temperature. The fuel pressure is normally controlled corresponding to the intake manifold vacuum pressure by means of the fuel pressure regulator.

6) Fail-Safe System

The ECM has a backup program for when a malfunction occurs in some important sensors, and the ECM is able to control the engine in a limited manner so the vehicle may be driven.

7) On Board Diagnosis System

The ECM is able to monitor major sensors and some actuators for incorrect signals. If a malfunction occurs due to missing, open or short circuits, the ECM self-diagnosis system will record a code that can be retrieved by a service technician during diagnosis.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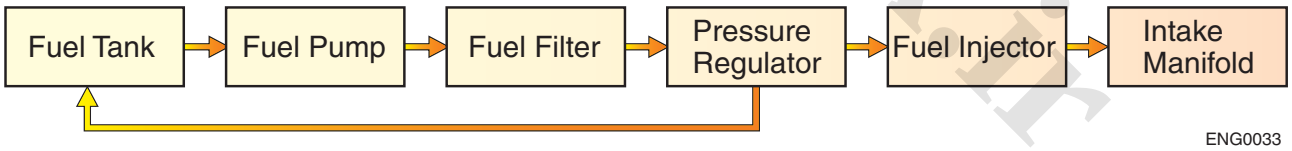
3. THREE MAJOR FLOW SYSTEMS

1) Fuel Flow System

All ECCS models have the same basic fuel flow system, as shown in the diagram below.
A fuel pump pulls the fuel from the fuel tank, moves it through the fuel lines (including a fuel filter) and eventually supplies it to the engine through the fuel injectors. The pressure control device maintains the specified fuel pressure throughout the system.



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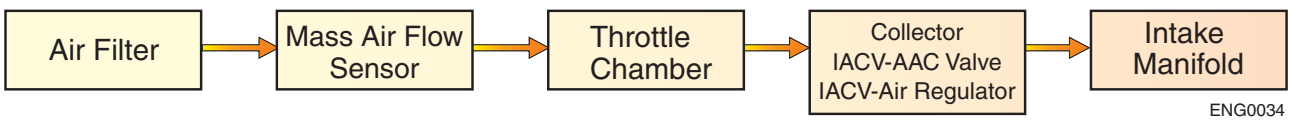
2) Air Flow System

As with the fuel flow system, ECCS air flow systems are basically the same from model to model. Since the quantity of air mixed with fuel (mixture ratio) is the key to engine performance, the control of intake air is extremely important.



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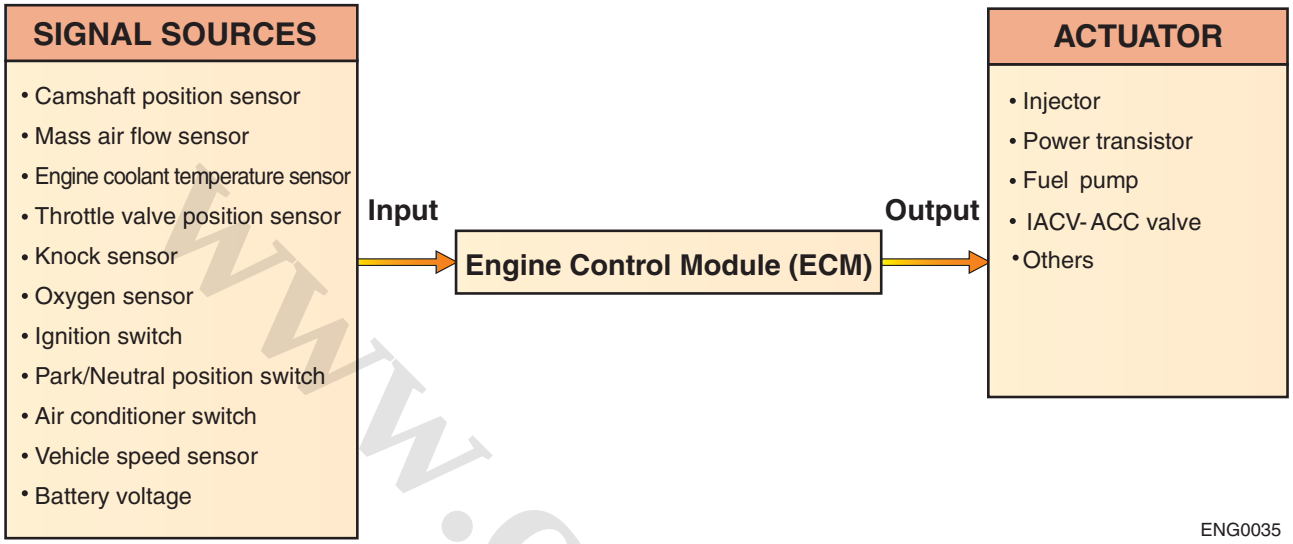
3) Electrical Flow System

The ECM receives signals primarily from the camshaft position sensor (indicating engine speed and piston position) and the mass air flow sensor (indicating mass air intake). The ECM then processes these signals and sends the resulting signals to the injectors and power transistor to control engine operation.



ON BOARD DIAGNOSTIC (OBD) SYSTEM

Introduction

INFOID:0000000003675496

The ECM has an on board diagnostic system, which detects malfunctions related to engine sensors or actuators. The ECM also records various emission-related diagnostic information including:

Emission-related diagnostic information
Diagnostic Trouble Code (DTC)
1st Trip Diagnostic Trouble Code (1st Trip DTC)

The malfunction indicator lamp (MIL) on the instrument panel lights up when the same malfunction is detected in two consecutive trips (Two trip detection logic), or when the ECM enters fail-safe mode. (Refer to EC-25, "Fail-Safe Chart".)

Two Trip Detection Logic

INFOID:0000000003675497

When a malfunction is detected for the first time, 1st trip DTC and 1st trip Freeze Frame data are stored in the ECM memory. The MIL will not light up at this stage. <1st trip>
If the same malfunction is detected again during the next drive, the DTC and Freeze Frame data are stored in the ECM memory, and the MIL lights up. The MIL lights up at the same time when the DTC is stored. <2nd trip> The “trip” in the “Two Trip Detection Logic” means a driving mode in which self-diagnosis is performed during vehicle operation. When the ECM enters fail-safe mode (Refer to EC-25, "Fail-Safe Chart".), the DTC is stored in the ECM memory even in the 1st trip.
When there is an open circuit on MIL circuit, the ECM cannot warn the driver by lighting up MIL when there is malfunction on engine control system.
Therefore, when electrical controlled throttle and part of ECM related diagnoses are continuously detected as NG for 5 trips, ECM warns the driver that engine control system malfunctions and MIL circuit is open by means of operating fail-safe function.
The fail-safe function also operates when above diagnoses except MIL circuit are detected and demands the driver to repair the malfunction.

Engine operating condition in fail-safe mode	Engine speed will not rise more than 2,500 rpm due to the fuel cut

Emission-related Diagnostic Information

INFOID:0000000003675498

EMISSION-RELATED DIAGNOSTIC INFORMATION ITEMS

×: Applicable –: Not applicable

Items	DTC*1 *2	Trip	MIL	Reference page
CAN COMM CIRCUIT	U1000	2	—	EC-66
CAN COMM CIRCUIT	U1001	2	—	EC-66
NO DTC IS DETECTED. FURTHER TESTING MAY BE REQUIRED.	**P0000**	—	—	—
INT/V TIM CONT-B1	P0011	2	—	EC-68
INT/V TIM CONT-B2	P0021	2	—	EC-68
MAF SEN/CIRCUIT	P0102	1	×	EC-70
MAF SEN/CIRCUIT	P0103	1	×	EC-70
ECT SEN/CIRC	P0117	2	×	EC-73
ECT SEN/CIRC	P0118	2	×	EC-73
TP SEN 2/CIRC	P0122	1	×	EC-76
TP SEN 2/CIRC	P0123	1	×	EC-76
HO2S2 (B1)	P0138	2	×	EC-79
HO2S2 (B2)	P0158	2	×	EC-79
TP SEN 1/CIRC	P0222	1	×	EC-84

Items	DTC*1 *2	Trip	MIL	Reference page
TP SEN 1/CIRC	P0223	1	×	EC-84
KNOCK SEN/CIRC-B1	P0327	2	—	EC-87
KNOCK SEN/CIRC-B1	P0328	2	—	EC-87
CKP SEN/CIRCUIT	P0335	2	×	EC-90
CMP SEN/CIRC-B1	P0340	2	×	EC-93
CMP SEN/CIRC-B2	P0345	2	×	EC-93
PW ST P SEN/CIRC	P0550	2	—	EC-98
ECM	P0605	1 or 2	× or —	EC-100
A/F SEN1 HTR (B1)	P1031	2	×	EC-102
A/F SEN1 HTR (B1)	P1032	2	×	EC-102
A/F SEN1 HTR (B2)	P1051	2	×	EC-102
A/F SEN1 HTR (B2)	P1052	2	×	EC-102
ECM BACK UP/CIRCUIT	P1065	2	×	EC-107
INT/V TIM V/CIR-B1	P1111	2	×	EC-110
ETC ACTR	P1121	1	×	EC-115
ETC FUNCTION/CIRC	P1122	1	×	EC-117
ETC MOT PWR	P1124	1	×	EC-120
ETC MOT PWR	P1126	1	×	EC-120
ETC MOT	P1128	1	×	EC-123
INT/V TIM V/CIR-B2	P1136	2	×	EC-110
TCS C/U FUNCTN	P1211	2	—	EC-126
TCS/CIRC	P1212	2	—	EC-127
ENG OVER TEMP	P1217	1	×	EC-128
CTP LEARNING	P1225	2	—	EC-136
CTP LEARNING	P1226	2	—	EC-137
SENSOR POWER/CIRC	P1229	1	×	EC-138
A/F SENSOR1 (B1)	P1271	2	×	EC-141
A/F SENSOR1 (B1)	P1272	2	×	EC-147
A/F SENSOR1 (B1)	P1276	2	×	EC-153
A/F SENSOR1 (B2)	P1281	2	×	EC-141
A/F SENSOR1 (B2)	P1282	2	×	EC-147
A/F SENSOR1 (B2)	P1286	2	×	EC-153
ASCD SW	P1564	1	—	EC-158
ASCD BRAKE SW	P1572	1	—	EC-161
ASCD VHL SPD SEN	P1574	1	—	EC-165
CVT C/U FUNCT	P1700	1	—	EC-166
P-N POS SW/CIRCUIT	P1706	2	×	EC-167
IN PULY SPEED	P1715	2	—	EC-170
V/SP SEN (A/T OUT)	P1720	2	—	EC-171
BRAKE SW/CIRCUIT	P1805	1	×	EC-172
APP SEN 1/CIRC	P2122	1	×	EC-175
APP SEN 1/CIRC	P2123	1	×	EC-175
APP SEN 2/CIRC	P2127	1	×	EC-178
APP SEN 2/CIRC	P2128	1	×	EC-178

Items	DTC*1 *2	Trip	MIL	Reference page
TP SENSOR	P2135	1	×	EC-181
APP SENSOR	P2138	1	×	EC-184

*1: 1st trip DTC No. is the same as DTC No.

*2: With omission of the letter “P” and “U”, the same DTC is applied for the diagnosis test mode II of the ECM.

DTC AND 1ST TRIP DTC

The 1st trip DTC (whose number is the same as the DTC number) is displayed for the latest self-diagnostic result obtained. If the ECM memory was cleared previously, and the 1st trip DTC did not reoccur, the 1st trip DTC will not be displayed.
If a malfunction is detected during the 1st trip, the 1st trip DTC is stored in the ECM memory. The MIL will not light up (two trip detection logic). If the same malfunction is not detected in the 2nd trip (meeting the required driving pattern), the 1st trip DTC is cleared from the ECM memory. If the same malfunction is detected in the 2nd trip, both the 1st trip DTC and DTC are stored in the ECM memory and the MIL lights up. In other words, the DTC is stored in the ECM memory and the MIL lights up when the same malfunction occurs in two consecutive trips. If a 1st trip DTC is stored and a non-diagnostic operation is performed between the 1st and 2nd trips, only the 1st trip DTC will continue to be stored. For fail-safe items, the DTC is stored in the ECM memory even in the 1st trip.
Procedures for clearing the DTC and the 1st trip DTC from the ECM memory are described in “HOW TO ERASE EMISSION-RELATED DIAGNOSTIC INFORMATION”.
When a 1st trip DTC is detected, check, write down and erase (1st trip) DTC as specified in Work Flow procedure Step 2, refer to EC-20, "Trouble Diagnosis Introduction". Then perform DTC Confirmation Procedure or Overall Function Check to try to duplicate the malfunction. If the malfunction is duplicated, the item requires repair.

How to Read DTC and 1st Trip DTC

DTC and 1st trip DTC can be read by the following methods.
The number of blinks of the MIL in the Diagnostic Test Mode II (Self-Diagnostic Results) indicates the DTC. Example: 0117, 0340, 1065, etc.

- **1st trip DTC No. is the same as DTC No.**

HOW TO ERASE EMISSION-RELATED DIAGNOSTIC INFORMATION

How to Erase DTC

1. If the ignition switch stays ON after repair work, be sure to turn ignition switch OFF once.
2. Wait at least 10 seconds and then turn it ON (engine stopped) again.
3. Change the diagnostic test mode from Mode II to Mode I by depressing the accelerator pedal.

- **If the battery is disconnected, the emission-related diagnostic information will be lost within 24 hours.**
- **The following data are cleared when the ECM memory is erased.**

- Diagnostic trouble codes
- 1st trip diagnostic trouble codes

Actual work procedures are explained using a DTC as an example. Be careful so that not only the DTC, but all of the data listed above, are cleared from the ECM memory during work procedures.

Procedure After Replacing ECM

INFOID:0000000003761081

When replacing ECM, the following procedure must be performed.

1. Perform EC-16, "Accelerator Pedal Released Position Learning".
2. Perform EC-17, "Throttle Valve Closed Position Learning".
3. Perform EC-17, "Idle Air Volume Learning".

Accelerator Pedal Released Position Learning

INFOID:0000000003761082

DESCRIPTION

Accelerator Pedal Released Position Learning is an operation to learn the fully released position of the accelerator pedal by monitoring the accelerator pedal position sensor output signal. It must be performed each time harness connector of accelerator pedal position sensor or ECM is disconnected.

OPERATION PROCEDURE

HOW TO SWITCH DIAGNOSTIC TEST MODE

NOTE:

- **It is better to count the time accurately with a clock.**
- **It is impossible to switch the diagnostic mode when an accelerator pedal position sensor circuit has a malfunction.**
- **Always ECM returns to Diagnostic Test Mode I after ignition switch is turned OFF.**

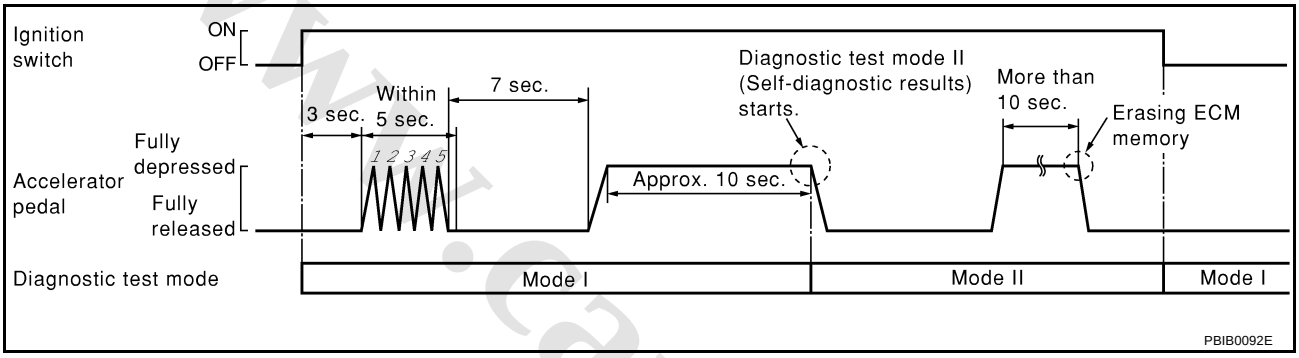
How to Set Diagnostic Test Mode II (Self-diagnostic Results)

1. Confirm that accelerator pedal is fully released, turn ignition switch ON and wait 3 seconds.
2. Repeat the following procedure quickly five times within 5 seconds.

a. Fully depress the accelerator pedal.

b. Fully release the accelerator pedal.

3. Wait 7 seconds, fully depress the accelerator pedal and keep it for approx. 10 seconds until the MIL starts blinking.
4. Fully release the accelerator pedal.
   ECM has entered to Diagnostic Test Mode II (Self-diagnostic results).

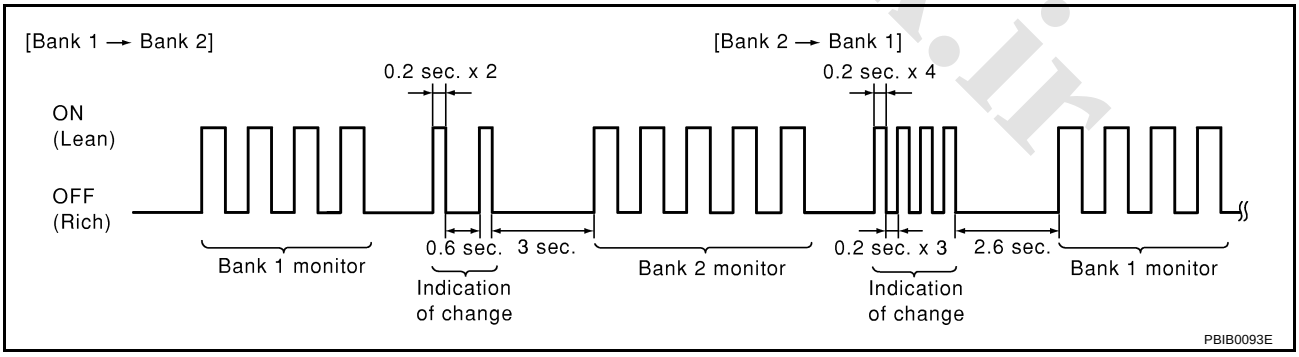


How to Set Diagnostic Test Mode II (Heated Oxygen Sensor 1 Monitor)

1. Set the ECM in Diagnostic Test Mode II (Self-diagnostic results). Refer to EC-465, "How to Set Diagnostic Test Mode II (Self-diagnostic Results)" .
2. Start Engine.
   ECM has entered to Diagnostic Test Mode II (Heated oxygen sensor 1 monitor).
   ECM will start heated oxygen sensor 1 monitoring from the bank 1 sensor.

How to Switch Monitored Sensor From Bank 1 to Bank 2 or Vice Versa

1. Fully depress the accelerator pedal quickly and then release it immediately.
2. Make sure that monitoring sensor has changed by MIL blinking as follows.



How to Erase Diagnostic Test Mode II (Self-diagnostic Results)

1. Set ECM in Diagnostic Test Mode II (Self-diagnostic results). Refer to EC-465, "How to Set Diagnostic Test Mode II (Self-diagnostic Results)" .
2. Fully depress the accelerator pedal and keep it for more than 10 seconds.
   The emission-related diagnostic information has been erased from the backup memory in the ECM.
3. Fully release the accelerator pedal, and confirm the DTC 0000 is displayed.

DIAGNOSTIC TEST MODE I — BULB CHECK

In this mode, the MIL on the instrument panel should stay ON. If it remains OFF, check the bulb. Refer to DI-46, "WARNING LAMPS" or see EC-930, "MIL AND DATA LINK CONNECTOR" .

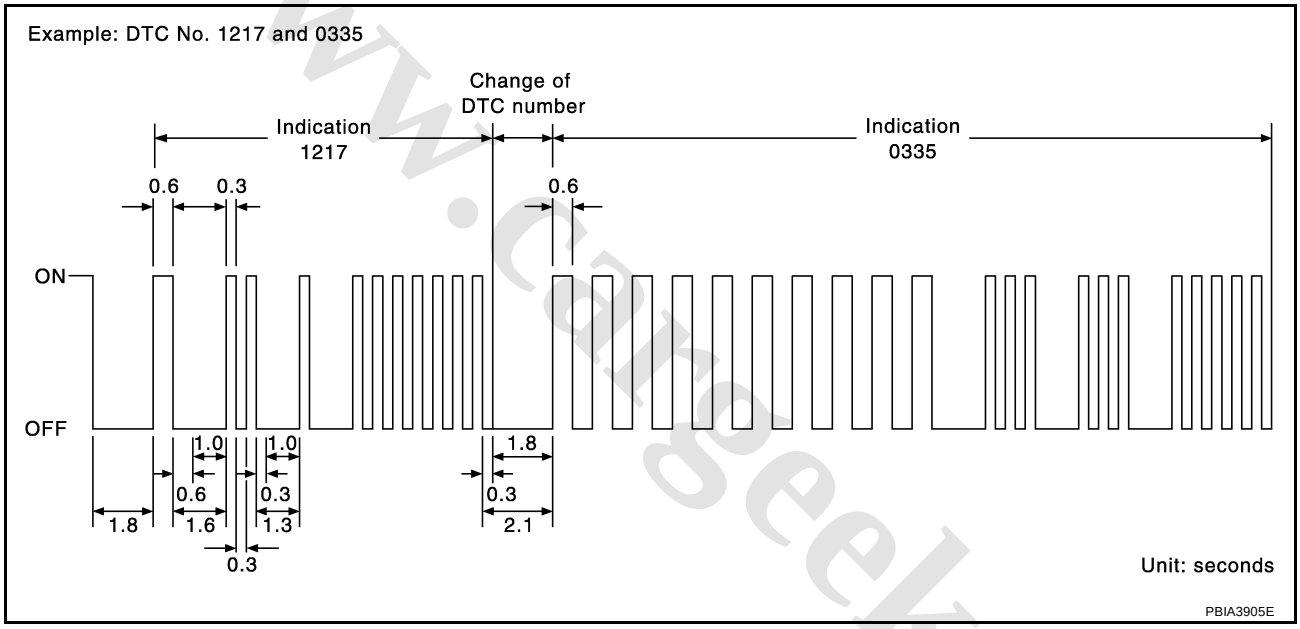
DIAGNOSTIC TEST MODE I — MALFUNCTION WARNING

MIL	Condition
ON	When the malfunction is detected.
OFF	No malfunction.

These DTC numbers are clarified in Diagnostic Test Mode II (SELF-DIAGNOSTIC RESULTS)

DIAGNOSTIC TEST MODE II — SELF-DIAGNOSTIC RESULTS

In this mode, the DTC and 1st trip DTC are indicated by the number of blinks of the MIL as shown below.
The DTC and 1st trip DTC are displayed at the same time. If the MIL does not illuminate in diagnostic test mode I (Malfunction warning), all displayed items are 1st trip DTCs. If only one code is displayed when the MIL illuminates in diagnostic test mode II (SELF-DIAGNOSTIC RESULTS), it is a DTC; if two or more codes are displayed, they may be either DTCs or 1st trip DTCs. DTC No. is same as that of 1st trip DTC. These unidentified codes can be identified by using the CONSULT-II or GST. A DTC will be used as an example for how to read a code.



A particular trouble code can be identified by the number of four-digit numeral flashes. The “zero” is indicated by the number of ten flashes. The length of time the 1,000th-digit numeral flashes on and off is 1.2 seconds consisting of an ON (0.6-second) - OFF (0.6-second) cycle.
The 100th-digit numeral and lower digit numerals consist of a 0.3-second ON and 0.3-second OFF cycle.
A change from one digit numeral to another occurs at an interval of 1.0-second OFF. In other words, the later numeral appears on the display 1.3 seconds after the former numeral has disappeared.
A change from one trouble code to another occurs at an interval of 1.8-second OFF.
In this way, all the detected malfunctions are classified by their DTC numbers. The DTC “0000” refers to no malfunction. (See EC-415, "INDEX FOR DTC")

How to Erase Diagnostic Test Mode II (Self-diagnostic Results)

The DTC can be erased from the back up memory in the ECM by depressing accelerator pedal. Refer to EC-465, "How to Erase Diagnostic Test Mode II (Self-diagnostic Results)" .

- **If the battery is disconnected, the DTC will be lost from the backup memory within hours.**
- **Be careful not to erase the stored memory before starting trouble diagnoses.**

DIAGNOSTIC TEST MODE II — HEATED OXYGEN SENSOR 1 MONITOR

In this mode, the MIL displays the condition of the fuel mixture (lean or rich) which is monitored by the heated oxygen sensor 1.

MIL	Fuel mixture condition in the exhaust gas	Air fuel ratio feedback control condition
ON	Lean	Closed loop system
OFF	Rich	
*Remains ON or OFF	Any condition	Open loop system

*: Maintains conditions just before switching to open loop.

To check the heated oxygen sensor 1 function, start engine in the Diagnostic Test Mode II and warm it up until engine coolant temperature indicator points to the middle of the gauge.
Next run engine at about 2,000 rpm for about 2 minutes under no-load conditions. Then make sure that the MIL comes ON more than 5 times within 10 seconds with engine running at 2,000 rpm under no-load.

OBD System Operation Chart

ABS00DWJ

RELATIONSHIP BETWEEN MIL, 1ST TRIP DTC, DTC, AND DETECTABLE ITEMS

- When a malfunction is detected for the first time, the 1st trip DTC and the 1st trip freeze frame data are stored in the ECM memory.
- When the same malfunction is detected in two consecutive trips, the DTC and the freeze frame data are stored in the ECM memory, and the MIL will come on. For details, refer to EC-452, "Two Trip Detection Logic" .
- The MIL will go off after the vehicle is driven 3 times with no malfunction. The drive is counted only when the recorded driving pattern is met (as stored in the ECM). If another malfunction occurs while counting, the counter will reset.
- The DTC and the freeze frame data will be stored until the vehicle is driven 40 times (driving pattern A) without the same malfunction recurring (except for Misfire and Fuel Injection System). For Misfire and Fuel Injection System, the DTC and freeze frame data will be stored until the vehicle is driven 80 times (driving pattern C) without the same malfunction recurring. The “TIME” in “SELF-DIAGNOSTIC RESULTS” mode of CONSULT-II will count the number of times the vehicle is driven.
- The 1st trip DTC is not displayed when the self-diagnosis results in OK for the 2nd trip.

SUMMARY CHART

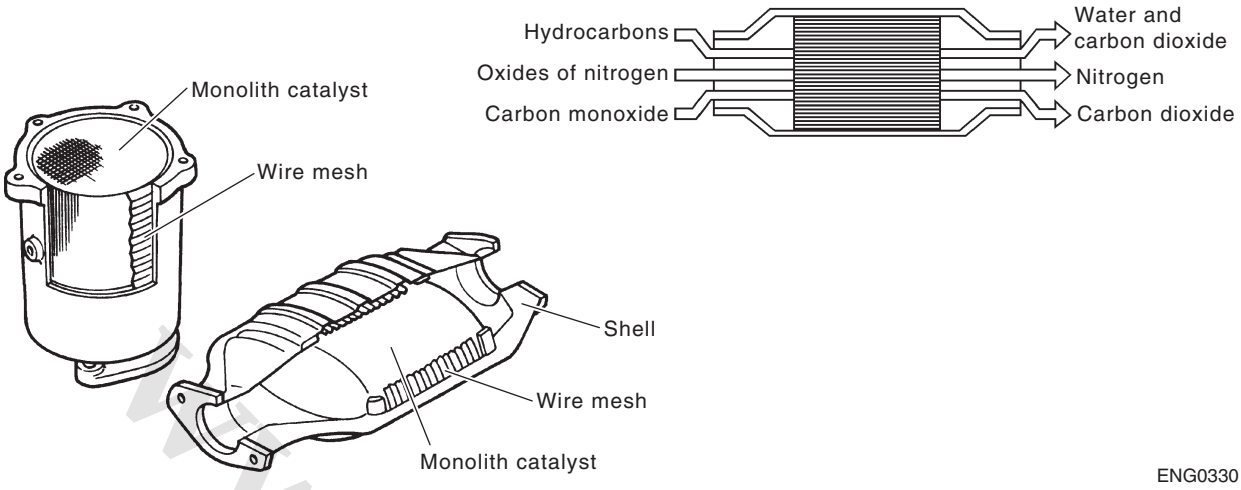
Items	Fuel Injection System	Misfire	Other
MIL (goes off)	3 (pattern B)	3 (pattern B)	3 (pattern B)
DTC, Freeze Frame Data (no display)	80 (pattern C)	80 (pattern C)	40 (pattern A)
1st Trip DTC (clear)	1 (pattern C), *1	1 (pattern C), *1	1 (pattern B)
1st Trip Freeze Frame Data (clear)	*1, *2	*1, *2	1 (pattern B)

For details about patterns B and C under “Fuel Injection System” and “Misfire”, see EC-469 .
For details about patterns A and B under “Other”, see EC-471 .
*1: Clear timing is at the moment OK is detected.
*2: Clear timing is when the same malfunction is detected in the 2nd trip.

EVAP system

[Outline]
- The EVAP canister is located under the vehicle.
- The following EVAP components are located in the engine compartment.
  - » EVAP canister purge volume control solenoid valve
  - » Intake manifold collector

1) Three-way Catalyst (TWC)



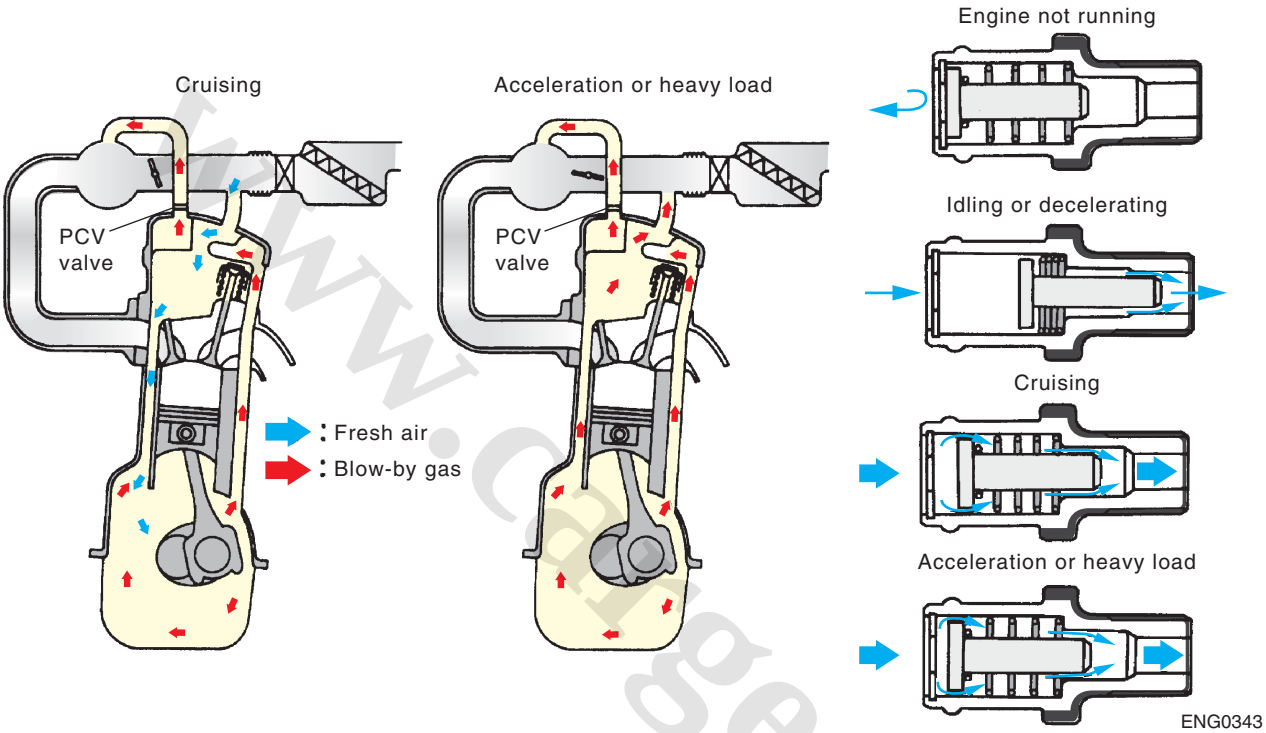
The three-way catalyst is fitted into the exhaust system between the manifold and the silencer. It consists of a chamber where a chemical reaction takes place to change toxic and harmful gases into less harmful ones. The three-way catalyst will change approximately 90% of the CO, HC and NOx to carbon dioxide (CO_2), nitrogen (N_2) and water (H_2O).
In order to convert these three toxic gases efficiently at the same time, it is necessary to control the air-fuel mixture within a narrow range near the stoichiometric ratio (14.7 to 1). To maintain the required mixture ratio, the system utilizes the closed loop system using the oxygen sensor.

The function of the three-way catalyst is explained in the e-Learning program provided here.

e-Learning

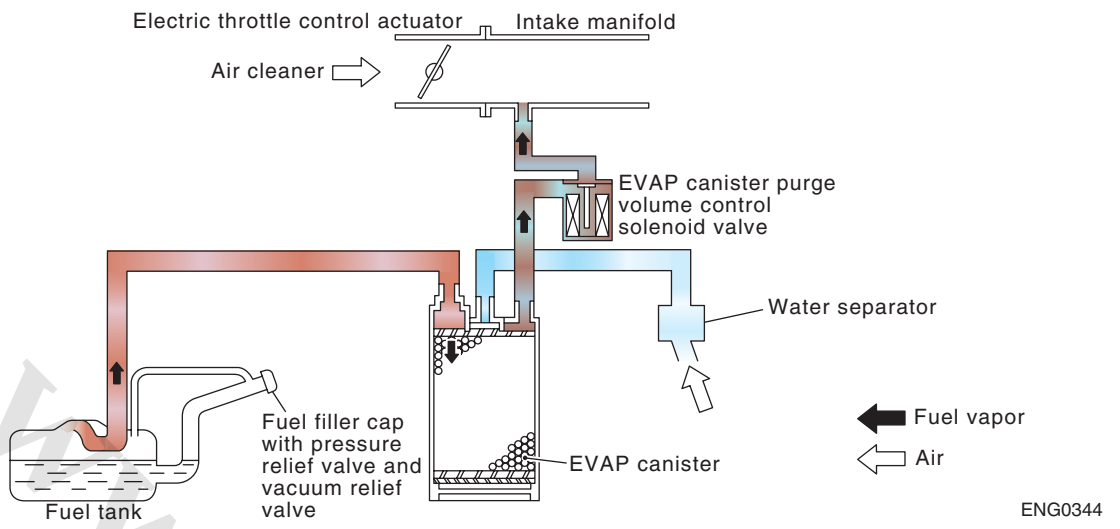
3) Crankcase Emission (Blow-by Gas) Control System

The crankcase emission control system is designed to allow the engine crankcase to breathe but also to prevent blow-by gas (HC and CO) from escaping into the atmosphere.
The system incorporates a positive crankcase ventilation (PCV) valve and connecting hose. When operating, the system allows the blow-by gas to be drawn from the crankcase into the inlet manifold, which thereby prevents the HC from being discharged.



The PCV system returns blow-by gas to both the intake manifold and air cleaner. During idle and light load conditions, the intake manifold vacuum sucks the blow-by gas through the PCV valve. Filtered air is supplied from the air cleaner to the crankcase via the rocker cover. During acceleration or under heavy load conditions, the manifold vacuum may be too little to draw all of the blow-by gas through the PCV valve. Blow-by gas may then also flow through the rocker cover to the air cleaner, where it is mixed with incoming air.

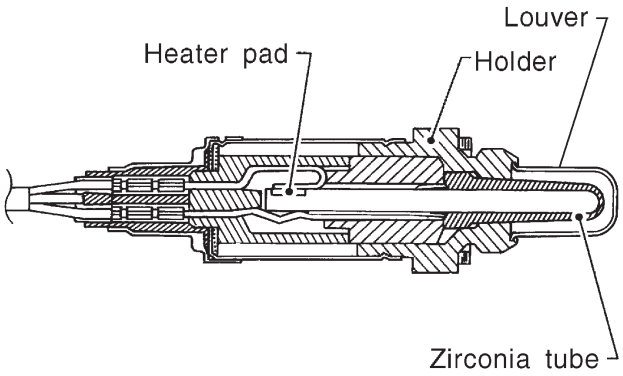
4) Evaporative Fuel Control System (EVAP)



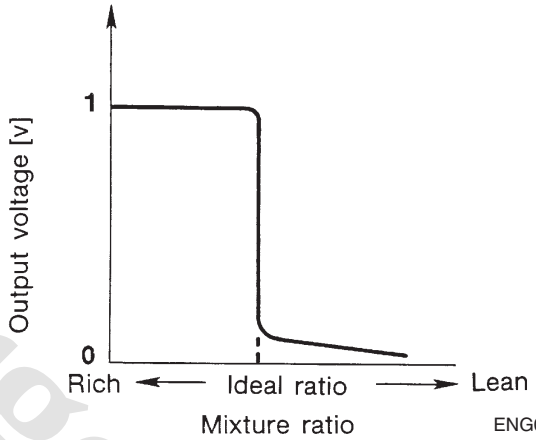
The EVAP system is designed to reduce the hydrocarbons emitted into the atmosphere from the fuel system. This reduction is achieved by using activated charcoal in the EVAP canister. Fuel vapor from the sealed fuel tank passes into the EVAP canister where it is stored when the engine is not running or is at idle speed. The vapor in the EVAP canister is purged by the air through the purge volume control solenoid valve that is controlled by ECM. When the engine operates, the flow rate of vapor controlled by the EVAP canister purge volume control solenoid valve is proportionally regulated as the air flow increases.

5) Heated Oxygen Sensor

The oxygen sensor detects the amount of oxygen in the exhaust gas compared to the outside air. The heated oxygen sensor has a closed-end tube made of ceramic zirconia. The zirconia generates voltage from approximately 1V in richer conditions to 0V in leaner conditions. The heated oxygen sensor signal is sent to the ECM. The ECM adjusts the injection pulse duration to achieve the ideal air-fuel ratio. The ideal air-fuel ratio occurs near the radical change from 1V to 0V.



ENG0443



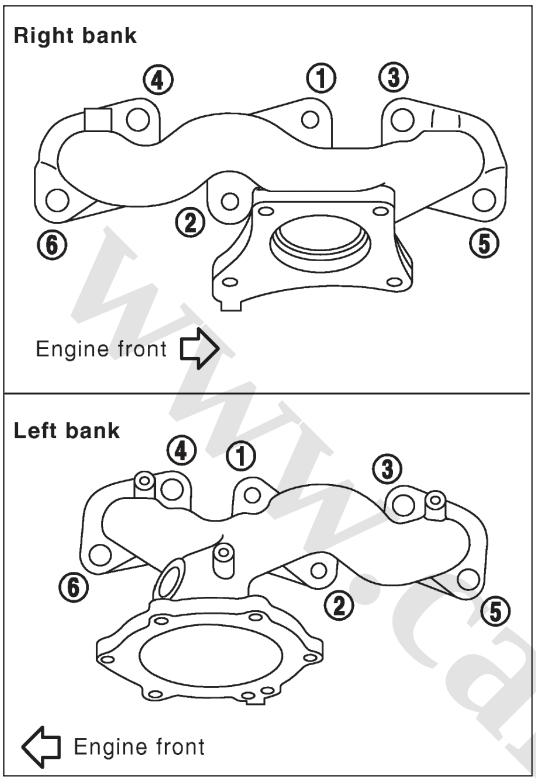
ENG0444

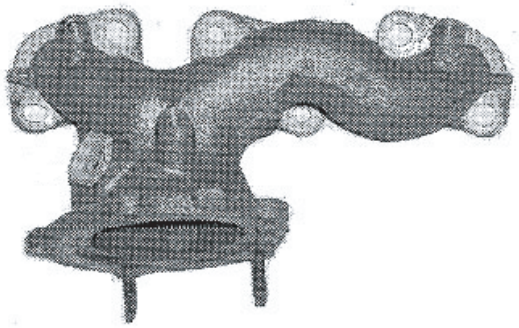
MONITOR ITEM	CONDITION		REFERENCE VALUE
HO2S1 (B1)	•Engine: After warming up	Maintaining engine speed at 2,000 rpm	0 - 0.3V←→Approx. 0.6 - 1.0V
HO2S1 MNTR (B1)			LEAN←→RICH Changes more than 5 times during 10 seconds.

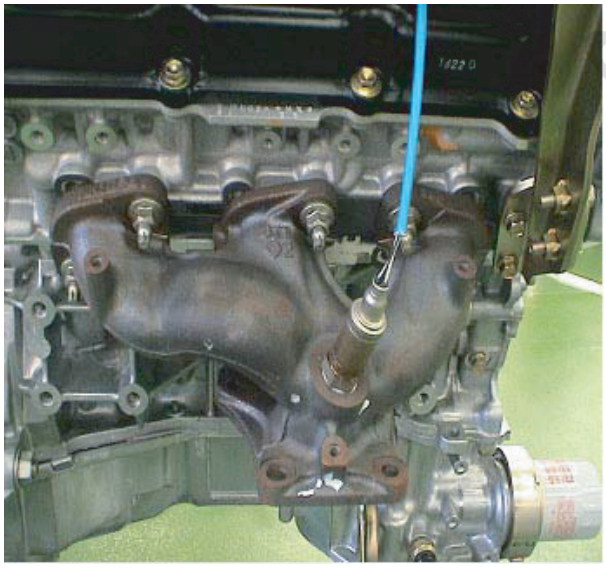
ENG0345

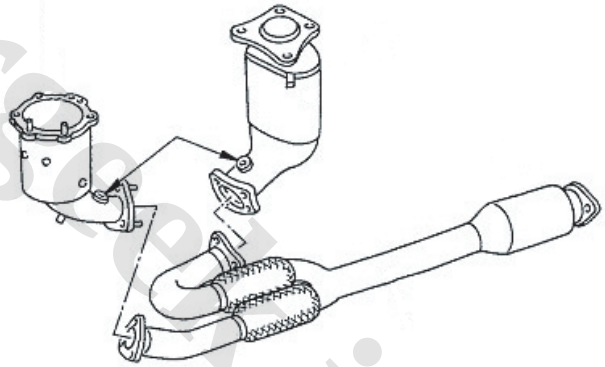
Exhaust manifold and catalyst

[Construction]
The exhaust manifold is made with cast iron. The tube has inner and outer tubes. The catalysts are located just after the exhaust manifolds. The tandem type catalysts are equipped to the LH and RH banks independently. The tandem type catalyst has two honeycomb elements in it. The rear O_2 sensor is located between two honeycomb elements. The exhaust manifold cover has an insulator, and it is a floating type construction.





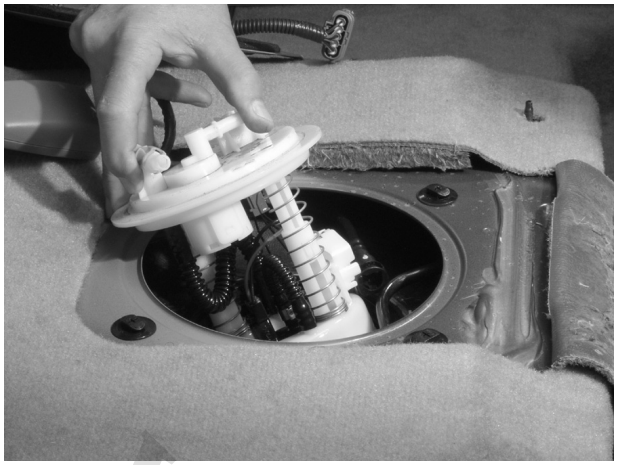


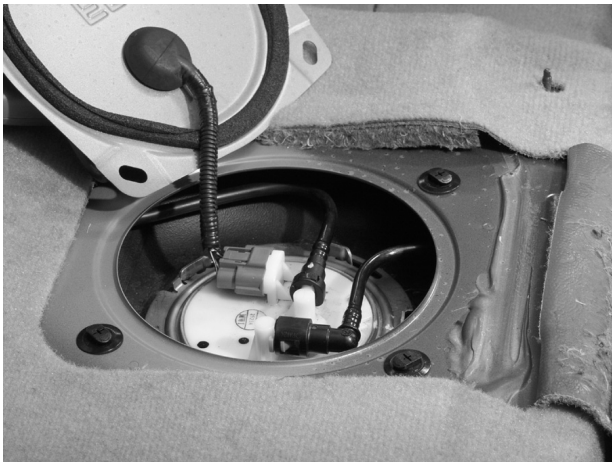


Z50iB005

Fuel system

[Outline]



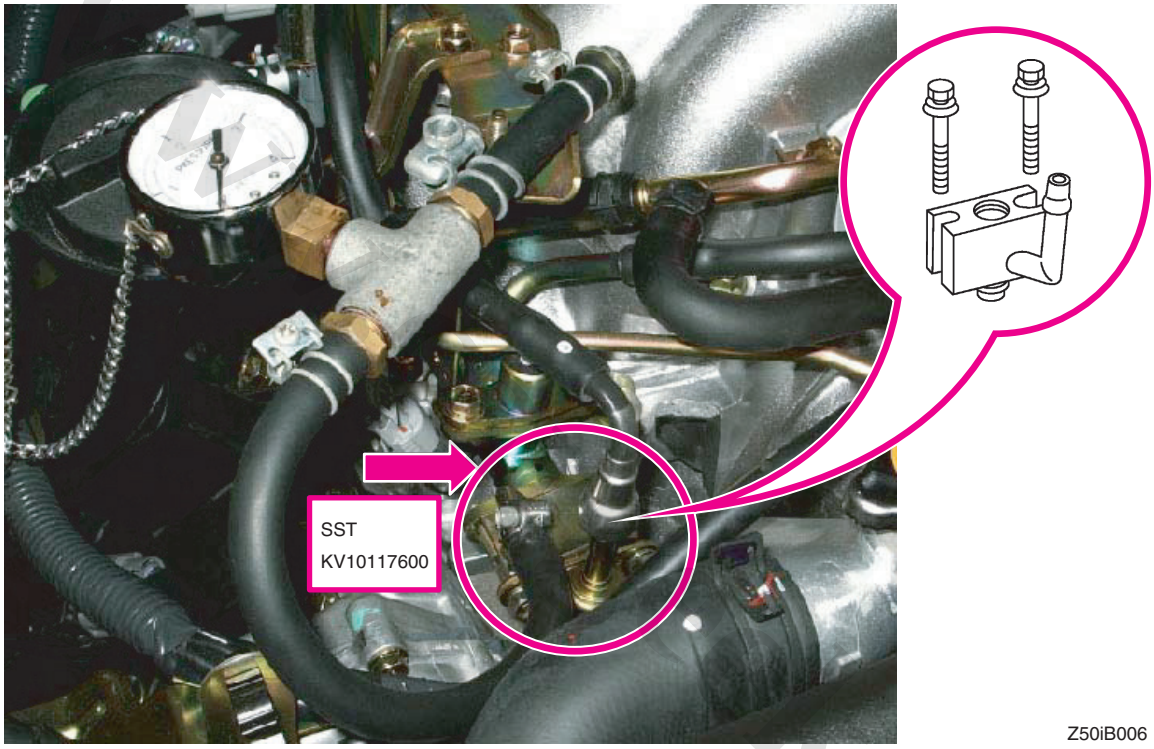


Z50iB004

- A return-less type fuel delivery system is used on Murano.
- The "saddle-style" fuel tank with a capacity of 82 liters is adopted.
  - » Removal of the fuel tank requires removal of the exhaust front tube, center and main mufflers, propeller shaft (AWD vehicles only) and parking brake cables.
  - » The fuel level sensor unit, fuel filter and fuel pump assemblies are located inside the fuel tank (refer to the "Interior" section of this material).
  - » The sub fuel level sensor unit is not serviceable, and it should be replaced as a unit.

[Construction]
The return-less fuel system is adopted. The pressure regulator is installed in the fuel tank. The relief pressure is 350 kPa (3.6 kgf/cm², 51psi) constant unrelated to the intake manifold pressure. Two fuel dampers are installed to the fuel tube. The fuel jet pump in the tank uses the exhausted fuel flow from the pressure regulator to suck the fuel from another side. The fuel is supplied to the engine by the plastic tube with a rubber insulator instead of the rubber hose alone. The system can keep the fuel temperature cooler in the tank, and this contributes to less vapor production. To improve the hot startability and to reduce the vapor in the fuel tube, the fuel pressure is set higher. The plastic tube contributes a reduction of the small vapor leakage. Small leakage refers to the leakage through between molecules.

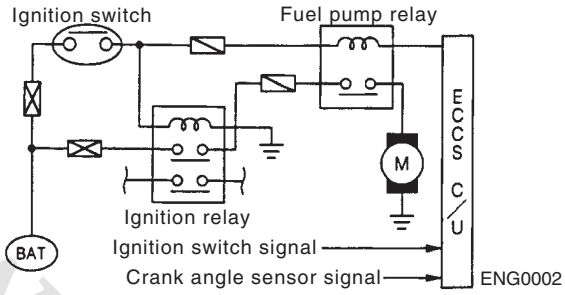
[Service point]
The fuel pressure should be checked with the SST KV101 17600 attached between the fuel damper and the gallery. For the fuel pressure gauge connecting position, remove the fuel damper and attach the gauge.



Z50iB006

Fuel pump control

[Operation]
ON-OFF fuel pump relay operation is controlled by ECM according to the driving conditions. The ECM activates the fuel pump for several seconds after the ignition switch is turned ON in order to improve the engine startability. If the ECM receives an engine speed signal from the crankshaft position sensor (POS signal) and camshaft position sensor (PHASE signal), the system detects that the engine is running, and thus, the pump will continuously operate. If the engine speed signal is not received while the ignition switch is ON, the ECM determines that the engine stalls. In this case, the ECM stops supplying power to the pump to prevent the battery from discharging, thereby safety is assured as well. The ECM does not directly drive the fuel pump, but it does control the fuel pump relay, which in turn controls the fuel pump.

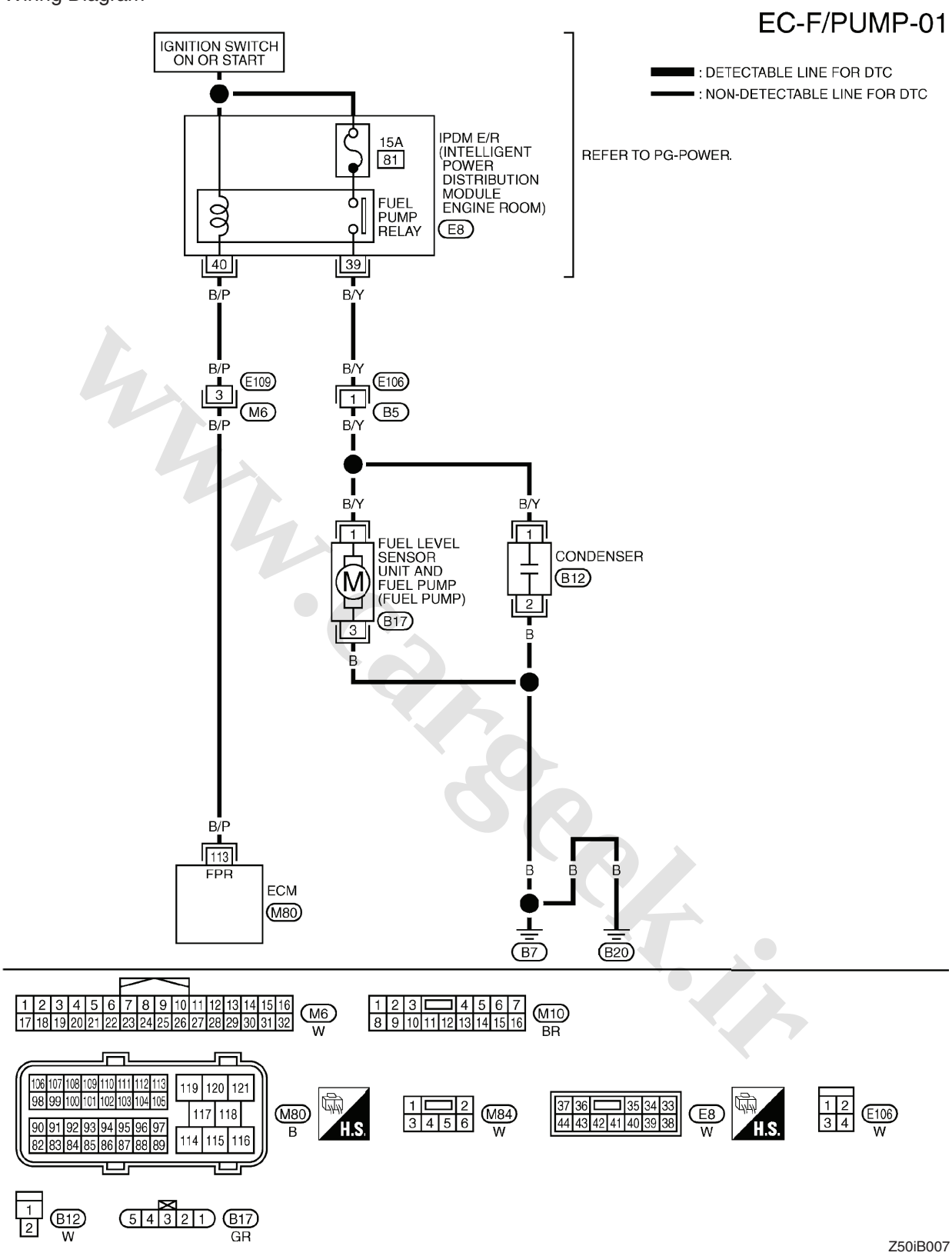


Sensor	Input Signal to ECM	ECM Function	Actuator
Crankshaft position sensor (POS)	Engine speed	Fuel pump control	Fuel pump relay
Camshaft position sensor (PHASE)	Engine speed and cylinder number		
Ignition switch	Start or ON signal		

Condition	Fuel pump operation
Ignition switch is turned to ON	Operates for 1 second
Engine running and cranking	Operates
When engine is stopped	Stops in 1.5 seconds
Except as shown above	Stops

Z50iB025

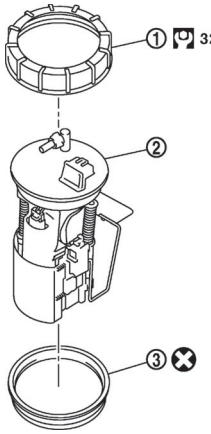
Wiring Diagram

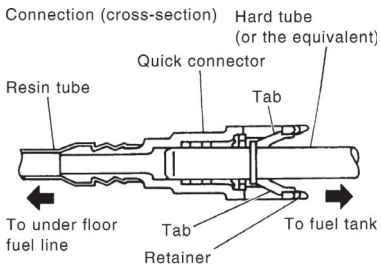


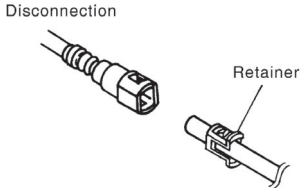
Fuel tank

The fuel level sensor unit, fuel filter and fuel pump are an assembly.

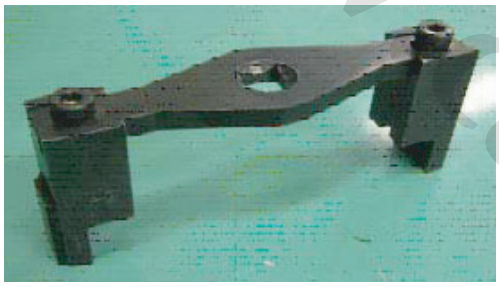
[Service point]
Removal and installation of the fuel level sensor unit.



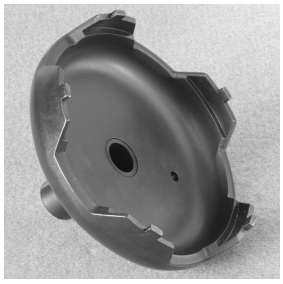




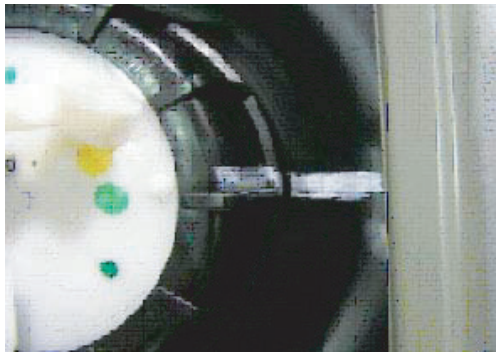
SST
Use the fuel tank lock ring wrench
(commercial service tool).

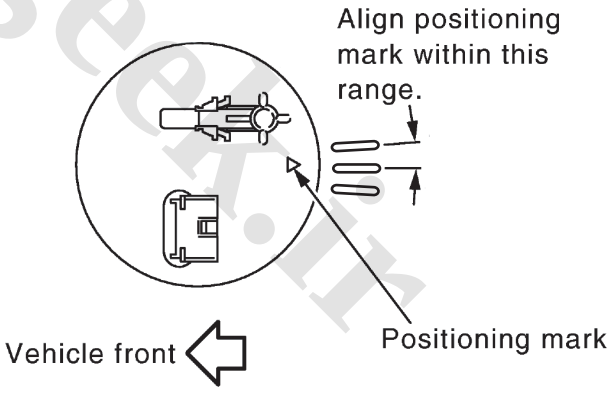


KV10118300



Align positioning mark (Install lock ring position)



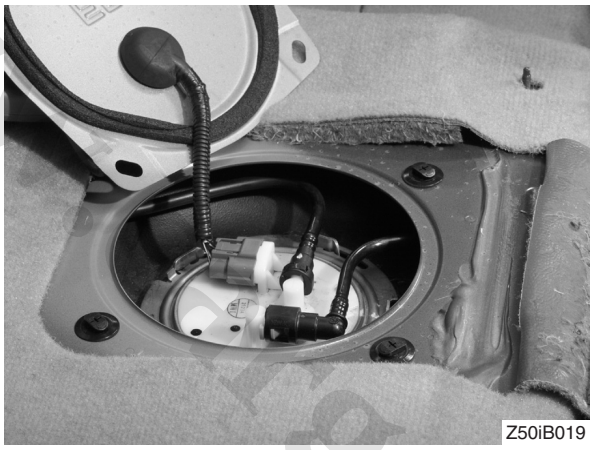


- Murano incorporates a new type lock ring for the fuel pump and sending unit retention. This new type of lock ring applies to low emission vehicle standards and requires a new tool for removal. It is a very hard job to loosen and tighten the fuel tank retainer. 2 persons are required. One person should place a foot on the tool to push down the tool and retainer and the other person should rotate the tool or the tool will release from the correct position.
  - » A new tool is used for the fuel pump module retaining ring (KV10118300).

- The shape of the Murano fuel tank causes the fuel to be dispersed into both chambers of the tank.
  - » A jet pump has been added to the fuel pump to help transfer fuel between the chambers.
  - » The jet pump operates by a siphoning action; excess fuel pressure is returned to the tank at the jet pump inlet.
  - » This creates a suction action to draw fuel from one chamber of the tank to the other chamber that contains the fuel pump.

Fuel tank access covers

[Service point]



The Murano fuel level sensor unit, fuel filter and fuel pump assemblies are located inside the fuel tank. They can be accessed via two removable fuel tank covers located under the rear seat cushions.

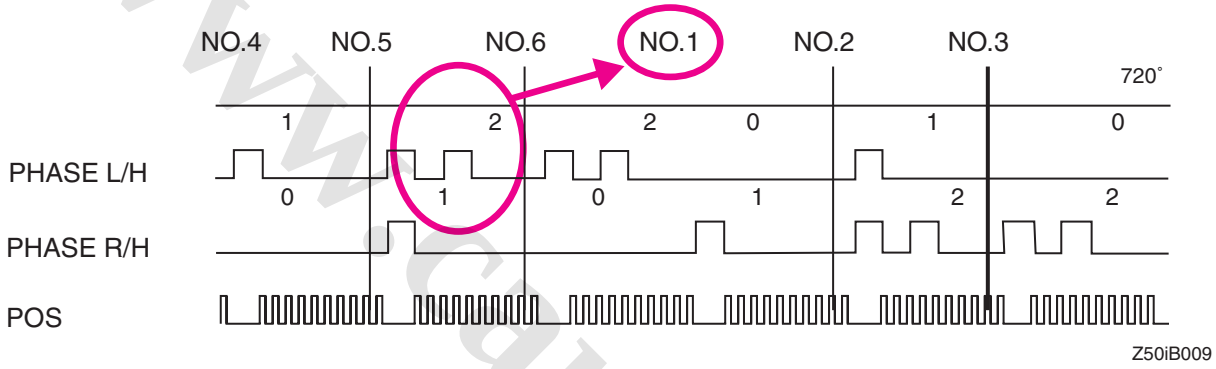
- The main fuel level sensor unit, fuel filter and fuel pump assembly are located under the left (driver's) side cover.
- The sub fuel level sensor unit is located under the right (passenger's) side cover.
- Special tools are required to access the fuel tank.
- Refer to the service procedures and general precautions listed in the ESM Section FL.

POS and PHASE sensors

[Construction]
J31's VQ35DE has no REF sensor but has two PHASE sensors on each bank. The PHASE sensors are located at each of the rear side of the cylinder head, and the POS sensor is located on the oil pan rear end. Both the POS and the PHASE sensors are the hall sensor type.

[Operation]
The POS sensor reads the drive plate signal plate notches and each PHASE sensor reads the each intake camshaft notches. Using the three signals, the ECM identifies the TDC and the cylinder number. The VTC sensor function is also included to the PHASE sensor. The ECM can detect the absolute camshaft position using the PHASE sensor signal of the bank and the POS sensor signal. The ECM judges the next TDC cylinder counting up the number of the PHASE signals between each 110 BTDC timing. For example, if the ECM find 2 PHASE L/H signals and 1 PHASE R/H signal, No.1 TDC on compression stroke will come next.

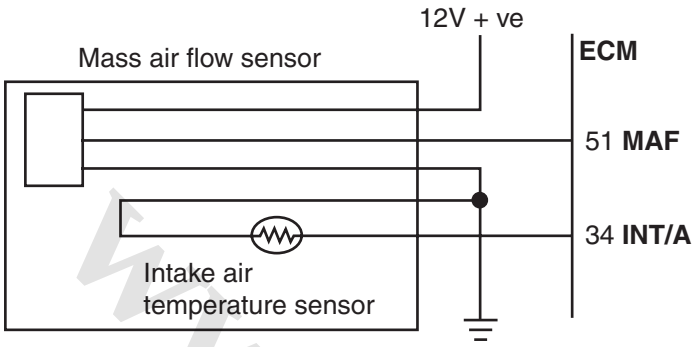
TDC on compression stroke

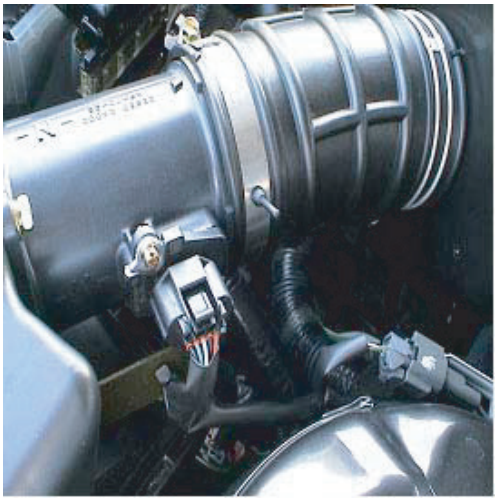


ATDC 20º and 30º POS signals are not produced. When IVTC (C-VTC) operates, the PHASE signal's phase will move to the advanced or retarded position.

MAF (Mass Air Flow) sensor

[Construction]
The MAF housing and air duct body are integrated. The intake air temperature sensor is built into the MAF sensor. The MAF connector has 5 terminals. Only battery voltage is supplied to the MAF sensor and 5V is not supplied. The MAF sensor signal ground is not independent, and it is combined with other senors ground lines.





Z50iB010

[Service point]
The output characteristics are completely different from the former type.

	IGN ON	Idling
Z50, J31, Y50 type	Approx. 0.4V	Approx. 1V
Former type	Approx. 1V	Approx. 1.3V

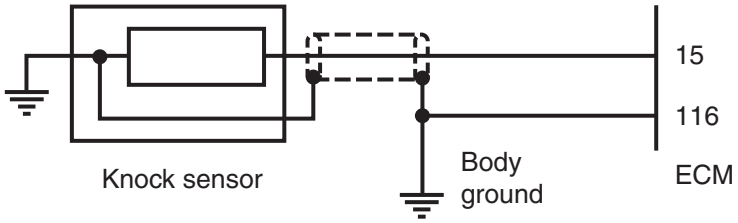
Z50iB026

In case a MAF sensor malfunction is detected, only the MAF sensor can be replaced. But in case P0101 is detected, the output characteristics are malfunctioning. So, you should check the whole intake passage system including the air cleaner.

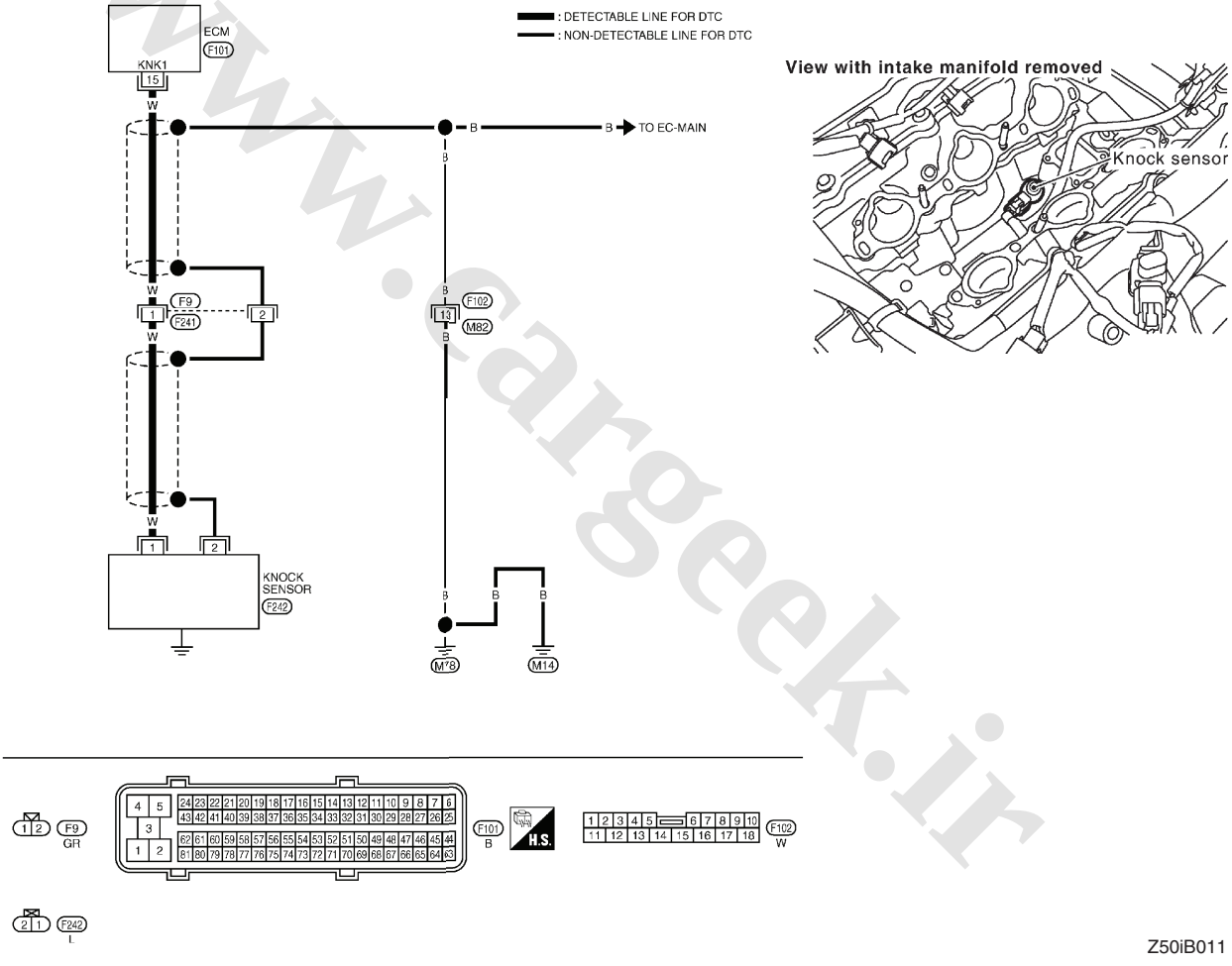
P0101 Characteristics malfunction --- Replace MAF unit only but check of air duct assembly is necessary
P0102 Abnormal low output ---------- Replace MAF unit only
P0103 Abnormal high output ---------- Replace MAF unit only

Knock sensor

[Construction]
The knock sensor connector has two terminals. The ground and shield earth line are built into the connector terminal. The knock sensor is attached to the cylinder block. It senses the engine knocking using a piezoelectric element. A knocking vibration from the cylinder block is sensed as vibrational pressure. This pressure is converted into a voltage signal and sent to the ECM.



EC-KS-01

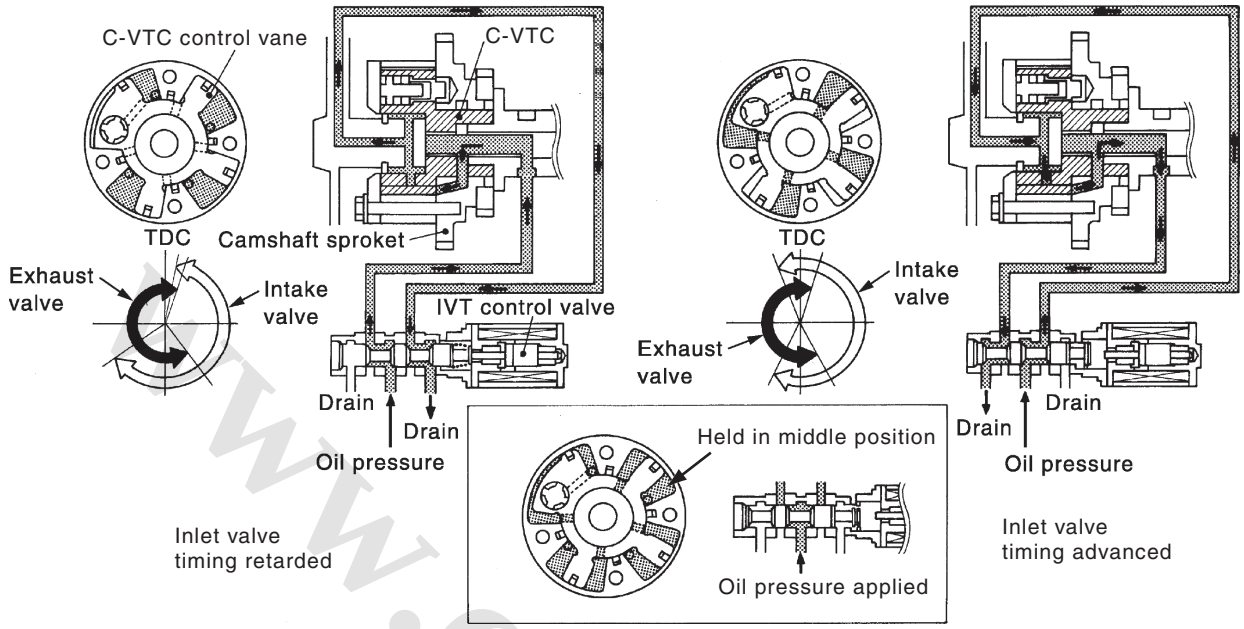


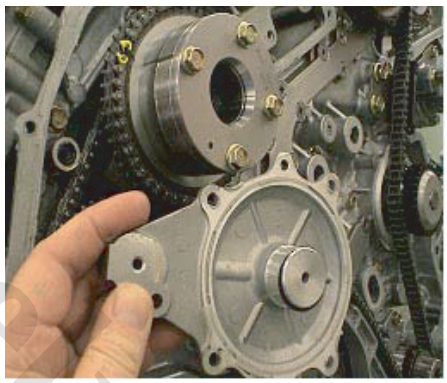
Z50iB011

IVT (Intake Valve Timing control system)

C-VTC (Continuously variable Valve Timing Control system)

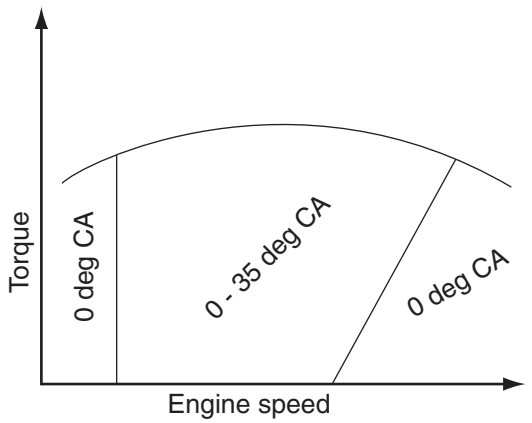
The C-VTC is equipped to the intake camshafts. That is the vane type. The PHASE sensor of each bank senses the notches of the camshaft tail end and the intake camshaft position is controlled by the feedback.





Z50iB012

[Operation]
The intake camshaft position is continuously controlled depending on the driving condition.



Z50iB013

Camshaft drive chain

[Construction]
The basic camshaft drive chain layout is not changed. The small pitch silent type is adopted to both the primary and the secondary chains. The primary chain has teeth both sides; inside teeth for intake camshafts drive and outside teeth for the water pump drive.

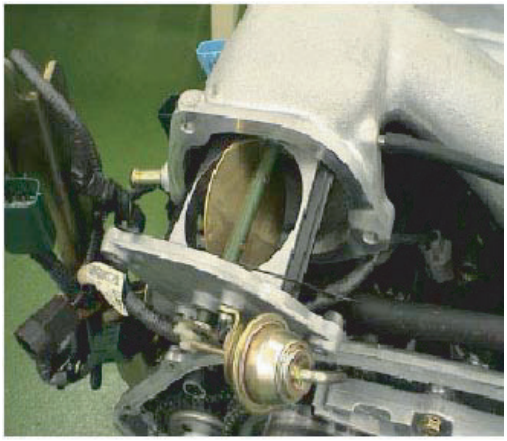

Z50iB027

Intake manifold

VIAS (Variable Intake Air System)

The intake manifold collector is a two-piece construction with a formed rubber gasket between the lower collector and intake manifold. The lower collector is designed to make each intake runner the same length and the upper collector is used to increase the effective length of individual manifold tracts. A power valve is mounted in the rear end of the lower collector and is used to divide this into two chambers. At low to medium engine speeds, this valve remains closed, which increases the individual port length, improving engine output torque.

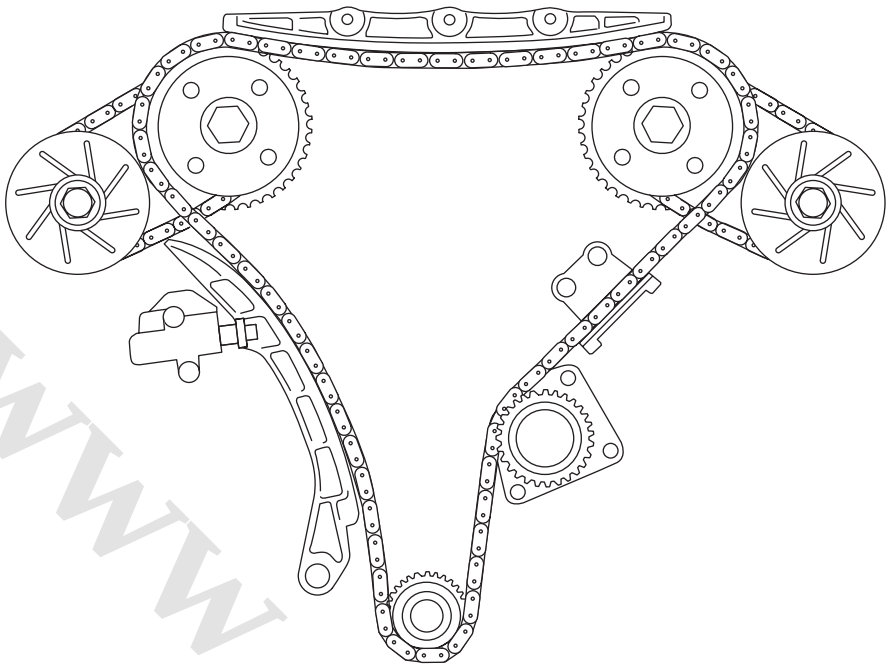
Power valve



Z50iB014

1. MAJOR COMPONENT PARTS

VQ engine



ENG0225

1) Timing Chain Design Features

- Compact structure that reduces vibration.
- New two-stage chain drive design is used.
- The water pump is driven not by a belt but the timing chain outer side to simplify the auxiliary equipment drive system and shorten the overall engine length.
- Primary and secondary stage chains with a single row featured and high strength is possible to reduce noise and shorten the overall engine length.

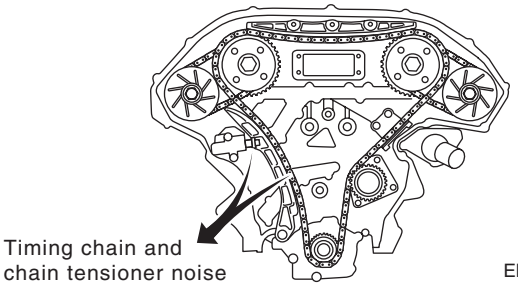
If noises are heard coming from the engine, diagnose by referring to the trouble diagnosis table information in the Service Manual.

2) Noise, Vibration and Harshness (NVH)

Diagnose the engine noise using the chart below to help you determine the cause of the noise.

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

Repair or replace the parts, if necessary.



ENG0226

Location of noise	Type of noise	Operation condition of engine						Source of noise	Check item
		Before warm-up	After warm-up	When start-ing	When idling	When racing	While driving		
Front of engine timing chain case	Tapping or ticking	A	A	—	B	B	B	Timing chain and chain ten-sioner noise	Timing chain cracks and wear Timing chain tensioner operation

A: Closely related B: Related —: Not related

ENG0227

If tapping or ticking noise occurs from the front side of the engine, use ESM information “NOISE, VIBRATION and HARSHNESS TROUBLESHOOTING”.

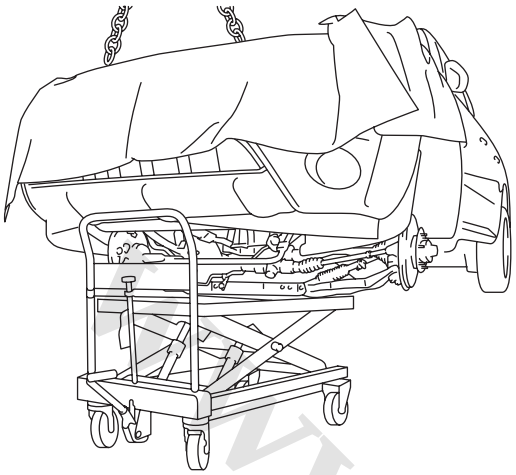
There are removal and installation procedures as shown below.

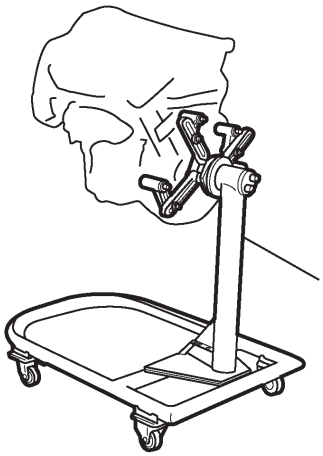
1. The ESM timing chain section describes the procedures for removal/installation of the front timing chain case, timing chain related parts and rear timing chain case, when the oil pan (upper) needs to be removed/installed for an engine overhaul, etc.

2. Procedures for removal/installation of the front timing chain case, timing chain and timing chain related parts without removing the oil pan (upper).

3) Removal

Remove the engine assembly from the vehicle as shown in the illustration below, and separate the front suspension member and the transaxle from the engine.





ENG0228

2. REMOVAL (FRONT TIMING CHAIN CASE)

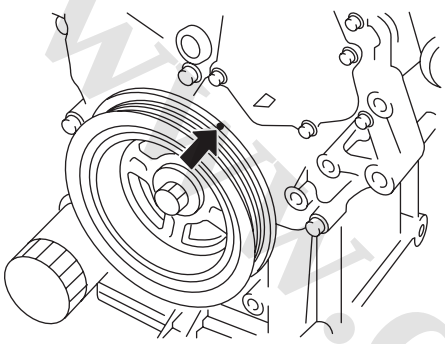
The procedure in which the oil pan (upper) needs to be removed/installed is explained here.

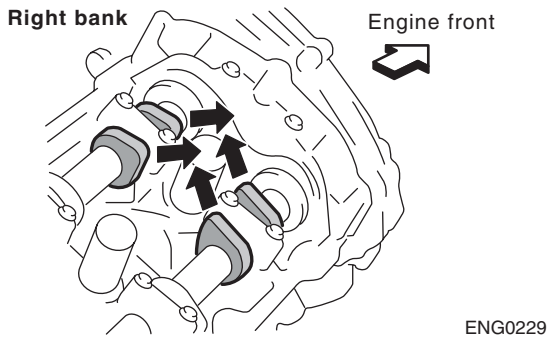
1) Obtain No. 1 Cylinder at TDC of Its Compression Stroke

Remove rocker covers (right and left banks).

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

b. Make sure that the intake and exhaust cam lobes on No. 1 cylinder are formed as shown in the figure.

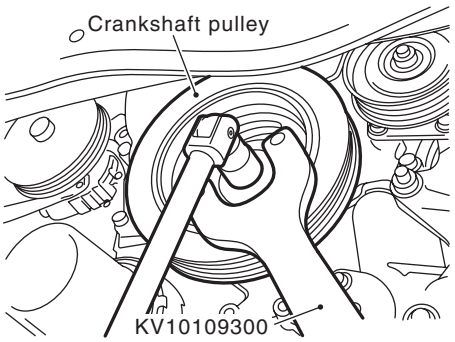


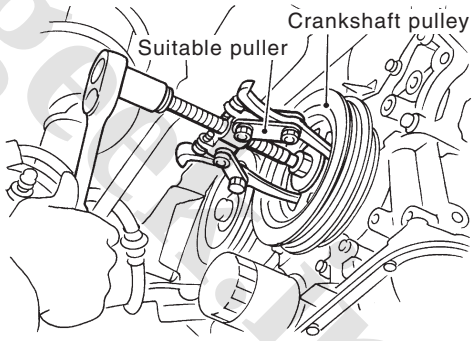


ENG0229

If the formation is not achieved, turn the crankshaft one more rotation (360 degrees).

c. Remove the crankshaft pulley.



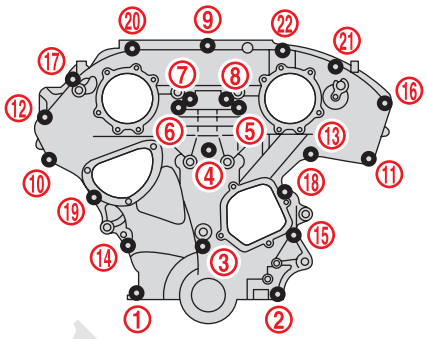


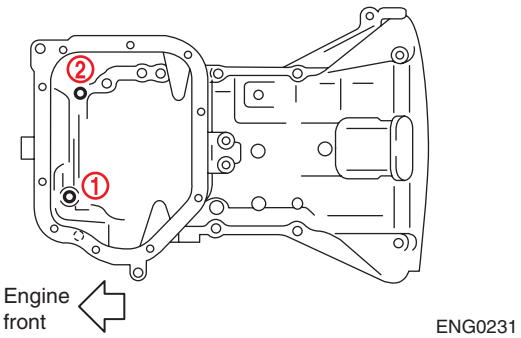
ENG0230

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

2) Remove Front Timing Chain Case

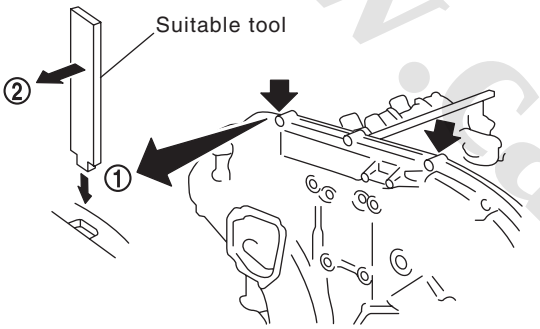
Loosen mounting bolts in the reverse order from that shown in the figure.

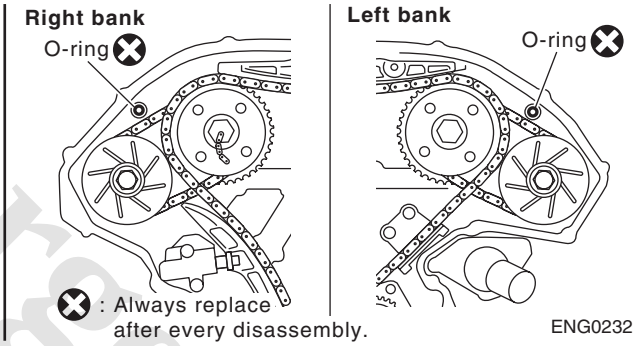




a. Insert a suitable tool into the notch at the top of the front timing chain case as shown (1).
b. Pry off the case by moving the tool as shown (2).

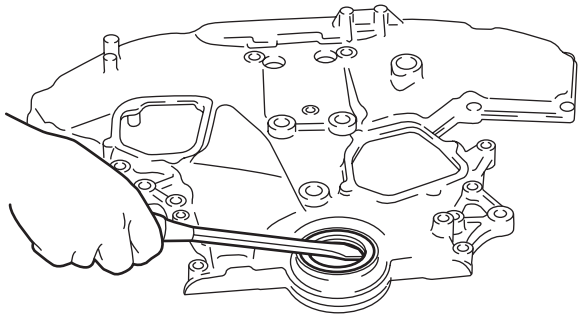
Use a seal cutter [SST: KV10111100] to cut liquid gasket for removal.





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

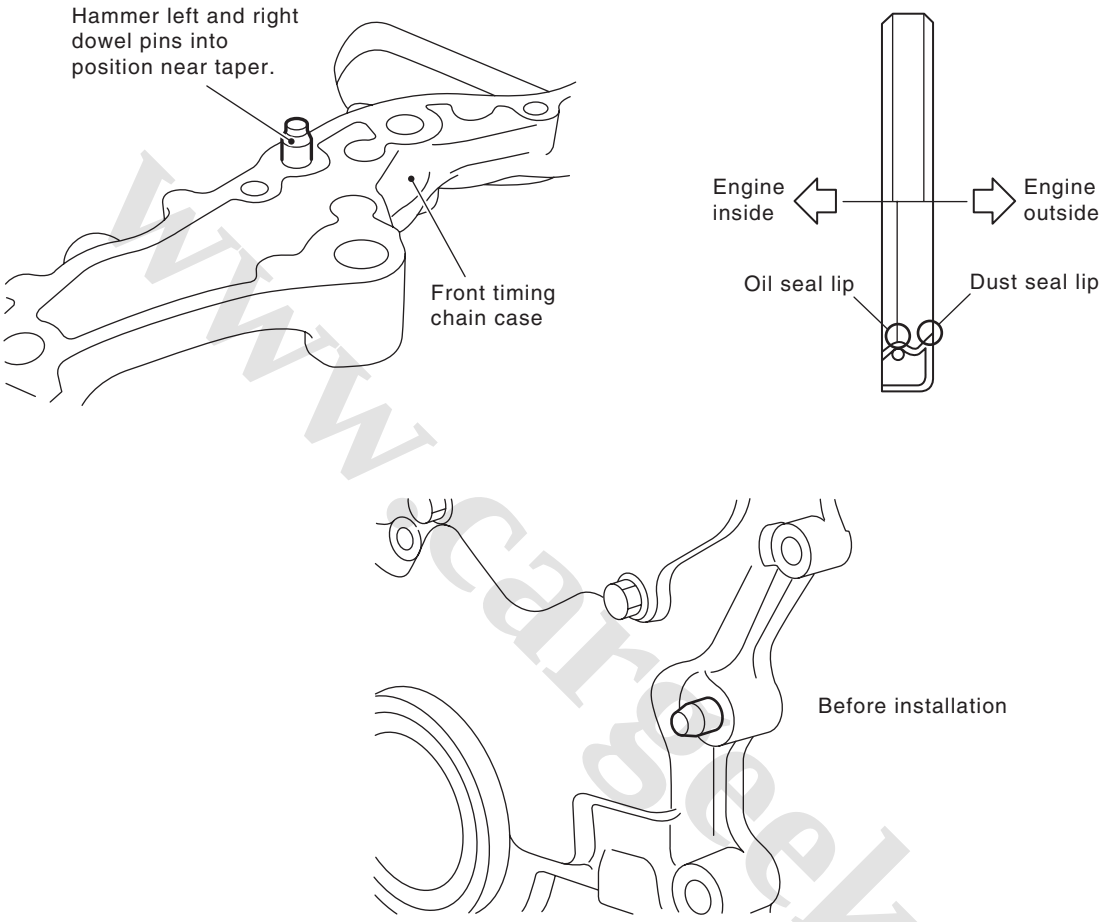
Remove the water pump cover and chain tensioner cover from the front timing chain case.
Use a seal cutter [SST: KV10111100] to cut the liquid gasket for removal.
Remove the front oil seal from the front timing chain case using a suitable tool.
Use a screwdriver for removal.



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

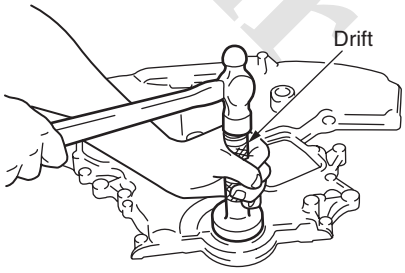
3) Installation

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



ENG0234

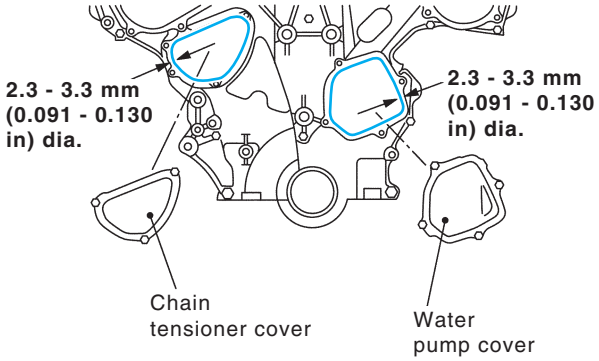
3. Using a suitable drift [outer diameter: 60 mm (2.36 in)], press-fit oil seal until it becomes flush with the front timing chain case end face. Make sure that the garter spring is in position and the seal lip is not inverted.



ENG0235

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

Use genuine liquid gasket or the equivalent.

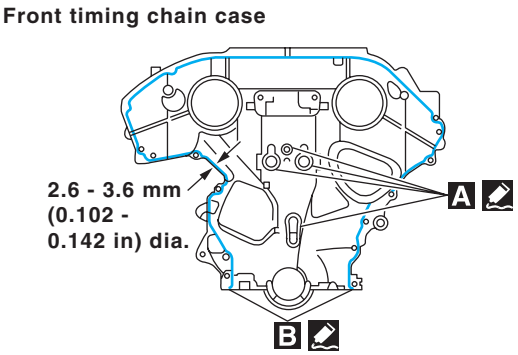


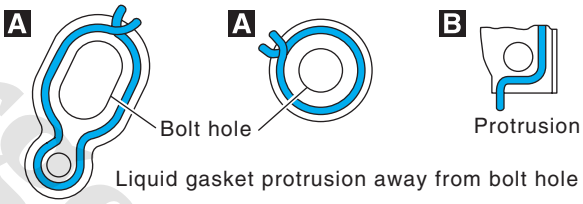
ENG0236

5. Install the front timing chain case as follows.

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

Use genuine liquid gasket or the equivalent.



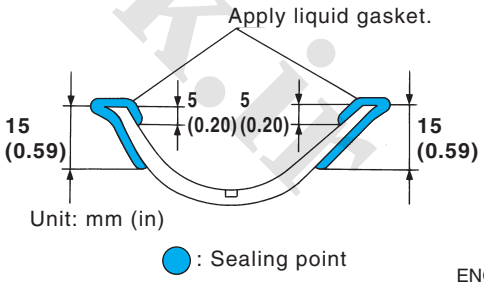


: Apply genuine liquid gasket or equivalent.

ENG0237

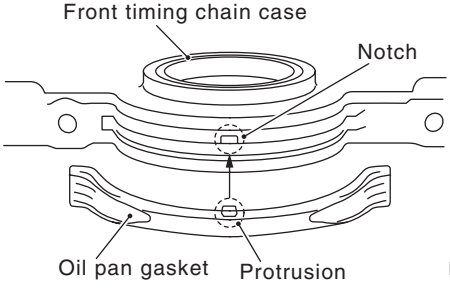
b. Install oil pan gasket
   Apply liquid gasket to the oil pan gasket as shown in the figure.

Use genuine liquid gasket or the equivalent.



ENG0238

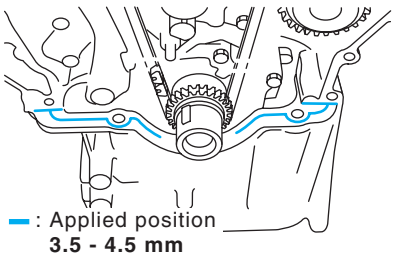
Align the notch of the front timing chain case with the protrusion of the oil pan gasket.



ENG0239

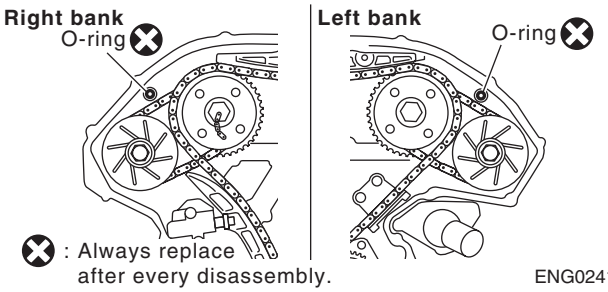
Apply liquid gasket with a tube presser [SST: WS39930000] to the top surface of the oil pan (upper) as shown in the figure.

Use genuine liquid gasket or the equivalent.



ENG0240

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



ENG0241

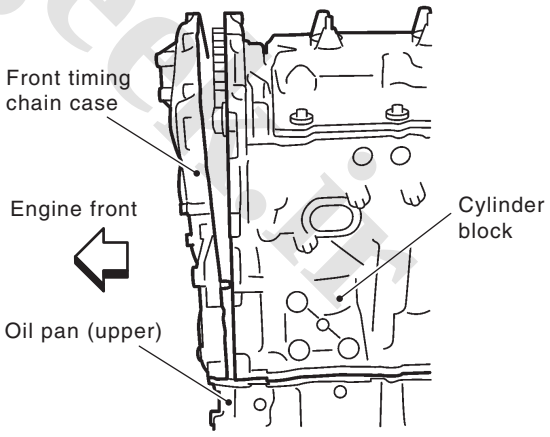
d. Assemble the front timing chain case as follows.

NOTE **This section explains when performing on an actual vehicle.**

1. Pull the dowel pin in the front timing chain case until the end becomes slightly lower the mating surface.

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

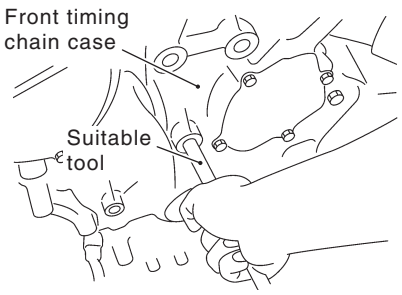
CAUTION:
Be sure that the oil pan gasket is in place.



ENG0242

3. Since the front timing chain case has no dowel pins to align the bolt holes, use a suitable tool to drag one bolt hole first as shown in the figure below. Tighten the bolts temporarily while holding the suitable tool.

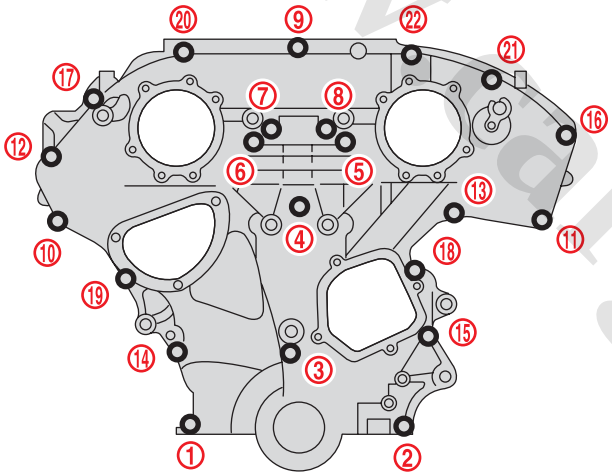
4. After lightening all the bolts by hand, insert the dowel pin while holding the front timing chain case from the front and top completely.



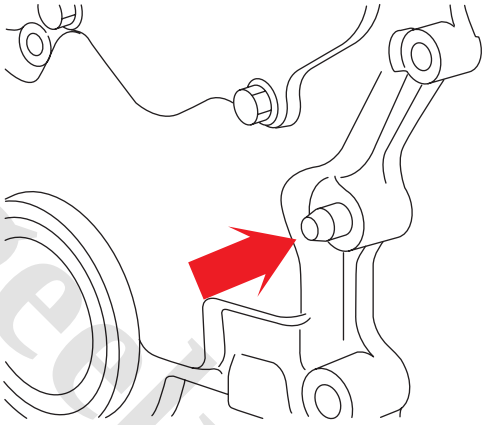
ENG0243

e. Tighten the mounting bolts to the specified torque in numerical order as shown in the figure. There are two types of mounting bolt. Refer to the following figure to identify the bolts.

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



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)



Hammer dowel pins after all bolts are installed by hand.

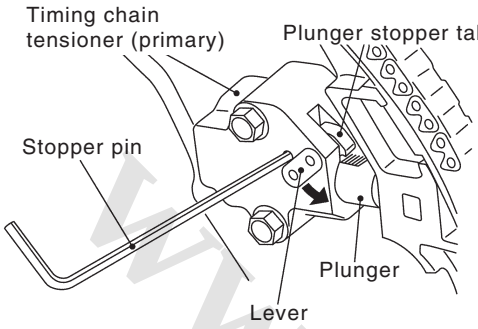
ENG0244

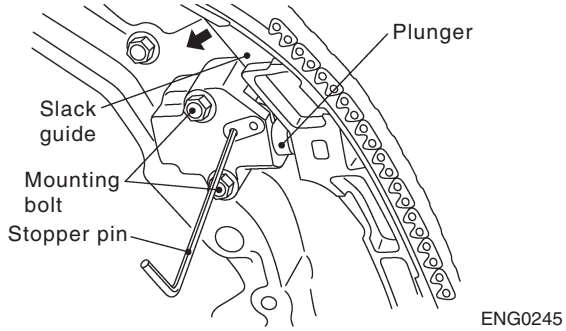
NOTE **When performing this operation on an actual vehicle, refer to the appropriate Service Manual for the necessary information.**

3. TIMING CHAIN REMOVE AND REINSTALLATION

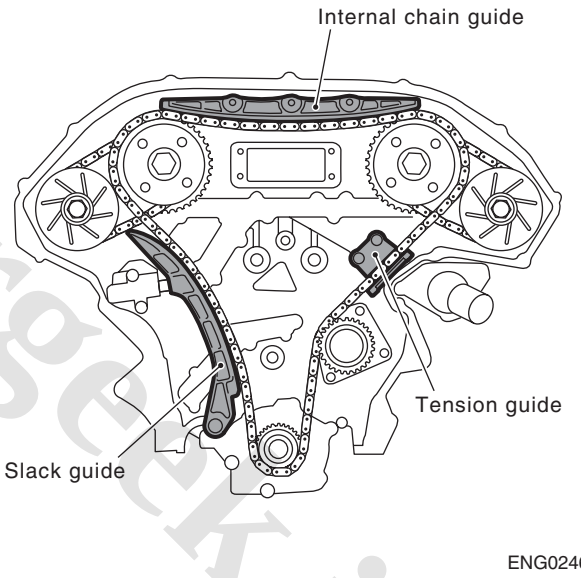
1) Remove Timing Chain Tensioner (Primary)

a. Pull the lever down and release the plunger stopper tab.
b. Plunger stopper tab can be pushed up to be released (coaxial structure with lever).





c. Insert the plunger into the tensioner body by pressing the slack guide.
d. Keep the slack guide pressed and hold it by pushing the stopper pin through the lever hole to the hole of the chain case.
e. Remove the mounting bolts and remove the timing chain tensioner (primary).



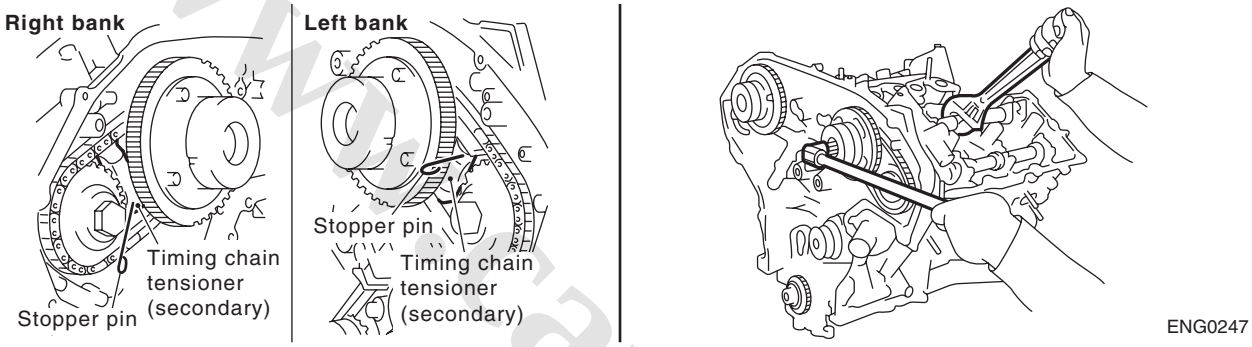
REMOVE INTERNAL CHAIN GUIDE, TENSION GUIDE AND SLACK GUIDE

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

2) Remove Timing Chain (Primary) and Crankshaft Sprocket

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

Remove the timing chain (secondary) and the camshaft sprockets as shown below.

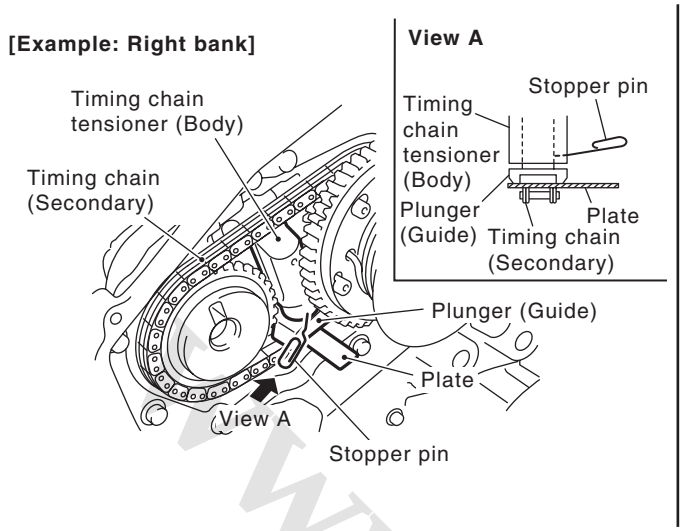


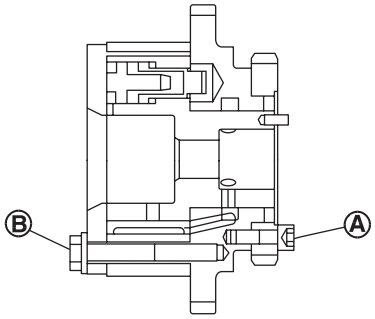
a. Remove the timing chain (secondary) together with the camshaft sprockets.
b. Turn the camshaft slightly to secure the slackness of the timing chain on the timing chain tensioner (secondary) side. Insert 0.5 mm (0.020 in)-thick metal or resin plate between the timing chain and the timing chain tensioner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

CAUTION:
Be careful of the plunger coming off when removing the timing chain (secondary). This is because the plunger of the timing chain tensioner (secondary) moves during the operation.

d. Camshaft sprocket (INT) is a dual type, one for the primary timing chain and the other for the secondary timing chain. When handling the camshaft sprocket (INT), be careful to follow the CAUTION described below.

CAUTION:
Handle carefully to avoid any shock to the camshaft sprocket.
Do not disassemble. (Do not loosen the bolts “A” and “B” that are shown in the figure).



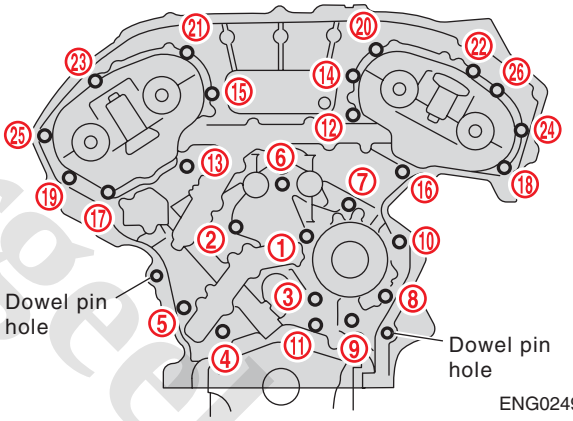


ENG0248

Remove the rear timing chain case as follows.

a. Loosen and remove the mounting bolts in the reverse order from that shown in the figure.

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



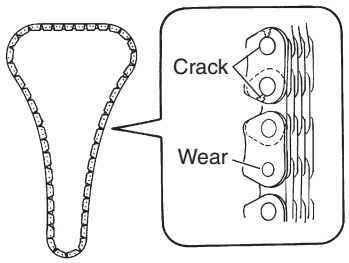
ENG0249

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

INSPECTION AFTER REMOVAL

Timing Chain

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

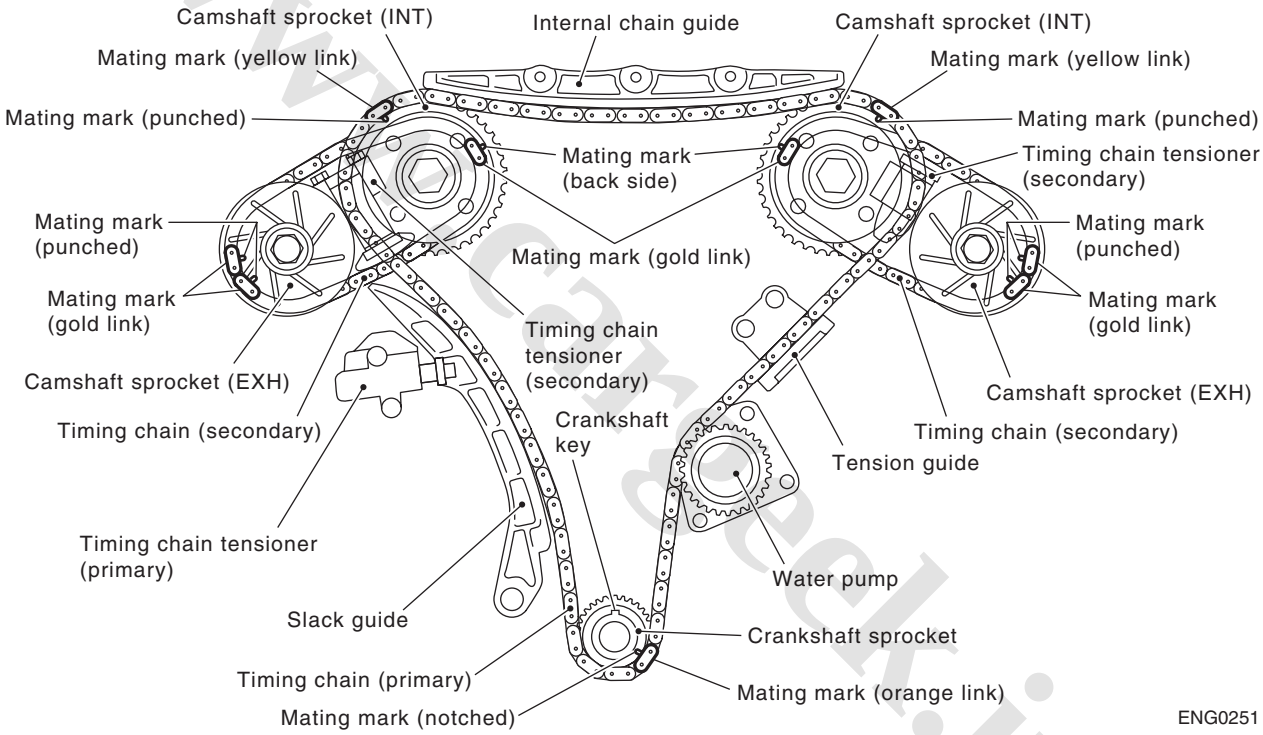


ENG0250

3). Install Timing Chain

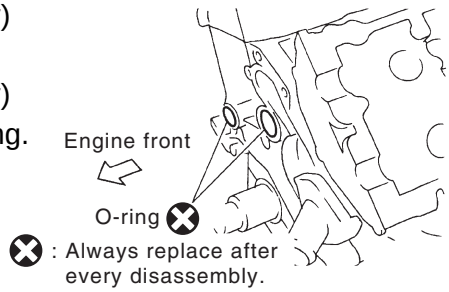
NOTE

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

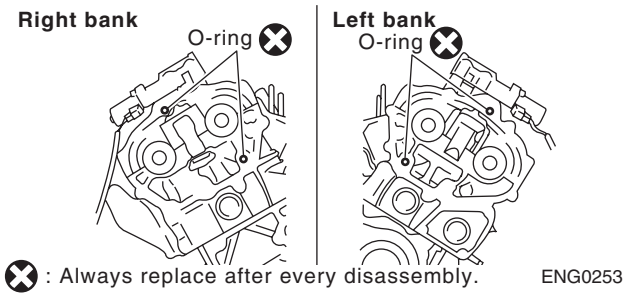


ENG0251

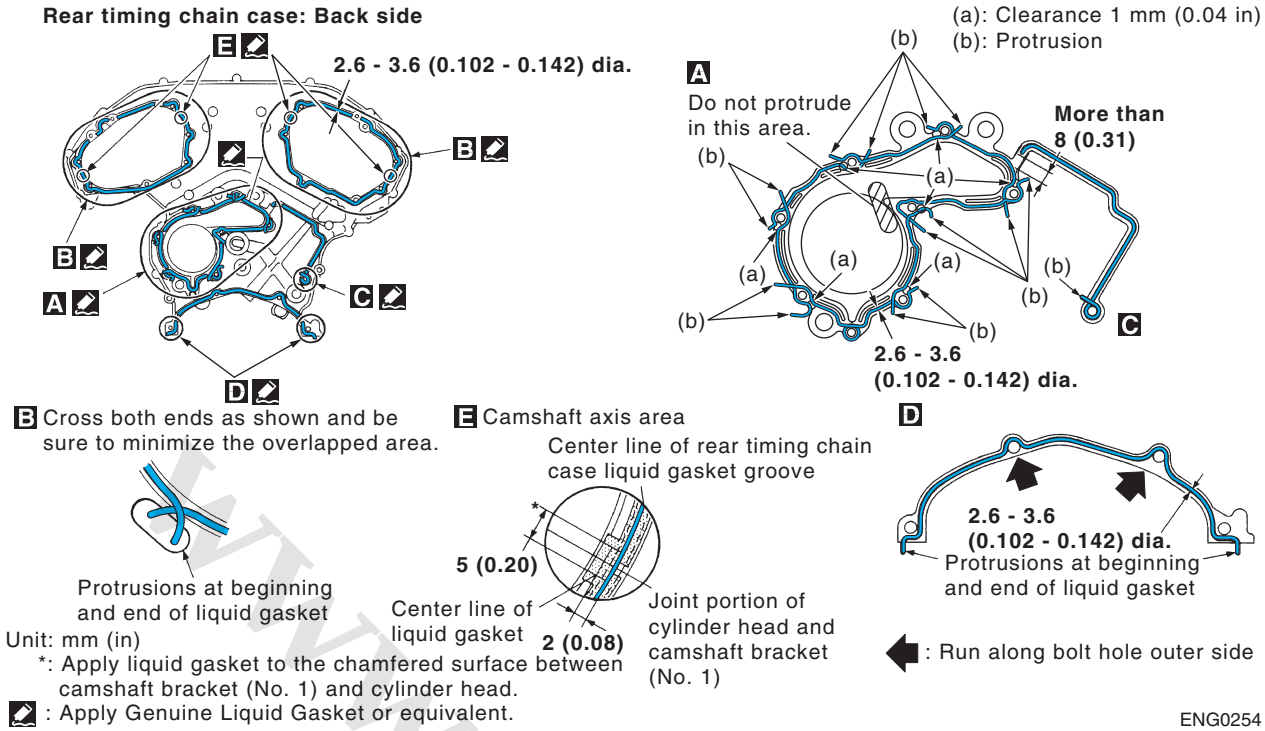
1. Install the timing chain tensioners (secondary) to the cylinder head as follows.
a. Install the timing chain tensioners (secondary) with the stopper pin attached and a new O-ring.
b. Install the camshaft brackets (No. 1).



2. Install the rear timing chain case as follows.
a. Install new O-rings onto the cylinder block.
b. Install new O-rings to the cylinder head.
c. Apply liquid gasket with a tube presser [SST: WS39930000] to the rear timing chain case back side as shown in the figure.



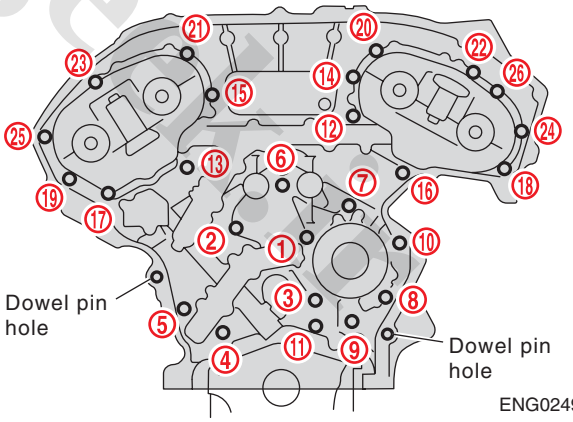
Use genuine liquid gasket or the equivalent.



d. Align the rear timing chain case and the water pump assembly with the dowel pins (right and left) on the cylinder block and install the rear timing chain case.
Make sure that the O-rings stay in place during installation to the cylinder block and the cylinder head.

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

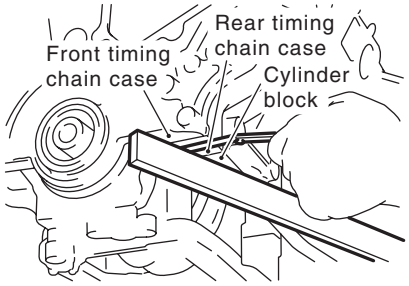
[Bolt length] [Bolt position]
20 mm (0.79 in) : 1, 2, 3, 6, 7, 8, 9, 10
16 mm (0.63 in) : Except the above
12.7 Nm (1.3 kg-m, 9 ft-lb)



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

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

Standard
Rear timing chain case to cylinder block:
−0.24 to 0.14 mm (−0.009 to 0.006 in)



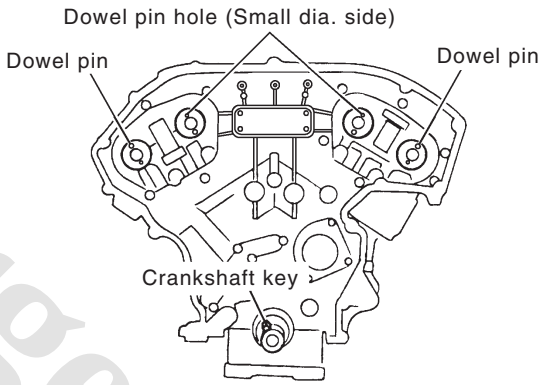
ENG0255

If it is out of standard, repeat the installation procedure.

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

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

Camshaft dowel pin hole (intake side):
Towards cylinder head upper face side in each bank.
Camshaft dowel pin (exhaust side):
Towards cylinder head upper face side in each bank.
Crankshaft key:
Towards the right bank cylinder head.

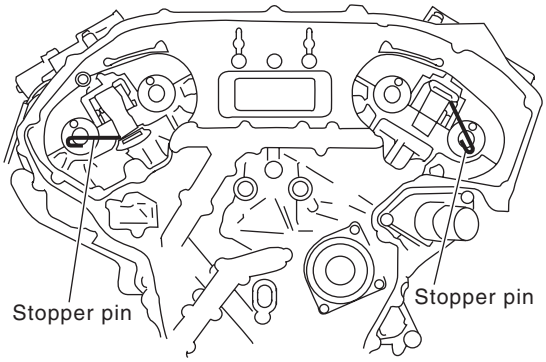


ENG0256

5. Install the timing chain (secondary) and camshaft sprockets (INT and EXH) according to the following procedures.

CAUTION:
Matching marks between the timing chain and the sprockets will slip out easily. Make sure that all matching marks are always aligned during the installation process.

a. Push the plunger of the chain tensioner (secondary) and keep it pressed with the stopper pin.
b. Install the timing chain (secondary) and camshaft sprockets (INT and EXH).
Align the matching marks on the timing chain (secondary) (gold link).



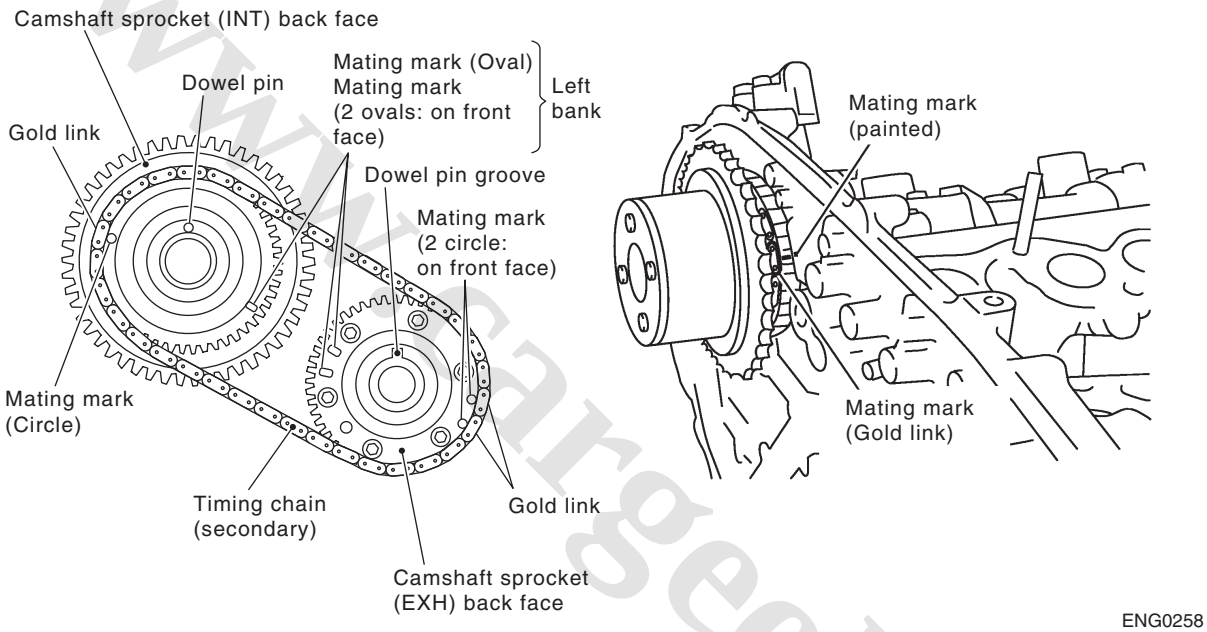
ENG0257

b. Install the timing chain (secondary) and camshaft sprockets (INT and EXH).
Align the matching marks on the timing chain (secondary) (gold link) with the ones on the camshaft sprockets (INT and EXH) (punched), and install them.

NOTE

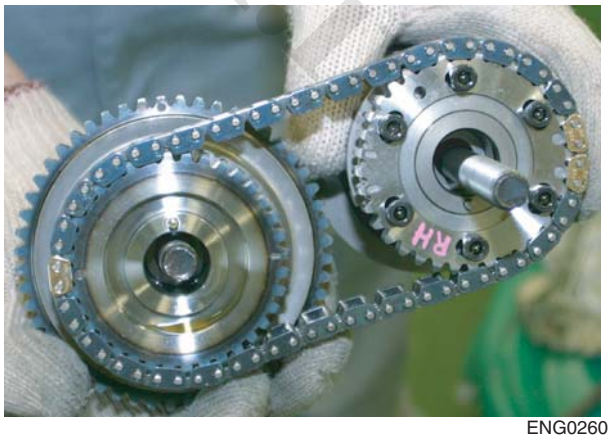
- **Matching marks for the camshaft sprocket (INT) are on the back side of the camshaft sprocket (secondary).**
- **There are two types of matching marks, circle and oval types.**
- **They should be used for the right and left banks, respectively.**
- **Align the dowel pin and the pin hole on the camshafts with the groove and dowel pin on the sprockets, and install them.**
- **On the intake side, align the pin hole on the small diameter side of the camshaft front end with the dowel pin on the back side of camshaft sprocket, and install them.**

Example: Right bank (Rear view)



ENG0258

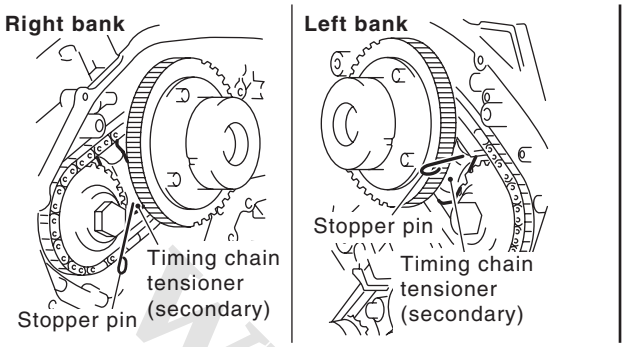
- On the exhaust side, align the dowel pin on the camshaft front end with the pin groove on the camshaft sprocket, and install them.
- In the case that the position of each matching mark and each dowel pin do not fit on the matching parts, make a fine adjustment with a wrench or equivalent to the position holding the hexagonal portion on the camshaft.
- Mounting bolts for the camshaft sprockets must be tightened in the next step. Tightening them by hand is sufficient to prevent the dislocation of dowel pins.

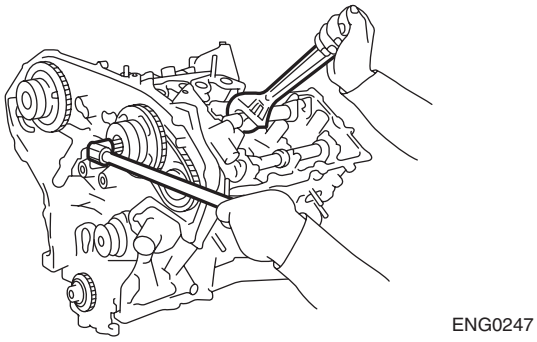


ENG0260

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

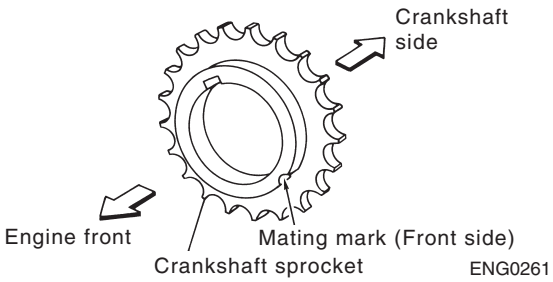
c. After confirming that the matching marks are aligned, tighten the camshaft sprocket mounting bolts. Secure the camshaft using a wrench at the hexagonal portion to tighten the mounting bolts.
d. Pull the stopper pins out from the timing chain tensioners (secondary).



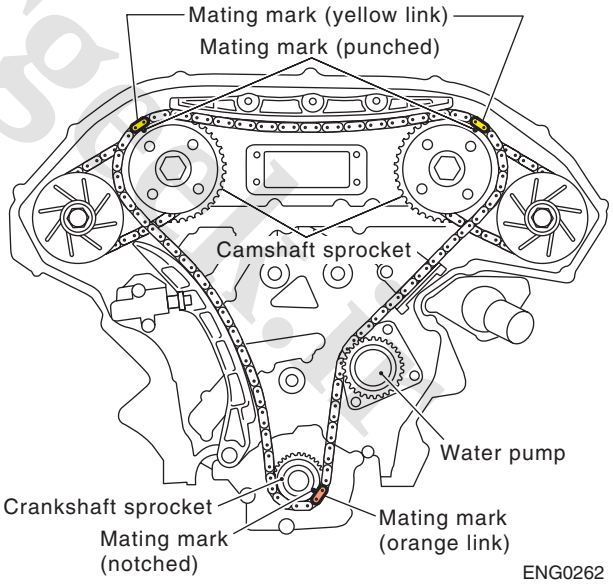


6. Install the tension guide.

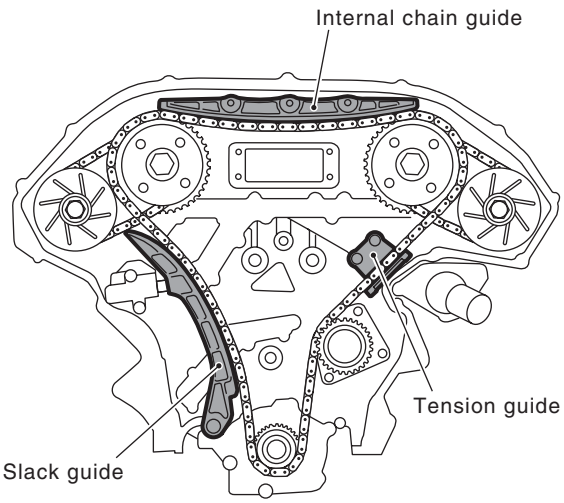
7. Install the timing chain (primary) as follows.
a. Install the crankshaft sprocket. Make sure that the mating marks on the crankshaft sprocket face the front of the engine.



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

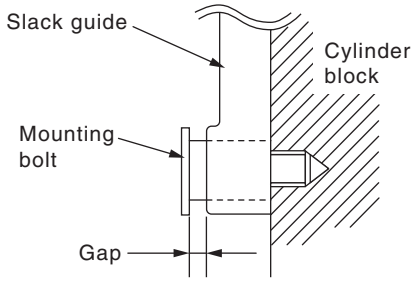


8. Install the internal chain guide, slack guide and the timing chain tensioner (primary).



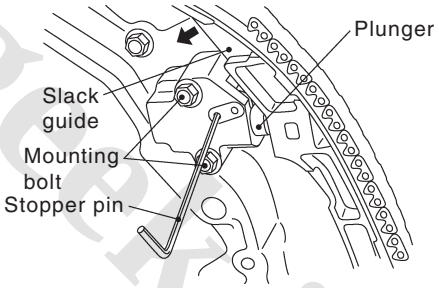
ENG0246

CAUTION:
Do not overtighten the slack guide mounting bolt. It is normal for a gap to exist under the bolt seat when the mounting bolt is tightened to the specified torque.



ENG0263

When installing the timing chain tensioner (primary), push in the plunger and keep it pressed with the stopper pin.
Remove any dirt and foreign materials completely from the back and the mounting surfaces of the timing chain tensioner (primary).
After installation, pull out the stopper pin by pressing the slack guide.



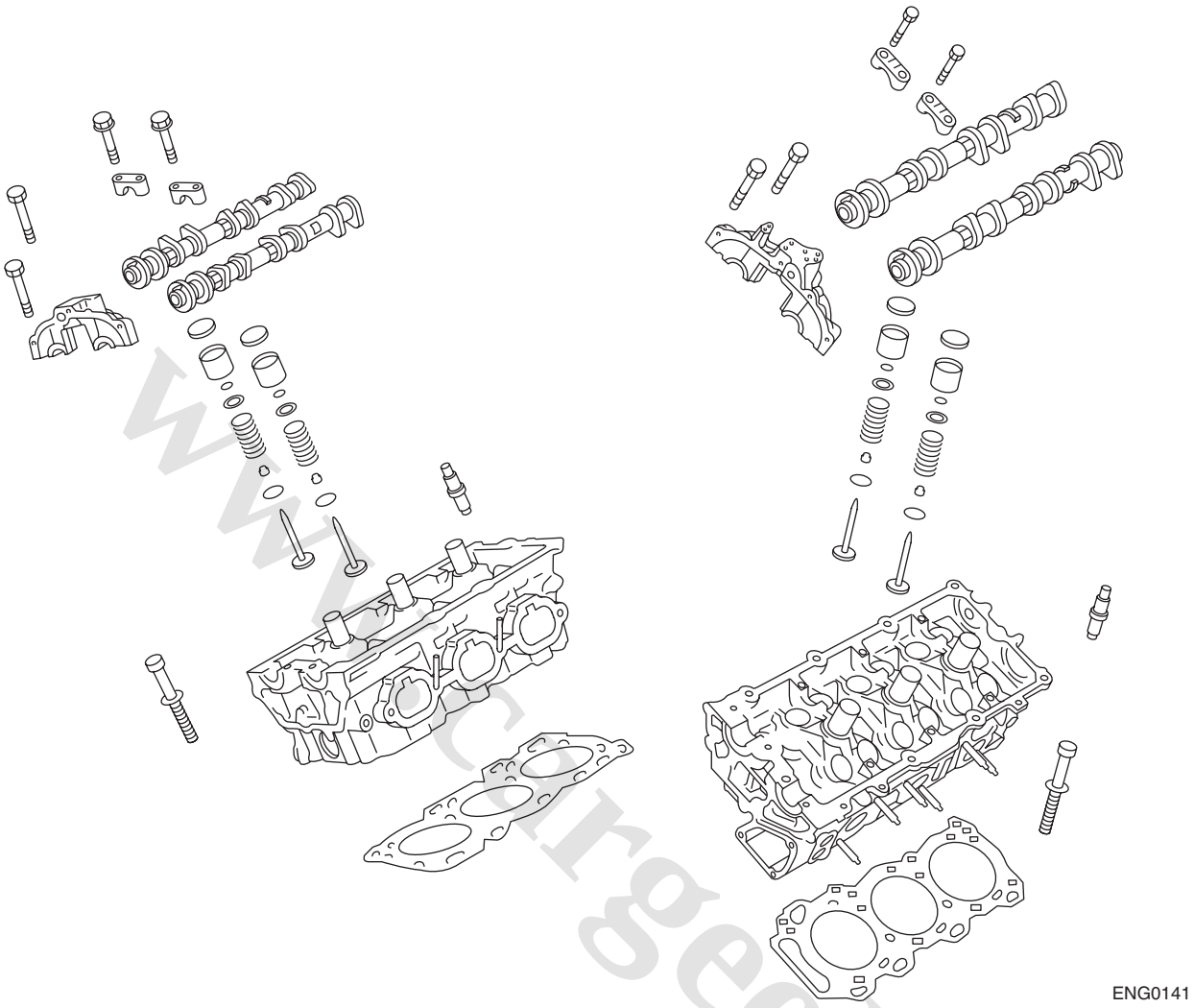
ENG0264

NOTE **When installing the front timing chain case, always follow the instructions described in the Service Manual.**

The installation of timing chain is demonstrated in the video program provided here.

Watch a video

1. MAJOR COMPONENT PARTS



ENG0141

2. TYPE OF VALVE MECHANISM

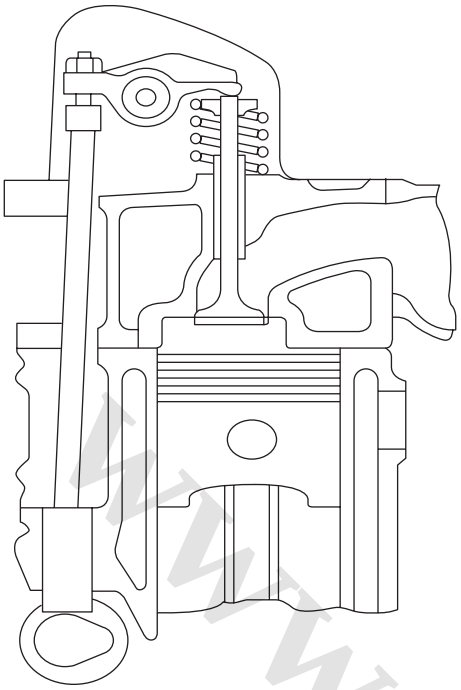
Overhead valve (OHV)

Overhead camshaft (OHC)
- Valve lifter with shim
- Shim-less valve lifter

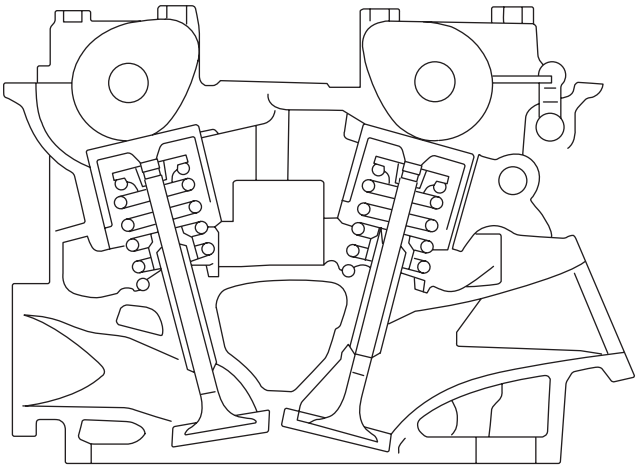
As a result of improvement over the OHV type, the OHC type has reduced the number of intermediate parts between the camshaft and valve, and the camshaft is located above the cylinder head.
Since the intermediate parts such as push rods, etc. are eliminated, this type is more suitable for higher speed operations than the OHV type.

The OHC is now the major type used in gasoline engines.
(GA, SR, VG, CR, QG, TB, VQ, VH, VK, HR and MR*)
* HR and MR are the new models of 2005.

Overhead valve (OHV)



Overhead camshaft (OHC)



ENG0142

1) Precautions for Inspection, Repair and Replacement

There are many reasons for overhauling an engine, despite the high cost of doing so. When performing an engine overhaul, be sure to inspect every part carefully. A replacement part must be checked before installation.

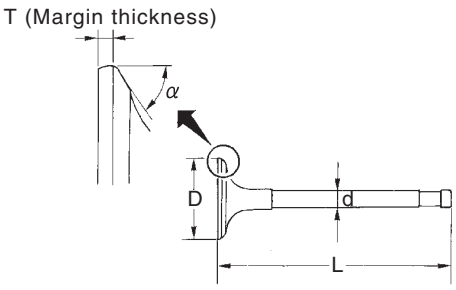
Reasons for an engine overhaul. [Examples]

1. The engine has overheated.
2. The engine consumes excessive amounts of oil.
3. The engine makes noise.
4. Some parts are broken.

2) Inspection After Disassembly

VALVE DIMENSIONS

For dimensions, refer to the Service Manual SDS.

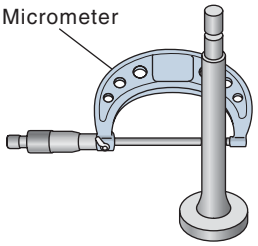


ENG0143

VALVE GUIDE CLEARANCE

Valve Stem Diameter

Measure the diameter of the valve stem with a micrometer.



ENG0144

Standard:

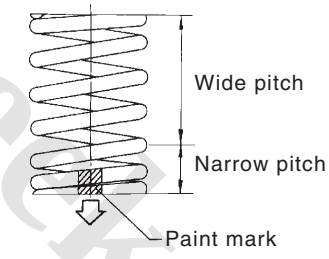
Intake: 5.965 - 5.980 mm (0.2348 - 0.2354 in)

Exhaust: 5.955 - 5.970 mm (0.2344 - 0.2350 in)

VALVE SPRING

A single spring with excellent durability, made of high-strength material, low load, and 2-step variable pitch is adopted to prevent surge and to reduce the friction.

Install the valve spring in the original position.

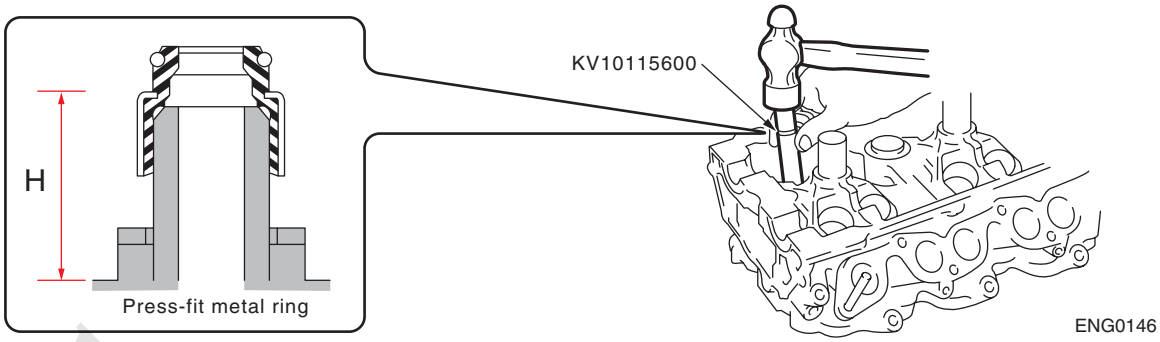


ENG0145

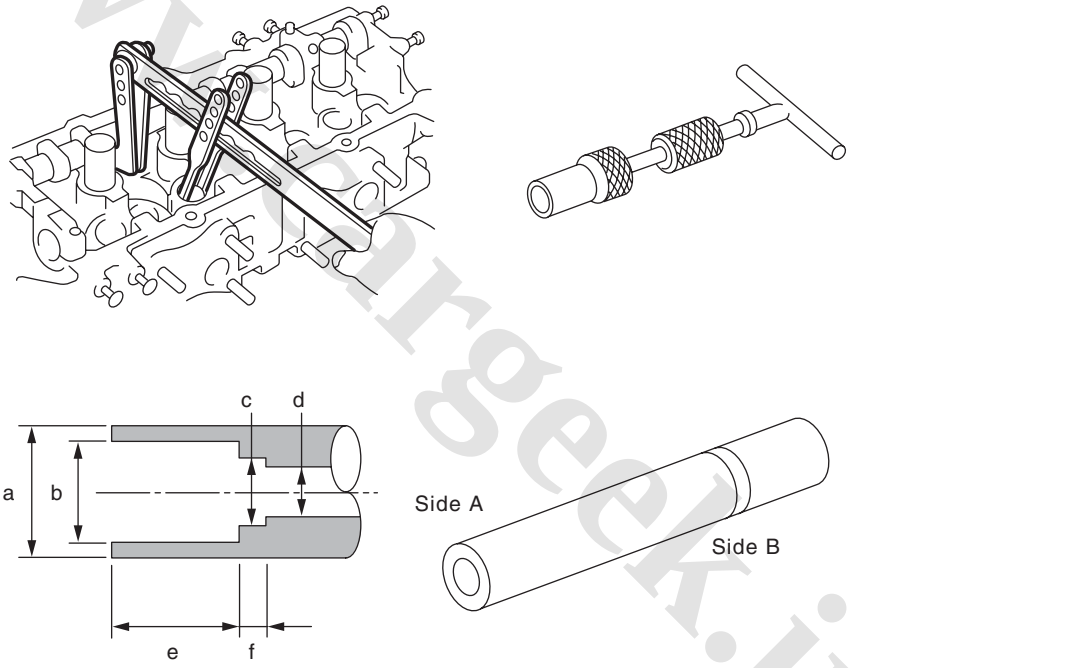
Engine	Paint mark color	
	Intake	Exhaust
VQ23DE	White	Purple or Orange
VQ35DE		Blue

VALVE OIL SEAL

Metal ring of the press-fit type is adopted.



Valve spring and valve oil seal are removed as shown in the illustration. (For SST No., refer to the Service Manual.)



VALVE LIFTER AND SHIMS

Valve Lifter (Shim-less Valve Lifter)

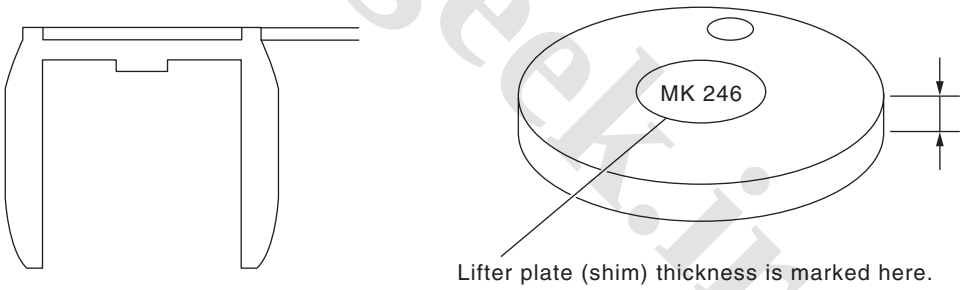
The valve lifter with a shim is made of a high-silicon, aluminum alloy to reduce the weight (used for the previous model of VQ engine).
The valve lifter without a shim is made of steel that is strong against wear (used for the current model of VQ engine). Therefore, no periodical maintenance is required.
But in case a valve lifter is replaced for some reason, it requires performing several procedures
described below.

1. Removal of the drive belts
2. Removal of the crank pulley
3. Removal of the oil pan
4. Removal of the chain cover
5. Removal of the chains
6. Removal of the collector
7. Removal of the rocker cover
8. Removal of the camshaft
9. Replacement of a valve lifter
10. Installation of all of the parts that were removed

The valve lifter sidewall has a barrel shape like the second piston ring (current VQ). This makes it easier to insert into the lifter bore.

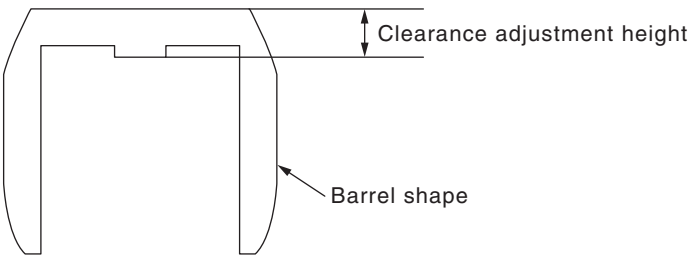
With Shim and Without Shim

With shim



Without shim

VQ35DE



ENG0148

3. NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING

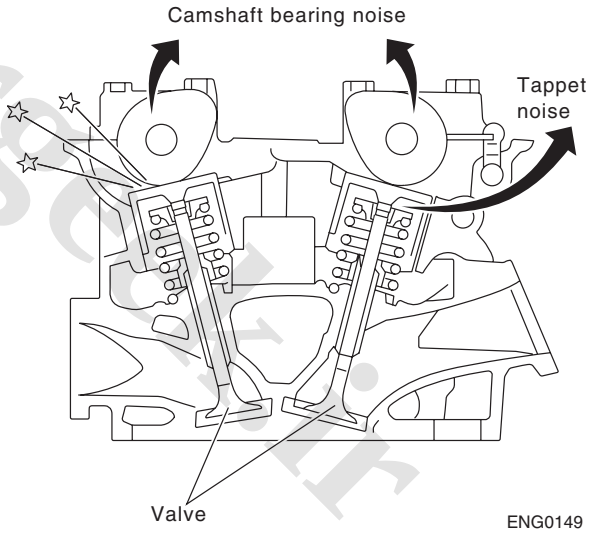
Use the chart below to help you find the cause of the symptom.

1. Locate the area where the noise comes from.
2. Confirm the type of noise.
3. Specify the operating condition of the engine.
4. Check the 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
		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 journal oil clearance camshaft runout

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

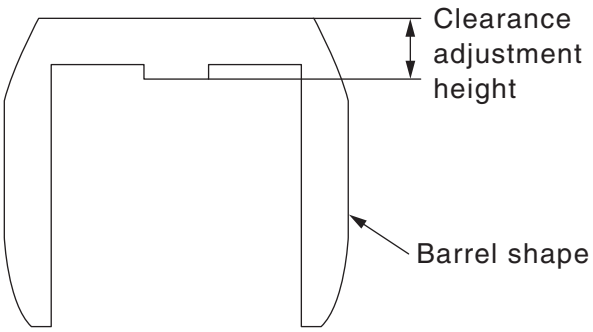


1) Valve Adjustment

Whenever new camshafts, valves, etc. are replaced, measure the valve clearances and select suitable adjusting shims.

ADJUSTING VALVE LIFTER REMOVAL PROCEDURE
(Valve lifter without shims VQ23, 35)

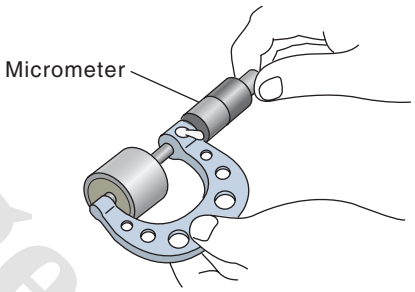
The valve lifter is made of steel, which is strong against wear. Thus, no periodical maintenance is required.



ENG0153

Adjustment can be performed by selecting the thickness of the lifter.

1. Remove the camshaft.
2. Remove the valve lifters at the locations that are out of the standard.
3. Measure the center thickness of the removed valve lifters with a micrometer.



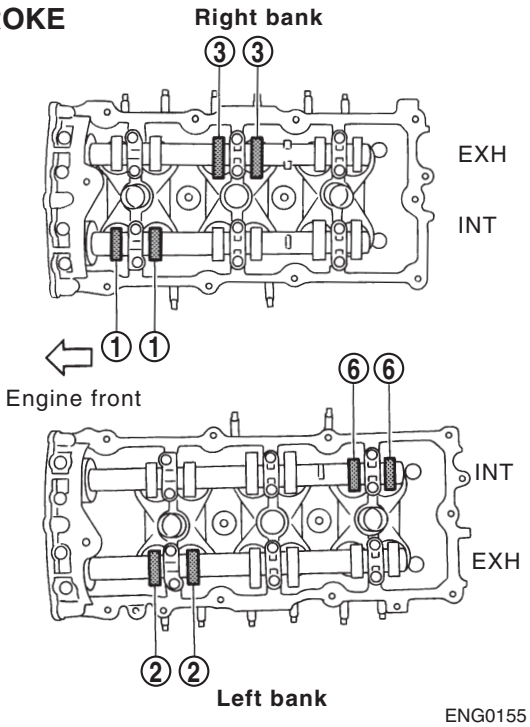
ENG0154

2) How to Set Up Measurement Procedure (VQ Engine)

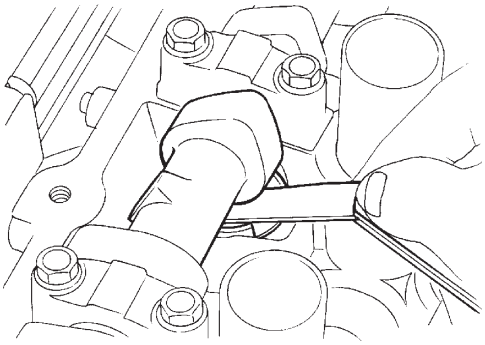
Referring to the figure, measure the valve clearances at locations marked with an "×" as shown in the table below (locations indicated in the figure) with a feeler gauge.

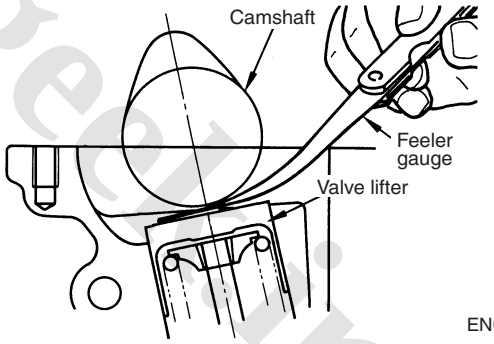
NO. 1 CYLINDER TDC AT COMPRESSION STROKE

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



ENG0155

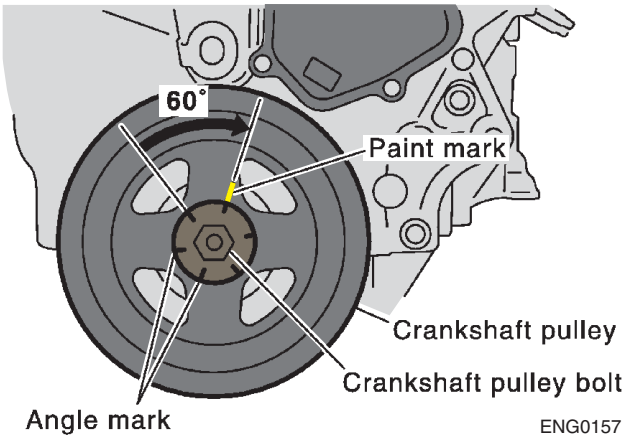




ENG0156

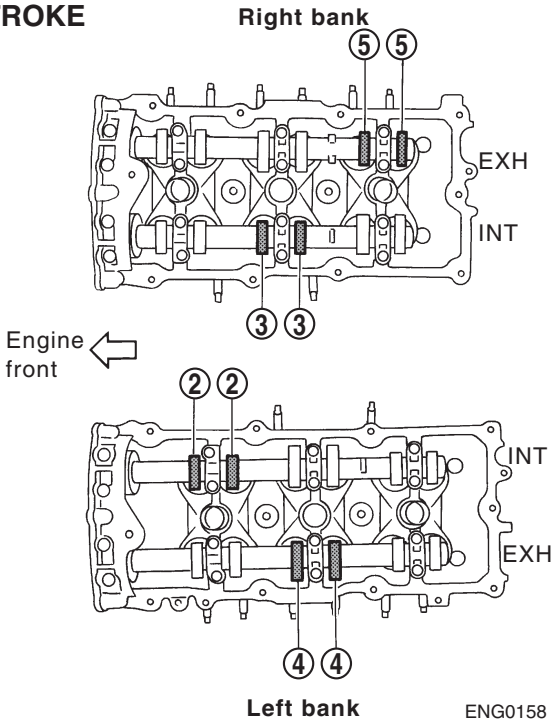
Rotate the crankshaft by 240 degrees clockwise (when viewed from the engine front) to align the No. 3 cylinder at TDC of its compression stroke.

NOTE **There is a crankshaft pulley mounting bolt flange that has a stamped line every 60 degrees on it. These can be used as a guide to the rotation angle.**



NO. 3 CYLINDER TDC AT COMPRESSION STROKE

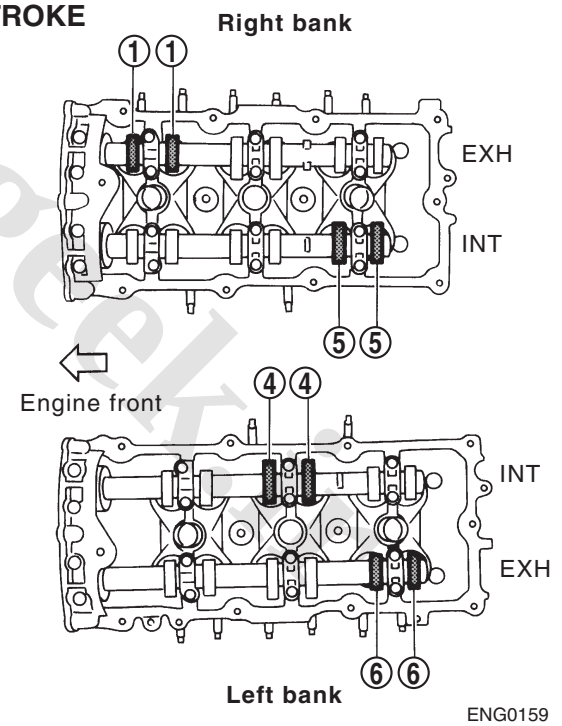
Measuring position (right bank)		No. 1 CYL	No. 3 CYL	No. 5 CYL
No. 3 cylinder at compression TDC	EXH			×
	INT		×	
Measuring position (left bank)		No. 2 CYL	No. 4 CYL	No. 6 CYL
No. 3 cylinder at compression TDC	INT	×		
	EXH		×	



ENG0158

NO. 5 CYLINDER TDC AT COMPRESSION STROKE

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



ENG0159

The actual performance of the valve clearance check is explained in the video program provided here.

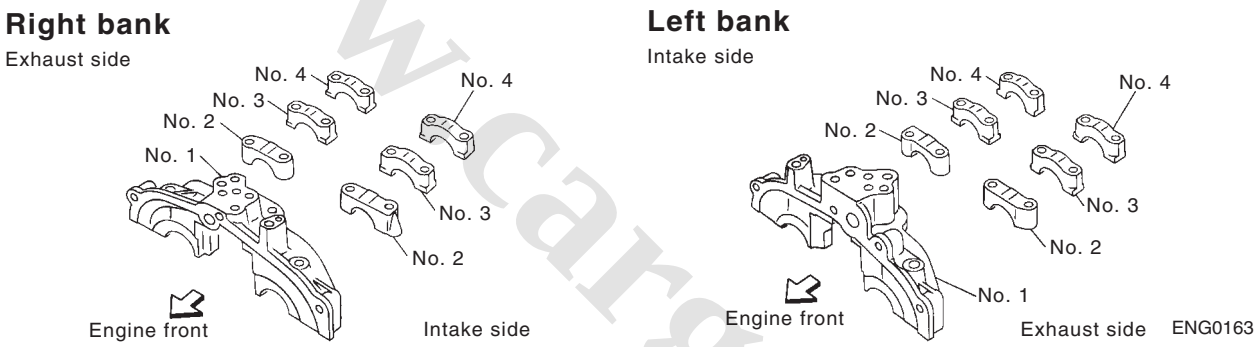
Watch a video

4. CAMSHAFT AND DRIVE MECHANISM

- The camshafts are driven by two-stage small-pitch silent chains. The primary chain drives the inner intake camshafts, which drive the outer exhaust camshafts by a secondary chain.
- A lighter and more compact camshaft driving system including sprockets is realized by adopting a small-pitch silent chain.
- Noise and friction in this driving system is reduced by adopting a silent chain and by providing micro-finish processing (super-precision finish) on the cam surface of the camshaft.

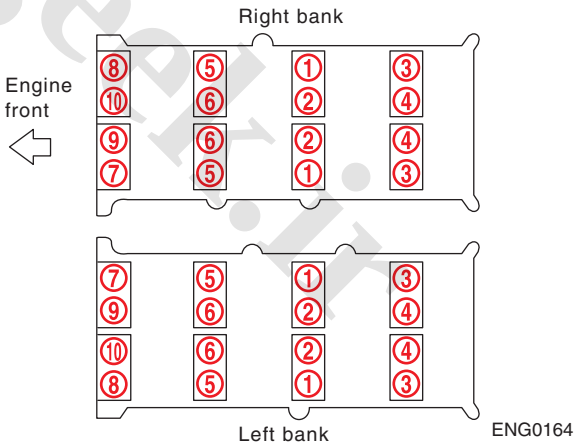
1) Camshaft Bracket

Camshaft brackets are made of an aluminum alloy, and they are designed to support one camshaft with four positions.
The No. 1 camshaft bracket is an intake/exhaust integrated type in order to enhance rigidity.



REMOVE CAMSHAFT BRACKETS

Mark the camshafts, camshaft brackets and bolts so that they will be placed in the same position and direction during installation.
The figure on the right shows the tightening procedure of the bracket bolts.
Equally loosen camshaft bracket bolts in several steps in the reverse order as that shown in the figure.



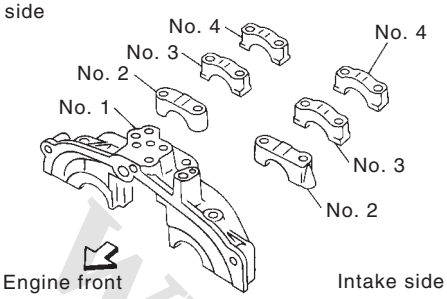
INSTALL CAMSHAFT BRACKETS

Completely remove any foreign material from the back of the camshaft bracket and from the cylinder head installation face.

Install the camshaft bracket in its original position and direction as shown in the figure.

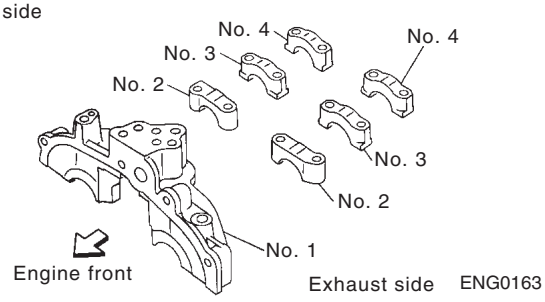
Right bank

Exhaust side

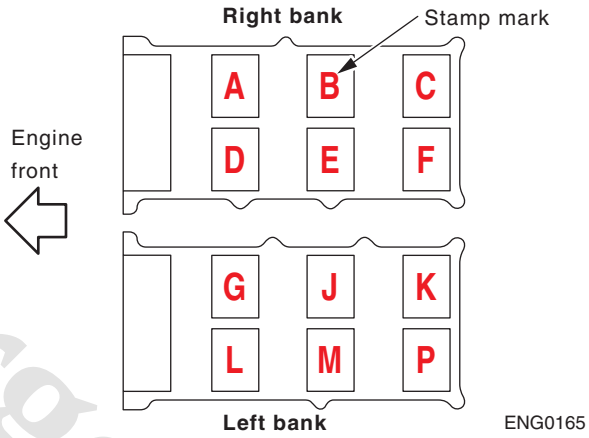


Left bank

Intake side



Install the camshaft brackets (No. 2 to No. 4) according to the designated position of the alphabetical ID marks as shown in the figure.

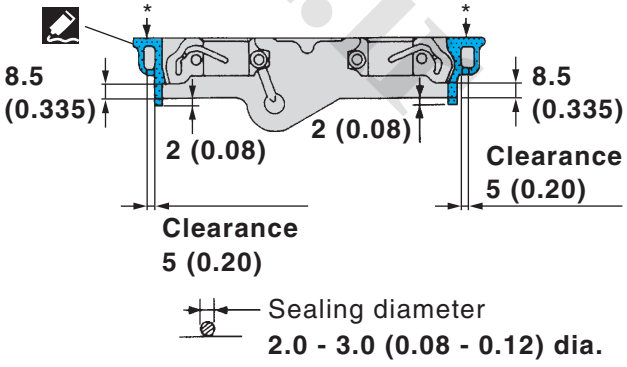


NOTE **There are no ID marks on the left and right No. 1 camshaft bracket.**

Apply liquid gasket to the mating surface of the camshaft bracket for the right and left banks as shown in the figure.

Use genuine liquid gasket or its equivalent

Camshaft bracket (No. 1)



* : Remove the protruding liquid gasket from front face.
(Remove the hardened liquid gasket from surface only.)

: Apply genuine liquid gasket or equivalent.

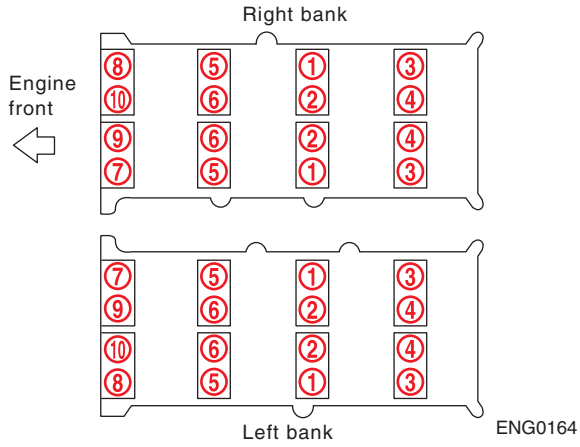
Unit: mm (in)

ENG0166

TIGHTEN CAMSHAFT BRACKET

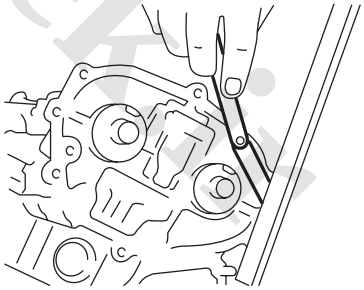
Tighten the camshaft bracket bolts in the following steps and order as shown in the figure.

a. Tighten No. 7 to No. 10 in the order as shown.	2.0 N·m (0.20 kg-m, 1 ft-lb)
b. Tighten No. 1 to No. 6 in the order as shown.	2.0 N·m (0.20 kg-m, 1 ft-lb)
c. Tighten No. 1 to No. 10 in the numerical order as shown.	5.9 N·m (0.60 kg-m, 4 ft-lb)
d. Tighten No. 1 to No. 6 in the numerical order as shown.	10.4 N·m (1.1 kg-m, 8 ft-lb)
e. Tighten No. 7 to No. 10 in the numerical order as shown.	9.3 N·m (0.95 kg-m, 7 ft-lb)



Tightening of the camshaft bracket bolts is explained in the video program provided here.

Watch a video



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

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

Measure the difference in levels between the front end faces of a single bank.
If the measured value is out of the standard, reinstall the No. 1 camshaft bracket.

2) Inspection of Camshaft After Removal

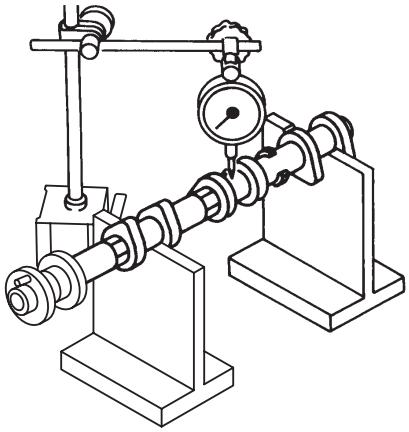
CAMSHAFT RUNOUT

1. Put a V-block on the flat base, and support No. 2 and No. 4 journals of the camshaft.

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

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

Standard:
0.02 mm (0.0010 in)
Limit:
0.05 mm (0.0020 in)



ENG0375

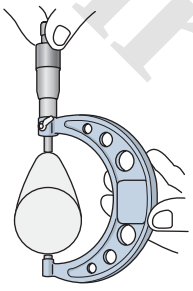
The method for measuring the camshaft runout is explained in the e-Learning program provided here.

e-Learning

CAMSHAFT CAM HEIGHT

1. Measure the camshaft cam height with a micrometer.

Standard cam height
Intake
VQ23DE: 44.265 - 44.455 mm (1.7427 - 1.7502 in)
VQ35DE: 44.865 - 45.055 mm (1.7663 - 1.7738 in)
Exhaust
VQ23DE: 43.405 - 43.595 mm (1.7089 - 1.7163 in)
VQ35DE: 44.865 - 45.055 mm (1.7663 - 1.7738 in
Cam wear limit:
0.2 mm (0.008 in)



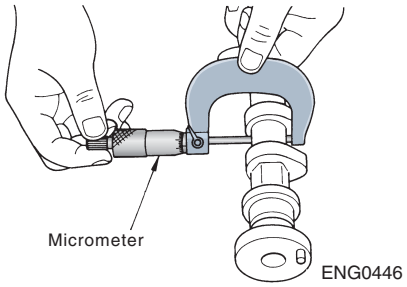
ENG0169

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

CAMSHAFT JOURNAL OIL CLEARANCE

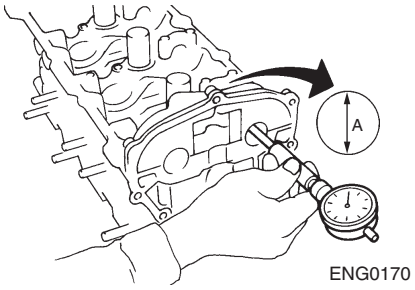
Measure the outer diameter of the camshaft journal with a micrometer.

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)



Measure the inner diameter of the camshaft bracket.

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)



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 – 0.0034)
Limit:
0.15 mm (0.0059 in)

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

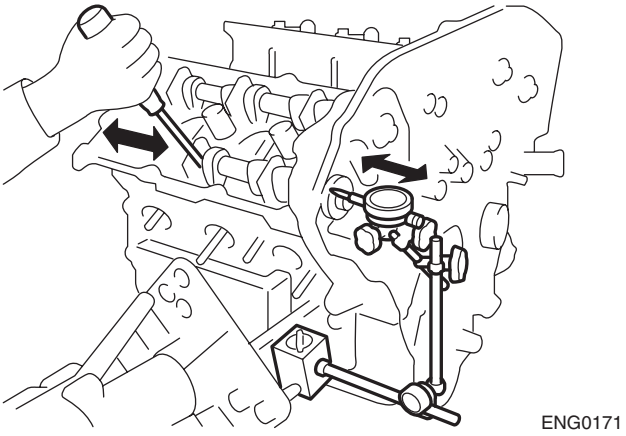
NOTE

The camshaft bracket cannot be replaced as a single part because it is machined together with the cylinder head.
Replace the whole cylinder head assembly.

CAMSHAFT END PLAY

Install the dial indicator in the thrust direction on the front end of the camshaft as shown in the figure. Measure the endplay of the dial indicator when the camshaft is moved forward/backward (in the axial direction).

Standard:
0.115 - 0.188 mm (0.0045 - 0.0074 in)
Limit:
0.24 mm (0.0094 in)



ENG0171

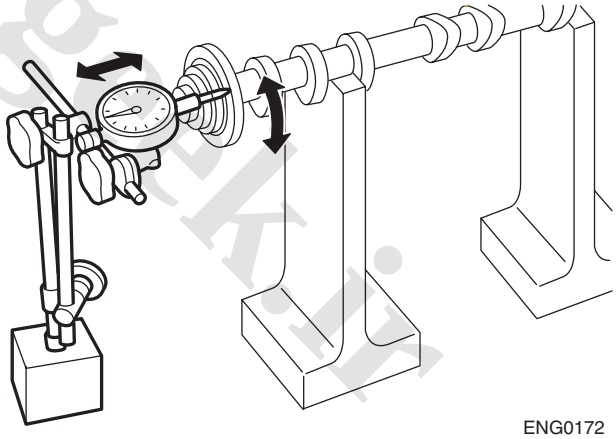
CAMSHAFT SPROCKET RUNOUT

1. Put a V-block on a flat base, and support No. 2 and No. 4 journal of the camshaft.

CAUTION:
Do not support the No. 1 journal because it has a different diameter than the other three locations.

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

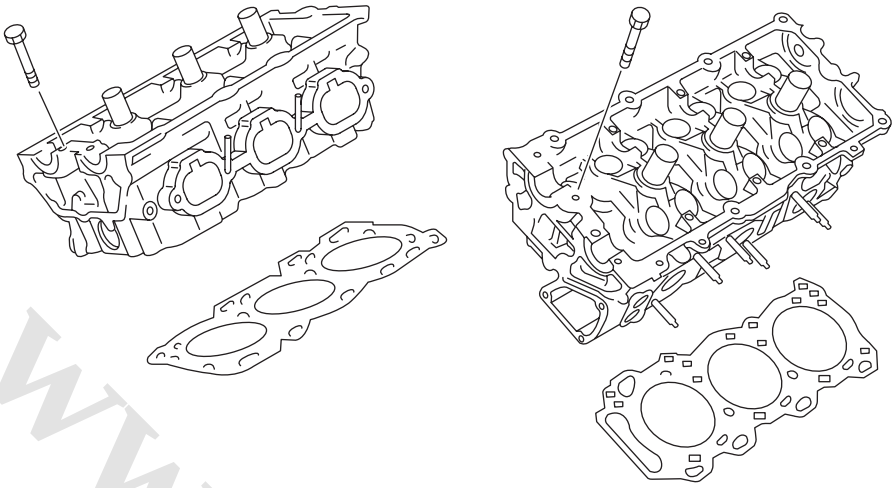
Limit:
0.15 mm (0.0059 in)



ENG0172

If it exceeds the limit, replace the camshaft sprocket.

1) Inspection of Cylinder Head After Removal

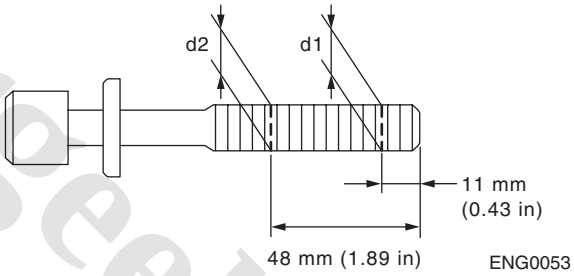


ENG0178

CYLINDER HEAD BOLTS OUTER DIAMETER

Cylinder head bolts are tightened by the plastic zone tightening method. Whenever the size difference between **d1** and **d2** exceeds the limit, replace them with new ones.
If a reduction of the outer diameter appears in a position other than **d2,** use it as **d2** point.

Limit (d1 – d2): 0.11 mm (0.0043 in)



ENG0053

The actual operation of cylinder head bolts tightening is explained in the video program provided here.

Watch a video

2) Cylinder Head Distortion

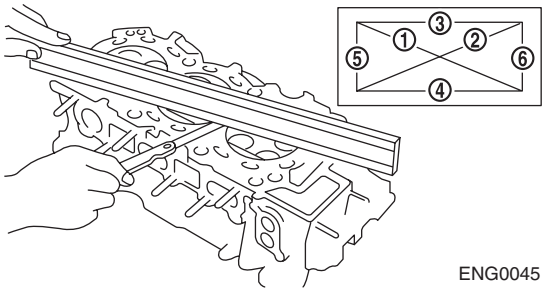
NOTE When inspecting the cylinder head distortion, the cylinder block surface distortion must also be checked.

1. Wipe off oil and remove the scale, gasket, sealant and carbon deposits from the surface of the cylinder head with a scraper and a rag.

CAUTION:
Make sure that the gasket debris does not enter passages of the engine oil or engine coolant.

2. At each of several locations on the surface of the cylinder head, measure the distortion in six directions.

Limit: 0.1 mm (0.004 in)



ENG0045

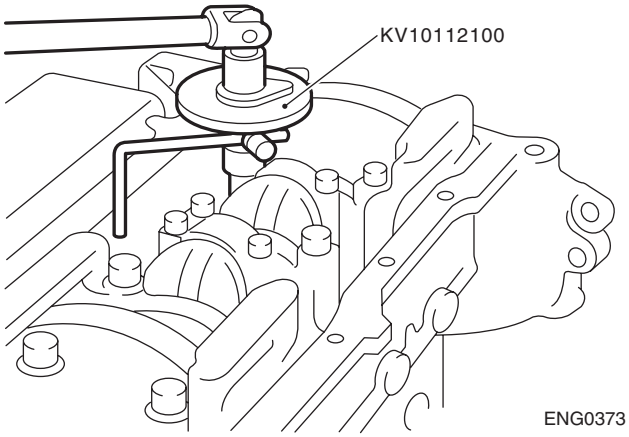
The method for checking the cylinder head distortion is shown in the video program provided here.

Watch a video

2) Angle Tightening

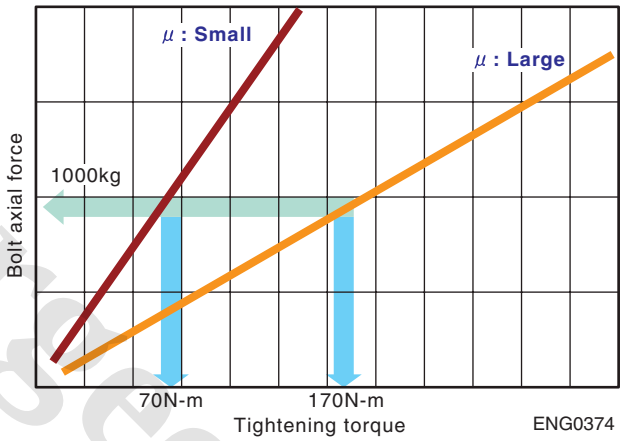
ANGLE TIGHTENING

An angle wrench must be used when tightening bolts for a bearing cap, cylinder head and crankshaft pulley, etc. Normally, 50 to 80% of the tightening torque applied to the bolt may be lost due to the friction of the threads and bolt seat and the cylinder block surface in this case.



NECESSARY AXIAL FORCE

The graph on the right shows that in order to obtain 1000 kg of bolt axial force, 70 N-m of tightening torque is required if the friction is small. 170 N-m is required if the friction is rather large.



info

BOLT TIGHTENING CHARACTERISTICS

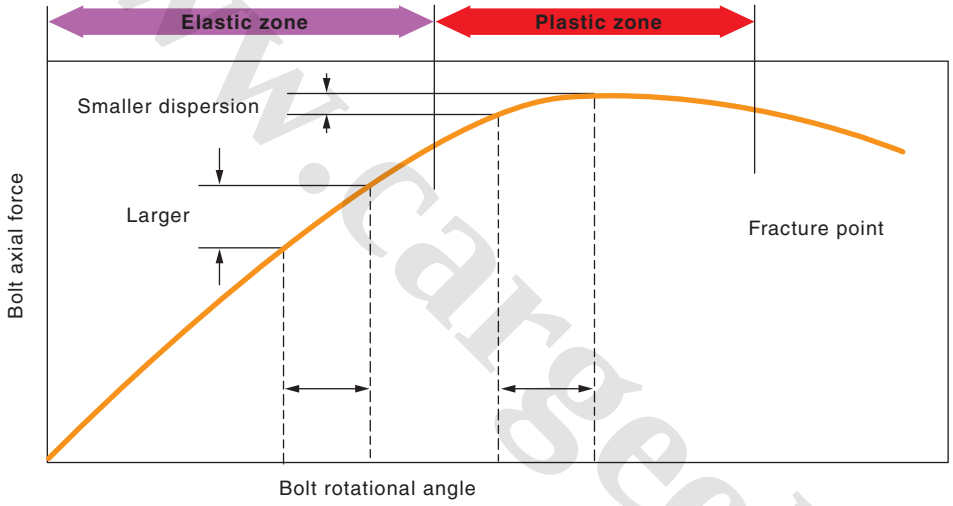
An ordinary bolt has an elastic zone and plastic zone in terms of axial force when it is tightened. In the elastic zone, the bolt axial force increases in proportion to the rotational angle of the bolt. When the bolt is tightened beyond the elastic zone, as the curve becomes gentle, the amount of bolt axial force changes a little even if the rotational angle of the bolt is large. This area is called the plastic zone, and by selecting a suitable material for the bolt, the target bolt axial force can be easily maintained.

ELASTICITY:

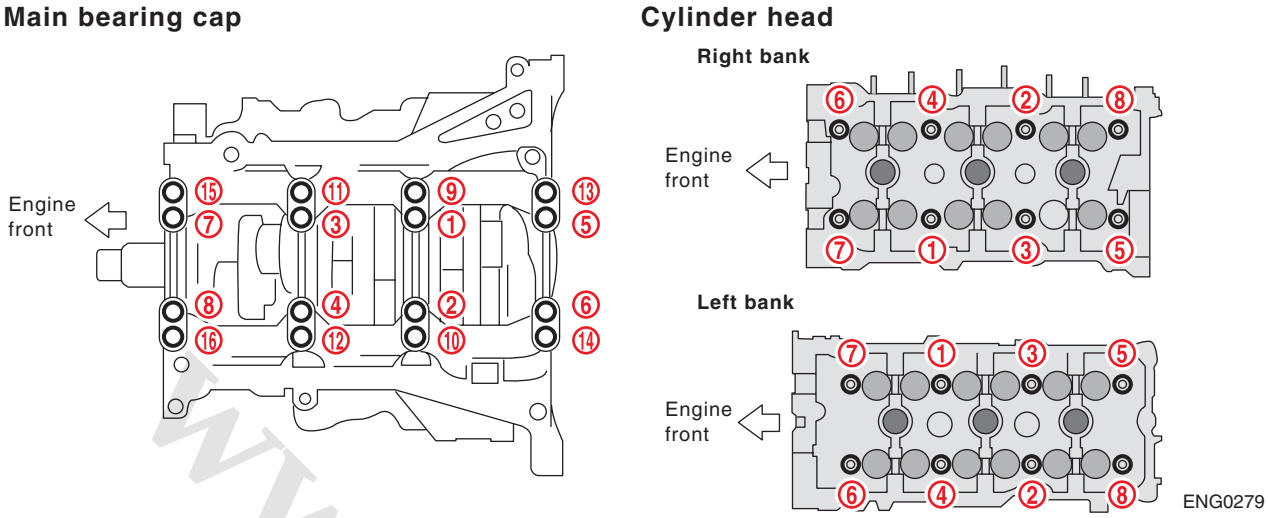
The property of a substance that tends to restore its original dimensions when the deformation is removed.

PLASTICITY:

The property of a substance that tends to be deformed permanently even if the deforming stress is removed.



3) Tighten Bearing Cap Bolts and Cylinder Head Bolts



CYLINDER HEAD BOLTS

- The cylinder head bolts are secured to be tightened using a “plastic zone” tightening method. More specifically, the bolts are tightened in two steps using an angular tightening method in six different stages to equalize the tightening torque, in order to prevent a decrease of axial torque and to improve sealing.
- The thread of the head bolt has been lengthened to expand the “plastic deformity” zone. As a result, the bolt can be reused as long as the specified dimension has been maintained.

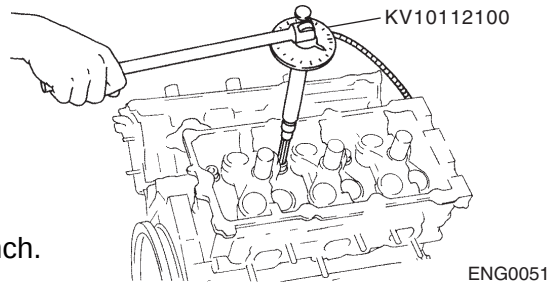
CYLINDER HEAD TIGHTENING PROCEDURE

Tightening method using angle wrench

a. Apply new engine oil to the threads and seat surfaces of the 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)

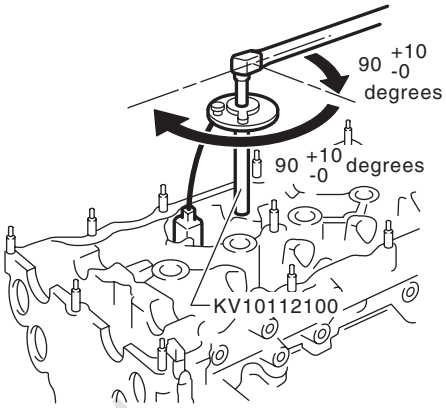
CAUTION:
In step “c”, loosen bolts in the reverse order of that indicated in the figure.

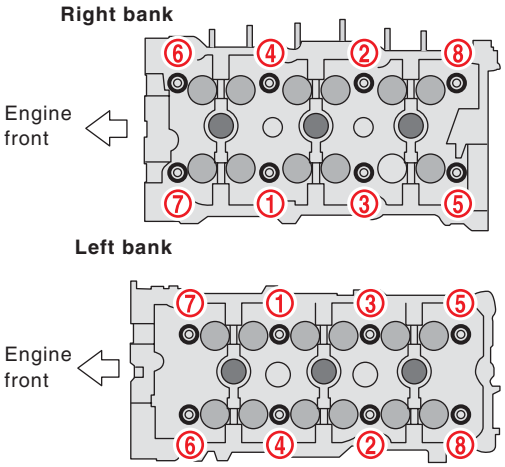
d. Tighten all cylinder head bolts.
   39.2 N·m (4.0 kg-m, 29 ft-lb)
e. Turn all cylinder head bolts **90 degrees** clockwise. (Angle tightening)



CAUTION:
Check the tightening angle using an angle wrench.

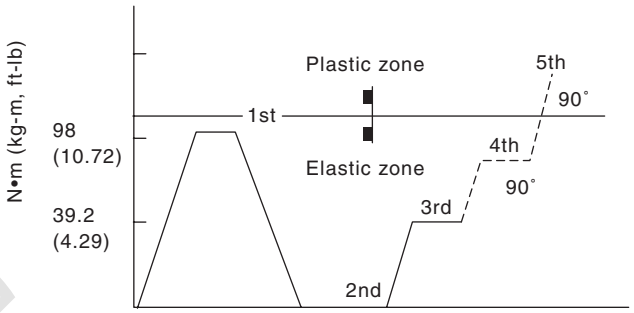
f. Turn all cylinder head bolts **90 degrees** clockwise again.





VQ DE engine

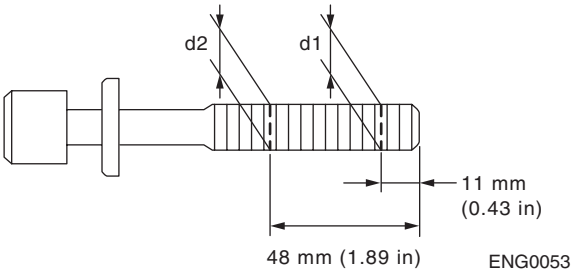
	Tightening torque N•m (kg-m, ft-lb)
1st	98.1 N•m (10 kg-m, 72 ft-lb)
2nd	0.0 N•m (0 kg-m, 0 ft-lb)
3rd	39.2 N•m (4.0 kg-m, 29 ft-lb)
4th	90 degrees
5th	90 degrees



info

A bolt extends

A bolt will extend if it is tightened in the plastic zone. Therefore, the cylinder head bolt's outer diameter needs to be inspected before reuse.



The actual operations for loosening and tightening cylinder head bolts and more information about the bolt plastic zone are shown in the video program provided here.

Watch a video

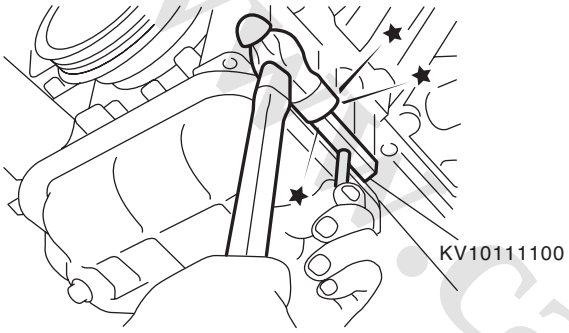
4. APPLY LIQUID GASKET

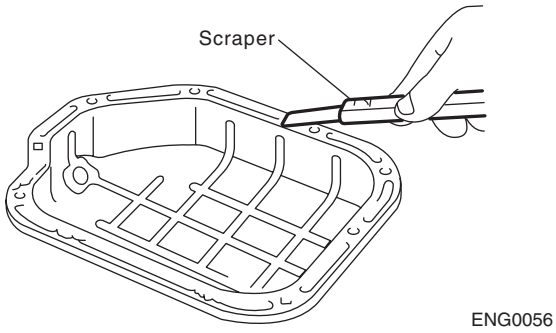
1) Remove Oil Pan

Insert seal cutter [SST] between the oil pan (lower) and oil pan.

CAUTION:
Be careful not to damage the mating surfaces. Do not insert a screwdriver because it will damage the mating surfaces.

Slide the seal cutter by tapping on the side of the tool with a hammer. Use a scraper to remove the old liquid gasket from the mating surfaces.

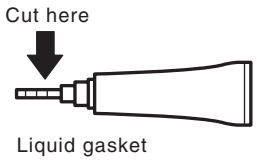


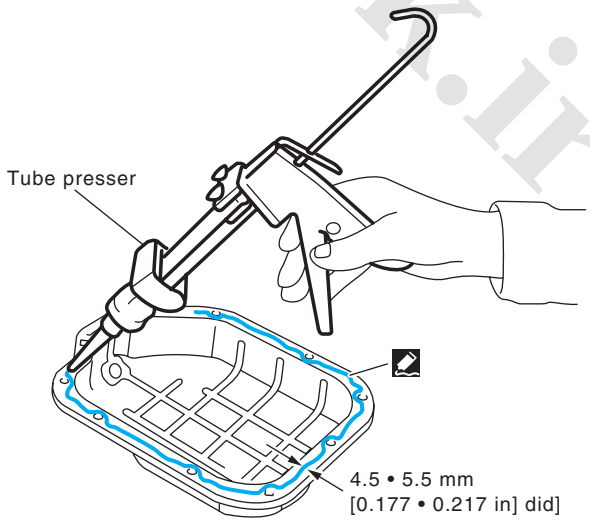


ENG0056

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

CAUTION:
Use genuine liquid gasket or the equivalent.
Complete the work within 5 minutes after coating.



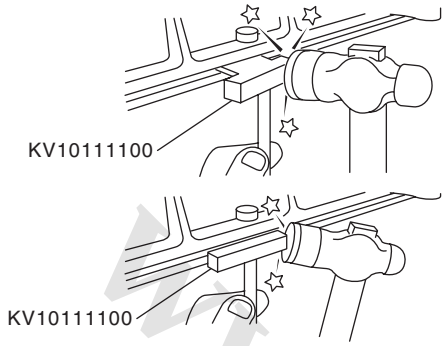


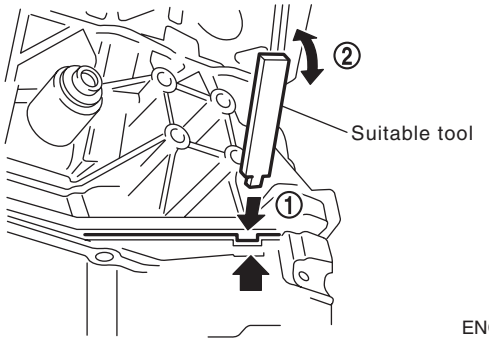
: Apply Genuine Liquid Gasket or equivalent.

ENG0057

2) Lower Cylinder Block

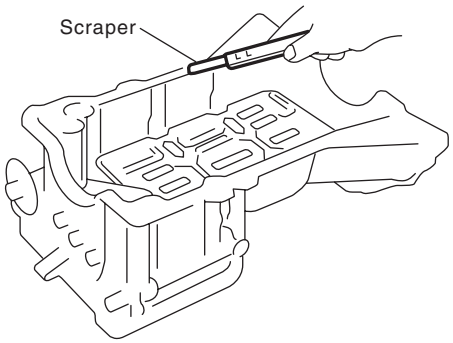
Insert a suitable tool into the notch of the oil pan (upper) as shown (1). Pry off the oil pan (upper) by moving the tool up and down as shown (2) to remove the oil pan (upper).

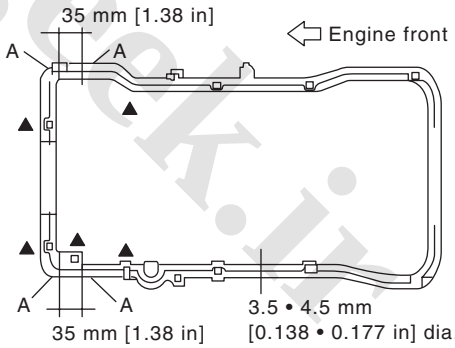




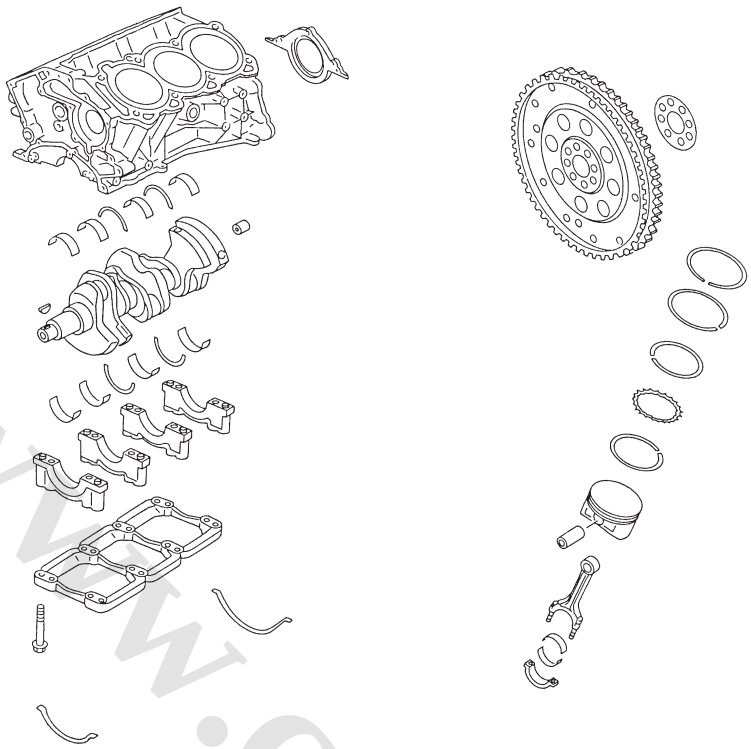
Use a scraper to remove the old liquid gasket from the mating surfaces. Also remove the old liquid gasket from the mating surface of the cylinder block.
Remove the old liquid gasket from the bolt holes and threads. Apply a continuous bead of liquid gasket with the tube presser (SST: WS39930000) to the cylinder block mating surface of the oil pan (upper) to a limited portion as shown in the figure.

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”. Complete the work within 5 minutes after coating. Use genuine liquid gasket or the equivalent.





1. MAJOR COMPONENT PARTS



ENG0395

1) Malfunction Causing Engine Overhaul

You will study what types of malfunctions will cause the need to overhaul an engine in this module. If you understand an incident pertaining to a specific part, this will help you to diagnose the malfunctions efficiently.

a. An engine with an overheating malfunction (piston ring and cylinder head distortion).
b. An engine with excessive oil consumption (piston ring and wear of the cylinder bore).
c. Noise that occurs from the area of the cylinder block (bearings, piston, piston pin and wear of the cylinder bore).
d. An incident that has recurred after repair (bearing and piston ring).
e. The engine power has declined (wear of internal parts).

2) Is Overhauling Necessary?

There are several reasons that the engine should be overhauled as mentioned above. Normally, an engine overhaul is a big job, and it takes many hours to perform. Also, it is an expensive repair and costs the customer a lot of money.
Therefore, a careful diagnosis is necessary before you decide to perform an overhaul.

3) NVH* Diagnosis

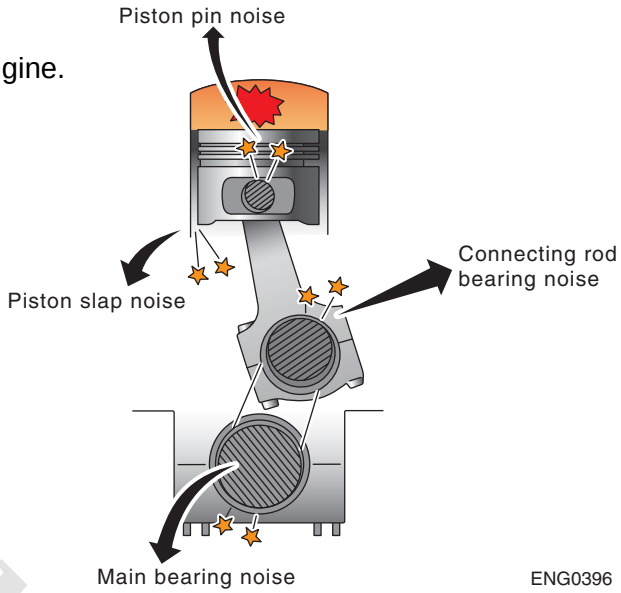
NVH*: Noise, Vibration and Harshness

In the Service Manual, an engine NVH symptom chart that is reproduced here is introduced. This will help you determine the cause when the engine makes noise.

SYMPTOM CHART

a. Locate the area where noise occurs.
b. Confirm the type of noise.
c. Specify the operating condition of the engine.
d. Check the specified noise source.

If necessary, repair or replace these parts.



ENG0396

Location of noise	Type of noise	Operating condition of engine						Source of noise	Check item
		Before warm-up	After warm-up	When start-ing	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
Crank-shaft pul-ley Cylinder block (Side of engine) Oil pan	Slap or knock	—	A	—	B	B	—	Piston pin noise	Piston to piston pin oil clearance Connecting rod bush-ing oil clearance
	Slap or rap	A	—	—	B	B	A	Piston slap noise	Piston to cylinder bore clearance Piston ring side clear-ance Piston ring end gap Connecting rod bend and torsion
	Knock	A	B	C	B	B	B	Connect-ing rod bearing noise	Connecting rod bush-ing oil clearance Connecting rod bear-ing oil clearance
	Knock	A	B	—	A	B	C	Main bearing noise	Main bearing oil clear-ance Crankshaft runout

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

ENG0397

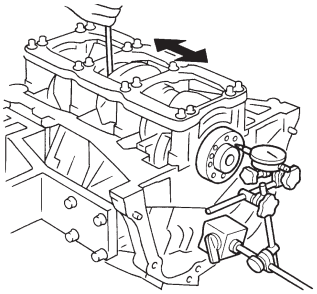
CRANKSHAFT ENDPLAY

Crankshaft endplay is an axial free play of the crankshaft, and it can be measured by a dial gauge.

If the measured value exceeds the limit, replace the thrust bearings, and then measure it again.

Standard:

0.10 - 0.25 mm (0.0039 - 0.0098 in)



ENG0398

The method to perform the measurement is demonstrated in the video program provided here.

Watch a video

2. ENGINE OVERHAUL (CASE 1)

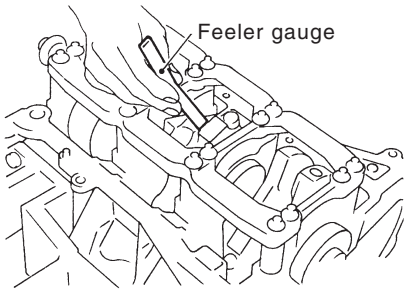
Having Excessive Oil Consumption

1) Removal

Removal of the piston and connecting rod assembly is described here.
Before removing the piston and connecting rod assembly, check the connecting rod side clearance.

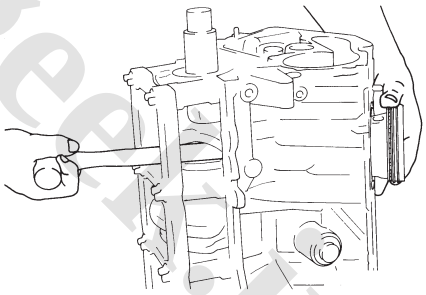
CONNECTING ROD SIDE CLEARANCE
Measure the clearance between the connecting rod and crankshaft arm with a feeler gauge. If the measured value exceeds the limit, replace the connecting rod, and then measure it again.

Standard:
0.20 - 0.35 mm (0.0079 - 0.0138 in)
Limit:
0.40 mm (0.0157 in)



ENG0399

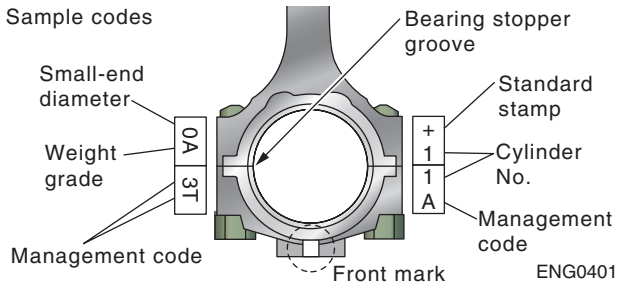
REMOVE CONNECTING ROD ASSEMBLY
a. Position the crankshaft pin of the connecting rod to be removed onto the BDC.
b. Remove the connecting rod bearing cap.
c. Using a hammer handle or similar tool, push the piston and connecting rod assembly out to the cylinder head side.


ENG0400

CAUTION:
Be careful not to damage the cylinder wall and crankshaft pin when tapping the parts.

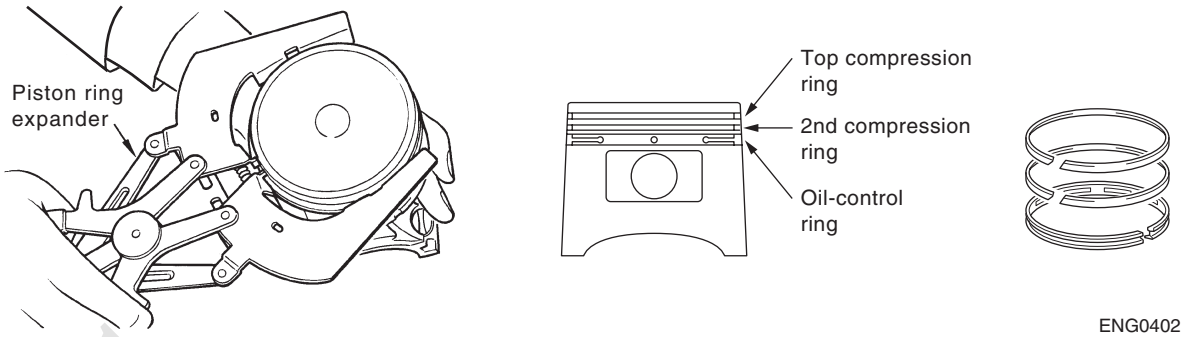
d. Remove connecting rod bearings from the connecting rod and the connecting rod bearing cap.

CAUTION:
Identify each bearing and cap so that they will be installed in the original position.



ENG0401

e. Remove the piston rings from the piston using a piston ring expander (commercial service tool).



2) Side Clearance of Piston Ring and Piston Ring Groove

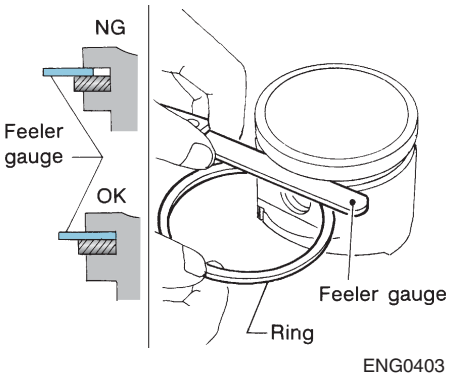
Measure the side clearance of the piston ring and piston ring groove with a feeler gauge.

Standard: mm (in)

	VQ23DE	VQ35DE
Top ring	0.0045 - 0.080 (0.0018 - 0.0031)	0.045 - 0.080 (0.0018 - 0.0031)
2nd ring	0.030 - 0.070 (0.0012 - 0.0028)	0.030 - 0.070 (0.012 - 0.0028)
Oil ring	0.045 - 0.125 (0.0018 - 0.0049)	0.030 - 0.070 (0.0012 - 0.0028)

Limit: mm (in)

	VQ23DE
Top ring	0.11 (0.0043)
2nd ring	0.10 (0.039)



If the measured value exceeds the limit, replace the piston ring, and then measure it again.

3) Piston Ring End Gap

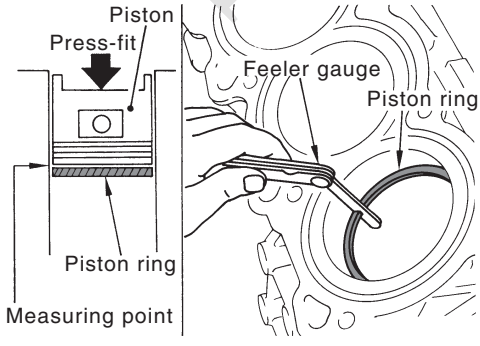
Make sure that the cylinder bore inner diameter is within the specification.

Standard: mm (in)

	VQ23DE	VQ35DE
Top ring	0.20 - 0.30 (0.0079 - 0.0018)	0.23 - 0.33 (0.0091 - 0.013)
2nd ring	0.31 - 0.46 (0.0122 - 0.0181)	0.33 - 0.48 (0.0130 - 0.0189)
Oil ring	0.20 - 0.60 (0.079 - 0.0236)	0.20 - 0.50 (0.0079 - 0.0197)

Limit: mm (in)

	VQ23DE
Top ring	0.54 (0.0213)
2nd ring	0.67 (0.0264)



Lubricate the piston and the piston ring with new engine oil, and then insert the piston ring until the middle of the cylinder with a piston. Measure the piston ring end gap with a feeler gauge.

4) Cylinder Bore Inner Diameter (Piston to Cylinder Bore Clearance)

Using a bore gauge, measure the cylinder bore for wear, out-of-round and the taper at six different points on each cylinder. (“X” and “Y” directions at “A”, “B” and “C”.) (“X” is in the longitudinal direction of engine.)

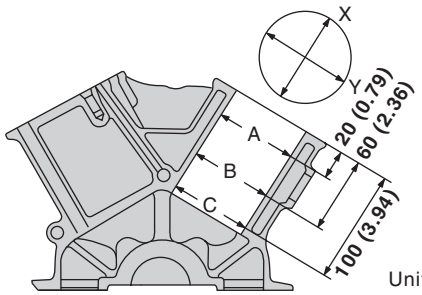
Standard inner diameter:
VQ23DE:
85.000 - 85.030 mm (3.3465 - 3.3476 in)

VQ35DE:
95.500 - 95.530 mm (3.7598 - 3.7610 in)

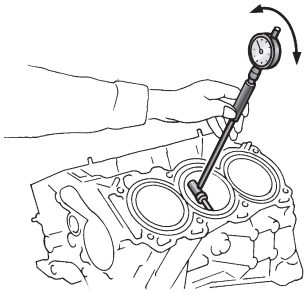
Wear limit:
0.2 mm (0.008 in)

Out-of-round (Difference between “X” and “Y”):
0.015 mm (0.0006 in)

Taper limit (Difference between “A” and “C”):
0.01 mm (0.0004 in)



Unit: mm (in)



ENG0405

If the measured value exceeds the limit, or if there are scratches and/or seizures on the cylinder inner wall, hone or re-bore the inner wall.
An oversized piston is provided. When using an oversized piston, re-bore the cylinder so that the clearance of the piston-to-cylinder bore satisfies the standard.

CAUTION:
When using an oversized piston, all the cylinders must be machined to the same side.

Oversize (OS):
0.2 mm (0.008 in)

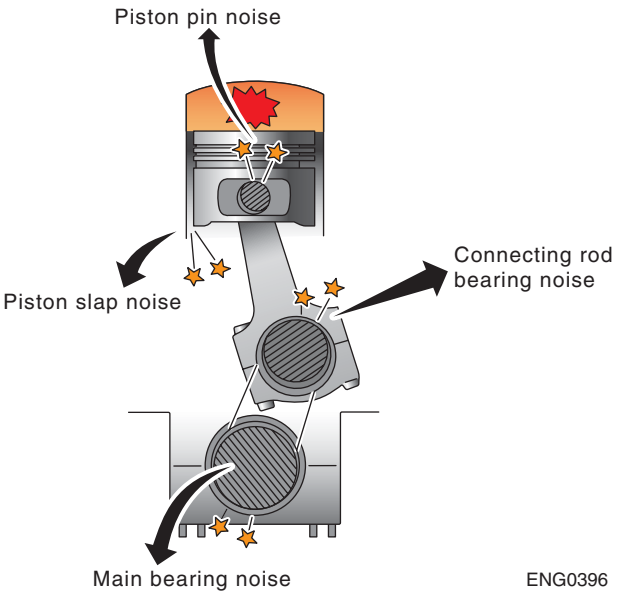
The method to measure the cylinder bore using a cylinder gauge is explained and demonstrated in the e-Learning program provided here.

e-Learning

3. ENGINE OVERHAUL (CASE 2)

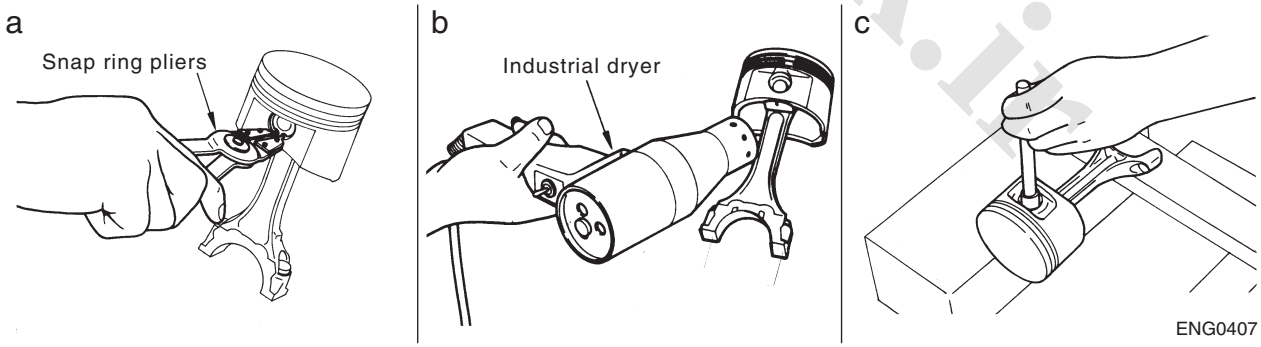
Noise from Cylinder Block Area

The engine noise that can be heard from the block area is normally categorized as shown in the illustration on the right.



1) Piston to Piston Pin Oil Clearance (Piston Pin Noise and Piston Slap Noise)

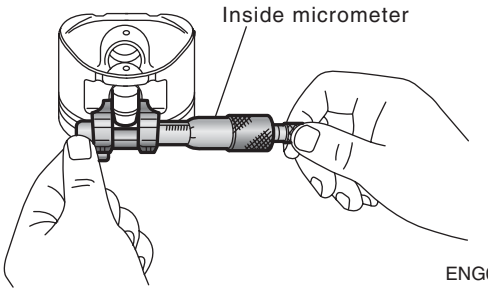
Remove the piston from the connecting rod as follows:
a. Using snap ring pliers, remove the snap ring.
b. Heat the piston to 60 to 70°C (140 to 158°F) with an industrial dryer or the equivalent.
c. Push out the piston pin with a drift that has an outer diameter of approximately 20.



PISTON PIN HOLE DIAMETER

Measure the inner diameter of a piston pin hole with an inside micrometer.

Standard:
21.993 - 22.005 mm (0.8659 - 0.8663 in)

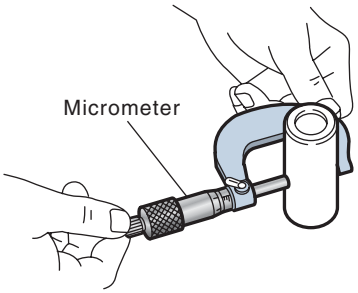


ENG0408

PISTON PIN OUTER DIAMETER

Measure the outer diameter of a piston pin with a micrometer.

Standard:
21.989 - 22.001 mm (0.8657 - 0.8662 in)



ENG0409

OIL CLEARANCE

(Piston to piston pin oil clearance) = (Piston pin hole diameter) – (Piston pin outer diameter)
If the calculated value is out of the standard, replace the piston and piston pin assembly.

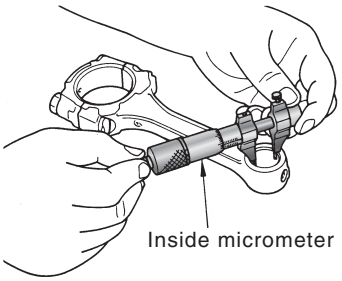
Standard:
0.0020 - 0.006 mm (0.001 - 0.0002 in)

2) Connecting Rod Bushing Oil Clearance

Measure the inner diameter of a connecting rod bushing with an inside micrometer. Then, measure the inner diameter of the piston pin hole.

Standard:
22.000 - 22.012 mm (0.8661 - 0.8666 in)
Limit:
0.030 mm (0.0012 in)

If the calculated value exceeds the limit, replace the connecting rod assembly and/or piston and piston pin assembly.



ENG0410

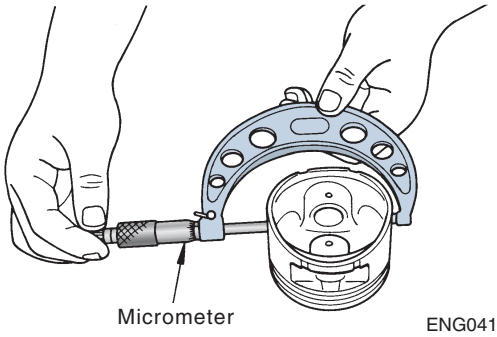
3) Piston to Cylinder Clearance

PISTON SKIRT DIAMETER

Measure the outer diameter of a piston skirt with a micrometer.

mm (in)

	VQ23DE	VQ35DE
Measurement point	Distance from the top 45.4 (1.787)	Distance from the top 41.0 (1.614)
Standard	84.980 - 85.010 (3.3457 - 3.3468)	95.480 - 95.510 (3.7590 - 3.7602)



ENG0411

NOTE **Measuring the cylinder bore diameter, refer to 2. 4) P9.**

If replacing the piston and piston pin assembly, follow the descriptions in the appropriate Service Manual.

See the ESM for the actual description ESM

4) Connecting Rod Bushing Oil Clearance

CLEARANCE

(Connecting rod bushing oil clearance) = (Connecting rod small end 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 the connecting rod assembly and/or piston and piston pin.

CONNECTING ROD BIG END DIAMETER

Install the connecting rod bearing cap without installing the connecting rod bearing, and tighten the connecting rod nuts (VQ23DE) or connecting rod bolts (VQ35DE) to the specified torque. Measure the inner diameter of the connecting rod big end with an inside micrometer or a cylinder gauge.

Standard:

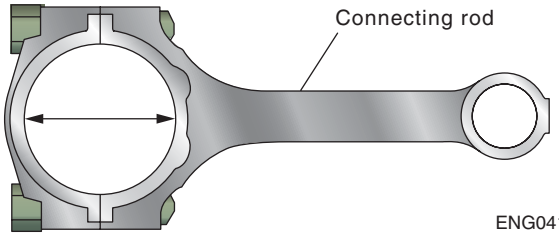
VQ23DE:

48.000 - 48.013 mm (1.8898 - 1.8903 in)

VQ35DE:

55.000 - 55.013 mm (2.1654 - 2.1659 in)

Example



CRANKSHAFT PIN JOURNAL DIAMETER

Measure the outer diameter of the crankshaft pin journal with a micrometer. Then, measure the inside diameter of the connecting rod bearing using the measuring method introduced below.

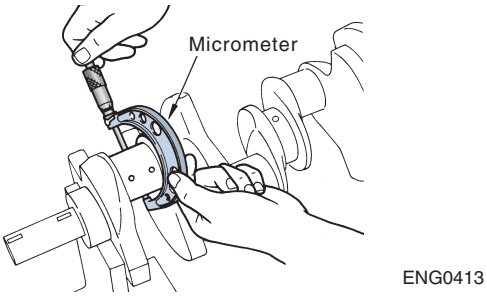
Standard:

VQ23DE:

44.956 - 44.974 mm (1.7699 - 1.7706 in) dia.

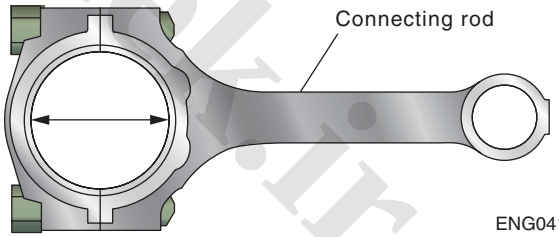
VQ35DE:

51.956 - 51.974 mm (2.0455 - 2.0462 in) dia.



METHOD BY CALCULATION

Example



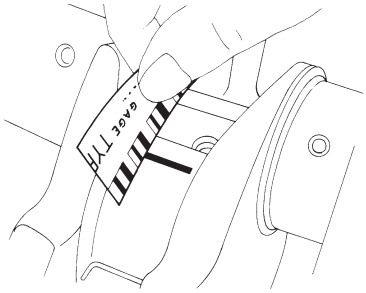
Install the connecting rod bearings to the connecting rod and the connecting rod bearing cap, and tighten the connecting rod nuts (VQ23DE) or connecting rod bolts (VQ35DE) to the specified torque. Then measure the inner diameter of the connecting rod bearing with an inside micrometer.

(Bearing oil clearance) = (Connecting rod bearing inner diameter) – (Crankshaft pin journal diameter)

If the calculated value exceeds the limit, select the proper thickness of the connecting rod bearing according to the connecting rod big end diameter and the crankshaft pin journal diameter to obtain the specified bearing oil clearance.

USING PLASTIGAGE

Example



ENG0417

Remove oil and dust on the crankshaft pin journal and the surfaces of each bearing completely.

Cut the plastigage slightly shorter than the bearing width, and place it on the crankshaft in the axial direction, avoiding the oil holes.

Install the connecting rod bearings to the connecting rod and connecting rod bearing cap, and tighten the connecting rod nuts (VQ23DE) or connecting rod bolts (VQ35DE) to the specified torque.

CAUTION:

Do not rotate the crankshaft once the plastigage has been set.

Remove the connecting rod bearing cap and bearing, and using the scale on the plastigage bag, measure the crushed plastigage width.

NOTE

One of the advantages of using a plastigage is that the oil clearance can be measured without removing the crankshaft from the block. However, the accuracy cannot always be guaranteed using this method.
Therefore, if the measurement results have any uncertainty, disassemble the engine and take the measurements with measuring tools.

5) Main Bearing Housing Inner Diameter (Main Bearing Noise)

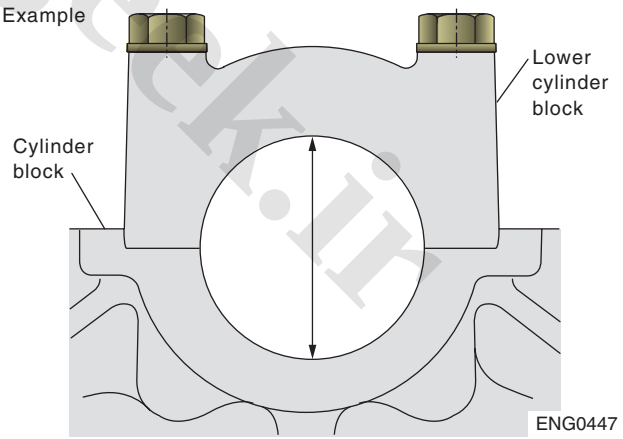
Install the main bearing caps and main bearing beam (VQ35DE) without installing the main bearings, and tighten the main bearing cap bolts to the specified torque.

Measure the inner diameter of the main bearing housing with a bore gauge.

Standard:

63.993 - 64.017 mm (2.5194 - 2.5203 in)

Example

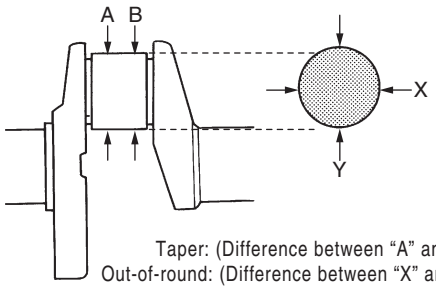


ENG0447

6) 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”.
If the measured value exceeds the limit, correct or replace the crankshaft.

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)



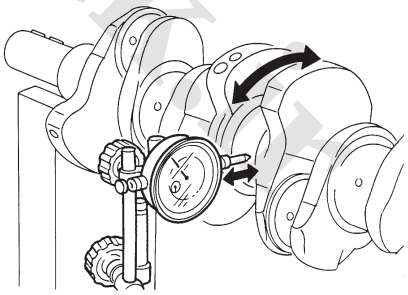
Taper: (Difference between “A” and “B”)
Out-of-round: (Difference between “X” and “Y”) ENG0414

If the measured value exceeds the limit, correct or replace the crankshaft.
If corrected, measure the bearing oil clearance of the corrected main journal and/or pin journal. Then select a main bearing and/or connecting rod bearing.

7) Crankshaft Runout

Place V-blocks on a precisely flat table and support the journals of both ends of the crankshaft.
Place the dial indicator straight up on the No. 3 journal as shown in the figure.
While rotating the crankshaft, read the movement of the pointer on the dial indicator. (Total indicator reading.)

Standard:
Less than 0.05 mm (0.002 in)
Limit:
0.1 mm (0.004 in)


ENG0415

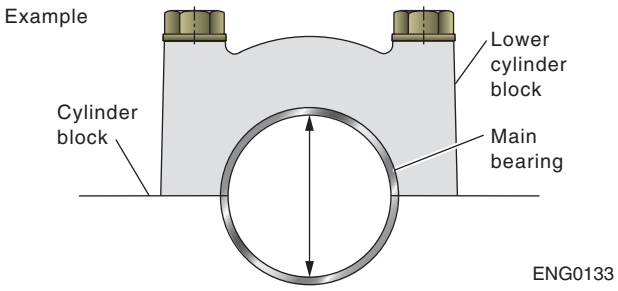
If it exceeds the limit, replace the crankshaft.

8) Main Bearing Oil Clearance

METHOD BY CALCULATION

Install the main bearings to the cylinder block and the main bearing caps, and tighten the main bearing cap bolts with the main bearing beam (VQ35DE) to the specified torque.
Measure the inner diameter of the main bearing with a bore gauge.
(Bearing clearance) = (Main bearing inner diameter) – (Crankshaft main journal diameter)

Standard:
0.035 - 0.045 mm (0.0014 - 0.0018 in) (actual clearance)
Limit:
0.065 mm (0.0026 in)



If the calculated value exceeds the limit, select the proper thickness of the main bearing according to the main bearing inner diameter and the crankshaft main journal diameter to obtain the specified bearing oil clearance.

METHOD OF USING PLASTIGAGE

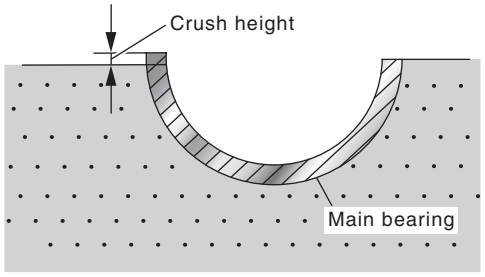
Oil clearance measurement using the plastigage can be also used. Refer to the previous page for the topic of “connecting rod bearing oil clearance” for details.

CRUSH HEIGHT OF MAIN BEARING

When the main bearing cap is removed after being tightened to the specified torque with the main bearings installed, the tip end of the bearing must protrude.

Standard:
There must be crush height.

If the standard is not met, replace the main bearings.

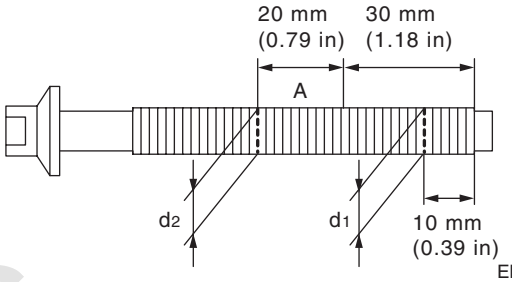


ENG0419

MAIN BEARING CAP BOLT OUTER DIAMETER

Measure the outer diameters (“d_1” and “d_2”) at two positions as shown in the figure.
If the phenomenon appears within the “A” range, regard it as “d_2”.
If it exceeds the limit (large difference in dimensions), replace the bolt.

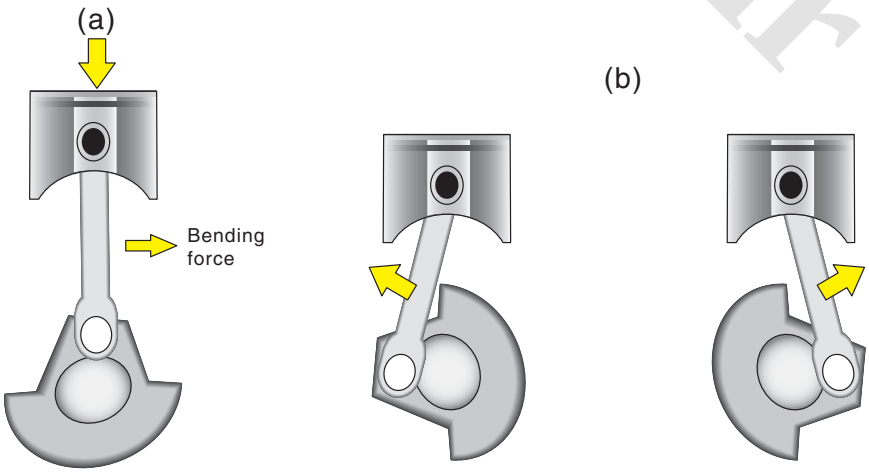
Limit:
(“d1 ” – “d2 ”) : 0.11 mm (0.0051 in)



ENG0416

info

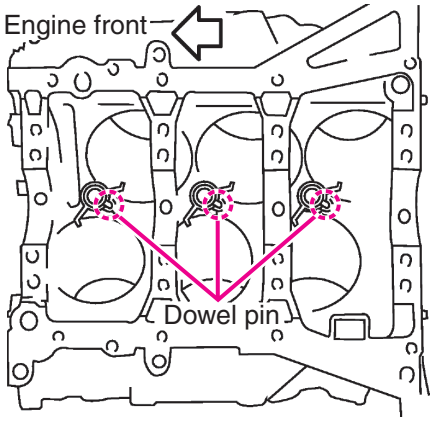
Incident caused by bent or twisted connecting rod:
If the crankpins and the piston pins are not aligned correctly, the combustion pressure will be applied to the pistons, piston pins, rings, cylinders and crankpins unevenly, thus causing localized wear on these parts. Also, as a result of the increased clearance, the bearings in the large and small end of the connecting rod will wear rapidly, which will produce a loud noise.



ENG0420

Cylinder block

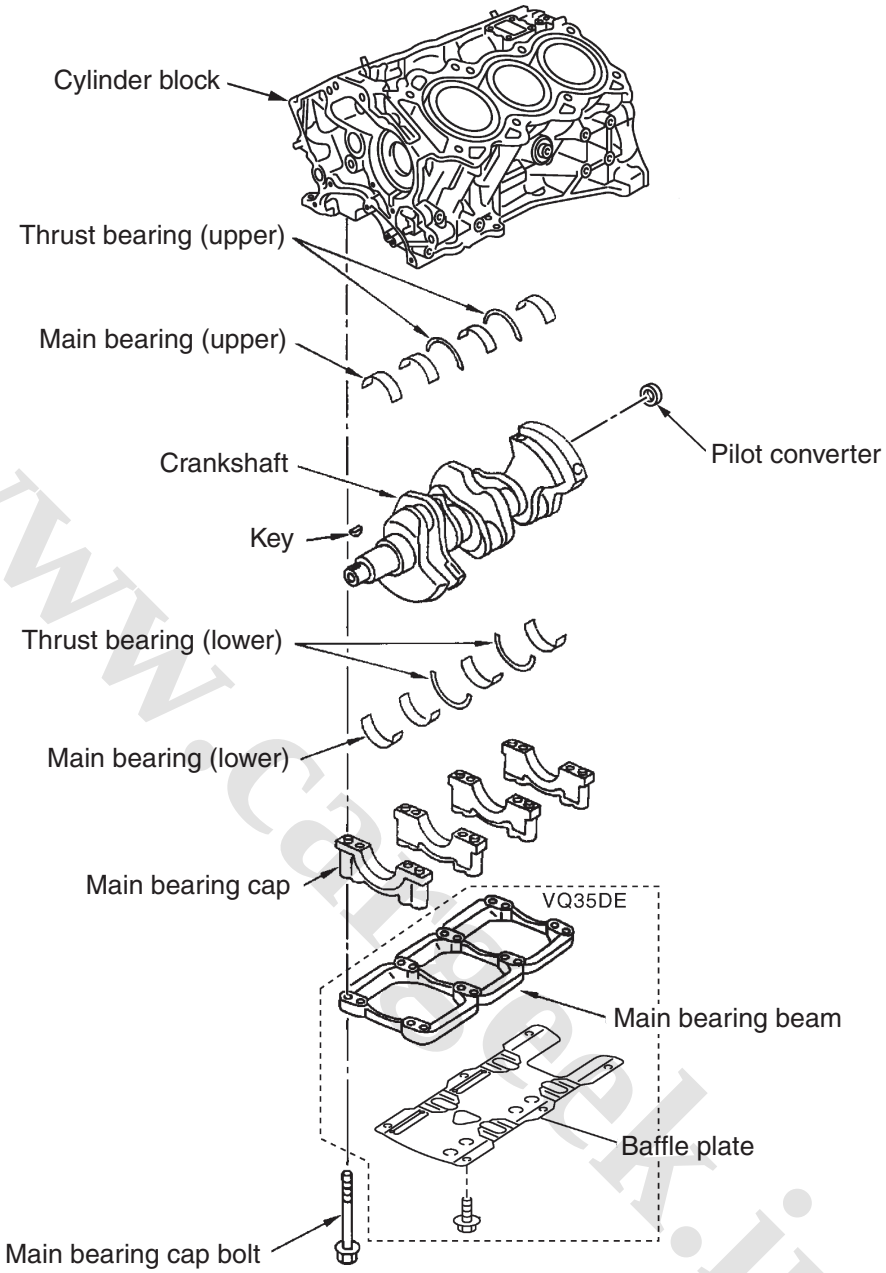
[Outline]
The piston cooling oil jet is located as shown below. The oil jet injection relief pressure is 0.27 MPa [2.8 kg/cm²].



Z50iB015

Main bearing beam

The buffer plate installation position is changed from the upper oil pan to the bearing beam.

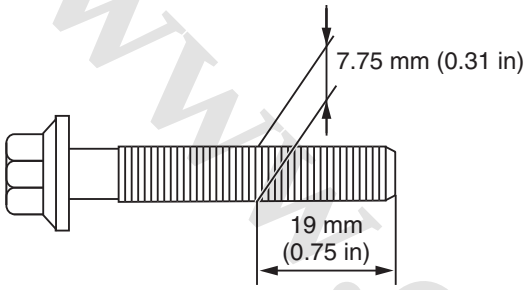


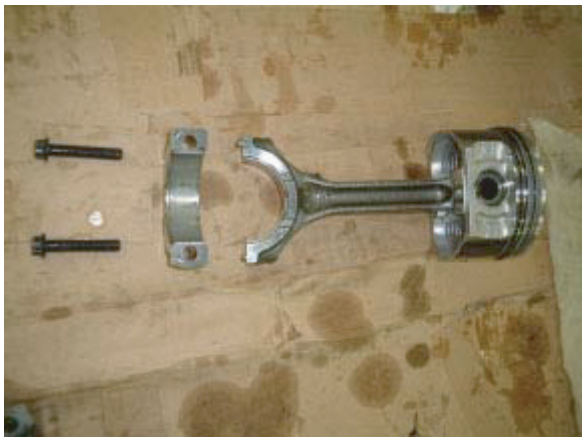
Piston and connecting rod

The tapered design is adopted to the connecting rod small end. The connecting cap is tightened by bolts, not by nuts.

[Purpose]
The tapered design contributes to the weight reduction.
The bolt tightening design contributes to the weight reduction.

[Service point]
The same weight grade connecting rods are installed to one engine at the engine plant. For servicing parts, the weight selection is not required. The connecting rod cap bolt should be turned to the end smoothly by hand. And, the diameter of the bolt at 19 mm from the end should be checked. The bolt should be replaced if the diameter is less than 7.75 mm.



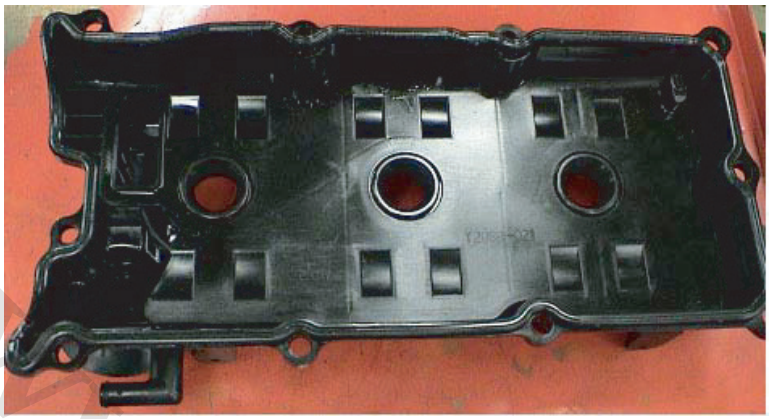


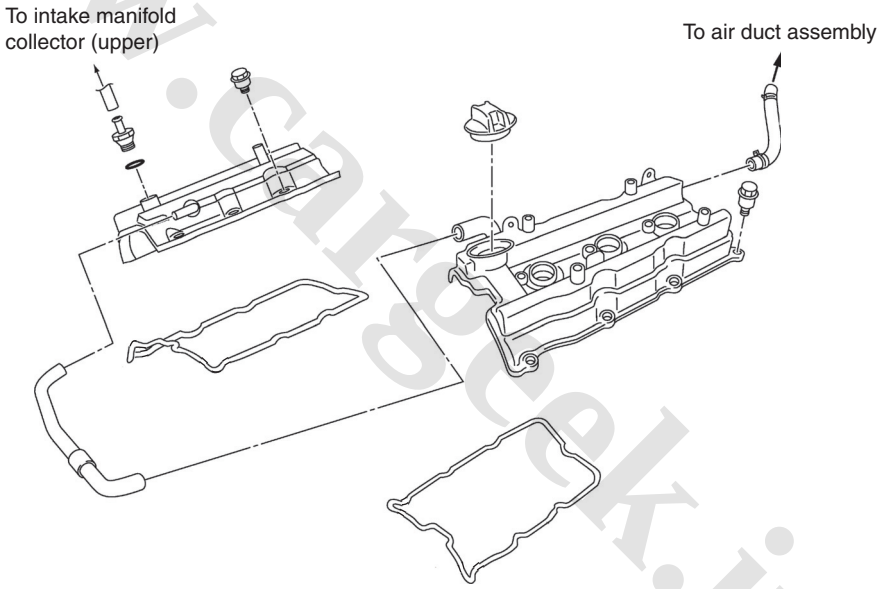
Z50iB017

Rocker cover

[Service point]
The rocker cover gasket is NOT reusable. It is not possible to replace the gasket with a spark plug tube. The rocker cover assembly should be replaced in case the gasket is damaged. The rocker cover bolts require the two-stage tightening method.

1st step: 0.96 - 2.96N·m (0.1 - 0.3 kg-m, 9 - 26 in-lb)
2nd step: 7.33 - 9.33N·m (0.75 - 0.95 kg-m, 65 - 82 in-lb)





Z50iB018

NOTES

X-TRONIC CVT

[Outline]
A CVT (Continuously Variable Transmission) is designed to provide outstanding efficiency and smooth, powerful driving performance. NISSAN has been developing and marketing vehicles with CVTs in Japan for more than a decade. In 1992, NISSAN introduced the NCVT on K10 (March/Micra). In 1997, the HYPER CVT was introduced to the Japanese market as the world's first unit designed for application to front-wheel-drive cars fitted with 2.0-liter class engines. The HYPER CVT has been sold in Japanese and international market models including P12, U14, W11, M12, N30, V10, Y11 and C24/C25. In 1999, the EXTROID CVT was introduced for large, rear-wheel-drive cars powered by 3.0-liter class engines, including Y34.

Note
More than one million NISSAN vehicles equipped with CVTs have been sold worldwide.

[Construction]


Z50iC001

With the new XTRONIC CVT, Murano becomes the first NISSAN model in GCC equipped with a CVT for the 3.5-liter engine.
- Unlike conventional stepped gear automatics, the XTRONIC CVT operates as essentially "one gear" through the use of a strong steel belt and two pulleys.
- The pulleys have V-shaped grooves in which the steel belt rides.
- One pulley receives the torque generated by the engine and the other pulley transmits drive torque to the tires.

[Operation]
When the mechanism is operated by various sensors, hydraulic cylinders increase or reduce the amount of space between the two sides of the pulleys.
- By infinitely varying the working diameters of the two pulleys, the transmission eliminates the steps between gears, resulting in a smoother, more efficient operation by keeping the engine in its optimum power range under a variety of driving and load conditions.
- The benefit is especially apparent in long uphill drives where the typical gear hunting is virtually eliminated.

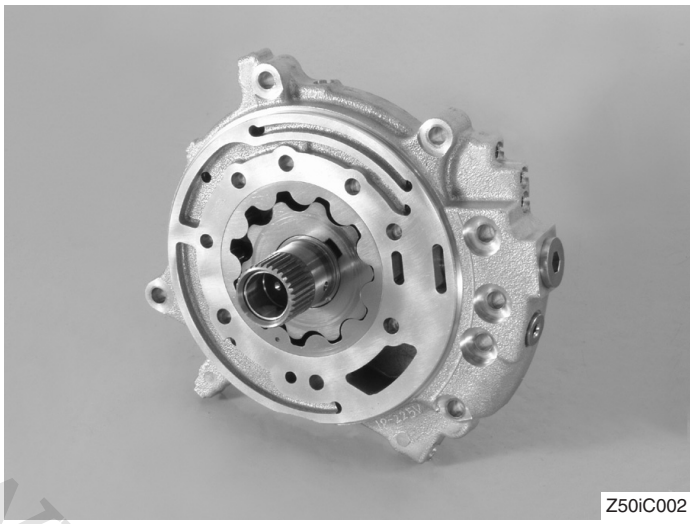
Transmitting the high torque produced by the Murano 3.5-liter V6 engine requires the application of greater pressure to the pulleys that squeeze the steel belt. A belt with sufficiently high durability was developed to withstand the additional pulley pressure.

Caution

Never push-start Murano due to the potential to cause damage to the CVT.

Hydraulic control

[Features]



NISSAN developed an oil pump capable of generating higher hydraulic pressure and a high-pressure hydraulic control system that reliably applies high hydraulic pressure to squeeze the belt when large amounts of torque are transmitted.

- It lessens the squeezing force to transmit less torque, thereby avoiding the wasteful use of energy.
- A torque converter is adapted for improving the start-off performance and enhancing the driving at very low vehicle speeds.

Oil cooler

[Features]

- A new type of bolt-on oil cooler and filter is used for the XTRONIC CVT. It also serves to warm-up the fluid when the transmission is cold.

Gated shifter

[Outline]

- A gated shifter for the XTRONIC CVT allows the driver to easily select from one position to another.

Gear ratio control

[Features]
- Compared with a conventional 5-speed automatic transmission, for example, the unit of Acura MDX and Murano XTRONIC CVT has a wider range of variable ratios.

	Murano XTRONIC CVT	Acura MDX 5-speed automatic
1st	2.371	2.564
2nd	—	1.552
3rd	—	1.022
4th	—	0.727
5th	0.439	0.520
Variation ratio (1st - 5th)	5.40	4.93

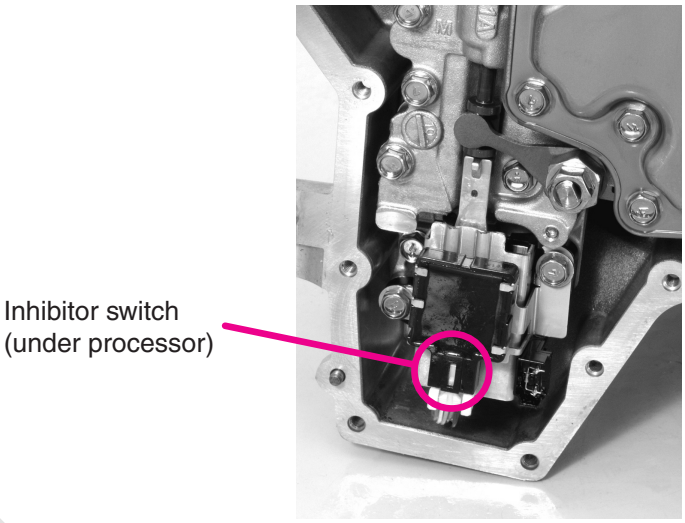
Z50iC011

Lockup zone

[Outline]
- To help improve the fuel economy, lockup is applied from the low speed range.
  - » The torque converter clutch piston in the torque converter is engaged to eliminate torque converter slip to increase power transmission efficiency.
  - » The torque converter clutch control valve operation is controlled by the torque converter clutch solenoid valve, which is controlled by a signal from the TCM.

Inhibitor switch

[Outline]



Z50iC005

- The inhibitor switch is located in the valve body.
- TCM sends the signal to the manual valve and affects the transmission by turning itself on or off as listed below.

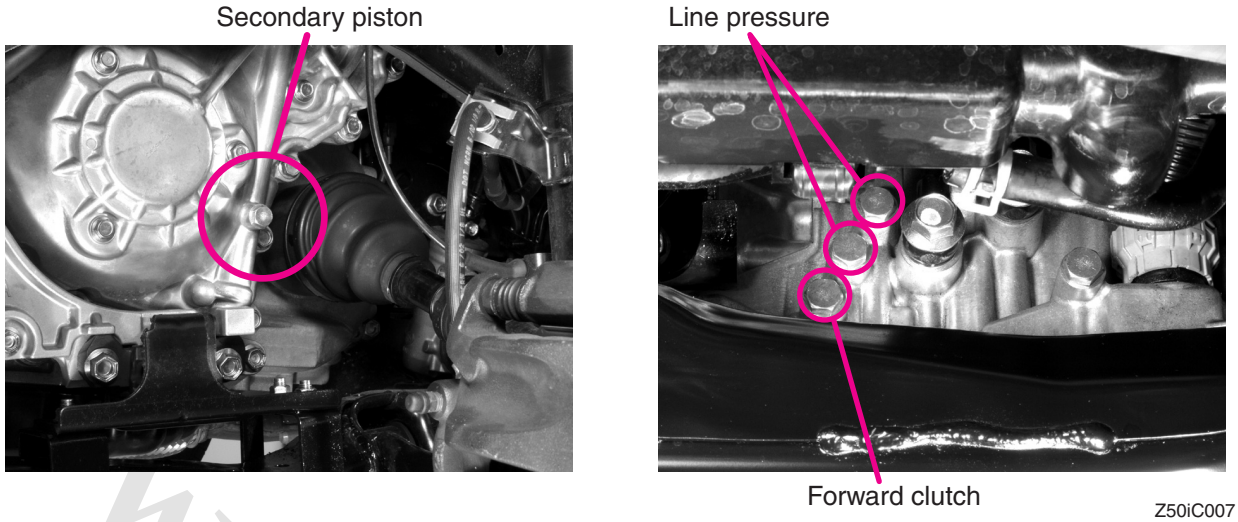
	SW1	SW2	SW3	SW4	SW3 MON
P	OFF	OFF	OFF	OFF	OFF
R	ON	OFF	OFF	ON	OFF
N	ON	ON	OFF	OFF	OFF
D	ON	ON	ON	ON	ON
S	ON	ON	ON	ON	ON
L	OFF	ON	ON	OFF	ON

Z50iC006

C

Service test port

[Service point]



- Four pressure test ports for the XTRONIC CVT are accessible at the front of the transmission, 1 is accessed from the front left wheelhouse area. Refer to ESM section CVT for details.

CVT DTCs

[Service point]
Refer to ESM for a complete list of new DTCs for the CVT.

Fail-safe modes

[Service point]

1. Secondary pulley speed sensor: In the event the TCM receives an abnormal signal from the secondary pulley speed sensor, it will control the gear ratio according to accelerator pedal position. The TCM terminates the second mode and controls the CVT as though it is in the D range.
2. Primary pulley speed sensor: In the event the TCM receives an abnormal signal from the primary pulley speed sensor, it controls the gear ratio according to accelerator pedal position and secondary pulley speed (vehicle speed). The TCM terminates the second mode and controls the CVT as though it is in D range.
3. Inhibitor switch: In the event the TCM receives an abnormal signal from the inhibitor switch, it controls the CVT as though it is in the D range. If the TCM is unable to identify the P or N positions, the engine cannot be restarted after it has been turned off. The engine torque is limited to less than 100N·m (73 ft-lbs), to prevent excessive pressure from being applied to the steel belt.
4. Oil temperature sensor: In the event the TCM receives an abnormal signal from the oil temperature sensor, it maintains the gear ratio at the range applied just prior to the malfunction being detected, based on the current driving condition. The engine speed is limited to less than 5000 rpm.
5. Secondary oil pressure sensor: In the event the TCM receives an abnormal signal from the secondary oil pressure sensor, it terminates feedback control of secondary oil pressure. The engine torque is limited to less than 100N·m (73 ft-lbs), to prevent excessive pressure from being applied to the steel belt. The TCM maintains normal gear ratio control.
6. Line pressure solenoid: In the event the TCM detects an abnormal operation of the line pressure solenoid, it switches the line pressure solenoid OFF to provide maximum line pressure to the hydraulic circuits. The TCM maintains normal gear ratio control.
7. Secondary pressure solenoid: In the event the TCM detects an abnormal operation of the secondary pressure solenoid, it switches the secondary pressure solenoid OFF to maintain maximum secondary piston pressure. While operating in this mode, the TCM only changes the gear ratio to a lower gear (higher gear ratio).
8. Lockup solenoid: In the event the TCM detects an abnormal operation of the lockup solenoid, it switches the lockup solenoid OFF to disengage the lockup clutch.
9. Stepper motor: In the event the TCM detects abnormal operation of the stepper motor, it terminates the output signal to the stepper motor and maintains the gear ratio at the range applied just prior to the malfunction being detected.
10. Lockup/select solenoid: In the event the TCM detects an abnormal operation of the lockup/select solenoid, it switches the lockup/select solenoid OFF to disengage the lockup clutch. Shift shock will increase when shifting from N to D range.

Note

The internal parts of the XTRONIC CVT are not serviceable at this time.

CVT fluid

[Service point]

Z50iC009

- The XTRONIC CVT uses a special type of fluid. This can be identified by its green color.
- To check the fluid level:
  - » Start the engine.
  - » Make sure that the engine is at the normal operating temperature.
  - » Remove the CVT dipstick by gently pressing the release tab with a screwdriver.
- Carefully add only Nissan Genuine CVT Fluid NS-2 as required.
- The specified CVT fluid is also described on caution labels located in the engine compartment.

Caution

- Do not force or damage the CVT dipstick when checking the fluid.
- Do not overfill the transmission, otherwise damage could occur including transmission failure.
- Use only NISSAN Genuine CVT Fluid NS-2. Do not mix with other fluids.
- Using CVT fluid other than Nissan Genuine CVT Fluid NS-2 will cause deterioration in driveability and CVT durability, and may damage the CVT, which is not covered by the Nissan new vehicle limited warranty.

• Using (or mixing) the wrong transmission fluid could result in the following malfunctions.

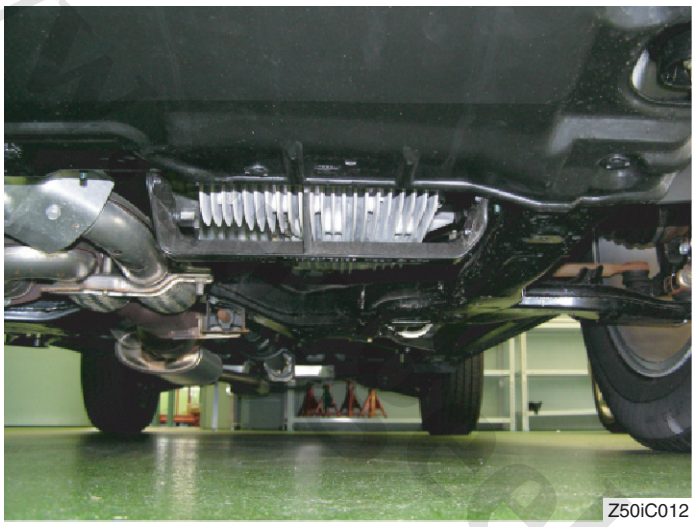
	Nissan genuine CVT fluid NS-2	Nissan genuine ATF fluid matic J or K
XTRONIC CVT for Murano	OK	Poor temperature performance Shift shock increased Belt pulley wear increased
Other Nissan A/T	Lock-up Clutch judder	OK (Matic J or K depends on model)

Z50iC010

Heat exchanger

[Service point]

• A finned heat exchanger is located on the bottom part of the oil pan, and it requires careful treatment to prevent damage.

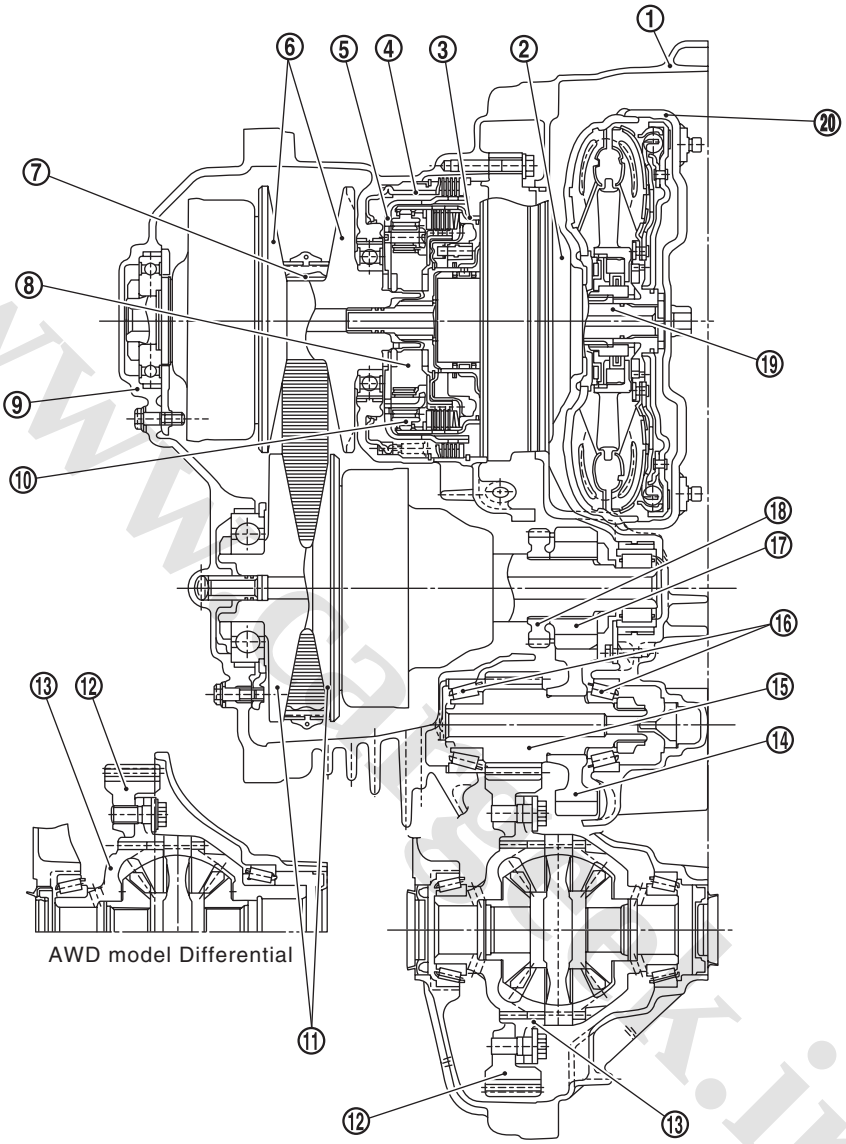


Z50iC012

2. MECHANICAL OUTLINE

1) Cross-Sectional View

RE0F09A type

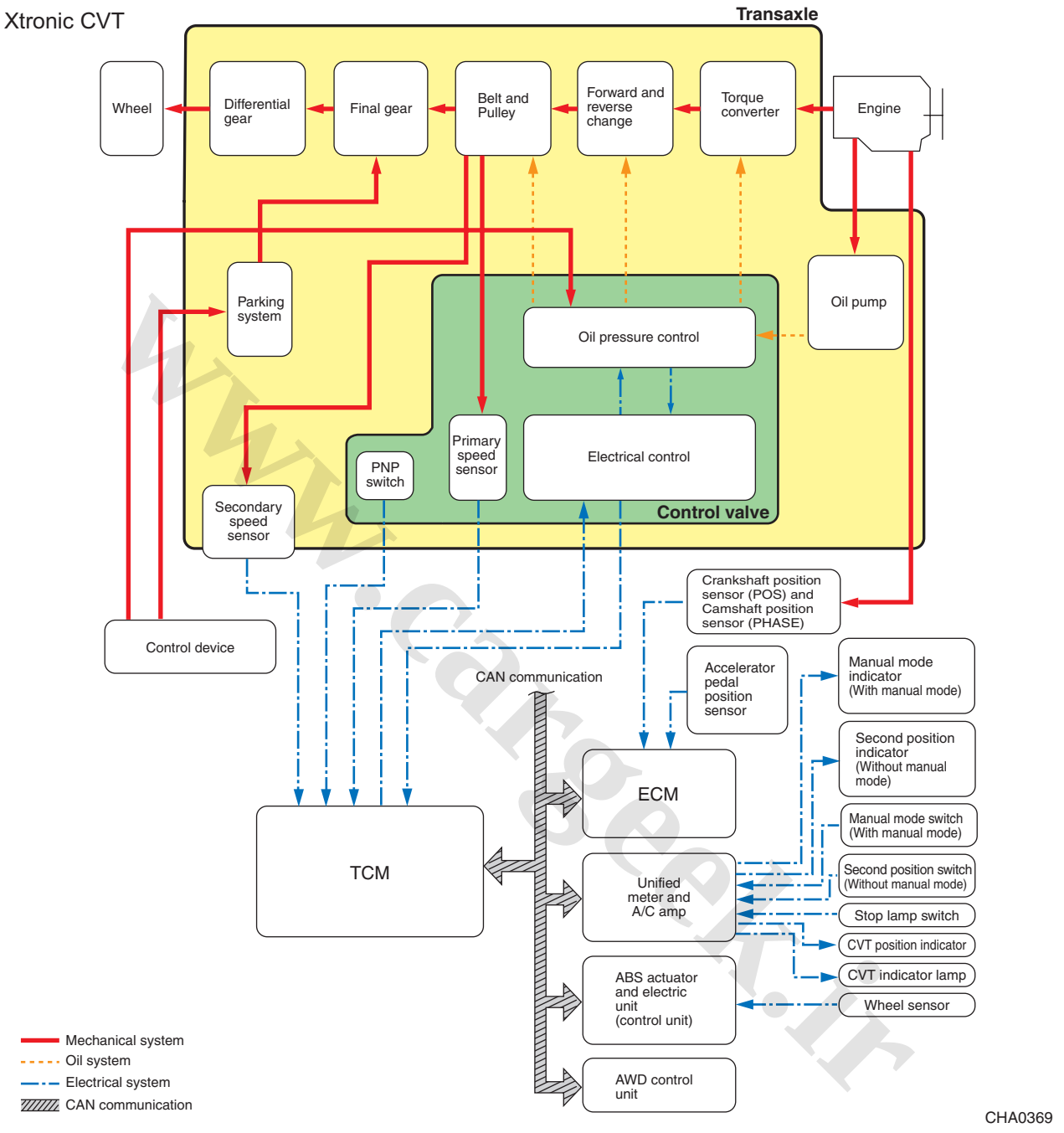


1. Converter housing
2. Oil pump
3. Forward clutch
4. Reverse brake
5. Planetary carrier
6. Primary pulley
7. Steel belt
8. Sun gear
9. Side cover
10. Internal gear
11. Secondary pulley
12. Final gear
13. Differential case
14. Idler gear
15. Reduction gear
16. Taper roller bearing
17. Output gear
18. Parking gear
19. Input shaft
20. Torque converter

CHA0368

Excerpt from ESM/2006 Z50 for North America

2) System Configuration



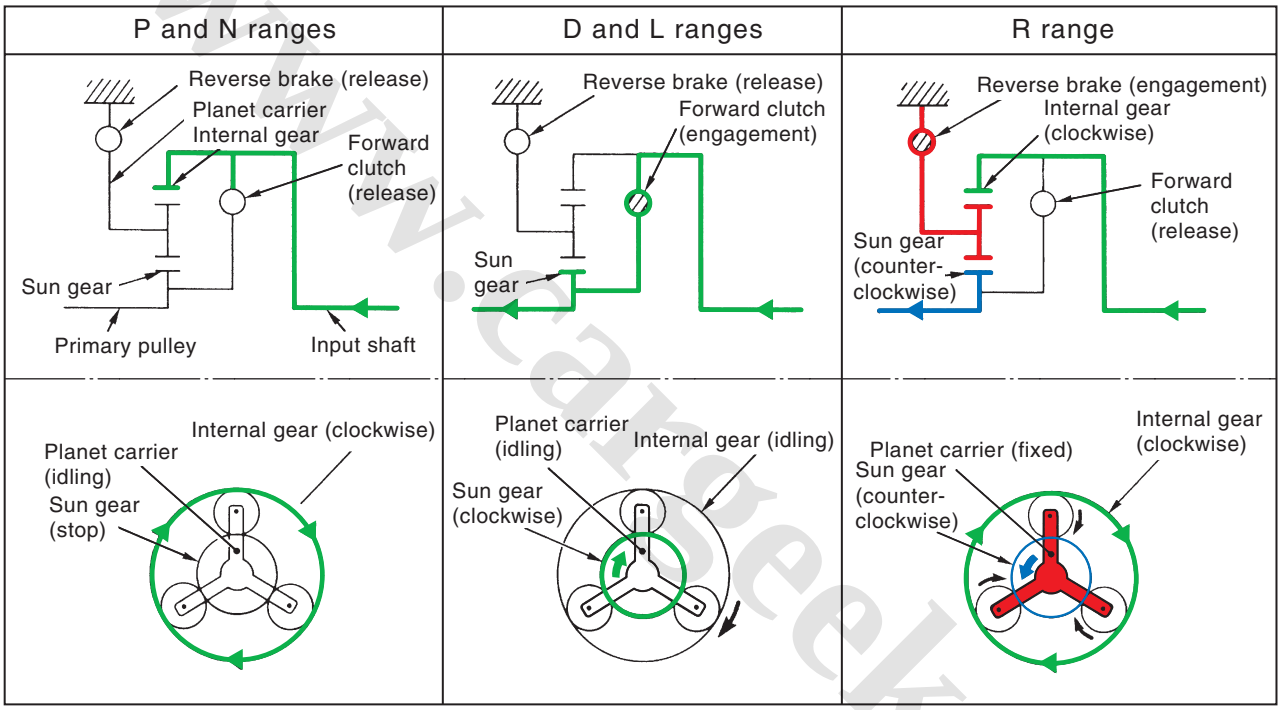
Excerpt from ESM/2006 Z50 for North America

3) Torque Converter

The torque converter increases the engine torque and transmits the torque to the transaxle, which is explained in the **A/T Mechanical Fundamentals ATTN0201AJ** module. It includes the lockup mechanism.

4) Forward/Reverse Gear Switching Mechanism

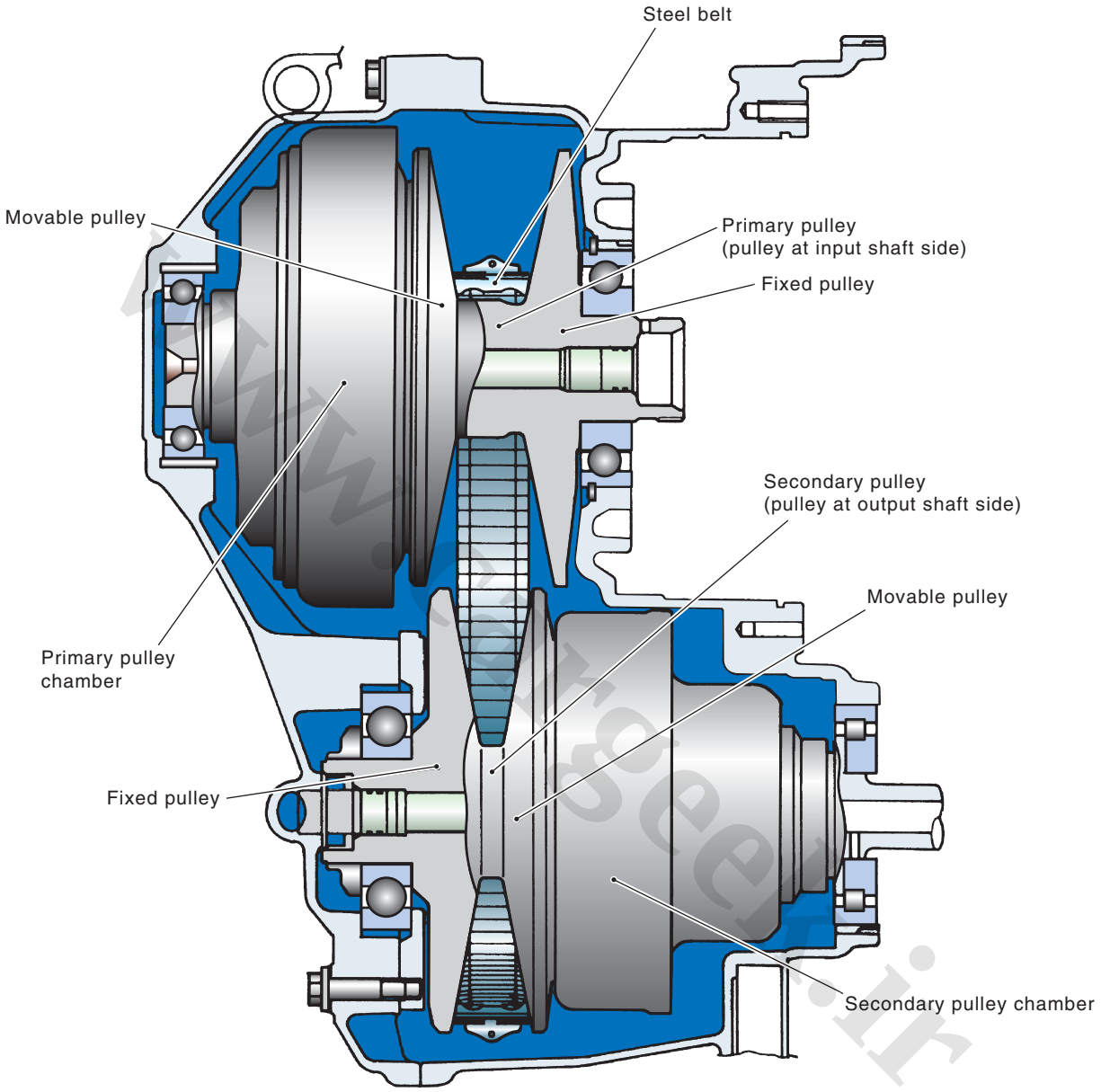
- The single planetary gear type forward/reverse switching mechanism is mounted between the torque converter and the primary pulley.
- The power from the torque converter is transmitted to the input shaft. The wet type multiple disc clutch is hydraulically operated to switch the forward/reverse gear.



CHA0370

3. BELT AND PULLEY

1) Cross-Sectional View

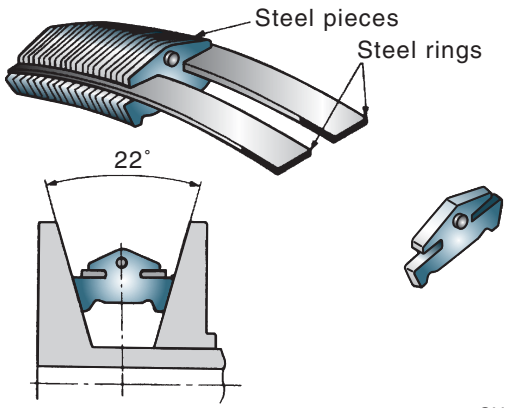


2) Mechanism

The unit consists of a pair of pulleys that allows free variation of the groove width in the axial direction and steel belts that are guided by continuous steel pieces and multi-layered steel rings on both sides. Shifting from the low gear (1st) to the high gear (overdrive) varies continuously without steps according to the winding diameter of the steel belt and the pulley. This groove width is controlled by the hydraulic pressure of the primary pulley and the secondary pulley.

3) Steel Belt

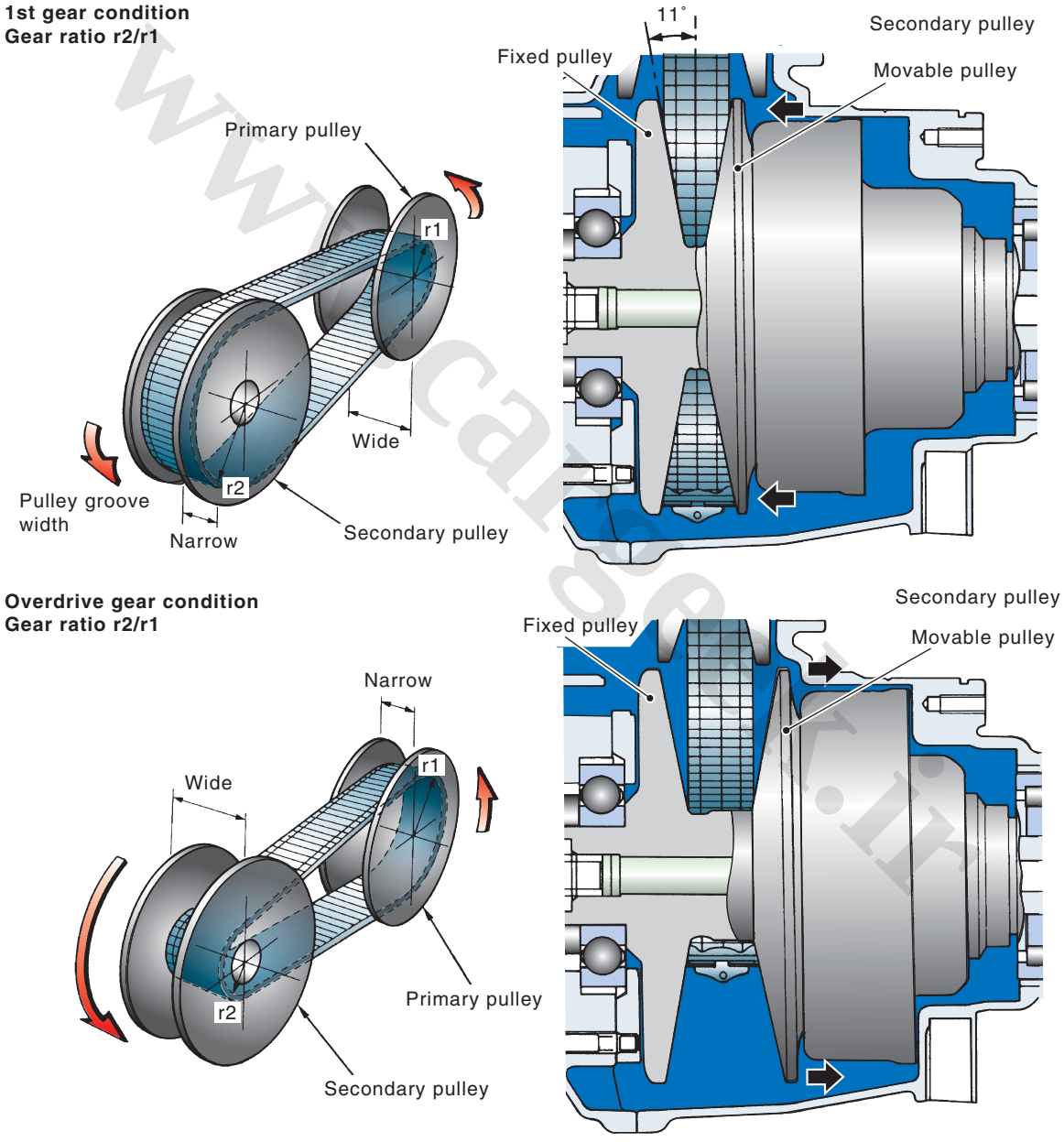
The belt consists of hundreds of steel pieces and two multi-layered steel rings. The feature of this steel belt is that the force is transmitted by compression of the steel pieces, instead of a rubber belt that transmits the force with tension.



CHA0373

4) Pulley

Both the primary and the secondary pulleys consist of the fixed pulleys with an inclined surface of 11° and the movable pulley. At the back of the movable pulley, the hydraulic chamber (primary and secondary chamber for each) is installed. The movable pulley slides on the shaft with the ball spine to change the pulley groove width. Input signals of the engine load (accelerator throttle opening), the primary pulley revolution and the secondary pulley revolution (vehicle speed) change the operation pressure of the primary and secondary pulleys to control the pulley groove width.



CHA0374

4. ELECTRONIC CONTROL

1) Control System Outline

The major functions of the Transmission Control Module (TCM) are as follows.

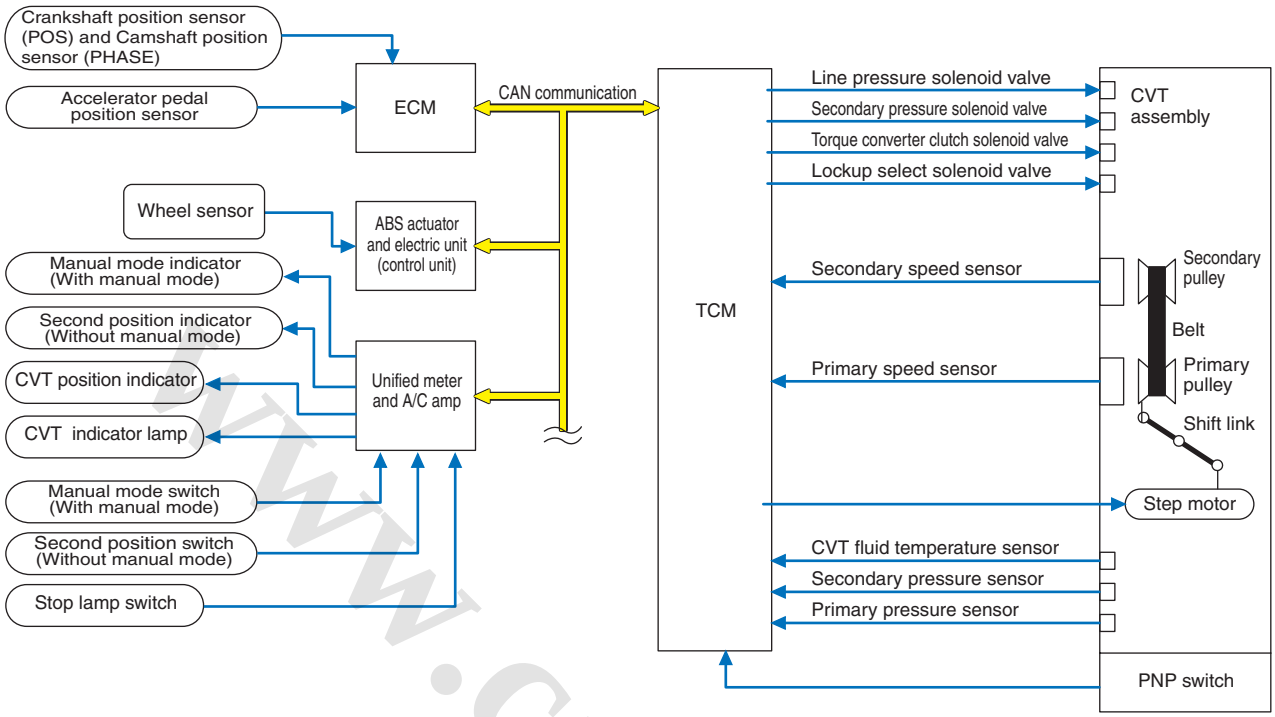
- Receive input signals sent from various switches and sensors.
- Determine the required line pressure, shifting point and lockup operation.
- Send required output signals to the step motor and the respective solenoids.

The CVT senses vehicle operation conditions through various sensors. It always controls the optimum shift position and reduces shifting and lockup shocks.

Sensors (or signals)	TCM	Actuators
PNP switch	Shift control	Step motor
Accelerator pedal position signal	Line pressure control	Torque converter clutch solenoid valve
Closed throttle position signal	Primary pressure control	Lockup select solenoid valve
CVT fluid temperature sensor	Secondary pressure control	Line pressure solenoid valve
Vehicle speed signal	Lockup control	Secondary pressure solenoid valve
Manual mode signal	Engine brake control	Manual mode indicator
Engine speed signal	Vehicle speed control	Second position indicator*
Second position signal*	Fail-safe control	CVT position indicator
Stop lamp switch signal	Self-diagnosis	CVT indicator lamp
Primary speed sensor	CONSULT-II communication line	Starter relay
Primary pressure sensor	Duet-EA control	
Secondary speed sensor	CAN system	
Secondary pressure sensor	On board diagnosis	

*: Without manual mode.

2) Control System Diagram



CHA0375

Excerpt from ESM/2006 Z50 for North America

4. DIAGNOSTIC METHODS

Review the inspection methods along with the Diagnostic Worksheet.

1) CVT Fluid Check

1. Start the engine.
2. Check for fluid leakage.
3. Drive the vehicle for approximately 10 minutes in urban areas.
4. Park the vehicle on a level surface and set the parking brake.
5. Move the selector lever throughout the entire shift range, while depressing the brake pedal, and leave the selector lever in the “P” position.
6. Remove the A/T fluid level gauge and wipe it clean with lint-free paper.
7. Insert the CVT fluid level gauge rotating 180° from the originally installed position, and then securely push the gauge.
8. Check the fluid level using the “HOT” range on the gauge with the engine idling.
9. Inspect the fluid condition.

Fluid condition	Possible cause	Corrective action
Varnished (viscous varnish state)	Clutch, brake scorched	Replace the CVT fluid and check the CVT main unit and the vehicle for malfunctions (wire harnesses, cooler pipes, etc.)
Milky white or cloudy	Water in the fluid	Replace the CVT fluid and check for places where water is getting in.
Large amount of metal powder mixed in	Unusual wear of sliding parts in CVT	Replace the CVT fluid and check for improper operation of the CVT.

2) Self-Diagnosis Result

The CVT indicator will illuminate for 2 seconds (for bulb check) when the ignition switch is turned on. If the CVT indicator illuminates with another pattern, read the self-diagnosis results using CONSULT-ll. The self-diagnosis result will be indicated with DTC (Diagnostic Trouble Code).

See the ESM for the actual description. ESM

3) Stall Test

Performing the stall test, possible damaged components, clutches or brakes can be found. The possible damaged components relating to each result are shown in the Service Manual.

The stall test is explained in the video program provided here.

Watch a video

Check the specification of the stall revolution by referring to the appropriate Service Manual.

	Selector lever position		Expected problem location
	"D"	"R"	
Stall revolution	H	O	• Forward clutch
	O	H	• Reverse brake
	L	L	• Engine and torque converter one-way clutch
	H	H	• Line pressure low • Primary pulley • Secondary pulley • Steel belt

O: Stall speed within standard value position.

H: Stall speed is higher than standard value.

L: Stall speed is lower than standard value.

See the ESM for the actual description.

ESM

NOTE

a. Stall revolution within specifications:

Phenomena	Possible causes
Vehicle does not achieve a speed of more than 80 km/h (50 MPH).	One-way clutch seizure in the torque converter

b. Stall revolution below specifications:

Phenomena	Possible causes
Poor acceleration when starting.	One-way clutch slippage in the torque converter

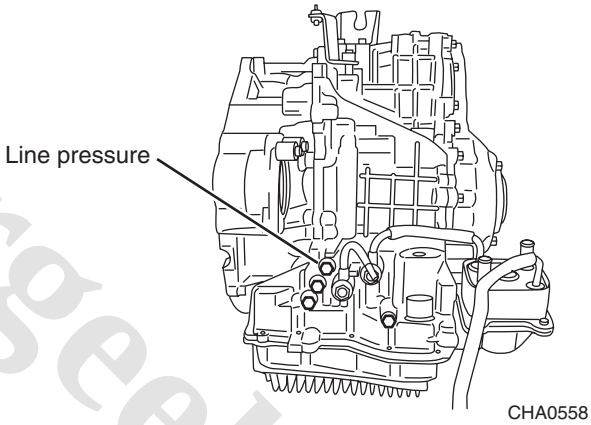
4) Line Pressure Test

If select shock*, slippage or improper transmission operation is found, it may be caused by improper line pressure. For example, the stall test result may indicate the low line pressure causing the high stall revolution in both D and R ranges. The line pressure can be checked using a pressure gauge.
When you find the improper line pressure, check the line pressure control related components such as the oil pump, line pressure solenoid circuit, throttle position sensor circuit, accelerator position sensor circuit or fluid temperature sensor circuit.

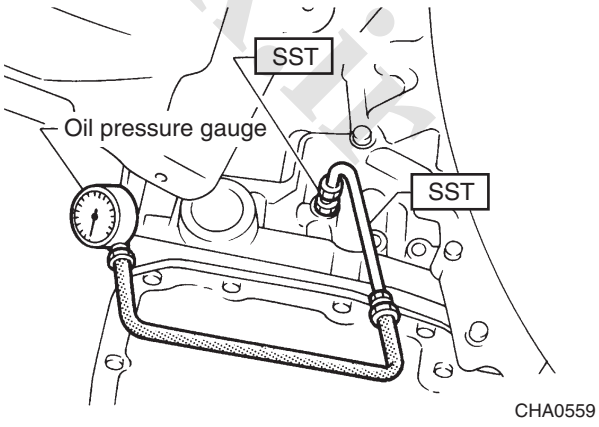
info

*__Select shock__: A stiff, abrupt shock felt during a shift is called select shock. CVT achieves shockless shift because of the transmission without steps. However, CVT still has a risk of select shock, which is felt as an abrupt shock when moving the selector lever from P to R or N to D.

Line pressure test ports are provided to the transmission case.



Install an oil pressure gauge to the corresponding line pressure port.



The procedure of the line pressure test is explained in the video program provided here.

Watch a video

Check the specification of the stall revolution by referring to the appropriate Service Manual.

See the ESM for the actual description. ESM

JUDGEMENT OF THE LINE PRESSURE TEST

Judgement		Possible cause
Idle speed	Low for all positions (P, R, N, D)	Possible causes include malfunctions in the pressure supply system and the low oil pump output. For example • Oil pump wear • Pressure regulator valve or plug is sticking or the spring is fatigue • Oil strainer⇒oil pump⇒pressure regulator valve passage oil leak • Engine idle speed too low
	Only low for a specific position	Possible causes include an oil pressure leak in a passage or device related to the position after the pressure is distributed by the manual valve.
	High	Possible causes include a sensor malfunction or malfunction in the line pressure adjustment function. For example • Accelerator pedal position signal malfunction • CVT fluid temperature sensor malfunction • Pressure control solenoid A (line pressure solenoid) malfunction (sticking in “OFF” state, filter clog, cut line) • Pressure regulator valve or plug sticking
Stall speed	Oil pressure does not rise higher than the oil pressure for idle.	Possible causes include a sensor malfunction or malfunction in the pressure adjustment function. For example • Accelerator pedal position signal malfunction • TCM malfunction • Pressure control solenoid A (line pressure solenoid) malfunction (shorting, sticking in “ON” state) • Pressure regulator valve or plug sticking
	The pressure rises, but does not enter the standard position.	Possible causes include malfunctions in the pressure supply system and malfunction in the pressure adjustment function. For example • Accelerator pedal position signal malfunction • Pressure control solenoid A (line pressure solenoid) malfunction (sticking, filter clog) • Pressure regulator valve or plug sticking
	Only low for a specific position	Possible causes include an oil pressure leak in a passage or device related to the position after the pressure is distributed by the manual valve.

CHA0560

NOTE **CONSULT-II “Data Monitor” can show the pressure sensor signals listed below, if the sensor is in good condition.**

- **Line pressure**
- **Primary pressure**
- **Secondary pressure**
- **Lockup pressure**

5) Road Test

4.	Perform “Road Test”.	
	4-1.	“Check Before Engine is Started”
		• Does CVT indicator lamp come on for about 2 seconds? • Read self-diagnosis result.
	4-2.	“Check at Idle”
		• Does the engine start in P and N position? • In P position, does the vehicle move forward or backward when pushed? • In N position, does the vehicle move? • Does the vehicle have sharp shock when shifting N→R position? • Does the vehicle creep backward in R position? • Does the vehicle creep forward in D position?
	4-3.	“Cruise Test”
		1/4 and full throttle acceleration check. Check engine speed in specified vehicle speed.
		Monitor the engine speed using Data Monitor Mode of CONSULT-II. • Does the CVT shift? Monitor the M GEAR POS using Data Monitor Mode of CONSULT-II. • Does the CVT switch to manual mode? • Does the CVT shift M1⇔M2⇔M3⇔M4⇔M5⇔M6 in manual mode? • Does engine brake effectively reduce speed in M1 position? Perform self-diagnosis. Enter checks for detected items.

CHA0561

You will need to check where the malfunctions occur. The Diagnostic Worksheet mentioned earlier will be useful. Let’s review what items should be checked.

6) Control Cable Adjustment

If the vehicle has a malfunction with the gear positioning, it might be caused by an incorrect adjustment of the control cable. The adjustment procedure is shown in the Service Manual.

See the ESM for the actual description. ESM

7) TCM Input/Output Signal Reference Value

When checking the electronic control system, TCM input/output signal reference values in the appropriate Service Manual should be referenced.

See the ESM for the actual description. ESM

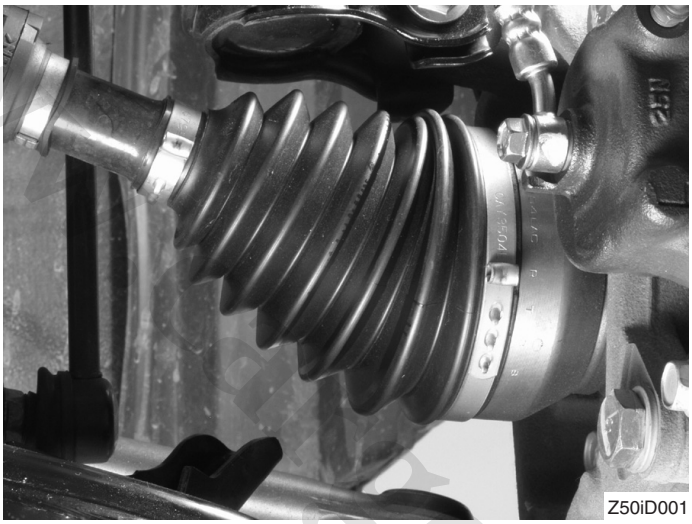
NOTES

PROPELLER SHAFT

[Outline]
- Murano uses a 2-piece type propeller shaft.
- The center bearing is not serviceable and requires replacement with the propeller shaft assembly.

Front axle

[Service point]
- Murano employs a new spring-loaded circlip type front axle drive shaft.
- Front drive shaft removal requires special attention to the seal, which is located in the transfer case housing.
- Boot clamps for the CV joints require a new tool for servicing.


Z50iD001

4WD (4-Wheel Drive)

[Outline]
Murano's new 4WD system (TY-20 Transfer + R145 Rear differential) is the same as the T30 X-Trail system, and it is different from existing NISSAN 4WD systems offered on R50 Pathfinder (it is not the same as All-Mode 4WD).
The 4WD system uses ECM to deliver optimum power to the front and rear axles for improved traction during all weather and road conditions. It is designed for light-duty off-road vehicle. The system automatically engages 4WD for no-slip start-ups and optimizes the power distribution in order to achieve the higher driving stability.
Under normal road conditions, the system operates as a front-wheel drive for optimum fuel efficiency. For conditions such as slippery surfaces, the driver can engage 4WD "LOCK" to maintain a constant 50/50 power split between the front and rear axles at speeds up to 30 km/h.

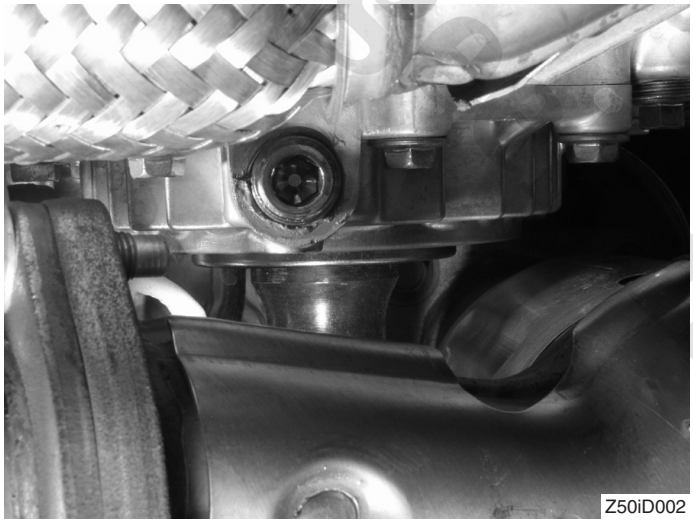
Front transfer case

[Operation]
The features of the 4WD front transfer case operations are as follows:
- Torque is transferred from the engine to the front transfer case.
- The transfer assembly is in constant mesh and driving the propeller shaft at all times.
- Torque is controlled to the rear axle via the 4WD coupling.

Caution

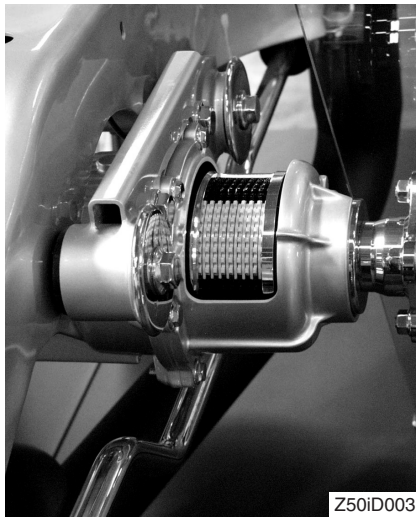
Never tow a 4WD Murano with any of the wheels on the ground. Doing so could cause damage to the transfer case.

[Service point]
- The location of the drain and filler plugs for the transfer case are shown below.
- The transfer uses the fluid type 80W-90/GL-5.



4WD coupling

[Construction]



[Operation]
Wheel speed sensors monitor the road conditions so that the ECM can control the optimum front-to-rear torque distribution. This improves the handling stability and straight-line acceleration during cornering as well as vehicle stability when driving at high speeds.

- 4WD control unit receives data corresponding to the driving conditions:
  - » Four wheel-speed sensors are used to determine the difference of the slip ratios occurring between the front wheels and the rear wheels.
  - » The brake pedal switch detects if the brake is being applied.

The 4WD control unit adjusts the current (positive voltage) flowing to an electromagnet which in turn controls the application force to the control clutch.

- The driver is alerted of a fail-safe mode by the 4WD warning light when a malfunction occurs on the electrical system.
- The 4WD coupling operates as follows:
  - » The 4WD controller sends an electric current to the 4WD solenoid/coupling.
  - » The electromagnet presses the control clutch.
  - » According to the torque of the control clutch, the force to press the main clutch is achieved by the cam.
  - » Torque is transmitted from the input shaft to the output shaft through the main clutch and transferred to the rear differential.
  - » In short, this unit couples the propeller shaft to the pinion shaft in the rear differential carrier.
- The control logic for the 4WD solenoid is as follows:
  - » The current is varied by the 4WD control unit according to the accelerator pedal opening ratio (the speed of change of the pedal position).
  - » The current is controlled by the 4WD control unit in accordance with the slip ratios of the front and rear wheels.

The calculation of the actual current is determined based on the above two criteria.

Rear differential

[Outline]
The Murano rear differential transfers the drive torque to the rear wheels according to the command value sent from the 4WD control unit.
- Rear differential includes a hypoid gear set that transfers the torque from the 4WD coupling to drive the rear wheels.
- The rear differential uses the fluid type 80W-90/GL-5.

4WD lock switch

[Operation]
The driver can select the 4WD AUTO or LOCK mode.
- With the switch set to the AUTO mode, distribution of the torque to the front and rear wheels is automatically changed.
- The LOCK mode can be activated as required, yet the system enters the AUTO mode at speeds above 30 km/h.
- When the system is activated, the 4WD LOCK indicator will illuminate.

4WD warning light

[Operation]
The 4WD warning light illuminates when the ignition is turned on. It runs off soon after the engine is started.
- If any malfunction occurs in the 4WD system when the ignition switch is on, the warning light will either remain illuminated or blink.
- A large difference in the diameter of the front and rear tires will make the 4WD warning light blink slowly (once per 2 seconds). This can be caused by the difference of the tire speed while driving. The vehicle needs to be serviced.
- If the difference between the front and rear wheel speed continues and the oil temperature of the drive system has increased, the 4WD warning light will blink rapidly (once per second).
- If the warning light blinks rapidly during operation, stop the vehicle immediately.
- Driving can continue after the light turns off.

Caution

The power train may be damaged if the vehicle is continuously to be driven with the 4WD warning light blinking rapidly.

1. ALL-MODE 4WD SYSTEM

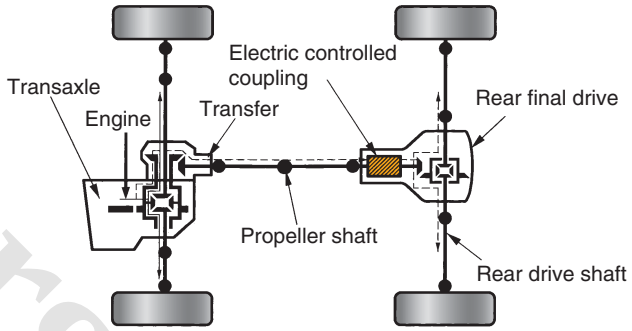
1) Outline

All-Mode 4WD automatically distributes the torque to the front and rear wheels by one-touch switch control. It provides an economical 2-wheel drive when driving on a dry and smooth road. When driving off-road, it delivers the power and handling of a full, rigid 4-wheel drive performance. On a poor road surface, it delivers both high driving power as well as the safe braking performance.

2) Types of All-Mode 4WD System

FOR THE FRONT WHEEL DRIVE BASED MODEL (SUCH AS THE MODEL T30)

The control unit applies to drive the rear axle as required via the multiple disc clutch installed in the final drive gear housing. While the system is set in AUTO mode, the front and rear torque distribution is operated by electromagnet and can vary from a range of 100:0 (front drive mode) to 50:50 (full-time 4WD mode).



CHA0751

3) All-Mode 4WD with Electronic Controlled Coupling

This newly developed 4WD system achieves improvements both in running performance and high fuel economy.

The electronic control system distributes the optimum torque to the front and rear wheels according to the road conditions.

The mode of 2WD (applied for some models), AUTO and LOCK, are selected manually using a switch. The smoothness and quick response contributes to easy and safe driving because the driver can concentrate on driving.

CHA0752

The electronic controlled coupling is built into the rear final drive gear case.

2. SPECIFICATIONS

1) Transfer

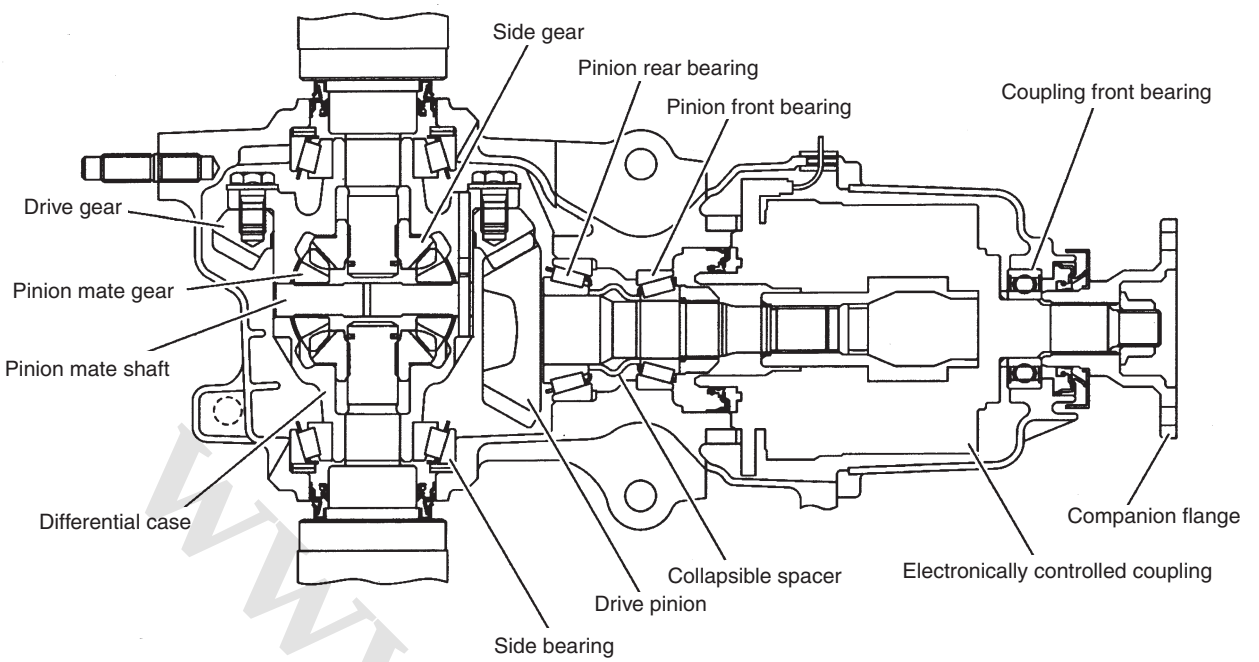
[Example: Models T30 and Z50]

Model		TY20A
Gear ratio		0.404
Number of teeth	Drive gear	42
	Drive pinion	17
Front differential type		2 pinion
Number of teeth on speedometer pickup		— (Detected by ABS sensor rotor)
Oil	Type	NISSAN Differential Oil Hypoid Super GL-5 80W-90
	Capacity (Liters)	Approx. 0.310

2) Rear Final Drive

[Example: Models T30 and Z50]

Model		R145
Final gear speed reduction ratio		2.466
Differential type		2-pinion
Number of teeth	Drive gear/Drive pinion	37/15
	Side gear/Pinion mate	14/10
Drive pinion adjustment spacer		Collapsible type
Oil	Type	NISSAN Differential Oil Hypoid Super GL-5 80W-90
	Capacity (Liters)	Approx. 0.55



Precautions for vehicle inspection and services

Speedometer test:

Mount the front wheels on a measuring roller and the rear on a simple free roller or jack up the rear wheels.

Brake test:

Use a low-speed type tester and chock wheels other than the wheels to be measured.

Towing: Tow the vehicle either with all four wheels on the ground or with all four wheels on a carriage board.

3) Functions of Component Parts

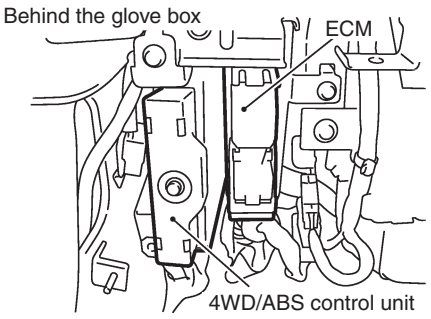
Component part		Function
Electronically controlled coupling main body	Rear final drive unit	Transfers the drive torque to the rear wheels according to the command value sent from the 4WD/ABS control unit.
Controlled system	ABS actuator	The necessary hydraulic pressure is transferred to the actuator according to the drive signal from the 4WD/ABS control unit.
	4WD/ABS control unit	• Controls driving force distribution ranging from front wheel drive status (100 to 0) to 4WD status (50 to 50) according to the signals from each sensor. • Increases, retains, and reduces the ABS actuator hydraulic pressure based on the ABS interdependent control. • Turns on the 4WD warning lamp, and changes the status to front wheel drive if a malfunction occurs with the 4WD system. • Turns on the ABS warning lamp, and changes the status to normal braking if a malfunction occurs with the ABS system. • Indicates a malfunction using the ABS warning lamp by means of built-in self-diagnostic function. • Enables self-diagnostic function to perform diagnosis with CONSULT-II.
	Wheel speed sensor	Detects the wheel speeds, and sends the signal to the 4WD/ABS control unit.
	G-sensor	Detects the longitudinal gravity (acceleration), and sends the signal to the 4WD/ABS control unit.
	4WD warning lamp	Flashes or illuminates to indicate the malfunction result if a malfunction occurs with the 4WD system.
	ABS warning lamp	Illuminates to indicate that the fail-safe status (normal braking status) is active if a malfunction occurs with the ABS system.
	AUTO indicator lamp	Optimum torque is distributed to front and rear wheels according to the road conditions.
	LOCK indicator lamp	Torque distribution rate to front and rear wheels is fixed, and provides a stable start when going up hills.

CHA0849

3. MAIN COMPONENT PARTS AND FUNCTIONS

1) 4WD/ABS Control Unit

The controllers of the 4WD system (All-Mode 4WD) and ABS system are integrated and installed behind the glove box (model T30).



CHA0754

2) Drive Mode Selection Switch

The mode is selected by pressing the three-position push button switch providing 2WD, AUTO or LOCK. The selected mode can be confirmed by checking the mode indicator lamp located at the bottom left in the center meter.

3) 4WD Mode (AUTO Indicator Lamp ON)

Electronic control allows optimal distribution of torque to the front/rear wheels to match the road conditions. Stable driving is possible without the wheels spinning on snowy roads or other slippery surfaces when using this system.

NOTE

When driving in AUTO mode or LOCK mode, and there is a large difference between the front and rear wheel speed for a long time, the oil temperature of the drive system parts becomes too high and the 4WD warning lamp flashes rapidly. (When the 4WD warning lamp flashes, the vehicle changes to the front wheel drive condition.) When driving in AUTO mode, the 4WD warning lamp may flash slowly if there is a significant difference due to the pressure or wear among tires. At this time, vehicle performance cannot be fully guaranteed and driving with caution is required.

If the 4WD warning lamp is flashing rapidly, stop the vehicle and allow it to idle for a short period of time. The flashing will stop and AUTO mode will be resumed.

If the warning lamp flashes slowly while driving but remains OFF after the engine is restarted, the system is normal. If it flashes slowly again after driving for a while, the vehicle needs to be inspected.

4) LOCK Mode (LOCK Indicator Lamp and AUTO Indicator Lamp ON)

With LOCK mode: → It switches to AUTO mode if the vehicle speed increases.
The front/rear wheel torque distribution is fixed to ensure stable driving when climbing slopes.
If the vehicle speed decreases, the vehicle automatically returns to direct 4WD mode.

NOTE **If there is a significant difference in the pressure or wear condition among tires, full vehicle performance is not available. Tire conditions are detected and LOCK mode may be prohibited, or speeds at which LOCK mode is enabled may be restricted.**

Memo **Why is the LOCK mode system equipped to FF vehicle?**
The weakness point of FF vehicle is poor traction when driving uphill with a heavy load. When driving on an uphill slope, the load on the rear wheels becomes heavier and the load on the front wheels become lighter.
A heavy load in the luggage compartment will cause a similar condition. A light load on the front wheels will lead to poor traction on FF models, so the hill climbing performance becomes poor. The AUTO mode automatically splits the driving force to the rear wheels 0% to 50% when the front wheels begin to slip. Thus, 50% of the driving force transfers to the rear wheels, and the vehicle easily climbs the hill. The LOCK mode will fix the AWD system in the direct 4WD. This should help in case of getting stuck on a snow-covered uphill road. The heavy load on the rear wheels will provide much traction for the FR based 4WD model, so the LOCK mode is not equipped on those models.

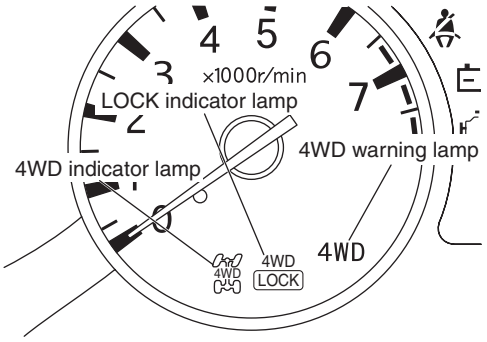
5) 2WD Mode (Indicator Lamp OFF)

NOTE **If the front wheels are slipping in 2WD mode, do not switch to AUTO or LOCK. When the shift switch is in 2WD mode, the torque distribution automatically changes to the 4WD mode depending on the driving condition (for example: depressing the accelerator pedal firmly). This is not a malfunction. However, the 4WD mode indicator lamp does not illuminate.**

6) 4WD Indicator Lamp and LOCK Indicator Lamp

The following table shows the indications of the indicator lamp.

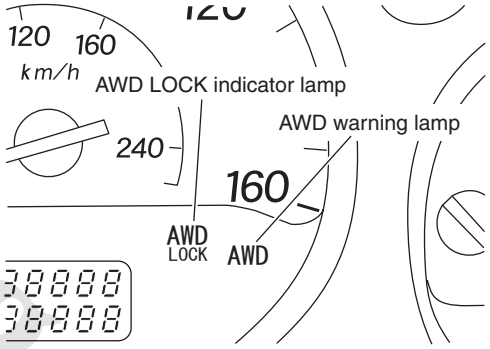
Condition	4WD indicator lamp	LOCK indicator lamp
AUTO mode	ON	OFF
LOCK mode	ON	ON
2WD mode	OFF	OFF
Lamp check	ON for approx. 1 second when ignition switch is turned ON.	



CHA0755

NOTE Other meter displays

Condition	AWD LOCK indicator lamp
AUTO mode	OFF
LOCK mode	ON
Lamp check	ON for approx. 1 second when ignition switch is turned ON.



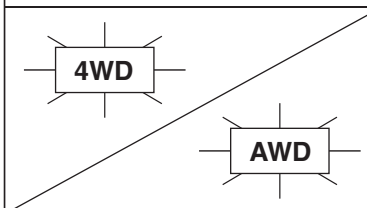
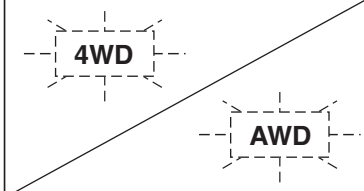
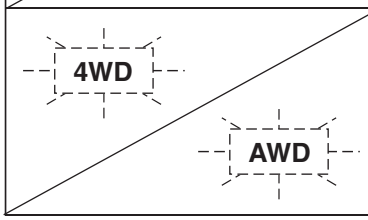
CHA0756

Condition	4WD LOCK indicator lamp
Lamp check	ON when ignition switch is turned ON. Turns OFF approx.1 second after engine start.
4WD system malfunction	ON
Protection function is activated due to heavy load to electric controlled coupling. (4WD system is not malfunctioning and 4WD system changes to 2WD mode)	Rapid flashing: 2 times/second (Flashing for approx. 1 minute and then turns OFF.)

7) 4WD Warning Lamp

The 4WD warning lamp turns ON when there is a malfunction in the 4WD system. It indicates that the fail-safe mode is engaged and the vehicle is in the 2WD (front-wheel drive). Also it turns ON when the ignition switch is turned ON, for the purpose of a bulb check. It turns OFF approximately 1 second after the engine starts if the system is normal.

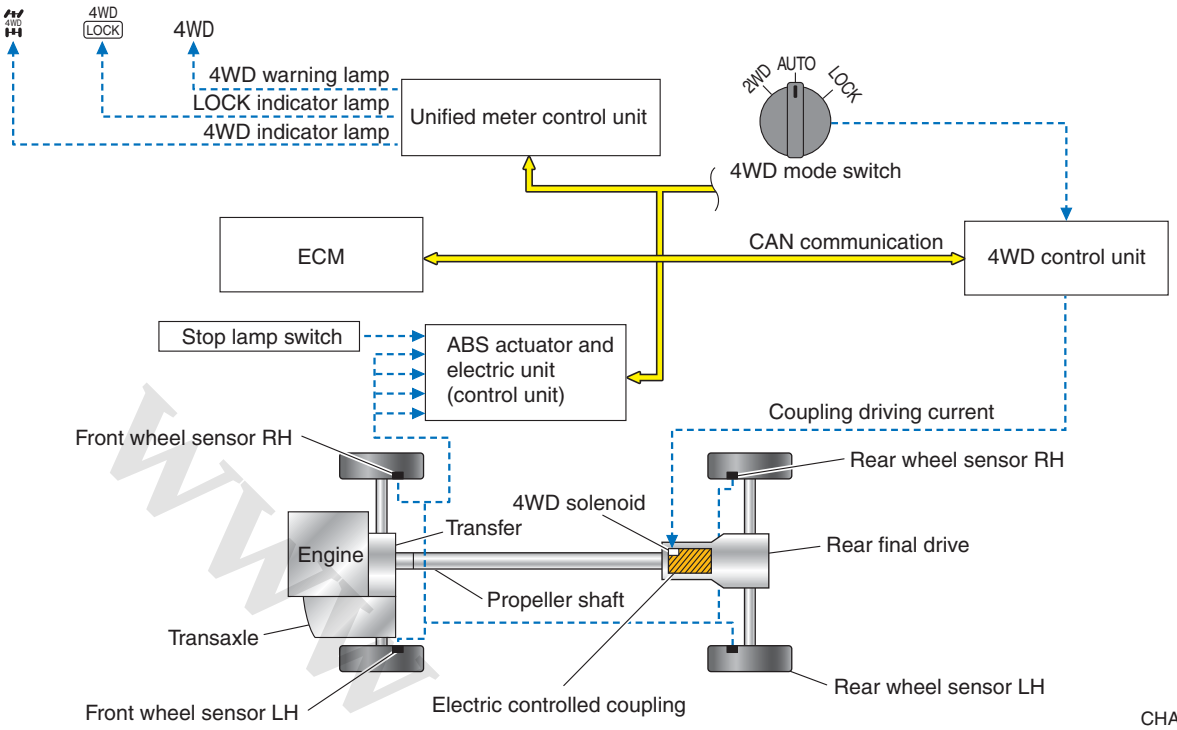
Condition	4WD LOCK indicator lamp
Lamp check	Turns ON when ignition switch is turned ON. Turns OFF approx.1 second after engine start.
4WD system malfunction	ON
Protection function is activated due to heavy load to electric controlled coupling. (4WD system is not malfunctioning and 4WD system changes to 2WD mode)	Rapid flashing: 2 times/second (Flashing for approx. 1 minute and then turns OFF.)

Warning light	Comes on or blinks	When
	**Comes on**	**There is a malfunction in the four-wheel drive/all-wheel drive system.**
	**Blinks rapidly**	**The power train oil temperature rises abnormally.**
	**Blinks slowly**	**The difference in wheel rotation is large.**

CHA0757

Condition	4WD warning lamp
Large difference in diameter of front/rear tires	Slow flashing: 1 time/2 seconds (Continuing to flash until turning ignition switch OFF)
Other than above (system normal)	OFF

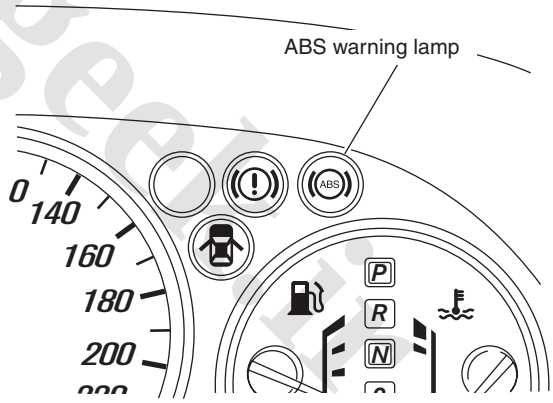
SYSTEM DIAGRAM



CHA0758

8) ABS Warning Lamp

If a malfunction occurs in the 4WD system, the ABS warning lamp illuminates to indicate that the fail-safe (ABS function inactive) is activated. In addition, the lamp illuminates for a bulb check when the ignition switch is turned ON. It turns off approximately 1 second after the engine is started if the system is operating correctly.



CHA0759

NOTES

E - SUSPENSION

FRONT SUSPENSION

Independent strut type

- To provide a passenger-car-feel handling and response, the Murano front suspension features an independent strut design that is similar that of a sedan.
- The strut system uses fewer parts, thus the weight is reduced and there is greater durability than many other types of front suspensions.
- A new type of pinch-bolt knuckle attachment is used on the lower joint for additional strength and durability in an SUV application.
- Due to the weight and higher center of gravity of Murano, thicker stabilizer bars are used to achieve the target roll motion.
- The front stabilizer bar is attached to the struts to help increase the roll stiffness.
- New rubber mounts positioned between the upper and lower spring mounting points help to reduce NVH.
- Paint marks located on the top coil of the front spring are designed to prevent unintentional reversal of the spring during front suspension assembly.

REAR SUSPENSION

Independent multi-link type

- Murano employs a sophisticated multi-link rear suspension that is rare in an SUV application.
- Use of multiple suspension links between the wheels and chassis and rubber mounts enhances control of wheel movement, combining excellent handling with a smooth and comfortable ride.
- Separation between springs and shock absorbers improves suspension performance by reducing friction and allowing components to perform without compromise.
- Use of lightweight aluminum alloy upper control arms reduces the weight of the suspension.

WHEELS AND TIRES

Aluminum alloy wheels

- Aluminum alloy 7.5 x 18 6-spoke wheels are standard.

Tires

- 225/65-18 all-season radial tires are standard.

Spare tire

- A normal size spare tire is located under the cargo floor.

Z50iE002

- Murano is equipped with the Bose audio system, and a woofer speaker is mounted inside the spare tire rim.
- The speaker is easy to remove if access to the spare tire is required.

NOTES

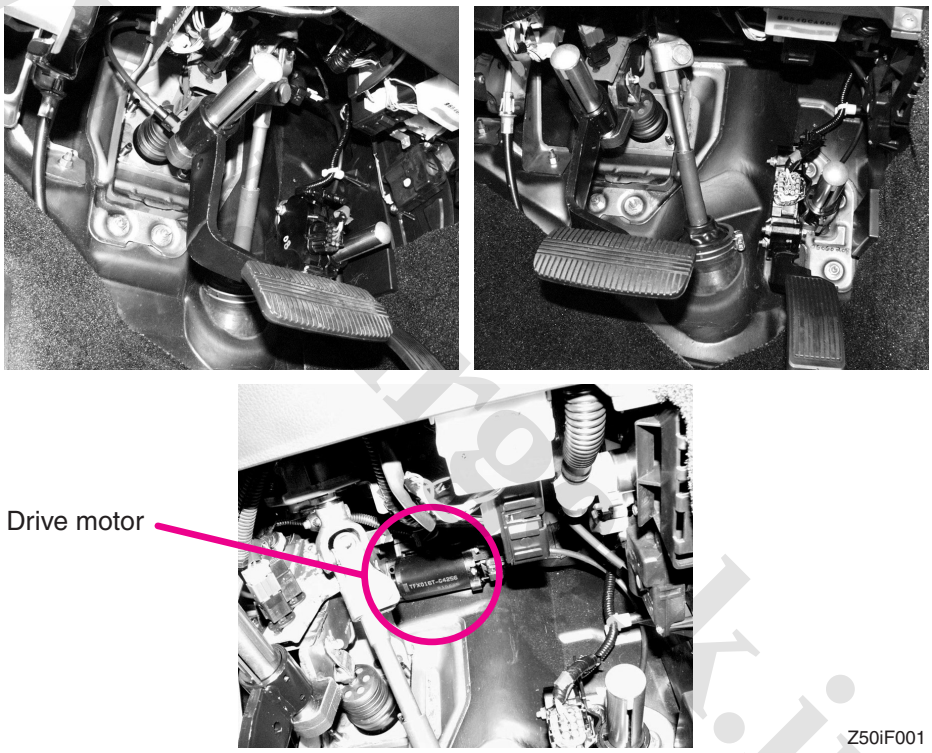
BRAKE SYSTEM

[Outline]
To provide the maximum stopping power under a wide range of handling, traction, and load conditions, all Murano models are fitted with:

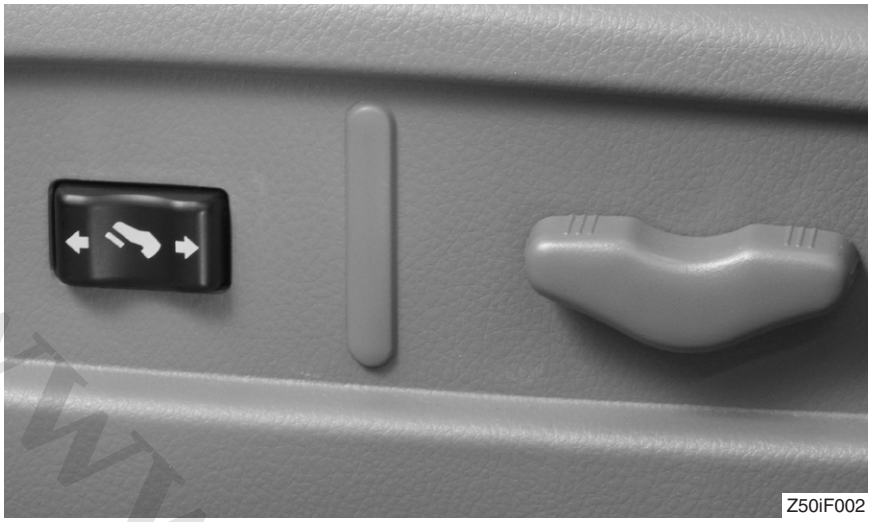
- 4-wheel Anti-lock Brake System (ABS)
- Brake Assist (BA)
- Electronic Brake force Distribution (EBD)
- Ventilated front and rear discs
  - » Front: 320 × 28 mm (12.60 × 1.10 in)
  - » Rear: 308 × 16 mm (12.13 × 0.63 in)

Adjustable pedals

[Construction]



- Adjustable accelerator and brake pedals ensure comfort and optimal positioning.
  - » Pedal height controls are located on the driver's seat near the power seat controls.
  - » The travel of the accelerator and brake pedals is approximately 75 mm.
  - » Adjustment requires a pedal height check.
  - » When replacing a pedal assembly, the pedals should be set at the full forward position (closest to bulkhead) in order to synchronize the operation.
- The exact position for two different drivers can be stored in the memory (option).


Z50iF002

NOTES

STEERING SYSTEM

[Outline]
Murano has modified the variable-assist power rack-and-pinion steering system from the pinion torque sensitive type to the pressure characteristics type that features:

- Light effort at a smaller steering angle by modifying the power assist (oil pressure) starting point.
- Linear steering effort at high speed to obtain more linear characteristics at low oil pressure.
- Light effort for easier driving at lower speeds by changing the steering effort (pinion torque).

Tilt steering column

Murano standard manual tilt steering column swivels at the neck.

Steering gear

Murano steering gear adjusting screw should not be loosened more than two rotations, otherwise the steering gear assembly should be replaced.

POWER STEERING FLUID

PFP:KLF20

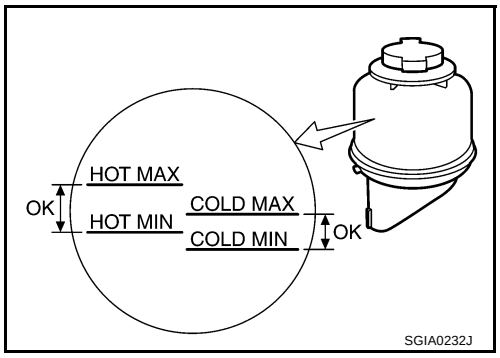
Checking Fluid Level

AGS000HR

- Stop engine before performing a fluid level check.
- Ensure that fluid level is between the MAX range and MIN level.
- Because fluid level differs within the HOT range and the COLD range, check it carefully.

HOT : Fluid temperatures from 50 to 80 °C (122 to 176°F)

COLD : Fluid temperatures from 0 to 30°C (32 to 86°F)



CAUTION:

- **Do not overfill the Max range.**
- **Do not reuse any used power steering fluid.**
- **Recommended fluid is Type DEXRON™ III or equivalent.**

Checking Fluid Leakage

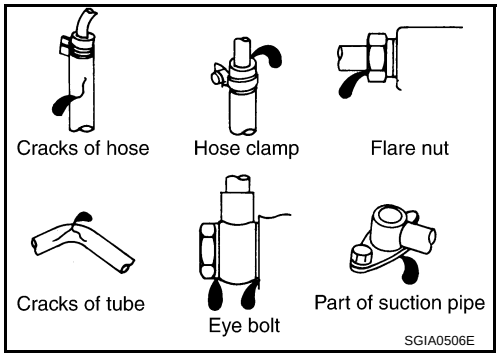
AGS000HS

Check the hydraulic piping lines for improper attachment and for leaks, cracks, damage, loose connections, chafing or deterioration.

1. Run engine until fluid temperature reaches 50 to 80° C (122 to 176°F) in reservoir tank. Keep engine speed idle.
2. Turn steering wheel right-to-left several times.
3. Hold steering wheel at each “lock” position for five seconds to check fluid leakage.

   CAUTION:

   Do not hold steering wheel in a locked position for more than 10 seconds. (There is the possibility that oil pump may be damaged.)



4. If fluid leakage at connections is noticed, then loosen flare nut and then retighten.

Air Bleeding Hydraulic System

AGS000HT

Incomplete air bleeding causes the following. When this happens, bleed air again.

- Generation of air bubbles in reservoir tank.
- Generation of clicking noise in oil pump.
- Excessive buzzing in oil pump.

NOTE:

When vehicle is stationary or while steering wheel is being turned slowly, some noise may be heard from oil pump or gear. This noise is normal and does not affect any system.

1. Stop engine, and then turn steering wheel fully to right and left several times.

   CAUTION:

   Do not allow steering fluid reservoir tank to go below the low-level line. Check tank frequently and add fluid as needed.

2. Run engine at idle speed. Turn steering wheel fully to the right and then fully to the left, and keep for about three seconds. Then check whether a fluid leakage has occurred.
3. Repeat the 2nd procedure several times at about three seconds intervals.

   CAUTION:

   Do not hold steering wheel in the locked position more than 10 seconds. (There is the possibility that oil pump may be damaged.)

4. Check generation of air bubbles and cloud in fluid.
5. If air bubbles and the cloud don't fade, stop engine, hold air bleeding until air bubbles and the cloud fade. Perform the 2nd and the 3rd procedures again.

6. Stop engine, check fluid level.

STEERING WHEEL

PFP:48430

On-Vehicle Inspection and Service

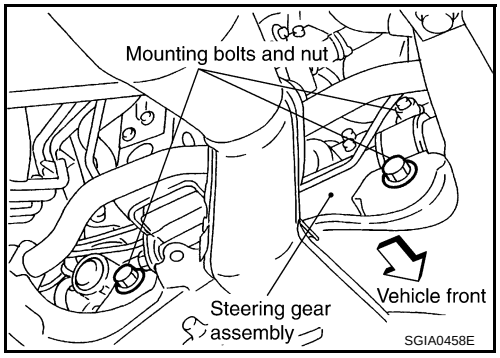
AGS000HU

CHECKING CONDITION OF INSTALLATION

- Check installation conditions of steering gear assembly, front suspension, axle and steering column.
- Check if movement exists when steering wheel is moved up and down, to the left and right and to the axial direction.

End play of the axial direction for steering wheel : 0 mm (0 in)

- Check if the mounting bolts and nut for steering gear assembly are loose or not. Refer to PS-14, "Removal and Installation" .



CHECKING STEERING WHEEL PLAY

- Set tires to the straight ahead, start engine, then turn steering wheel to the left and right lightly, and measure steering wheel movement on the outer circumference when steering wheel is turned up to the point where tires start moving.

Steering wheel play on the outer circumference : 0 – 35 mm (0 – 1.38 in)

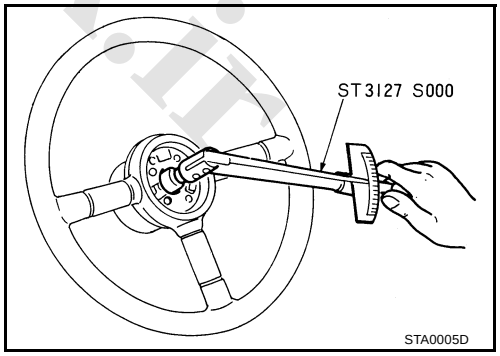
CHECKING NEUTRAL POSITION ON STEERING WHEEL

- Check if steering gear assembly, steering column and steering wheel are in the installation position with normal condition.
- Check wheel alignment first. Refer to FSU-5, "Wheel Alignment Inspection" .
- Set the vehicle to the straight ahead position and check if steering wheel is in the neutral position.
- If the steering wheel is not in the neutral position, loosen lock nut of outer socket and adjust the position rotating inner socket to the right and left equally.

CHECKING STEERING WHEEL TURNING FORCE

1. Park vehicle on a level and dry surface, set parking brake.
2. Remove driver air bag module from steering wheel. Refer to SRS-36, "DRIVER AIR BAG MODULE" .
3. Start engine at idle, then check steering wheel turning torque with pre-load gauge [SST].

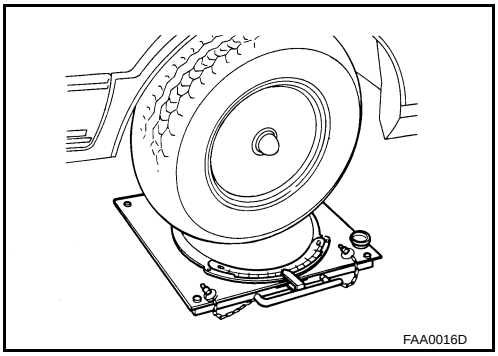
Turning torque: 7.45 N·m (0.76 kg-m, 66 in-lb) or less



4. If steering wheel turning force is out of the specification, check relief hydraulic pressure of oil pump. Refer to PS-29, "POWER STEERING OIL PUMP" .

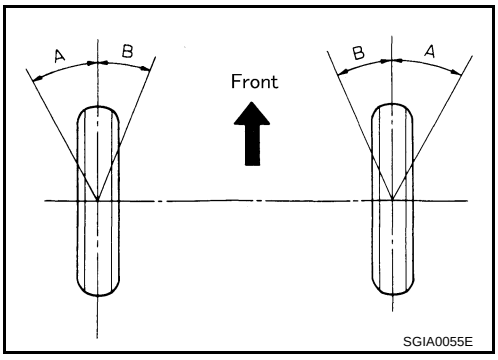
CHECKING FRONT WHEEL TURNING ANGLE

- Check front wheel turning angle after the toe-in inspection. Place front wheels on turning radius gauges and rear wheels on stands so that vehicle can be level. Check the maximum inner and outer wheel turning angles for LH and RH road wheels.



- Start engine and run at idle, turn steering wheel all the way right and left, measure the turning angle.

Inner wheel (Angle: A)	Minimum	34°30′ (34.5°)
	Nominal	38°00′ (38.0°)
	Maximum	39°00′ (39.0°)
Outer wheel (Angle: B)	Nominal	31°30′ (31.5°)

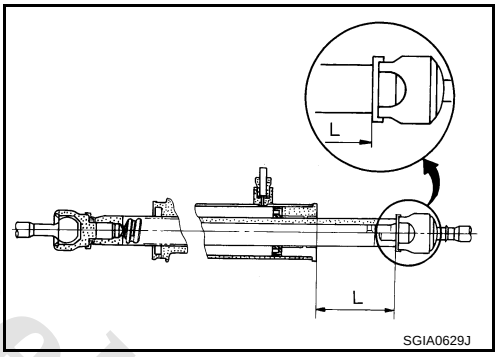


- If it is not within specification, measure the rack strokes.

Rack stroke "L" : 71.5 mm (2.815 in)

- If the rack stroke is out of specification, disassemble steering gear to check the rack stroke.
- Turning angle are not adjustable. If any of the steering angles is not within specification, check the following components for wear or damage.
  - Steering gear
  - Steering column
  - Front suspension components

If they are damaged, replace with new one respectively.



Removal and Installation

AGS000HV

Refer to PS-10, "STEERING COLUMN" .

NOTES

PASSENGER RESTRAINT SYSTEMS

Murano comes with many standard safety features such as driver and front passenger air bags (SRS), driver and front passenger side-impact air bags (SRS) and roof-mounted curtain side-impact air bags (SRS). 3-point seat belts for all seating positions, front seat belts with pre-tensioners and load limiters, child restraint seat tether anchors, LATCH (Lower Anchors and Tether for CHildren) system and front-seat active headrests are all standard.

3-point seat belts

Z50iH001

- 3-point seat belts for all seating positions
- The rear center seat belt/shoulder harness anchor can be stowed in the roof when the seat is folded down
- ELR (Emergency Locking Retractor) driver's seat belt
- Front-passenger and rear-seat ALR/ELR (Automatic Locking Retractor) seat belts
- Front seat belts with pre-tensioners and load limiters

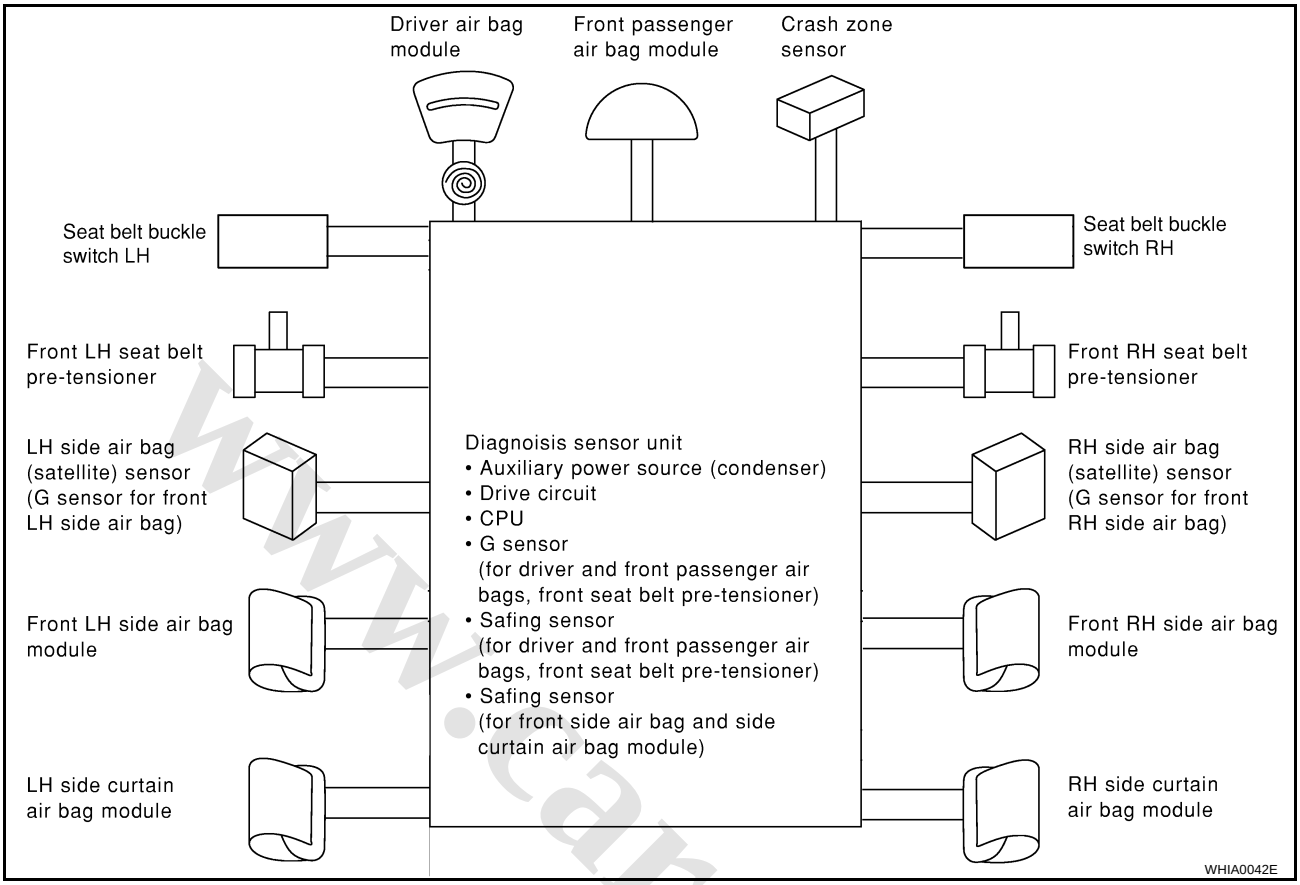
[Service point]
- Refer to the warnings and cautions described in the ESM section SB for removal and installation of seat belts.

SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

PFP:28556

SRS Configuration

AHS000IU



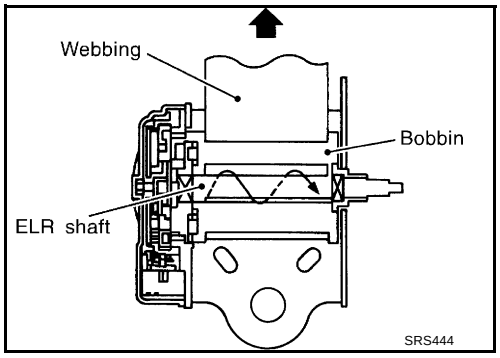
The air bag deploys if the diagnosis sensor unit activates while the ignition switch is in the ON or START position.
The collision modes for which supplemental restraint systems are activated are different among the SRS systems. For example, the driver air bag module and front passenger air bag module are activated in a frontal collision but not in a side collision.
SRS configurations which are activated for some collision modes are as follows;

SRS configuration	Frontal collision	Left side collision	Right side collision
Driver air bag module	×	—	—
Front passenger air bag module	×	—	—
Front LH seat belt pre-tensioner	×	—	—
Front RH seat belt pre-tensioner	×	—	—
Front LH side air bag module	—	×	—
Front RH side air bag module	—	—	×
LH side curtain air bag module	—	×	—
RH side curtain air bag module	—	—	×

Front Seat Belt Pre-Tensioner with Load Limiter

AHS000IV

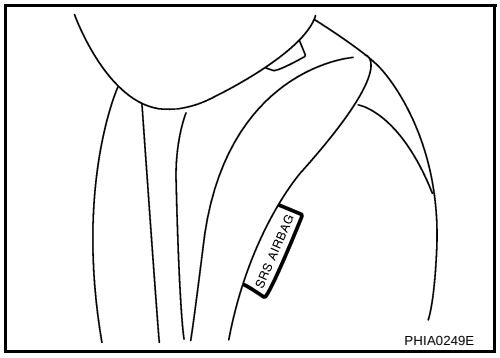
The seat belt pre-tensioner system with load limiter is installed for both the driver's seat and the front passenger's seat. It operates simultaneously with the SRS air bag system in the event of a frontal collision with an impact exceeding a specified level.
When the frontal collision with an impact exceeding a specified level occurs, seat belt slack resulting from clothing or other factors is immediately taken up by the pre-tensioner. Vehicle passengers are securely restrained.
When passengers in a vehicle are thrown forward in a collision and the restraining force of the seat belt exceeds a specified level, the load limiter permits the specified extension of the seat belt by the twisting of the ELR shaft, and a relaxation of the chest-area seat belt web tension while maintaining force.



Front Side Air Bag

AHS000IW

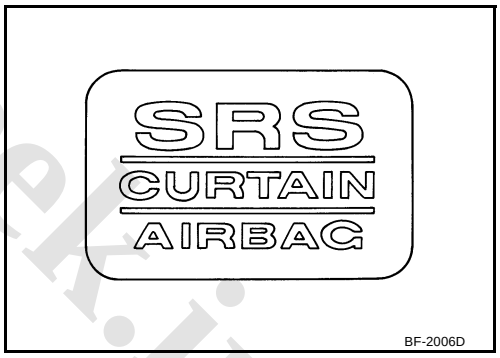
Front side air bag is built-in type.
The front seatbacks with built-in type side air bag have the labels as shown.



Side Curtain Air Bag

AHS000IX

The side curtain air bags have the labels as shown.



NOTES

EXTERIOR

[Outline]

Sculpted exterior design

Murano body styling is futuristic, imaginative and invigorating. Rather than being confined to a traditional two-box vehicle with the wheels at the corners, Murano designers had free rein to create a more dramatic and dynamic exterior that reflects the target buyer's individuality. It also presents the same strong NISSAN identity that has emerged in recent designs. Guided by a sculpture in motion theme, the exterior offers a new wraparound surface construction, a dramatic front grille, and sporty upswept D-pillars. Blending with the rounded rear back door, the eye-catching design of Murano presents a very 3-dimensional look. Aerodynamic body enhancements include use of a body cover under the engine, front and rear tire deflectors, front spoiler and rear spoiler.

Cradle sub-frame

Murano has the cradle type front sub-frame. The following enhancements have been made to improve its performance under the greater demands of an urban SUV.

- Improved design for greater ride comfort
- Enhanced isolation of cradle sub-frame for reduced NVH (Noise, Vibration and Harshness)
- Improved handling and performance versus traditional body-on-frame SUVs
- Improved front impact performance
- Low insulator lateral stiffness coexists with high suspension lateral stiffness for added rigidity

UNDERBODY

Towing hook

- Remove the towing hook cover from the right side bumper fascia using a suitable tool.
  - » Securely install the towing hook (stored with the jack in the cargo compartment).
  - » Properly keep the towing hook in its storage receptacle after use.
- Towing chains or cables must be attached only to the main structural members of the vehicle.
- Pulling devices should be routed so they do not touch any part of the suspension, steering, brake or cooling systems.

Headlamp assemblies

[Outline]

Z50il003

Murano is fitted with vertically arranged, multi-lens headlamp assemblies that house the low beams, high beams, turn signals, parking lights and front side marker lights. On models equipped with HID (High Intensity Discharge) xenon headlamps, a high-voltage transformer is mounted on each headlamp assembly.

- Individual bulbs can be replaced without removing the headlamp cluster from the vehicle.
  - » Remove the fender protector from the wheel arch.
  - » Bulbs are located behind the weatherproof covers for protection.
  - » The high-beam connector can be pulled straight off.
  - » The low-beam connector requires 1/4 turn to release it.
  - » Both headlamp bulbs are held in place with spring-loaded retainers that must be released (squeeze together to release from the assembly; with the retainer released, the bulb lifts straight out).
- The headlamp aiming procedure is described in the ESM section LT.

Headlamp level control

[Outline]

VDC/TCS is not equipped with GCC model.

Z50il004

Murano headlamp level control allows the driver to manually adjust the vertical axis of the headlamps.

- Depending on the number of occupants in the vehicle and the load it is carrying, the headlamp axis can be manually adjusted.

I

Rear combination lamp

[Outline]

Z50il005

Designed to mimic the look of the headlamps, Murano tail lamps also bring to mind the sleek contours of the NISSAN 350Z. Tail lamp assemblies can be easily removed for bulb replacement.

[Service point]

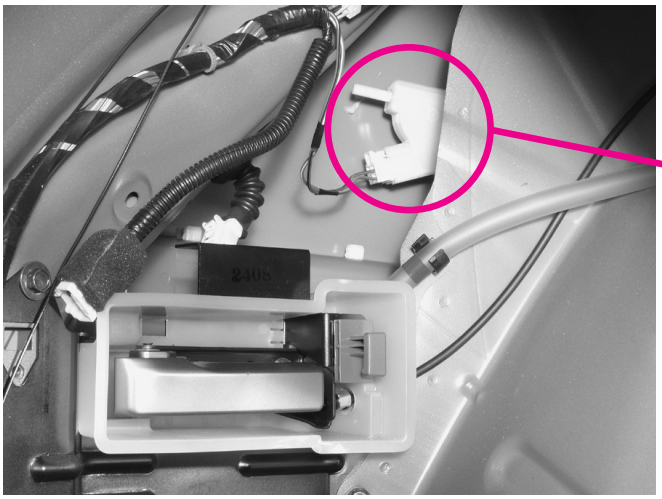
Removal

- Remove the trim plate that covers the area between the tail lamp and the body.
- Remove the rear combination lamp attaching bolts.
- Carefully pull the rear combination lamp away from the vehicle.
- Individual bulbs can be replaced for the rear turn signals, parking lamps, stop/tail lamp and side marker lamps.

FUEL FILLER LID

Fuel lid opener actuator

[Outline]



Z50il006

- Murano employs a push-to-open fuel filler lid that does not use a cable.
- To open the fuel filler lid, unlock it using one of the following actions:
  - » Press the unlock button on the key fob once.
  - » Turn the driver's exterior door lock clockwise once.
  - » Press the power door lock/unlock switch to the unlock position.
- To lock the fuel filler lid, close it and lock the vehicle doors.
- To open the fuel filler lid when the battery is dead or disconnected or if the electrical mechanism does not operate in a locked condition:
  - » Remove the left rear quarter panel trim inside the cargo compartment.
  - » To unlock the mechanism, pull the white plastic rod rearward.

Composite back door assembly

[Construction]

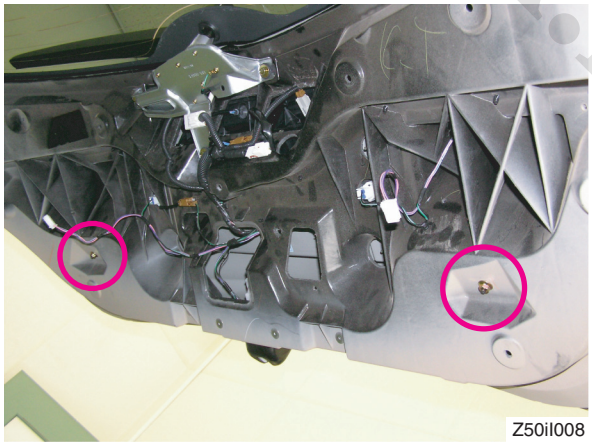
- The unique shape of the Murano back door is made possible using various composites.
  - » A steel inner reinforcement is sandwiched between an injection-molded composite, dent-resistant outer skin and a hot-stamped molded inner skin. This reduces the weight of the back door by approximately 15 percent compared to the conventional construction.

[Service point]

- The back door adjustment procedure can be found in ESM section BL.
- Never loosen or remove the outer back door hinge bolts.
- The back door is not serviceable and must be replaced as an entire assembly.
- The wiring harness is not serviceable and must be replaced with the entire back door assembly.

Caution

Loosen or remove only the inner back door hinge bolts when adjusting or replacing the back door. Otherwise the initial position of the hinge will rise and it will become difficult to install the back door properly.
Do not loosen the damper fixing bolt. Once it is loosened, the damper cannot be fixed.



Z50il009

Removal and installation

- The rear window wiper blade requires a new procedure for removal.
  - » Pull the blade downward
  - » Move the blade to the top
  - » Remove the hook
  - » Move the blade to the rear
  - » Move the blade until it touches the spring
  - » Hold the rear of the blade and pull
  - » Remove the blade
- To install a new blade, reverse the procedure.

DOOR LOCK

Remote keyless entry

[Operation]
Murano remote keyless entry enables the driver to lock or unlock the doors, back door and fuel filler lid, activate the panic alarm and lower the front windows. The keyfob is customizable and reprogrammable.

Locking doors
- Remove the ignition key (doors will lock with the keyfob while the key is in the ignition, however, the panic alarm will not activate with the key in the ignition).
- Close all of the doors (the doors will lock with the keyfob while any door is open, however, the hazard indicator and horn mode will not function).
- Push the LOCK button on the keyfob.
- All of the doors, back door and fuel filler lid will lock (even though a door remains open and/or the ignition key is in the ON position).
- The hazard indicator flashes twice and the horn sounds once.

Unlocking doors
- Push the UNLOCK button on the keyfob once and the driver's door and fuel filler lid will unlock.
- The hazard indicator flashes once if all doors are completely closed with the ignition key in any position except the ON position.
- Push the UNLOCK button on the keyfob again within five seconds and all of the doors and the back door will unlock.
- The hazard indicator flashes once if all of the doors are completely closed.
- If within five minutes after pressing the UNLOCK button, no door has been opened or the ignition key has not been turned to the ON position, all of the doors will be locked automatically.

Opening front windows
- Push the UNLOCK button on the keyfob, and the driver's door will unlock.
- Continue holding the UNLOCK button for three seconds, and the front windows will begin to lower.
- To stop lowering the windows, release the UNLOCK button.
- To resume lowering the windows, press the UNLOCK button again for three more seconds.
- Windows can also be lowered and raised by operating the driver's exterior door lock (with the key).

INTERIOR

Instrument panel

Z50il010

Murano high-tech instrument panel places all controls within easy reach of the driver. In addition to presenting a stylish design, the large, analog gauges are easy to read in daylight and at night. The circular, 3-pod design positions all gauges within the arc of the steering wheel for optimum visibility.

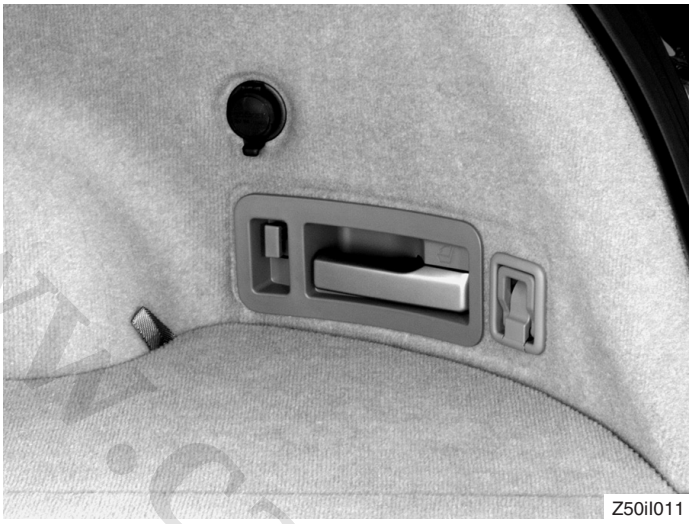
I

SEATS

Front-seat active head restraints

[Outline]
- Design helps to reduce whiplash neck injuries in certain rear-end collisions.
- The system mechanically moves the head restraint of the seat upward and forward, helping to support the occupant's head.
- Springs in the seat structure are designed to return the head restraint to its normal position after a collision.

Rear seats


Z50il011

[Outline]
- Rear-seat reclining seatbacks allow passengers to tilt the seatback to the most comfortable position
  - » Pull the reclining strap and position the seatback at the desired angle.
  - » Release the reclining strap.

- To fold the rear seats flat
  - » Secure the seat belts at the belt hooks on the sidewall.
  - » Stow the center seat belt into the retractor base.
  - » Stow the seat belt buckles in the seat cushion.
  - » Pull the strap on the rear seat or pull the lever in the cargo area and fold down the seatback.
  - » When resetting the seat, be sure to install the center seat belt.

Child restraint seat tether anchors

[Outline]

- Three anchors are located in the cargo area for child restraint seats that require tether anchors.
  - » Tether straps anchors for the outboard seating positions are located on the seatbacks.
  - » A tether strap anchor for the center seat is located under a cover in the cargo floor near the point where the rear plate latches to the body.
  - » Use a small flat-bladed screwdriver or other tool to gain access to the center tether strap anchor.
  - » Keep the removed cover in a secure place to facilitate reinstallation.

Door window module assembly

- The reset procedure for the Murano power door window limit switch is different from other NISSAN models because there is no reset switch. Reset the limit switch if any of the following work has been done.
  - » Removal and installation of the regulator
  - » Removal and installation of the motor from the regulator
  - » Removal and installation of the glass
  - » Removal and installation of the glass run

[Service point]

- The limit switch resetting procedure is as follows.
  - » Remove the motor from the regulator.
  - » Connect the harness to the motor and power window switch.
  - » While holding the motor in your hand, operate the manual up switch for more than 5 seconds.
  - » Install the motor to the regulator and then install the module to the door.
  - » Use the Manual Up function to run the regulator to TDC (Top Dead Center). This sets the limit switch.
  - » Use the Auto Down function to run the regulator to BDC and then use the Auto Up function to run the regulator to TDC. Limit switch reset is now complete.
  - » Position the regulator to the approximate midpoint to reinstall the door glass.
  - » Retest the Auto function.

Sunroof

[Outline]

- The Murano power sliding/tilt glass sunroof features a variable position switch that allows the driver to open the sunroof to any of five desired positions.
  - » The sunroof can be opened or closed with one touch.
  - » The safety-reverse feature prevents the sunroof from closing if it detects an obstruction.

- The sunroof CPU memory will be lost if any of the following conditions occur.
  - » When the battery is out or the connector is disconnected while the sunroof is operating or within 5 seconds after the sunroof stops.
  - » When the sunroof motor is replaced.
  - » When the sunroof does not operate normally (incomplete memory reset conditions).

- To return the sunroof to normal operation, perform the following initialization procedure (memory reset).
  - » Turn the ignition ON.
  - » Move the sunroof slide switch to the closed (forward) position.
  - » Push and hold the TILT UP switch until the sunroof cycles tilt up and tilt down.
  - » Push and hold the TILT UP switch again until the sunroof cycles slide open, slide close, tilt up and tilt down.
  - » Verify that initialization is complete by operating the sunroof through all functions.
  - » Refer to ESM section RF for more information.

NOTES

ATC (DIGITAL AUTOMATIC TEMPERATURE CONTROL)

[Outline]

Z50iJ001

Murano ATC allows the driver to set a desired temperature level on the system to maintain the preset cabin temperature. The system continuously measures the exterior temperature, interior temperature and the sunlight intensity. It varies both the fan speed and air flow distribution to automatically maintain the preset temperature. Dual-zone climate controls allow the driver and front seat passenger to establish their own preferred temperature settings.

Automatic operation

- Push the AUTO button (AUTO will be displayed).
- Turn the temperature set dial to the left or right to set the desired temperature.
  - » Adjust the temperature dial to about 24ºC for normal operation.
  - » The temperature of the passenger compartment will be maintained automatically.
  - » The air flow distribution and fan speed are also controlled automatically.
- The driver and front passenger temperatures can be set independently when the DUAL button is pressed (the DUAL indicator will illuminate). Also, rotating the passenger side temperature dial will switch the system to the Dual mode.
  - » To turn off the passenger side temperature control, push the DUAL button again.

Manual operation

- Rotate the fan control dial to control the fan speed.
  - » Push the AUTO button to return to automatic control of the fan speed.

Rear seat ventilation

- Air ventilators are conveniently located on each B-pillar for providing the additional function of comfort for the rear seat passengers.

Evaporator and heater core

- The evaporator is located inside the passenger compartment.
- The heater core is located inside the passenger compartment.
- Refer to ESM section ATC for removal and replacement of these units.

In-cabin microfilter

- The in-cabin microfilter is located behind the glove compartment.
- The microfilter should be replaced periodically (24,000 km) or if the air flow decreases significantly or if the windows fog up easily when operating the heater or air conditioning systems.

HVAC ducting

- Refer to ESM section ATC for illustrations of Murano dual-zone ATC ducting.

ATC On-board diagnosis

- Refer to ESM section ATC for on-board diagnosis.

Blower motor

- Murano uses a newly designed brushless blower motor for increased durability.
- Refer to ESC section ATC for removal and replacement of the blower motor.

NOTES

Battery

- Battery type: 80D23L
- Voltage: 12V
- Cold cranking current: 582A

Starting system

- Starter type: M0T60881/4WD
- System voltage: 12V
- No-load
  - » Terminal voltage: 11V
  - » Current: less than 90A
  - » Revolution: More than 2500 rpm/4WD

Charging system

- Alternator type: LR1110-723V
- Nominal rating: 12V-110A
- Regulated output voltage: 14.1 - 14.7V

CAN system

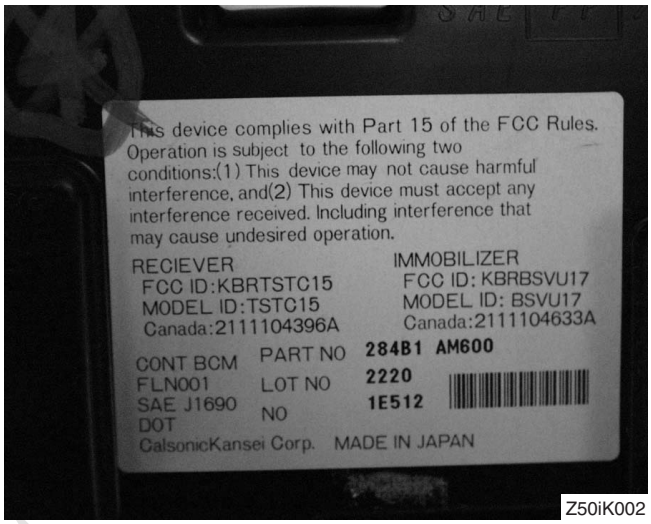
- CAN (Controller Area Network) is an on-vehicle multiplex communication system with high data communication speed and excellent error detection ability. CAN controls a number of control units with two communication lines that allow a high rate of information transmission with less wiring:
  - » CAN H (high)
  - » CAN L (low)
- Each control unit transmits and receives data, but selectively reads required data only.
- Control units linked in the CAN system are:
  - » Engine Control Module (ECM)
  - » Automatic Transmission Control Module (TCM)
  - » Data link connector (this is not a control unit, but it is connected to the CAN system)
  - » Unified meter and A/C amp
  - » Body Control Module (BCM)
  - » ABS actuator and electric unit (control unit)
  - » IPDM E/R

Meters and gauges

- The odometer and twin trip meter are displayed when the ignition key is in the ON position.
  - » A record of the odometer is kept even if the battery cable is disconnected.
  - » A record of the trip meter is erased when the battery cable is disconnected.
- Pushing the reset button located on the left side of the meter panel changes the display as follows:
  - » Trip A > Trip B > Trip A
  - » Push the reset button for more than one second to reset.
- The fuel gauge needle is designed to move to the E (Empty) position when the ignition switch is turned to the OFF position
- The speedometer, odometer/trip meter, tachometer, fuel gauge and water temperature gauge are controlled by the unified meter control unit, which is built into the combination meter. The unified meter control unit receives signals from the unified meter and A/C amp
  - » ECM sends the engine coolant temperature signal and engine speed signal to the unified meter and A/C amp with the CAN communication line.
  - » The fuel level sensor provides the approximate fuel level in the fuel tank to the unified meter and A/C amp.
  - » The unified meter and A/C amp provides the unified meter control unit (combination meter) with the engine coolant temperature, engine speed and fuel level information via the TX and RX communication lines.
  - » The TX and RX communication lines are part of the LAN system that works between the combination meter and the unified meter and A/C amp.
  - » The ABS control unit provides a vehicle speed signal to the unified meter and A/C amp via the CAN communication line.
  - » The unified meter and A/C amp changes the vehicle speed signal to an 8-pulse signal and provides it to the combination meter.
- The odometer, trip meter and A/T indicator display segments can be checked in the self-diagnosis mode.

NISSAN vehicle immobilizer system

Murano employs an enhanced edition of the Nissan Vehicle Immobilizer System/Nissan Anti-Theft System (NVIS/NATS). This system uses the advanced anti-theft functions that are password-protected to prevent unauthorized access into the NATS registration procedure.



Z50iK002

- NATS uses a new BCM that incorporates the immobilizer function.
- NATS will not allow the engine to start without the use of a registered key.
  - » Murano ignition keys can be identified by the black transponder chip holder
  - » Each vehicle is supplied with 2 registered keys.
  - » A maximum of 5 ignition keys can be registered to the NATS.
  - » NATS key codes are permanently encoded to the transponder chip at the time of its manufacture and cannot be changed.
- NATS re-initialization
- If CONSULT-II is used with no connecting the CONSULT-II converter, malfunctions might be detected in the self-diagnosis depending on the control unit that incorporates the CAN communication.
- If the converter is not connected with CONSULT-II, the vehicle might enter the "FAIL SAFE MODE" which is "LIGHT UP the HEAD LIGHT" and/or "COOLING FAN ROTATING" when CONSULT-II functions.
- Previous CONSULT-II "I" and "Y" DLC-I and DLC-II cables should not be used because their DDL connector pins might be damaged during cable swapping.

Steering-wheel controls

Z50iK003

- Audio controls (left side)
  - » VOL = volume (up/down)
  - » MODE (left) and POWER (on/off)
  - » Seek (up/down)
- Cruise control (right side)
  - » RESUME/ACCEL (up) and COAST/SET (down)
  - » ON/OFF
  - » CANCEL

Audio systems

The Bose audio system with AM/FM/cassette/in-dash 6-disc CD changer is equipped.

Z50iK004

- The high-power Bose audio system is custom-designed to match the acoustics of the Murano interior. System features include:
  - » 240-watt digital amplifier
  - » Four 6.5-inch Neo-dymism full-range door-mounted speakers
  - » Two 25 mm dash-mounted tweeters
  - » Richbass™ 5.25-inch subwoofer mounted inside the spare tire in the cargo compartment provides powerful sound without intruding on the cargo space
  - » Steering-wheel-mounted audio controls
  - » Speed-sensitive audio volume control

K

Antenna location

- The AM/FM antenna is located on the center of the roof above the front passenger compartment.
  - » The antenna can be manually adjusted to three different positions.
  - » The rod can be removed by turning it counterclockwise.

Self-diagnosis

- Diagnosis functions consist of the self-diagnosis mode and the confirmation/adjustment mode.
- The self-diagnosis mode checks for connection among the audio unit and CD auto changer, analyzing each unit and displaying the results.
- Refer to ESM section AV for more information.

Information monitor

The Murano standard information monitor includes an easy-to-read mono-color liquid crystal display. The 6.3-inch screen features information for the audio system, dual-zone ATC, display settings and trip computer. Controls include:

- TRIP drive computer button
- FUEL ECON button
- Clock adjust button
- TRIP RESET button
- E/M (English [USA]/Metric) button
- SETTING button
- Joystick and ENTER button
- PREV (previous) button
- DAY/NIGHT brightness control button

Trip computer functions

- When the TRIP button is pushed, the following modes will display on the screen:
  - » TRIP 1 (TIME, DIST, AVG) > TRIP 2 (TIME, DIST, AVG) > OFF
  - » Journey time choices include TIME (max 99 hours, 59 minutes), trip odometer DIST (mile or km) and average speed AVG (MPH or km/h).
  - » To reset TRIP 1 or TRIP 2, push the TRIP button for more than 2 seconds.
- When the FUEL ECON button is pushed, the average fuel consumption (MPG or 1/100 km) and distance to empty (MI or km) will appear on the screen.
  - » The average fuel consumption is calculated from the time that the last trip was reset.
  - » The distance to empty shows an estimate of the distance that the vehicle can be driven before the fuel is totally consumed.

Maintenance functions

- Pushing the MAINT button will change the maintenance menu as follows:
  - » ENGINE OIL > TIRE ROTATION
  - » To reset the driving distance, push the MAINT button or TRIP REST button or more than 2 seconds.
  - » To set the distance, push the joystick to the left or right.

Clock and ambient temperature display

- To adjust the clock, press the SETTING button; clock functions include:
  - » Adjusting the time.
  - » Setting daylight saving time.
  - » Refer to the Owner's Manual section 3 - 4 for clock adjustment.
- The ambient (outside) temperature is also displayed on the information monitor.

Interior illumination

- The instrument panel brightness can be controlled.
- To adjust the brightness of the instrument panel lights:
  - » Press the "+" control switch to brighten the lights.
  - » Press the "-" control switch to darken the lights.
  - » When the "-" switch is set to the maximum, the lights will be turned off.
- Automatic headlamp switch is standard.
  - » Set the headlamp switch to AUTO.
  - » Headlamps will automatically turn on when it is dark and turn off when it is light.
  - » Headlamps remain on for up to 45 seconds after the ignition key is turned off (and a front door is open and closed).
  - » If the ignition key is turned off and one of the doors is opened, the headlamps remain on for five minutes.

Note

Do not place objects over the photo sensor located on the top left-hand corner of the instrument panel. The photo sensor controls the automatic on/off headlamps. If it is covered, the photo sensor reacts as if it is dark and the headlamps will illuminate.

Seats

Front seat active head restraints
- The Design helps to reduce whiplash neck injuries in certain rear-end collisions.
- The system mechanically moves the head restraint upward and forward, helping to support the occupant's head.
- Springs in the seat structure are designed to return the head restraint to its normal position after a collision.

Automatic entry/exit system
- The Murano automatic entry/exit system with 2-driver memory (option) stores the positions of the driver's seat, accelerator and brake pedals and outside mirrors.
- To set positions in memory:
  - » The transmission lever must be in the Park position.
  - » Turn the ignition on.
  - » Adjust the driver's seat, outside mirrors and pedals to the desired positions.
  - » Push the SET switch and, within 5 seconds, push memory switch 1 or 2 for at least 1 second.
  - » The indicator light for the memory switch will illuminate and stay on for approximately 5 seconds.
  - » After the indicator light turns off, the selected positions are stored in the memory.
  - » Refer to ESM section SE for diagnosis functions.

12-volt power outlets

- Murano is equipped with three 12-volt power outlets.
  - » A single outlet is located on the passenger-side lower dash.
  - » Two additional outlets are located inside the center console and in the cargo area.

Cargo area

- The cargo net helps secure small articles.
- The retractable cargo area cover can be retracted or removed to store larger objects.
- Four tie-down hooks are standard.

Storage compartments

- A compartment beneath the cargo floor provides storage for the spare tire.
  - » A 3-partition tray sits above the spare tire to store the cargo net or other small items.
- Two additional compartments provide storage for the jack and tools.

Dimensions

Interior: mm (in)	
• Seating capacity	5 persons
• Front seats	
» Headroom with sunroof	100 (3.95)
» Headroom without sunroof	103 (4.06)
» Legroom	110 (4.33)
» Hip-room	143 (5.63)
» Shoulder-room	151 (5.94)
• Rear seats	
» Headroom with sunroof	100 (3.94)
» Headroom without sunroof	101 (3.98)
» Legroom	92 (3.62)
» Hip-room	144 (5.67)
» Shoulder-room	150 (5.91)
• Cargo dimensions (L x W x H)	
» Seat up	180 x 139 x 85 (7.09 x 5.47 x 3.35)

NOTES