ON-CAR SERVICES 2-2

1. Foreword

This chapter describes major inspection and service procedures for the engine mounted on the body. For procedures not found in this chapter, refer to the service procedure section in the applicable chapter.

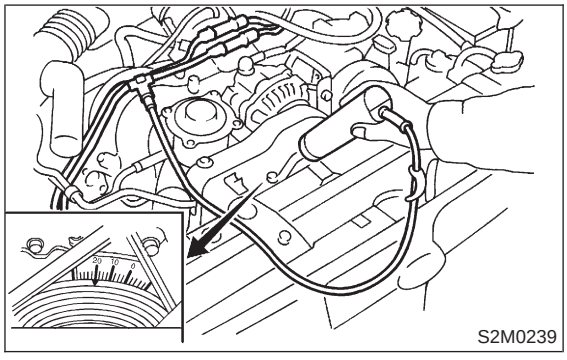
2. Ignition Timing

A: MEASUREMENT

CAUTION:
After warming-up, engine becomes very hot. Be careful not to burn yourself during measurement.

1) Warm-up the engine.
2) o check the ignition timing, connect a timing light to #1 cylinder spark plug cord, and illuminate the timing mark with the timing light.
3) Start the engine at idle speed and check the ignition timing.

Ignition timing [BTDC/rpm]:
2200 cc California spec. vehicles
15°±8°/700
Except 2200 cc California spec. vehicles
10°±8°/700 (MT model)
15°±8°/700 (AT model)



If the timing is not correct, check the ignition control system.
<Ref. to 2-7 [T6A0]>

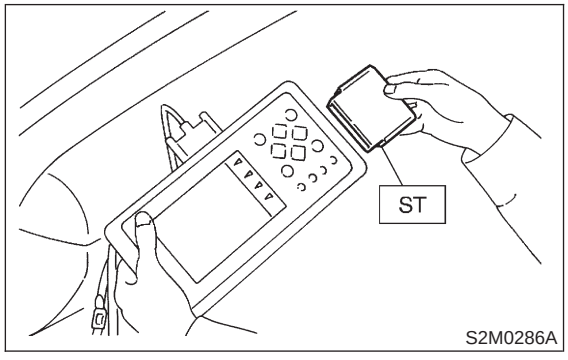
3. Engine Idle Speed

A: MEASUREMENT

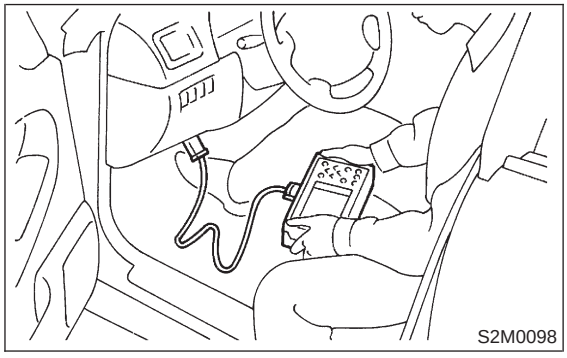
1) Before checking idle speed, check the following:
(1) Ensure that air cleaner element is free from clogging, ignition timing is correct, spark plugs are in good condition, and that hoses are connected properly.
(2) Ensure that malfunction indicator light (CHECK ENGINE light) does not illuminate.
2) Warm-up the engine.
3) Stop the engine, and turn ignition switch to OFF.
4) When using SUBARU SELECT MONITOR;

NOTE:
For detailed operation procedures, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

(1) Insert the cartridge to SUBARU SELECT MONITOR. <Ref. to 1-6 [G1100].>

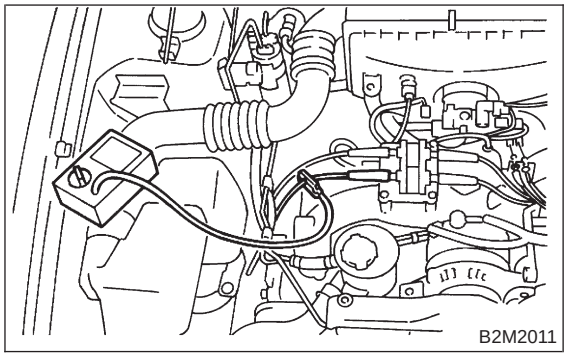


(2) Connect SUBARU SELECT MONITOR to the data link connector.
(3) Turn ignition switch to ON, and SUBARU SELECT MONITOR switch to ON.
(4) Select {2. Each System Check} in Main Menu.
(5) Select {Engine Control System} in Selection Menu.
(6) Select {1. Current Data Display & Save} in EGI/EMPI Diagnosis.
(7) Select {1.12 Data Display} in Data Display Menu.
(8) Start the engine, and read engine idle speed.



5) When using tachometer (Secondary pick-up type).
(1) Attach the pick-up clip to No. 1 cylinder spark plug cord.
(2) Start the engine, and read engine idle speed.

NOTE:
● When using the OBD-II general scan tool, carefully read its operation manual.
● This ignition system provides simultaneous ignition for #1 and #2 plugs. It must be noted that some tachometers may register twice that of actual engine speed.



6) Check idle speed when unloaded. (With headlights, heater fan, rear defroster, radiator fan, air conditioning, etc. OFF)

Idle speed (No load and gears in neutral (MT), or N or P (AT) position):
700±100 rpm

7) Check idle speed when loaded. (Turn air conditioning switch to "ON" and operate compressor for at least one minute before measurement.)

Idle speed [A/C "ON", no load and gears in neutral (MT) or N or P (AT) position]:
850±50 rpm

CAUTION:
Never rotate idle adjusting screw. If idle speed is out of specifications, refer to General On-board Diagnosis Table under "2-7 On-Board Diagnostics II System".

4. Engine Compression

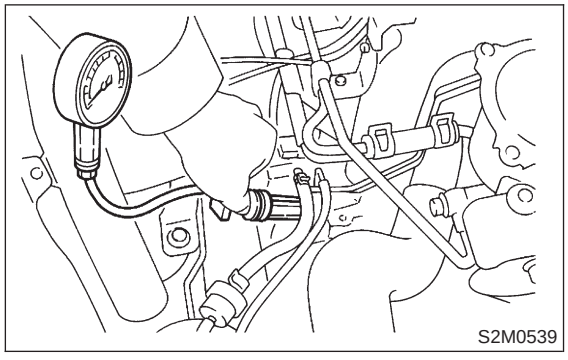
A: MEASUREMENT

CAUTION:
After warming-up, engine becomes very hot. Be careful not to burn yourself during measurement.

1) After warming-up the engine, turn ignition switch to OFF.
2) Make sure that the battery is fully charged.
3) Disconnect battery ground cable.
4) Remove all the spark plugs. <Ref. to 6-1 [W3A0].>
5) Disconnect connectors from fuel injectors.
6) Connect battery ground cable.
7) Fully open throttle valve.
8) Check the starter motor for satisfactory performance and operation.
9) Hold the compression gauge tight against the spark plug hole.

CAUTION:
When using a screw-in type compression gauge, the screw (put into cylinder head spark plug hole) should be less than 18 mm (0.71 in) long.

10) Crank the engine by means of the starter motor, and read the maximum value on the gauge when the pointer is steady.


S2M0539

11) Perform at least two measurements per cylinder, and make sure that the values are correct.

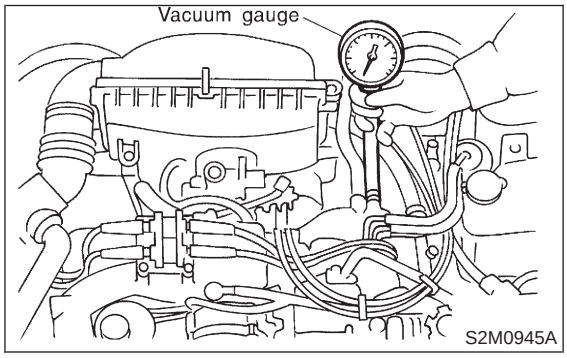
Compression (350 rpm and fully open throttle):
Standard;
1,216 kPa (12.4 kg/cm^2, 176 psi)
Limit;
941 kPa (9.6 kg/cm^2, 137 psi)
Difference between cylinders;
49 kPa (0.5 kg/cm^2, 7 psi), or less

5. Intake Manifold Vacuum

A: MEASUREMENT

1) Warm-up the engine.
2) Disconnect the brake vacuum hose and install the vacuum gauge to the hose fitting on the manifold.
3) Keep the engine at the idle speed and read the vacuum gauge indication.
By observing the gauge needle movement, the internal condition of the engine can be diagnosed as described below.

Vacuum pressure (at idling, A/C "OFF"):
Less than −60.0 kPa (−450 mmHg, −17.72 inHg)

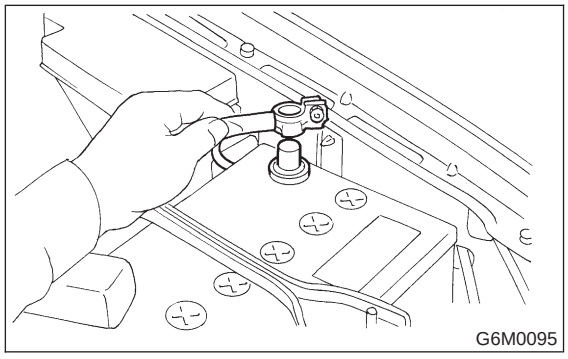


Diagnosis of engine condition by measurement of manifold vacuum	
Vacuum gauge indication	Possible engine condition
1. Needle is steady but lower than normal position. This tendency becomes more evident as engine temperature rises.	Leakage around intake manifold gasket or disconnection or damaged vacuum hose
2. When engine speed is reduced slowly from higher speed, needle stops temporarily when it is lowering or becomes steady above normal position.	Back pressure too high, or exhaust system clogged
3. Needle intermittently drops to position lower than normal position.	Leakage around cylinder
4. Needle drops suddenly and intermittently from normal position.	Sticky valves
5. When engine speed is gradually increased, needle begins to vibrate rapidly at certain speed, and then vibration increases as engine speed increases.	Weak or broken valve springs
6. Needle vibrates above and below normal position in narrow range.	Defective ignition system or throttle chamber idle adjustment

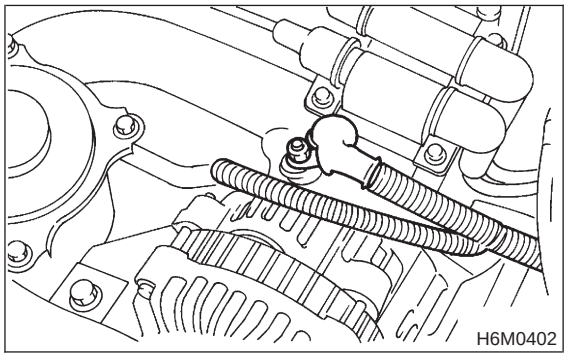
6. Engine Oil Pressure

A: MEASUREMENT

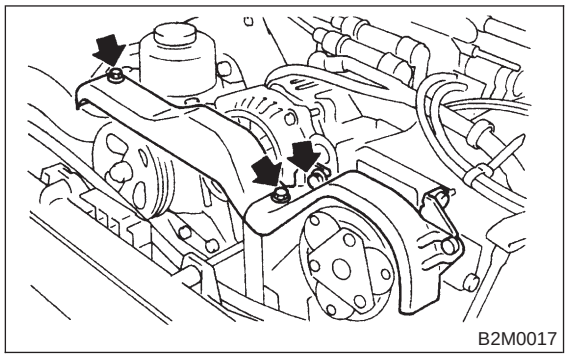
1) Disconnect battery ground cable.



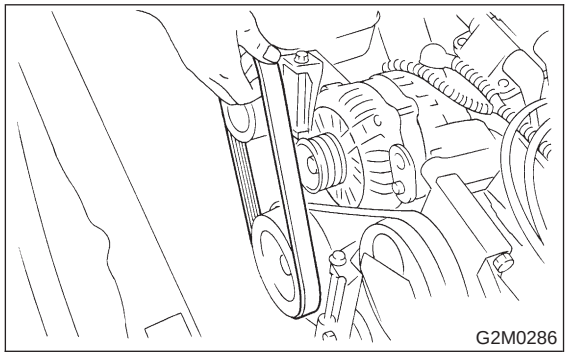
2) Remove generator from bracket.
(1) Disconnect connector and terminal from generator.



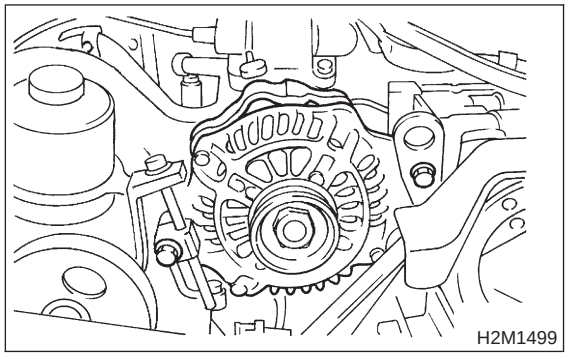
(2) Remove V-belt cover


B2M0017

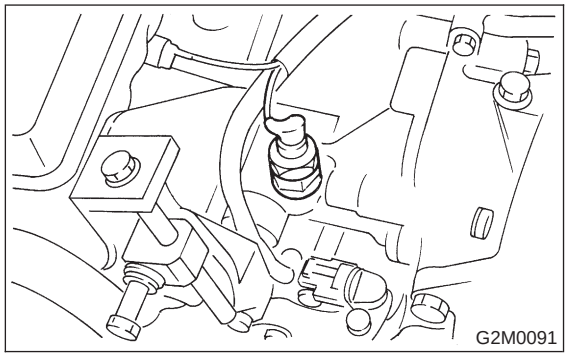
(3) Loosen lock bolt and slider bolt, and remove front side V-belt.


G2M0286

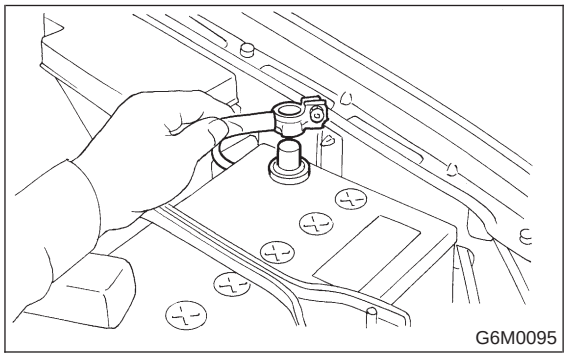
(4) Remove generator lock bolt.
(5) Remove bolt which install generator on bracket.


H2M1499

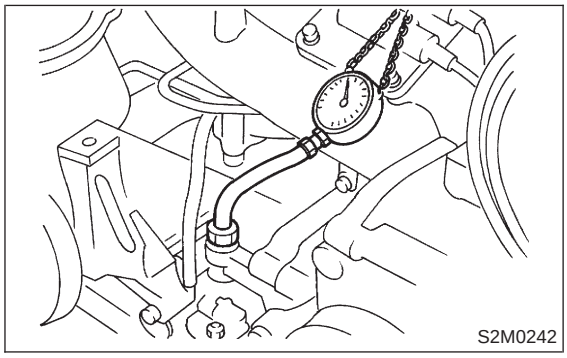
3) Disconnect connector from oil pressure switch.
4) Remove oil pressure switch from engine cylinder block. <Ref. to 2-4 [W3A0].>


G2M0091

5) Connect oil pressure gauge hose to cylinder block.
6) Connect battery ground cable.


G6M0095

7) Start the engine, and measure oil pressure.


S2M0242

Oil pressure:
98 kPa (1.0 kg/cm^2,14 psi) or more at 800 rpm
294 kPa (3.0 kg/cm^2, 43 psi) or more at 5,000 rpm

CAUTION:
● If oil pressure is out of specification, check oil pump, oil filter and lubrication line. <Ref. to 2-4 ENGINE LUBRICATION SYSTEM.>
● If oil pressure warning light is turned ON and oil pressure is in specification, replace oil pressure switch. <Ref. to 2-4 ENGINE LUBRICATION SYSTEM.>

NOTE:
The specified data is based on an engine oil temperature of 80°C (176°F).

8) After measuring oil pressure, install oil pressure switch. <Ref. to 2-4 [W3B0].>

Tightening torque:
25±3 N·m (2.5±0.3 kg-m, 18.1±2.2 ft-lb)

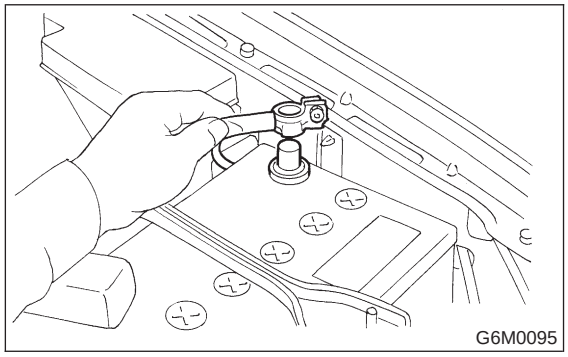
9) Install generator and V-belt in the reverse order of removal, and adjust the V-belt deflection. <Ref. to 1-5 [G2A0].>

7. Valve Clearance

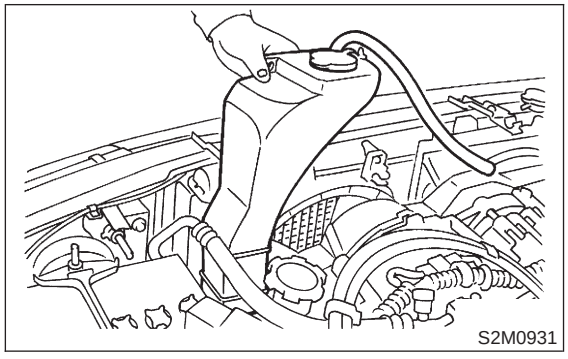
A: INSPECTION

CAUTION:
Inspection and adjustment of valve clearance should be performed while engine is cold.

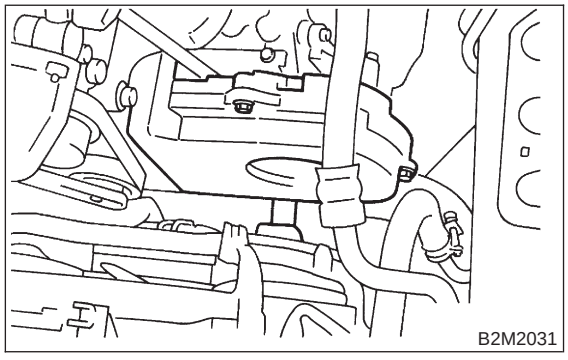
1) Set the vehicle onto the lift.
2) Disconnect battery ground cable.


G6M0095

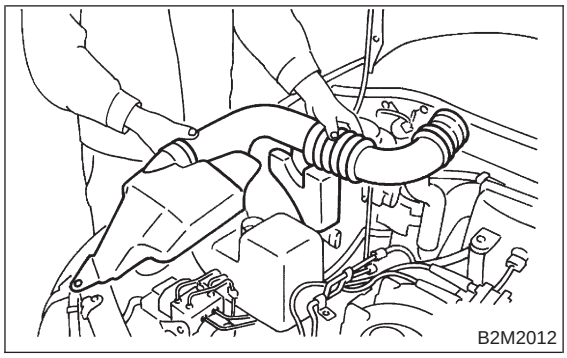
3) Remove engine coolant reservoir tank.
<Ref. to 2-5 [W9A0].>


S2M0931

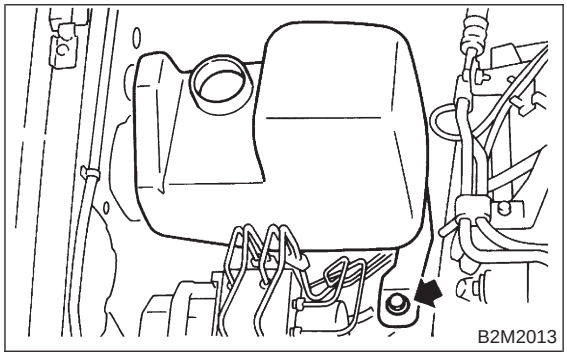
4) Remove timing belt cover (LH).


B2M2031

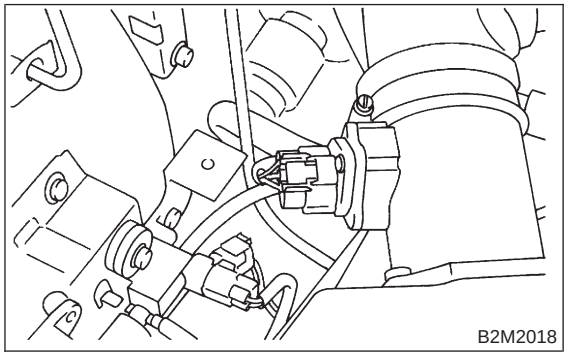
5) Remove rocker cover.
6) When inspecting #1 and #3 cylinders:
(1) Remove air intake duct as a unit (2200 cc California spec. vehicles).


B2M2012

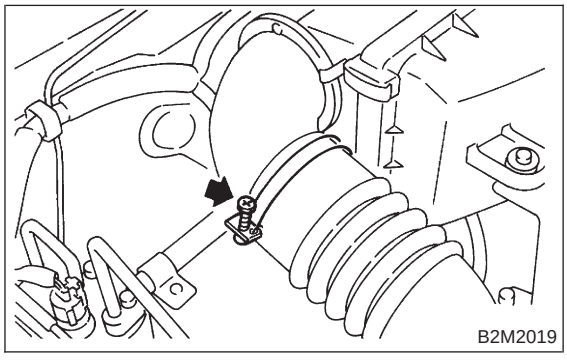
(2) Remove resonator chamber (2200 cc California spec. vehicles).


B2M2013

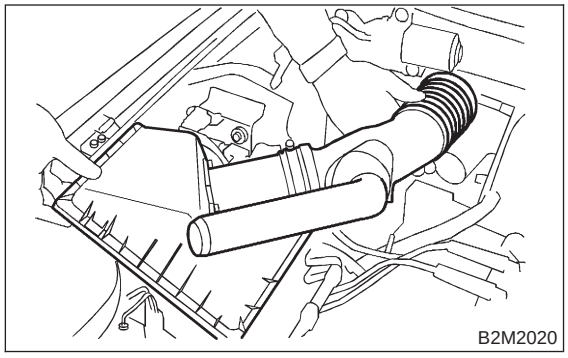
(3) Disconnect connector from mass air flow sensor (Except 2200 cc California spec. vehicles).


B2M2018

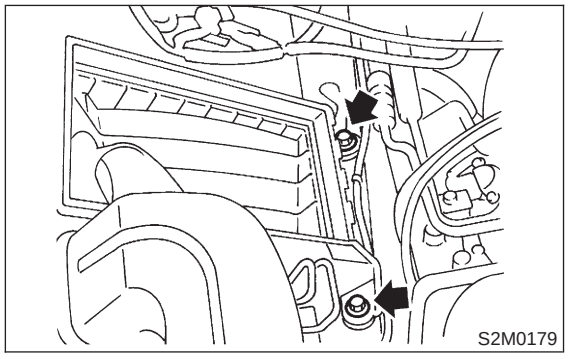
(4) Loosen clamp which connects air intake duct and air intake chamber (Except 2200 cc California spec. vehicles).


B2M2019

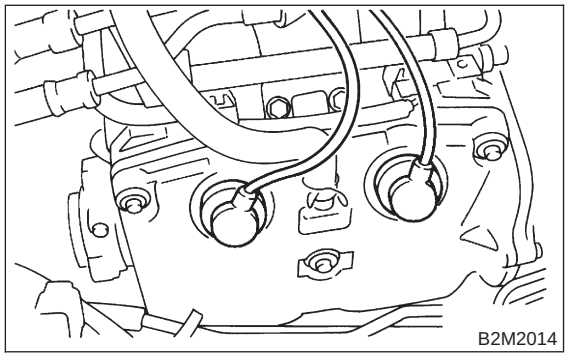
(5) Remove clips of air cleaner upper cover (Except 2200 cc California spec. vehicles).
(6) Remove air intake duct and air cleaner upper cover as a unit (Except 2200 cc California spec. vehicles).


B2M2020

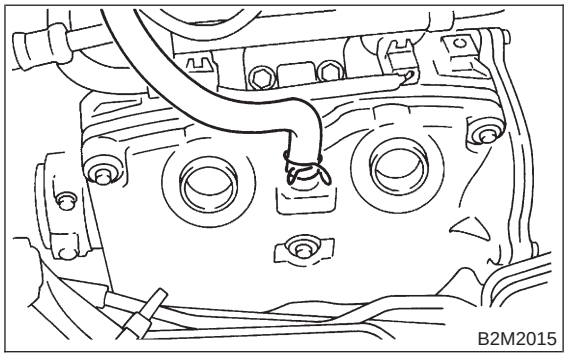
(7) Remove air cleaner element (Except 2200 cc California spec. vehicles).
(8) Remive air cleaner lower case (Except 2200 cc California spec. vehicles).


S2M0179

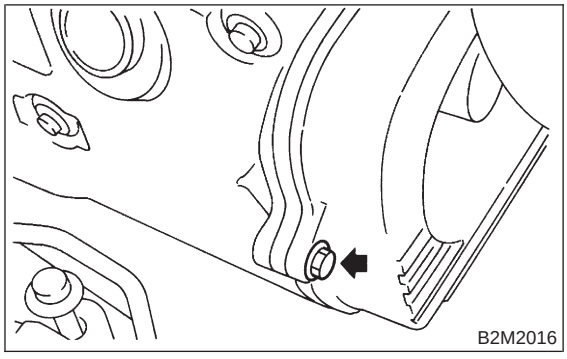
(9) Disconnect spark plug cords from spark plugs (#1 and #3 cylinders).


B2M2014

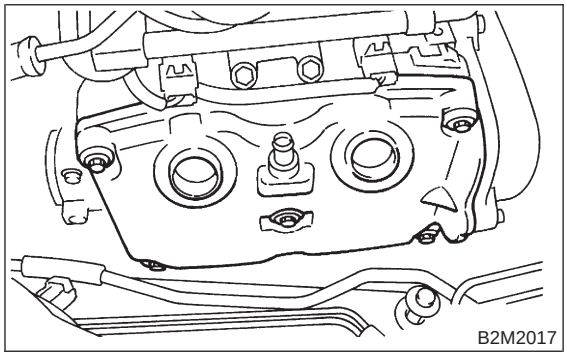
(10) Disconnect blow-by hose from rocker cover (RH).


B2M2015

(11) Lift-up the vehicle.
(12) Remove under cover (RH).
(13) Place suitable container under the vehicle.
(14) Lower the vehicle.
(15) Remove the timing belt cover (RH) bolt.

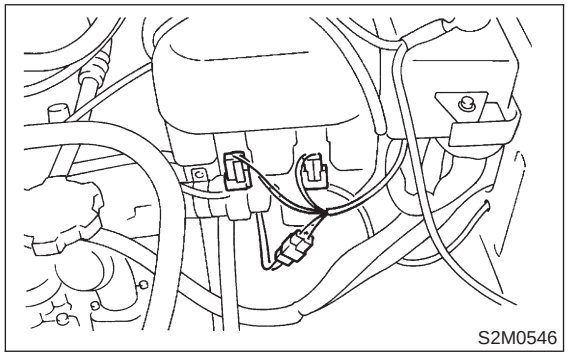

B2M2016

(16) Remove rocker cover bolts, then remove rocker cover (RH).

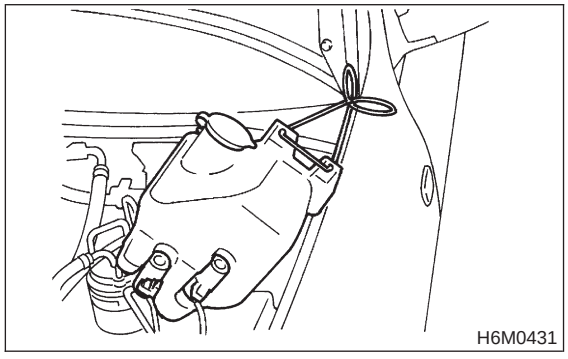

B2M2017

7) When inspecting #2 and #4 cylinders:
(1) Disconnect battery cables, and then remove battery and battery carrier.

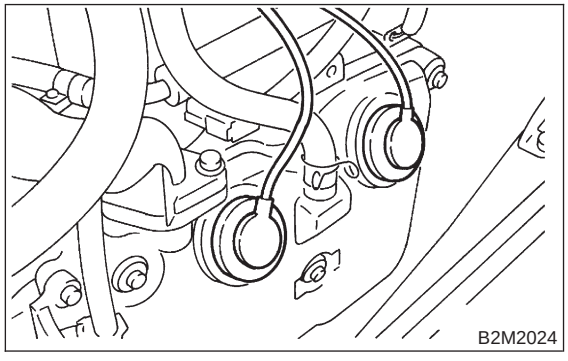
(2) Disconnect front window washer motor connector.
(3) Disconnect rear gate glass washer motor connector. (Wagon only)


S2M0546

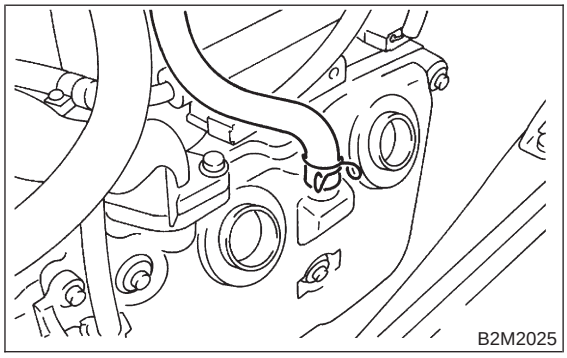
(4) Disconnect rear gate glass washer hose from washer motor, then plug connection with a suitable cap. (Wagon only)
(5) Remove the two bolts which hold washer tank, then secure the tank away from working area.


H6M0431

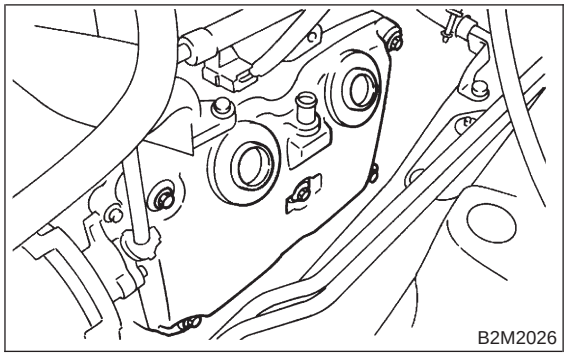
(6) Disconnect spark plug cords from spark plugs (#2 and #4 cylinders).


B2M2024

(7) Disconnect blow-by hose form rocker cover (LH).

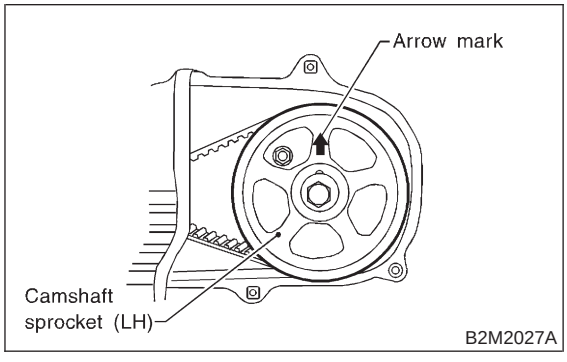

B2M2025

(8) Lift-up the vehicle.
(9) Remove under cover (LH).
(10) Place suitable container under the vehicle.
(11) Remove rocker cover bolts, then remove rocker cover (LH).


B2M2026

8) Set #1 cylinder piston to top dead center of compression stroke by rotating crankshaft pulley clockwise.

NOTE:
When arrow mark on camshaft sprocket (LH) comes exactly to the top, #1 cylinder piston is brought to the top dead center of the compression stroke.

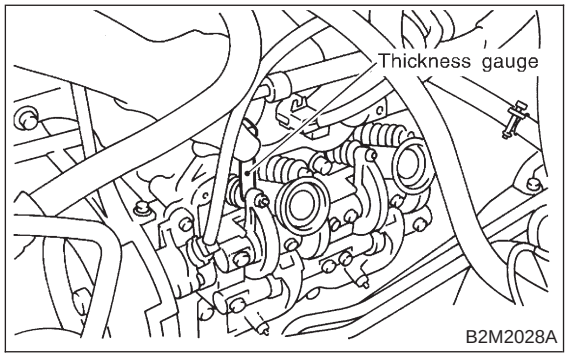


B2M2027A

9) Measure #1 cylinder valve clearance by using thickness gauge.

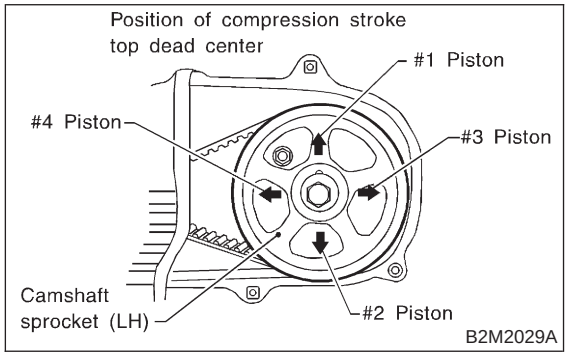
CAUTION:
● Insert the thickness gauge in at as horizontal a direction as a possible with respect to the valve stem end face.
● Measure exhaust valve clearances while lifting-up the vehicle.

Valve clearance:
Intake: 0.20±0.02 mm (0.0079±0.0008 in)
Exhaust: 0.25±0.02 mm (0.0098±0.0008 in)



10) If necessary, adjust the valve clearance. <Ref. to 2-2 [W7B0].>
11) Similar to measurement procedures used for #1 cylinder, measure #2, #3 and #4 cylinder valve clearances.

NOTE:
● Be sure to set cylinder pistons to their respective top dead centers on the compression stroke before measuring valve clearances.
● To set #3, #2 and #4 cylinder pistons to their top dead centers on the compression stroke, turn crankshaft pulley clockwise 90° at a time starting with arrow mark on left-hand camshaft sprocket facing up.



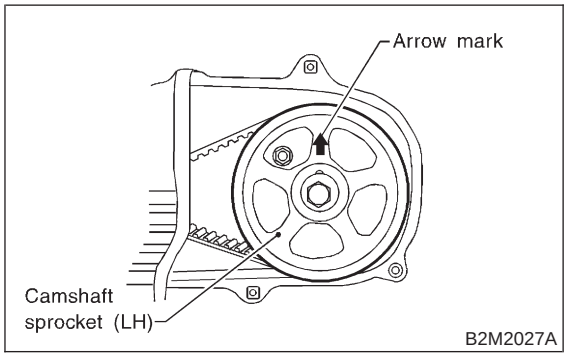
12) After inspection, install the related parts in the reverse order of removal.

B: ADJUSTMENT

CAUTION:
Adjustment of valve clearance should be performed while engine is cold.

1) Set #1 cylinder piston to top dead center of compression stroke by rotating crankshaft pulley clockwise.

NOTE:
When arrow mark on camshaft sprocket (LH) comes exactly to the top, #1 cylinder piston is brought to the top dead center of the compression stroke.

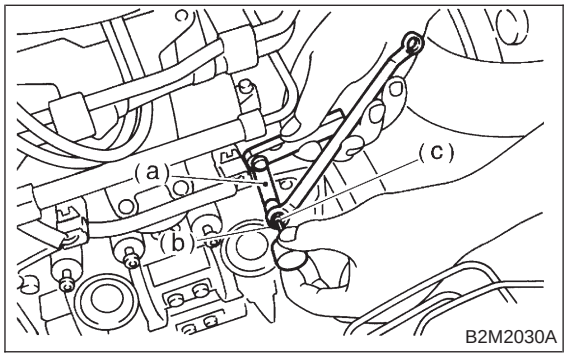


2) Adjust the #1 cylinder valve clearance.
(1) Loosen the valve rocker nut and screw.
(2) Place suitable thickness gauge.
(3) While noting valve clearance, tighten valve rocker adjust screw.
(4) When specified valve clearance is obtained, tighten valve rocker nut.

Tightening torque:
10±1 N·m (1.0±0.1 kg-m, 7.2±0.7 ft-lb)

CAUTION:
● Insert the thickness gauge in at as horizontal a direction as possible with respect to the valve stem end face.
● Adjust exhaust valve clearances while lifting-up the vehicle.

Valve clearance:
Intake: 0.20±0.02 mm (0.0079±0.0008 in)
Exhaust: 0.25±0.02 mm (0.0098±0.0008 in)



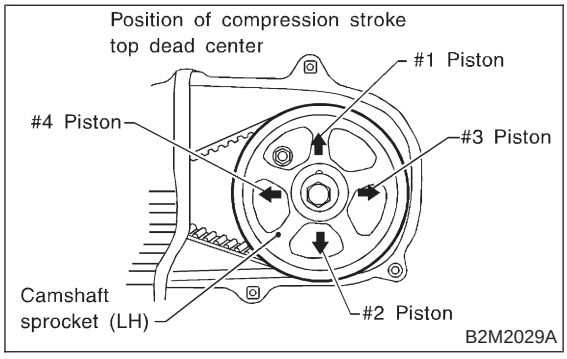
(a) Thickness gauge
(b) Valve rocker nut
(c) Valve rocker screw

3) Ensure that valve clearances are within specifications.

4) Turn crankshaft two complete rotations until #1 cylinder piston is again set to top dead center on compression stroke.
5) Ensure that valve clearances are within specifications. If necessary, re-adjust valve clearances.

6) Similar to adjustment procedures used for #1 cylinder, adjust #2, #3 and #4 cylinder valve clearances.

NOTE:
● Be sure to set cylinder pistons to their respective top dead centers on the compression stroke before adjusting valve clearances.
● To set #3, #2 and #4 cylinder pistons to their top dead centers on the compression stroke, turn crankshaft pulley clockwise 90° at a time starting with arrow mark on left-hand camshaft sprocket facing up.



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