WORKSHOP MANUAL

C&E SERIES

ENGINE

(6WF1-TC (Common Rail) model)

SECTION 1

ISUZU

NOTICE

Before using this Workshop Manual to assist you in performing vehicle service and maintenance operations, it is recommended that you carefully read and thoroughly understand the information contained in Section-0 under the headings "GENERAL REPAIR INSTRUCTIONS".

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Applicable Model:

C&E Series

This Manual is applicable to 2006 year model and later vehicles.

THIS MANUAL INCLUDES THE FOLLOWING SECTIONS:

SECTION No.	CONTENTS
1B	Engine Mechanical
1C	Cooling System
1D	Fuel System
1E	Engine Electrical
1F	—
1G	Exhaust System
1H	Lubrication System
1I	Accelerator Pedal Assembly
1J	Supercharge System
1K	Preheating System
1L	Power Take Off

ENGINE

Engine Mechanical
(6WF1-TC)
TABLE OF CONTENTS

6WF1-TC Engine

Maintenance Precautions

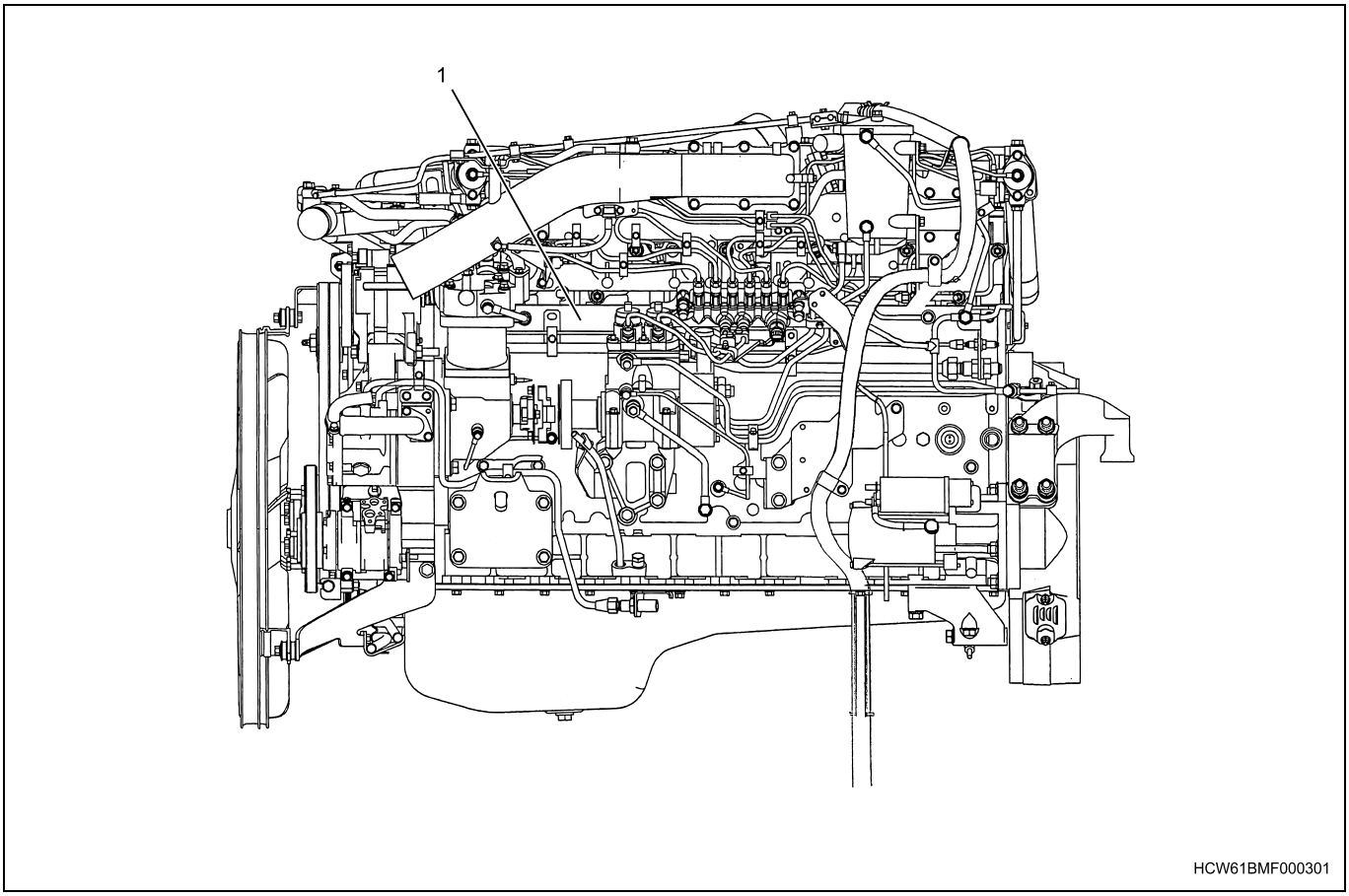
Observe the following precautions when conducting engine maintenance in order to both safeguard against engine damage and maintain the reliability of the engine performance.

- When raising or supporting the engine, do not allow the jacks to come into contact with the oil pan.
  When lowering the engine, use an engine pallet, wood frame or other such means to support it at the engine foot and flywheel housing.
- When the intake system has been removed, cover the air intake to prevent foreign matter from entering the cylinders. If foreign matter is allowed to enter, the cylinders and other parts may be seriously damaged when the engine is run.
- When conducting maintenance work on the engine body, be absolutely sure to disconnect the battery grounding cable. When power needs to be supplied to the engine during inspections or other such jobs, exercise care since short-circuiting may occur.
- Apply plenty of engine oil to the sliding surfaces in order to protect and lubricate the sliding surfaces during the initial operation.
- When the valve train parts, pistons, piston rings, connecting rods, connecting rod bearings and crankshaft journal bearings have been disassembled, arrange them in sequence and store them.
- When re-mounting the parts, mount the same parts in the same positions where they were prior to disassembly.
- Whenever the gaskets, oil seals, O-rings and other such parts are disassembled, be absolutely sure to replace them with new parts.
- When using liquid gaskets, remove all the old ones, wash the parts where they were used to remove any oil, grease, moisture and contamination, and then apply the designated liquid gaskets and assemble the parts.
- Assemble the parts within 7 minutes after applying the liquid gaskets.
  If more than 7 minutes have elapsed, remove the liquid gaskets, and re-apply them.
- During the assembly and mounting processes, tighten the parts to the specified tightening torque, and ensure that the parts are mounted properly.

Precautions for jobs inherent to this engine

In the fuel system, all the holes and clearances inside the injector that serves as the fuel passages and other parts are finished to a high level of precision. For this reason, these parts are particularly sensitive to foreign matter, and the entry of foreign matter may lead to malfunctioning or other trouble. Therefore, take every means possible to keep these holes and clearances free from foreign matter.

How to Read the Model

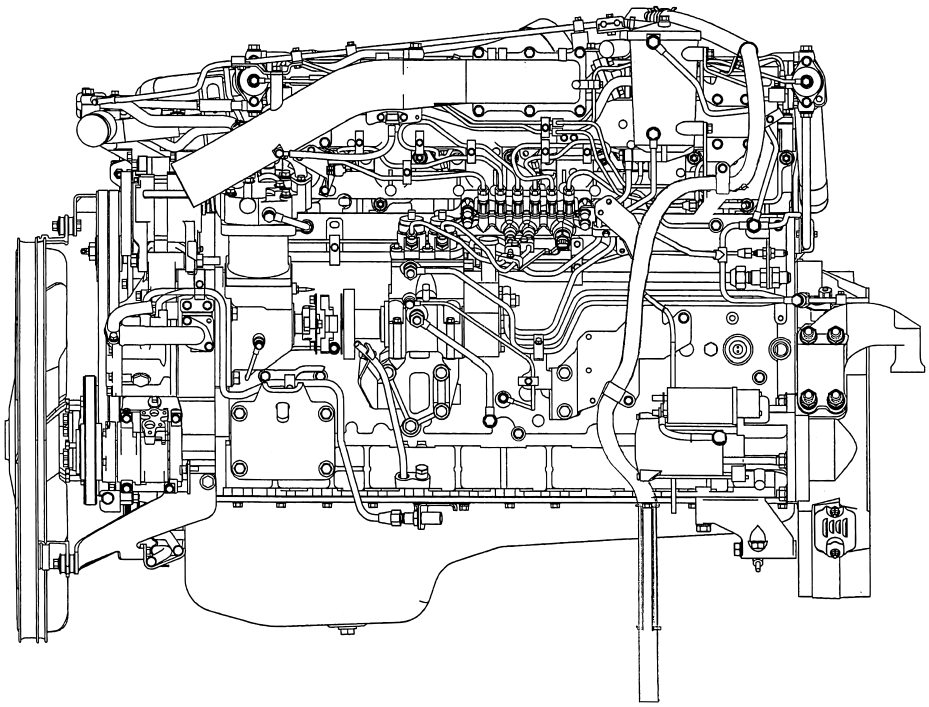


Legend

1. Engine serial number (6WF1-. . . . . .)

Description of Functions and Operation

Structural view of engine



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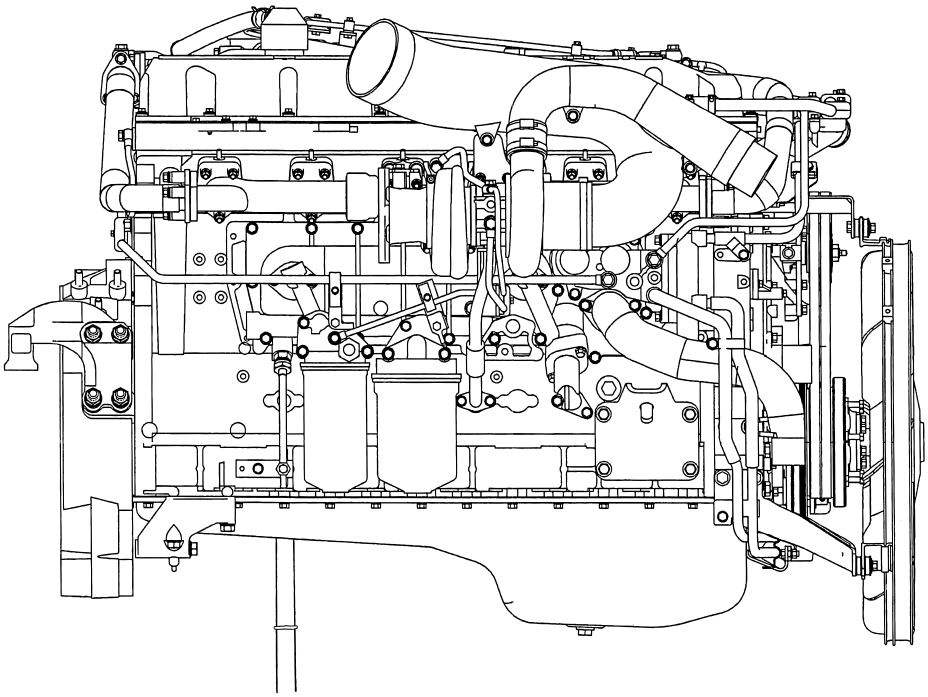

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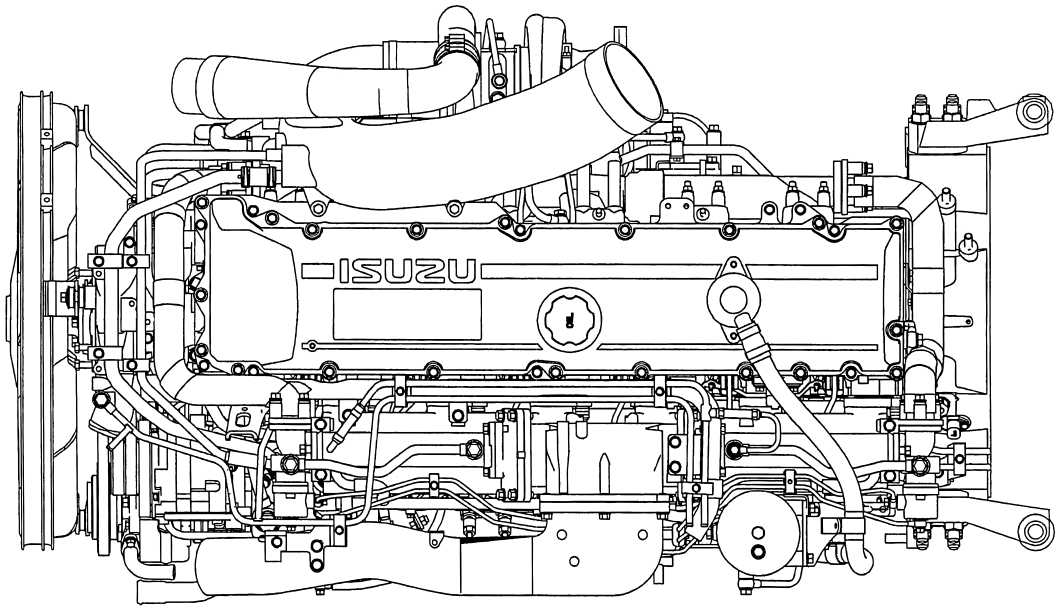

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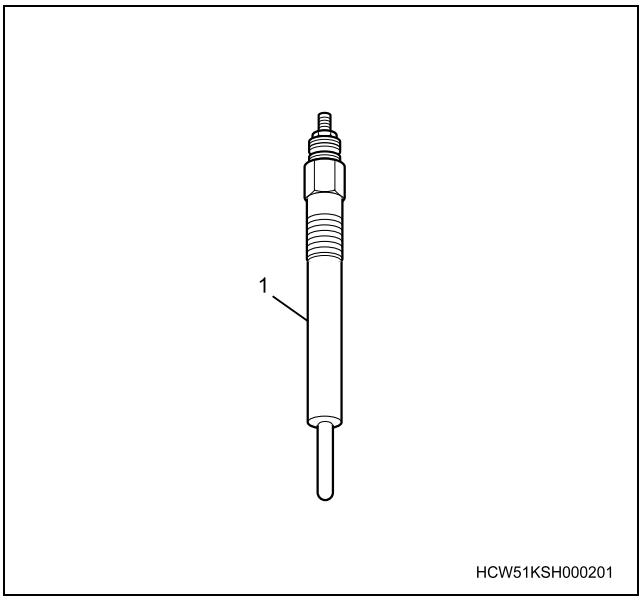
Functional Inspection:

Measurement of compression pressure

Measure the compression pressure with the battery and starter motor in a trouble-free state while the engine is cold (water temperature of 20°C/68°F).

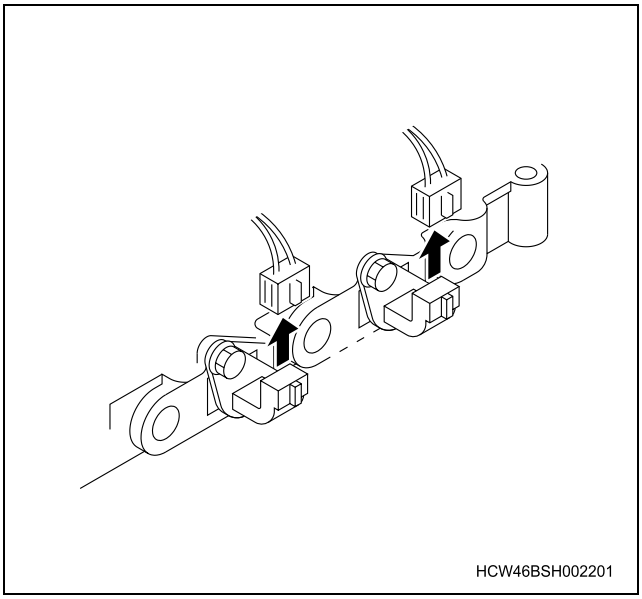
Removal of glow plugs

- Remove all the glow plugs (1).



Disconnection of injector harness connectors

- Disconnect the injector harness connectors from the lower head cover (No fuel injected).

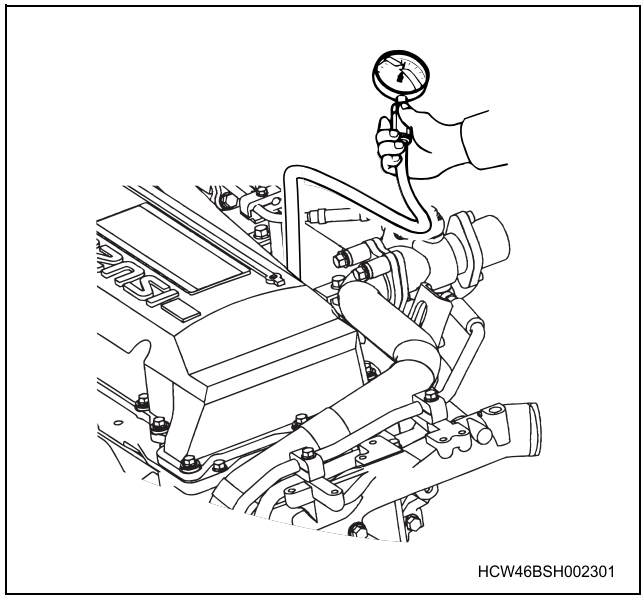


Mounting of compression gauge

- Insert the compression adapter into the holes where the glow plugs are installed, and mount the compression gauge.

Special tools

Compression adapter: 5-8531-7001-0



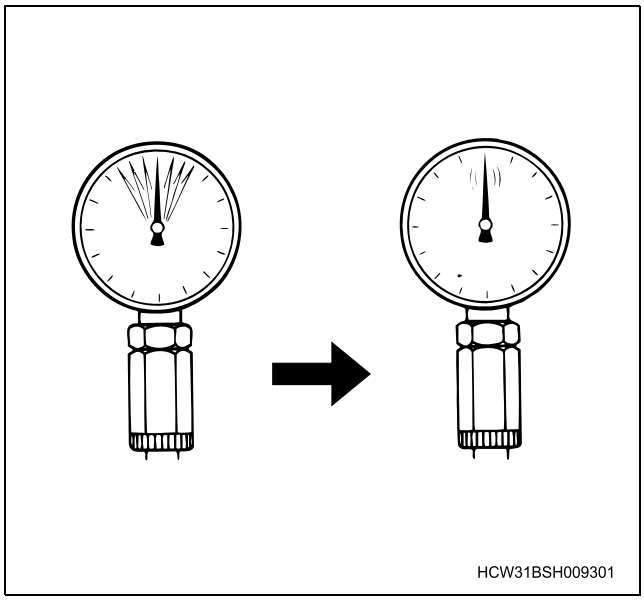
Measurement of compression pressure

- Run the starter motor (at a speed of 200 rpm), and read off the compression pressure when the pointer of the compression gauge has stabilized.

NOTE:

- Bear in mind that air will shoot out with great force from the glow hole while the motor is running.
- Measure the compression force for all the cylinders.
- When disconnecting the harness connectors, the ECM will identify this as a failure and record an error code. Upon completion of the measurements, be absolutely sure to clear the ECM memory.(For details on how to clear the ECM memory, refer to the Troubleshooting Manual.)

Item	Compression pressure kPa (kg/cm^2/psi)/ rpm	Difference between cylinders kPa (kg/cm^2/psi)/rpm
standard	2840 (29 / 412) / 200	200 (2.0 / 28) / 200
limit	2260 (23 / 327) / 200	—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Determining when overhauling is to be performed

Overhauling is required in the following cases.

Drop in compression pressure

When the compression pressure has dropped below 2260 kPa (23kg/cm^2/327psi) according to the measurement method set forth in "Measurement of compression pressure."

Increase in rate at which engine oil is consumed

When, if 100% serves as the amount of engine oil consumed (number of kilometers traveled per liter of oil) by a new vehicle, this rate has dropped below 50%.

Increase in rate at which fuel is consumed

When, if 100% serves as the amount of fuel consumer (km/liter) by a new vehicle, this rate has dropped below 60%.

Abnormal noises inside the engine

When abnormal noises are heard from inside the engine. Implement overhauling as soon as possible and remedy the problem.

NOTE:
Examples of possible factors that may cause abnormal noises include engine parts wear, seizures and overheating.

Maintenance Precautions

1. Allow the engine to cool off sufficiently since its parts will be hot immediately after the engine has been run.
2. Since self-diagnosis codes are stored in the ECM memory, remember to check the codes stored in the ECM using the scanning tool before inspecting the sensors.
3. Be absolutely sure to disconnect the battery terminals in order to protect the sensors and other electronic components from damage and prevent a fire.
4. There is a risk of electric shocks from the high voltages present in the injector harness and solenoid valve areas. Before proceeding with the maintenance work, be absolutely sure to set the starter switch to the "lock" position and pull out the key.

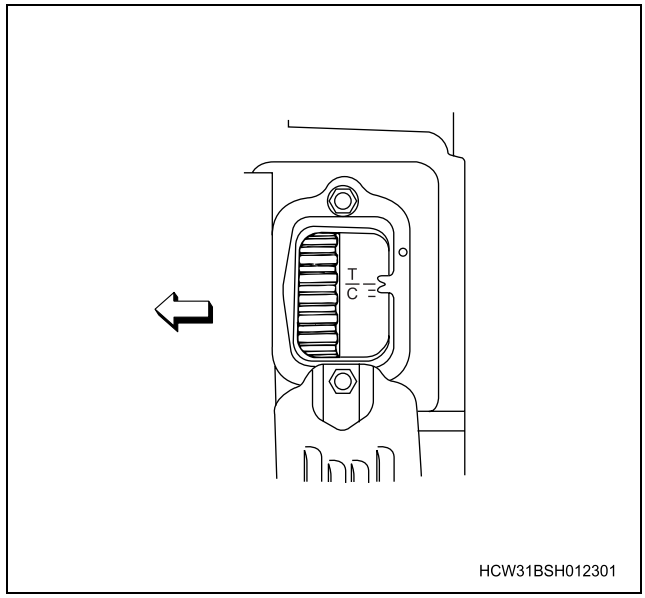
Adjustment of valve clearance

Adjust the valve clearance in two stages: first with the #1 cylinder set to the compression top dead center, and then with the #6 cylinder set to the compression top dead center.

Adjustment of valve clearance

Setting the #1 (or #6) cylinder to the compression top dead center

Turn the crankshaft in the forward direction, and align the T/C ruled line of the flywheel to the pointer. At this point, check that there is a clearance between the cam and rocker arm of the #1 (or #6) cylinder (compression top dead center).



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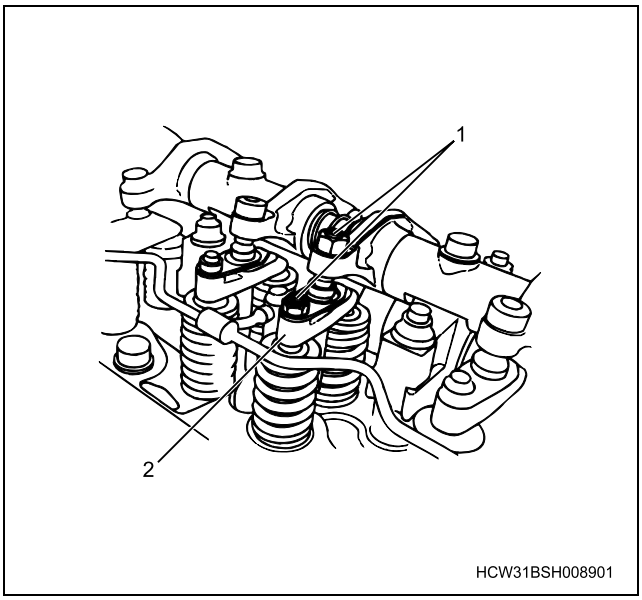
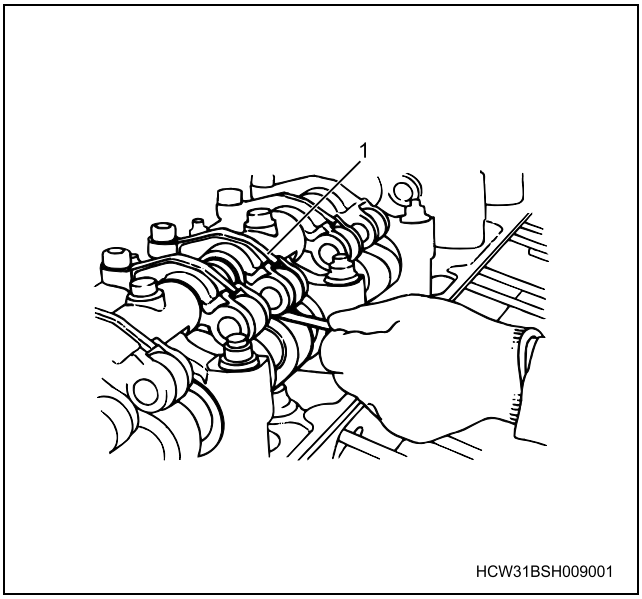
Adjustment of valve clearance

1. Adjust the valves listed in the valve clearance adjustment table.

2. Loosen the adjusting screws (1) of the rocker arm and bridge (2) completely.



3. Insert the thickness gauge between the rocker arm (1) and cam, make the adjustment using the adjusting screw of the rocker arm, and then secure using the lock nut.



4. With the thickness gauge still inserted, tighten the adjusting screw of the bridge until the gauge ceases to move.
5. Gradually loosen the adjusting screw of the bridge, re-adjust so that the insertion and removal of the thickness gauge feel suitably stiff, and secure the lock nut of the bridge.

Valve clearance mm(in) (when cold)

0.40(0.016) for both intake and exhaust

Tightening torque:N·m(kgf·m/lb·ft)

Rocker arm adjusting screw lock nut	78 (8.0 / 58)
Bridge adjusting screw lock nut	54 (5.5 / 40)

NOTE:

- Before starting the work, stop the engine, and allow enough time for the engine to cool off.
- A small amount of oil oozes out when the head cover is removed, so use a rag to clean it up.

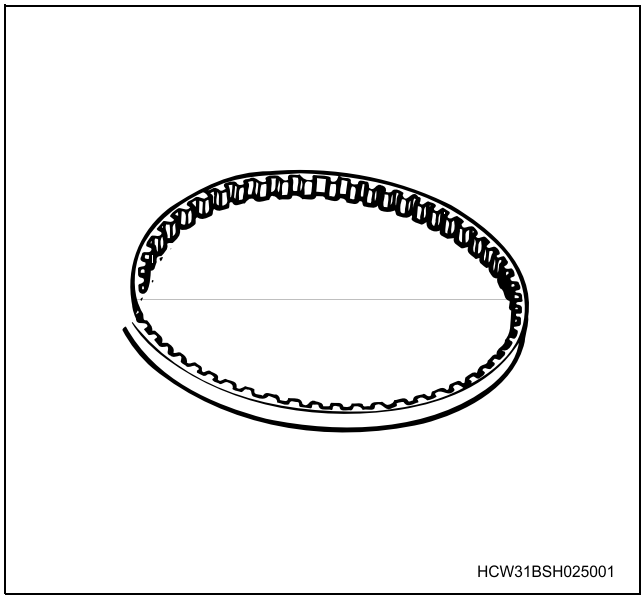
Valve clearance adjustment table

	Cylinder No.	1		2		3		4		5		6	
Condition	Arrangement of valves	EXH	IN	EXH	IN	EXH	IN	EXH	IN	EXH	IN	EXH	IN
Valve to be adjusted	When the #1 cylinder is set at the compression top dead center	○	○		○	○			○	○			
	When the #6 cylinder is set at the compression top dead center			○			○	○			○	○	○

Injection sequence (1 - 5 - 3 - 6 - 2 - 4)

Inspection and adjustment of belts

Inspect the V-belt for wear and cracks.

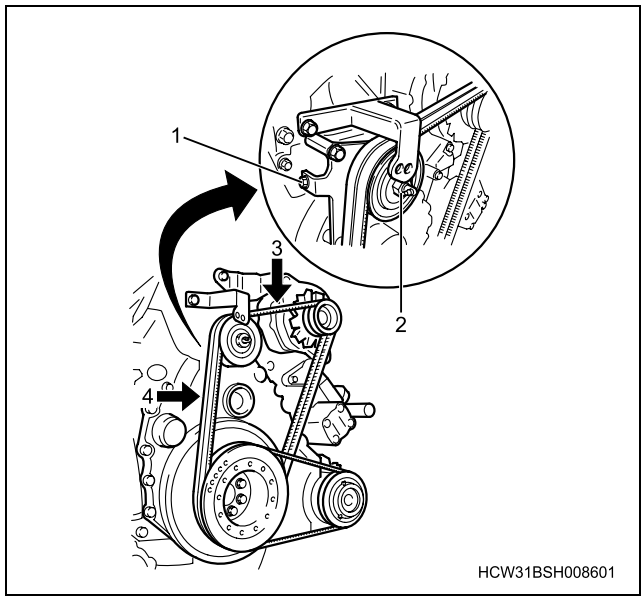


Adjustment of generator drive belt tension

1. Loosen the lock nut of the idle pulley.
2. Using the adjusting bolt of the idle pulley, adjust the belt tension to the reference value.
3. Deflection amount when the centers between the idle pulley and generator pulley (F1) and between the crank pulley and idle pulley (F2) are pressed with a force of 98N (10 kgf/22lb).

Reference values

	New product mm(in)	When tension is re-adjusted mm(in).
F1	10 – 13 (0.39 – 0.51)	11 – 14 (0.43 – 0.55)
F2	13 – 16 (0.51 – 0.63)	15 – 18 (0.59 – 071)



Legend
1. Adjusting bolt
2. Lock nut
3. F1
4. F2

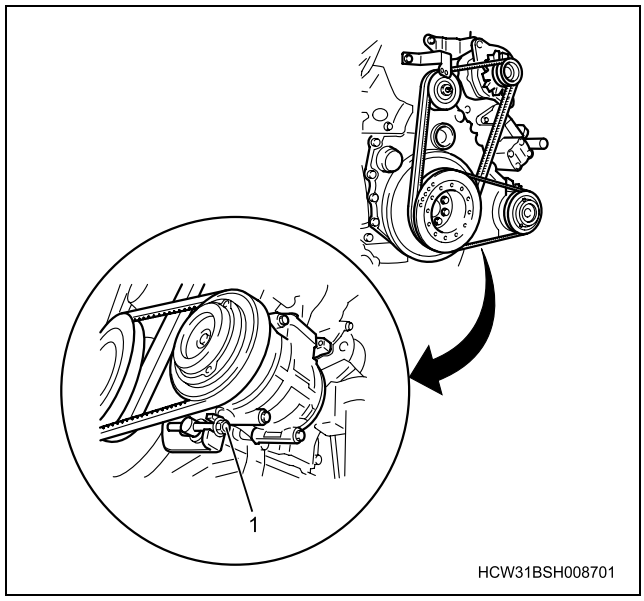
Adjustment of A/C compressor drive belt tension

1. Loosen the bolt and nut shown in the illustration.
2. Using the adjusting bolt, adjust the belt tension to the reference value.

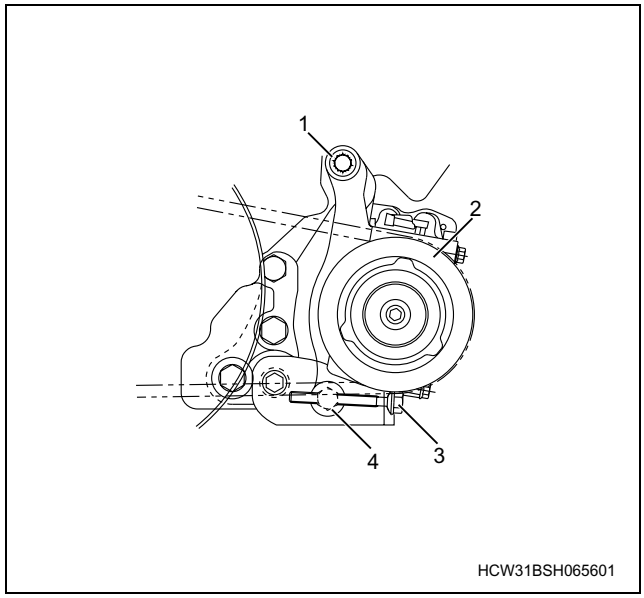
Reference values

Deflection amount when the center between the crank pulley and A/C compressor is pressed with a force of 98N (10 kgf/22lb): 10 – 13 mm(0.39 – 0.51 in)

3. Tighten the bolt and nut.



Legend
1. Adjusting bolt



Legend
1. Bolt
2. A/C compressor
3. Adjusting bolt
4. Nut (rear side)

List of Trouble Symptoms

- The engine fails to turn over
- The engine turns over but fails to start
- Lots of black smoke is emitted
- Lots of white smoke is emitted
- Engine knocking occurs
- The engine does not turn over properly
- Battery charging trouble

Symptom: The engine fails to turn over

Condition	Possible Cause	Correction
The starter fails to turn.	The battery relay is defective.	Replace.
	Something is wrong with the wiring.	Connect or repair.
	The battery capacity is insufficient.	Recharge or replace.
	The starter brush has stuck or is worn or damaged.	Repair or replace.
	Something is wrong with the functions inside the starter.	Disassemble and repair.
The starter turns but fails to engage with the flywheel.	The ring gear is worn.	Repair or replace.
	The magnetic switch of the starter is not adjusted properly.	Adjust or repair.
The starter pinion engages with the ring gear but fails to turn.	Something is wrong with the battery capacity.	Charge or repair.
	The contact pressure of the starter brush and commutator is insufficient.	Disassemble and repair.
	The armature of the starter is stuck.	Disassemble and repair.
	The engine has seized up inside.	Disassemble and repair.

Symptom: The engine turns over but fails to start

Condition	Possible Cause	Correction
Fuel does not reach the supply pump.	Air has found its way inside the fuel system.	Purge the air.
	Air has been sucked in from the fuel pump.	Purge the air or replace the pump.
	The engine is out of fuel.	Replenish.
	The strainer in the fuel suction area is clogged.	Clean or replace.
	The fuel pipe is clogged.	Clean or replace.
	Something is wrong with the functions of the supply pump.	Disassemble and repair.
	In extremely cold weather, fuel which is not designed to be used in cold areas, is being used.	Replace with the suitable fuel.
	The fuel filter is clogged.	Replace.
	Something is wrong with the engine control system.	Diagnose the engine control system.
Fuel reaches the supply pump.	The injection pipe connections are loose.	Tighten up the parts.
	The overflow valve is not completely airtight.	Replace.
	A failure has occurred inside the supply pump.	Inspect or repair.
	The wiring is not connected properly or is broken.	Repair or replace.
	The rotation sensor is defective.	Replace.
	Something is wrong with the engine control system.	Diagnose the engine control system.
Insufficient or unstable amount of fuel injected	Air has found its way inside the fuel system.	Purge the air.
	The fuel pipe is clogged.	Clean or replace.
	Something is wrong with the functions of the supply pump.	Disassemble and repair.
	The injector nozzle is stuck.	Replace.
	The wiring is not connected properly or is broken.	Repair or replace.
	The fuel filter is clogged.	Replace.
	Something is wrong with the engine control system.	Diagnose the engine control system.

Symptom: Lots of black smoke is emitted

Condition	Possible Cause	Correction
Defective ignition timing	Something is wrong with the engine control system.	Diagnose the engine control system.
Something is wrong with the injection status of the injector.	The nozzle is stuck.	Replace.
	Something is wrong with the engine control system.	Diagnose the engine control system.
Insufficient compression pressure	The valve clearance is excessive.	Adjust.
	The valve stem is stuck (valve open status).	Disassemble and repair.
	The valve spring is defective.	Replace.
	The valve seat is worn.	Disassemble and repair.
	The compression pressure is leaking due to a defective piston ring or other part.	Disassemble and repair.
	A gasket is defective.	Disassemble and repair.
	A piston has seized up.	Disassemble and repair.
The quality of the fuel is not high enough.	Moisture has become mixed in with the fuel.	Replace.
	A low-grade fuel is being used.	Replace.
Defective air intake	The intake pipe is clogged.	Repair or replace.
	The air cleaner element is clogged.	Clean or replace.
Trouble detected by engine control system	Trouble in the sensors or other parts	Repair or replace.
	Something is wrong with the engine control system.	Diagnose the engine control system.
The EGR or exhaust valve is defective.	The EGR valve is stuck.	Repair or replace.
	The exhaust brake valve is stuck.	Repair or replace.
	Something is wrong with the engine control system.	Diagnose the engine control system.

Symptom: Lots of white smoke is emitted

Condition	Possible Cause	Correction
Defective ignition timing	The rotation sensor is defective.	Replace.
	Something is wrong with the engine control system.	Diagnose the engine control system.
Trouble detected by engine control system	Trouble in the sensors or other parts	Replace.
	Something is wrong with the control unit.	Replace.
	Something is wrong with the engine control system.	Diagnose the engine control system.
The compression pressure is defective.	The valve clearance is excessive or insufficient.	Adjust.
	The valve stem is stuck (valve open status).	Disassemble and repair.
	The valve spring is defective.	Replace.
	The valve seat is worn.	Disassemble and repair.
	The compression pressure is leaking due to a defective piston ring or other part.	Disassemble and repair.
	A gasket is defective.	Disassemble and repair.
	A piston has seized up.	Disassemble and repair.
The quality of the fuel is not high enough.	Moisture has become mixed in with the fuel.	Replace.
High oil consumption	The piston ring is worn or broken.	Disassemble and repair.
	The valve stem oil seal is defective.	Disassemble and repair.

Symptom: Engine knocking occurs

Condition	Possible Cause	Correction
Defective ignition timing	Something is wrong with the engine control system.	Diagnose the engine control system.
Trouble detected by engine control system	Trouble in the sensors or other parts	Replace.
	Something is wrong with the control unit.	Replace.
	Something is wrong with the engine control system.	Diagnose the engine control system.
Fuel	A low-grade fuel is being used.	Replace.
Defective air intake	The intake pipe is clogged.	Repair or replace.
	Something is wrong with the engine control system.	Diagnose the engine control system.
Abnormal noises from the engine	Foreign matter has found its way inside the cylinders.	Repair or replace.
	A piston, bearing or other part has seized up.	Repair or replace.