

**CX490D**  
**CX500D**  
**Tier 4B (final)**  
Crawler Excavator

**SERVICE MANUAL**

**Part number 47937809**

English

February 2016





## **SERVICE MANUAL**

**CX490D Crawler excavators LC version (TIER4 FINAL) - NA Market**  
**CX490D Crawler excavators RTC version (TIER4 FINAL) - NA Market**  
**CX500D Crawler excavators LC Mass excavator version (TIER4 FINAL) -**  
**NA Market**  
**CX500D Crawler excavators RTC Mass excavator version (TIER4 FINAL)**  
**- NA Market**

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## **INTRODUCTION**

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## **Foreword - Important notice regarding equipment servicing**

All repair and maintenance work listed in this manual must be carried out only by qualified dealership personnel, strictly complying with the instructions given, and using, whenever possible, the special tools.

Anyone who performs repair and maintenance operations without complying with the procedures provided herein shall be responsible for any subsequent damages.

The manufacturer and all the organizations of its distribution chain, including - without limitation - national, regional, or local dealers, reject any responsibility for damages caused by parts and/or components not approved by the manufacturer, including those used for the servicing or repair of the product manufactured or marketed by the manufacturer. In any case, no warranty is given or attributed on the product manufactured or marketed by the manufacturer in case of damages caused by parts and/or components not approved by the manufacturer.

The manufacturer reserves the right to make improvements in design and changes in specifications at any time without notice and without incurring any obligation to install them on units previously sold. Specifications, descriptions, and illustrative material herein are as accurate as known at time of publication but are subject to change without notice.

In case of questions, refer to your CASE CONSTRUCTION Sales and Service Networks.

## Safety rules

### Personal safety



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible death or injury.

Throughout this manual you will find the signal words **DANGER**, **WARNING**, and **CAUTION** followed by special instructions. These precautions are intended for the personal safety of you and those working with you.

Read and understand all the safety messages in this manual before you operate or service the machine.

 **DANGER** indicates a hazardous situation that, if not avoided, will result in death or serious injury.

 **WARNING** indicates a hazardous situation that, if not avoided, could result in death or serious injury.

 **CAUTION** indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

**FAILURE TO FOLLOW DANGER, WARNING, AND CAUTION MESSAGES COULD RESULT IN DEATH OR SERIOUS INJURY.**

### Machine safety

**NOTICE:** *Notice indicates a situation that, if not avoided, could result in machine or property damage.*

Throughout this manual you will find the signal word **Notice** followed by special instructions to prevent machine or property damage. The word **Notice** is used to address practices not related to personal safety.

### Information

**NOTE:** *Note indicates additional information that clarifies steps, procedures, or other information in this manual.*

Throughout this manual you will find the word **Note** followed by additional information about a step, procedure, or other information in the manual. The word **Note** is not intended to address personal safety or property damage.

## **Safety rules – General information**

### **Cleaning**

Clean the metal parts with cleaning solution that meets the standard and steam cleaning. (except for bearings)

After cleaning, dry well, and inject oil in all parts.

Also inject oil into the bearings after drying.

### **Inspection**

When disassembling parts, check all the parts.

If there are any worn or damaged parts, replace them.

Inspect carefully to prevent initial breakdowns.

### **Bearing**

Replace any loose bearings.

Air dry bearings before installing them.

### **Needle bearing**

When inserting needle bearings, be very careful not to damage them.

Apply grease to the section where the needle bearing will be inserted.

### **Gear**

Check that there is no wear and no damage.

### **Oil seal, O-ring, gasket**

Always install new oil seals, O-rings, and gaskets.

Apply grease to sections where oil seals and O-rings will be inserted.

### **Shaft**

Check that there is no wear and no damage.

Check the bearings and check for damaged oil seals on the shaft.

### **Service parts**

Install CASE CONSTRUCTION genuine service parts.

When placing an order, check the parts catalog. It contains the CASE CONSTRUCTION genuine part numbers.

Any breakdowns arising from the installation of non-genuine parts are not covered by the warranty.

### **Lubricants (fuel, hydraulic oil)**

Use the oil from the specified company or specified in the operator's manual or service Manual.

Any breakdowns arising from any fuel or hydraulic oil other than those specified are not covered by the warranty.



## **SERVICE MANUAL**

### **Engine**

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## Engine - General specification

### Engine main specifications

Item		Engine model 6UZ1
Type		Diesel/4-cycle/water-cooled, inline 6 cylinder OHC
Cylinder bore x stroke		<b>120 mm (4.72 in) x 145 mm (5.71 in)</b>
Displacement		<b>9.839 L (600.41 in<sup>3</sup>)</b>
Compression ratio		16.2
Compression pressure		<b>2750.0 kPa (398.9 psi) / 200 RPM</b>
Shape of combustion chamber		Direct injection type
Cylinder liner type		Dry liner, tight-fit type
Maximum output		<b>270.0 kW (367.1 Hp) / 2000 RPM</b>
Maximum torque		<b>1435 N·m (1058.4 lb ft) / 1500 RPM</b>
Dimensions: length x width x height		<b>1235.0 mm (48.6 in) x 1149 mm (45.2 in) x 1314 mm (51.7 in)</b>
Dry weight		<b>940.0 kg (2072.3 lb)</b>
Fuel injection timing		<b>2.5 ° BTDC</b>
Injection order		1, 5, 3, 6, 2, 4
Idling speed		<b>875 RPM to 925 RPM</b>
Valve clearance	Intake	<b>0.2 mm (0.008 in) While cool</b>
	Exhaust	<b>0.5 mm (0.020 in) While cool</b>
Opening/closing timing of intake valve	Open	<b>22 ° BTDC</b>
Opening/closing timing of intake valve	Close	<b>30 ° ABDC</b>
Opening/closing timing of exhaust valve	Open	<b>48.5 ° ABDC</b>
Opening/closing timing of exhaust valve	Close	<b>23.5 ° BBDC</b>
Ignition method		Compression ignition
Lubrication system		
Oil pump type		Gear type
Oil filter type		Full-flow bypass integrated type x 2
Engine oil level		<b>30.0 L (7.9 US gal) to 41 L (10.8 US gal)</b>
Oil pan capacity		<b>25 L (6.6 US gal) to 36 L (9.5 US gal)</b>
Oil cooling type		Water-cooled multiple-disc type (6 steps)
Cooling system		
Cooling type		Water cooling
Coolant capacity in engine		<b>22.5 L (5.9 US gal)</b>
Water pump type		V-belt drive spiral type
Thermostat type		Wax type
Fuel system		
Injection pump type		Electronic control common rail (fuel rail) type
Governor type		Electronic type
Timer type		Electronic type
Injection nozzle type		Multi-hole type 8 holes, inner diameter $\varnothing$ <b>0.151 mm (0.0059 in)</b>
Turbocharger type		RHG7V {IHI}

### Cooling system main specifications

Item	Specifications
Pulley ratio	1.3
Thermostat	Wax pellet type
Open valve temperature	<b>80.0 °C (176.0 °F) to 84.0 °C (183.2 °F)</b>
Full open temperature	<b>95 °C (203 °F)/ 11.0 mm (0.4 in)</b>

### Electrical system main specifications

Generator	
Item	Specification
Manufacturer name	Mitsubishi Electric Corporation
Isuzu parts number	1-81200-603-7
Manufacturer type	A004TU6285
Nominal output	<b>24 V — 50 A</b>
Rated speed	<b>5000 RPM</b>
Regulator type	IC type
Regulated voltage	<b>28 V to 29 V / 5000 RPM</b> with a load <b>5 A</b> or less, measured between L and E
Output characteristics (Voltage: <b>27 V</b> )	<b>more than 45 A 2500 RPM</b>
	<b>more than 50 A 5000 RPM 9.6 kg (21.2 lb)</b>
	<b>9.6 kg (21.2 lb)</b>

Starter		
Item	Specification	
Manufacturer	Mitsubishi Electric Corporation	
Isuzu parts number	8-9822-2203-2	
Manufacturer code number	M009T62372	
Output	<b>24 V/ 5.5 kW</b>	
Rating	<b>30 s</b>	
York outer diameter	<b>85.0 mm (3.35 in)</b>	
Rotational direction	Right	
Protection type	Dust proof, drip proof	
Low speed mechanism	Inner contact gear	
Weight	<b>8.5 kg (18.7 lb)</b>	
Pinion	Module	3.5
	Pressure angle	<b>14.5 °</b>
	Number of teeth	11
No load	Voltage	<b>23 V</b>
	Current	<b>120 A</b> or less
	Rotational speed	<b>3100 RPM</b> or more
Load	Voltage, current	<b>17.8 V / 450 A</b>
	Torque	<b>27.0 N·m (19.9 lb ft)</b> or more
	Rotational speed	<b>1140 RPM</b> or more
Restraint	Voltage	<b>8 V</b>
	Current	<b>1800 A</b> or less
	Torque	<b>76 N·m (56.1 lb ft)</b> or more
Pinion engaged voltage	<b>16.0 V</b> or less	

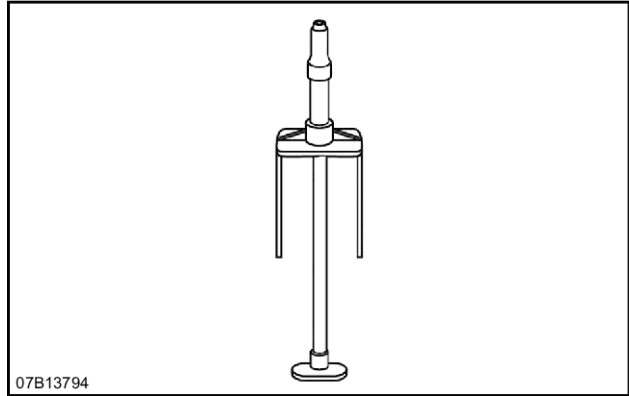
Glow plug	
Item	Type
Preheat device model	Glow plug QOSII
Glow plug rated voltage/current	<b>23 V</b>

### Major specifications of the lubrication system

Item		Specifications
Lubrication device		Forced-circulation system
Oil pump	Discharge amount	<b>0.79 MPa (114.6 psi)</b> Discharge pressure
		<b>97.4 L/min (25.7 US gpm)</b> <b>2460 RPM</b> Pump rotation speed
	Open valve pressure of the relief valve	<b>0.96 MPa (139.25 psi) to 1.16 MPa (139.25 psi)</b>
Open valve pressure of the oil gallery relief valve		<b>540 kPa (78.3 psi)</b>
Open valve temperature of the oil thermostat		<b>101.5 °C (214.7 °F) to 104.5 °C (220.1 °F)</b>

## Crankcase Liner - Special tools

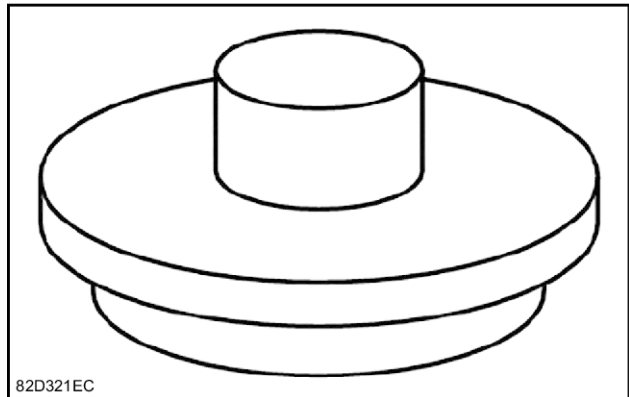
Isuzu reference	1-8523-1021-0
CASE CONSTRUCTION tool number	<b>380300007</b>
Description	Cylinder liner remover



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Isuzu reference	1-8522-1073-0
CASE CONSTRUCTION tool number	<b>380300008</b>
Description	Cylinder liner installer

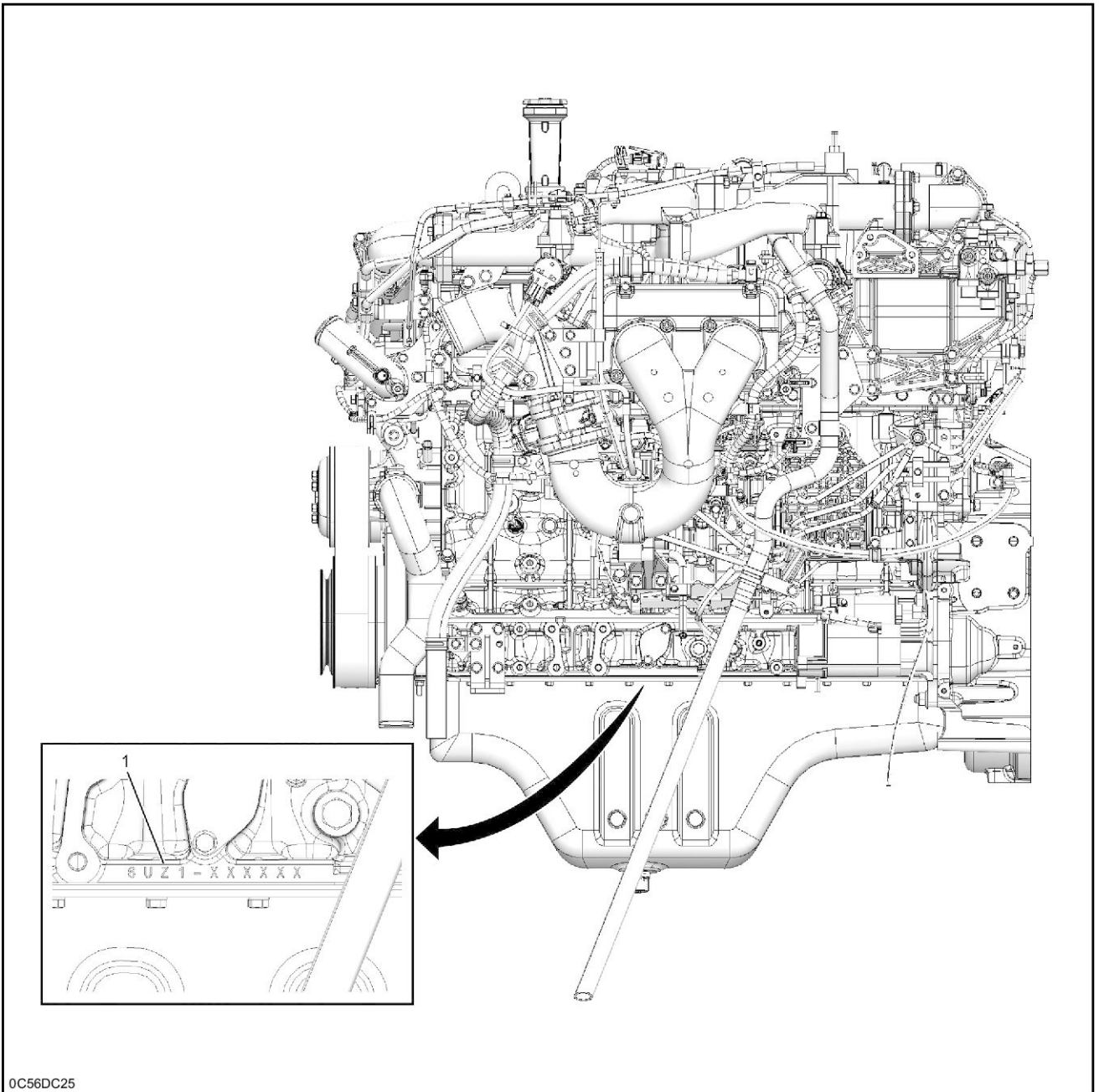


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## Engine - Identification

### Engine number



1. Engine number stamping

## Engine - Prepare

### **⚠ WARNING**

#### **Escaping fluid!**

Hydraulic fluid or diesel fuel leaking under pressure can penetrate the skin and cause infection or other injury. To prevent personal injury: Relieve all pressure before disconnecting fluid lines or performing work on the hydraulic system. Before applying pressure, make sure all connections are tight and all components are in good condition. Never use your hand to check for suspected leaks under pressure. Use a piece of cardboard or wood for this purpose. If injured by leaking fluid, see your doctor immediately.

Failure to comply could result in death or serious injury.

W0178A

### **⚠ WARNING**

#### **Avoid injury!**

Shut off the engine, remove the key, and make sure all motion is stopped before servicing the machine.

Failure to comply could result in death or serious injury.

W1128A

### **⚠ WARNING**

#### **Crushing hazard!**

The lifting systems must be operated by qualified personnel who are aware of the correct procedures to follow. Make sure all lifting equipment is in good condition, and all hooks are equipped with safety latches.

Failure to comply could result in death or serious injury.

W0256A

### **⚠ WARNING**

#### **Heavy objects!**

Lift and handle all heavy components using lifting equipment with adequate capacity. Always support units or parts with suitable slings or hooks. Make sure the work area is clear of all bystanders.

Failure to comply could result in death or serious injury.

W0398A

### **⚠ WARNING**

#### **Explosion hazard!**

Batteries emit explosive gases. Always ventilate when using in an enclosed area or when charging. Keep the battery away from sparks, open flames, and other ignition sources.

Failure to comply could result in death or serious injury.

W0369A

**NOTICE:** *Keep away from flames.*

**NOTICE:** *The air conditioner circuit is filled with high pressure gas, gas may spray out dangerously when loosening lines.*

Items to prepare:

- Wrenches [ **7 mm, 13 mm, 19 mm, 36 mm** ]
- Box wrench [ **46 mm**]
- Shackle (that fulfills slinging capacity) x 4
- Wire rope (that fulfills breaking load)
- Lifting equipment (that fulfills slinging capacity)
- Marking pen
- Cap
- Plug
- Waste oil can
- Rag
- Cleaning fluid
- Wood plank, etc.

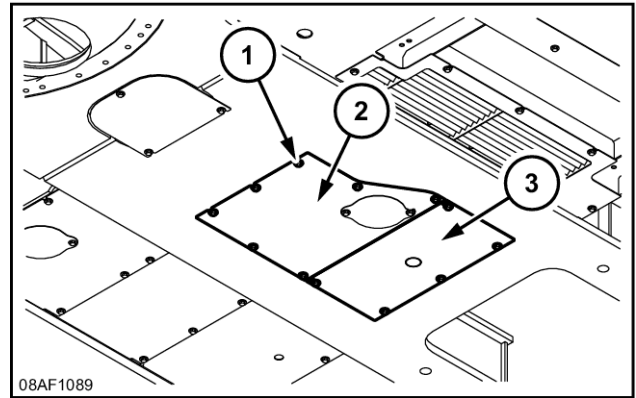
## Engine - Remove

1. Remove the cable connected to minus side of the battery. Or turn OFF the battery disconnect switch.
  - Secure the terminal and harness in order to prevent them from touching the frame or other parts when they have been removed.
  - Or protect them with a rubber cap or other cap to prevent sparks.

**NOTICE:** While the indicator (LED) of the battery disconnect switch is lit, do not turn OFF the battery disconnect switch nor disconnect its negative cable from the battery. After turning the key OFF, the LED is lit for a maximum duration of **3 min**.

2. Remove the 12 bolts (1) with a wrench [ **19 mm** ] to remove the under covers (2) and (3).

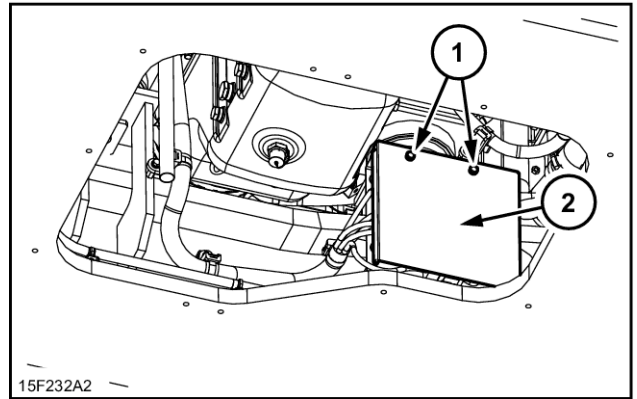
Bolt tightening torque: **63.7 - 73.5 N·m (47.0 - 54.2 lb ft)**



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3. Drain engine oil.
4. Drain coolant of the radiator. (See **Radiator - Remove (10.400)** for detail.)
5. Remove the engine hood. (See **Hood - Remove (90.100)** for detail.)
6. Remove the hydraulic pump. (See **Variable displacement pump - Remove (35.106)** for detail.)
7. Remove the radiator hose, the hydraulically-operated fan, and fan shroud. (See **Radiator - Remove (10.400)** for detail.)
8. Remove lines from the compressor. (See **Air-conditioning compressor - Remove (50.200)** for detail.)
9. Remove the starter. (See **Engine starter - Remove (55.201)** for detail.)
10. Remove wirings from the alternator. (See **Alternator - Remove (55.301)** for detail.)

11. Remove the 2 bolts (1) with a wrench [ 13 mm] to remove the box cover (2).

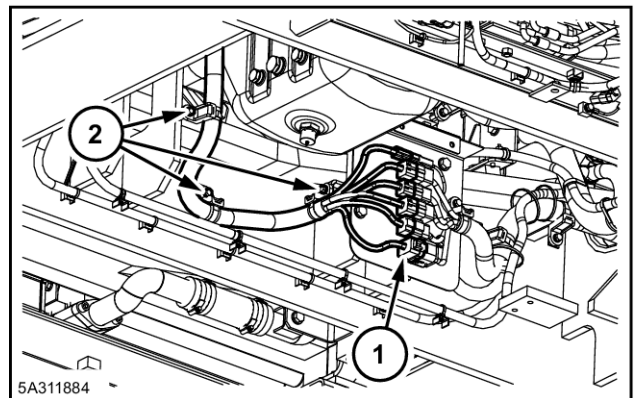


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12. Disconnect the 6 connections (1) of the engine harness and frame main wire harness in the box.

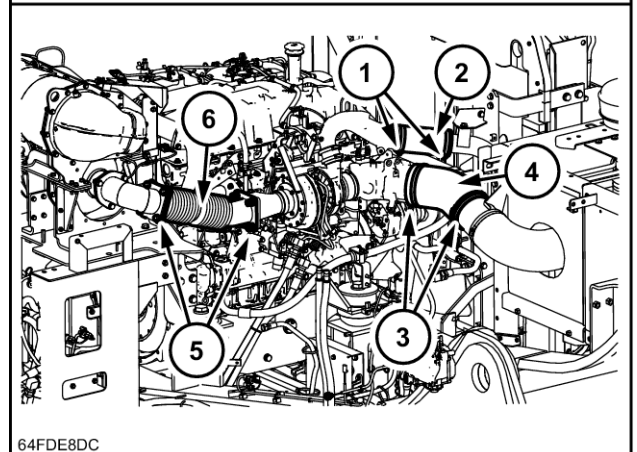
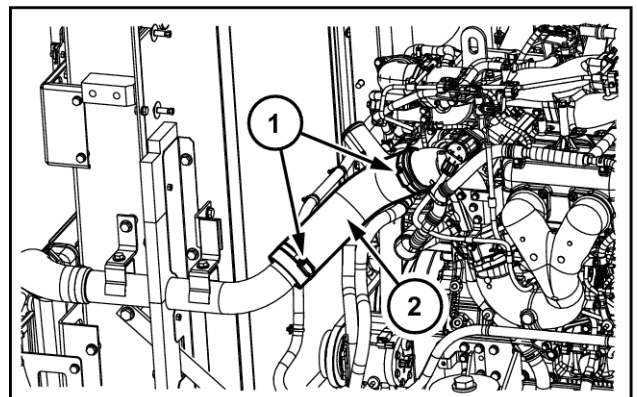
Remove the 3 bolts (1) with a wrench [ 13 mm] to disconnect the engine harness from the frame.

- Wrap the disconnected connectors with a vinyl after bundle them so as to prevent invasion of water, dust and dirt.



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13. Loosen the 2 hose band (1) with a wrench [ 7 mm] to disconnect the 2 intercooler hoses (2).  
Loosen the hose bands (3) with a wrench [ 7 mm] to disconnect the air cleaner hose (4).  
Remove the 8 nuts (5) with a wrench [ 19 mm] to remove the exhaust pipe (6).

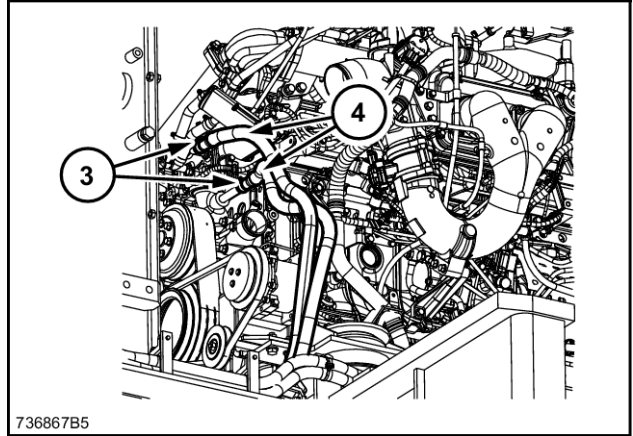
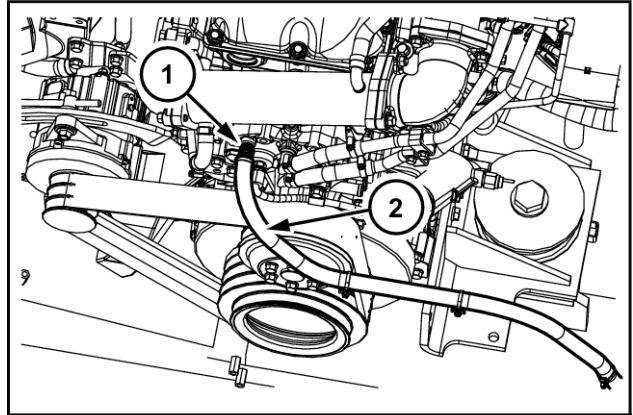


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14. Remove the hose band (1) to disconnect the urea coolant hose (2).

Remove the hose band (3) to remove the 2 heater hoses (4).

- Attach caps and plugs to the engine and the hoses to prevent the entry of water, dust, and dirt.

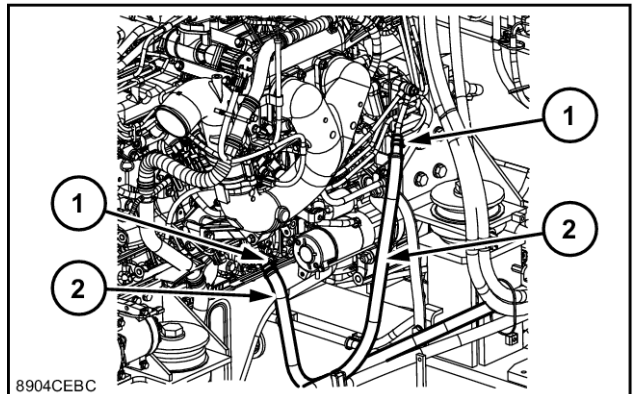


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15. Remove the hose band (1) to remove the 2 fuel hoses (2).

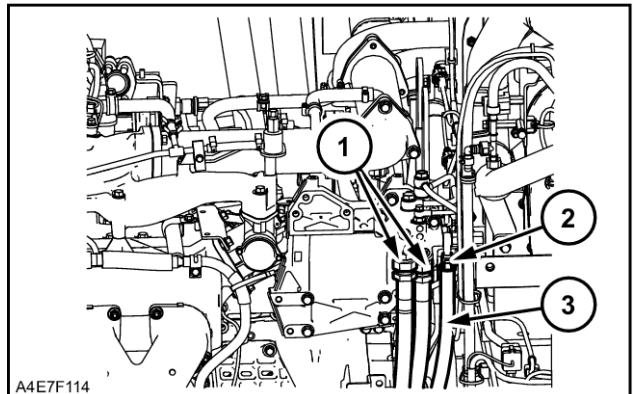
- Attach caps and plugs to the engine and the hoses to prevent the entry of water, dust, and dirt.



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16. Disconnect the 2 fuel hoses (1) with a wrench [36 mm].

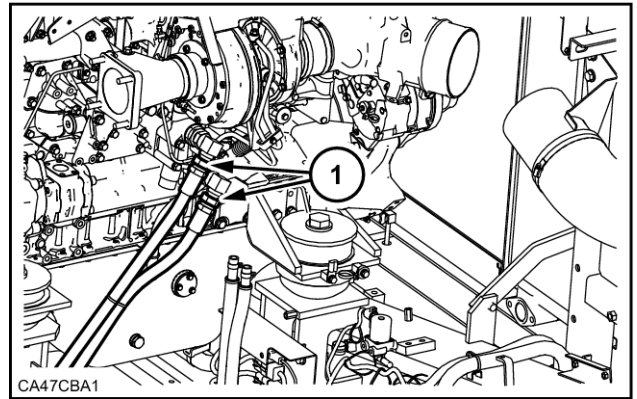


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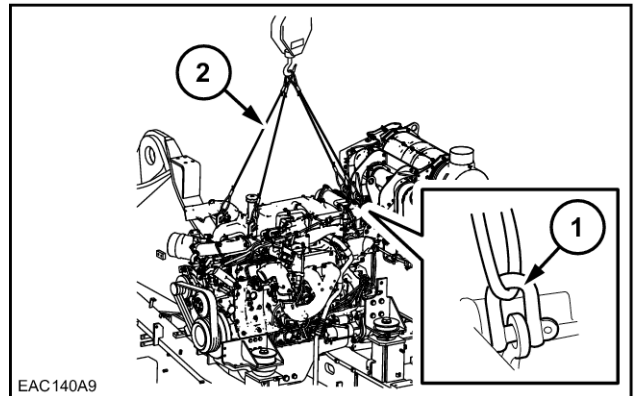
17. Prepare a waste oil can and then remove the 2 engine oil remote hoses (1) with a wrench [ 36 mm].

- Apply marking to each location of the engine and hoses so as to match connections at assembling.
- Attach caps and plugs to each location of the engine and hoses to prevent the entry of water, dust, and dirt.
- Wash each location of the engine and hoses by blowing parts cleaner so as to prevent adhering dirt at connections and not to damage them.



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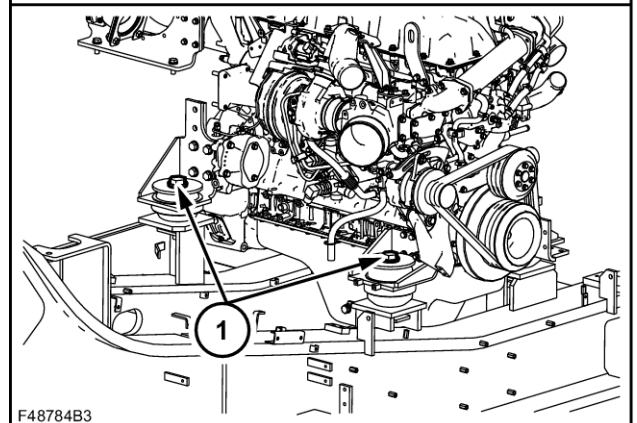
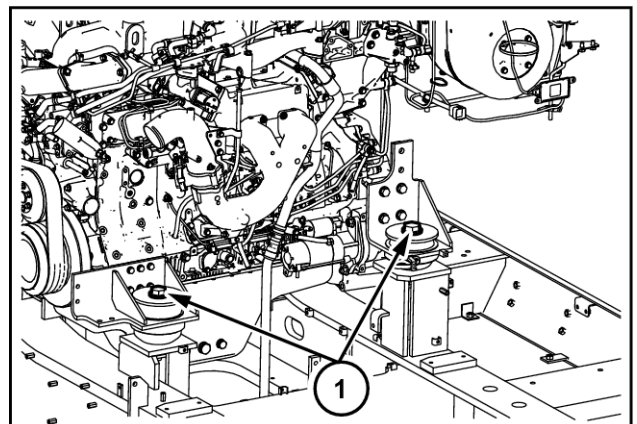
18. Attach the 4 shackles (1), and secure the engine main unit with wire ropes (2) and a lifting equipment.



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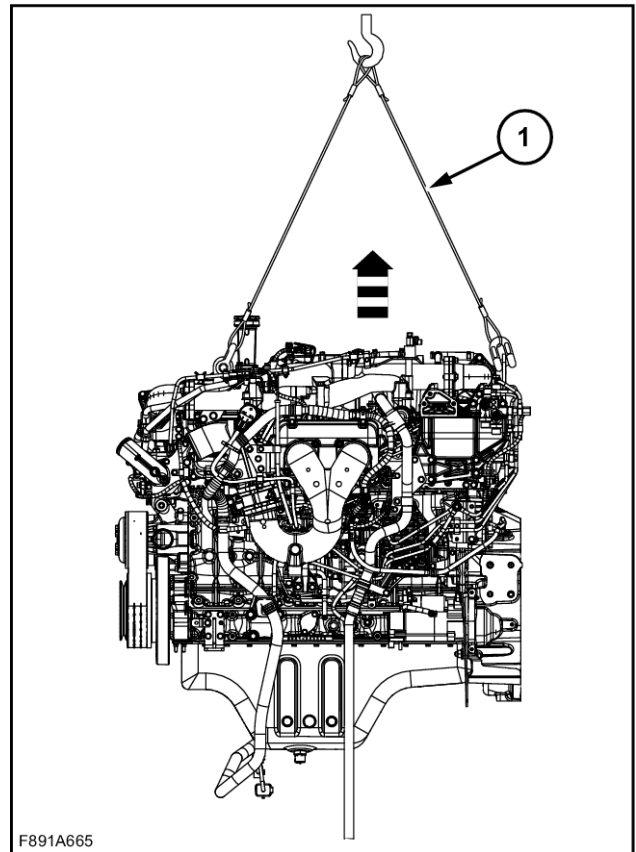
19. Remove the 4 bolts (1) of the mount with a box wrench [ 46 mm].

Bolt tightening torque: **843.4 - 980.7 N·m (622.06 - 723.33 lb ft)**



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20. Lift the engine main unit with wire ropes **(1)** and a lifting equipment.  
Make sure that the area is safe, and then place the engine on wood planks.



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## Engine - Install

1. Install the engine in the reversed order of the procedure for removal.

Each bolt has to be tightened in the specified torque.

Refer to the **Torque – Bolt and nut ()** for tightening torque for bolts without instruction.

After installation, fill coolant, fill engine oil, bleed air from the fuel line, wash and fill air conditioner gas.

Follow respective procedures and descriptions for detail.

2. Make sure that there is no water leak or oil leak by running the engine in idle speed with no load.

## Engine - Check - Engine oil

### ⚠ WARNING

#### Burn hazard!

Do not handle any service fluid (engine coolant, engine oil, hydraulic oil, etc.) at temperatures that exceed 49 °C (120 °F). Allow fluids to cool before proceeding.  
Failure to comply could result in death or serious injury.

W0330B

**NOTICE:** The engine should be in a horizontal position.

**NOTICE:** Wait at least 5 min before starting the engine and after stopping the engine.

### Engine oil inspection

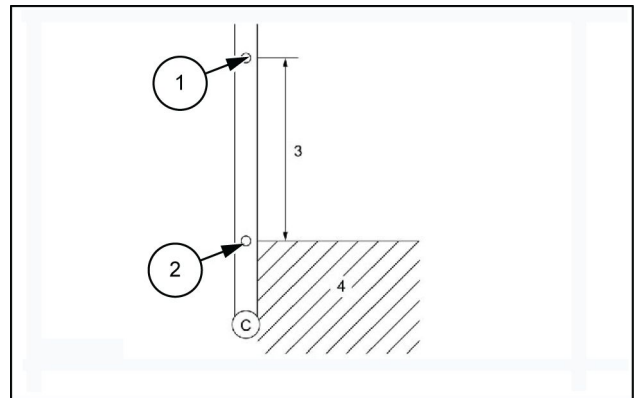
1. Remove the oil level gauge from the oil level gauge guide tube.

**NOTE:** Wipe off the engine oil remaining on the oil level gauge.

2. Install the oil level gauge to the oil level gauge guide tube.
3. Remove the oil level gauge from the oil level gauge guide tube.
4. Inspect the engine oil.

**NOTE:** Check the engine oil remaining on the oil level gauge to inspect the engine oil level.

1. MAX
2. MIN
3. Acceptable oil amount
4. Requires replenishment

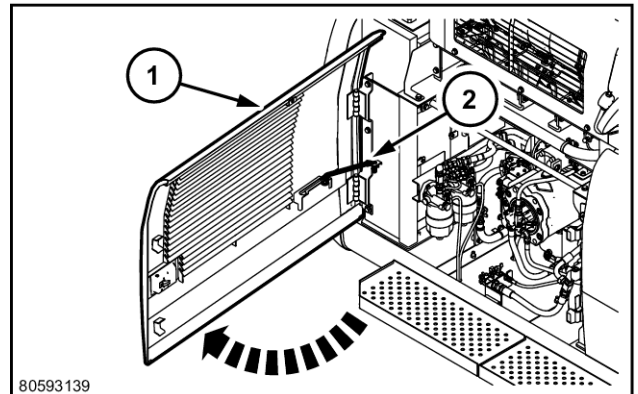


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## Engine - Test - Engine oil

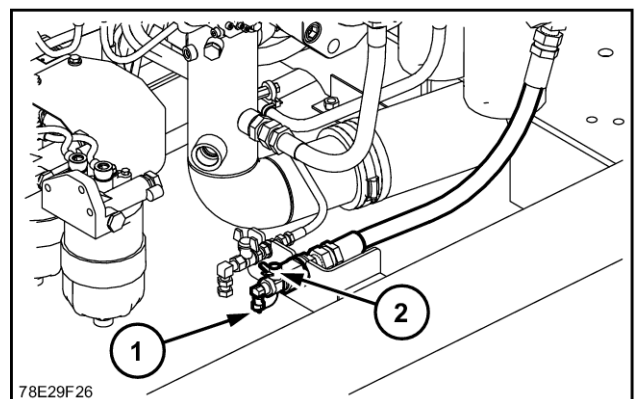
### Sampling of engine oil

1. Open the side door (1).  
At this time, make sure to apply the lock (2).



80593139 1

2. Place a sampling container under the sampling port (1).
3. Open the valve (2) to drain a proper amount of oil.
4. Close the valve (2) to check that there is no leakage.
5. If necessary, add the same amount of oil as the drained oil.

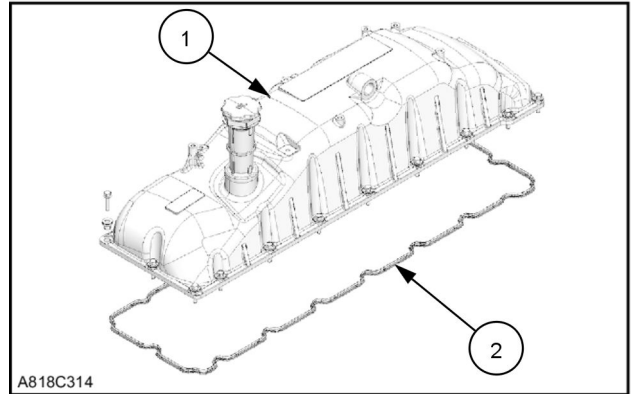


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## Engine - Compression test

**NOTE:** Warm up the engine.

1. Confirm that there is no abnormality with the battery and the starter.
2. Remove the head cover.

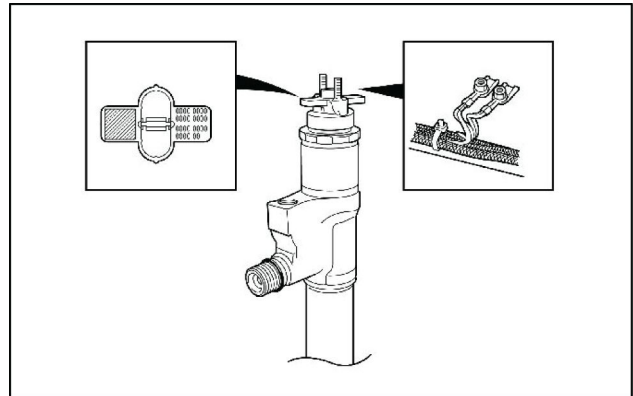


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3. Loosen the injector side sleeve nut of the injection pipe.
4. Remove the injector harness.
  - Loosen the terminal tightening nut to remove the harness.
  - Remove the harness bracket assembly.

**NOTICE:** Removal of the injector harness causes the ID code plate to come off, so avoid mix-up with other injector ID code plates.

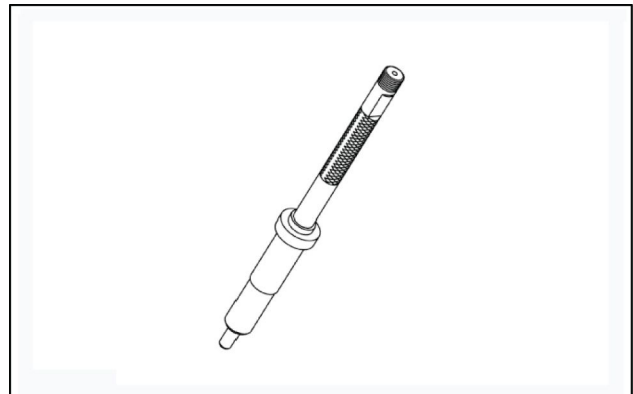
1. Compression gauge
2. Compression gauge adaptor



SMIL13CEX6817AA 2

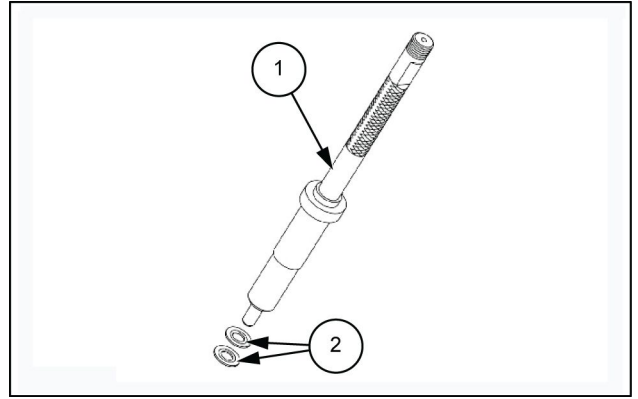
5. Remove the injector leak-off pipe.
6. Remove the injector from the cylinder head assembly.
  - Remove all injectors.
7. Install the special tool to the cylinder head assembly.
  - Put 2 gaskets in the compression gauge adaptor and insert it into the injector installation hole.

Special tool: Compression gauge adaptor (see **Cylinder head - Special tools (10.101)** )



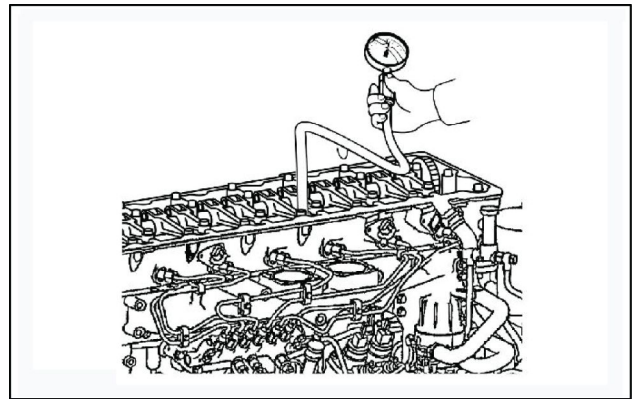
SMIL13CEX7147AA 3

1. Compression gauge adaptor
2. Gasket



SMIL13CEX7148AB 4

8. Tighten the compression gauge adapter using the injector clamp.
  - Set the clamp position to the center of the adapter.
9. Install the compression gauge to the compression gauge adaptor.
  - Remove all the injector gaskets other than the measuring cylinder.



SMIL13CEX7149AA 5

10. Measure the compression pressure.
  - Rotate the starter and read the indication of the compression pressure when the compression gauge needle stabilizes with an engine speed of approximate **200 RPM**.
  - Measure the compression pressure of all cylinders.

Standard value	<b>2750 kPa (398.9 psi)</b>
Limit value	<b>2260 kPa (327.8 psi)</b>
Difference between each cylinder	<b>196 kPa (28.4 psi)</b>

**NOTICE:** Be aware that air bursts out through the injector hole during rotation.

**NOTE:** When the starter switch is turned to ON with the injector harness connector removed, the ECM determines a malfunction and records a DTC, so make sure the DTC has been cleared after the inspection is completed.

## Crankcase - Remove

### Battery ground cable disconnect

1. Disengage the battery ground cable from the battery.

**NOTICE:** While the indicator (LED) of the battery disconnect switch is lit, do not turn OFF the battery disconnect switch nor disconnect its negative cable from the battery. After turning the key OFF, the LED is lit for a maximum duration of **3 min.**

### Coolant drain

#### ⚠ WARNING

##### Burn hazard!

Hot coolant can spray and scald if you remove the radiator or deaeration tank cap while the system is hot. To remove the cap: allow the system to cool, turn the cap to the first notch, and wait for all pressure to release. Remove the cap only after all pressure has released. Failure to comply could result in death or serious injury.

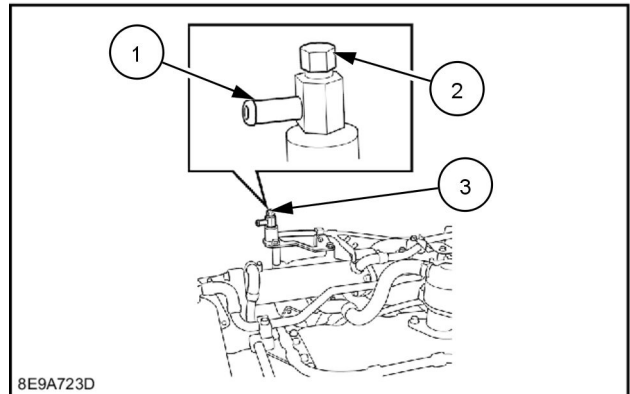
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1. Remove the radiator cap from the radiator.
2. Drain coolant from the radiator.

**NOTE:** Loosen the radiator drain plug, and drain the coolant.

**NOTICE:** Do not forget to tighten the drain plug.

3. Remove the cap from the pipe (1).
4. Loosen the plug (2) using a wrench.
  3. Air bleeding cock

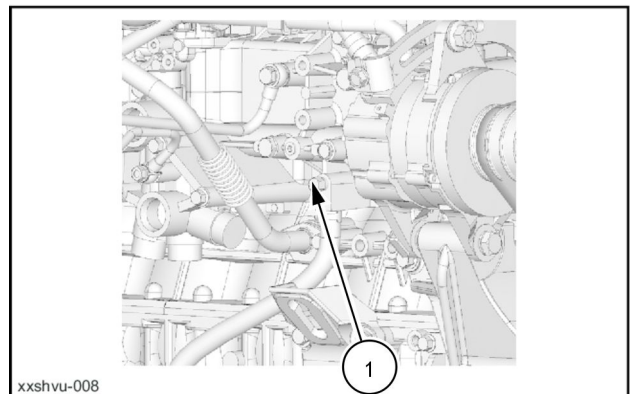


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5. Discharge coolant from the cylinder block.

**NOTE:** Loosen the drain plug on the cylinder block, and drain the coolant.

**NOTICE:** Do not forget to tighten the drain plug (1).



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## Engine oil drain

1. Remove the drain plug from the oil pan.

**NOTE:** Drain engine oil into the drain pan.

2. Install the drain plug to the oil pan.

Tightening torque: **70 N·m (52 lb ft)**

Tightening torque: **50 - 60 N·m (37 - 44 lb ft)**

**NOTICE:** Be careful not to forget to tighten the drain plug.

## Oil level gauge guide tube removal

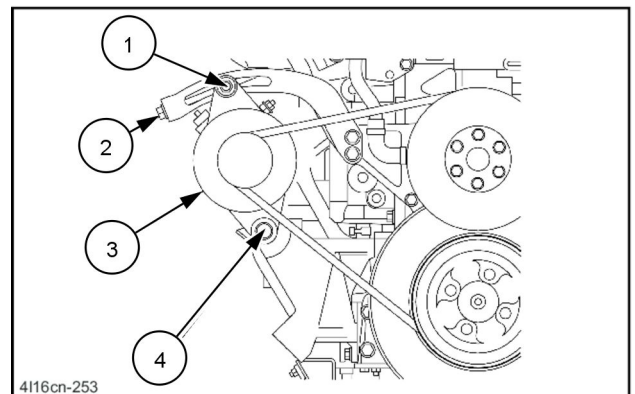
1. Remove the oil level gauge guide tube from the cylinder block.

**NOTICE:** Be careful not to damage the O-ring.

## Generator (3) drive belt removal

1. Remove the generator (3) drive belt from the pulley.

**NOTE:** Loosen the lock nut (1) and penetration bolt (4), and then loosen the adjust bolt (2) to remove the generator (3) drive belt.



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## Generator removal

1. Remove the generator from the bracket.

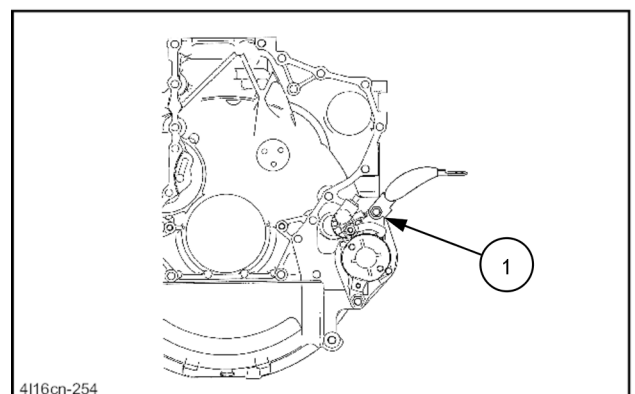
## Generator bracket removal

1. Remove the generator bracket from the cylinder block.
2. Remove the adjust plate from the cylinder block.

## Starter assembly removal

1. Remove the starter assembly from the flywheel housing.

**NOTE:** Remove the collectively tightened starter ground cables (1) together.



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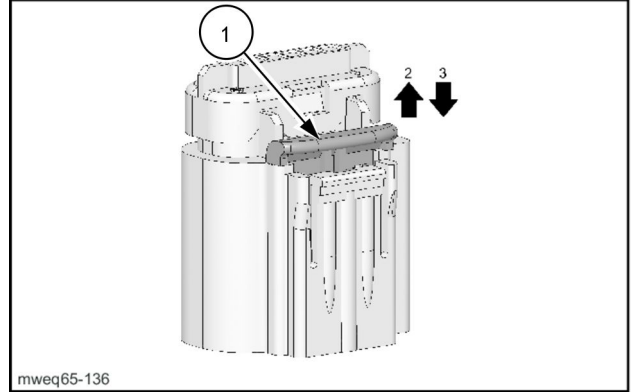
## Engine harness removal

1. Disconnect the engine harness from the connector.

**NOTE:** Before removing, place a mark with paint at the installation position of the harness clip.

Disconnect the connectors from every sensor and device.

Sensor, device	Parts
EGR motor	EGR valve
CKP sensor	Upper left side of the flywheel housing
FRP sensor	Common rail (Fuel rail)
CMP sensor	Fuel supply pump
Fuel temperature sensor	Fuel supply pump
PCV	Fuel supply pump
Boost pressure sensor/ boost temperature sensor	Inlet pipe
Solenoid valve	Injector
Engine coolant temperature sensor	Thermostat housing
Oil pressure sensor	Left side of the cylinder block
Intake throttle position sensor	Between the inlet duct and the intake duct
VGS actuator	Turbocharger
IMT sensor	Inlet cover
MAF and IAT sensor	Air duct



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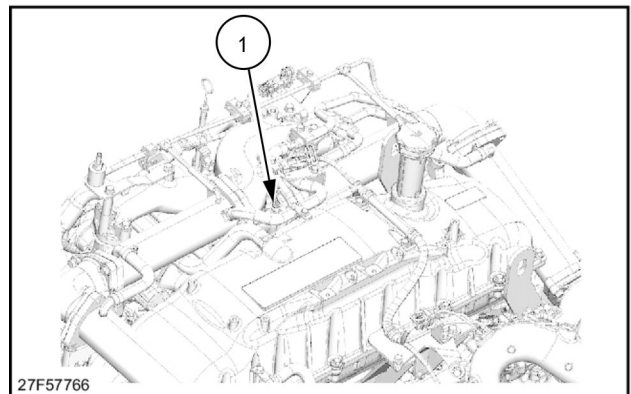
MWEQ65-136 5

**NOTE:** When disconnecting the harness connector from the intake throttle valve, pull the lock control section (1) to release the lock (3).

2. Lock release

## EGR gas temperature sensor 2 (1) removal

1. Disconnect the harness connector from EGR gas temperature sensor 2 (1).
2. Remove EGR gas temperature sensor 2 (1) from the EGR cooler duct.



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