WSM

WORKSHOP MANUAL

DIESEL ENGINE

V1505-CR-TE5

Kubota

KiSC issued 02, 2021 A

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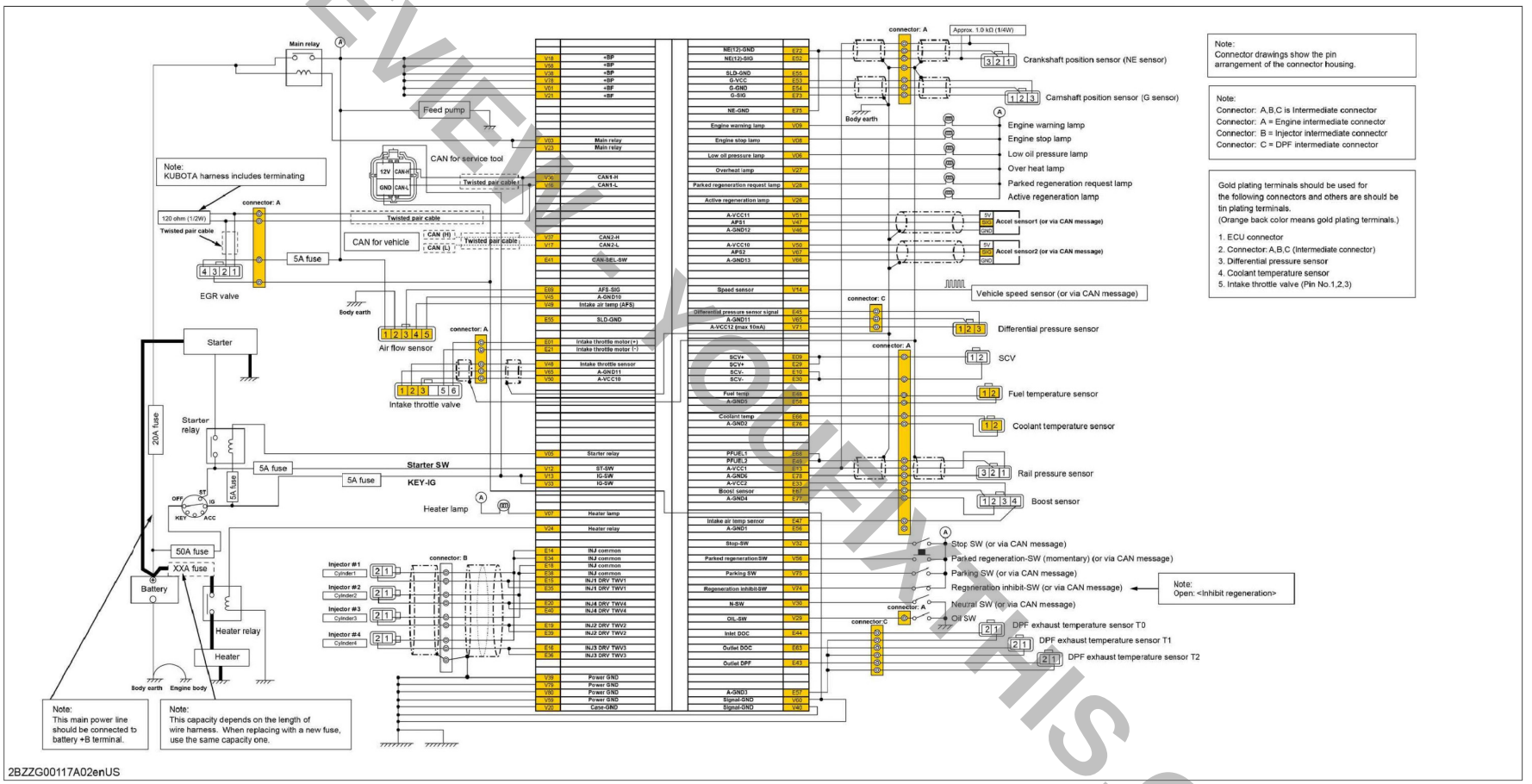
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4.4 System wiring diagram



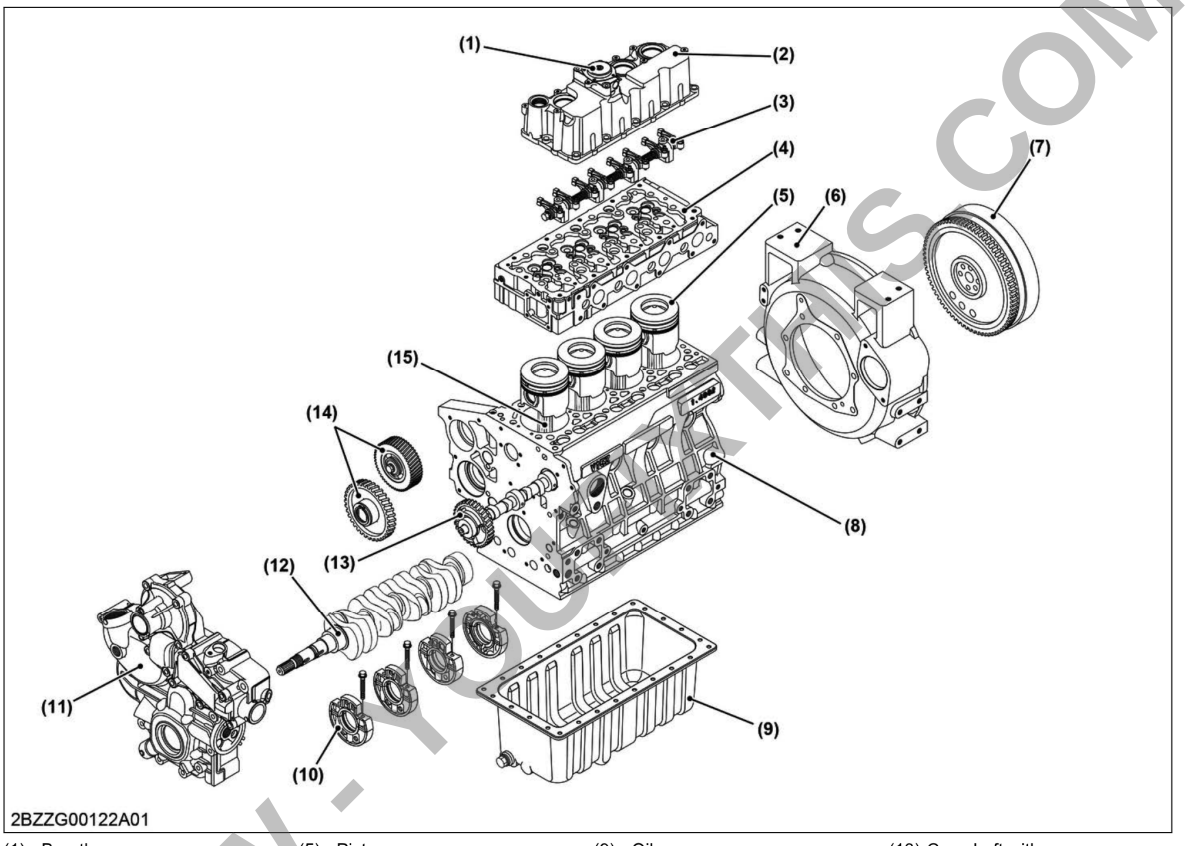
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2. Engine body

2.1 Structure of engine body

The engine body is the main part of the engine.
It is made up of cylinder related, primary motion, and valve train mechanisms.



(1) Breather
(2) Cylinder head cover
(3) Rocker arm
(4) Cylinder head
(5) Piston
(6) Flywheel housing
(7) Flywheel
(8) Crankcase
(9) Oil pan
(10) Main bearing case
(11) Gear case
(12) Crankshaft
(13) Camshaft with cam gear
(14) Idle gears
(15) Connecting rod

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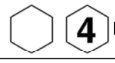
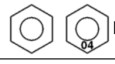
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3. Tightening torques

Refer to the following table if the tightening torques of screws, bolts and nuts are not specified in each part.

3.1 Tightening torques of screws, bolts and nuts for general use

If the tightening torque is not specified, refer to the table below for the none specified torques values.

Indication on top of bolt	 No-grade or 4T			 7T		
Indication on top of nut	 No-grade or 4T					
Unit	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft
M6	7.8 to 9.3	0.80 to 0.94	5.8 to 6.8	9.80 to 11.3	1.00 to 1.15	7.23 to 8.33
M8	17.7 to 20.6	1.81 to 2.10	13.1 to 15.1	23.5 to 27.5	2.40 to 2.80	17.4 to 20.2
M10	39.2 to 45.1	4.00 to 4.59	29.0 to 33.2	49.0 to 55.9	5.00 to 5.70	36.2 to 41.2
M12	62.8 to 72.6	6.41 to 7.40	46.4 to 53.5	77.5 to 90.2	7.91 to 9.19	57.2 to 66.5

3.2 Tightening torques of screws, bolts and nuts for special use

■ NOTE

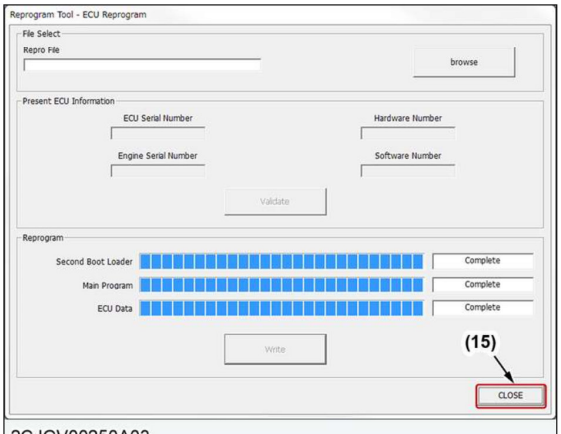
- **For the screws, bolts and nuts with the mark "*", apply engine oil to their threads and seats before you tighten.**
- **The alphabet "M" in Dimension × Pitch shows that the screw, bolt or nut dimensions are in the metric system. The dimension is the nominal external diameter in mm of the threads. The pitch is the nominal distance in mm between 2 threads.**

Disassembling and assembling

Item	Dimension × Pitch	N·m	kgf·m	lbf·ft
Drain plug (oil)	M12 × 1.25	32.4 to 37.3	3.31 to 3.80	23.9 to 27.5
Drain plug (coolant)	Rp 1/4	32.0 to 43.0	3.27 to 4.38	23.6 to 31.7
Alternator pulley nut	—	58.4 to 78.9	5.95 to 8.05	43.1 to 58.2
*Main bearing case screw 1	M8 × 1.25	29.4 to 34.3	3.00 to 3.49	21.7 to 25.2
*Main bearing case screw 2	M9 × 1.25	49.0 to 53.9	5.00 to 5.49	37.0 to 39.7
Flywheel housing mounting screw	M10 × 1.25	49.0 to 55.9	5.00 to 5.70	36.2 to 41.2
*Flywheel screw	M10 × 1.25	53.9 to 58.8	5.50 to 5.99	39.8 to 43.3
*Connecting rod screw	M8 × 1.0	41.1 to 46.0	4.20 to 4.69	30.4 to 33.9
Camshaft mounting screw	M6 × 1.0	9.80 to 11.3	1.00 to 1.15	7.23 to 8.33
Idle gear 2 mounting screw	M6 × 1.0	12.0 to 14.0	1.23 to 1.42	8.85 to 10.3
Supply pump mounting screw	M8 × 1.25	23.5 to 27.5	2.40 to 2.80	17.4 to 20.2
Fuel temperature sensor	M12 × 1.5	17.6 to 26.5	1.80 to 2.70	13.0 to 19.5

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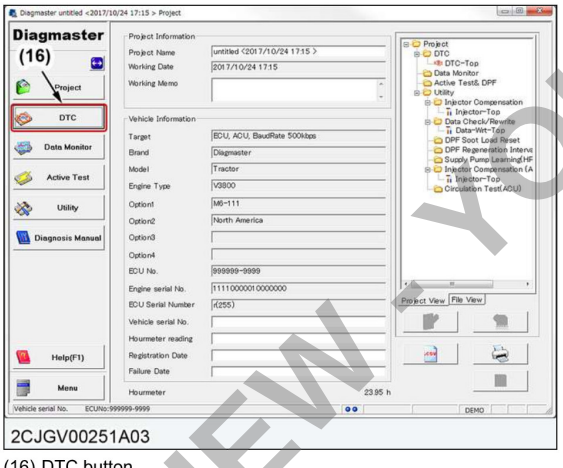


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(15) CLOSE button

Clear DTC

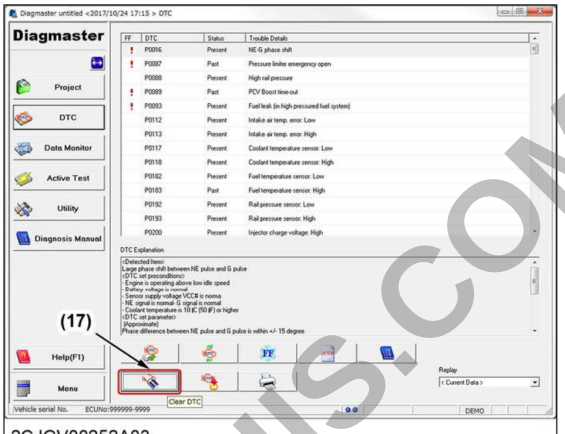
1. Connect the reprogrammed service engine ECU to the engine, then key switch ON.
2. Start "Diagmaster", then click the **[DTC]** button (16) from the project window.



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(16) DTC button

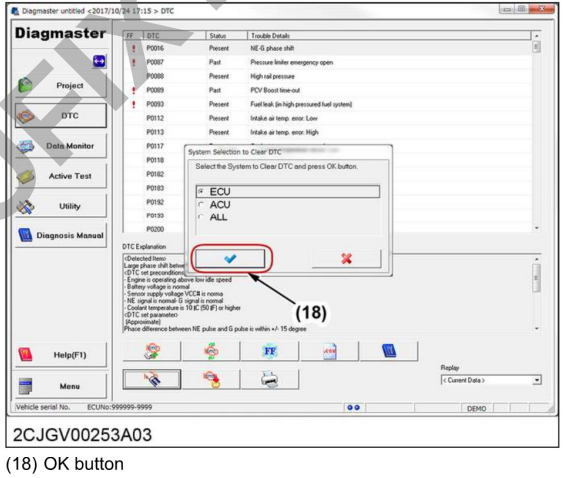
3. Click the **[Clear DTC]** button (17).



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(17) Clear DTC button

4. Select the "ECU" system, then click the **[OK]** button (18).



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(18) OK button

5. Click the **[Clear DTC]** button (19) to clear DTC and exit function.

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GENERAL WORKING PRECAUTIONS

- When servicing, observe the safety regulations in the operator's manual and workshop manual.
- Clean the machine before maintenance.
- Before working, remove the negative (-) terminal from the battery or turn off the battery isolator switch.
- Disassemble the machine at a clean location.
- Whenever a special tool is required, use the special tool that Kubota recommends. Or, craft the special tools according to the illustrations in this manual.
- Use genuine Kubota parts to ensure safety and machine performance.


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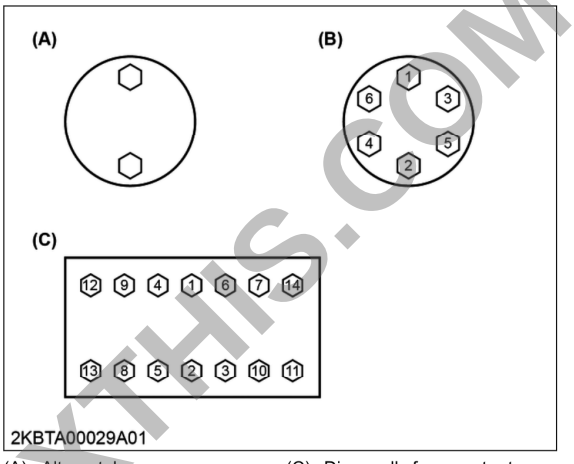
1. Tightening bolts and nuts

- Tighten the bolts and nuts with their specified torque.

■ NOTE

– Tighten the bolts and nuts alternately from top to bottom and left to right so the torque is distributed evenly.

– Gradually tighten the bolts and nuts two or three times.

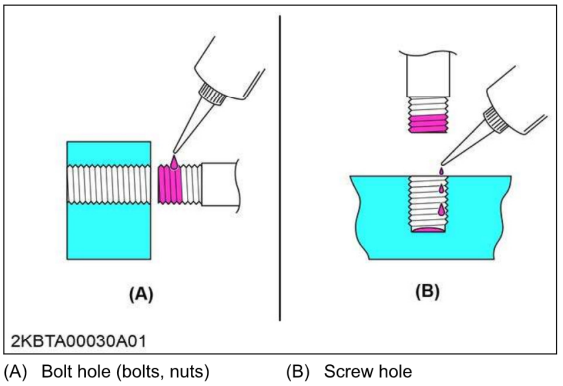


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(A) Alternately
(B) Diagonally
(C) Diagonally from center to outside

2. Applying thread-locking fluid

1. Clean and dry the location where a thread-locking fluid will be applied with a solvent to remove moisture, oil, and dirt.
2. Apply the thread-locking fluid to the tip of the bolt.
3. If the threads are large, apply the thread-locking fluid all around the bolt hole.



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(A) Bolt hole (bolts, nuts)
(B) Screw hole

3. Installing circlips

- When installing the circlip, assemble the circlip's angular side (3) toward the side that receives force (4) as shown in the figure.

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SERVICING

1. Troubleshooting

1.1 Troubleshooting for V1505-CR-TE5

This "Troubleshooting" shows only mechanical failures. The failures related to the common rail system (CRS), refer to the diagnosis manual (DM) for common rail system engine.

Symptom	Probable cause and checking procedure	Solution	Reference page
The engine does not start	1. No fuel	Fill up the fuel	—
	2. Air in the fuel system	Bleed the air	—
	3. Water in the fuel system	Change the fuel and repair or replace the fuel system	3-12 3-13 3-29
	4. The fuel pump is damaged	Replace	—
	5. The fuel hose is clogged	Clean or replace	3-8
	6. The fuel filter is clogged	Replace	3-12
	7. The viscosity of fuel at low temperature is too high	Replace the specified fuel	3-1
	8. The cetane number of fuel is low	Replace the specified fuel	3-1
	9. Fuel leakage because of loose injection pipe retaining nut	Tighten the retaining nut	4-149
	10. The injector is clogged	Replace	4-195
	11. The supply pump is damaged	Replace	4-192
	12. Seizure of the crankshaft, camshaft, piston or bearing	Repair or replace	—
	13. Compression leakage from the cylinder	Replace the head gasket Tighten the cylinder head screw	4-122 4-146
	14. Incorrect valve timing	Check the timing gear	4-140
	15. Piston ring and cylinder are worn out	Replace	4-137 4-179
	16. Incorrect valve clearance	Adjust valve clearance	4-94
The starter does not operate	1. Discharged battery	Charge or replace	4-98
	2. Starter is damaged	Repair or replace	4-100
	3. The key switch is damaged	Replace	—
	4. The connection of the wires is incorrect	Check or correct	—

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INFORMATION

1. Specifications

1.1 Specification for V1505-CR-TE5

Model	V1505-CR-TE5
Number of cylinder	4
Engine type	Vertical, water-cooled, 4-cycle DI diesel engine
Bore × stroke	78.0 × 78.4 mm (3.07 × 3.09 in.)
Total displacement	1498 cm^3 (91.41 cu.in.)
SAE gross continuous	28.7 kW / 3000 min^{-1}(rpm) (38.5 HP / 3000 min^{-1}(rpm))
SAE gross intermittent	33.0 kW / 3000 min^{-1}(rpm) (44.9 HP / 3000 min^{-1}(rpm))
SAE net intermittent	31.3 kW / 3000 min^{-1}(rpm) (42.0 HP / 3000 min^{-1}(rpm))
Maximum bare speed	3220 min^{-1}(rpm)
Minimum bare idling speed	1000 to 1100 min^{-1}
Combustion chamber	Reentrant type, Center direct injection system (E-CDIS)
Fuel injection pump	DENSO common rail system
Governor	
Injector	
Fuel injection timing	
Fuel injection pressure	
Direction of rotation	Counter-clockwise (Viewed from flywheel side)
Firing order	1-3-4-2
Compression ratio	17.6
Lubricating system	Forced lubrication by trochoid pump
Oil pressure indicating	Electrical type switch
Lubricating filter	Full flow paper filter (Cartridge type)
Cooling system	Pressurized radiator, forced circulation with water pump
Starting system	Electric starting with starter
Starter motor	12 V, 1.2 kW
Starting support device	Intake air heater in intake manifold
EGR	External EGR (EGR cooler + Electric EGR valve + Reed valve)
Battery	12 V, 55 AH equivalent
Charging alternator	12 V, 720 W
Fuel	Diesel Fuel No. 2-DULS
Lubricating oil	Class CJ-4 or CK-4 lubricating oil as per API classification is recommended. For details on recommended lubricating oils.
Lubricating oil capacity	6.7 L (1.8 U.S.gals, 1.5 Imp.gals)
Weight (Dry)	173 kg (381 lbs)

■ NOTE

- **The specification described above is of the standard engine of each model.**
- **Conversion formula: HP = 0.746 kW, PS = 0.7355 kW**

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MAINTENANCE CHECK LIST

To make sure that the engine operates safely for a long time, refer to the table below to do regular inspections.

	Inspection item	Service interval													Reference page
		Daily	Initial 50 hrs	Every 50 hrs	Every 100 hrs	Every 250 hrs	Every 400 hrs	Every 500 hrs	Every 800 hrs	Every 1500 hrs	Every 3000 hrs	Every 3000 to 6000 hrs	Every 1 year	Every 2 years	
	Checking engine oil level	○													3-5
	Checking fuel level	○													3-5
	Checking coolant level	○													3-6
	Checking fan belt	○													3-7
	Changing engine oil		○			○									3-7
	Replacing oil filter cartridge		○				○								3-8
	Checking fuel hoses and clamp bands			○											3-8
	Checking and draining water separator (Type 1)			○											3-9
	Checking radiator hose and clamp bands				○										3-9
*2	Cleaning air cleaner primary element				○										3-10
	Adjusting fan belt tension				○										3-10
	Checking intake air line				○								○		3-11
*1	Replacing fuel filter cartridge						○								3-12
	Cleaning water separator (Type 1)						○								3-12
	Replacing water separator filter (Type 2)							○							3-13
	Cleaning water jacket and radiator interior							○							3-13
	Replacing fan belt							○						○	3-14
	Removing sediment in fuel tank							○							—
	Checking valve clearance								○						3-15
*3	Checking injector (with Diagmaster)									○					3-16
*3	Checking EGR cooler									○					3-17
	Checking head cover valve									○					3-18
*3	Checking turbocharger										○				3-18
*3	Checking EGR system (with Diagmaster)										○				3-19
*3	Cleaning DPF											○			3-20
*3	Judging to reuse DPF filter comp before cleaning (only service dealer)											○			3-22
*3	Judging to reuse DPF filter comp after cleaning (only cleaning contractor)											○			3-22
*2	Replacing air cleaner element												○		3-23

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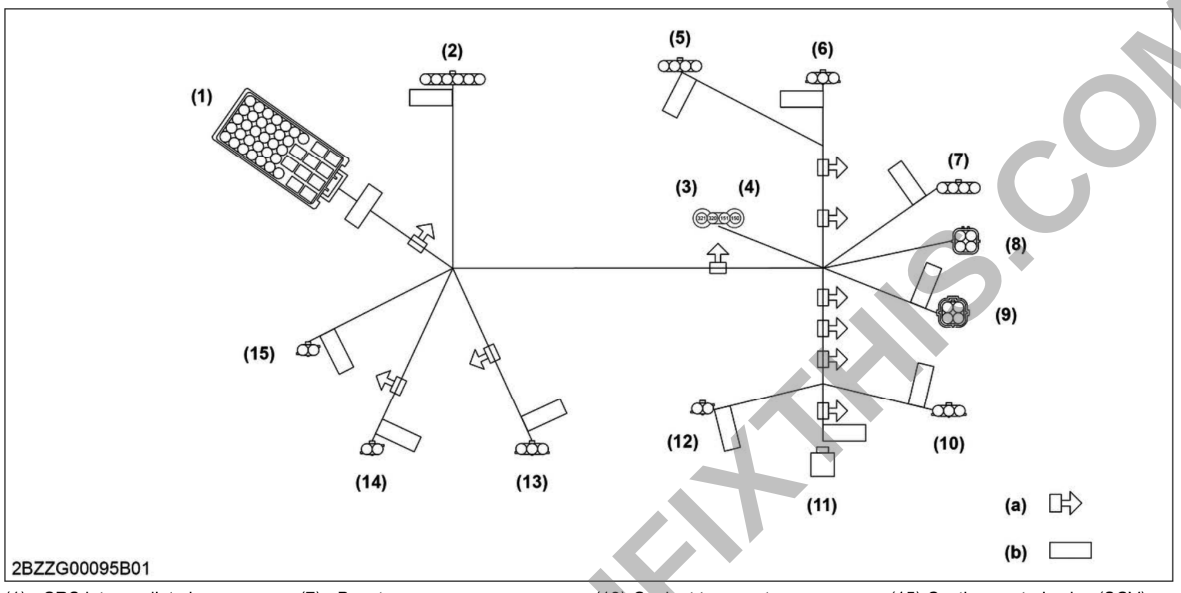
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4. Wiring diagram

4.1 Engine intermediate harness (Engine side harness)



(1) CRS intermediate harness
(2) Intake throttle valve connector
(3) Resistor 120 Ω
(4) Resistor approx. 1.0 kΩ
(5) EGR valve connector
(6) Rail pressure sensor connector
(7) Boost pressure sensor connector
(8) CAN connector
(9) CAN connector
(10) Camshaft position sensor connector
(11) Oil pressure switch connector
(12) Coolant temperature sensor connector
(13) Crankshaft position sensor connector
(14) Fuel temperature sensor connector
(15) Suction control valve (SCV) connector
(a) Clamp
(b) Name plate

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3. Replace new air cleaner primary element (3) and secondary element (2).

NOTE
- **The air cleaner uses a dry element. Never apply oil to it.**
- **Do not operate the engine with filter element removed.**

4. Install the removed parts.

12.2 Checking DPF differential pressure pipes and hoses

IMPORTANT
- **Be sure to loosen the differential pressure pipe tightening nut with crowfoot wrench to prevent the damage of the sensor or pipe. If it is still hard to loosen, apply the lubricant spray to threaded portion and soak it with lubricant.**
- **Tighten bolts and nuts to their specified torque. Also tighten the differential pressure pipe tightening nut to the specified torque with crowfoot wrench.**

Tools required
- Crowfoot wrench

1. Check the DPF differential pressure pipe (2), (3) for crack, gas leakage and loose mounting nut.

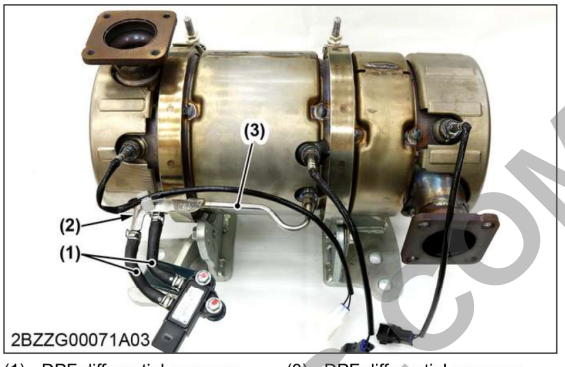
NOTE
- **If you find a crack, change the DPF differential pressure pipe.**
- **If you find a gas leakage, remove the DPF differential pressure pipe and wipe off the anti-seize & lubricating compound.**

2. Apply the anti-seize and lubricating compound again, then tighten the DPF differential pressure pipe to the specified torque.

NOTE
- **When you change the DPF differential pressure pipe, apply the anti-seize and lubricating compound (Bostik, NEVER-SEEZ, Pure nickel special grade) to the DPF differential pressure pipe.**

3. Check the DPF differential pressure hose (1) for crack, gas leakage.

NOTE
- **If you find a crack or gas leakage, change the DPF differential pressure hose.**

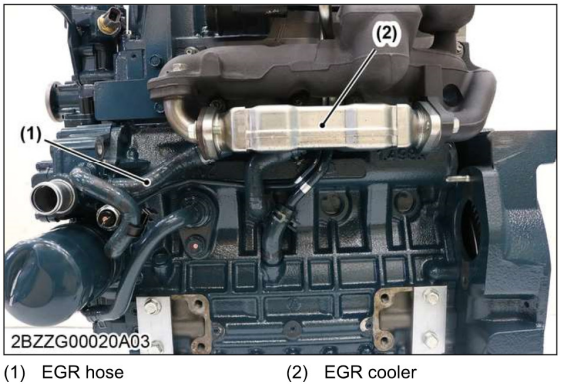


(1) DPF differential pressure hose
(2) DPF differential pressure pipe
(3) DPF differential pressure pipe

12.3 Checking EGR piping

1. Check the EGR cooler (2) and the EGR hose (1) for a crack, gas leakage and loose mounting screw.

NOTE
- **If you find a crack, replace the EGR cooler (2) or EGR hose (1) which has cracked.**
- **If you find a gas leakage, tighten the mounting screw again or replace the gasket with a new one.**
- **If you find a loose mounting screw, tighten the mounting screw again.**



(1) EGR hose
(2) EGR cooler

12.4 Checking intake air line

IMPORTANT
- **To prevent serious damage to the engine, keep out dust in the intake air line.**

1. Make sure that the intake air hose(s) (1) are connected correctly or not.
2. Visually check for cracks gas leak and anything else unusual.

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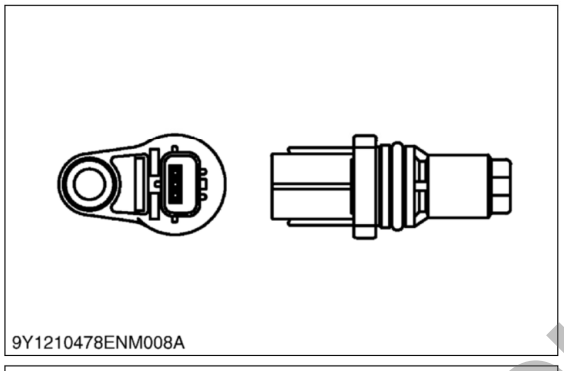
3.17 Crankshaft position sensor

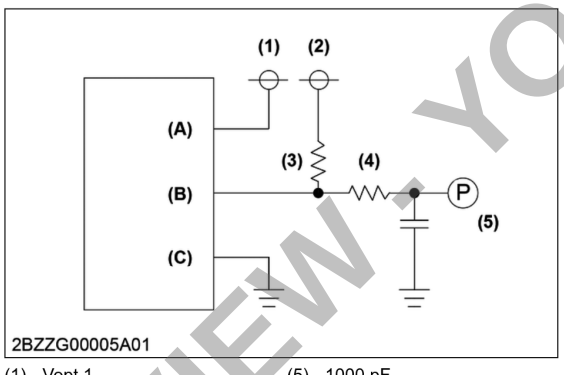
3.17.1 Outline of crankshaft position sensor

The crankshaft position sensor senses the teeth on a pulsar gear and detects the angular position of the crankshaft.

3.17.2 Structure of crankshaft position sensor

The crank position sensor is made up of a magnet and connector and the like.





(1) Vopt 1
(2) Vopt 2
(3) 1 kΩ
(4) 10 kΩ
(5) 1000 pF
(A) Vcc
(B) Output signal (Vout)
(C) Ground

3.17.3 Function of crankshaft position sensor

The crankshaft position sensor senses the teeth on a pulsar gear and detects the angular position of the crankshaft.
The pulsar gear (1) has some teeth missing.
The engine ECU calculates the piston position and engine speed based on the signal detected.
The crankshaft position sensor is a magnetic resistance element type sensor.

When the pulsar gear (1) passes by the crankshaft position sensor part, the internal magnetic field changes.
AC voltage is generated by the change in magnetic field and this is rectified and output to the engine ECU.

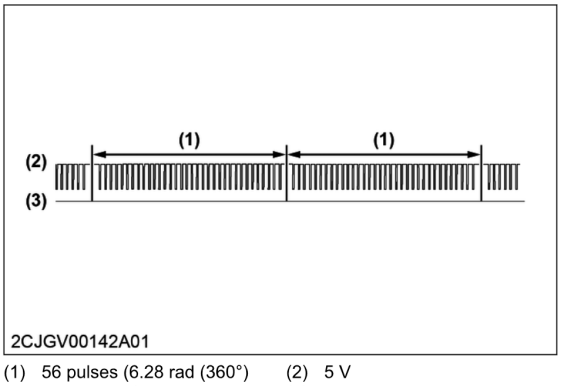


(1) Pulsar gear (crank)

3.17.4 Specification of crankshaft position sensor

Operating voltage	5 V
Pulsar gear number of teeth	56

Output waveform



(1) 56 pulses (6.28 rad (360°) crank angle)
(2) 5 V
(3) 0 V

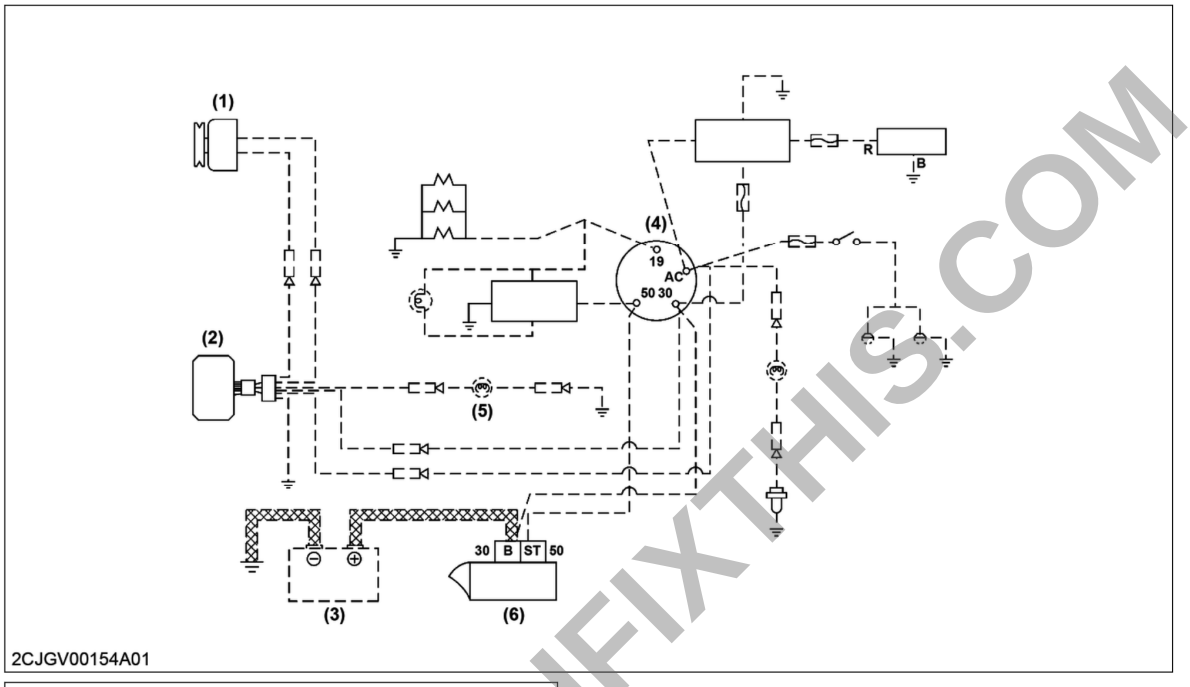
■ NOTE

- **Noted as Ne sensor on Diagmaster.**

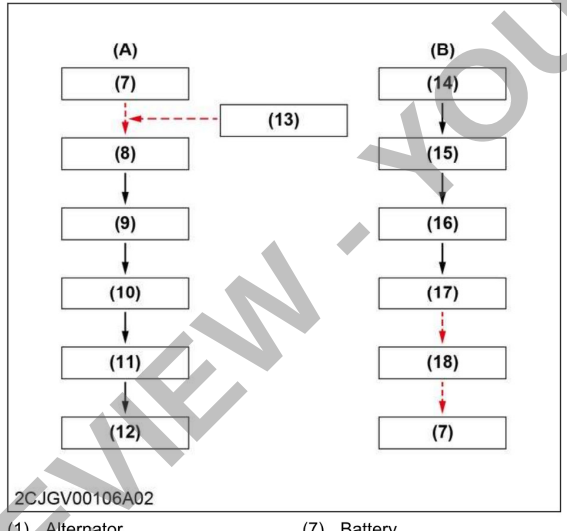
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8.3 Flow of electrical system



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2CJGV00106A02

(1) Alternator
(2) Regulator
(3) Battery
(4) Key switch
(5) Charge lamp
(6) Starter
(7) Battery
(8) Starter
(9) Pinion gear
(10) Ring gear (flywheel)
(11) Crankshaft
(12) Start engine
(13) Key switch on the start position
(14) Crankshaft
(15) Fan drive pulley
(16) Fan belt
(17) Alternator pulley
(18) Alternator
(A) Start flow
(B) Charge flow

Start flow

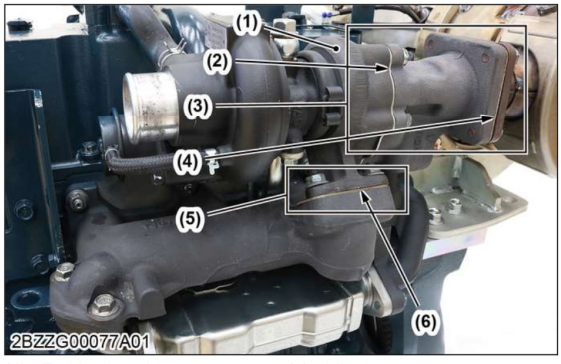
1. When the key switch is rotated to the start position, current flows from the battery to the starter.
2. Upon receiving current, the starter motor rotates and a pinion gear engages and starts to rotate.
3. The pinion gear that engages meshes with the ring gear (flywheel) and causes the flywheel to rotate.
4. The crankshaft that is connected to the flywheel rotates, initial combustion occurs in the engine and the engine starts.

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4.16 Checking exhaust gas leakage of turbocharger turbine side

1. Check the exhaust port (3) and the inlet port (5) side of the turbine housing (1) for exhaust gas leakage.



(1) Turbine housing
(2) Gasket
(3) Exhaust port
(4) Gasket
(5) Inlet port
(6) Gasket

■ NOTE
- **If you find a gas leakage, tighten the screws and nuts again or replace the gasket (2) / (4) / (6) with a new one.**

4.17 Checking air leakage of turbocharger compressor side

1. Check the inlet hose of the compressor cover (1) for air leakage.
2. Check the suction side of the inlet hose for loose connections or cracks.

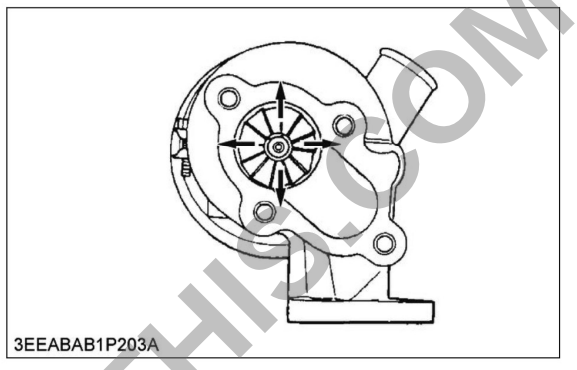


(1) Compressor cover

■ NOTE
- **If you find an air leakage, change the clamps and / or the inlet hose.**

4.18 Checking radial clearance of turbocharger

1. Check the radial clearance between the wheel and the housing.



■ NOTE
- **If the wheel touches the housing, replace the turbocharger assembly with a new one.**

4.19 Checking injector

Tools required
- Circuit tester

1. Disconnect the injector harness.

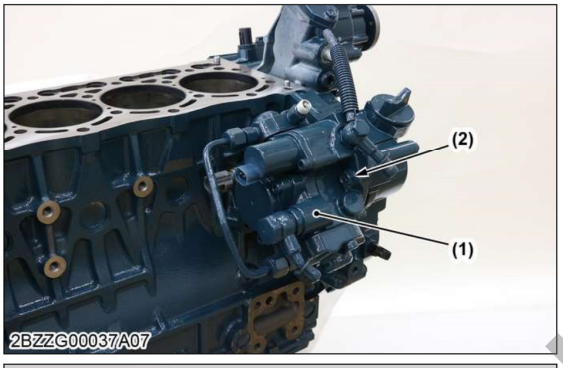
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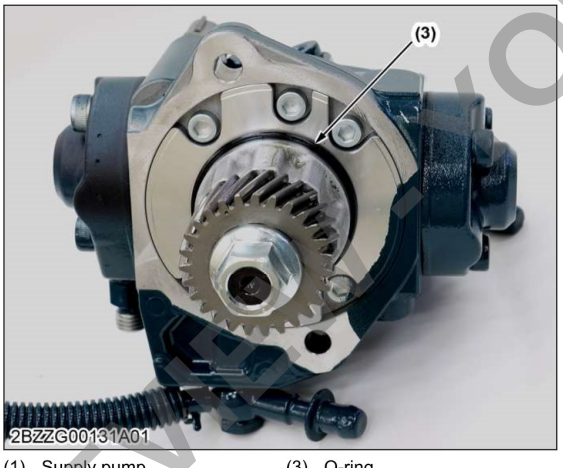
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6.13 Installing supply pump

1. Install the supply pump (1).

■ NOTE
- **Do not disassemble the supply pump (1).**
- **Replace the O-ring (3) of the supply pump (1) with a new one.**
- **Replace the supply pump gear cover gasket with a new one.**
- **When replacing the supply pump (1) with a new one, use the diagnosis tool to conduct learning of discrepancies in the new supply pump.**





(1) Supply pump
(2) Supply pump mounting screws
(3) O-ring

2. Tighten the supply pump mounting screws (2) to specified torque.

Tightening torque	Supply pump mounting screws (2)	23.5 to 27.5 N·m 2.40 to 2.80 kgf·m 17.4 to 20.2 lbf·ft

— RELATED PAGE —
7.58 Replacing supply pump on page 4-192

6.14 Installing idle gear

1. Install the idle gear (SUP.) (2) and tighten idle gear (SUP.) mounting screw to the specified torque.

■ NOTE
- **Apply the engine oil inside of idle gear (SUP.) (2).**

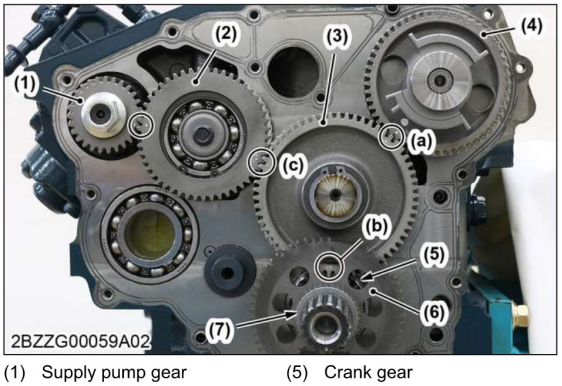
■ IMPORTANT
- **Align the alignment marks of supply pump gear (1) and idle gear (SUP.) (2).**

Tightening torque	Idle gear (SUP.) mounting screw	12.0 to 14.0 N·m 1.23 to 1.42 kgf·m 8.85 to 10.3 lbf·ft

2. Install the collar and the idle gear 1 (3).

■ NOTE
- **Make sure the oil hole of the idle gear bush should match the oil hole of the idle gear 1 (3).**

■ IMPORTANT
- **Make sure all the marks aligned to the respective gears.**
  - **a. Idle gear 1 (3) and cam gear (4)**
  - **b. Idle gear 1 (3) and crank gear (5)**
  - **c. Idle gear 1 (3) and idle gear (SUP.) (2)**
- **Be careful not to miss the claws of pulsar gear (6).**



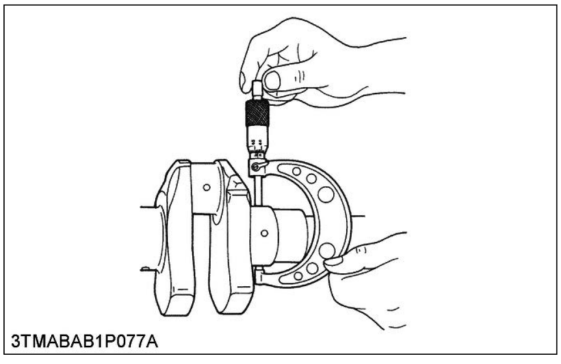
(1) Supply pump gear
(2) Idle gear (SUP.)
(3) Idle gear 1
(4) Cam gear
(5) Crank gear
(6) Pulsar gear
(7) Oil pump drive gear

3. Install the collar and the circlip.
4. Install the pulsar gear (6) by aligning the claw position of the pulsar gear (6) with the key position of the crankshaft.
5. Put the oil pump drive gear (7) on a hot plate at 150 ℃ (302 ℉) for more than 10 minutes.

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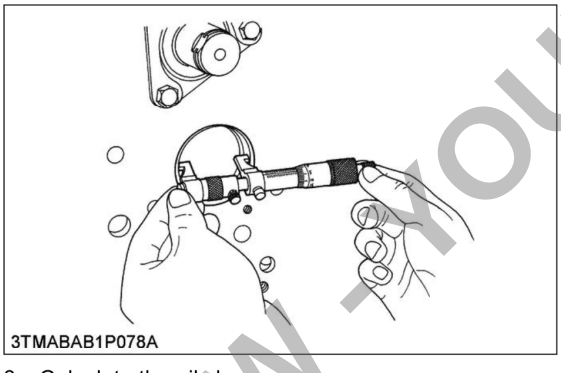
1. Measure the O.D. of the crankshaft journal with an outside micrometer.

Crankshaft journal O.D.	Service specification	47.934 to 47.950 mm 1.8872 to 1.8877 in.


3TMABAB1P077A

2. Measure the I.D. of the crankshaft bearing 1 with an inside micrometer.

Crankshaft bearing 1 I.D.	Service specification	47.984 to 48.048 mm 1.8892 to 1.8916 in.


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3. Calculate the oil clearance.

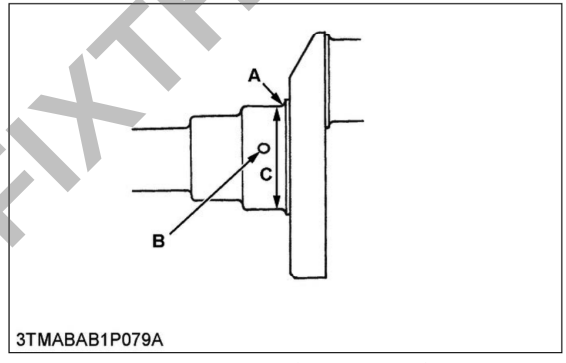
■ NOTE
- **If the oil clearance is more than the service limit, replace the crankshaft bearing 1.**
- **If the same dimension bearing is not applicable because of the crankshaft journal wear, replace it with an undersize one.**

Oil clearance between crankshaft journal and crankshaft bearing 1	Service specification	0.0340 to 0.114 mm 0.00134 to 0.00448 in.
	Service limit	0.20 mm 0.0079 in.

(Reference)
- Undersize dimensions of crankshaft journal

Undersize	0.2 mm 0.008 in.	0.4 mm 0.02 in.
Dimension A	2.3 to 2.7 mm radius 0.091 to 0.10 in. radius	2.3 to 2.7 mm radius 0.091 to 0.10 in. radius
Dimension B*	1.0 to 1.5 mm relief 0.040 to 0.059 in. relief	1.0 to 1.5 mm relief 0.040 to 0.059 in. relief
Dimension C	47.734 to 47.750 mm dia. 1.8793 to 1.8799 in. dia.	47.534 to 47.550 mm dia. 1.8715 to 1.8720 in. dia.
The crankshaft journal must be fine-finished to higher than Rmax = 0.8 S		

* Holes to be de-burred and edges rounded with 1.0 to 1.5 mm (0.040 to 0.059 in.) relief.



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A: Dimension A
B: Dimension B
C: Dimension C

7.35 Replacing crankshaft bearing 1

Tools required
- Crankshaft bearing 1 replacing tool

Removing crankshaft bearing 1
1. Press out the used crankshaft bearing 1 with the crankshaft bearing 1 replacing tool.

Installing crankshaft sleeve
1. Clean a new crankshaft bearing 1 and crankshaft journal bore and apply engine oil to them.
2. Make sure that the seam (1) of the new bearing 1 (2) points to the exhaust manifold side (see the figure).
3. Press fit the new crankshaft bearing 1 (2) with the crankshaft bearing replacing tool.

Dimension (A)	Service specification	0.00 to 0.30 mm 0.00 to 0.11 in.

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