WSM

WORKSHOP MANUAL

DIESEL ENGINE

D1803-CR-E4,D1803-CR-TE4, D1803-CR-TIE4,V2403-CR-E4, V2403-CR-TE4,V2403-CR-TE4BG, V2403-CR-TIE4

Kubota

KiSC issued 08, 2019 A

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SAFETY FIRST

This symbol, the industry's "Safety Alert Symbol", is used throughout this manual and on labels on the machine itself to warn of the possibility of personal injury. Read these instructions carefully. It is essential that you read the instructions and safety regulations before you try to repair or use this unit.

DANGER
- **Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.**

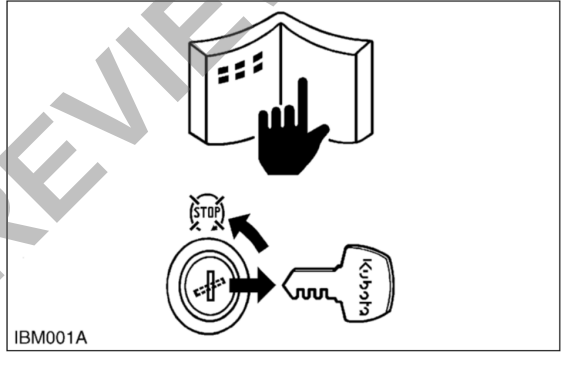
WARNING
- **Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.**

CAUTION
- **Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.**

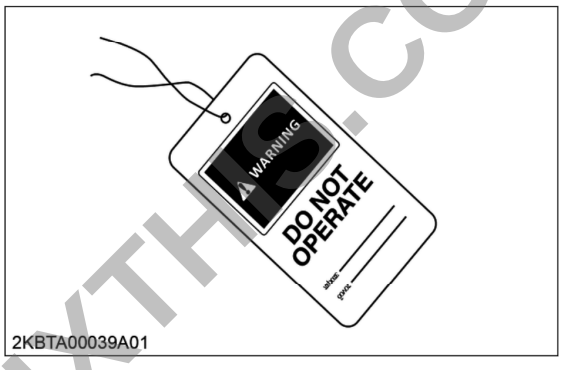
IMPORTANT
- **Indicates that equipment or property damage could result if instructions are not followed.**

NOTE
- **Gives helpful information.**

1. Working precautions



- Understand all safety instructions and safety labels in this manual.
- Park the machine on a stable and level ground then lower the attachment to check the machine safely.
- Stop the engine and remove the key when leaving the operator's seat for cleaning, maintenance, and servicing.



- Hang a DO NOT OPERATE tag near the operator's seat.
- Do not use worn or cracked tools. Use tools in a proper way with enough strength.
- In regards to the facility which is used in the workshop, follow each safety instruction.

2. Preparing for emergencies



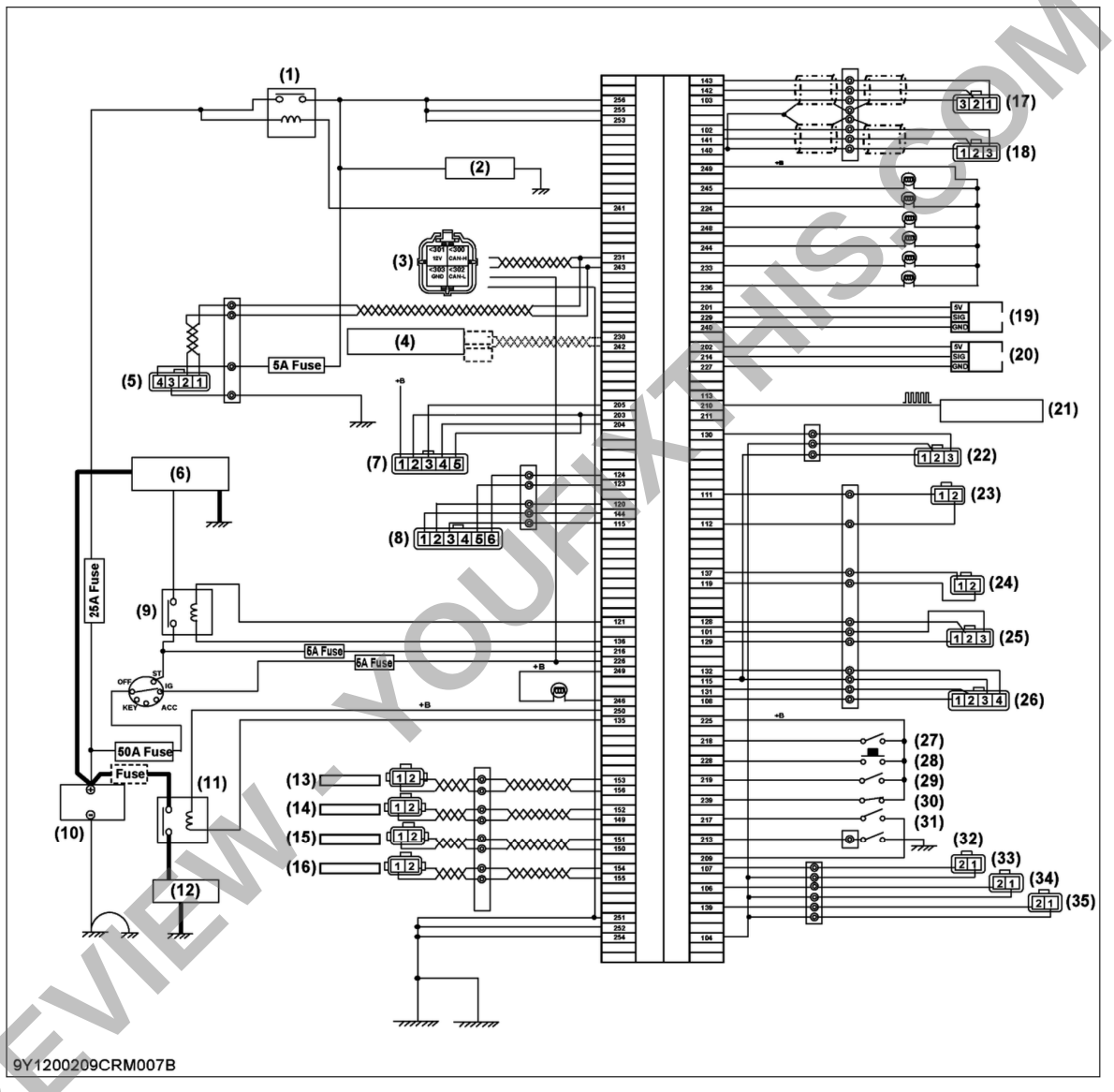
- Keep a first aid kit and fire extinguisher ready at all times.
- Keep emergency numbers near your telephone at all times.

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6.4 System wiring diagram for D1803-CR-E4, D1803-CR-TE4, V2403-CR-E4, V2403-CR-TE4, V2403-CR-TE4BG

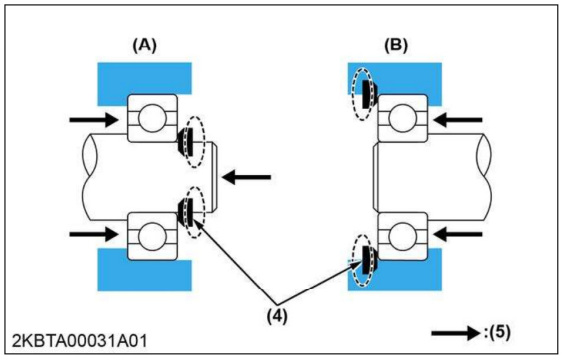
D1803-CR-E4, D1803-CR-TE4, V2403-CR-E4, V2403-CR-TE4, V2403-CR-TE4BG



(1)	Main relay	(13)	Injector 1	(25)	Rail pressure sensor
(2)	Fuel feed pump	(14)	Injector 2	(26)	Boost pressure sensor
(3)	CAN1 connector (for service)	(15)	Injector 3	(27)	Stop switch
(4)	CAN2 connector (for vehicle)	(16)	Injector 4*	(28)	Parked regeneration switch
(5)	EGR valve	(17)	Crankshaft position sensor	(29)	Parking switch
(6)	Starter	(18)	Camshaft position sensor	(30)	Regeneration inhibit switch

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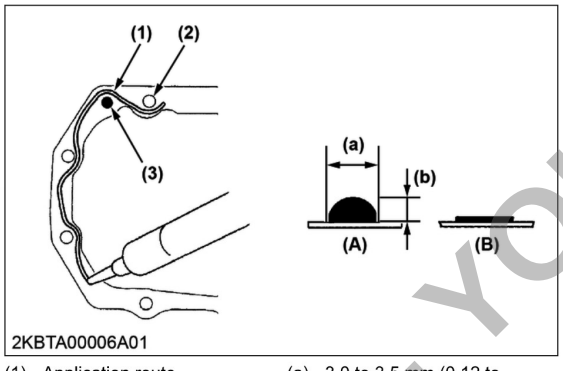
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(4) Side that receives force
(5) Force
(A) External circlip
(B) Internal circlip

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

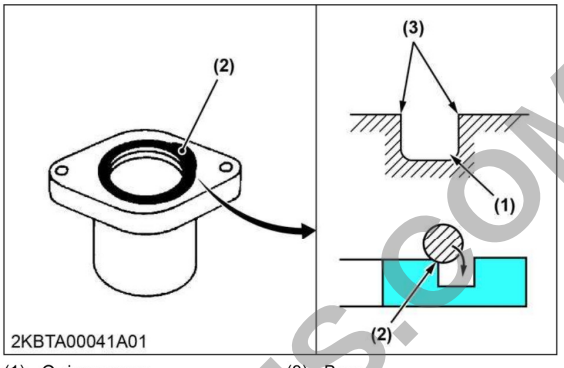
4. Handling liquid gasket



(1) Application route
(2) Bolt hole
(3) Dowel pin
(A) Correct
(B) Incorrect
(a) 3.0 to 3.5 mm (0.12 to 0.13 in.)
(b) 3.0 to 5.0 mm (0.12 to 0.19 in.)

- Use the specified liquid gasket.
- When using liquid gasket, fully remove the old gasket and grease or oil.
- When applying liquid gasket, apply it on the joint surface with a thickness of 3.0 to 5.0 mm (0.12 to 0.13 in.) without making any gaps.
- When applying liquid gasket near the bolt hole (2), apply it in the inner side.
- If there is a risk of oil leakage or if the hole goes all the way through when applying liquid gasket near the dowel pin (3) hole, apply it in the inner side.
  If there is no concern of oil leakage, apply it on the outer side.
- Reassemble within 15 minutes after applying; wait for 30 minutes or more then fill with oil.

5. Replacing O-rings

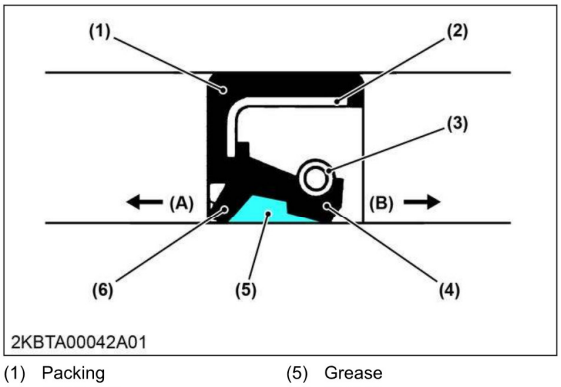


(1) O-ring groove
(2) O-ring
(3) Burr

1. Remove the burr and clean the O-ring groove.
2. Lubricate the O-ring. Do not apply any grease to the floating seal.
3. Put the O-ring in the groove.

■ NOTE
- **Do not twist the O-ring.**
- **Remove the burr to avoid damage on the O-ring caused by the burr.**

6. Replacing oil seals



(1) Packing
(2) Metal ring
(3) Spring
(4) Seal lip
(5) Grease
(6) Dust lip
(A) Air side
(B) Oil side

1. Do not face the lip of the oil seal in the wrong direction. Face the seal lip toward the material to be sealed.
2. Use a press to install the oil seal until firmly fixed to the boss.

■ NOTE
- **In cases when installing an oil seal without a press, place a wooden board on the seal and gently tap the board with a hammer; install the oil seal straightly and evenly.**

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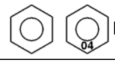
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3. Tightening torques

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	M12 × 1.25	32.4 to 37.2	3.31 to 3.79	23.9 to 27.4
Alternator pulley nut	—	58.4 to 78.9	5.95 to 8.05	43.1 to 58.2
*Main bearing case screw 1	M9 × 1.25	46.1 to 51.0	4.70 to 5.20	34.0 to 37.6
*Main bearing case screw 2	M10 × 1.25	68.6 to 73.5	7.00 to 7.49	50.6 to 54.2
*Flywheel screw	M12 × 1.25	98.10 to 107.9	10.01 to 11.00	72.36 to 79.58
*Connecting rod screw	M8 × 1.0	40.0 to 45.0	4.08 to 4.58	29.5 to 33.1
Oil pump gear 1 mounting nut	M12 × 1.25	78.5 to 88.3	8.01 to 9.00	57.9 to 65.1
Camshaft set screw	M8 × 1.25	23.5 to 27.5	2.40 to 2.80	17.4 to 20.2
Idle gear mounting screw	M8 × 1.25	23.5 to 27.5	2.40 to 2.80	17.4 to 20.2
Fan drive pulley mounting nut	M30 × 1.5	167 to 205	17.1 to 20.9	124 to 151
Oil cooler joint screw	M18 × 1.5	39.2 to 49.0	4.00 to 4.99	29.0 to 36.1

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SERVICING

1. Troubleshooting

1.1 Troubleshooting for 03 series engine

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	Solution	Reference page
The engine does not start	No fuel	Fill up the fuel	—
	Air in the fuel system	Bleed the air	—
	Water in the fuel system	Change the fuel and repair or replace the fuel system	3-8 3-13 3-13
	The fuel pump is damaged	Replace	—
	The fuel hose is clogged	Clean or replace	3-8
	The fuel filter is clogged	Replace	3-12
	The viscosity of fuel at low temperature is too high	Replace the specified fuel	3-1
	The cetane number of fuel is low	Replace the specified fuel	3-1
	Fuel leakage because of loose injection pipe retaining nut	Tighten the retaining nut	4-154
	The injector is clogged	Replace	4-191
	The supply pump is damaged	Replace	4-125 4-148
	Seizure of the crankshaft, camshaft, piston or bearing	Repair or replace	—
	Compression leakage from the cylinder	Replace the head gasket Tighten the cylinder head screw	4-111 4-149
	Incorrect valve timing	Check the timing gear	4-145
	Piston ring and cylinder are worn out	Replace	4-141 4-183
	Incorrect valve clearance	Adjust valve clearance	4-98
The starter does not operate	Discharged battery	Charge or replace	4-102
	Starter is damaged	Repair or replace	—
	The key switch is damaged	Replace	—
	The connection of the wires is incorrect	Check or correct	—

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3. Specifications

3.1 Specification for D1803-CR-E4, TE4

Model	D1803-CR-E4	D1803-CR-TE4
Number of cylinder	3	
Engine type	Vertical, water-cooled, 4-cycle diesel	
Bore × Stroke	87 × 102.4 mm (3.43 × 4.031 in.)	
Total displacement	1826 cm^3 (111.4 cu.in.)	
SAE gross continuous	24.3 kW / 2700 min^{-1} (rpm) (32.6 HP / 2700 min^{-1} (rpm))	32.1 kW / 2700 min^{-1} (rpm) (43.0 HP / 2700 min^{-1} (rpm))
SAE gross intermittent	28.0 kW / 2700 min^{-1} (rpm) (37.5 HP / 2700 min^{-1} (rpm))	37.0 kW / 2700 min^{-1} (rpm) (49.6 HP / 2700 min^{-1} (rpm))
Maximum bare speed	2900 min^{-1} (rpm)	
Minimum bare idling speed	800 min^{-1} (rpm)	
Combustion chamber	Reentrant type (Direct injection)	
Fuel supply pump	BOSCH common rail system	
Governor system		
Injector		
Fuel supply timing		
Fuel injection pressure		
Direction of rotation	Counter-clockwise (Viewed from flywheel side)	
Firing order	1-2-3	
Compression ratio	18.1	
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, 1.4 kW	
Starting support device	By glow plug in combustion chamber	
EGR	External EGR (EGR cooler + Electric EGR valve + Reed valve)	
Battery	12 V, 88 AH (105E41R) equivalent	
Charging alternator	12 V, 480 W	
Fuel	Diesel fuel No. 2-D S15, see page 3-1.	
Lubricating oil (API classification)	Class CJ-4 lubricating oil as per API classification is recommended. For details on recommended lubricating oils, see page 3-1.	
Lubricating oil capacity	7.0 L (1.8 U.S.gals, 1.5 Imp.gals)	
Weight (Dry)	185 kg (408 lbs)	196 kg (432 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

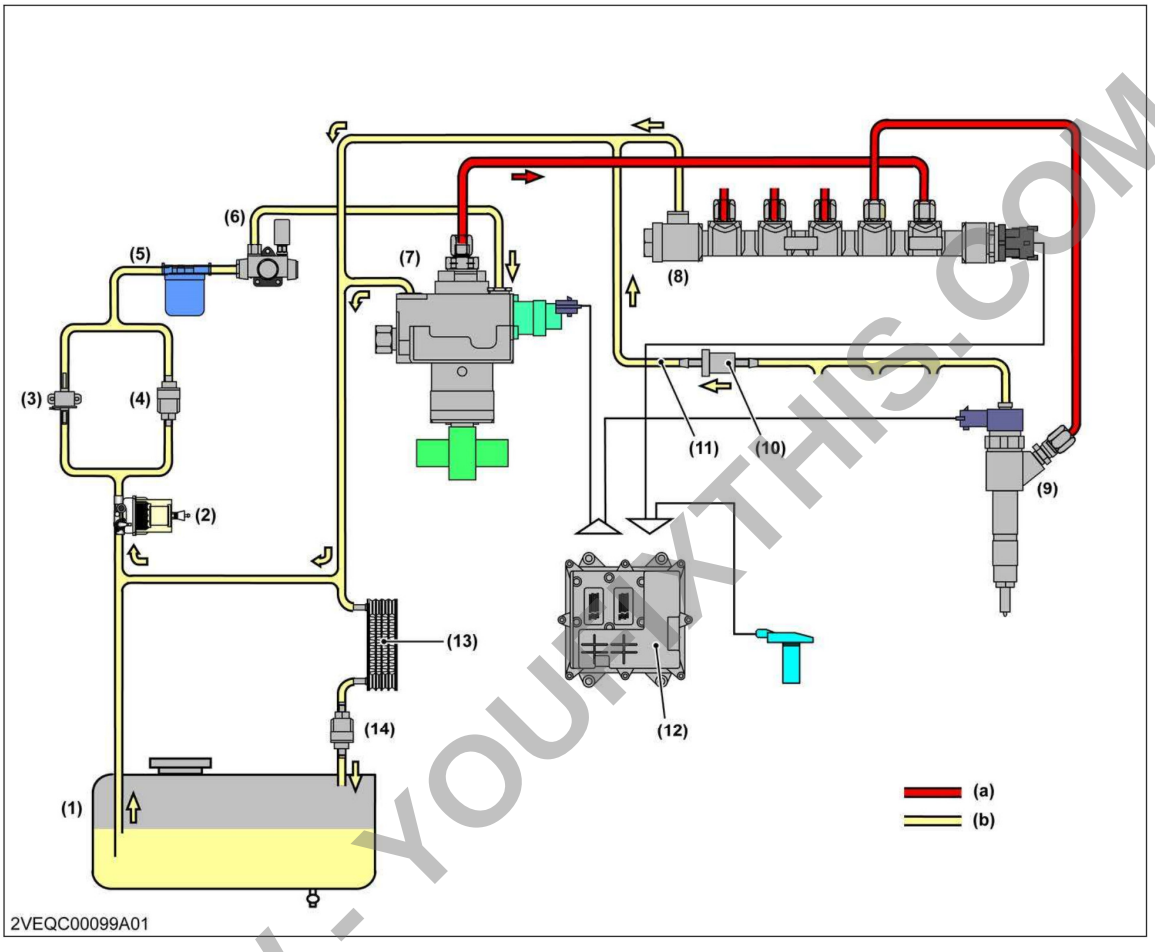
To make sure that the engine operates safely for a long time, refer to the table below to do regular inspections.

Inspection item		Service interval											Reference page
		Daily	Initial 50 hrs	Every 50 hrs	Every 250 hrs	Every 400 hrs	Every 500 hrs	Every 1000 hrs	Every 1500 hrs	Every 3000 hrs	Every 1 year	Every 2 years	
	Checking engine oil level	○											3-5
	Checking fuel level	○											3-6
	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
	Cleaning of air cleaner element (replace the element after 6-times cleaning)				○								3-9
	Adjusting fan belt tension				○								3-10
	Checking radiator hose and clamp bands				○								3-10
	Checking intake air line				○						○		3-11
	Replacing fuel filter cartridge						○						3-12
	Cleaning water separator (Type 1)						○						3-13
	Cleaning fuel tank interior						○						–
	Cleaning water jacket and radiator interior						○						3-13
	Replacing fan belt						○					○	3-15
	Replacing water separator filter (Type2)						○				○		3-13
	Checking valve clearance							○					3-16
*1	Checking injector (with Diagmaster)								○				3-17
*1	Checking EGR cooler								○				3-18
*1	Replacing oil separator element								○				3-19
*1	Checking positive crankcase ventilation (PCV) valve								○				3-19
*1	Checking turbocharger									○			3-19
*1 *2	Cleaning DPF									○			3-20
*2	Checking EGR system (with Diagmaster)									○			3-24
	Replacing air cleaner element										○		3-25
*1	Checking DPF differential pressure pipes and hoses										○		3-25
	Checking EGR piping										○		3-26

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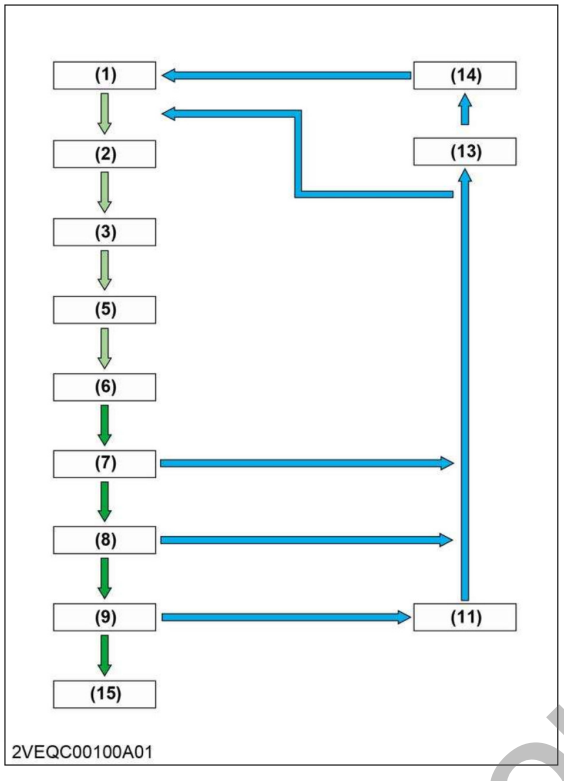
3.3 Flow of common rail system (CRS) engine



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Fuel flow



(1) Fuel tank
(2) Water separator
(3) Electromagnetic fuel feed pump
(4) Check valve
(5) Fuel filter
(6) Fuel pump
(7) Supply pump
(8) Rail
(9) Injector
(10) Check valve
(11) Overflow pipe
(12) Engine ECU
(13) Fuel cooler
(14) Check valve
(15) Fuel injection
(a) High pressure fuel flow
(b) Low pressure fuel flow

1. Fuel from the fuel tank is passed through a water separator and fuel filter by an electromagnetic fuel feed pump and is supplied to the supply pump.
2. Fuel is pressurized by the supply pump and fed to the rail and injectors.
3. The injectors inject fuel based on instructions from the engine ECU.
4. After injection, surplus fuel passes through overflow pipe and fuel cooler and is returned to the fuel tank.

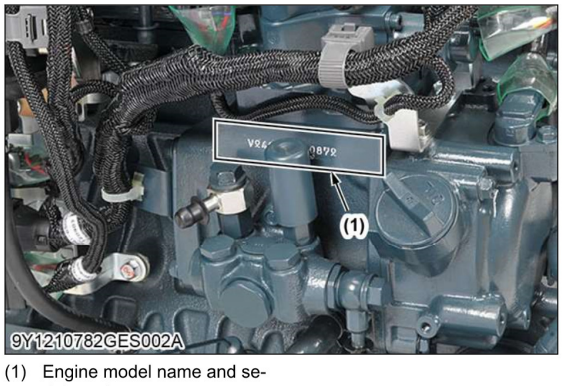
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GENERAL MACHINE INFORMATION

1. Engine identification

1.1 Engine model name and engine serial number



(1) Engine model name and serial number

You must identify the engine model name and serial number before you start a job.
When you get in touch with the manufacturer, always tell your engine model name and serial number.

Engine serial number

The engine serial number is an identified number for the engine.
It appears after the engine model name.
It shows the month and year of manufacture as below.

Engine series

Number or alphabet	Series
1	05 (include: WG)
2	V3 (include: WG)
3	08
4	SM (include: WG)
5	Air cooled gasoline
6	GZ, OC, AC, EA, E
7	03 (include: WG)
8	07
A	EA, RK
B	03 (KET production)
C	V3, 07 (KEW production)

Production year

Alphabet or number	Year
1	2001
2	2002
3	2003
4	2004
5	2005
6	2006
7	2007
8	2008
9	2009
A	2010
B	2011
C	2012
D	2013
E	2014
F	2015
G	2016
H	2017
J	2018
K	2019
L	2020
M	2021
N	2022
P	2023
R	2024
S	2025
T	2026
V	2027

* Alphabetical letters "I" and "O" are not used.

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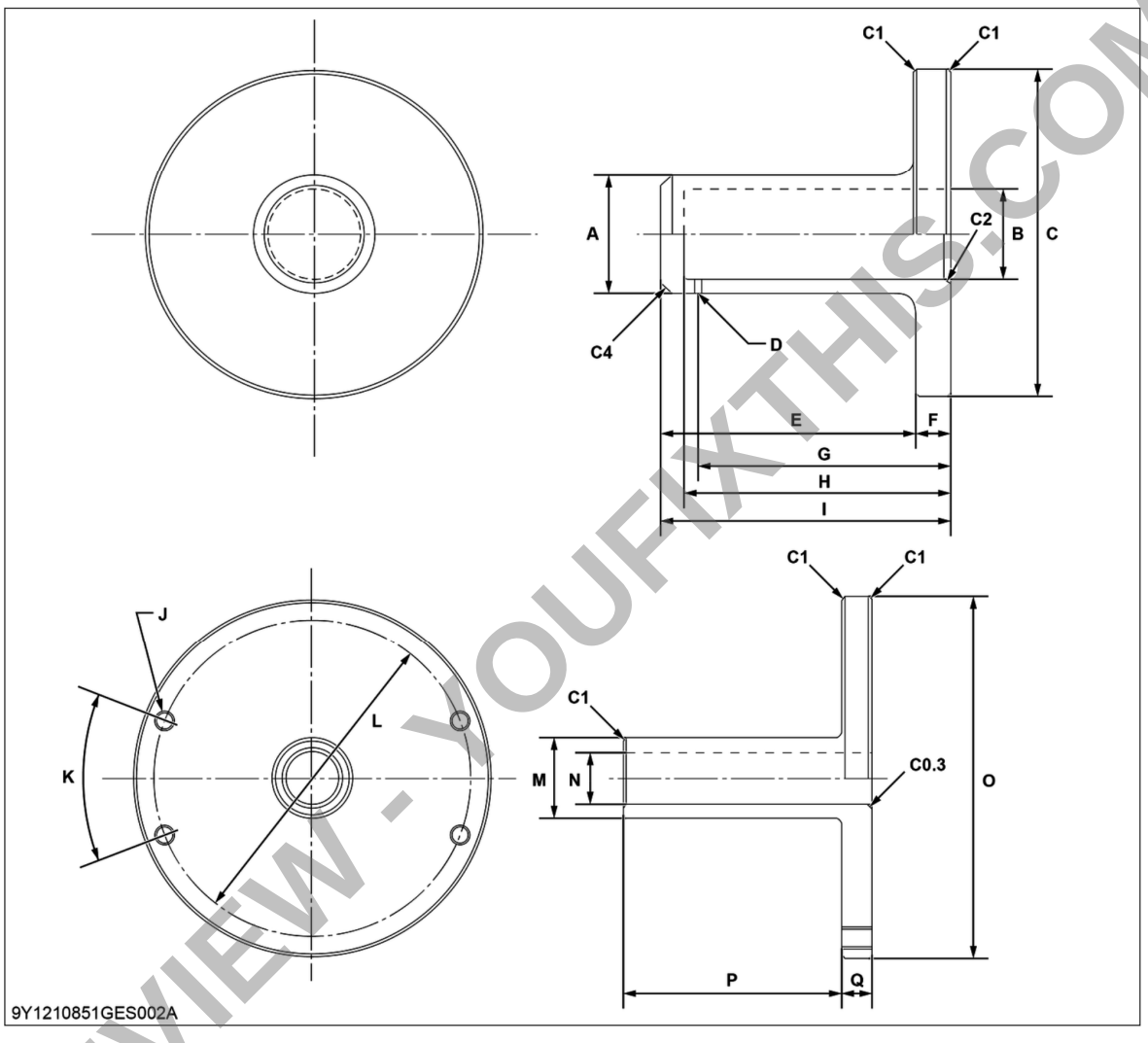
Last digit of the Code No.	Month of Revision	Part name	Main revised point and corrective measure	Reference page
7	2018.12	Mechanism Servicing	Added the information about all mechanism section. Added the follow information about checking and adjusting. • Checking injector • Checking suction control valve (SCV) • Checking sensors • Adjusting air gap between crank/camshaft position sensor and flywheel/pulsar gear Separate disassembling and assembling Added follow servicing information. • Replacing injector • Replacing engine ECU • Replacing DPF Change notification about fan drive pulley mounting nut tightening torque	4-96 4-107 4-107 4-114 4-115 4-191 4-193 4-196
8	2019.08	Injector Oil switch Exhaust gas temperature sensor	Correction point • System wiring diagram for D1803-CR-E4, D1803-CR-TE4, V2403-CR-E4, V2403-CR-TE4 V2403-CR-TE4BG • System wiring diagram for D1803-CR-TIE4, V2403-CR-TIE4	2-29 2-31

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10. Bearing case cover oil seal replacing tool

Use for install bearing case cover oil seal.
This special tool is not provided, so make it referring to the figure.



A	42 mm dia. (1.7 in. dia.)
B	32.000 to 32.025 mm dia. (1.2599 to 1.2608 in. dia.)
C	116 mm dia. (4.57 in. dia.)
D	3 mm dia. (0.1 in. dia.)
E	88 mm (3.5 in.)
F	12 mm (0.47 in.)
G	88 mm (3.5 in.)
H	92 mm (3.6 in.)

(Continued)

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3.11.3 Function of injection pipe

Injection pipes connect the supply pump and rail as well as the rail and injectors.

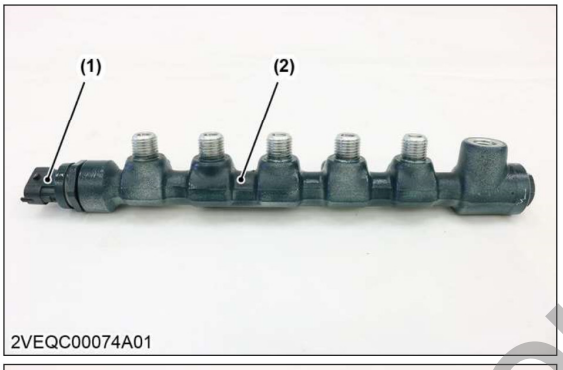
3.12 Rail assembly

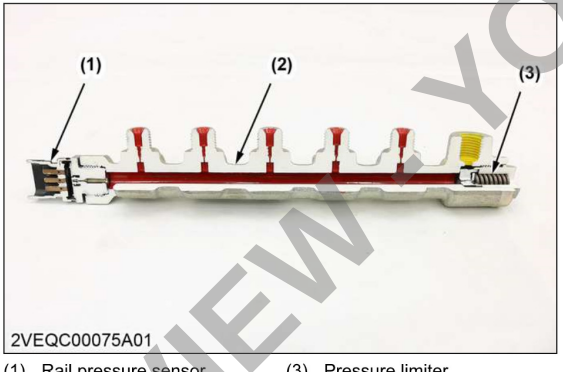
3.12.1 Outline of rail assembly

The rail stores high pressure fuel and delivers it to each of the injectors.

3.12.2 Structure of rail assembly

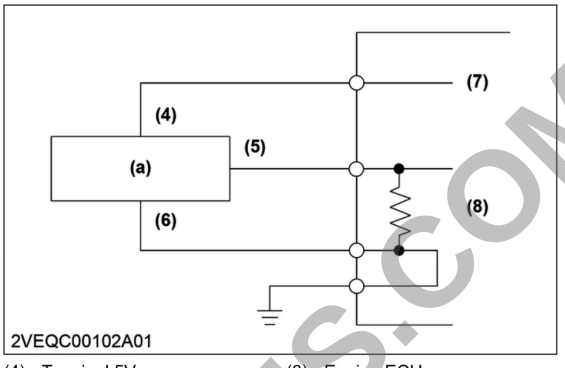
The rail assembly is made up of a rail body, rail pressure sensor, and pressure limiter.





(1) Rail pressure sensor
(2) Rail body
(3) Pressure limiter

Wiring diagram



(4) Terminal 5V
(5) Terminal signal
(6) Terminal ground
(7) +5 V
(8) Engine ECU
(a) Rail pressure sensor connector

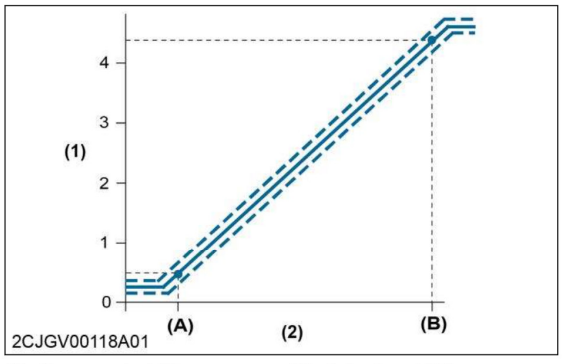
3.12.3 Function of rail assembly

The rail assembly stores high pressure fuel fed from the supply pump and while retaining the pressure, delivers fuel to the injectors for each cylinder.
The pressure of the fuel in the rail is detected by the rail pressure sensor, and optimal feedback control is provided for the engine speed and load.
This greatly improves the ability to raise the pressure at low speed and enables high-pressure injection from low speed ranges.

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Output characteristics



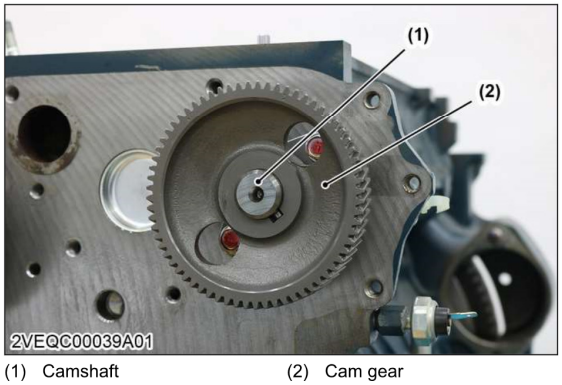
(1) Sensor output (V)
(2) Sensor operating angle (degree)
(A) Fully closed (0°)
(B) Fully open (81.4°)

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2. Tighten the camshaft set screw to the specified torque.

Tightening torque	Camshaft set screw	23.5 to 27.5 N·m 2.40 to 2.80 kgf·m 17.4 to 20.2 lbf·ft



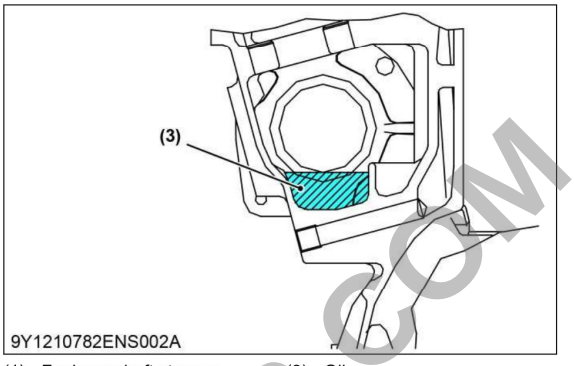
(1) Camshaft (2) Cam gear

6.16 Installing fuel camshaft with supply pump gear

1. Install the fuel camshaft with supply pump gear (2).
2. Install the fuel camshaft stopper (1).

■ **NOTE**
- **After installing the fuel camshaft, store oil in the pump room as shown in drawing Recommended oil amount: More than 50 ml (cc)**



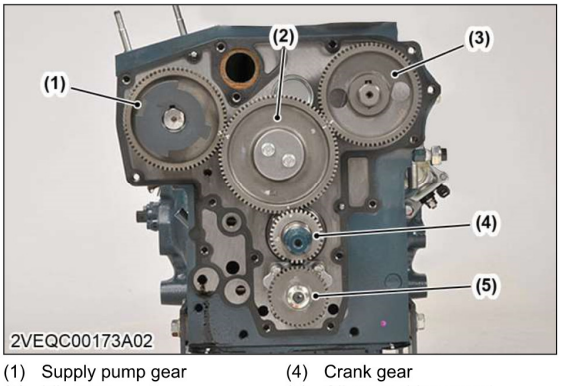


(1) Fuel camshaft stopper (3) Oil
(2) Fuel camshaft with supply pump gear

6.17 Installing idle gear

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

■ **IMPORTANT**
- **Apply the engine oil inside of idle gear (2).**
- **When mounting idle gear (2), bring the piston of cylinder 1 to T.D.C. and mount the gears with their marks aligned to the respective gears.**
  - **a. Idle gear (2) and cam gear (3)**
  - **b. Idle gear (2) and crank gear (4)**
  - **c. Idle gear (2) and supply pump gear (1)**



(1) Supply pump gear (4) Crank gear
(2) Idle gear (5) Oil pump drive gear 1
(3) Cam gear

2. Tighten the idle gear mounting screw to the specified torque.

Tightening torque	Idle gear mounting screw	23.5 to 27.5 N·m 2.40 to 2.80 kgf·m 17.4 to 20.2 lbf·ft

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