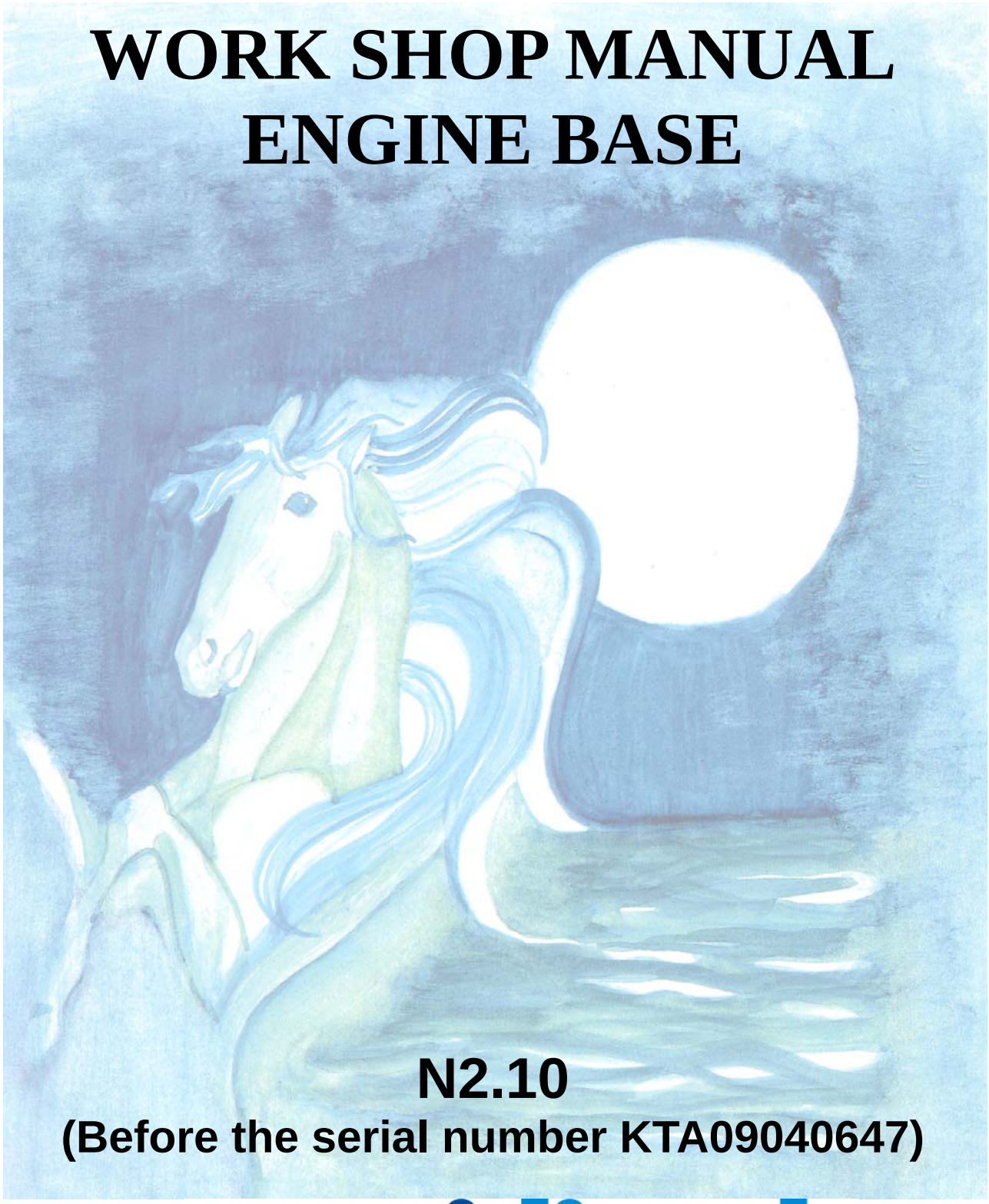
WORK SHOP MANUAL
ENGINE BASE



N2.10
(Before the serial number KTA09040647)

nanni diesel

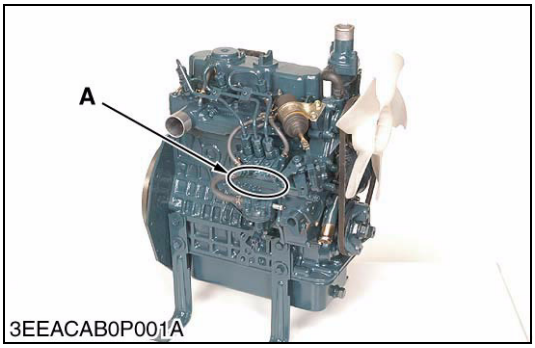
energy in blue

NANNI INDUSTRIES S.A.S – Zone Industrielle
11 avenue MARIOTTE
B.P.107 – 33260 LA TESTE - FRANCE

60300171

1. ENGINE IDENTIFICATION

[1] MODEL NAME AND ENGINE SERIAL NUMBER



When contacting the manufacture, always specify your engine model name and serial number.

The engine model and its serial number need to be identified before the engine can be serviced or parts replaced.

■ **Engine Serial Number**

The engine serial number is an identified number for the engine. It is marked after the engine model number.

It indicates month and year of manufacture as follows.

- **Year of manufacture**

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

A : Engine Model Name and Serial Number

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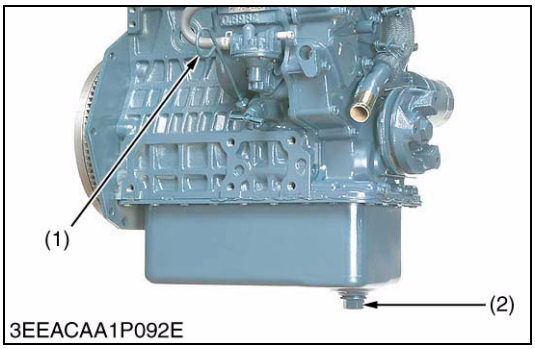
[4] CHECK POINT OF EVERY 75 HOURS



Changing Engine Oil (for Optional Depth Oil Pans)

CAUTION

- **Be sure to stop engine before changing engine oil.**

1. Start and warm up the engine for approx. 5 minutes.
2. Place an oil pan underneath the engine.
3. To drain the used oil, remove the drain plug (2) at the bottom of the engine and drain the oil completely.
4. Screw the drain plug (2).
5. Fill new oil up to upper line on the dipstick (1).

IMPORTANT

- **When using an oil of different maker or viscosity from the previous one, remove all of the old oil.**
- **Never mix two different types of oil.**
- **Engine oil should have properties of API classification CD/CE/CF/CF-4/CG-4.**
- **Use the proper SAE Engine Oil according to ambient temperature.**
- **Upon an oil change, be sure to replace the gasket with new one.**

Above 25 °C (77 °F)	SAE 30 or SAE 10W-30 SAE 10W-40
0 °C to 25 °C (32 °F to 77 °F)	SAE 20 or SAE 10W-30 SAE 10W-40
Below 0 °C (32 °F)	SAE 10W or SAE 10W-30 SAE 10W-40

Oil pan depth / Models	Engine oil capacity	
	101 mm (3.98 in.)	121 mm (4.76 in.)
*Z482-E2B	2.1 L 0.55 U.S.gals	2.5 L 0.66 U.S.gals
*D662-E2B *D722-E2B	3.2 L 0.85 U.S.gals	3.8 L 1.00 U.S.gals
D782-E2B	–	3.6 L 0.95 U.S.gals
Z602-E2B	2.5 L 0.66 U.S.gals	–
D902-E2B	3.7 L 0.98 U.S.gals	–

* 101 mm (3.98 in.) oil pan depth is optional.

Tightening torque	Drain plug with copper gasket	M12 × 1.25	32.4 to 37.3 N·m 3.3 to 3.8 kgf·m 23.9 to 27.5 ft-lbs
		M22 × 1.5	63.7 to 73.5 N·m 6.5 to 7.5 kgf·m 47.0 to 54.2 ft-lbs
	Drain plug with rubber coated gasket	M22 × 1.5	44.1 to 53.9 N·m 4.5 to 5.5 kgf·m 32.5 to 39.8 ft-lbs

(1) Dipstick (2) Drain Plug

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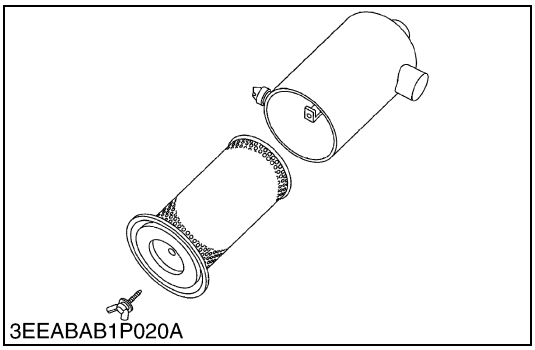
[11] CHECK POINT OF EVERY YEAR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Replacing Air Cleaner Element

1. Remove used air cleaner element.
2. Replace new air cleaner element.

■ **NOTE**

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

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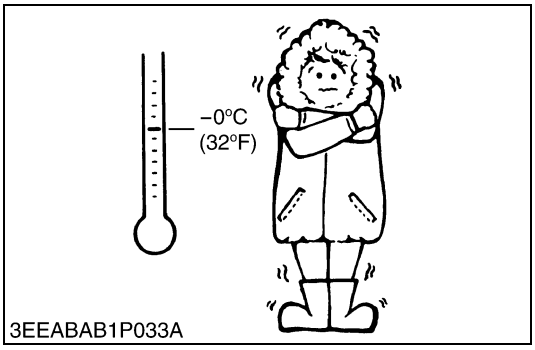

Changing Radiator Coolant (L.L.C.) (Continued)

(Anti-freeze)

- There are two types of anti-freeze available: use the permanent type (PT) for this engine.
- Before adding anti-freeze for the first time, clean the radiator interior by pouring fresh, soft water and draining it a few times.
- The procedure for mixing water and anti-freeze differs according to the maker of the anti-freeze and the ambient temperature. Basically, it should be referred to SAE J1034 standard, more specifically also to SAE J814c.
- Mix the anti-freeze with fresh, soft water, and then fill into the radiator.

■ **IMPORTANT**

- **When the anti-freeze is mixed with fresh, soft water, the anti-freeze mixing ratio must be less than 50 %.**

Vol % anti-freeze	Freezing point		Boiling point*	
	°C	°F	°C	°F
40	–24	–11.2	106	222.8
50	–37	–34.6	108	226.4

* At 1.013 × 100000 Pa (760 mmHg) pressure (atmospheric). A higher boiling point is obtained by using a radiator pressure cap which permits the development of pressure within the cooling system.

■ **NOTE**

- **The above data represents industrial standards that necessitate a minimum glycol content in the concentrated anti-freeze.**
- **When the coolant level drops due to evaporation, add fresh, soft water only to keep the anti-freeze mixing ratio less than 50 %. In case of leakage, add anti-freeze and fresh, soft water in the specified mixing ratio.**
- **Anti-freeze absorbs moisture. Keep unused anti-freeze in a tightly sealed container.**
- **Do not use radiator cleaning agents when anti-freeze has been added to the coolant.**
  (Anti-freeze contains an anti-corrosive agent, which will react with the radiator cleaning agent forming sludge which will affect the engine parts.)

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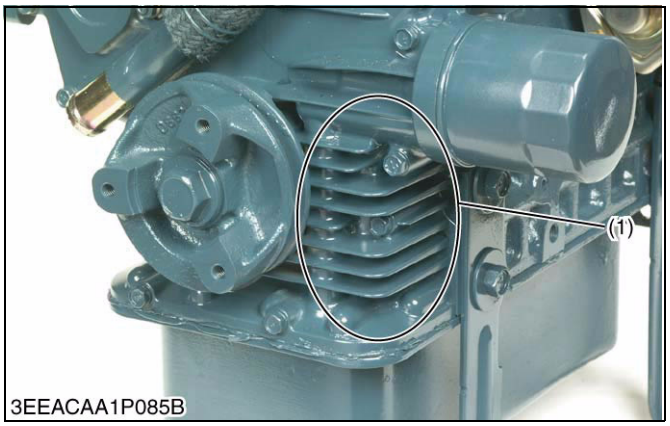
2. COOLING SYSTEM

[1] COOLING FIN (Z602-E2B, D902-E2B)



The cooling fin is set up around the oil passage in the gear case.

Therefore, the temperature of oil is decreased by the wind generated by the cooling fan.

(1) Cooling Fin

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COOLING SYSTEM

Item		Factory Specification	Allowable Limit
Fan Belt	Tension	7.0 to 9.0 mm / 98 N 0.28 to 0.35 in. / 98 N (10 kgf, 22 lbs)	–
Thermostat	Valve Opening Temperature (At Beginning)	69.5 to 72.5 °C 157.1 to 162.5 °F	–
	Valve Opening Temperature (Opened Completely)	85 °C 185 °F	–
Radiator Cap	Pressure Falling Time	10 seconds or more 88 → 59 kPa 0.9 → 0.6 kgf/cm^2 13 → 9 psi	–
Radiator	Water Leakage Test Pressure	No leak at specified pressure 157 kPa 1.6 kgf/cm^2 23 psi	–

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FUEL SYSTEM

Item		Factory Specification	Allowable Limit
Injection Pump **[Z482/D662/D722-E2B]**	Injection Timing (3600 min^{-1} (rpm))	0.33 to 0.37 rad (19 to 21°) before T.D.C.	–
Injection Pump **[D782-E2B]**	Injection Timing (3200 min^{-1} (rpm))	0.28 to 0.31 rad (16 to 18°) before T.D.C.	–
Injection Pump **[Z602/D902-E2B]**	Injection Timing (3200 min^{-1} (rpm))	0.30 to 0.33 rad (17 to 19°) before T.D.C.	–
Injection Pump **[Z602/D902-E2B]**	Injection Timing (3600 min^{-1} (rpm))	0.33 to 0.37 rad (19 to 21°) before T.D.C.	–
Pump Element	Fuel Tightness	–	13.73 MPa 140 kgf/cm^2 1991 psi
Delivery Valve	Fuel Tightness	10 seconds 13.73 → 12.75 MPa 140 → 130 kgf/cm^2 1991 → 1849 psi	5 seconds 13.73 → 12.75 MPa 140 → 130 kgf/cm^2 1991 → 1849 psi
Injection Nozzle	Injection Pressure	13.73 to 14.71 MPa 140 to 150 kgf/cm^2 1991 to 2134 psi	–
Injection Nozzle Valve Seat	Valve Seat Tightness	When the pressure is 12.75 MPa (130 kgf/cm^2, 1849 psi), the valve seat must be fuel tightness.	–

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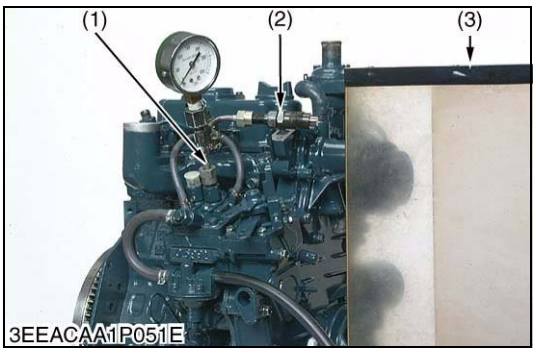

Fuel Tightness of Pump Element

1. Remove the engine stop solenoid.
2. Remove the injection pipes and glow plugs.
3. Install the injection pump pressure tester to the injection pump.
4. Install the injection nozzle (2) jetted with the proper injection pressure to the injection pump pressure tester (1). (Refer to the photo.)
5. Set the speed control lever to the maximum speed position.
6. Run the starter to increase the pressure.
7. If the pressure can not reach the allowable limit, replace the pump with new one or repair with a Kubota-authorized pump service shop.

Fuel tightness of pump element	Allowable limit	13.73 MPa 140 kgf/cm^2 1991 psi

■ **NOTE**

- **Never try to disassemble the injection pump assembly. For repairs, you are strongly requested to contact a Kubota-authorized pump service shop.**

(1) Injection Pump Pressure Tester (3) Protection Cover for Jetted Fuel
(2) Injection Nozzle

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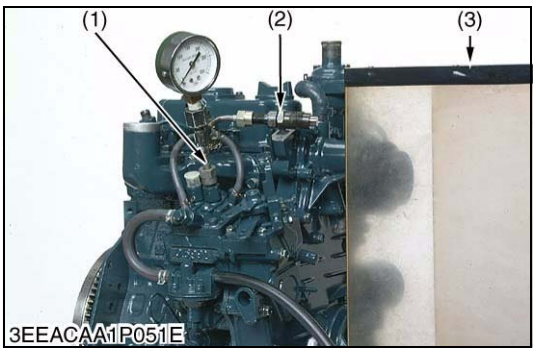

Fuel Tightness of Delivery Valve

1. Remove the engine stop solenoid.
2. Remove the injection pipes and glow plugs.
3. Set a pressure tester to the fuel injection pump.
4. Install the injection nozzle (2) jetted with the proper injection pressure to the injection pump pressure tester (1).
5. Run the starter to increase the pressure.
6. Stop the starter when the fuel jets from the injection nozzle. After that, turn the flywheel by hands and raise the pressure to approx. 13.73 MPa (140 kgf/cm^2, 1991 psi).
7. Now turn the flywheel back about half a turn (to keep the plunger free). Maintain the flywheel at this position and clock the time taken for the pressure to drop from 13.73 to 12.75 MPa (from 140 to 130 kgf/cm^2, from 1991 to 1849 psi).
8. Measure the time needed to decrease the pressure from 13.73 to 12.75 MPa (140 to 130 kgf/cm^2, 1991 to 1849 psi).
9. If the measurement is less than allowable limit, replace the pump with new one or repair with a Kubota-authorized pump service shop.

Fuel tightness of delivery valve	Factory spec.	10 seconds 13.73 → 12.75 MPa 140 → 130 kgf/cm^2 1991 → 1849 psi
	Allowable limit	5 seconds 13.73 → 12.75 MPa 140 → 130 kgf/cm^2 1991 → 1849 psi

■ **NOTE**

- **Never try to disassemble the injection pump assembly. For repairs, you are strongly requested to contact a Kubota-authorized pump service shop.**

(1) Injection Pump Pressure Tester (3) Protection Cover for Jetted Fuel
(2) Injection Nozzle

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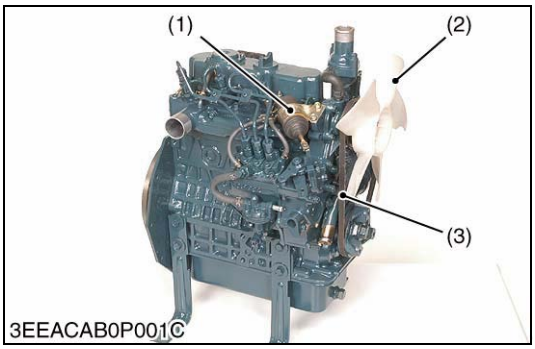
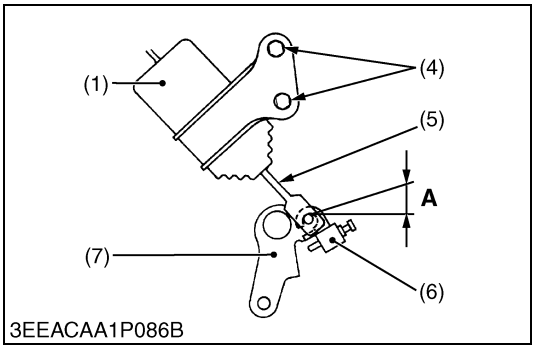
(2) External Components





Alternator, Starter and Others

1. Remove the air cleaner and muffler.
2. Remove the engine stop solenoid (1).
3. Remove the cooling fan (2), fan pulley and fan belt (3).
4. Remove the alternator.
5. Remove the starter.

(When reassembling)

- Check to see that there are no cracks on the belt surface.

■ **IMPORTANT**

- **Keep the engine stop lever (7) to touch the stopper (6). Tighten the engine stop solenoid mounting screw (4) so that there be no gap between the engine stop lever and the engine stop solenoid plunger (5).**
- **After reassembling the fan belt, be sure to adjust the fan belt tension.**
- **Do not confuse the direction of the fan.**

(1) Engine Stop Solenoid
(2) Cooling Fan
(3) Fan Belt
(4) Engine Stop Solenoid Mounting Screw
(5) Plunger
(6) Stopper
(7) Engine Stop Lever

A : 0 mm (0 in.)

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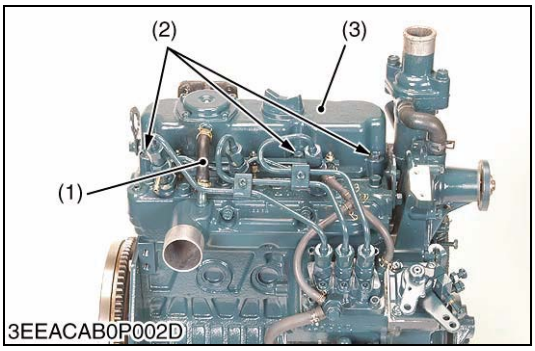
(3) Cylinder Head, Valves and Oil Pan



Cylinder Head Cover

1. Disconnect the breather hose (1).
2. Remove the cylinder head cover screws (2).
3. Remove the cylinder head cover (3).

(When reassembling)

- Check to see if the cylinder head cover gasket is not defective.

Tightening torque	Cylinder head cover screw	6.86 to 11.3 N·m 0.7 to 1.15 kgf·m 5.1 to 8.3 ft-lbs

(1) Breather Hose
(2) Cylinder Head Cover Screws
(3) Cylinder Head Cover

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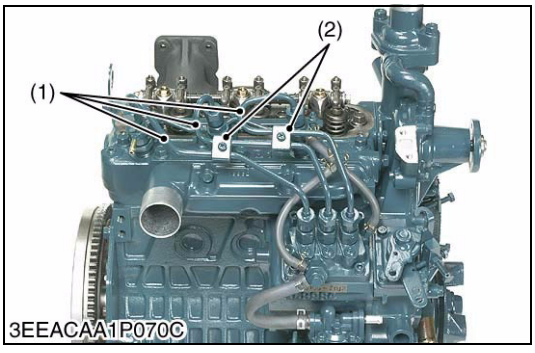

Injection Pipes

1. Loosen the screws to the pipe clamp (2).
2. Detach the injection pipes (1).

(When reassembling)

- Sent compressed air into the pipes to blow out dust. Then, reassemble the pipes in the reverse order.

Tightening torque	Injection pipe retaining nut	24.5 to 34.3 N·m 2.5 to 3.5 kgf·m 18.1 to 25.3 ft-lbs

(1) Injection Pipe
(2) Pipe Clamp

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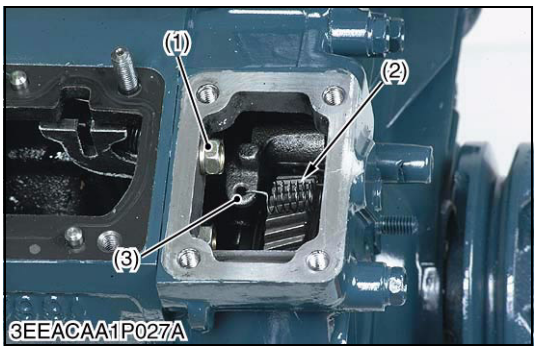

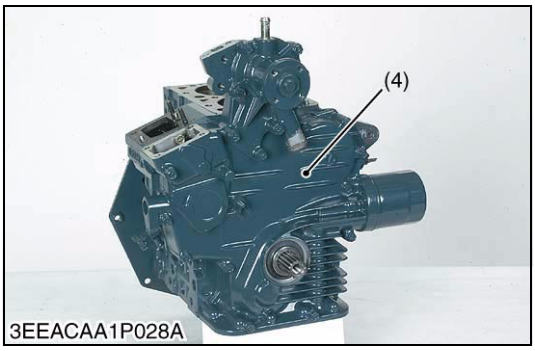

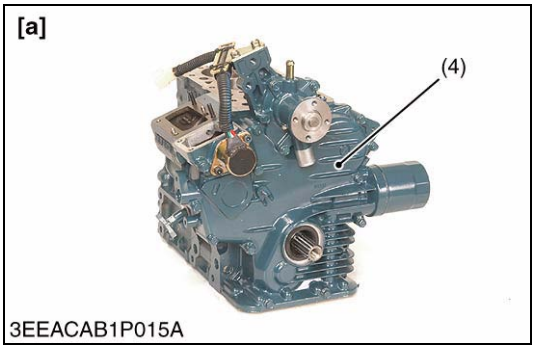

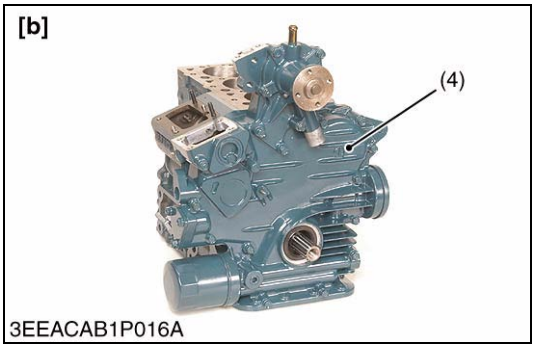

Gear Case

1. Disconnect the start spring (2) from the fork lever 1 (3).
2. Remove the screw (1) of inside the gear case and outside screws.
3. Remove the gear case (4).

(When reassembling)

- Apply a liquid gasket (Three Bond 1215 or equivalent) to both sides of the gear case gasket.
- Be sure to set three O-rings inside the gear case.

■ **NOTE**

- **The gear case for energize to run type stop solenoid and the gear case for one-side maintenance are available to meet customer's requirements. (Option)**

(1) Screw (Inside)
(2) Start Spring
(3) Fork Lever 1
(4) Gear Case

[a] Gear Case for Energize to Run Type Stop Solenoid (Option)
[b] Gear Case for One-side Maintenance (Option)

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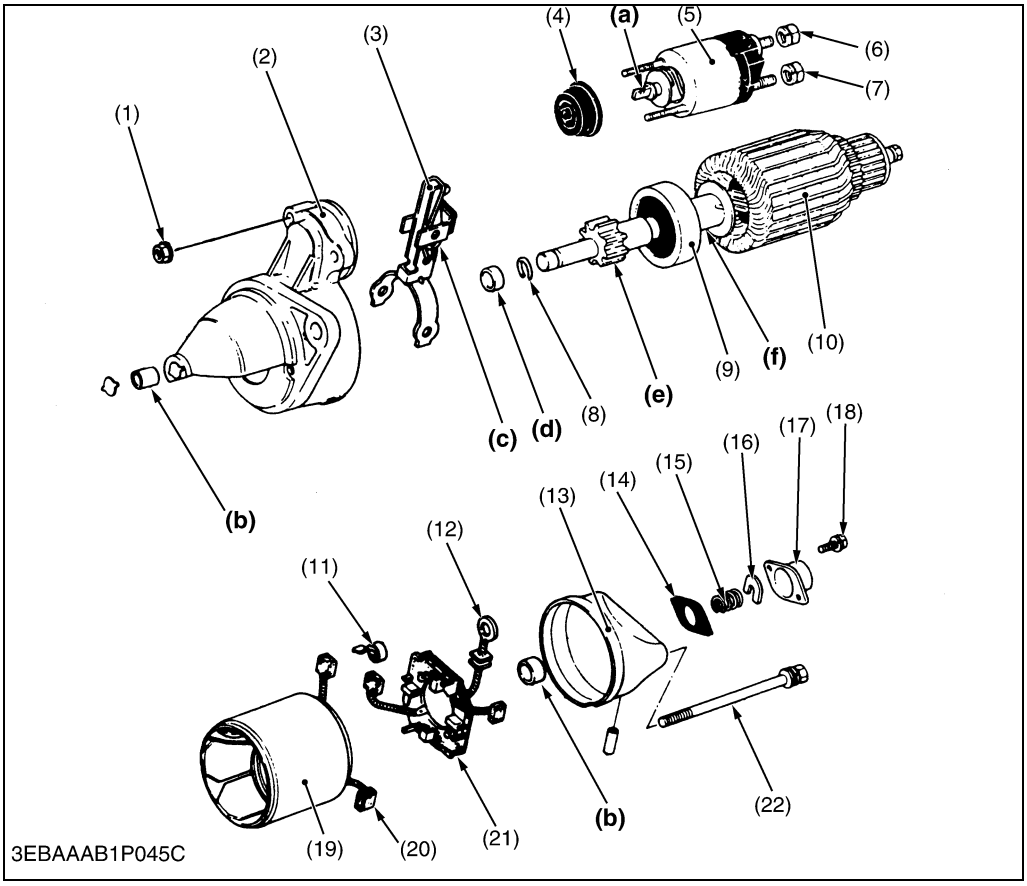
(7) Starter

■ Electromagnetic Drive Type



(1) Solenoid Switch Mounting Nut
(2) Starter Drive Housing
(3) Drive Lever
(4) Gasket
(5) Solenoid Switch
(6) **B** Terminal Nut
(7) **C** Terminal Nut
(8) Snap RIng
(9) Overrunning Clutch
(10) Armature
(11) Brush Spring
(12) Connecting Lead
(13) Rear End Frame
(14) Gasket
(15) Brake Spring
(16) Brake Shoe
(17) End Frame Cap
(18) Screw
(19) Yoke
(20) Brush
(21) Brush Holder
(22) Through Bolt

W1037593

1. Unscrew the **C** terminal nut (7), and disconnect the connecting lead (12).
2. Unscrew the solenoid switch mounting nuts (1), and remove the solenoid switch (5).
3. Remove the end frame cap (17).
4. Remove the brake shoe (16), brake spring (15) and gasket (14).
5. Unscrew the through bolts (22), and remove the rear end frame (13).
6. Remove the brush from the brush holder while holding the spring up.
7. Remove the brush holder (21).
8. Draw out the yoke (19) from the starter drive housing (2).
9. Draw out the armature (10) with the drive lever (3).

■ **NOTE**

- **Do not damage to the brush and commutator.**

(When reassembling)

- Apply grease (DENSO.CO.LTD. No. 50 or equivalent) to the parts indicated in the figure.
  - Joint of solenoid switch **(a)**
  - Bushing **(b)**
  - Drive lever **(c)**
  - Collar **(d)**
  - Teeth of pinion gear **(e)**
  - Armature shaft **(f)**

Tightening torque	**B** terminal nut	7.8 to 9.8 N·m 0.8 to 1.0 kgf·m 5.8 to 7.2 ft-lbs

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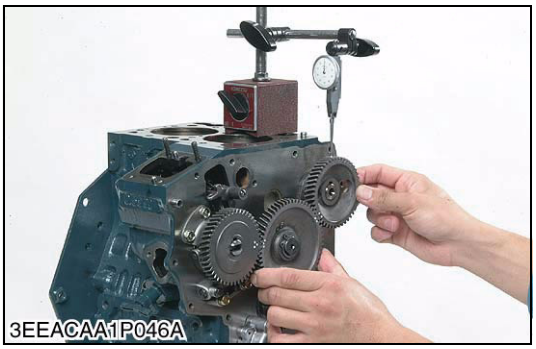
(2) Timing Gears



Timing Gear Backlash

1. Set a dial indicator (lever type) with its tip on the gear tooth.
2. Move the gear to measure the backlash, holding its mating gear.
3. If the backlash exceeds the allowable limit, check the oil clearance of the shaft and the gear.
4. If the oil clearance is not proper, replace the gear.

Backlash between idle gear and crank gear	Factory spec.	0.043 to 0.124 mm 0.00169 to 0.00488 in.
	Allowable limit	0.15 mm 0.0059 in.
Backlash between idle gear and cam gear	Factory spec.	0.047 to 0.123 mm 0.00185 to 0.00484 in.
	Allowable limit	0.15 mm 0.0059 in.
Backlash between idle gear and injection pump gear	Factory spec.	0.046 to 0.124 mm 0.00181 to 0.00488 in.
	Allowable limit	0.15 mm 0.0059 in.
Backlash between oil pump drive gear and crank gear	Factory spec.	0.041 to 0.123 mm 0.00161 to 0.00484 in.
	Allowable limit	0.15 mm 0.0059 in.

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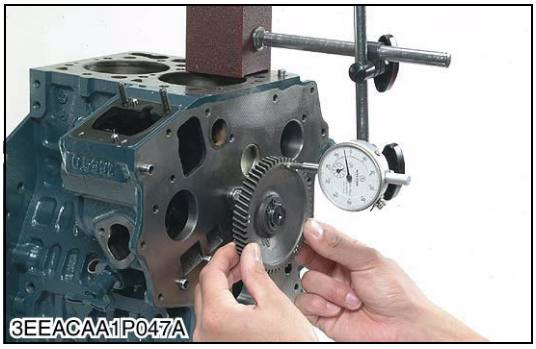

Idle Gear Side Clearance

1. Set a dial indicator with its tip on the idle gear.
2. Measure the side clearance by moving the idle gear to the front and rear.
3. If the measurement exceeds the allowable limit, replace the idle gear collar.

Idle gear side clearance	Factory spec.	0.20 to 0.51 mm 0.0079 to 0.0201 in.
	Allowable limit	0.80 mm 0.0315 in.

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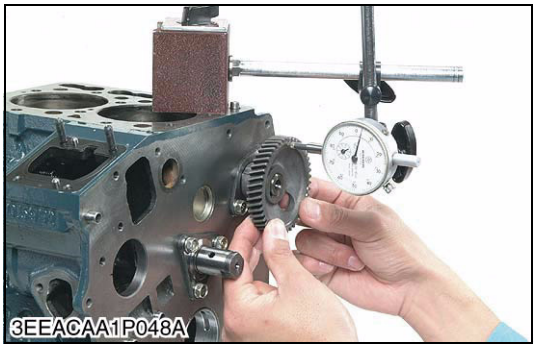

Camshaft Side Clearance

1. Set a dial indicator with its tip on the camshaft.
2. Measure the side clearance by moving the cam gear to the font and rear.
3. If the measurement exceeds the allowable limit, replace the camshaft stopper.

Camshaft side clearance	Factory spec.	0.15 to 0.31 mm 0.0059 to 0.0122 in.
	Allowable limit	0.50 mm 0.0197 in.

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