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SAFE OPERATION

Careful operation is your best insurance against an accident. Read and understand this section carefully before operating the engine. All operators, no matter how much experience they may have had, should read this and other related manuals before operating the engine or any equipment attached to it. It is the owner's obligation to instruct all operators in safe operation.

Be sure to observe the following for safe operation.

1. OBSERVE SAFETY INSTRUCTIONS

- Read and understand carefully this "OPERATOR'S MANUAL" and "LABELS ON THE ENGINE" before attempting to start and operate the engine.
- Learn how to operate and work safely. Know your equipments and its limitations. Always keep the engine in good condition.
- Before allowing other people to use your engine, explain how to operate and have them read this manual before operation.
- DO NOT modify the engine by yourself. UNAUTHORIZED MODIFICATIONS to the engine may impair the function and/or safety and affect engine life.



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2. WEAR SAFETY CLOTHING

- DO NOT wear loose, torn or bulky clothing around the machine that may catch on working controls and projections causing personal injury.
- Use additional safety items, e.g. hard hat, safety protection, gloves, etc., as appropriate or required.
- DO NOT operate machine or any equipment attached to it while under alcohol, medication, or other drugs, or while fatigued.
- DO NOT wear radio or music headphones while operating engine.



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3. CHECK BEFORE OPERATION & STARTING THE ENGINE

- Be sure to check the engine before operation. If something is wrong with the engine, do not fail to repair it quickly.
- Keep all guards and shields in place before operating the engine. Replace any that are damaged or missing.
- Check to see if there is a safe distance from the engine before starting.
- Always keep the engine at least 3 feet (1 meter) away from buildings and other facilities.
- DO NOT allow children or livestock to approach the machine while the engine is running.
- DO NOT start the engine by shorting across starter terminals. The machine may start in gear and move.



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4. KEEP AROUND THE ENGINE CLEAN

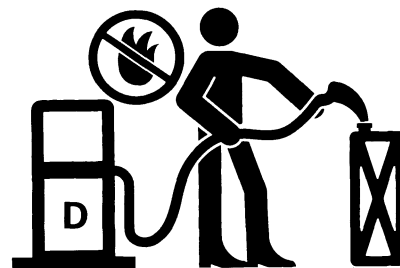
- Be sure to stop the engine before cleaning.
- Keep the engine clean and free of accumulated dirt, grease and trash to avoid a fire. Store flammable fluids away from sparks and fire.
- DO NOT stop the engine without idling; Temperatures around the engine rise suddenly. Keep the engine idling for over about 5 minutes before stopping.



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5. SAFE HANDLING OF FUEL AND LUBRICANTS -KEEP OFF FIRE-

- Always stop the engine before refueling or/and lubricating.
- DO NOT smoke or allow flames or sparks in your working area. Fuel is extremely flammable and explosive under certain conditions.
- Refuel at a well ventilated and open place. When fuel and lubricants are spilled, refuel after letting engine cool off.
- DO NOT mix gasoline or alcohol with diesel fuel. The mixture can cause a fire.



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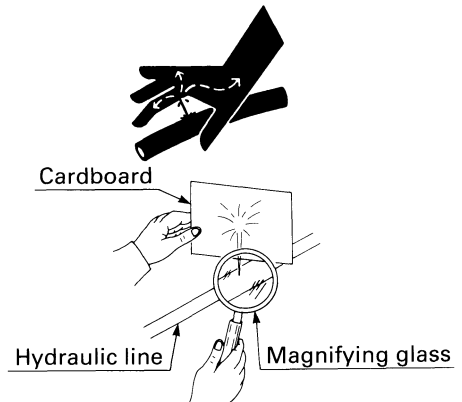
6. EXHAUST GASES & FIRE PREVENTION

- Engine exhaust fumes can be very harmful if allowed to accumulate. Be sure to run the engine in a well ventilated place and where there are no people or livestock near the engine.
- The exhaust gas from the muffler is very hot. To prevent a fire, do not expose dry grass, mowed grass, oil and any other combustible materials to exhaust gas. Also, keep the engine and muffler clean all the time.
- To avoid a fire, be alert for leaks of flammables from hoses and lines. Be sure to check for leaks from hoses or pipes, such as fuel and hydraulic by following the maintenance check list.
- To avoid a fire, do not short across power cables and wires. Check to see that all power cables and wirings are in good condition. Keep all power connections clean. Bare wire or frayed insulation can cause a dangerous electrical shock and personal injury.



7. ESCAPING FLUID

- Relieve all pressure in the air, the oil and the cooling systems before any lines, fittings or related items are removed or disconnected.
- Be alert for possible pressure when disconnecting any device from a system that utilizes pressure. DO NOT check for pressure leaks with your hand. High pressure oil or fuel can cause personal injury.
- Escaping hydraulic fluid under pressure has sufficient force to penetrate skin causing serious personal injury.
- Fluid escaping from pinholes may be invisible. Use a piece of cardboard or wood to search for suspected leaks: do not use hands and body. Use safety goggles or other eye protection when checking for leaks.
- If injured by escaping fluid, see a medical doctor immediately. This fluid can produce gangrene or severe allergic reaction.



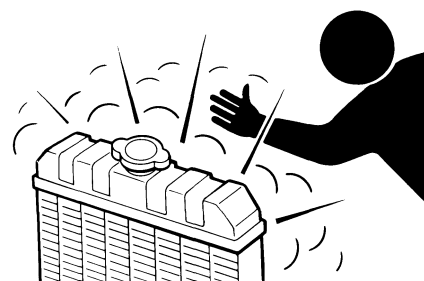
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8. CAUTIONS AGAINST BURNS & BATTERY EXPLOSION

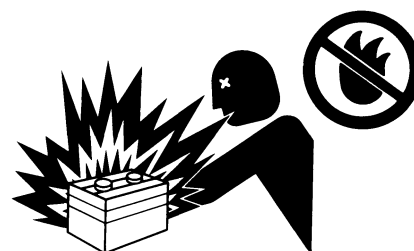
- To avoid burns, be alert for hot components, e.g. muffler, muffler cover, radiator, pipings, engine body, coolants, engine oil, etc. during operation and just after the engine has been shut off.
- DO NOT remove the radiator cap while the engine is running or immediately after stopping. Otherwise hot water will spout out from radiator. Wait for more than ten minutes to cool the radiator, before removing the cap.
- Make sure to shut the drain valve of coolant and oil to close pressure cap, to fasten pipe band before operating. If those parts are taken off, or loosen, it will result in serious personal injury.
- The battery presents an explosive hazard. When the battery is being activated, hydrogen and oxygen gases are extremely explosive.
- DO NOT use or charge the battery if its fluid level stands below the LOWER mark.
Otherwise, the component parts may deteriorate earlier than expected, which may shorten the service life or cause an explosion. Immediately, add distilled water until the fluid level is between the UPPER and LOWER levels.
- Keep sparks and open flames away from the battery, especially when charging the battery. DO NOT strike a match near the battery.
- DO NOT check battery charge by placing a metal object across the terminals. Use a voltmeter or hydrometer.
- DO NOT charge battery if frozen. It can be explosive. When frozen, warm the battery up more than 16°C (61°F).



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9. HANDS AND BODY AWAY FROM THE ROTATING PARTS

- Be sure to stop the engine before checking or adjusting belt tension and cooling fan.
- Keep your hands and body away from the rotating parts, such as cooling fan, V-belt, fan drive V-belt, pulley or flywheel causing personal injury.
- DO NOT run the engine with installed safety guards detached. Install safety guards securely during operation.



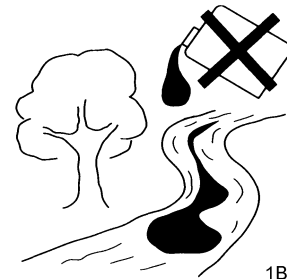
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10. ANTI-FREEZE & DISPOSAL OF FLUIDS

- Anti-freeze contains poison. Wear rubber gloves to avoid personal injury. In case of contact with skin, wash it off immediately.
- DO NOT mix different types of Anti-freeze. The mixture can produce chemical reaction causing harmful substances. Use approved or genuine KUBOTA Anti-freeze.
- Be mindful of the environment and the ecology. Before draining any fluids, find out the correct way of disposing of them. Observe the relevant environmental protection regulations when disposing of oil, fuel, coolant, brake fluid, filters and batteries.
- When draining fluids from the engine, place some container underneath the engine body.
- DO NOT pour waste onto the grounds, down a drain, or into any water source.



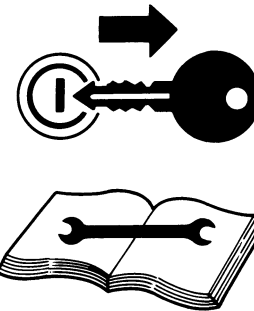
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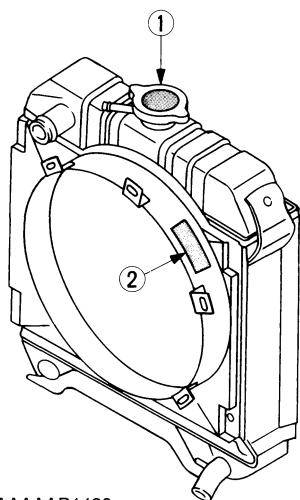
11. CONDUCTING SAFETY CHECKS & MAINTENANCE

- When checking engine or servicing, place the engine on a wide and level ground. DO NOT work on anything that is supported ONLY by lift jacks or a hoist. Always use blocks or correct stands to support the engine before servicing.
- Detach the battery from the engine before conducting service. Put a "DO NOT OPERATE!" tag in the key switch to avoid accidental starting.
- To avoid sparks from an accidental short circuit always disconnect the battery's ground cable (-) first and connect it last.
- Be sure to stop the engine and remove the key when conducting daily and periodic maintenance, servicing and cleaning.
- Check or conduct maintenance after the engine, coolant, muffler, or muffler cover have been cooled off completely.
- Always use the appropriate tools and jig-fixture in good condition when performing any service work. Make sure you understand how to use them before service.
- Use ONLY correct engine barring techniques for manually rotating the engine. DO NOT attempt to rotate the engine by pulling or prying on the cooling fan and V-belt. This practise can cause serious personal injury or premature machine damage to the cooling fan.
- Replace fuel pipes and lubricant pipes with their hose clamps every 2 years or earlier whether they are damaged or not. They are made of rubber and are aged gradually.
- When servicing is performed together by two or more persons, take care to perform all work safely.
- Keep first aid kit and fire extinguisher handy at all times.



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12. WARNING AND CAUTION LABELS



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- ① Part No.19077-8724-1 or 16667-8724-1
(55mm in diameter) (37mm in diameter)



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- ② Part No.TA040-4957-1
Stay clear of engine fan and fan belt



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13. CARE OF WARNING AND CAUTION LABELS

1. Keep warning and caution labels clean and free from obstructing material.
2. Clean warning and caution labels with soap and water, dry with a soft cloth.
3. Replace damaged or missing warning and caution labels with new labels from your local KUBOTA dealer.
4. If a component with warning and caution label(s) affixed is replaced with new part, make sure new label(s) is (are) attached in the same location(s) as the replaced component.
5. Mount new warning and caution labels by applying on a clean dry surface and pressing any bubbles to outside edge.

SERVICING OF THE ENGINE

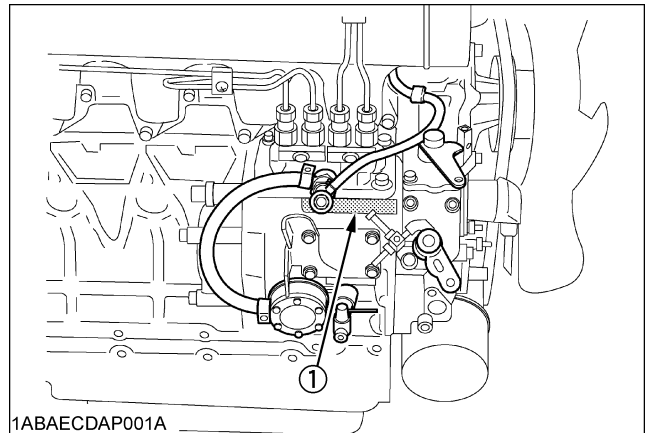
Your dealer is interested in your new engine and has the desire to help you get the most value from it. After reading this manual thoroughly, you will find that you can do some of the regular maintenance yourself.

However, when in need of parts or major service, be sure to see your KUBOTA dealer.

For service, contact the KUBOTA Dealership from which you purchased your engine or your local KUBOTA dealer. When in need of parts, be prepared to give your dealer the engine serial number.

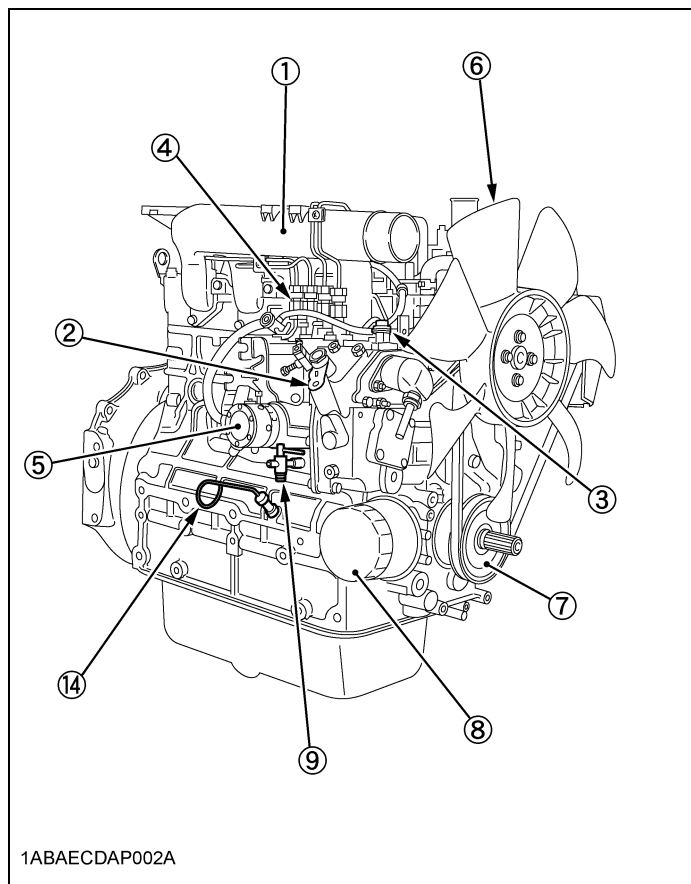
Locate the serial number now and record them in the space provided.

	Type	Serial No.
Engine		
Date of Purchase		
Name of Dealer		
(To be filled in by purchaser)		

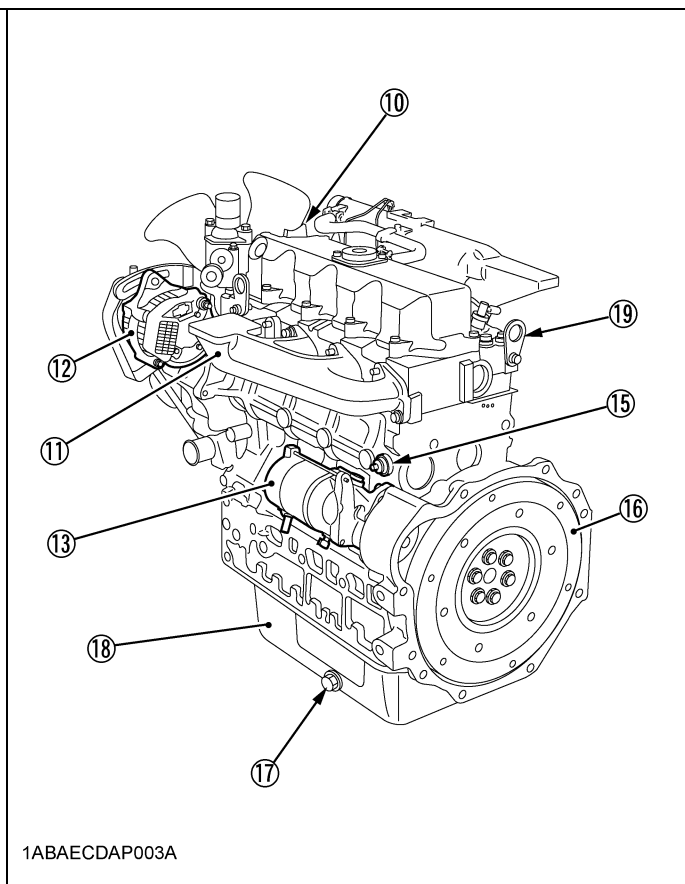


(1) Engine serial number

NAMES OF PARTS



- (1) Intake manifold
- (2) Speed control lever
- (3) Engine stop lever
- (4) Injection pump
- (5) Fuel feed pump
- (6) Cooling fan
- (7) Fan drive pulley
- (8) Oil filter cartridge
- (9) Water drain cock



- (10) Oil filler plug
- (11) Exhaust manifold
- (12) Alternator
- (13) Starter
- (14) Oil level gauge
- (15) Oil pressure switch
- (16) Flywheel
- (17) Oil drain plug
- (18) Oil pan
- (19) Engine hook

PRE-OPERATION CHECK

BREAK-IN

During the engine break-in period, observe the following by all means:

1. Change engine oil and oil filter cartridge after the first 50 hours of operation (See "ENGINE OIL" in Periodic Service Section).
2. When ambient temperature is low, operate the machine after the engine has been completely warmed up.

DAILY CHECK

To prevent trouble from occurring, it is important to know the conditions of the engine well. Check it before starting.



CAUTION

To avoid personal injury:

- Be sure to install shields and safeguards attached to the engine when operating.
- Stop the engine at a flat and wide space when checking.
- Keep dust or fuel away from the battery, wiring, muffler and engine to prevent a fire. Check and clear them before operating everyday. Pay attention to the heat of the exhaust pipe or exhaust gas so that it can not ignite trash.

Item		Ref. page
1. Parts which had trouble in previous operation		-
2. By walking around the machine	(1) Oil or water leaks	14 to 19
	(2) Engine oil level and contamination	14,15
	(3) Amount of fuel	11
	(4) Amount of coolant	17 to 19
	(5) Dust in air cleaner dust cup	20,20
	(6) Damaged parts and loosened bolts and nuts	-
3. By inserting the key into the starter switch	(1) Proper functions of meters and pilot lamps; no stains on these parts	-
	(2) Proper function of glow lamp timer	-
4. By starting the engine	(1) Color of exhaust fumes	7
	(2) Unusual engine noise	7

OPERATING THE ENGINE

STARTING THE ENGINE(NORMAL)



CAUTION

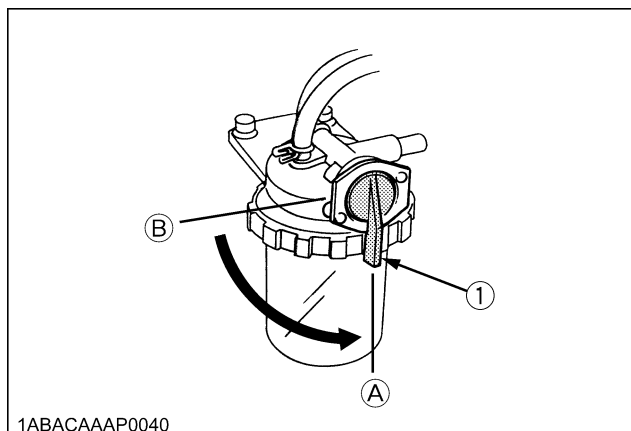
To avoid personal injury:

- Do not allow children to approach the machine while the engine is running.
- Be sure to install the machine on which the engine is installed, on a flat place.
- Do not run the engine on gradients.
- Do not run the engine in an enclosed area. Exhaust gas can cause air pollution and exhaust gas poisoning.
- Keep your hands away from rotating parts (such as fan, pulley, belt, flywheel etc.) during operation.
- Do not operate the machine while under the influence of alcohol or drugs.
- Do not wear loose, torn or bulky clothing around the machine. It may catch on moving parts or controls, leading to the risk of accident. Use additional safety items, e.g. hard hat, safety boots or shoes, eye and hearing protection, gloves, etc., as appropriate or required.
- Do not wear radio or music headphones while operating engine.
- Check to see if it is safe around the engine before starting.
- Reinstall safeguards and shields securely and clear all maintenance tools when starting the engine after maintenance.

IMPORTANT :

- Do not use ether or any starting fluid for starting the engine, or a severe damage will occur.
- When starting the engine after a long storage (of more than 3 months), first set the stop lever to the "STOP" position and then activate the starter for about 10 seconds to allow oil to reach every engine part.

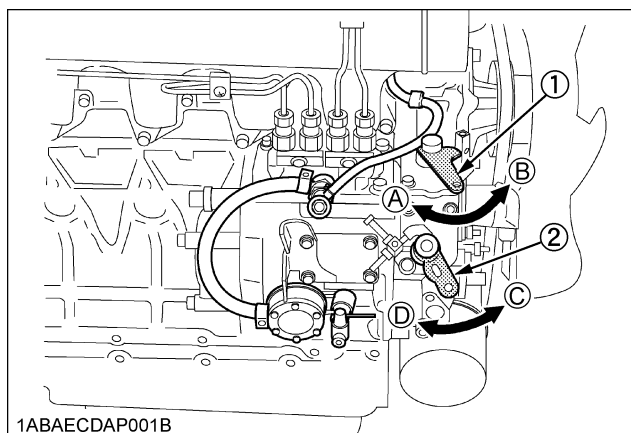
1. Set the fuel lever to the "ON" position.



(1) Fuel lever

(A) "ON"
(B) "OFF"

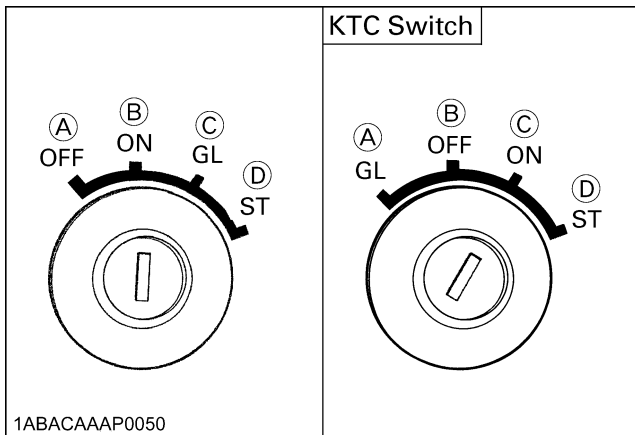
2. Place the engine stop lever to the "START" position.
3. Place the speed control lever at more than half "OPERATION".



(1) Engine stop lever
(2) Speed Control lever

(A) "STOP"
(B) "START"
(C) "IDLING"
(D) "OPERATION"

4. Insert the key into the key switch and turn it to the "OPERATION" position.



- (A) "OFF" SWITCHED OFF
(B) "ON" OPERATION
(C) "PREHEAT"
(D) "START"

- (A) "PREHEAT"
(B) "OFF" SWITCHED OFF
(C) "ON" OPERATION
(D) "START"

5. Turn the starter switch to the "PREHEAT" position to allow the glow lamp to redden.

NOTE :

(with lamp timer in use)

- The glow lamp goes out in about 5 seconds when the lamp timer is up. Refer to this for pre-heating. Even with the glow lamp off, the glow plug can be pre-heated by turning the starter switch to the "PREHEAT" position.

6. Turn the key to the "START" position and the engine should start. Release the key immediately when the engine starts.

- 7. Check to see that the oil pressure lamp and charge lamp are off. If the lamps are still on, immediately stop the engine, and determine the cause.**
(See "CHECKS DURING OPERATION" in Operating the Engine Section)

NOTE :

- If the oil pressure lamp should be still on, immediately stop the engine and check;
 - if there is enough engine oil.
 - if the engine oil has dirt in it.
 - if the wiring is faulty.

8. Warm up the engine at medium speed without load.

IMPORTANT :

- If the glow lamp should redden too quickly or too slowly, immediately ask your KUBOTA dealer to check and repair it.
- If the engine does not catch or start at 10 seconds after the starter switch is set at "START" position, wait for another 30 seconds and then begin the engine starting sequence again. Do not allow the starter motor to run continuously for more than 20 seconds.

COLD WEATHER STARTING

If the ambient temperature is below -5°C (23°F)* and the engine is very cold, start it in the following manner:

Take steps (1) through (4) above.

5. Turn the key to the "PREHEAT" position and keep it there for a certain period mentioned below.

IMPORTANT :

- Shown below are the standard preheating times for various temperatures. This operation, however, is not required, when the engine is warmed up.

Ambient temperature	Preheating time
Above 10°C (50°F)	NO NEED
10°C (50°F) to -5°C (23°F)	Approx. 5 seconds
*Below -5°C (23°F)	Approx. 10 seconds
Limit of continuous use	20 seconds

6. Turn the key to the "START" position and the engine should start.

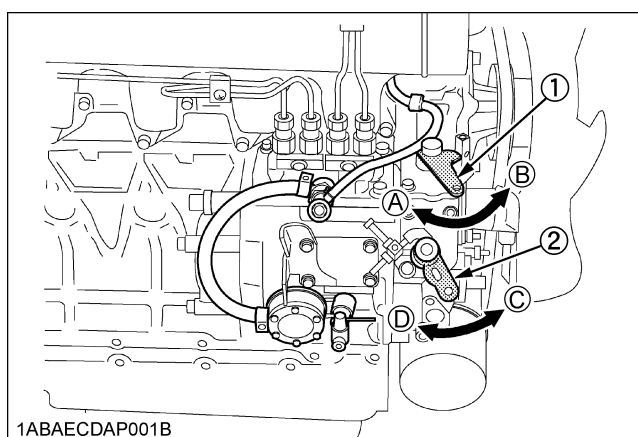
(If the engine fails to start after 10 seconds, turn off the key for 5 to 30 seconds. Then repeat steps (5) and (6).)

IMPORTANT :

- Do not allow the starter motor to run continuously for more than 20 seconds.
- Be sure to warm up the engine, not only in winter, but also in warmer seasons. An insufficiently warmed-up engine can shorten its service life.
- When there is fear of temperature dropping below -15°C (5°F) detach the battery from the machine, and keep it indoors in a safe area, to be reinstalled just before the next operation.

STOPPING THE ENGINE

1. Return the speed control lever to low idle, and run the engine under idling conditions.
2. Set the engine stop lever to the "STOP" position.
3. With the starter switch placed to the "SWITCHED OFF" position, remove the key. (Be sure to return the engine stop lever to the "START" position to be ready for the next start.)



- (1) Engine stop lever
(2) Speed control lever

- (A) "STOP"
(B) "START"
(C) "IDLING"
(D) "OPERATION"

IMPORTANT :

- If equipped with a turbo-charger, allow the engine to idle for 5 minutes before shutting it off after a full load operation.
Failure to do so may lead to turbo-charger trouble.

CHECKS DURING OPERATION

While running, make the following checks to see that all parts are working correctly.

■ Radiator Cooling water(Coolant)



WARNING

To avoid personal injury:

- Do not remove radiator cap until coolant temperature is well below its boiling point. Then loosen cap slightly to the stop position, to relieve any pressure, before removing cap completely.

When the engine overheats and hot coolant overflows through the radiator and hoses, stop the engine immediately and make the following checks to determine the cause of trouble:

Check item

1. Check to see if there is any coolant leak;
2. Check to see if there is any obstacle around the cooling air inlet or outlet;
3. Check to see if there is any dirt or dust between radiator fins and tube;
4. Check to see if the fan belt is too loose;
5. Check to see if radiator water pipe is clogged; and
6. Check to see if anti-freeze is mixed to a 50/50% mix of water and anti-freeze.

■ Oil pressure lamp

The lamp lights up to warn the operator that the engine oil pressure has dropped below the prescribed level. If this should happen during operation or should not go off even after the engine is accelerated more than 1000rpm, immediately stop the engine and check the following:

1. Engine oil level (See "ENGINE OIL" in Maintenance Section).
2. Lubricant system (See "ENGINE OIL" in Maintenance Section).

■Fuel



CAUTION

To avoid personal injury:

- Fluid escaping from pinholes may be invisible. Do not use hands to search for suspected leaks; Use a piece of cardboard or wood, instead. If injured by escaping fluid, see a medical doctor at once. This fluid can produce gangrene or a severe allergic reaction.
- Check any leaks from fuel pipes or fuel injection pipes. Use eye protection when checking for leaks.

Be careful not to empty the fuel tank. Otherwise air may enter the fuel system, requiring fuel system bleeding. (See "FUEL" in Maintenance Section).

■Color of exhaust

While the engine is run within the rated output range:

- The color of exhaust remains colorless.
- If the output slightly exceeds the rated level, exhaust may become a little colored with the output level kept constant.
- If the engine is run continuously with dark exhaust emission, it may lead to trouble with the engine.

■Immediately stop the engine if;

- The engine suddenly slow down or accelerates.
- Unusual noises suddenly appear.
- Exhaust fumes suddenly become very dark.
- The oil pressure lamp or the water temperature alarm lamp lights up.

REVERSED ENGINE REVOLUTION AND REMEDIES



CAUTION

To avoid personal injury:

- Reversed engine operation can make the machine reverse and run it backwards. It may lead to serious trouble.
- Reversed engine operation may make exhaust gas gush out into the intake side and ignite the air cleaner; It could catch fire.

Reversed engine revolution must be stopped immediately since engine oil circulation is cut quickly, leading to serious trouble.

■How to tell when the engine starts running backwards

1. Lubricating oil pressure drops sharply. Oil pressure warning light, if used, will light.
2. Since the intake and exhaust sides are reversed, the sound of the engine changes, and exhaust gas will come out of the air cleaner.
3. A louder knocking sound will be heard when the engine starts running backwards.

■Remedies

1. Immediately set the engine stop lever to the "STOP" position to stop the engine.
2. After stopping the engine, check the air cleaner, intake rubber tube and other parts and replace parts as needed.

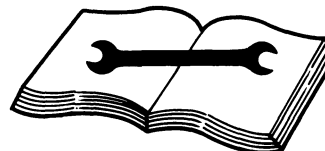
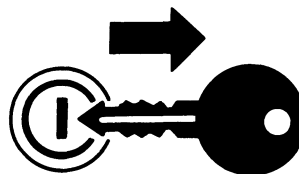
MAINTENANCE



CAUTION

To avoid personal injury:

- Be sure to conduct daily checks, periodic maintenance, refueling or cleaning on a level surface with the engine shut off and remove the key.
- Before allowing other people to use your engine, explain how to operate, and have them read this manual before operation.
- When cleaning any parts, do not use gasoline but use regular cleanser.
- Always use proper tools, that are in good condition. Make sure you understand how to use them, before performing any service work.
- When installing, be sure to tighten all bolts lest they should be loose. Tighten the bolts by the specified torque.
- Do not put any tools on the battery, or battery terminals may short out. Severe burns or fire could result. Detach the battery from the engine before maintenance.
- Do not touch muffler or exhaust pipes while they are hot; Severe burns could result.



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SERVICE INTERVALS

Observe the following for service and maintenance.

The lubricating oil change intervals listed in the table below are for Classes CF, CE and CD lubricating oils of API classification with a low-sulfur fuel in use. If the CF-4 or CG-4 lubricating oil is used with a high-sulfur fuel, change the lubricating oil at shorter intervals than recommended in the table below depending on the operating condition.

Interval	Item	Ref.page		
Every 50 hours	Check of fuel pipes and clamp bands	13		@
See NOTE	Change of engine oil (depending on the oil pan)	14 to 16	◎	
Every 100 hours	Cleaning of air cleaner element	20,20	*1	@
	Cleaning of fuel filter	13		
	Check of battery electrolyte level	21,22		
	Check of fan belt tightness	23		
Every 200 hours	Check of radiator hoses and clamp bands	18		
	Replacement of oil filter cartridge, using standard oil pan	16	◎	
	Check of intake air line	-		@
Every 400 hours	Replacement of oil filter cartridge, using standard oil pan	16	◎	
	Replacement of fuel filter cartridge	14		@
Every 500 hours	Removal of sediment in fuel tank	-		
	Cleaning of water jacket (radiator interior)	17 to 19		
	Replacement of fan belt	23		
Every one or two months	Recharging of battery	21,22		
Every year	Replacement of air cleaner element	20	*2	@
Every 800 hours	Check of valve clearance	25		
Every 1500 hours	Check of fuel injection nozzle injection pressure	-	*3	@
Every 3000 hours	Check of turbo charger	-	*3	@
	Check of injection pump	-	*3	@
Every two years	Change of radiator coolant (L.L.C.)	17 to 19		
	Replacement of battery	21,22		
	Replacement of radiator hoses and clamp bands	18		
	Replacement of fuel pipes and clamp bands	13	*3	@
	Replacement of intake air line	-	*4	@

IMPORTANT :

- The jobs indicated by ◎ must be done after the first 50 hours of operation.
 - *1 Air cleaner should be cleaned more often in dusty conditions than in normal conditions.
 - *2 After 6 times of cleaning.
 - *3 Consult your local KUBOTA Dealer for this service.
 - *4 Replace only if necessary.
 - When the battery is used for less than 100 hours in a year, check its electrolyte yearly. (for refillable battery's only)
 - The items listed above (@ marked) are registered as emission related critical parts by KUBOTA in the U.S. EPA nonroad emission regulation. As the engine owner, you are responsible for the performance of the required maintenance on the engine according to the above instruction.
- Please see the Warranty Statement in detail.

NOTE :● **Changing interval of engine oil**

Models	*Oil pan depth	
	124 mm (4.88 in.)	*90 mm (3.54 in.)
V2203-M-DI-E V2003-M-DI-T-E V2403-M-DI-E	400 Hrs	200 Hrs
Initial	50 Hrs	

* 90 mm (3.54 in.) oil pan depth is optional.

**Standard replacement interval

- API service classification: above CD grade
- Ambient temperature: below 35° C (95° F)

NOTE :**Lubricating oil**

With the emission control now in effect, the CF-4 and CG-4 lubricating oils have been developed for use of a low-sulfur fuel on on-road vehicle engines. When an off-road vehicle engine runs on a high-sulfur fuel, it is advisable to employ the CF, CD or CE lubricating oil with a high total base number. If the CF-4 or CG-4 lubricating oil is used with a high-sulfur fuel, change the lubricating oil at shorter intervals.

- **Lubricating oil recommended when a low-sulfur or high-sulfur fuel is employed.**

○ : Recommendable X : Not recommendable

Lubricating oil class	Fuel		Remarks
	Low-sulfur	High-sulfur	
CF	○	○	TBN ≥ 10
CF-4	○	X	
CG-4	○	X	

PERIODIC SERVICE

FUEL

Fuel is flammable and can be dangerous. You should handle fuel with care.



CAUTION

To avoid personal injury:

- Do not mix gasoline or alcohol with diesel fuel. This mixture can cause an explosion.
- Be careful not to spill fuel during refueling. If fuel should spill, wipe it off at once, or it may cause a fire.
- Do not fail to stop the engine before refueling. Keep the engine away from the fire.
- Be sure to stop the engine while refueling or bleeding and when cleaning or changing fuel filter or fuel pipes. Do not smoke when working around the battery or when refueling.
- Check the above fuel systems at a well ventilated and wide place.
- When fuel and lubricant are spilled, refuel after letting the engine cool off.
- Always keep spilled fuel and lubricant away from engine.

Fuel level check and refueling

1. Check to see that the fuel level is above the lower limit of the fuel level gauge.
2. If the fuel is too low, add fuel to the upper limit. Do not overfill.

No.2-D is a distillate fuel oil of lower volatility for engines in industrial and heavy mobile service.

(SAE J313 JUN87)

Grade of Diesel Fuel Oil According to ASTM D975

Flash Point, °C (°F)	Water and Sediment, volume %	Carbon Residue on, 10 percent Residuum, %	Ash, weight %
Min	Max	Max	Max
52 (125)	0.05	0.35	0.01

Distillation Temperatures, °C (°F) 90% Point		Viscosity Kinematic cSt or mm ² /s at 40°C		Viscosity Saybolt, SUS at 37.8°C (100°F)	
Min	Max	Min	Max	Min	Max
282 (540)	338 (640)	1.9	4.1	32.6	40.1

Sulfur, weight %	Copper Strip Corrosion	Cetane Number
Max	Max	Min
0.50	No. 3	40

The cetane number is required not to be less than 45.

IMPORTANT :

- Be sure to use a strainer when filling the fuel tank, or dirt or sand in the fuel may cause trouble in the fuel injection pump.
- For fuel, always use diesel fuel. You are required not to use alternative fuel, because its quality is unknown or it may be inferior in quality. Kerosene, which is very low in cetane rating, adversely affects the engine. Diesel fuel differs in grades depending on the temperature.
- Be careful not to let the fuel tank become empty, or air can enter the fuel system, necessitating bleeding before next engine start.

■ Air bleeding the fuel system



CAUTION

To avoid personal injury;

- Do not bleed a hot engine as this could cause fuel to spill onto a hot exhaust manifold creating a danger of fire.

Air bleeding of the fuel system is required if;

- after the fuel filter and pipes have been detached and refitted;
- after the fuel tank has become empty; or
- before the engine is to be used after a long storage.

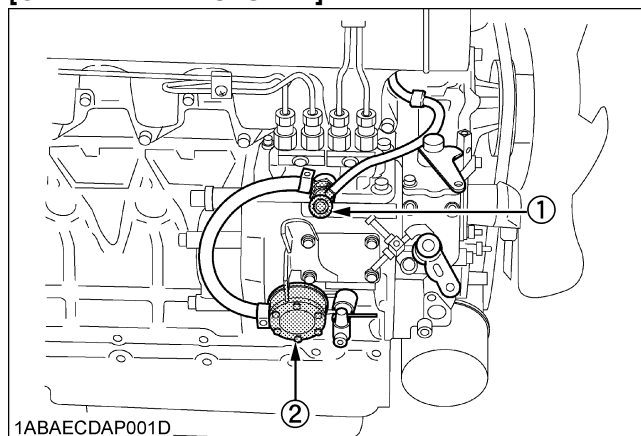
[PROCEDURE (A)] (gravity feed fuel tanks only)

1. Fill the fuel tank to the fullest extent. Open the fuel filter lever.
2. Open the air vent cock on top of the fuel injection pump.
3. Turn the engine, continue it for about 10 seconds, then stop it, or move the fuel feed pump lever by hand (optional).
4. Close the air vent cock on top of the fuel injection pump.

IMPORTANT :

- Always keep the air vent cock on the fuel injection pump closed except when air is vented, or it may cause the engine to stop.

[GRAVITY FEED SYSTEM]



- (1) Air vent cock
- (2) Fuel feed pump

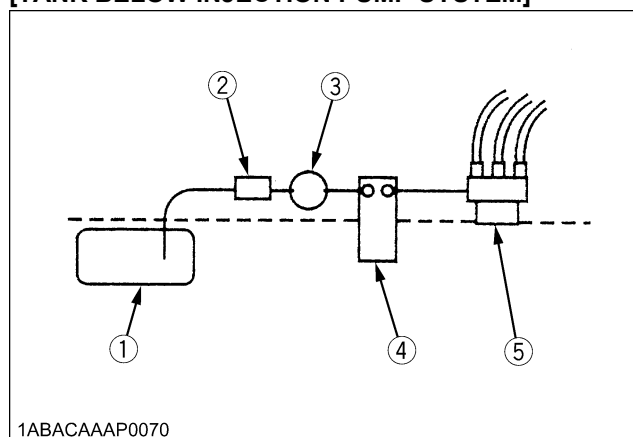
[PROCEDURE (B)] (fuel tanks lower than injection pump)

1. For fuel tanks that are lower than the injection pump. The fuel system must be pressurized by the fuel system electric fuel pump.
2. If an electric fuel pump is not used, you must manually actuate the pump by lever to bleed.
3. The primary fuel filter must be on the pressure side of the pump if the fuel tank is lower than the injection pump.
4. To bleed, follow (2) through (4) above.

IMPORTANT :

- Tighten air vent plug of the fuel injection pump except when bleeding, or it may stop the engine suddenly.

[TANK BELOW INJECTION PUMP SYSTEM]



- (1) Fuel tank below injection pump
- (2) Pre-filter
- (3) Electric or Mechanical pump
- (4) Main Filter
- (5) Injection pump

■ Checking the fuel pipes



CAUTION

To avoid personal injury;

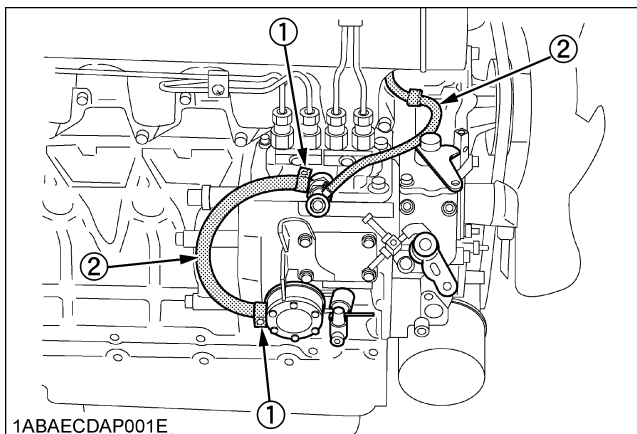
- Check or replace the fuel pipes after stopping the engine. Broken fuel pipes can cause fires.

Check the fuel pipes every 50 hours of operation. When if;

1. If the clamp band is loose, apply oil to the screw of the band, and tighten the band securely.
2. If the fuel pipes, made of rubber, became worn out, replace them and clamp bands every 2 years.
3. If the fuel pipes and clamp bands are found worn or damaged before 2 years' time, replace or repair them at once.
4. After replacement of the pipes and bands, air-bleed the fuel system.

IMPORTANT :

- When the fuel pipes are not installed, plug them at both ends with clean cloth or paper to prevent dirt from entering. Dirt in the pipes can cause fuel injection pump malfunction.

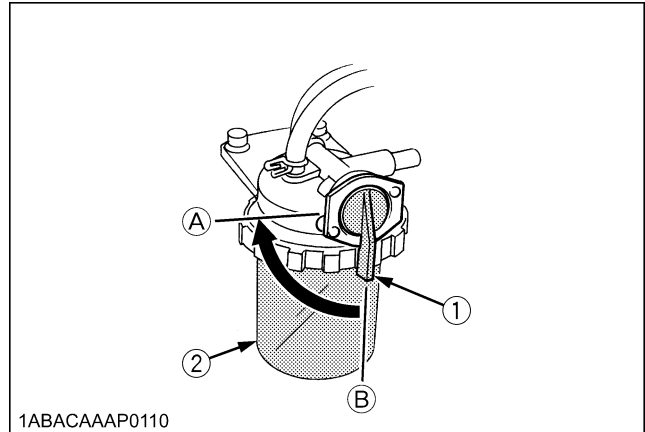


- (1) Clamp band
(2) Fuel pipe

■ Cleaning the fuel filter pot

Every 100 hours of operation, clean the fuel filter in a clean place to prevent dust intrusion.

1. Close the fuel filter lever.

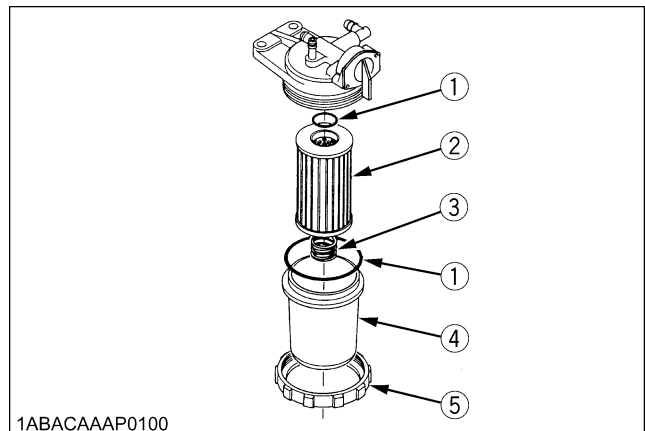


- (1) Fuel filter lever (A) "OFF"
(2) Fuel filter pot (B) "ON"

2. Remove the top cap, and rinse the inside with diesel fuel.
3. Take out the element, and rinse it with diesel fuel.
4. After cleaning, reinstall the fuel filter, keeping out of dust and dirt.
5. Air-bleed the injection pump.

IMPORTANT :

- Entrance of dust and dirt can cause a malfunction of the fuel injection pump and the injection nozzle. Wash the fuel filter cup periodically.



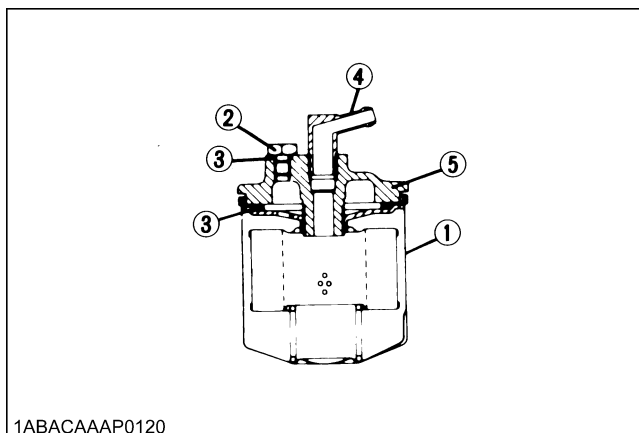
- (1) O ring
(2) Filter element
(3) Spring
(4) Filter bowl
(5) Screw ring

■ Fuel filter cartridge replacement

1. Replace the fuel filter cartridge with a new one every 400 operating hours.
2. Apply fuel oil thinly over the gasket and tighten the cartridge into position by hand-tightening only.
3. Finally, vent the air.

IMPORTANT :

- Replace the fuel filter cartridge periodically to prevent wear of the fuel injection pump plunger or the injection nozzle, due to dirt in the fuel.



- (1) Fuel filter cartridge
(2) Air vent plug
(3) O ring
(4) Pipe joint
(5) Cover

ENGINE OIL



CAUTION

To avoid personal injury:

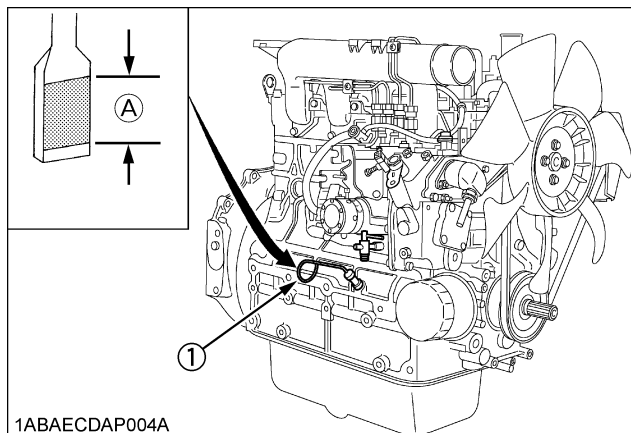
- Be sure to stop the engine before checking and changing the engine oil and the oil filter cartridge.
- Do not touch muffler or exhaust pipes while they are hot; Severe burns could result. Always stop the engine and allow it to cool before conducting inspections, maintenance, or for a cleaning procedure.
- Contact with engine oil can damage your skin. Put on gloves when using engine oil. If you come in contact with engine oil, wash it off immediately.

NOTE :

- Be sure to inspect the engine, locating it on a level place. If placed on gradients accurately, oil quantity may not be measured.

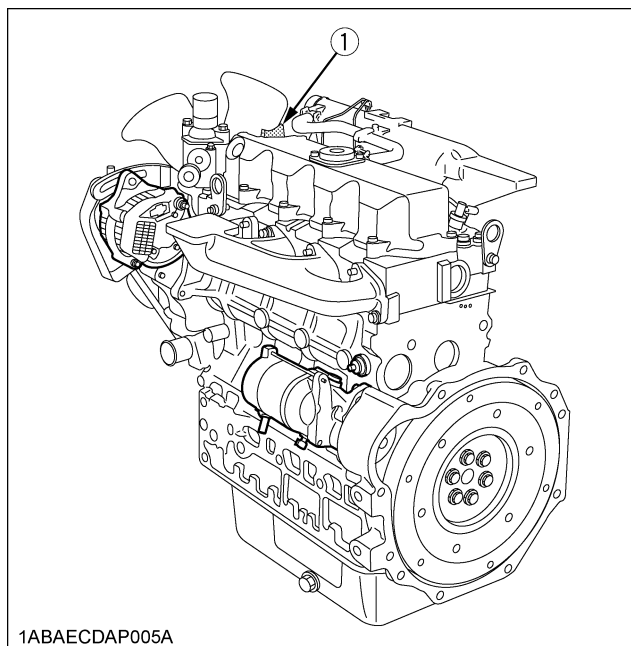
■ Checking oil level and adding engine oil

1. Check the engine oil level before starting or more than 5 minutes after stopping the engine.
2. Remove the oil level gauge, wipe it clean and reinstall it.
3. Take the oil level gauge out again, and check the oil level.



(1) Oil level gauge

[Lower end of oil level gauge]
(A) Engine oil level within this range is proper.



4. If the oil level is too low, remove the oil filler plug, and add new oil to the prescribed level.
5. After adding oil, wait more than 5 minutes and check the oil level again. It takes some time for the oil to drain down to the oil pan.

Engine oil quantity

Model	Oil pan depth	
	124 mm (4.88 in.)	*90 mm (3.54 in.)
V2203-M-DI-E V2003-M-DI-T-E V2403-M-DI-E	9.5 L (2.51 U.S.gals.)	7.6 L (2.01 U.S.gals.)

* 90mm(3.54in.) oil pan depth is optional.

Oil quantities shown are for standard oil pans.

IMPORTANT :

- Engine oil should be MIL-L-2104C or have properties of API classification CD grades or higher.
Change the type of engine oil according to the ambient temperature.

above 25° C(77° F)	SAE30 or SAE10W-30 SAE10W-40
0° C to 25° C(32° F to 77° F)	SAE20 or SAE10W-30 SAE10W-40
below 0° C(32° F)	SAE10W or SAE10W-30 SAE10W-40

- When using oil of different brands from the previous one, be sure to drain all the previous oil before adding the new engine oil.

Changing engine oil



CAUTION

To avoid personal injury:

- Be sure to stop the engine before draining engine oil.
- When draining engine oil, place some container underneath the engine and dispose it according to local regulations.
- Do not drain oil after running the engine. Allow engine to cool down sufficiently.

1. Change oil after the initial 50 hours of operation and every 200 hours thereafter. (See table below.)

NOTE :

- Changing interval thereafter

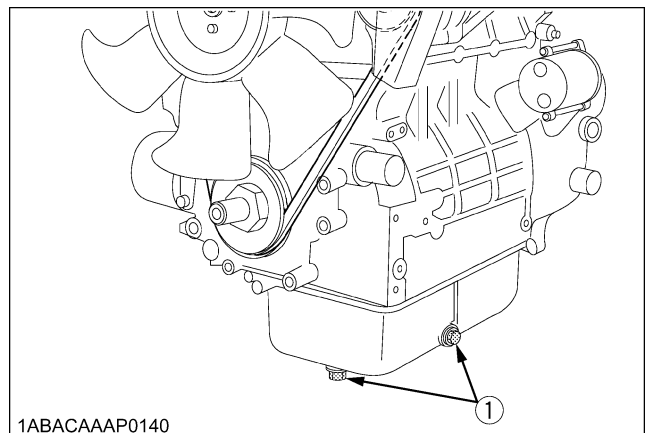
Models	Oil pan depth	
	124 mm (4.88in.)	*90 mm (3.54in.)
V2203-M-DI-E V2003-M-DI-T-E V2403-M-DI-E	400 Hrs	200 Hrs
Initial	50 Hrs	

* 90mm(3.54 in) oil pan depth is optional.

**Standard replacement interval

- API service classification:above CD grade
- Ambient temperature:below 35 °C (95 °F)

2. Remove the drain plug at the bottom of the engine, and drain all the old oil. Drain oil will drain easier when the oil is warm.



1ABACAAAP0140

(1) Oil drain plug

3. Add new engine oil up to the upper limit of the oil level gauge.

■Replacing the oil filter cartridge

⚠ CAUTION

To avoid personal injury:

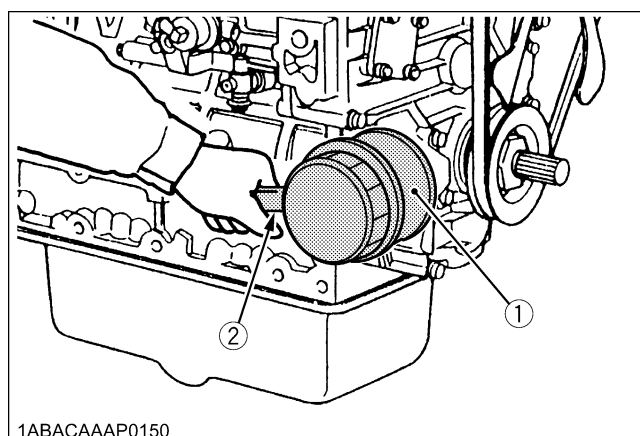
- Be sure to stop the engine before changing the oil filter cartridge.
- Allow engine to cool down sufficiently, oil can be hot and cause burns.

1. Replace the oil filter cartridge. Oil filter cartridge should be replaced, as following operation hours.

Models	Oil pan depth	
	124 mm (4.88in.)	*90 mm (3.54in.)
V2203-M-DI-E V2003-M-DI-T-E V2403-M-DI-E	400 Hrs	200 Hrs
Initial	50 Hrs	

* 90mm(3.54in.) oil pan depth is optional.

2. Remove the old oil filter cartridge with a filter wrench.
3. Apply a film of oil to the gasket for the new cartridge.
4. Screw in the cartridge by hand. When the gasket contacts the seal surface, tighten the cartridge enough by hand. Because, if you tighten the cartridge with a wrench, it will be tightened too much.



1ABACAAAP0150

- (1) Oil filter cartridge
- (2) Remove with a filter wrench
(Tighten with your hand)

5. After the new cartridge has been replaced, the engine oil level normally decreases a little. Thus, run the engine for a while and check for oil leaks through the seal before checking the engine oil level. Add oil if necessary.

NOTE :

- Wipe off any oil sticking to the machine completely.

RADIATOR

Coolant will last for one day's work if filled all the way up before operation start. Make it a rule to check the coolant level before every operation.

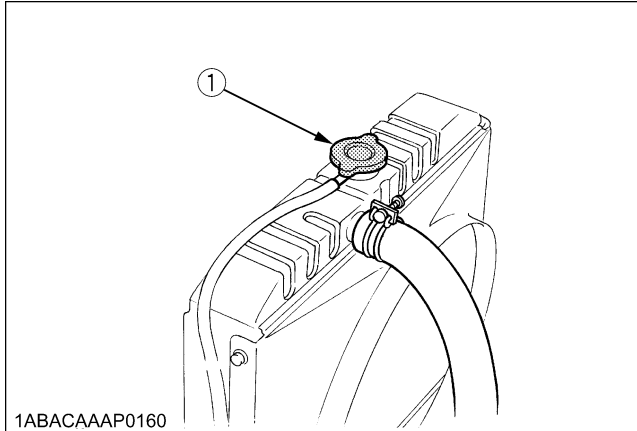
⚠ WARNING

To avoid personal injury:

- Do not stop the engine suddenly, stop it after about 5 minutes of unloaded idling.
- Work only after letting the engine and radiator cool off completely (more than 30 minutes after it has been stopped).
- Do not remove the radiator cap while coolant is hot. When cool to the touch, rotate cap to the first stop to allow excess pressure to escape. Then remove cap completely. If overheats should occur, steam may gush out from the radiator or reserve tank; Severe burns could result.

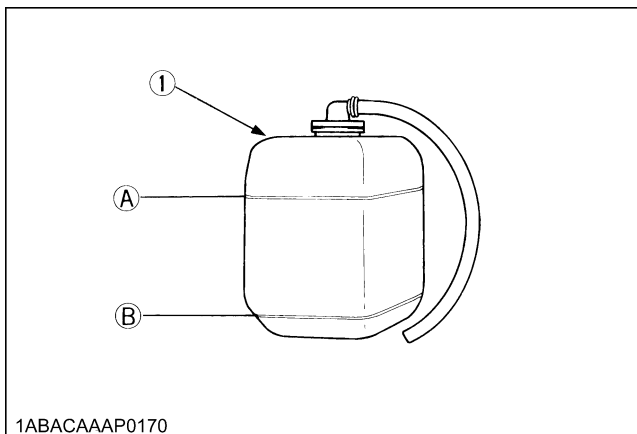
■Checking coolant level, adding coolant

1. Remove the radiator cap, after the engine has completely cooled, and check to see that coolant reaches the supply port.



(1) Radiator pressure cap

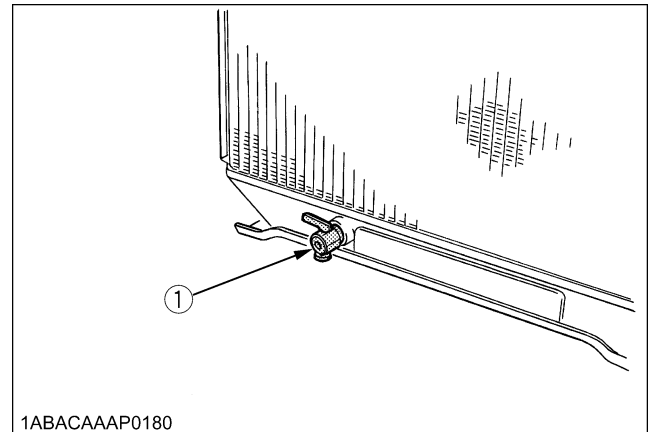
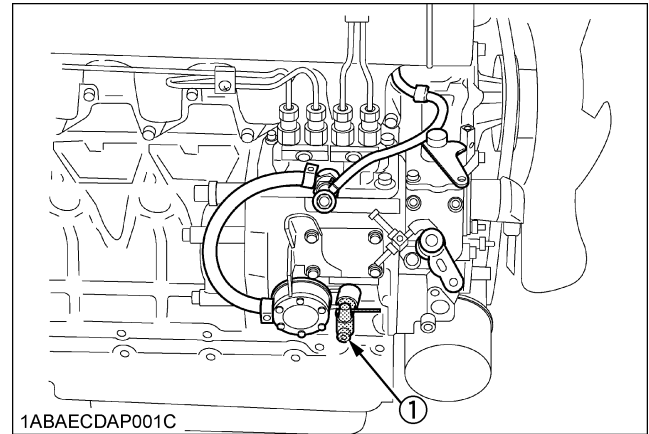
2. If the radiator is provided with a reserve tank, check the coolant level of the reserve tank. When it is between the "FULL" and "LOW" marks, the coolant will last for one day's work.



(1) Reserve tank

(A) "FULL"
(B) "LOW"

3. When the coolant level drops due to evaporation, add water only up to the full level.
4. Check to see that two drain cocks; one is at the crankcase side and the other is at the lower part of the radiator as figures below.



(1) Coolant drain cock

IMPORTANT :

- If the radiator cap has to be removed, follow the caution and securely retighten the cap.
- If coolant should be leak, consult your local KUBOTA dealer.
- Make sure that muddy or sea water does not enter the radiator.
- Use clean, fresh water and 50% anti-freeze to fill the recovery tank.
- Do not refill reserve tank with coolant over the "FULL" level mark.
- Be sure to close the radiator cap securely. If the cap is loose or improperly closed, coolant may leak out and decrease quickly.

■ Changing coolant

1. To drain coolant, always open both drain cocks and simultaneously open the radiator cap as well. With the radiator cap kept closed, a complete drain of water is impossible.
2. Remove the overflow pipe of the radiator pressure cap to drain the reserve tank.
3. Prescribed coolant volume (U.S.gallons)

Models	Quantity
V2203-M-DI-E	8.1 L (2.14 U.S.gals.)
V2003-M-DI-T-E V2403-M-DI-E	8.4 L (2.22 U.S.gals.)

NOTE :

- Coolant quantities shown are for standard radiators.
4. An improperly tightened radiator cap or a gap between the cap and the seat quickens loss of coolant.
 5. Coolant (Radiator cleaner and anti-freeze)

Season	Coolant
Summer	Pure water and radiator cleaner
Winter (when temperature drops below 0°C (32°F)) or all season	Pure water and anti-freeze (See "Anti-freeze" in RADIATOR Section)

■ Remedies for quick decrease of coolant

1. Check any dust and dirt between the radiator fins and tube. If any, remove them from the fins and the tube.
2. Check the tightness of the fan belt. If loose, tighten it securely.
3. Check the internal blockage in the radiator hose. If scale forms in the hose, clean with the scale inhibitor or its equivalent.

■ Checking radiator hoses and clamp



CAUTION

To avoid personal injury:

- Be sure to check radiator hoses and hose clamps periodically. If radiator hose is damaged or coolant leaks, overheats or severe burns could occur.

Check to see if radiator hoses are properly fixed every 200 hours of operation or 6 months, whichever comes first.

1. If hose clamps are loose or water leaks, tighten hose clamp securely.
2. Replace hoses and tighten hose clamps securely, if radiator hoses are swollen, hardened or cracked.

Replace hoses and hose clamps every 2 years or earlier, if checked and found that hoses are swollen, hardened or cracked.

■ Precaution at overheating

Take the following actions in the event the coolant temperature is nearly or more than the boiling point, what is called "Overheating". Take these actions if the engine's alarm buzzer sounds or the alarm lamp lights up.

1. Stop the engine operation in a safe place and keep the engine unloaded idling.
2. Do not stop the engine suddenly. Stop it after about 5 minutes of unloaded idling.
3. If the engine stalls within about 5 minutes of running under no load, immediately leave and keep yourself away from the machine. Do not open the hood and any other part.
4. Keep yourself and others well away from the engine for further 10 minutes or while the steam blown out.
5. Checking that there gets no danger such as burn, get rid of the causes of overheating according to the manual, see "Troubleshooting" section. And then, start again the engine.

■ Cleaning radiator core(outside)

If dust is between the fin and tube, wash it away with running water.

IMPORTANT :

- Do not clean radiator with firm tools such as spatulas or screwdrivers. They may damage specified fin or tube. It can cause coolant leaks or decrease coolings performance.

■Anti-freeze



CAUTION

To avoid personal injury:

- When using anti-freeze, put on some protection such as rubber gloves (Anti-freeze contains poison.).
- If should drink anti-freeze, throw up at once and take medical attention.
- When anti-freeze comes in contact with the skin or clothing, wash it off immediately.
- Do not mix different types of anti-freeze. The mixture can produce chemical reaction causing harmful substances.
- Anti-freeze is extremely flammable and explosive under certain conditions. Keep fire and children away from anti-freeze.
- When draining fluids from the engine, place some container underneath the engine body.
- Do not pour waste onto the grounds, down a drain, or into any water source.
- Also, observe the relevant environmental protection regulations when disposing of anti-freeze.

If it freezes, coolant can damage the cylinders and radiator. If the ambient temperature falls below 0°C (32°F) or before a long-term storage, let out cooling water completely, or mix fresh water with long-life coolant and fill the radiator and reserve tank with the mixture.

1. Long-life coolant (hereafter LLC) comes in several types. Use ethylene glycol (EG) type for this engine.
2. Before employing LLC-mixed cooling water, fill the radiator with fresh water and empty it again. Repeat this procedure 2 or 3 times to clean up the inside.
3. Mixing the LLC
Put the LLC in cooling water in the percentage (%) for a target temperature. When mixing, stir it up well, and then fill into the radiator.
4. The procedure for the mixing of water and anti-freeze differs according to the make of the anti-freeze and the ambient temperature. Refer to SAE J1034 standard, more specifically also to SAE J814c.

IMPORTANT :

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

Vol % Anti-freeze	Freezing Point		Boiling Point *	
	°C	°F	°C	°F
40	-24	-12	106	222
50	-37	-34	108	226

*At 1.013x10⁵Pa (760mmHg) pressure (atmospheric). A higher boiling point is obtained by using a radiator pressure cap which permits the development of pressure within the cooling system.

5. Adding the LLC
 - (1) Add only water if the mixture reduces in amount by evaporation.
 - (2) If there is a mixture leak, add the LLC of the same manufacturer and type in the same mixture percentage.

*Never add any long-life coolant of different manufacturer. (Different brands may have different additive components, and the engine may fail to perform as specified.)
6. When the LLC is mixed, do not employ any radiator cleaning agent. The LLC contains anti-corrosive agent. If mixed with the cleaning agent, sludge may build up, adversely affecting the engine parts.
7. Kubota's genuine long-life coolant has a service life of 2 years. Be sure to change the coolant every 2 years.

NOTE :

- The above data represent industry standards that necessitate a minimum glycol content in the concentrated anti-freeze.
- When the coolant level drops due to evaporation, add water only to keep the anti-freeze mixing ratio less than 50%. In case of leakage, add anti-freeze and water in the specified mixing ratio before filling into the radiator.

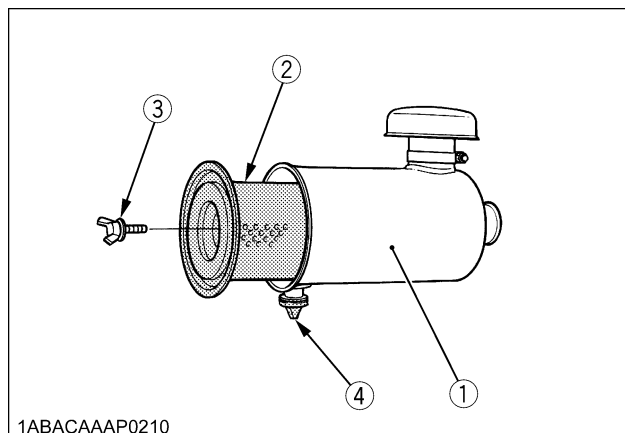
■Radiator cement

As the radiator is solidly constructed, there is little possibility of water leakage. Should this happen, however, radiator cement can easily fix it. If leakage is serious, contact your local KUBOTA dealer.

AIR CLEANER

Since the air cleaner employed on this engine is a dry type, never apply oil to it.

1. Open the evacuator valve once a week under ordinary conditions - or daily when used in a dusty place. This will get rid of large particles of dust and dirt.
2. Wipe the inside air cleaner clean with cloth if it is dirty or wet.
3. Avoid touching the element except when cleaning.
4. When dry dust adheres to the element, blow compressed air from the inside turning the element. Pressure of compressed air must be under 205kPa (2.1kgf/cm², 30psi).
5. When carbon or oil adheres to the element, soak the element in detergent for 15 minutes, then wash it several times in water, rinse with clean water and dry it naturally.
6. After the element is fully dried, inspect the inside of the element with a light, and check if it is damaged or not. (referring to the instructions on the label attached to the element.)
7. Replace the element every year or every 6 cleanings.



- (1) Air cleaner body
- (2) Element
- (3) Wing bolt
- (4) Evacuator valve

IMPORTANT :

- Make sure the wing bolt for the element is tight enough. If it is loose, dust and dirt may be sucked in, wearing down the cylinder liner and piston ring earlier and thereby resulting in poor power output.
- Do not overservice the air cleaner element. Overservicing may cause dirt to enter the engine causing premature wear. Use the dust indicator as a guide on when to service.

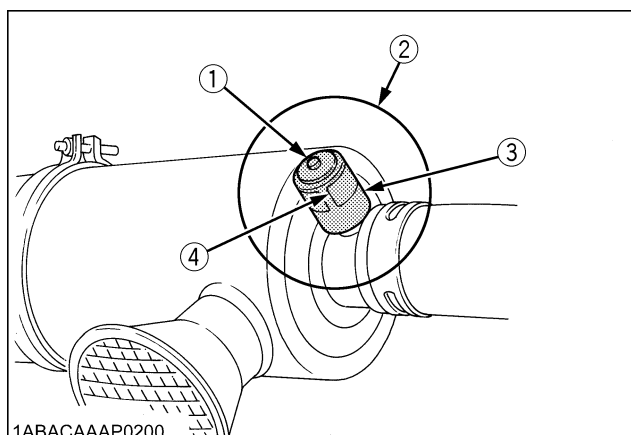
■ Evacuator valve

Open the evacuator valve once a week under ordinary conditions - or daily when used in a dusty place - to get rid of large particles of dust and dirt.

■ Dust indicator (optional)

If the red signal on the dust indicator attached to the air cleaner is visible, the air cleaner has reached the service level.

Clean the element immediately, and reset the signal with the "RESET" button.



- (1) "RESET" button
- (2) Dust indicator
- (3) Service level
- (4) Signal

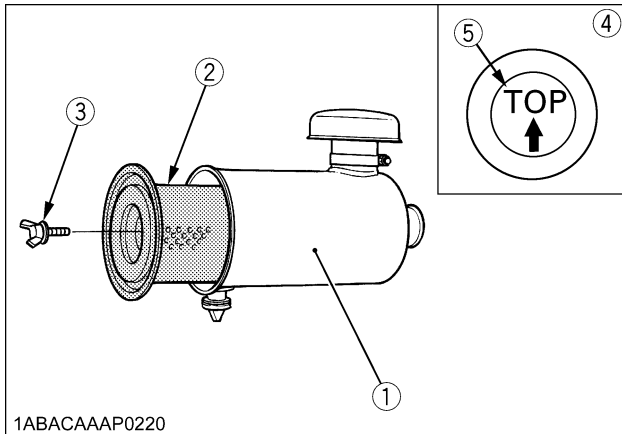
■ For the air cleaner with a dust cup (optional)

Remove and clean out the dust cup before it becomes half full with dust; usually once a week, or even every day if the working surroundings are dusty.

Install the air cleaner dust cup with "TOP" indicated on the rear of the cup in the up position. (However, it may be installed in either direction when the cover is placed at the lower part.)

IMPORTANT :

- If the dust cup is mounted incorrectly, dust or dirt does not collect in the cup, and direct attachments of the dust to the element will cause its lifetime to shorten to a great extent.



- (1) Air cleaner body
- (2) Element
- (3) Wing bolt
- (4) Dust cup
- (5) "TOP" mark

BATTERY



CAUTION

To avoid personal injury:

- Be careful not to let the battery electrolyte contact your body or clothing.
- Wear eye protection and rubber gloves, since the diluted sulfuric acid solution burns skin and eats holes in clothing. Should this occur, immediately wash it off with running water and get medical attention.

Mishandling of the battery shortens the service life and adds to maintenance costs. Obtain the maximum performance and the longest life of the battery by handling properly and with care.

Engine starting will be more difficult, if the battery charge is low. Be careful to recharge it at an early occasion before it is too late.

■ Battery charging



DANGER

The battery comes in two types: refillable and non-refillable.

- For using the refillable type battery, follow the instructions below.

Do not use or charge the battery if its fluid level stands below the LOWER (lower limit level) mark.

Otherwise, the battery component parts may deteriorate earlier than expected, which may shorten the battery's service life or cause an explosion.

Immediately, add distilled water until the battery's fluid level is between the UPPER and LOWER levels.

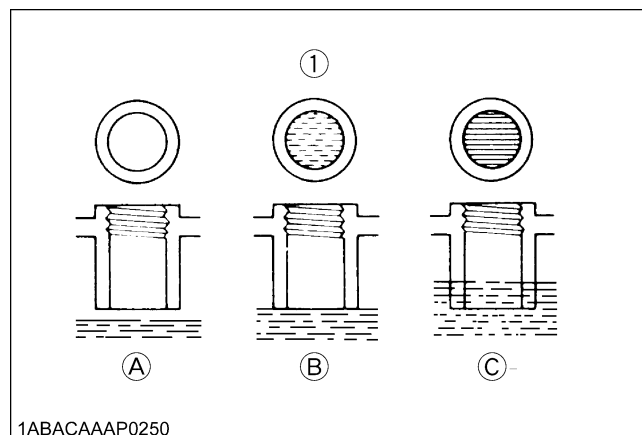


CAUTION

To avoid personal injury:

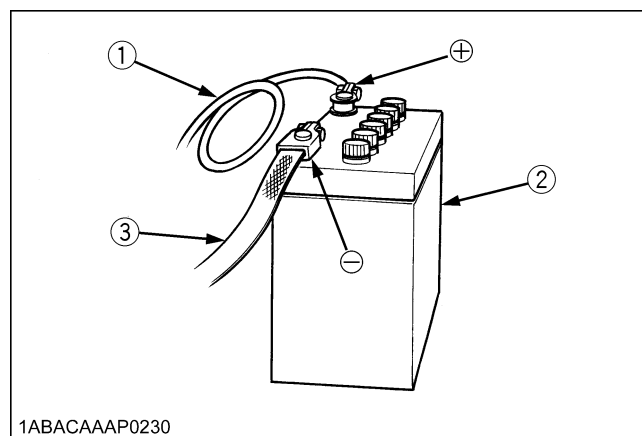
- When the battery is being activated, hydrogen and oxygen gases in the battery are extremely explosive. Keep open sparks and flames away from the battery at all times, especially when charging the battery.
- When charging the battery, remove the battery vent plugs.
- When disconnecting the cable from the battery, start with the negative terminal, and when connecting them, start with the positive terminal first.
- DO NOT check the battery charge by placing a metal object across the terminals. Use a voltmeter or hydrometer.

1. Make sure each electrolyte level is to the bottom of vent wells, if necessary, add only distilled water in a well-ventilated place.

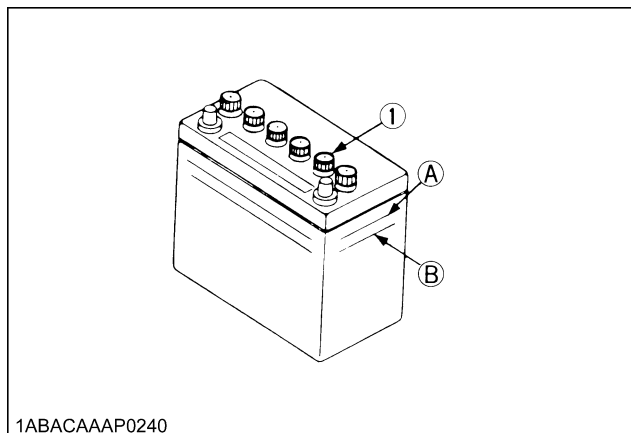


- (1) Battery electrolyte level
- (A) "TOO LOW"
(B) "PROPER"
(C) "TOO HIGH"

2. To slow charge the battery, connect the charger positive terminal to the battery positive terminal, and the negative to the negative, then recharge in the standard fashion.
3. Quick recharging charges the battery at a high rate in a short time. This is only for emergencies.
4. Recharge the battery as early as possible, or battery life will be extremely shortened.
5. When exchanging an old battery for a new one, use battery of equal specification shown in **Page 27**.



- (1) Thick cable red(+)
(2) Battery case
(3) Earth cable black(-)



- (1) Plug
- (A) "HIGHEST LEVEL"
(B) "LOWEST LEVEL"

IMPORTANT :

- Connect the charger positive terminal to the battery positive terminal, and negative to the negative.
- When disconnecting the cable from the battery, start with the negative terminal first.
When connecting the cable to the battery, start with the positive terminal first.
If reversed, the contact of tools on the battery may cause a short.

Direction for long term storage

1. When storing the engine for long periods of time, remove the battery, adjust the electrolyte to the proper level, and store in a dry and dark place.
2. The battery naturally discharges while it is stored. Recharge it once a month in summer, and every 2 months in winter.

ELECTRIC WIRING



CAUTION

To avoid personal injury:

- ◆ Shorting of electric cable or wiring may cause a fire.
 - Check to see if electric cables and wiring are swollen, hardened or cracked.
 - Keep dust and water away from all power connections.
- Loose wiring terminal parts, make bad connections. Be sure to repair them before starting the engine.

Damaged wiring reduces the capacity of electrical parts. Change or repair damaged wiring immediately.

FAN BELT

■ Adjusting Fan Belt Tension



CAUTION

To avoid personal injury:

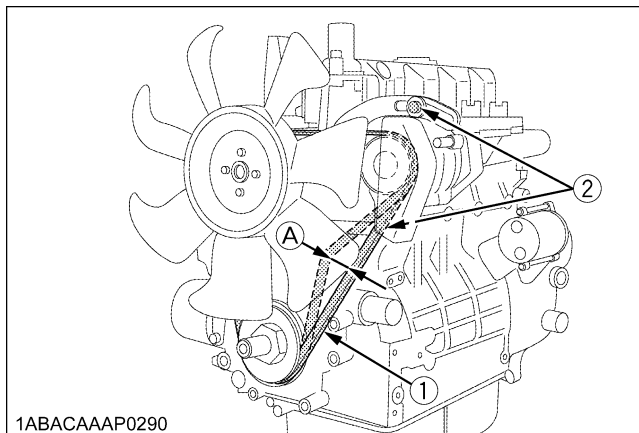
- Be sure to stop the engine and remove the key before checking the belt tension.
- Be sure to reinstall the detached safety shield after maintenance or checking.

Proper fan belt tension	A deflection of between 7 to 9 mm (0.28 to 0.35 in.) when the belt is pressed in the middle of the span.
-------------------------	--

1. Stop the engine and remove the key.
2. Apply moderate thumb pressure to belt between the pulleys.
3. If tension is incorrect, loosen the alternator mounting bolts and, using a lever placed between the alternator and the engine block, pull the alternator out until the deflection of the belt falls within acceptable limits.
4. Replace fan belt if it is damaged.

IMPORTANT :

- If belt is loosen or damaged and the fan is damaged, it could result in overheats or insufficient charging. Correct or replace belt.



- (1) Fan belt
(2) Bolt and nut

- (A) 7 to 9 mm (0.28 to 0.35 in.)
(under load of 10 kgf (22.1 lbs))

CARRIAGE AND STORAGE

CARRIAGE



CAUTION

To avoid personal injury:

- Fix the engine securely not to fall during operation.
- Do not stand near or under the engine while carrying it.
- The engine is heavy. In handling it, be very alert not to get your hands and body caught in.

1. Use carrier such as crane when carrying the engine, or hurt your waist and yourself. Support the engine securely with rope not to fall while carrying it.
2. When lifting the engine, put the hook securely to metal fittings attached to the engine. Use strong hook and fittings enough to hang the engine.

STORAGE



CAUTION

To avoid personal injury:

- Do not clean the machine with engine running.
- To avoid the danger of exhaust fume poisoning, do not operate the engine in a closed building without proper ventilation.
- When storing the engine just after running, let the engine cool off.

Before storing the engine for more than a few months, remove any dirt on the machine, and:

1. Drain the coolant in the radiator. Open the cock at the bottom of the radiator, and remove the pressure cap to drain water completely. Leave the cock open. Hang a note written "No water" on the pressure cap. Since water may freeze when the temperature drops below 0°C (32°F), it is very important that no water is left in the machine.
2. Remove dirty engine oil, fill with new oil and run the engine for about 5 minutes to let the oil penetrate to all the parts.
3. Check all the bolts and nuts, and tighten if necessary.
4. Remove the battery from the engine, adjust the electrolyte level, and recharge it. Store the battery in a dry and dark place.
5. When the engine is not used for a long period of time, run it for about 5 minutes under no load every 2 to 3 months to keep it free from rust. If the engine is stored without any running, moisture in the air may condense into dew over the sliding parts of the engine, resulting in rust there.
6. If you forget to run the engine for longer than 5 to 6 months, apply enough engine oil to the valve guide and valve stem seal and make sure the valve works smoothly before starting the engine.
7. Store the engine in a flat place and remove the key from engine.
8. Do not store the engine in a place where has flammable materials such as dry grass or straw.
9. When covering the engine for storage, let engine and muffler cool off completely.
10. Operate the engine after checking and repairing damaged wirings or pipes, and clearing flammable materials carried by mouse.

TROUBLESHOOTING

If the engine does not function properly, use the following chart to identify and correct the cause.

■ When it is difficult to start the engine

Cause	Countermeasures
Fuel is thick and doesn't flow.	*Check the fuel tank and fuel filter. *Remove water, dirt and other impurities. *As all fuel will be filtered by the filter, if there should be water or other foreign matters on the filter, clean the filter with kerosene.
Air or water mixed in fuel system	*If air is in the fuel filter or injection lines, the fuel pump will not work properly. To attain proper fuel injection pressure, check carefully for loosened fuel line coupling, loose cap nut, etc. *Loosen joint bolt stop fuel filter and air vent screws of fuel injection pump to eliminate all the air in the fuel system.
Thick carbon deposits on orifice of injection nozzle.	*This is caused when water or dirt is mixed in the fuel. Clean the nozzle injection piece, being careful not to damage the orifice. *Check to see if nozzle is working properly or not. If not, install a new nozzle.
Valve clearance is not as specified.	*Adjust valve clearance to 0.18 to 0.22mm(0.007 to 0.0087 in.) when the engine is cold.
Leaking valves	*Grind valve.
Fuel injection timing is not as specified.	*Check injection timing *The injection timing 0.19 rad(11°) before top dead center.
Engine oil becomes thick in cold weather and engine cranks slow.	*Change grade of oil according to the weather (temperature.)
Low compression	*Bad valve or excessive wear of rings, pistons and liners cause insufficient compression. Replace with new parts.
Battery is discharged and the engine will not crank.	*Charge battery. *In winter, always remove battery from machine, charge fully and keep indoors. Install in machine at time of use.

■ When output is insufficient

Cause	Countermeasures
Carbon stuck around orifice of nozzle piece	*Clean orifice and needle valve, being very careful not to damage the nozzle orifice. *Check nozzle to see if good. If not, replace with new parts.
Compression is insufficient. Leaking valves	*Bad valve and excessive wear of rings, pistons and liners cause insufficient compression. Replace with new parts. *Grind valves.
Fuel is insufficient.	*Check fuel system.
Overheating of moving parts	*Check lubricating oil system. *Check to see if lubricating oil filter is working properly. *Filter element deposited with impurities would cause poor lubrication. Change element. *Check the clearance of bearing are within factory specs. *Check injection timing. *Check timing 0.19 rad(11°) before top dead center.
Valve clearance is not as specified.	*Adjust to proper valve clearance of 0.18 to 0.22 mm(0.007 to 0.0087 in.) with engine cold.
Air cleaner is dirty	*Clean the element every 100 hours of operation.
Fuel injection pressure is not as specified.	*Check injection pressure. 1st Stage 18.6 MPa(190 kgf/cm ² ; 2702 psi) 2nd Stage 22.6 MPa(230 kgf/cm ² ; 3271 psi)
Injection pump wear	*Do not use poor quality fuel as it will cause wear of the pump. Only use No. 2-D diesel fuel. *Check the fuel injection pump element and delivery valve assembly and replace as necessary.

NOTE :

- If the cause of trouble can not be found or if you can not adjust by yourself, contact your KUBOTA dealer.

■ When engine suddenly stops

Cause	Countermeasures
Lack of fuel	*Check the fuel tank and refill the fuel, if necessary. *Also check the fuel system for air or leaks.
Bad nozzle	*If necessary, replace with a new nozzle.
Moving parts are overheated due to shortage of lubrication oil or improper lubrication.	*Check amount of engine oil with oil level gauge. *Check lubricating oil system. *At every 2 times of oil change, oil filter cartridge should be replaced. *Check to see if the engine bearing clearances is within factory specs.

NOTE :

- When the engine has suddenly stopped, turn the engine lightly by pulling on the fan belt. If the engine turns easily without abnormalities, the cause of the trouble is usually lack of fuel or bad nozzle.

■ When color of exhaust is especially bad

Cause	Countermeasures
Fuel governing device bad	*Contact dealer for repairs.
Fuel is of extremely poor quality.	*Select good quality fuel. Use No. 2-D diesel fuel only.
Nozzle is bad.	*If necessary, replace with new nozzle.
Combustion is incomplete.	*Cause is poor atomization, improper injection timing, etc. Because of trouble in injection system or in poor valve adjustment, or compression leakage, poor compression, etc. Check for the cause.

■ When engine must be stopped immediately

Cause	Countermeasures
Engine revolution suddenly decreases or increases.	*Check the adjustments, injection timing and the fuel system.
Unusual sound is heard suddenly.	*Check all moving parts carefully.
Color of exhaust suddenly turns dark.	*Check the fuel injection system, especially the fuel injection nozzle.
Bearing parts are overheated.	*Check the lubricating system.
Oil lamp lights up during operation.	*Check the lubricating system. *Check, if the engine bearing clearances are within factory specs. *Check the function of the relieve valve in the lubricating system. *Check pressure switch. *Check filter base gasket.

■ When engine overheats

Cause	Countermeasures
Engine oil insufficient	*Check oil level. Replenish oil as required.
Fan belt broken or elongated	*Change belt or adjust belt tension.
Coolant insufficient	*Replenish coolant.
Excessive concentration of antifreeze	*Add water only or change to coolant with the specified mixing ratio.
Radiator net or radiator fin clogged with dust	*Clean net or fin carefully.
Inside of radiator or coolant flow route corroded	*Clean or replace radiator and parts.
Fan or radiator or radiator cap defective	*Replace defective parts.
Thermostat defective	*Check thermostat and replace if necessary.
Temperature gauge or sensor defective	*Check temperature with thermometer and replace if necessary.
Overload running	*Reduce load.
Head gasket defective or water leakage	*Replace parts.
Incorrect injection timing	*Adjust to proper timing.
Unsuitable fuel used	*Use the specified fuel.

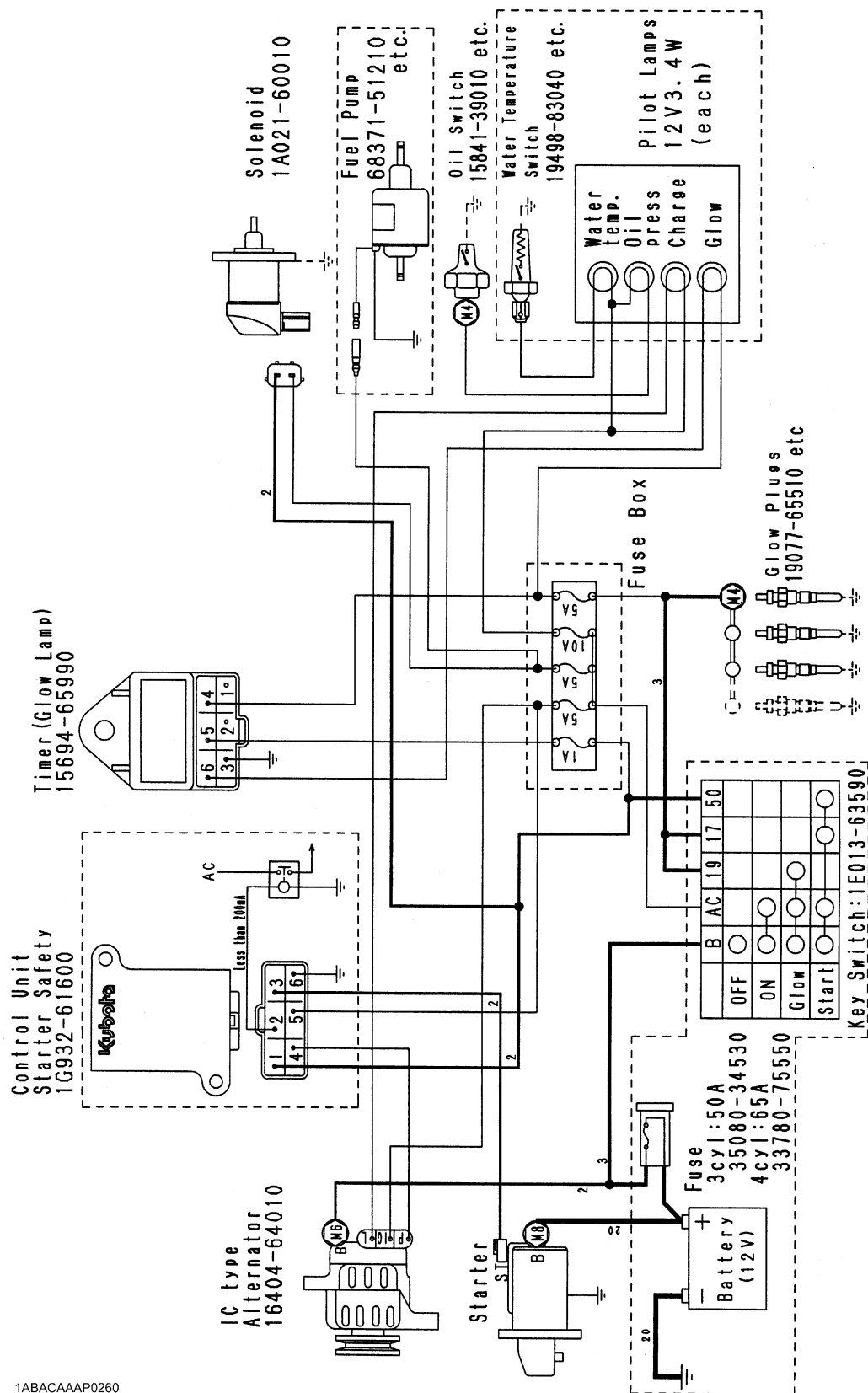
SPECIFICATIONS

Model	V2203-M-DI-E	V2003-M-DI-T-E	V2403-M-DI-E
Type	Vertical, water-cooled, 4-cycle diesel engine		
Number of cylinders	4		
Bore and stroke mm (in.)	87 x 92.4 (3.43 x 3.64)	83 x 92.4 (3.26 x 3.64)	87 x 102.4 (3.43 x 4.04)
Total displacement cm³ (cu.in.)	2197 (134.07)	1999 (121.99)	2434 (148.53)
Combustion chamber	Re-entrant Type (Direct Injection)		
SAE NET Intermittent kW / rpm H.P. (SAEJ1349) (HP / rpm)	34.8 / 2800 (46.7 / 2800)	41.0 / 2800 (55.0 / 2800)	36.6 / 2600 (49.1 / 2600)
SAE NET Continuous kW / rpm H.P. (SAEJ1349) (HP / rpm)	30.2 / 2800 (40.5 / 2800)	35.6 / 2800 (47.7 / 2800)	31.8 / 2600 (42.6 / 2600)
Maximum bare speed rpm	3000		2800
Maximum bare idling speed rpm	850 to 950		
Order of firing	1-3-4-2		
Direction of rotation	Counter-clockwise (viewed from flywheel side)		
Injection pump	Bosch "K" Type mini pump		
Injection pressure	1st Stage 18.6 Mpa (190 kgf/cm², 2702 psi) 2nd Stage 22.6 Mpa (230 kgf/cm², 3271 psi)		
Injection timing (Before T.D.C.)	0.143 rad(8.2°)	0.161 rad(9.25°)	0.113 rad(6.5°)
Compression ratio	20		
Fuel	Diesel Fuel No.2-D or No.2-DLS		
Lubricant (API classification)	above CD grade		
Dimension mm (in.) (length x width x height)	667.1 x 507.1 x 635.0 (26.3 x 20.0 x 25.0)	667.1 x 507.1 x 698.3 (26.3 x 20.0 x 27.5)	670.9 x 499.0 x 684.5 (26.4 x 19.7 x 26.9)
Dry weight (BB Spec.) kg (lbs.)	180 (397)	184 (406)	
Starting system	Cell starter (with glow plug)		
Starting motor	12 V, 1.4 kW		12 V, 2.0 kW
Charging generator	12 V, 480 kW		
Recommended battery capacity	12 V, 100 to 120 AH		

NOTE :

- Specifications are subject to change without notice.

WIRING DIAGRAMS



★ The parts boxed in [] are reference, NOT equipped for standard engine spec.

★ Non marked wire dia. is 0.8 ~ 1.25 mm².