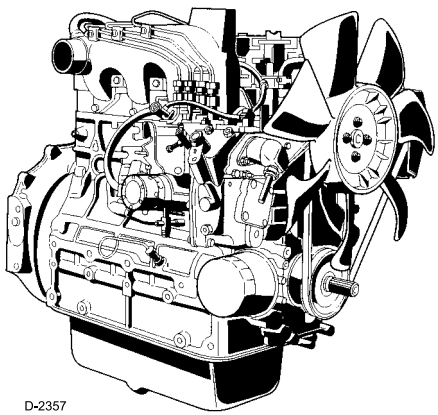
OPERATOR'S MANUAL

ENGLISH

KUBOTA
DIESEL ENGINE

MODELS
D1503-M-E3 · D1703-M-E3 · D1803-M-E3
V2003-M-E3 · V2203-M-E3 · V2403-M-E3 · V2403-M-T-E3



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READ AND SAVE THIS BOOK

Kubota

FOREWORD

You are now the proud owner of a KUBOTA Engine. This engine is a product of KUBOTA quality engineering and manufacturing. It is made of fine materials and under a rigid quality control system. It will give you long, satisfactory service. To obtain the best use of your engine, please read this manual carefully. It will help you become familiar with the operation of the engine and contains many helpful hints about engine maintenance. It is KUBOTA's policy to utilize as quickly as possible every advance in our research. The immediate use of new techniques in the manufacture of products may cause some small parts of this manual to be outdated. KUBOTA distributors and dealers will have the most up-to-date information. Please do not hesitate to consult with them.

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 attempt to assemble 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, may result in minor or moderate injury.
IMPORTANT :	Indicates that equipment or property damage could result if instructions are not followed.
NOTE :	Gives helpful information.

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SAFE OPERATION

Before using this machine, be sure to carefully read and fully understand this "OPERATOR'S MANUAL" to operate it safely. The precautions below must be strictly followed for safe operation. Besides, the ⚠DANGER, ⚠WARNING, ⚠CAUTION and IMPORTANT safety instructions are given in the text.

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 equipment 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. UNAUTHORIZED MODIFICATIONS to the engine may impair the function and/or safety and affect engine life. If the engine does not perform properly, consult your local Kubota Engine Distributor first.

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2. SAFE CLOTHING AND OPERATOR'S ATTITUDES

- **For operation, wear clothing that is suited for the type of work. Also wear the work-related personal protective equipment as required.**
- **DO NOT wear baggy clothing, necklaces and others that might get caught by the control levers and projections, which otherwise may get you injured.**
- Keep yourself in good shape for running the machine. Under the influence of alcohol, from overwork, when feeling feverish and in poor physical condition, the operator is inattentive, which may cause a serious accident.
- DO NOT listen to the radio NOR wear music-listening headphones during operation in order to ensure the safety of yourself and other people.


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3. CHECK BEFORE STARTING & OPERATING THE ENGINE

- **Be sure to inspect the engine before operation. Do not operate the engine if there is something wrong with it. Repair it immediately.**
- **Before operation, install the protective devices (circuits) and safety covers that come with the engine.**
- **Before starting the engine, make sure to check around yourself for added safety.**
- **If using the engine with co-worker(s), give signals to each other, before getting started, to protect yourselves.**
- **DO NOT allow children or livestock to approach the machine while the engine is running.**
- **Before getting the starter activated, set the key switch to the "ON" (OPERATION) position and make sure the engine's protective devices (circuits) function as specified.**
- **DO NOT start the engine with any other means but the key switch.**
- DO NOT start the engine by shorting across starter terminals. The machine may start in gear and move. Do not bypass or defeat any safety devices.

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4. KEEP THE ENGINE AND SURROUNDINGS CLEAN

- Be sure to stop the engine before cleaning.
- **If the engine and its surrounding are dirty, a fire may be caused.**
- To prevent a fire, keep clean the engine, its surrounding, radiator, battery, fuel tank, exhaust pipes, muffler and other pipes and cables all the time.
- **"COOL DOWN"** the engine to allow it to cool down gradually. (Run it idling for at least 5 minutes.)
- If you stop the engine without cooling down (idling), the temperature around the engine may rise suddenly, posing a danger.

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5. SAFE HANDLING OF FUEL AND LUBRICANTS -KEEP AWAY FROM FIRE

- Always stop the engine before refueling and/or lubricating.
- NEVER refuel the engine while you are smoking or in the vicinity of open flames or sparks.
- Refuel at a well ventilated and open place.
- Check to see if a still hot zone may ignite spilled fuel or lubricants. In such case, wait until the engine cools down enough and refuel it.
- Always wipe off any spilled fuel or lubricants.
- To avoid a fire, wipe dust deposits, oily and greasy substances, and dirt clean off the engine.
- Store fuel and other flammable oils and greases away from open flames.
- DO NOT mix gasoline or alcohol with diesel fuel. The mixture can cause a fire or severe engine damage.

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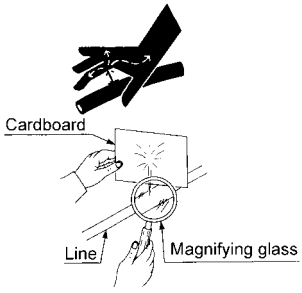
6. EXHAUST GASES & FIRE PREVENTION

- Engine exhaust fumes can be very harmful if allowed to accumulate. Be sure to run the engine in a well ventilated location 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 or any other combustible materials to exhaust gas. Keep the engine and muffler clean at all times.
- To avoid a fire, be alert for leaks of flammable substances from hoses and lines. Be sure to check for leaks from hoses or pipes, such as fuel and hydraulic fluid by following the SERVICE INTERVALS list.
- Check to see if the clamps are loose or missing, if the hoses are twisted, and if the hoses and pipes are twisted and in contact with each other.
- The fuel pipes, lubricant pipes and other rubber-made products will get degraded with age. Replace these parts every 2 years, together with the clamping bands, even if they are not damaged. If found damaged, immediately replace any of them with new one.
- Using a cardboard or a thin wooden sheet, check to see if there is any high-pressure oil leak. Do not touch any high-pressure gushing oil directly with your hand and body.
- **A short-circuited electrical cable and wire may cause a fire.**
- Check the electrical cables and wires to see if they are not loose, twisted, stiff or worn out.
- Keep all the electrical connections clean.
- **To prevent a fire, operate the engine 1 m (3 feet) or more away from the buildings and other facilities.**

7. PROTECTION AGAINST HIGH-PRESSURE OIL

- **It is dangerous if high-pressure oil penetrates your skin.**
- Using a cardboard or a thin wooden sheet, check to see if there is any high-pressure oil leak from the fuel injection pipes and high-pressure oil pipes. Do not touch any high-pressure gushing oil directly with your hand and body.
  If you are directly exposed to high-pressure gushing oil, immediately seek medical care. If such oil penetrates your skin, get the oil removed within several hours, because otherwise the skin may develop into gangrene.



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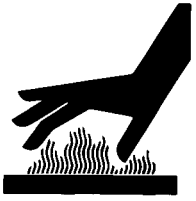
8. CAUTIONS AGAINST BURNS & BATTERY EXPLOSION

- **While the engine is running and just after it has been stopped, the muffler, muffler cover, radiator, pipes, engine itself, coolant and engine oil are still hot. Do not touch them with your hands and other skin, because otherwise you may get burned.**
- After operation, wait until the engine and radiator cool down enough (longer than 30 minutes after the stop) if you work on the engine.
- After stopping the engine, wait until the radiator filler port can be touched with bare hands. Then remove the cap.
- First gradually loosen the cap to the first stop, relieve the entire pressure, and then turn the cap more to remove it.
- **If by any chance the engine gets overheated, steam may gush out of the radiator and recovery tank. It may get your hands and other skin burned.**
- DO NOT stop the engine suddenly. Turn off the load and keep the engine idling **(COOLING DOWN)** for at least 5 minutes. Let the engine cool down gradually and stop it.
- **If the radiator hose is damaged or there is a coolant leak from any connection, it may cause an overheat or get you burned.**
- Be sure to check the radiator hoses and cooling system pipes for coolant leak, referring to the SERVICE INTERVALS list.
- The hoses and other rubber-made products will get degraded with age. Replace these parts every 2 years, together with the clamp bands, even if they are not damaged. If found damaged, immediately replace any of them with new one.
- **DO NOT run the engine with the cooling fan or fan belt damaged. The cooling system itself may get damaged or an overheat may be caused, thereby getting you burned.**



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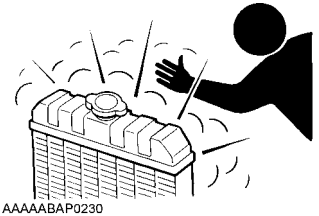

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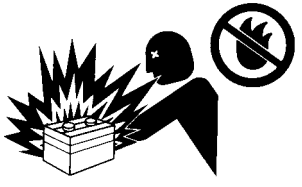

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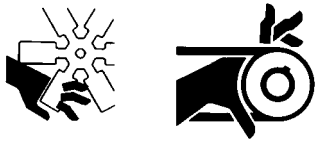
- Before operation, be sure to check for cracks and anything unusual, referring to the SERVICE INTERVALS list. Replace any cracked or peeled-off part with new one.
- **The gas from the battery is explosive.**
- DO NOT use or charge the battery if its fluid level is below the LOWER mark.
  Otherwise, 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 marks.
- Keep sparks and open flames away from the battery, especially during charging. DO NOT strike a match near the battery.
- DO NOT check the battery charge by placing a metal object across the terminals. Use a voltmeter or hydrometer.
- DO NOT charge a frozen battery. There is a risk of explosion. When frozen, warm the battery up to at least 16°C (61°F).

9. KEEP HANDS AND BODY AWAY FROM ROTATING PARTS

- Be sure to stop the engine before checking or adjusting the belt tension and cooling fan.
- Keep your hands and body away from rotating parts, such as the cooling fan, V-belt, fan drive pulley or flywheel. Contact with rotating parts can cause severe personal injury.
- DO NOT run the engine without protective covers. Install protective covers securely before operation.



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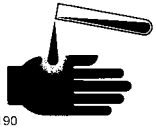
10. ANTI-FREEZE & DISPOSAL OF FLUIDS

- **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 a chemical reaction causing harmful substances.**
- Use genuine KUBOTA Anti-freeze.
- When draining fluids from the engine, place a suitable container underneath the engine body.



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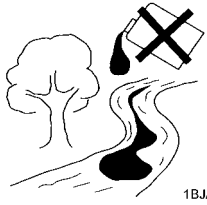

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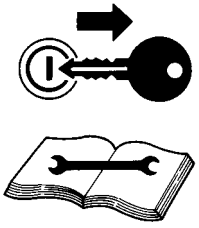
11. CONDUCTING SAFETY CHECKS & MAINTENANCE

- **When inspecting the engine or servicing, place the engine on a large flat surface. DO NOT work on anything that is supported ONLY by lift jacks or a hoist. Always use blocks or the correct stands to support the engine before servicing.**
- **Disconnect the battery from the engine before conducting service. Put a "DO NOT OPERATE!" tag on the key switch to avoid accidental starting.**
- To avoid sparks from an accidental short circuit always disconnect the battery's ground cable (-) first and reconnect it last.
- **Be sure to stop the engine and remove the key when conducting daily and periodic maintenance, service and cleaning.**
- **Check or conduct maintenance after the engine, coolant, muffler, or muffler cover have cooled off completely.**
- **Always use the appropriate tools and fixtures. Verify that they are in good condition before performing any service work. Make sure you understand how to use them before service.**
- **DO NOT turn the engine by rotating the cooling fan or pulling the V belt with your hand.**
  You may get your hand injured or the cooling fan may get damaged.
- **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 age gradually.**
- **If using the engine with co-worker(s), give signals to each other, before getting started, to protect yourselves.**
- **Keep a first aid kit and fire extinguisher handy at all times.**



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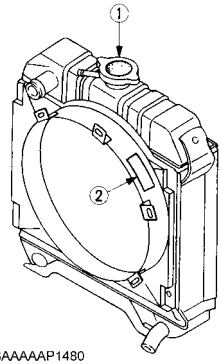
12. WARNING AND CAUTION LABELS



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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
Do not get your hands close
to engine fan and fan belt.

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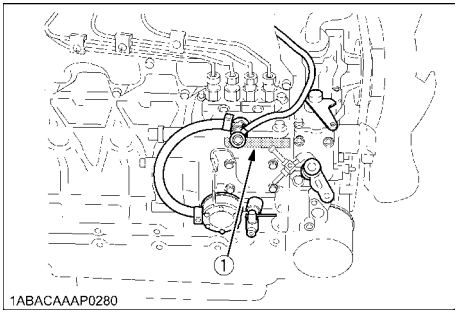
13. CARE OF WARNING AND CAUTION LABELS

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 a new part, make sure the new label(s) is (are) attached in the same location(s) as the replaced component.
5. Mount new warning and caution labels by applying to a clean dry surface and pressing any bubbles to the outside edge.
6. When washing the machine with a high-pressure washer, be careful not to apply high-pressure water directly to the labels. They may get peeled off.
7. When replacing the label-applied parts with new ones, replace the labels too at the same time.

SERVICING AND WARRANTY

Your dealer has the **[Customer Service Counter]**. Contact the staff if you have any questions on or any operating problem with your machine. The genuine KUBOTA parts lists are available at the dealer.
In such a case, give us the following information.

1. Engine model and engine serial number.
2. If the engine is mounted on another machine, its manufacturer name, machine name and machine number.



(1) Engine serial number

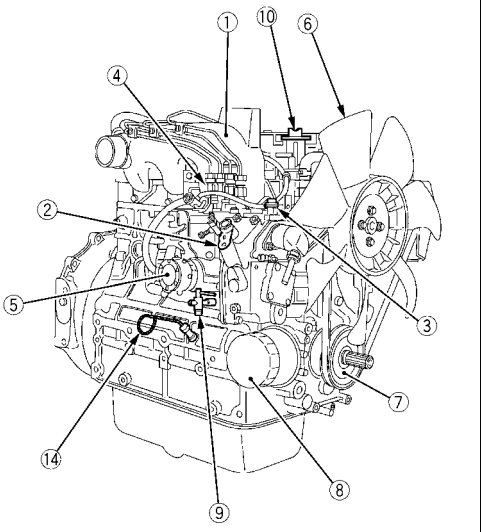
WARNING

To avoid personal injury:

No tampering

- **Never tamper with the machine. Any modification to the machine is dangerous.**
  Note that any tampering and troubles by users other than specified in the Operator's Manual, as well as the use of non-genuine parts, are not covered by the manufacturer's warranty.

NAMES OF PARTS



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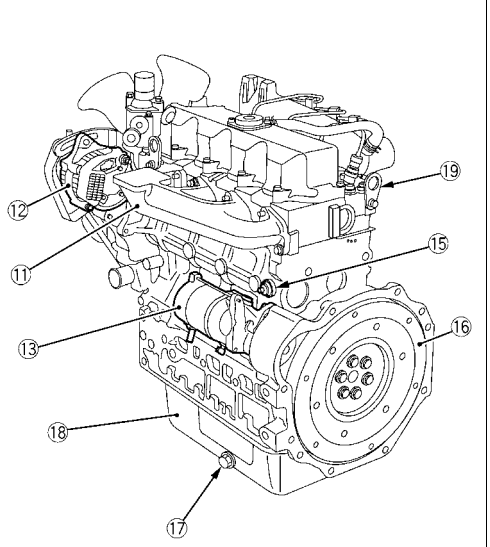

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(1) Intake manifold
(2) Speed control lever
(3) Engine stop lever
(4) Injection pump
(5) Fuel feed pump
(6) Cooling fan
(7) Fan drive pulley
(8) Oil filter cartridge
(9) Water drain cock
(10) Oil filler plug
(11) Exhaust manifold
(12) Alternator
(13) 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 "MAINTENANCE" 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 run the engine with the accompanying protective devices (circuits) and safety covers in place. Otherwise it is very dangerous.**
- **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	15 to 20
	(2) Engine oil level and contamination	15,16
	(3) Amount of fuel	12
	(4) Amount of coolant	18 to 20
	(5) Dust in air cleaner dust cup	21
	(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
	(3) Engine start-up condition	5
	(4) Slow-down and acceleration behavior	7

OPERATING THE ENGINE

STARTING THE ENGINE (NORMAL)

⚠ CAUTION

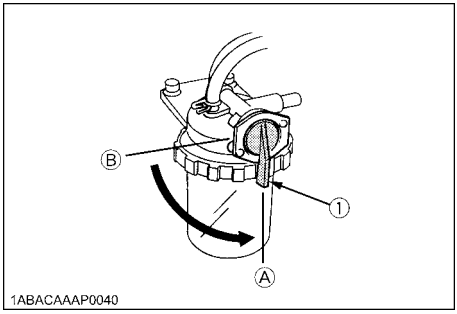
To avoid personal injury:

- **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.**
- **Wear proper clothing that is suited for running the engine safely.**
  Baggy jacket and pants, towels around your neck or hanging from your waist, apron and other improper clothing are very hazardous, because they may easily get caught by the moving parts.
- **Do not wear radio or music headphones while operating engine.**
- **Check to see if it is safe around the engine before starting.**
- **Reinstall safety covers and protective devices (circuits) securely and clear all maintenance tools when starting the engine after maintenance.**

IMPORTANT :

- Do not use ether and any other assistant agent to get the engine started.
- 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.

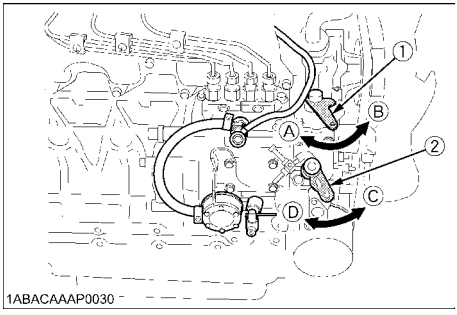
1. Set the fuel lever to the "ON" position.



(1) Fuel lever
(A) "ON"
(B) "OFF"

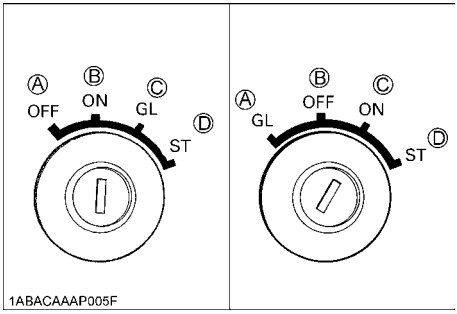
2. Place the engine stop lever to the "OPERATION" position.

3. Place the speed control lever to "MEDIUM SPEED" position.



(1) Engine stop lever
(2) Speed Control lever
(A) "STOP"
(B) "OPERATION"
(C) "MEDIUM SPEED"
(D) "OPERATION"

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



(A) "OFF" SWITCHED OFF
(B) "ON" OPERATION
(C) "GL" PREHEATING
(D) "ST" STARTING

(A) "GL" PREHEATING
(B) "OFF" SWITCHED OFF
(C) "ON" OPERATION
(D) "ST" STARTING

5. Turn the starter switch to the "GL" (PREHEATING) 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 "GL" (PREHEATING) position.

6. Turn the key to the "ST" (STARTING) 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 engine does not catch or start at 10 seconds after the starter switch is set at "ST" (STARTING) 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, or it may lead to trouble with the engine.
- Do not use any assistant agent (ether or the like) for starting the engine.
- Do not turn the starter key while the engine is running.
- Do not start the engine by directly connecting the starter terminal and the safety switch.

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 "GL" (PREHEATING) 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.

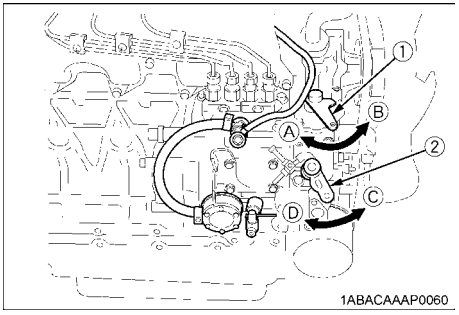
Ambient temperature	Preheating time
Above 10°C (50°F)	NO NEED
10°C (50°F) to -5°C (23°F)	Approx. 5 seconds
*Below -5°C (23°F)	Approx. 10 seconds
Limit of continuous use	20 seconds

6. Turn the key to the "ST" (STARTING) 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. Poor warm-up may fail to allow the engine to perform well and, what's worse, it may shorten the engine 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, and run the engine at medium speed.**
2. **Set the engine stop lever to the "STOP" position.**
3. **With the starter switch placed to the "OFF" (SWITCHED OFF) position, remove the key. (Be sure to return the engine stop lever to the "OPERATION" position to be ready for the next start.)**



(1) Engine stop lever
(2) Speed control lever
(A) "STOP"
(B) "OPERATION"
(C) "MEDIUM SPEED"
(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. **If anything is unusual, inspect it, referring to the relevant description in "MAINTENANCE".**

■Radiator 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.**

If the coolant temperature warning lamp lights up or if steam or coolant does not stop squirting from the radiator overflow pipe, turn off the load and **keep the engine idling (COOLING-DOWN) for at least 5 minutes** to let it cool down gradually. Then stop the engine and take the following inspection and servicing.

1. Check to see if the coolant runs short or 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; and
5. Check to see if radiator water pipe is clogged.

■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:

Check of the fuel injection pipes

- **Using a cardboard or a thin wooden sheet, check to see if there is any high-pressure oil leak. Do not touch any high-pressure gushing oil directly with your hand and body.**
  If you are directly exposed to high-pressure gushing oil, immediately seek medical care. If such oil penetrates your skin, get the oil removed within several hours, because otherwise the skin may develop into gangrene.

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 slows down or accelerates.
- Unusual noises are suddenly heard.
- 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.
   (When the engine is not equipped with the stop lever, set the speed control lever to the "STOP" position or the key switch to the "OFF" (SWITCHED OFF) position.)
2. After stopping the engine, check the air cleaner, intake rubber tube and other parts, and then replace parts as needed.

PRECAUTIONS ON GENERATOR-EQUIPPED ENGINE

CAUTION

To avoid personal injury:

If the engine is kept running under no load or light load (load factor below 30%), unburnt fuel or carbon builds up in the exhaust system. As a result, the engine may get damaged or cause a fire. Run the engine under enough load at regular intervals to remove unburnt fuel and carbon deposits.

- **Before doing the load operation, make sure there is nothing flammable around the engine.**
- **Do not put a load all at once on the engine, but gradually.**
- **If by any chance, spark rises out of the muffler outlet, DO NOT GET THE ENGINE UNLOADED, BUT INTERRUPT IT IMMEDIATELY.**

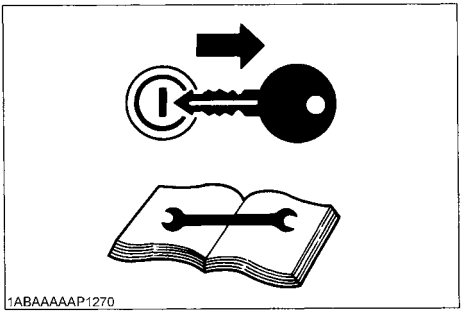
MAINTENANCE

ENGLISH

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.**
- **When disassembling and reassembling, use the specified tools and fixtures, not anything unspecified and rough-and-ready at hand.**
- **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 and fixtures 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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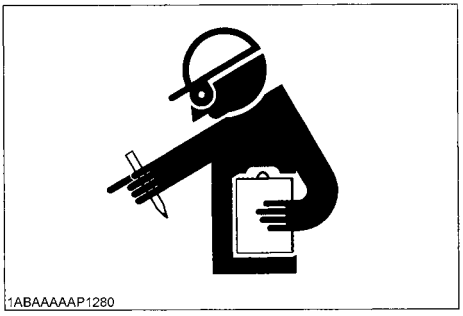
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SERVICE INTERVALS

Observe the following for service and maintenance.

The lubricating oil change intervals listed in the table below are for Class CF or better lubricating oil of API classification with a low-sulfur fuel in use. If the CF-4, CG-4, CH-4 or CI-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. (approximately half)

Interval	Item	Ref. page		
Every 50 hours	Check of fuel pipes and clamp bands	14		@
See NOTE	Change of engine oil (depending on the oil pan)	15 to 17	◎	
Every 100 hours	Cleaning of air cleaner element	21,22	*1	@
	Cleaning of fuel filter pot	14		
	Check of battery electrolyte level	23,24		
	Check of fan belt tightness	25		
	Draining water separator	-		
Every 200 hours	Replacement of oil filter cartridge (depending on the oil pan)	17	◎	
	Check of intake air line	-		@
Every 200 hours of operation or six months	Check of radiator hoses and clamp bands	20		
Every 400 hours	Replacement of fuel filter cartridge	15		@
	Cleaning of water separator	-		
Every 500 hours	Removal of sediment in fuel tank	-		
	Cleaning of water jacket (radiator interior)	20		
	Replacement of fan belt	25		
Every one or two months	Recharging of battery	23,24		
Every year	Replacement of air cleaner element	21,22	*2	@
Every 800 hours	Check of valve clearance	27		
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.)	15 to 20		
	Replacement of battery	23,24		
	Replacement of radiator hoses and clamp bands	20		
	Replacement of fuel pipes and clamp bands	14	*3	@
	Replacement of intake air line and clamp bands	-	*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.)
D1503-M-E3 D1703-M-E3 D1803-M-E3 V2003-M-E3 V2203-M-E3 V2403-M-E3 V2403-M-T-E3	200 Hrs	150 Hrs
Initial	50 Hrs	

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

- American Petroleum Institute (API) classification: above CF
- Ambient temperature: below 35°C (95°F)

NOTE :

Lubricating oil

With strict emission control regulations now in effect, the CF-4 and CG-4 engine oils have been developed for use with low sulfur fuels, for On-Highway vehicle engines. When a Non-Road engine runs on high sulfur fuel, it is advisable to use a "CF or better" classification engine oil with a high Total Base Number (a minimum TBN of 10 is recommended).

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

○ : Recommendable X : Not recommendable

Lubricating oil classification	**Fuel		Remarks
	Low-sulfur	High-sulfur	
CF	○	○	*TBN≧ 10
CF-4	○	X	
CG-4	○	X	
CH-4	○	X	
CI-4	○	X	

* TBN: Total Base Number
**Fuel

- Diesel Fuel Specification Type and Sulfur Content % (ppm) used, must be compliant with all applicable emission regulations for the area in which the engine is operated.
- Use of diesel fuel with sulfur content less than 0.10 % (1000 ppm) is strongly recommended.
- If high-sulfur fuel (sulfur content 0.50 % (5000 ppm) to 1.0 % (10000 ppm)) is used as a diesel fuel, change the engine oil and oil filter at shorter intervals. (approximately half).
- DO NOT USE Fuels that have sulfur content greater than 1.0 % (10000 ppm).
- Since KUBOTA diesel engines of less than 56 kW (75 hp) utilize EPA Tier 4 and Interim Tier 4 standards, the use of ultra low sulfur fuel is mandatory for these engines, when operated in US EPA regulated areas. Therefore, please use No.2-D S15 diesel fuel as an alternative to No.2-D, and use No.1-D S15 diesel fuel as an alternative to No.1-D for ambient temperatures below -10 ℃ (14 ℉).
  1) No.1-D or No.2-D, S15 : Ultra Low Sulfur Diesel (ULSD) 15 ppm or 0.0015 wt.%

- CJ-4, DH-2, DL-1 classification oil is intended for use in engines equipped with DPF (Diesel Particulate Filter) and is Not Recommended for use in Kubota E3 specification engines.

- Oil used in the engine should have API classification and Proper SAE Engine Oil according to the ambient temperatures as shown below:

Above 25℃ (77℉)	SAE30, SAE10W-30 or 15W-40
-10 to 25℃ (14℉ to 77℉)	SAE10W-30 or 15W-40
Below -10℃ (14℉)	SAE10W-30

- Recommended API classification
  Refer to the following table for the suitable American Petroleum Institute (API) classification of engine oil according to the engine type (with internal EGR, external EGR or non-EGR) and the Fuel Type Used : (Low Sulfur, Ultra Low Sulfur or High Sulfur Fuels).

Fuel type	Engine oil classification (API classification)	
	Engines with non-EGR Engines with internal EGR	Engines with external EGR
High Sulfur Fuel [0.05 % (500 ppm) ≤ Sulfur Content < 0.50 % (5000 ppm)]	**CF** (If the "CF-4, CG-4, CH-4 or CI-4" engine oil is used with a high-sulfur fuel, change the engine oil at shorter intervals. (approximately half))	---
Low Sulfur Fuel [Sulfur Content < 0.05 % (500 ppm)] or Ultra Low Sulfur Fuel [Sulfur Content < 0.0015 % (15 ppm)]	**CF, CF-4, CG-4, CH-4 or CI-4**	**CF or CI-4** (Class CF-4, CG-4 and CH-4 engine, oils cannot be used on EGR type engines.)

EGR: Exhaust Gas Re-circulation

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 sure to stop the engine before refueling, air-bleeding, fuel filter clean-up and replacement, fuel pipe replacement, and other fuel system-related servicing. Do not hold cigarette between your lips and allow any open flames nearby.**

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- **Check the above fuel systems at a well ventilated and wide place.**
- **Check to see if a still hot zone may ignite spilled fuel. In such case, wait until the engine cools down enough and refuel it.**
- **Always wipe off any spilled fuel.**

■Fuel level check

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.

■Refueling

For fuel, use JIS-conforming light diesel oil. Do not use any substitute fuels such as kerosene. Unspecified fuels are unknown for their quality, and kerosene is very low in cetane rating, which may adversely affect the engine.

- Change the type of diesel fuel according to the ambient temperature

Ambient temperature	Diesel fuel
above -10°C (14°F)	JIS No. 2
-10°C to -20°C (14°F to -4°F)	JIS No. 3
-20°C to -30°C (-4°F to -22°F)	JIS Special No. 3

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 mm²/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

- Cetane Rating : The minimum recommended Fuel Cetane Rating is 45. A cetane rating greater than 50 is preferred, especially for ambient temperatures below -20°C (-4°F) or elevations above 1500 m (5000 ft).
- Diesel Fuel Specification Type and Sulfur Content % (ppm) used, must be compliant with all applicable emission regulations for the area in which the engine is operated.
- Use of diesel fuel with sulfur content less than 0.10 % (1000 ppm) is strongly recommended.
- If high-sulfur fuel (sulfur content 0.50 % (5000 ppm) to 1.0 % (10000 ppm)) is used as a diesel fuel, change the engine oil and oil filter at shorter intervals. (approximately half).
- DO NOT USE Fuels that have sulfur content greater than 1.0 % (10000 ppm).

- Diesel fuels specified to EN 590 or ASTM D975 are recommended.
- No.2-D is a distillate fuel of lower volatility for engines in industrial and heavy mobile service. (SAE J313)
- Since KUBOTA diesel engines of less than 56 kW (75 hp) utilize EPA Tier 4 and Interim Tier 4 standards, the use of ultra low sulfur fuel is mandatory for these engines, when operated in US EPA regulated areas. Therefore, please use No.2-D S15 diesel fuel as an alternative to No.2-D, and use No.1-D S15 diesel fuel as an alternative to No.1-D for ambient temperatures below -10 ℃ (14 ℉).
  1) SAE : Society of Automotive Engineers
  2) EN : European Norm
  3) ASTM : American Society of Testing and Materials
  4) US EPA : United States Environmental Protection Agency
  5) No.1-D or No.2-D, S15 : Ultra Low Sulfur Diesel (ULSD) 15 ppm or 0.0015 wt.%

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

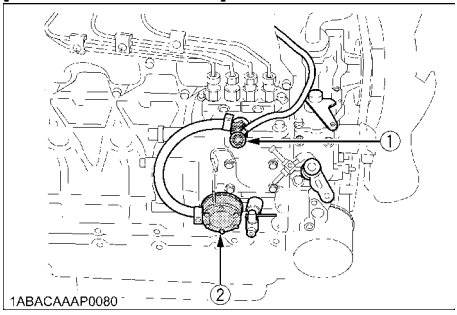
To avoid personal injury;
- **Do not air-bleed the engine just after operation. If the fuel spills over the exhaust manifold, a fire may be caused.**

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 Ⓐ] (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. It may cause the engine to stop.

[GRAVITY FEED SYSTEM]

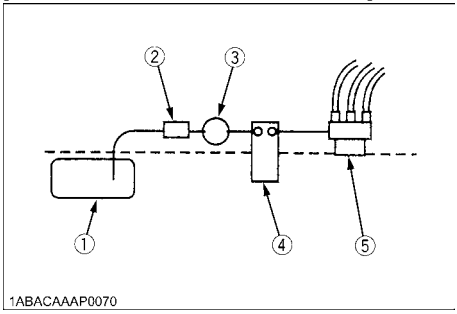


(1) Air vent cock
(2) Fuel feed pump

[PROCEDURE Ⓑ] (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. It may cause the engine to stop.

[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 the fuel pipes for fuel leak.

- **If any of the fuel pipes is damaged, a fire may be caused. Be sure to check the pipes. If damaged, replace the pipe with new one.**

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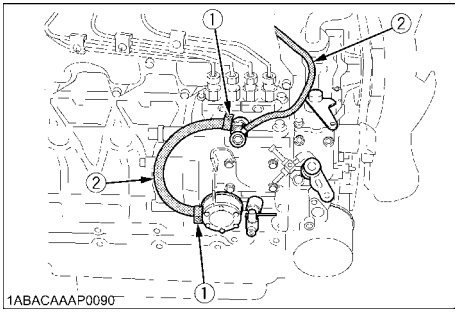
Check the fuel pipes every 50 hours of operation. When if;

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, become 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' pass, 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.



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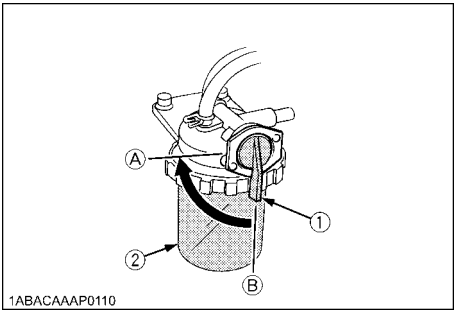
(1) Clamp band
(2) Fuel pipe

■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.



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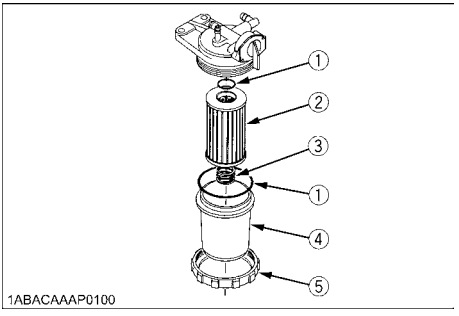
(1) Fuel filter lever
(2) Fuel filter pot
(A) "OFF"
(B) "ON"

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.



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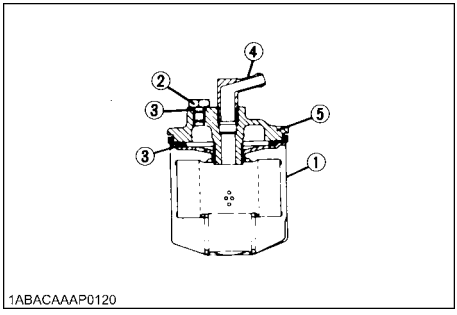
(1) O ring
(2) Filter element
(3) Spring
(4) Filter bowl
(5) Screw ring

■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:

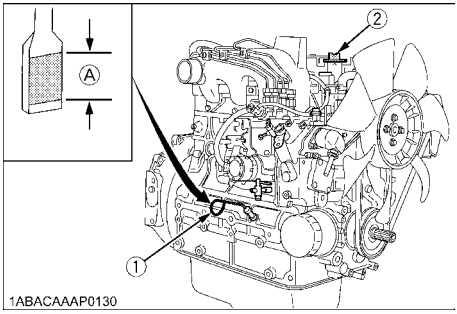
- **Be sure to stop the engine before checking and changing the engine oil and the oil filter cartridge.**
- **Do not touch muffler or exhaust pipes while they are hot; Severe burns could result. Always stop the engine and allow it to cool before conducting inspections, maintenance, or for a cleaning 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 filler plug
(2) 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

Models	*Oil pan depth	
	124 mm (4.88 in.)	*90 mm (3.54 in.)
D1503-M-E3 D1703-M-E3 D1803-M-E3	7.0 L (1.85 U.S.gals.)	5.6 L (1.48 U.S.gals.)
V2003-M-E3 V2203-M-E3 V2403-M-E3 V2403-M-T-E3	9.5 L (2.51 U.S.gals.)	7.6 L (2.01 U.S.gals.)

* 90 mm (3.54 in.) 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 CF or higher.
  Change the type of engine oil according to the ambient temperature.

above 25℃ (77℉)	SAE30 or SAE10W-30 SAE15W-40
-10℃ to 25℃ (14℉ to 77℉)	SAE10W-30 or SAE15W-40
below -10℃ (14℉)	SAE10W-30

- 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

WARNING

To avoid personal injury:
Disposal of waste products
Do not throw away and incinerate waste products, which may pollute the environment and lead to a legal penalty. To dispose of waste materials, keep the following points in mind.

- **When letting waste fluid out of the engine, receive the fluid in a container.**
- **Be careful not to discharge the fluid on the ground, into the river, lake, sea and any other places.**
- **To dispose of or incinerate waste oil, fuel, coolant (anti-freeze), refrigerant, solvent, filter, battery, rubber materials and other harmful substances, contact your dealer or your local industrial waste disposal contractor for legal disposal and treatment procedures.**

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

NOTE :

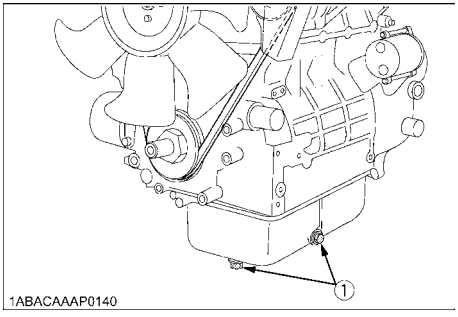
- **Changing interval thereafter**

Models	*Oil pan depth	
	124 mm (4.88 in.)	*90 mm (3.54 in.)
D1503-M-E3 D1703-M-E3 D1803-M-E3 V2003-M-E3 V2203-M-E3 V2403-M-E3 V2403-M-T-E3	200 Hrs	150 Hrs
Initial	50 Hrs	

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

- API service classification : above CF
- Ambient temperature : below 35℃ (95℉)

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.



(1) Oil drain plug

3. Add new engine oil up to the upper limit of the oil level gauge.
4. Do not add the oil above the upper limit of the oil level gauge.

■Replacing the oil filter cartridge

CAUTION

To avoid personal injury:

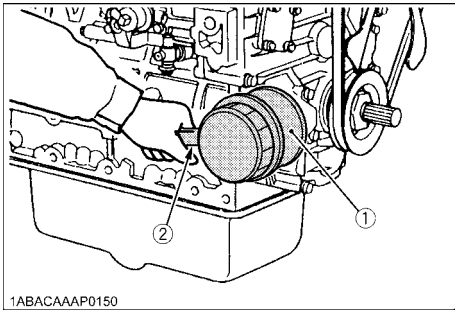
- **Be sure to stop the engine before changing the oil filter cartridge.**
- **Allow engine to cool down sufficiently, oil can be hot and cause burns.**

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

Models	Oil pan depth	
	124 mm (4.88 in.)	*90 mm (3.54 in.)
D1503-M-E3 D1703-M-E3 D1803-M-E3 V2003-M-E3 V2203-M-E3 V2403-M-E3 V2403-M-T-E3	200 Hrs	150 Hrs
Initial	50 Hrs	

* 90 mm (3.54 in.) 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.



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(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. In checking the cooling system, such as coolant, radiator hoses and clamps, be sure to follow the precautions in ⚠CAUTION.

CAUTION

To avoid personal injury:

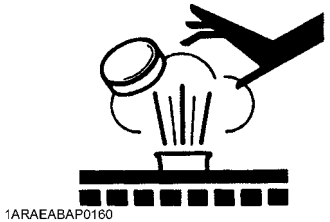
Prevention of burns

- **While the engine is running and just after it has been stopped, the muffler, muffler cover, radiator, pipes, engine itself, coolant and engine oil are still hot. Do not touch them with your hands and other skin, because otherwise you may get burned.**

1BJABAAAP0100

- **After operation, wait until the engine and radiator cool down enough (longer than 30 minutes after the stop) if you work on the engine.**
- **After stopping the engine, wait until the radiator filler port can be touched with bare hands. Then remove the cap.**
- **First gradually loosen the cap to the first stop, relieve the entire pressure, and then turn the cap more to remove it.**

- **If by any chance the engine gets overheated, steam may gush out of the radiator and recovery tank. It may get your hands and other skin burned.**
  - **DO NOT stop the engine suddenly. Turn off the load and keep the engine idling (COOLING DOWN) for at least 5 minutes. Let the engine cool down gradually and stop it.**



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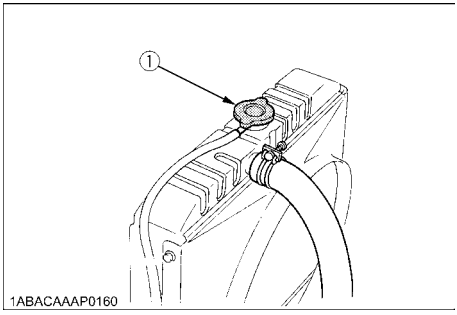
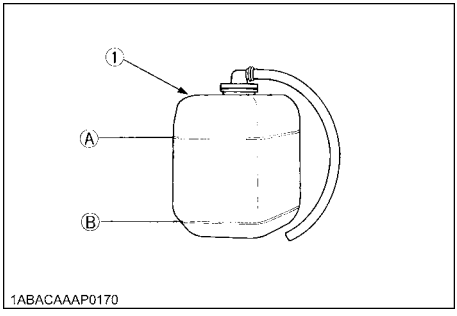
■Checking coolant level, adding coolant

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



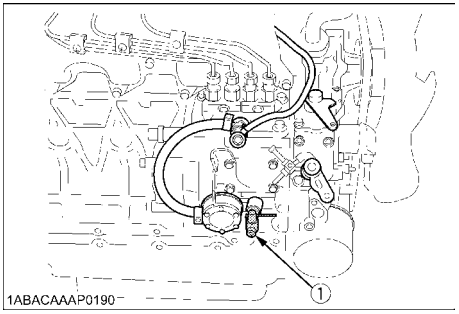
(1) Radiator pressure cap

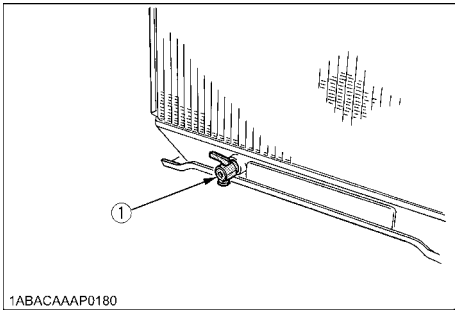
2. If the radiator is provided with a recovery tank, check the coolant level of the recovery tank. Check if the coolant level is between the "FULL" and "LOW" marks.



(1) Recovery tank
(A) "FULL"
(B) "LOW"

3. If coolant runs short due to evaporation, add only clean (soft) water, such as tap water.
   If coolant runs short because of leak, first prepare the specified-ratio mixture of clean (soft) water and anti-freeze, and then add it to the system.
4. Make sure that the coolant drain cocks, one on the radiator bottom and the other on the crankcase side, are tightly shut.





(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 recovery 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 recovery tank.
3. Prescribed coolant volume (U.S.gallons)

Models	Quantity
D1503-M-E3 D1703-M-E3	5.5 L (1.45 U.S.gals.)
D1803-M-E3	5.8 L (1.53 U.S.gals.)
V2003-M-E3 V2203-M-E3	8.1 L (2.14 U.S.gals.)
V2403-M-E3 V2403-M-T-E3	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.

■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 radiator coolant pipes for scale deposits. If so, clean up the pipes with radiator cleaning agent.

■Checking radiator hoses and clamp bands

CAUTION

To avoid personal injury:
Prevention of burns

- **If the radiator hose is damaged or there is a coolant leak from any connection, it may cause an overheat or get you burned.**
  - **If there is a coolant leak or any of the clamps is loose, apply oil to the clamp threads and tighten up the clamp.**
  - **The hoses and other rubber-made parts get degraded with age even if the engine is not used. Together with the clamps, replace such rubber parts every 2 years whether damaged or not. Or if any of them is found defective during inspection, immediately replace it with new one.**

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.

■Precaution at overheating

The event that the coolant temperature is nearly or more than the boiling point is called **"OVERHEATING"**.
While running, make the following checks to see that all parts are working correctly. **If anything is unusual, inspect it, referring to the relevant description in. "MAINTENANCE"**.

◆ Coolant

If the coolant temperature warning lamp lights up or if steam or coolant does not stop squirting from the radiator overflow pipe, turn off the load and **keep the engine idling (COOLING-DOWN) for at least 5 minutes** to let it cool down gradually. Then stop the engine and take the following inspection and servicing.

1. Check to see if the coolant runs short or 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; and
5. Check to see if radiator water pipe is clogged.

■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 cooling performance.

■Cleaning the radiator (inside)

1. Clean up the coolant line inside in the following cases.
   - As per the SERVICE INTERVALS list.
   - When changing the coolant.
2. Use a **radiator cleaning agent**. This helps wash away scale deposits.

■Anti-freeze

WARNING

To avoid personal injury:
Disposal of waste products
Do not throw away and incinerate waste products, which may pollute the environment and lead to a legal penalty. To dispose of waste materials, keep the following points in mind.

- **When letting waste fluid out of the engine, receive the fluid in a container.**
- **Be careful not to discharge the fluid on the ground, into the river, lake, sea and any other places.**
- **To dispose of or incinerate waste oil, fuel, coolant (anti-freeze), refrigerant, solvent, filter, battery, rubber materials and other harmful substances, contact your dealer or your local industrial waste disposal contractor for legal disposal and treatment procedures.**

⚠ CAUTION

To avoid personal injury:
Handling the anti-freeze

- **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 antifreeze. The mixture can produce chemical reaction causing harmful substances.**
  - **Anti-freeze is classified as No. 3 petroleum and flammable. Keep fire away. Store it out of reach of children.**

Always use a 50/50 mix of long-life coolant and clean soft water in KUBOTA engines.
Contact KUBOTA concerning coolant for extreme conditions.

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, flush the radiator with fresh water. Repeat this procedure 2 or 3 times to clean up the radiator and engine block from inside.
3. Mixing the LLC
   Premix 50% LLC with 50% clean soft water. 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. Refer to SAE J1034 standard, more specifically also to SAE J814c.

Vol % Anti-freeze	Freezing Point		Boiling Point *	
	℃	℉	℃	℉
50	-37	-34	108	226

*At 1.013 x 10^5Pa (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.

5. Adding the LLC
   (1) Add only water if the coolant level reduces in the cooling system by evaporation.
   (2) If there is a coolant leak, add the LLC of the same manufacturer and type in the same coolant 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.

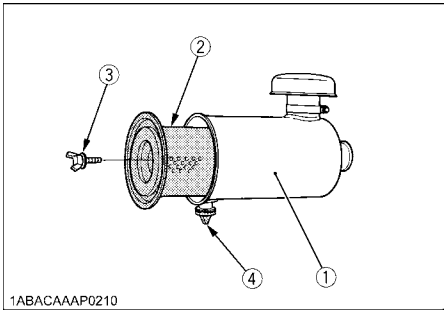
NOTE :

- The above data represents industry standards that necessitate minimum glycol content in the concentrated anti-freeze.

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 205 kPa (2.1 kgf/cm², 30 psi).
5. 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 (optional) as a guide on when to service.

■Evacuator valve

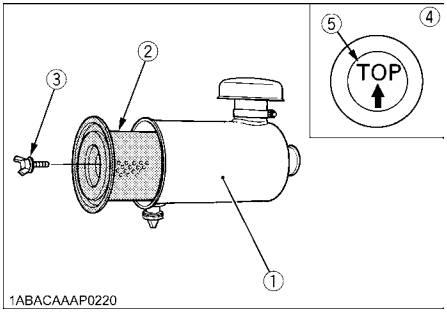
Open the evacuator valve once a week under ordinary conditions - or daily when used in a dusty place - to get rid of large particles of dust and dirt.

■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 :

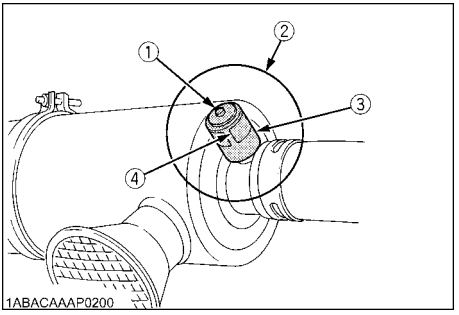
- If the dust cup is mounted incorrectly, dust or dirt does not collect in the cup, and direct attachments of the dust to the element will cause its lifetime to shorten to a great extent.



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

■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

BATTERY

CAUTION

To avoid personal injury:

- **The battery electrolyte is diluted sulfuric acid and very hazardous.**
  - **Be careful not to let the battery electrolyte contact your body or clothing.**
  - **If the battery electrolyte contacts you, immediately wash it away with water. If by any chance the electrolyte comes into your eyes or month, wash it away with much water and see a medical specialist.**
  - **During operation, wear goggles and rubber gloves.**

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.

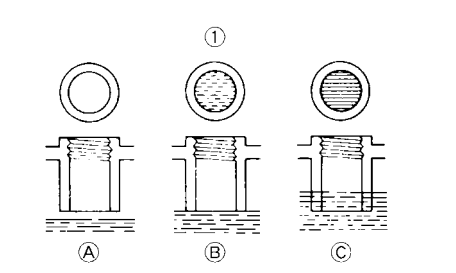
- **For using the refillable type battery, follow the instructions below.**
  Do not use or charge the battery if its fluid level stands below the LOWER (lower limit level) mark.
  Otherwise, the battery component parts may deteriorate earlier than expected, which may shorten the battery's service life 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:

- **The gas from the battery is explosive.**
  - **Keep sparks and open flames away from the battery. DO NOT strike a match near the battery.**
  - **DO NOT check the battery charge by placing a metal object across the terminals. It is dangerous. Use a voltmeter or hydrometer.**
  - **Do not place anything metallic, such as tools, on the battery. A short-circuit may be caused.**
  - **DO NOT charge a frozen battery. There is a risk of explosion. When frozen, warm the battery up to at least 16°C (61°F).**

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



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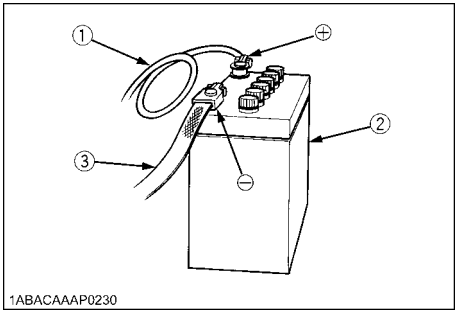
(1) Battery electrolyte level
(A) "TOO LOW"
(B) "PROPER"
(C) "TOO HIGH"

2. For charging, be sure to detach the battery from the machine itself. The electrical components and their wiring may be damaged.
3. Before charging, connect the battery's positive (+) cable to the charger's positive (+) terminal, and the former's negative (-) cable to the latter's negative (-) terminal. Avoid quick charging whenever possible.
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 29**.



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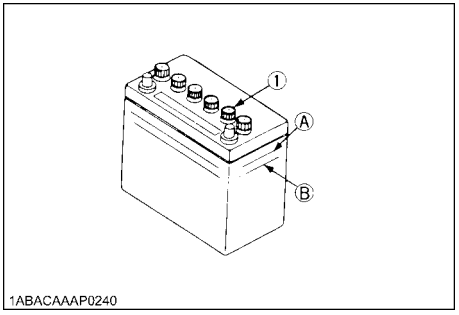
(1) Thick cable red (+)
(2) Battery case
(3) Earth cable black (-)



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(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:

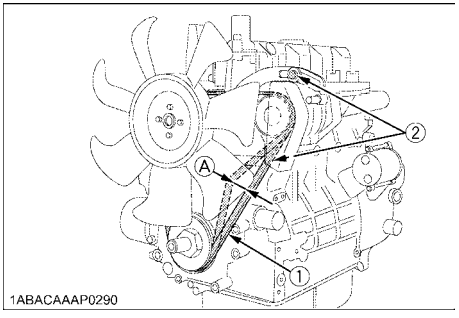
- **Be sure to stop the engine and remove the key before checking the belt tension.**
- **Be sure to reinstall the detached safety shield after maintenance or checking.**

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 the belt is sagging too much, loosen the alternator mounting nuts and bolts and shift the alternator to readjust the belt tension.
   Thereafter, tighten up the above nuts and bolts.
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.

NOTE :

- When using anti-freeze, it is not necessary to take step (1) above.

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. * 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 0.22 mm (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.
Engine oil becomes thick in cold weather and engine cranks slow.	* Change grade of oil according to the weather (temperature.)
Low compression	* Defective valve or worn-out 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
Compression is insufficient. Leaking valves	* Defective valve or worn-out rings, pistons and liners cause insufficient compression. Replace with new parts. * Grind valves.
Fuel is insufficient.	* Refueling.
Overheating of moving parts	* Check lubricating oil system. * Check to see if lubricating oil filter is working properly. * Change element. * Check the clearance of bearing are within factory specs. * Check injection timing. * Adjust timing.
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 wrong.	* Adjust to proper pressure. 13.7 Mpa (140 kgf/cm²; 1991 psi)
Injection pump wear	* Do not use poor quality fuel. (See "FUEL" in "MAINTENANCE" section.)

NOTE :
- If the cause of trouble can not be found, 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.

■ 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.
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	D1503-M-E3	D1703-M-E3	D1803-M-E3
Type	Vertical, water-cooled, 4-cycle diesel engine		
Number of cylinders	3		
Bore and stroke mm (in.)	83 x 92.4 (3.27 x 3.64)	87 x 92.4 (3.43 x 3.64)	87 x 102.4 (3.43 x 4.04)
Total displacement L (cu.in.)	1.499 (91.44)	1.647 (100.51)	1.826 (111.43)
Combustion chamber	Spherical Type (E-TVCS)		
SAE NET Intermittent kW / rpm H.P. (SAEJ1349) (HP / rpm)	21.7 / 2800 (29.1 / 2800)	24.3 / 2800 (32.6 / 2800)	26.5 / 2700 (35.5 / 2700)
SAE NET Continuous kW / rpm H.P. (SAEJ1349) (HP / rpm)	18.8 / 2800 (25.2 / 2800)	21.1 / 2800 (28.3 / 2800)	23.0 / 2700 (30.8 / 2700)
Maximum bare speed rpm	3000		2900
Minimum bare idling speed rpm	750 to 850		
Order of firing	1-2-3		
Direction of rotation	Counter-clockwise (viewed from flywheel side)		
Injection pump	Bosch Type mini pump		
Injection pressure	13.73 MPa, 1991 psi (140 kgf/cm²)		
Injection timing (Before T.D.C.)	0.28 rad (16.25°)	0.30 rad (17.25°)	
Compression ratio	22.8	22.0	24.3
Fuel	Diesel Fuel No.2-D		
Lubricant (API classification)	above CF		
Dimension mm (in.) (length x width x height)	572.1 x 499.0 x 643.0 (22.5 x 19.8 x 25.3)		575.9 x 499.0 x 684.0 (22.7 x 19.8 x 27.0)
Dry weight (BB Spec.) kg (lbs.)	148 (326.3)		151 (332.9)
Starting system	Cell starter (with glow plug)		
Starting motor	12 V, 1.4 kW		12 V, 2.0 kW
Charging generator	12 V, 480 W		
Recommended battery capacity	12 V, 70 to 80 AH		12 V, 100 to 120 AH

NOTE :
- Specifications are subject to change without notice.

Model	V2003-M-E3	V2203-M-E3
Type	Vertical, water-cooled, 4-cycle diesel engine	
Number of cylinders	4	
Bore and stroke mm (in.)	83 x 92.4 (3.27 x 3.64)	87 x 92.4 (3.43 x 3.64)
Total displacement L (cu.in.)	1.999 (121.94)	2.197 (134.07)
Combustion chamber	Spherical Type (E-TVCS)	
SAE NET Intermittent kW / rpm H.P. (SAEJ1349) (HP / rpm)	29.8 / 2800 (39.9 / 2800)	33.1 / 2800 (44.4 / 2800)
SAE NET Continuous kW / rpm H.P. (SAEJ1349) (HP / rpm)	25.9 / 2800 (34.7 / 2800)	28.7 / 2800 (38.5 / 2800)
Maximum bare speed rpm	3000	
Minimum bare idling speed rpm	750 to 850	
Order of firing	1-3-4-2	
Direction of rotation	Counter-clockwise (viewed from flywheel side)	
Injection pump	Bosch Type mini pump	
Injection pressure	13.73 MPa, 1991 psi (140 kgf/cm²)	
Injection timing (Before T.D.C.)	0.30 rad (17.25°)	
Compression ratio	22.8	22.0
Fuel	Diesel Fuel No.2-D	
Lubricant (API classification)	above CF	
Dimension mm (in.) (length x width x height)	667.1 x 499.0 x 633.5 (26.3 x 19.8 x 24.9)	
Dry weight (BB Spec.) kg (lbs.)	180 (396.9)	
Starting system	Cell starter (with glow plug)	
Starting motor	12 V, 1.4 kW	
Charging generator	12 V, 480 W	
Recommended battery capacity	12 V, 100 to 120 AH	

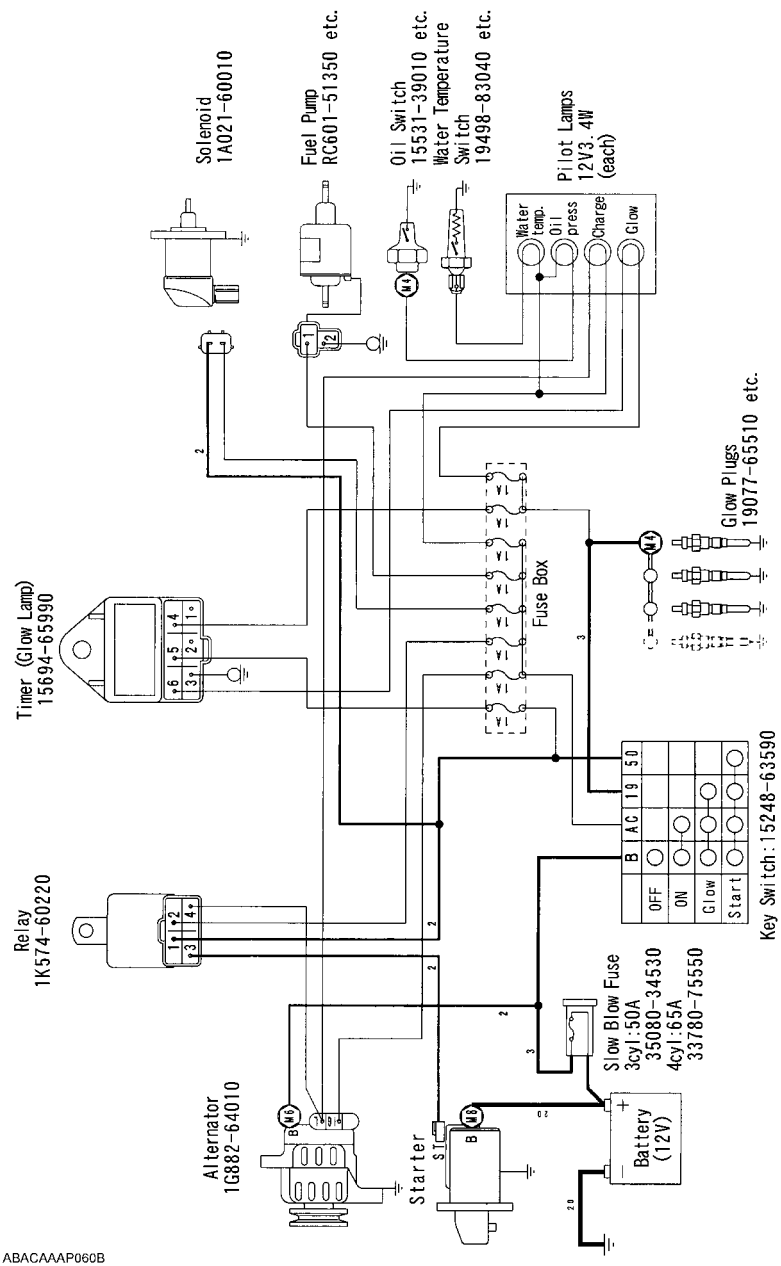
NOTE :
- Specifications are subject to change without notice.

Model	V2403-M-E3	V2403-M-T-E3
Type	Vertical, water-cooled, 4-cycle diesel engine	
Number of cylinders	4	
Bore and stroke mm (in.)	87 x 102.4 (3.43 x 4.04)	
Total displacement L (cu.in.)	2.434 (148.53)	
Combustion chamber	Spherical Type (E-TVCS)	
SAE NET Intermittent kW / rpm H.P. (SAEJ1349) (HP / rpm)	33.9 / 2700 (45.4 / 2700)	41.2 / 2700 (55.2 / 2700)
SAE NET Continuous kW / rpm H.P. (SAEJ1349) (HP / rpm)	29.4 / 2700 (39.4 / 2700)	35.8 / 2700 (47.9 / 2700)
Maximum bare speed rpm	2900	2950
Minimum bare idling speed rpm	750 to 850	850 to 950
Order of firing	1-3-4-2	
Direction of rotation	Counter-clockwise (viewed from flywheel side)	
Injection pump	Bosch Type mini pump	
Injection pressure	13.73 MPa, 1991 psi (140 kgf/cm²)	
Injection timing (Before T.D.C.)	0.30 rad (17.25°)	0.16 rad (9.25°)
Compression ratio	23.2	22.5
Fuel	Diesel Fuel No.2-D	
Lubricant (API classification)	above CF	
Dimension mm (in.) (length x width x height)	670.9 x 499.0 x 684.0 (26.4 x 19.8 x 26.9)	670.9 x 499.0 x 724.6 (26.4 x 19.8 x 28.5)
Dry weight (BB Spec.) kg (lbs.)	184.0 (405.7)	188.0 (414.5)
Starting system	Cell starter (with glow plug)	
Starting motor	12 V, 2.0 kW	
Charging generator	12 V, 480 W	
Recommended battery capacity	12 V, 100 to 120 AH	

NOTE :
- Specifications are subject to change without notice.

ENGLISH

WIRING DIAGRAMS



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