WSM

WORKSHOP MANUAL
DIESEL ENGINE

V3800DI-E2B,V3800DI-T-E2B

Kubota

KiSC issued 06, 2006 A

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GENERAL

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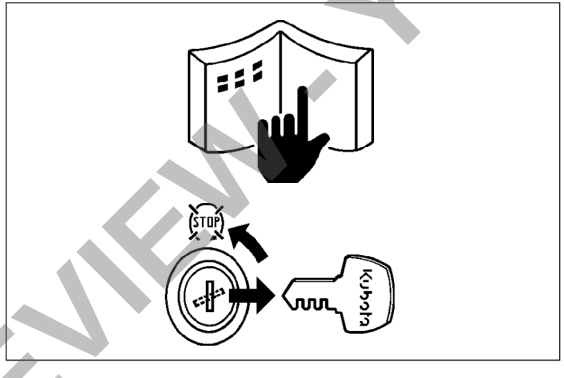
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SAFETY FIRST

This symbol, the industry's "Safety Alert Symbol", is used throughout this manual and on labels on the machine itself to warn of the possibility of personal injury. Read these instructions carefully.

It is essential that you read the instructions and safety regulations before you attempt to repair or use this unit.

DANGER	**: Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.**
WARNING	**: Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.**
CAUTION	**: Indicates a potentially hazardous situation which, if not avoided, 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.**



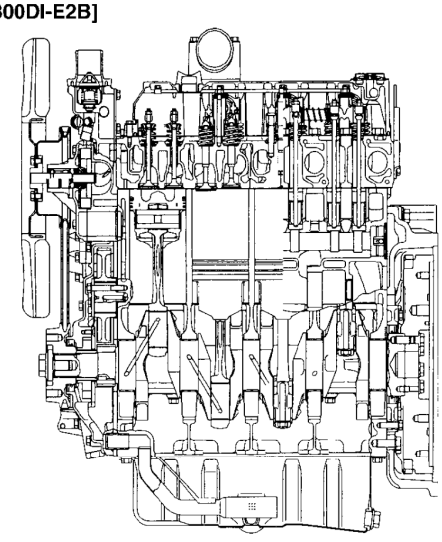
BEFORE SERVICING AND REPAIRING

- Read all instructions and safety instructions in this manual and on your engine safety decals.
- Clean the work area and engine.
- Park the machine on a firm and level ground.
- Allow the engine to cool before proceeding.
- Stop the engine, and remove the key.
- Disconnect the battery negative cable.
- Hang a "**DO NOT OPERATE**" tag in operator station.

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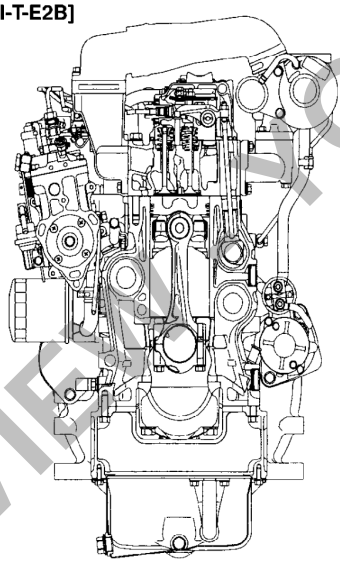
1. FEATURE

[V3800DI-E2B]



3EEABAC1P001C

[V3800DI-T-E2B]



3EEABAC1P002C

The V3 series DI engine are the vertical type 4-cycle diesel engine featuring the advanced performances shown below.

This is a small sized, high power and environment conscious engine, which employs the four valve system, two inlet valves with double ports, and two exhaust valves with the new E-CDIS. Thus, this engine achieves high combustion efficiency and complies with various regulations of exhaust gas.

Based upon the conventional model, Kubota developed a unique governor system and various new mechanisms which reduces exhaust emission, noise and vibration and realize durability and high torque.

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3. TIGHTENING TORQUES

Screws, bolts and nuts must be tightened to the specified torque using a torque wrench, several screws, bolts and nuts such as those used on the cylinder head must be tightened in proper sequence and the proper torque.

[1] TIGHTENING TORQUES FOR GENERAL USE SCREWS, BOLTS AND NUTS

When the tightening torques are not specified, tighten the screws, bolts and nuts according to the table below.

Grade / Nominal Diameter / Unit	Standard Screw and Bolt ④			Special Screw and Bolt ⑦		
	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs
M6	7.9 to 9.3	0.80 to 0.95	5.8 to 6.9	9.8 to 11.3	1.00 to 1.15	7.23 to 8.32
M8	17.7 to 20.6	1.8 to 2.1	13.0 to 15.2	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
M10	39.2 to 45.1	4.0 to 4.6	28.9 to 33.3	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
M12	62.8 to 72.6	6.4 to 7.4	46.3 to 53.5	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5

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Screw and bolt material grades are shown by numbers punched on the screw and bolt heads. Prior to tightening, be sure to check out the numbers as shown below.

Punched number	Screw and bolt material grade
None or 4	Standard screw and bolt SS41, S20C
7	Special screw and bolt S43C, S48C (Refined)

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1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Engine Does Not Start	No fuel	Replenish fuel	G-9
	Air in the fuel system	Vent air	G-9
	Water in the fuel system	Change fuel and repair or replace fuel system	–
	Fuel hose clogged	Clean or replace	G-9, 25
	Fuel filter clogged	Replace	G-11, 13
	Excessively high viscosity of fuel or engine oil at low temperature	Use specified fuel or engine oil	4, G-12
	Fuel with low cetane number	Use specified fuel	4
	Fuel leak due to loose injection pipe retaining nut	Tighten retaining nut	S-30
	Incorrect injection timing	Adjust	S-20
	Fuel camshaft worn	Replace	S-40
	Injection nozzle clogged	Repair or replace	S-22, 30
	Injection pump malfunctioning	Repair or replace	S-21, 42
	Seizure of crankshaft, camshaft, piston, cylinder or bearing	Repair or replace	–
	Compression leak from cylinder	Replace head gasket, tighten cylinder head screw and nozzle holder	S-30, 31, 32, 33
	Improper valve timing	Correct or replace timing gear	S-46
	Piston ring and cylinder worn	Replace	S-49, 50, 67, 72
	Excessive valve clearance	Adjust	S-16
	Stop solenoid malfunctioning	Replace	S-26
Starter Does Not Run	Battery discharged	Charge	G-16, 17
	Starter malfunctioning	Repair or replace	S-25, 54, 73
	Key switch malfunctioning	Replace	–
	Wiring disconnected	Connect	–

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SPECIFICATIONS

Model	V3800DI-E2B	V3800DI-T-E2B
Number of Cylinder	4	
Type	Vertical, water-cooled, 4-cycle DI diesel engine	
Bore × Stroke	100 × 120 mm (3.94 × 4.72 in.)	
Total Displacement	3769 cm^3 (230 cu.in.)	
ISO Net Continuous	51.1 kW / 2600 min^{-1} (rpm) (68.5 HP / 2600 min^{-1} (rpm))	61.3 kW / 2600 min^{-1} (rpm) (82.2 HP / 2600 min^{-1} (rpm))
ISO / SAE Net Intermittent	58.8 kW / 2600 min^{-1} (rpm) (78.8 HP / 2600 min^{-1} (rpm))	70.6 kW / 2600 min^{-1} (rpm) (94.6 HP / 2600 min^{-1} (rpm))
SAE Gross Intermittent	60.8 kW / 2600 min^{-1} (rpm) (81.5 HP / 2600 min^{-1} (rpm))	72.8 kW / 2600 min^{-1} (rpm) (97.6 HP / 2600 min^{-1} (rpm))
Maximum Bare Speed	2800 min^{-1} (rpm)	
Minimum Bare Idling Speed	775 to 825 min^{-1} (rpm)	
Combustion Chamber	Reentrant Type, Center Direct Injection Type (E-CDIS)	
Fuel Injection Pump	Bosch Type Mini Pump	
Governor	All speed mechanical governor	
Direction of Rotation	Counter-clockwise (Viewed from flywheel side)	
Injection Nozzle	Bosch P Type	
Injection Timing	0.23 rad (13.0 °) before T.D.C.	
Firing Order	1-3-4-2	
Injection Pressure	1st stage 18.6 MPa (190 kgf/cm^2, 2702 psi), 2st stage 23.5 MPa (240 kgf/cm^2, 3414 psi)	
Compression Ratio	20.0	19.0
Lubricating System	Forced lubrication by trochoid pump	
Oil Pressure Indicating	Electrical Type Switch	
Lubricating Filter	Full Flow Paper Filter (Cartridge Type)	
Cooling System	Pressurized radiator, forced circulation with water pump	
Starting System	Electric Starting with Starter	
Starting Motor	12 V, 3.0 kW	
Starting Support Device	Intake Air Heater in Intake Manifold	
Battery	12 V, 136 AH, equivalent	
Charging Alternator	12 V, 540 W	
Fuel	Diesel Fuel No. 2-D (ASTM D975)	
Lubricating Oil	Class CF lubricating oil as per API classification is recommended. If this class of lubricating oil is not available, preferably use Class CD or CE lubricating oil. For details on recommended lubricating oils, see page G-5, 12.	
Lubricating Oil Capacity	13.2 L (3.49 U.S.gals)	
Weight (Dry)	248 kg (546.7 lbs)	257 kg (566.6 lbs)

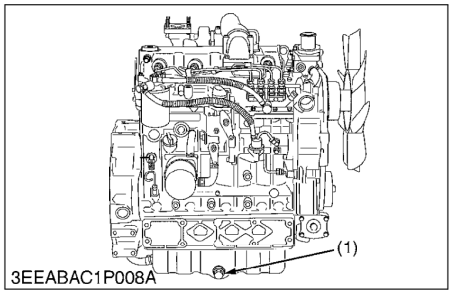
* The specification described above is of the standard engine of each model.
* Conversion Formula : HP = 0.746 kW, PS = 0.7355 kW

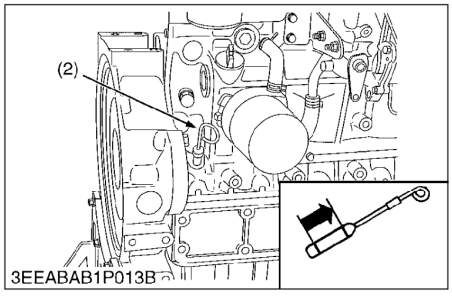
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[2] CHECK POINTS OF INITIAL 50 HOURS





Changing Engine Oil

CAUTION

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

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

IMPORTANT

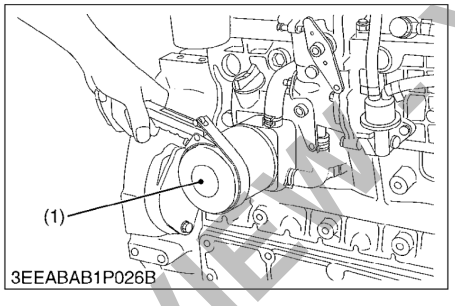
- **When using an oil of different maker or viscosity from the previous one, remove all of the old oil.**
- **Never mix two different types of oil.**
- **Engine oil should have properties of API classification CD/CE/CF/CF-4/CG-4.**
- **Use the proper SAE Engine Oil according to ambient temperature.**

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

Engine oil capacity	13.2 L 3.49 U.S.gals

(1) Drain Plug (2) Dipstick

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Replacing Oil Filter Cartridge

CAUTION

- **Be sure to stop the engine before changing filter cartridge.**

1. Remove the oil filter cartridge (1) with the filter wrench.
2. Apply a slight coat of oil onto the new cartridge gasket.
3. To install the new cartridge, screw it in by hand. Over tightening may cause deformation of rubber gasket.
4. After the new cartridge has been replaced, the engine oil normally decrease a little. Thus see that the engine oil does not leak through the seal and be sure to read the oil level on the dipstick. Then, replenish the engine oil up to the specified level.

IMPORTANT

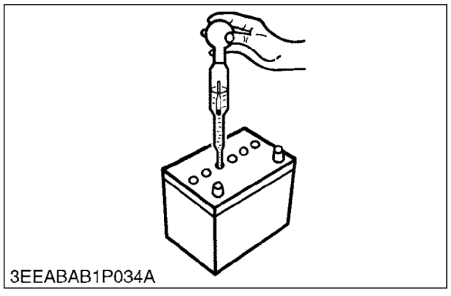
- **To prevent serious damage to the engine, replacement element must be highly efficient. Use only a KUBOTA genuine filter or its equivalent.**

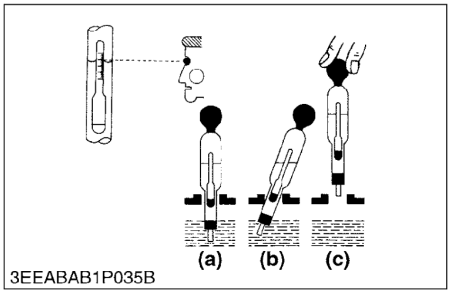
(1) Engine Oil Filter Cartridge

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Battery Specific Gravity

1. Check the specific gravity of the electrolyte in each cell with a hydrometer.
2. When the electrolyte temperature differs from that at which the hydrometer was calibrated, correct the specific gravity reading following the formula mentioned in **(Reference)**.
3. If the specific gravity is less than 1.215 (after it is corrected for temperature), charge or replace the battery.
4. If the specific gravity differs between any two cells by more than 0.05, replace the battery.

NOTE

- **Hold the hydrometer tube vertical without removing it from the electrolyte.**
- **Do not suck too much electrolyte into the tube.**
- **Allow the float to move freely and hold the hydrometer at eye level.**
- **The hydrometer reading must be taken at the highest electrolyte level.**

(Reference)

- Specific gravity slightly varies with temperature. To be exact, the specific gravity decreases by 0.0007 with an increase of 1 °C (0.0004 with an increase of 1 °F) in temperature, and increases by 0.0007 with a decreases of 1 °C (0.0004 with a decrease of 1 °F).

  Therefore, using 20 °C (68 °F) as a reference, the specific gravity reading must be corrected by the following formula :
  - Specific gravity at 20 °C = Measured value + 0.0007 × (electrolyte temperature : 20 °C)
  - Specific gravity at 68 °F = Measured value + 0.0004 × (electrolyte temperature : 68 °F)

Specific Gravity	State of Charge
1.260 Sp. Gr.	100 % Charged
1.230 Sp. Gr.	75 % Charged
1.200 Sp. Gr.	50 % Charged
1.170 Sp. Gr.	25 % Charged
1.140 Sp. Gr.	Very Little Useful Capacity
1.110 Sp. Gr.	Discharged

At an electrolyte temperature of 20 °C (68 °F)

(a) Good
(b) Bad
(c) Bad

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2. SERVICING SPECIFICATIONS

ENGINE BODY

Item		Factory Specification	Allowable Limit
Cylinder Head Surface	Flatness	–	0.05 mm 0.0020 in.
Top Clearance		0.72 to 0.90 mm 0.0283 to 0.0354 in.	–
Compression Pressure	V3800DI-E2B	3.92 MPa / 250 min^{-1} (rpm) 40.0 kgf/cm^2 / 250 min^{-1} (rpm) 569 psi / 250 min^{-1} (rpm)	2.90 MPa / 250 min^{-1} (rpm) 29.6 kgf/cm^2 / 250 min^{-1} (rpm) 421 psi / 250 min^{-1} (rpm)
	V3800DI-T-E2B	3.47 MPa / 250 min^{-1} (rpm) 35.4 kgf/cm^2 / 250 min^{-1} (rpm) 503 psi / 250 min^{-1} (rpm)	2.56 MPa / 250 min^{-1} (rpm) 26.1 kgf/cm^2 / 250 min^{-1} (rpm) 371 psi / 250 min^{-1} (rpm)
Variance Among Cylinders		–	10 % or less
Valve Seat	Angle (Intake)	1.047 rad 60 °	–
	Angle (Exhaust)	0.785 rad 45 °	–
	Width (Intake)	1.6 to 2.0 mm 0.0630 to 0.0790 in.	–
	Width (Exhaust)	2.3 to 2.6 mm 0.0906 to 0.1024 in.	–
Valve Face	Angle (Intake)	1.047 rad 60 °	–
	Angle (Exhaust)	0.785 rad 45 °	–
Valve Recessing	Intake	0.6 to 0.8 mm 0.0236 to 0.0315 in.	1.2 mm 0.0472 in.
	Exhaust	0.85 to 1.05 mm 0.0335 to 0.0413 in.	1.2 mm 0.0472 in.

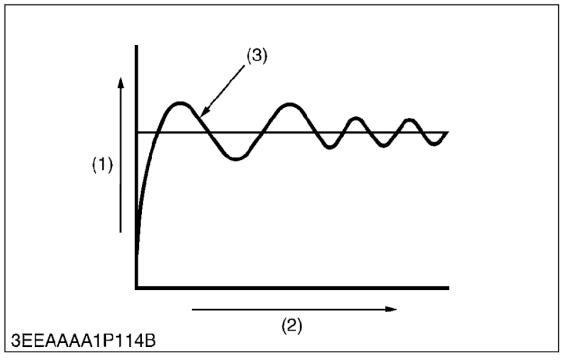
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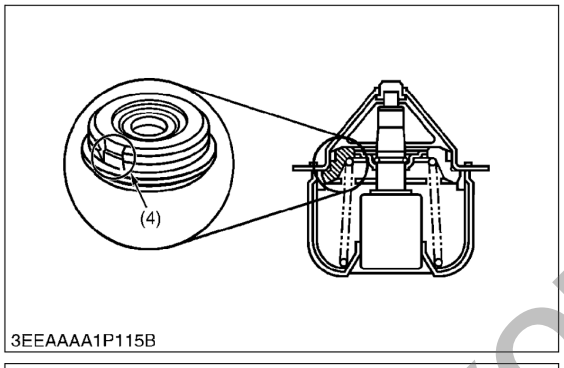
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4. COOLING SYSTEM

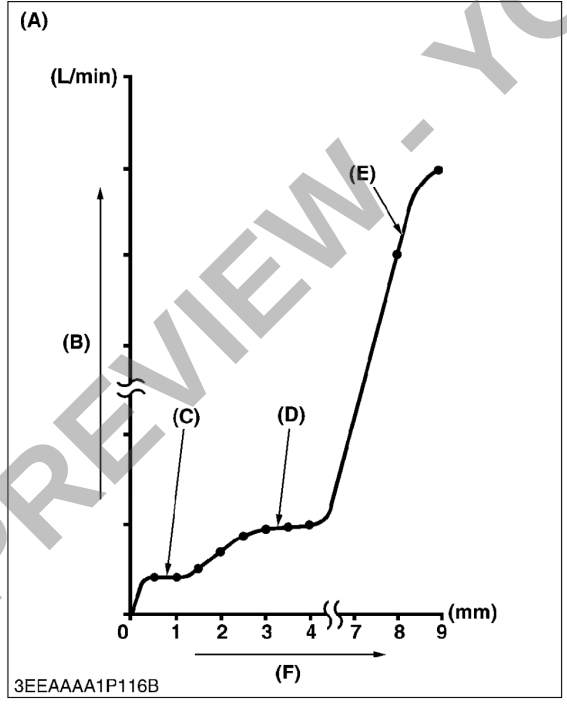
[1] THERMOSTAT



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Conventional thermostatically-controlled valves (outlet water temperature control type) open against the flow of coolant. In this design, the pressure (steam pressure + water pump's discharge pressure) affects the open/close performance of such valve. In other words, the valve may be delayed in opening at a preset opening temperature opening suddenly, above the preset temperature. This is called the overshoot phenomenon.

The overshoot problem invites the undershoot phenomenon too. Too much water cooled by the radiator flows through the water passage, which suddenly closes the valve below the thermostat's preset valve closing temperature.

A repeated cycle of such overshoot and undershoot phenomena is called the water temperature hunting. This hunting problem may adversely affects the cooling system parts, and also the engine and its related components.

To cope with this trouble, the V3 series engine is equipped with the flow control thermostat. The valve has a notch to control the coolant flowrate smoothly in small steps.

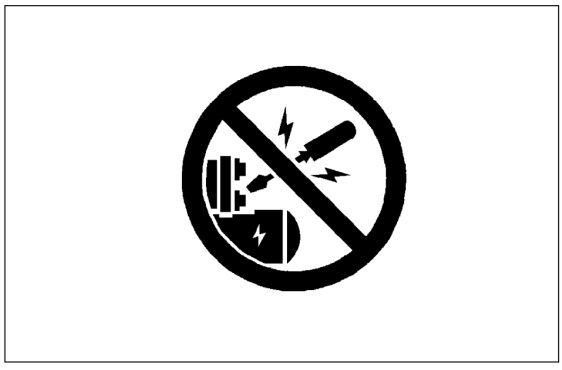
(1) Coolant Temperature
(2) Time
(3) Overshoot
(4) Notch

(A) Valve Lift Versus Flowrate
(B) Flowrate
(C) At Short Valve Lift
(D) At Medium Valve Lift
(E) At High Valve Lift
(F) Valve Lift

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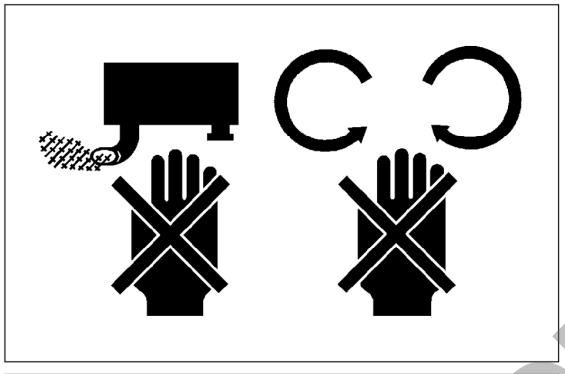
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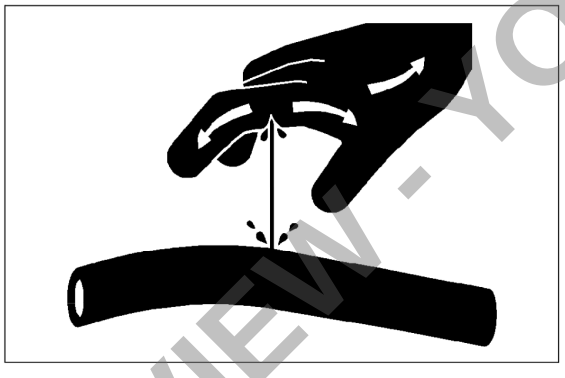
SAFETY STARTING

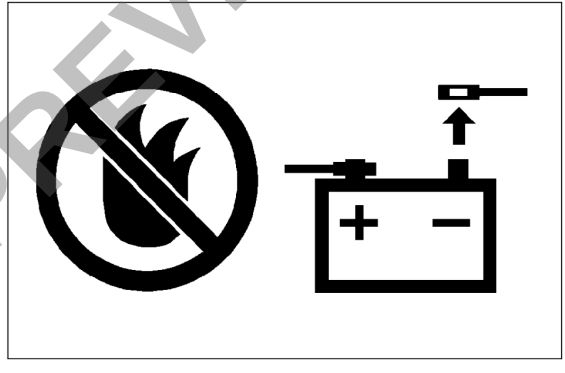
- Do not start the engine by shorting across starter terminals or bypassing the safety start switch.
- Unauthorized modifications to the engine may impair the function and / or safety and affect engine life.



SAFETY WORKING

- Do not work on the machine while under the influence of alcohol, medication, or other substances or while fatigued.
- Wear close fitting clothing and safety equipment appropriate to the job.
- Use tools appropriate to the work. Makeshift tools, parts, and procedures are not recommended.
- When servicing is performed together by two or more persons, take care to perform all work safely.
- Do not touch the rotating or hot parts while the engine is running.
- Never remove the radiator cap while the engine is running, or immediately after stopping. Otherwise, hot water will spout out from radiator. Only remove radiator cap when cool enough to touch with bare hands. Slowly loosen the cap to first stop to relieve pressure before removing completely.
- Escaping fluid (fuel or hydraulic oil) under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic or fuel lines. Tighten all connections before applying pressure.
- Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.





AVOID FIRES

- Fuel is extremely flammable and explosive under certain conditions. Do not smoke or allow flames or sparks in your working area.
- To avoid sparks from an accidental short circuit, always disconnect the battery negative cable first and connect it last.
- Battery gas can explode. Keep sparks and open flame away from the top of battery, especially when charging the battery.
- Make sure that no fuel has been spilled on the engine.

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