WSM

WORKSHOP MANUAL
GASOLINE / LPG ENGINE

WG1005,DF1005

Kubota

KiSC issued 05, 2006 A

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MECHANISM

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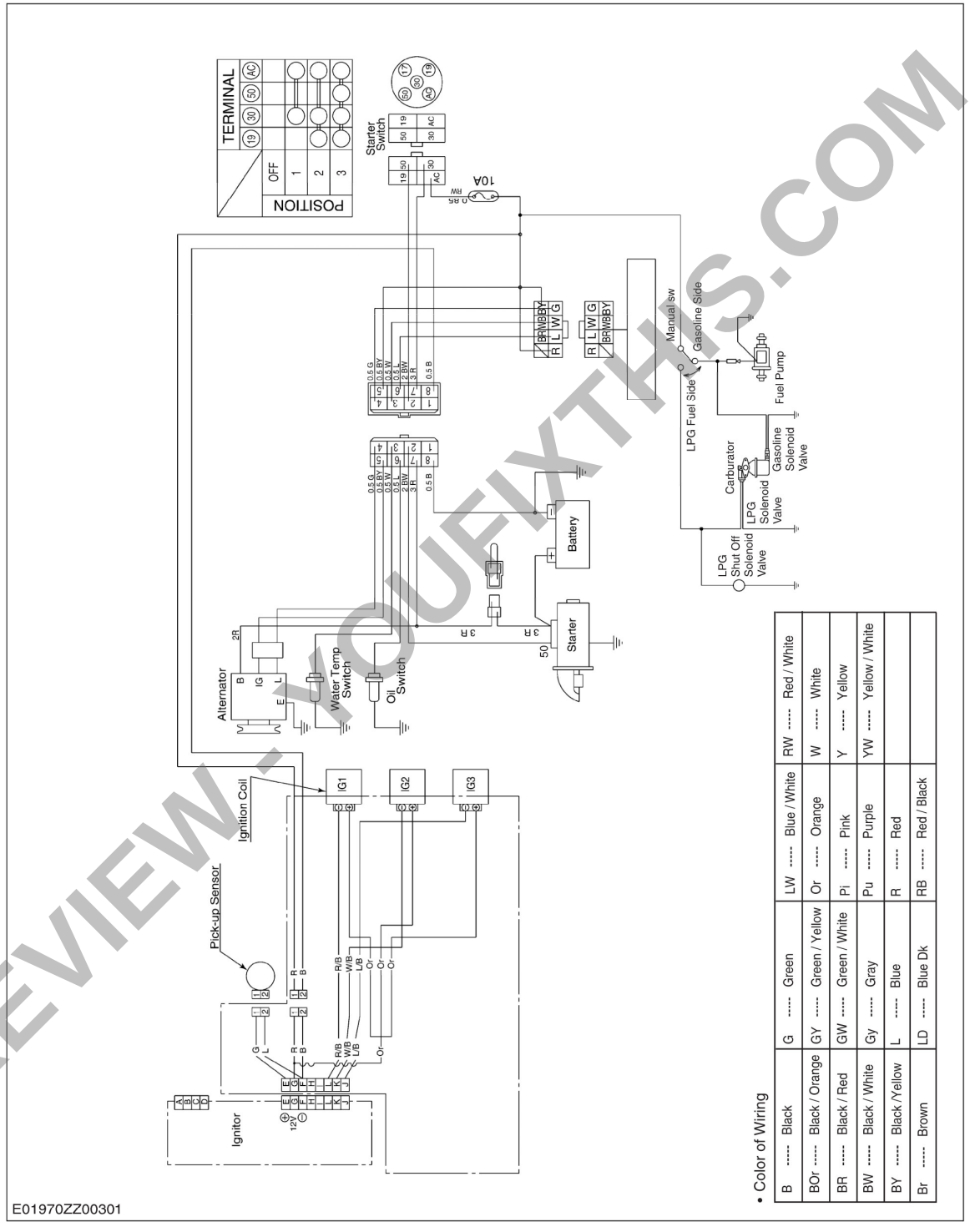
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WIRING DIAGRAM



• Color of Wiring

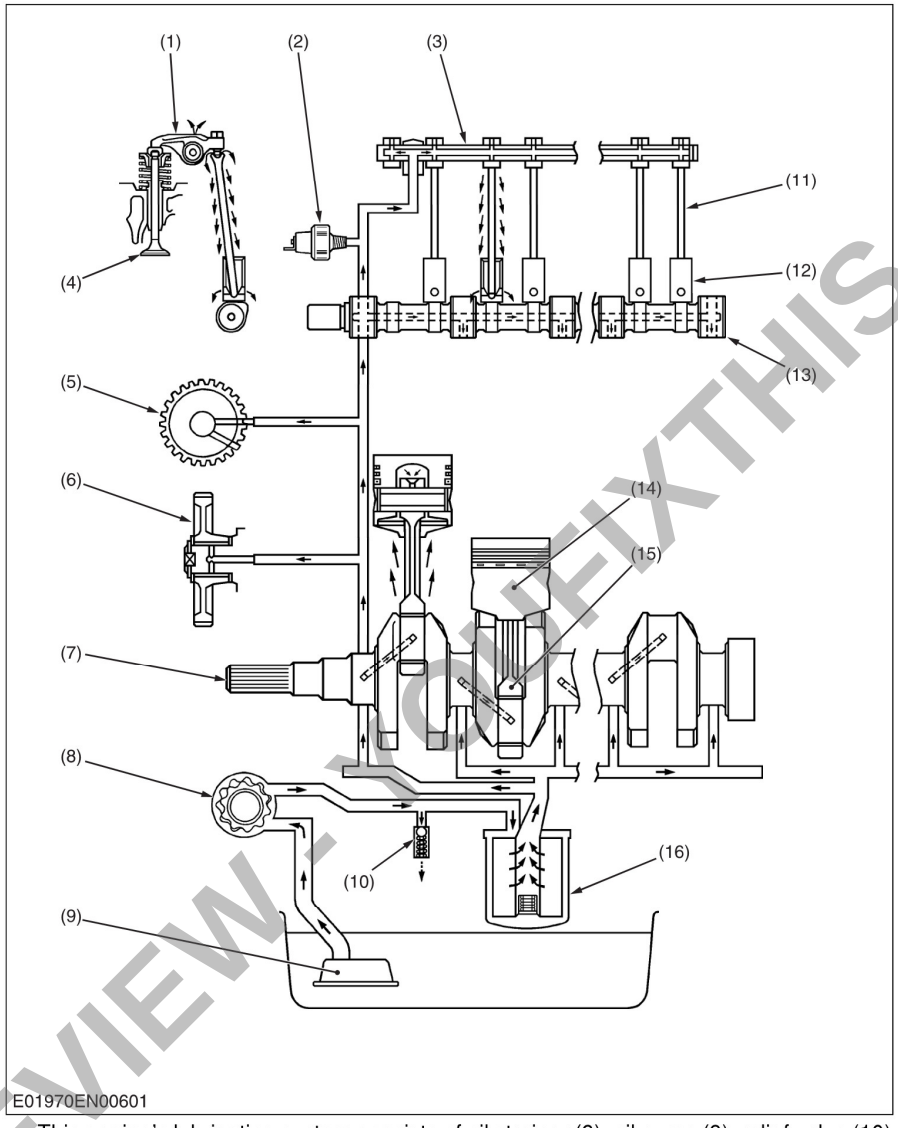
B ----- Black	G ----- Green	LW ----- Blue / White	RW ----- Red / White		
BOr ----- Black / Orange	GY ----- Green / Yellow	Or ----- Orange	W ----- White		
BR ----- Black / Red	GW ----- Green / White	Pi ----- Pink	Y ----- Yellow		
BW ----- Black / White	Gy ----- Gray	Pu ----- Purple	YW ----- Yellow / White		
BY ----- Black / Yellow	L ----- Blue	R ----- Red			
Br ----- Brown	LD ----- Blue Dk	RB ----- Red / Black			

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2. LUBRICATING SYSTEM

[1] GENERAL



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(1) Rocker Arm
(2) Oil Pressure Switch
(3) Rocker Arm Shaft
(4) Valve
(5) Governor Shaft
(6) Idle Gear
(7) Crankshaft
(8) Oil Pump
(9) Oil Strainer
(10) Relief Valve
(11) Push Rod
(12) Tappet
(13) Camshaft
(14) Piston
(15) Connecting Rod
(16) Oil Filter Cartridge

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This engine's lubricating system consists of oil strainer (9), oil pump (8), relief valve (10), oil filter cartridge (16) and oil pressure switch (2).

The oil pump sucks lubricating oil from the oil pan through the oil strainer and the oil flows down to the filter cartridge, where it is further filtered. Then the oil is forced to crankshaft (7), connecting rods (15), idle gear (6), governor shaft (5), camshaft (13) and rocker arm shaft (3) to lubricate each part.

Some part of oil, splashed by the crankshaft or leaking and dropping from gaps of each part, lubricates these parts: pistons (14), cylinders, small ends of connecting rods, tappets (12), push rods (11), inlet and exhaust valves (4) and timing gears.

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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 Special Use Screws, Bolts and Nuts

NOTE

- **For "*" marked screws, bolts and nuts on the table, apply engine oil to their threads and seats before tightening.**
- **The letter "M" in Size x Pitch means that the screw, bolt or nut dimension stands for metric. The size is the nominal outside diameter in mm of the threads. The pitch is the nominal distance in mm between two threads.**

Item	Size x Pitch	N·m	kgf·m	ft-lbs
* Cylinder head cover cap nuts	M7 × 1.0	6.9 to 8.8	0.7 to 0.9	5.1 to 6.5
* Cylinder head screws	M10 × 1.25	63.7 to 68.6	6.5 to 7.0	47.0 to 50.6
* Main bearing case screws 1	M8 × 1.25	29.4 to 34.3	3.0 to 3.5	21.7 to 25.3
* Main bearing case screws 2	M9 × 1.25	49.0 to 53.9	5.0 to 5.5	36.2 to 39.8
* Flywheel screws	M10 × 1.25	53.9 to 58.8	5.5 to 6.0	39.8 to 43.4
* Connecting rod screws	M8 × 1.0	41.2 to 46.1	4.2 to 4.7	30.4 to 34.0
* Rocker arm bracket nuts	M7 × 1.0	21.6 to 26.5	2.2 to 2.7	15.9 to 19.5
* Idle gear shaft screws	M6 × 1.0	9.8 to 11.3	1.00 to 1.15	7.2 to 8.3
* Fan drive pulley screw	M14 × 1.5	235 to 245	24.0 to 25.0	174 to 181
* Bearing case cover screws	M6 × 1.0	9.8 to 11.3	1.00 to 1.15	7.2 to 8.3
Oil switch	PT 1/8	14.7 to 19.6	1.5 to 2.0	10.8 to 14.5
Starer's terminal **B** mounting nut	M8	8.8 to 11.8	0.9 to 1.2	6.5 to 8.7
Spark plug	M14 × 1.25	24.5	2.5	18.1
Governor lever screw	M6 × 1.0	11.2 to 22.5	1.14 to 2.6	8.2 to 18.8
Carburetor mounting nut	M8 × 1.0	23.5 to 27.5	2.4 to 2.8	17.4 to 20.2
Joint for LPG hose of vaporizer (local arrangement)	RC-1/4	19.6 to 32.9	2.0 to 4.0	14.5 to 28.8
Joint for vapor hose of vaporizer	R-3/8	29.4 to 58.8	3.0 to 6.0	21.6 to 43.2
Joint for water hose of vaporizer	R-38	29.4 to 58.8	3.0 to 6.0	21.6 to 43.2
Pulley nut of alternator		58.3 to 78.9	5.9 to 8.05	43.0 to 58.2

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(2) Tightening Torques for General Use Screws, Bolts and Nuts

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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[4] TROUBLESHOOTING

(1) For Gasoline Fuel

Symptom	Probable Cause	Solution	Reference Page
Engine Will Not Turn Over	• Engine jammed	Check engine to find the problem and repair it	–
	• Battery discharged	Charge	–
	• Starter malfunctioning	Repair or replace	S-64
	• Wires disconnected	Reconnect	
Engine Turns Over Slowly but Does Not Start	• Increased resistance of moving parts	Repair or replace	–
	• Excessively high viscosity engine oil at low temperature	Use specified engine oil	S-16
Engine Turns Over at Normal Speed but Does Not Start	• No fuel	Replenish fuel	–
	• Compression leak	Check the compression pressure and repair	S-27
	• Improper valve clearance	Adjust	S-19
	• Defective ignition coil	Replace	–
	• Defective spark plug	Adjust spark plug gap or replace	S-18
	• Defective ignitor	Replace	–
	• Defective fuel system	Check fuel line and carburetor and repair	S-16
	• Over choked	Clean spark plug	S-18
	• Flooding from carburetor	Check carburetor and repair / replace	–
	• Clogged air cleaner	Clean or replace	–
Rough Low-Speed Running and Idling	• Defective ignition coil	Replace	S-62
	• Defective spark plug	Adjust spark plug gap or replace	S-62
	• Defective ignitor	Replace	S-63
	• Incorrect carburetor idle adjustment	Adjust	S-59
	• Incorrect governor adjustment	Adjust	S-59
	• Improper valve clearance	Adjust	S-19
Rough High-Speed Running	• Defective ignitor	Replace	S-63
	• Defective spark plug	Adjust spark plug gap or replace	S-62
	• Defective ignition coil	Replace	S-62
	• Incorrect governor adjustment	Adjust	S-59
Engine Speed Does Not Increase	• Incorrect governor adjustment	Adjust	S-59
	• Defective ignitor	Replace	S-63
	• Incorrect carburetor adjustment	Adjust	S-59
	• Clogged air cleaner	Clean or replace	S-17

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[6] MAINTENANCE CHECK LIST

To maintain long-lasting and safe engine performance, make it a rule to carry out regular inspections by following the table below.

[WG1005]

Item	Interval	Every 50 hours	Every 100 hours	Every 200 hours	Every 1000 hours	Every 1 year	Every 2 years	Reference Page
Engine oil	Change							S-16
Oil filter cartridge	Change							S-16
Spark plug	Clean							S-18
	Change							S-19
Air cleaner element	Clean							S-17
	Change*							–
Intake pipe / clamp bands	Change							–
Fuel filter	Check							–
	Change							S-20
Fuel pipe / clamps	Check							S-16
	Change							–
Carburetor	Clean							–
Radiator coolant	Change							–
Radiator hoses and clamp bands	Check							–
	Change							S-18
Radiator and water jacket	Clean							–
Fan belt tension	Check							S-17
Valve clearance	Adjust							S-19
Valve seats	Check							S-40
Cylinder head	Clean							–

* Change more often when operating under dusty conditions.

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CAUTION

- **When changing or inspecting, be sure to level and stop the engine.**

NOTE

- **Regarding the daily check items, see the operator's manual.**

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[5] SERVICING SPECIFICATIONS

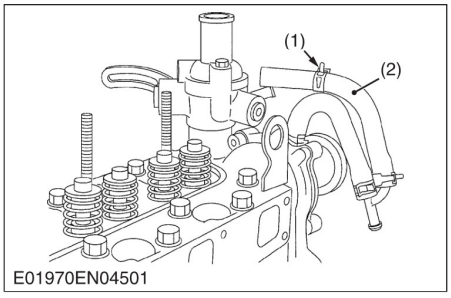
(1) Engine Body

Item		Factory Specification	Allowable Limit
Cylinder Head Surface	Flatness	–	0.05 mm 0.0020 in.
Top Clearance		1.35 to 1.65 mm 0.0531 to 0.0650 in.	–
Compression Pressure		1.27 MPa 13.0 kgf/cm^2 185 psi	0.88 MPa 9.0 kgf/cm^2 128 psi
Variance Among Cylinders		–	10 % or less
Valve Clearance (Cold)		0.145 to 0.185 mm 0.0057 to 0.0073 in.	–
Valve Seat	Width	2.12 mm 0.0835 in.	–
Valve Seat	Angle	1.047 rad. 60 °	–
Valve Face	Angle	1.047 rad. 60 °	–
Valve Recessing		–0.1 to 0.30 mm –0.0039 to 0.0118 in.	–
Valve Stem to Valve Guide	Clearance	0.035 to 0.065 mm 0.0014 to 0.0025 in.	0.10 mm 0.0039 in.
Valve Stem	O.D.	6.960 to 6.975 mm 0.2742 to 0.2764 in.	–
Valve Guide	I.D.	7.010 to 7.025 mm 0.2760 to 0.2766 in.	–
Valve Timing (Intake Valve)	Open	0.38 rad. (22 °) before T.D.C.	–
	Close	0.82 rad. (47 °) after B.D.C.	–
Valve Timing (Exhaust Valve)	Open	0.91 rad. (52 °) before B.D.C.	–
	Close	0.26 rad. (15 °) after T.D.C.	–

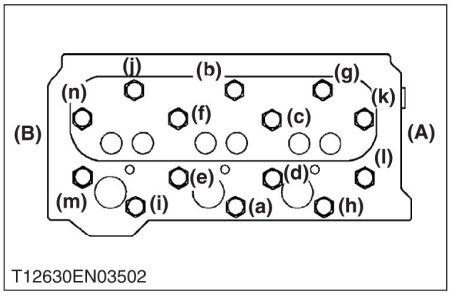
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T12630EN03502

Cylinder Head

1. Loosen the pipe band (1), and remove the water return pipe (2).
2. Remove the cylinder head screws in the order of **(n)** to **(a)**, and remove the cylinder head.
3. Remove the cylinder head gasket and O-ring.

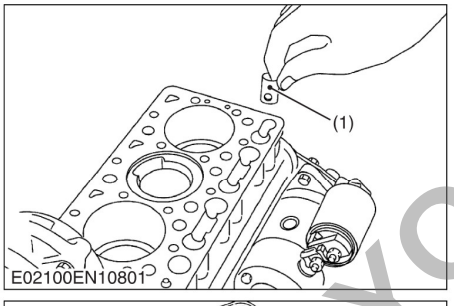
(When reassembling)

- Replace the head gasket with a new one.
- Install the cylinder head, using care not to damage the O-ring.
- Tighten the cylinder head screws gradually in the order of **(a)** to **(n)** after applying engine oil.
- Retighten the cylinder head screws after running the engine for 30 minutes.

Tightening torque	Cylinder head screw	63.7 to 68.6 N·m 6.5 to 7.0 kgf·m 47.0 to 50.6 ft-lbs

(1) Pipe Band
(2) Water Return Pipe
(A) Gear Case Side
(B) Flywheel Side

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Tappets

1. Remove the tappets (1) from the crankcase.

(When reassembling)

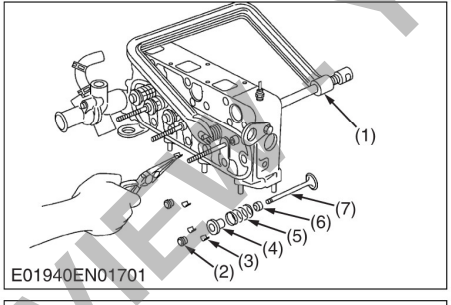
- Before installing the tappets, apply engine oil thinly around them.

IMPORTANT

- **Mark the cylinder number to the tappets to prevent interchanging.**

(1) Tappet

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Valves

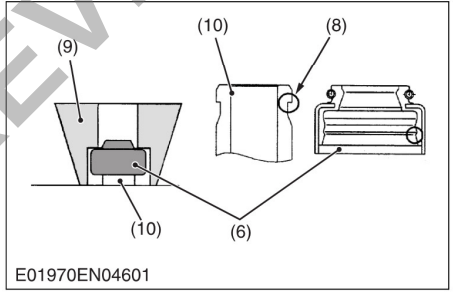
1. Remove the valve cap (2).
2. Remove the valve spring collet (3) with a valve lifter.
3. Remove the valve spring retainer (4), valve spring (5) and valve (7).

(When reassembling)

- Wash the valve stem and valve guide hole, and apply engine oil sufficiently.
- After installing the valve spring collects, lightly tap the stem to assure proper fit with a plastic hammer.
- Install a new stem seal on the valve guide (10) vertically with a jig (9) when insert the stem seal (6).

IMPORTANT

- **Be sure stem seal (6) seats firmly against groove (8) on valve guide.**
- **Use care to prevent damage to lip of stem seal and valve stem when detach the valve spring collet by compressing the valve spring.**



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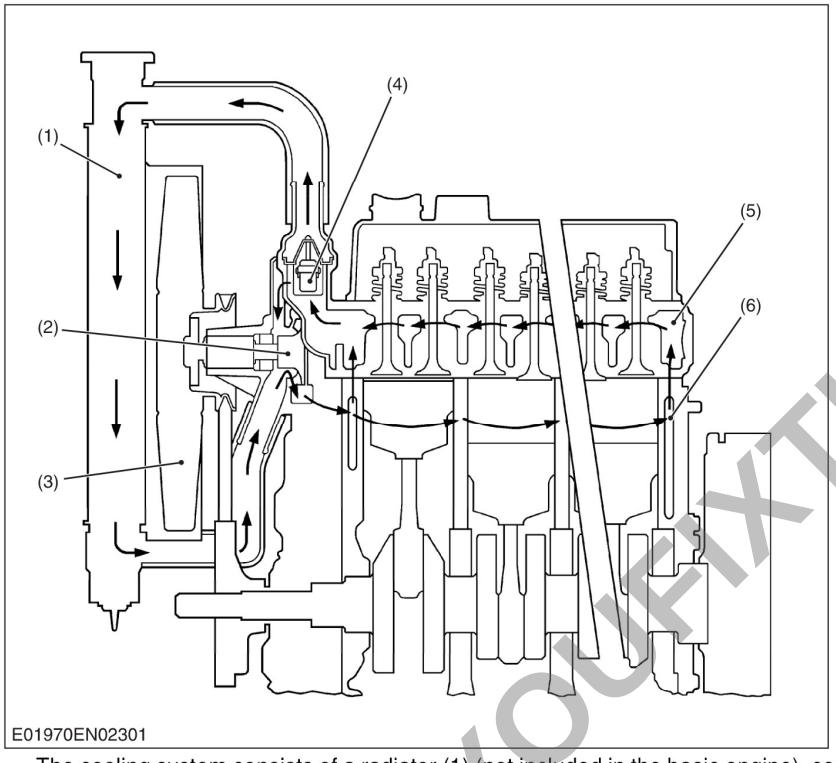
(1) Valve Lifter
(2) Valve Cap
(3) Valve Spring Collet
(4) Valve Spring Retainer
(5) Valve Spring
(6) Valve Stem Seal
(7) Valve
(8) Groove of Valve Guide
(9) Jig
(10) Valve Guide

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3. COOLING SYSTEM

[1] GENERAL



(1) Radiator
(2) Water Pump
(3) Suction Fan
(4) Thermostat
(5) Cylinder Head
(6) Cylinder Block

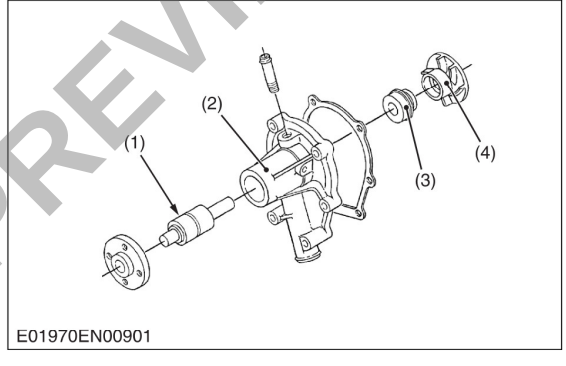
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The cooling system consists of a radiator (1) (not included in the basic engine), centrifugal water pump (2), suction fan (3) and thermostat (4).

The water is cooled through the radiator core, and the fan set behind the radiator pulls cooling air through the core to improve cooling.

The water pump sucks the cooled water, forces it into the cylinder block and draws out the hot water. Then the cooling is repeated. Furthermore, to control temperature of water, a thermostat is provided in the system. When the thermostat opens, the water moves directly to radiator, but when it closes, the water moves toward the water pump through the bypass between thermostat and water pump. The opening temperature of thermostat is approx. 71 °C (159.8 °F).

[2] WATER PUMP

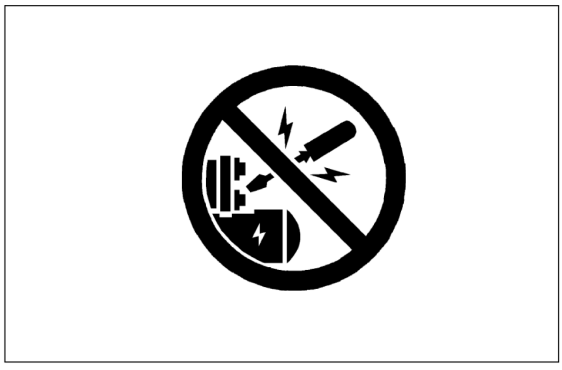


The water pump is driven by the crankshaft via a V belt. Water cooled in the radiator is sucked into the water pump from its lower portion and is sent from the center of the water pump impeller (4) radially outward into the water jacket in the crankcase.

(1) Bearing Unit
(2) Water Pump Body
(3) Mechanical Seal
(4) Water Pump Impeller

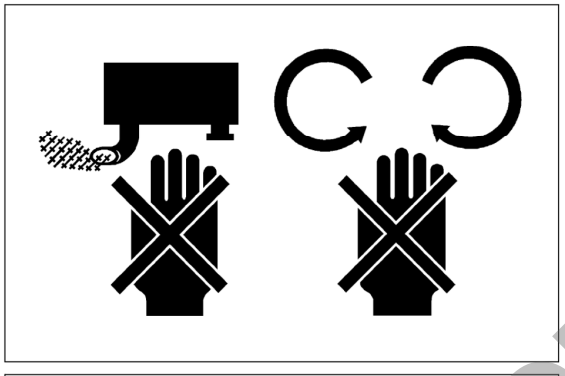
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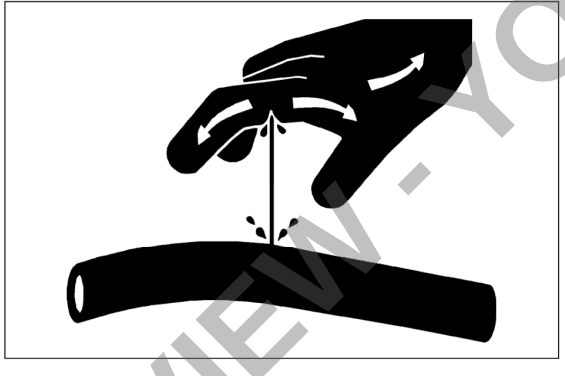
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SAFETY STARTING

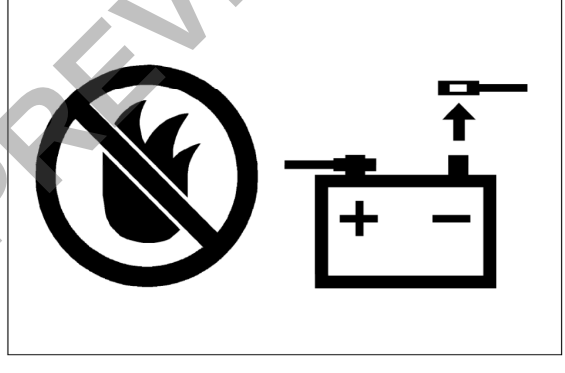
- Do not start the engine by shorting across starter terminals or bypassing the safety start switch.
- Unauthorized modifications to the engine may impair the function and / or safety and affect engine life.





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.



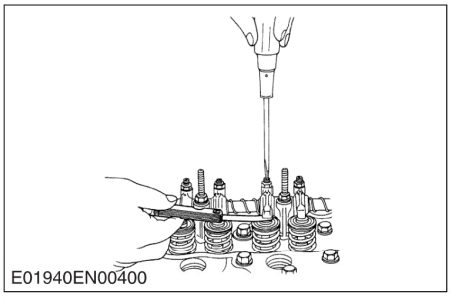
AVOID FIRES

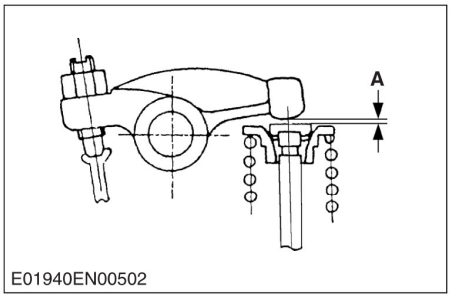
- Fuel is extremely flammable and explosive under certain conditions. Do not smoke or allow flames or sparks in your working area.
- To avoid sparks from an accidental short circuit, always disconnect the battery negative cable first and connect it last.
- Battery gas can explode. Keep sparks and open 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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(4) Check Point of Every 1000 hours


E01940EN00400



E01940EN00502

Checking Valve Clearance

IMPORTANT

- **Valve clearance must be checked and adjusted when engine is cold.**

1. Remove the head cover.
2. Align the **"1TC"** mark on the flywheel and projection on the housing so that the No. 1 piston comes to the compression or overlap top dead center.
3. Check the following valve clearance marked with " " using a feeler gauge.
4. If the clearance, adjust with the adjusting screw.

Valve clearance	Factory spec.	0.145 to 0.185 mm 0.0057 to 0.0073 in.

NOTE

- **The "TC" marking on the flywheel is just for No. 1 cylinder. There is no "TC" marking for the other cylinders.**
- **No. 1 piston comes to the T.D.C. position when the "TC" marking is aligned with the projection in the window on flywheel-housing. Turn the flywheel 0.26 rad. (15°) clockwise and counter clockwise to see if the piston is at the compression top dead center or the overlap position. Now referring to the table below, readjust the valve clearance. (The piston is at the top dead center when both the IN. and EX. valves do not move; it is at the overlap position when both the valves move.**
- **Finally turn the flywheel 6.28 rad. (360 °) and align the "TC" marking and the projection perfectly. Adjust the other valve clearance as required.**
- **After turning the flywheel counter clockwise twice or three times, recheck the valve clearance.**
- **After adjusting the valve clearance, firmly tighten the lock nut of the adjusting screw.**

Number of cylinders Valve arrangement Adjustable cylinder Location of piston		IN.	EX
When No. 1 piston is compression top dead center	1st		
	2nd		
	3rd		
When No. 1 piston is overlap position	1st		
	2nd		
	3rd		

A : Valve Clearance

W1059460

Changing Spark Plug

See page S-18.

Spark Plug	NGK BKR4E or equivalent

W1061994

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