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WORKSHOP MANUAL FOR F2000/ F2100/
F2100E/ F2400

WORKSHOP MANUAL (ADDITION) FOR F2100 /
F2100E / F2400

Part Number: 9789710284



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TO THE READER

In this section, the altered points of F2100, F2100E and F2400 from F2000 are explained. It is divided into two parts, MECHANISM and SERVICING.

As for the items which are not explained in this section, refer to the first section of this book (Workshop Manual for F2000).

All information, illustrations and specifications contained in this manual are based on the latest production information available at the time of publication.

KUBOTA reserves the right to make changes in information at any time without notice.

Mar '90

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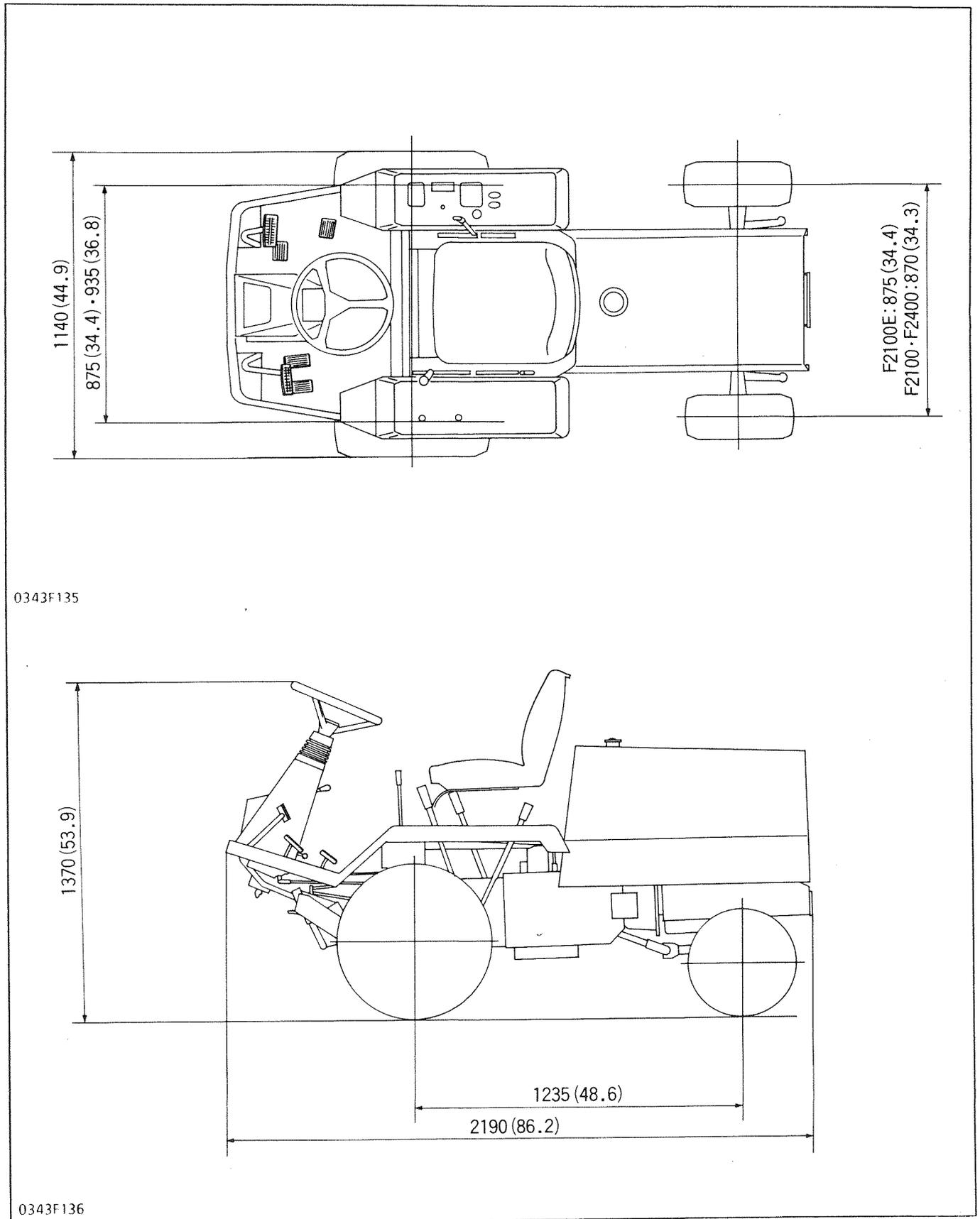
SPECIFICATIONS

Model		F2100E	F2100	F2400
Maximum P.T.O. power		16.5 HP (12.3 kW) *1		19 HP (14.2 kW) *1
Engine gross H.P. (SAE)		20 HP (14.9 kW) *1		24 HP (17.9 kW) *1
Engine	Model	D950-FM		D1105-F
	Type	Vertical, water-cooled, 4-cycle diesel		
	Number of cylinders	3		
	Bore and stroke	75 mm x 70 mm (3.0 in. x 2.8 in.)		78 mm x 78.4 mm (3.1 in. x 3.1 in.)
	Total displacement	927 cm ³ (56.6 cu. in.)		1123 cm ³ (68.5 cu. in.)
	Rated revolution	2600 rpm (43.3 r/s)		
	Combustion chamber	Spherical type		New TVCS
	Fuel injection pump	Bosh type K mini pump (ND-PFR3KD50/2NP4)		Bosh type MD mini pump (ND-PER3NC50A1ND461)
	Governor	Centrifugal ball mechanical governor		Centrifugal mechanical governor
	Injection nozzle	"Throttle" type (ND-DN12SD12)		"Throttle" type (ND-DNOPD55)
	Injection timing	20° to 22° before top dead center		17° to 19° before top dead center
	Injection order	1-2-3		
	Injection pressure	13.73 MPa (140 kgf/cm ² , 1991 psi) to 14.71 MPa (150 kgf/cm ² , 2133 psi)		
	Compression ratio	22		
	Lubricating system	Forced lubrication by trochoidal pump		
	Cooling system	Water with pressurized radiator, Forced lubrication by pump		
	Lubricating oil	API Service CC or CD		
	Starting system	Electric starter with battery, glow plug, 12 V, 0.8 kW		
	AC dynamo	12 V (300 W)		12 V (480 W)
	Battery	12 V (65 Ah)		
Fuel	Diesel fuel No.2-D [No. 1 diesel fuel, if temperature is below -10°C (15°F)]			
Weight (Dry)	105 kg (232 lbs)		98 kg (216 lbs)	
Capacities	Fuel tank	34 ℓ (9.0 U.S. gals.)		
	Engine crankcase	3.1 ℓ (3.3 U.S. qts.)		3.3 ℓ (3.5 U.S. qts.)
	Engine coolant	3.7 ℓ (3.9 U.S. qts.)		3.3 ℓ (3.5 U.S. qts.)
	Transmission case	12.7 ℓ (13.4 U.S. qts)		
	Rear axle diff. case	—	1.5 ℓ (1.6 U.S. qts.)	
	Rear axle gear case	—	0.5 ℓ (0.5 U.S. qts.)	
Tires	Front	23 x 10.50-12 (4PR) Turf		
	Rear	16 x 6.50-8 (4PR) Rib, Turf	16 x 6.50 - 8 (4PR) Turf	
Traveling speeds	Forward	Low	0 to 7.4 km/h (4.6 mph) *2	
		High	0 to 15.2 km/h (9.5 mph) *2	
	Reverse	Low	0 to 4.4 km/h (2.8 mph) *2	
		High	0 to 9.0 km/h (5.6 mph) *2	
Dimensions	Overall length	2190 mm (86.2 in.)		
	Overall width	1140 mm (44.9 in.)		
	Overall height	1370 mm (53.9 in.)		
	Wheel base	1235 mm (48.6 in.)		
	Min. ground clearance	175 mm (6.9 in.)		
	Treads	Front	875 mm (34.4 in.) · 935 mm (36.8 in.)	
Rear		875 mm (34.4 in.)	870 mm (34.3 in.)	
Weight	619 kg (1367 lbs) *3	625 kg (1380 lbs) *3	640 kg (1410 lbs) *3	
Front PTO	Kubota 10 tooth involute spline, 2 speeds (1130 and 2550 rpm at 2600 engine rpm) (18.9 and 42.5 r/s at 43.3 engine r/s)			
Clutch	Dry single			
Steering	Power, hydrostatic with tilt steering			
Transmission	Main-hydrostatic transmission, High-Low gear shift (2 forward, 2 reverse)			
Minimum turning radius	0.4 m (1.3 feet) w/o brake			
Brake	Internal expanding type, right and left independent			
Differential	Bevel gear			

Note: *1 Manufacturer's estimate
 *2 at 2600 engine rpm (43.3 engine r/s)
 *3 without mower deck

DIMENSIONS

mm (in.)



TO THE READER

This Workshop Manual has been prepared to provide servicing personnel with information on the mechanism, service and maintenance of KUBOTA Front Mower F2000. It is divided into two parts, "Mechanism" and "Servicing".

■ Mechanism

Information on construction and function are included for each section. This part should be understood before proceeding with troubleshooting, disassembling and servicing.

■ Servicing

Under the heading "General" comes general precautions, check and maintenance and special tools. For each section, there are troubleshooting, servicing specification lists, checking and adjusting, disassembling and assembling, and servicing which cover procedures, precautions, factory specifications and allowable limits.

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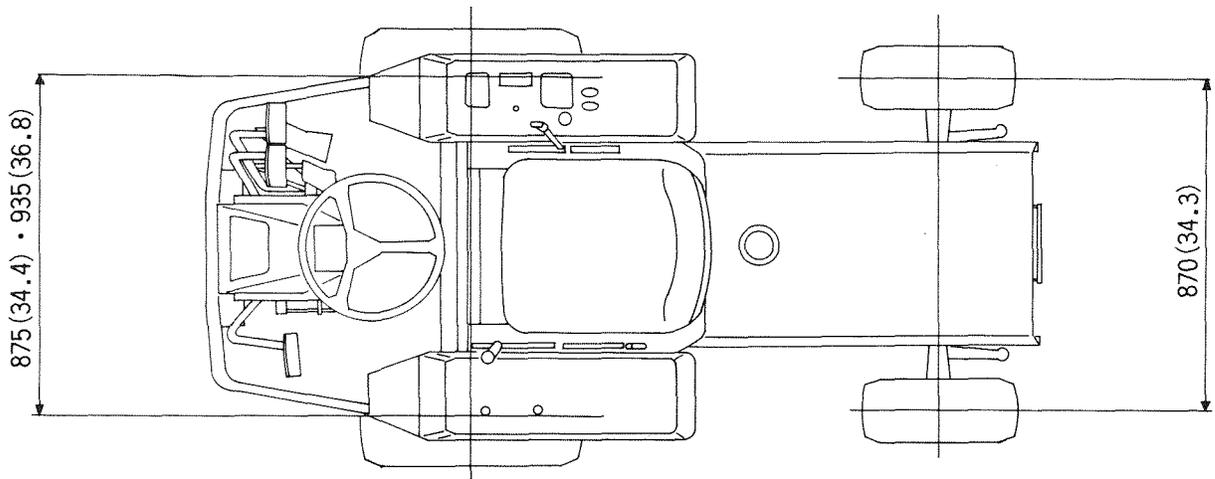
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SPECIFICATIONS

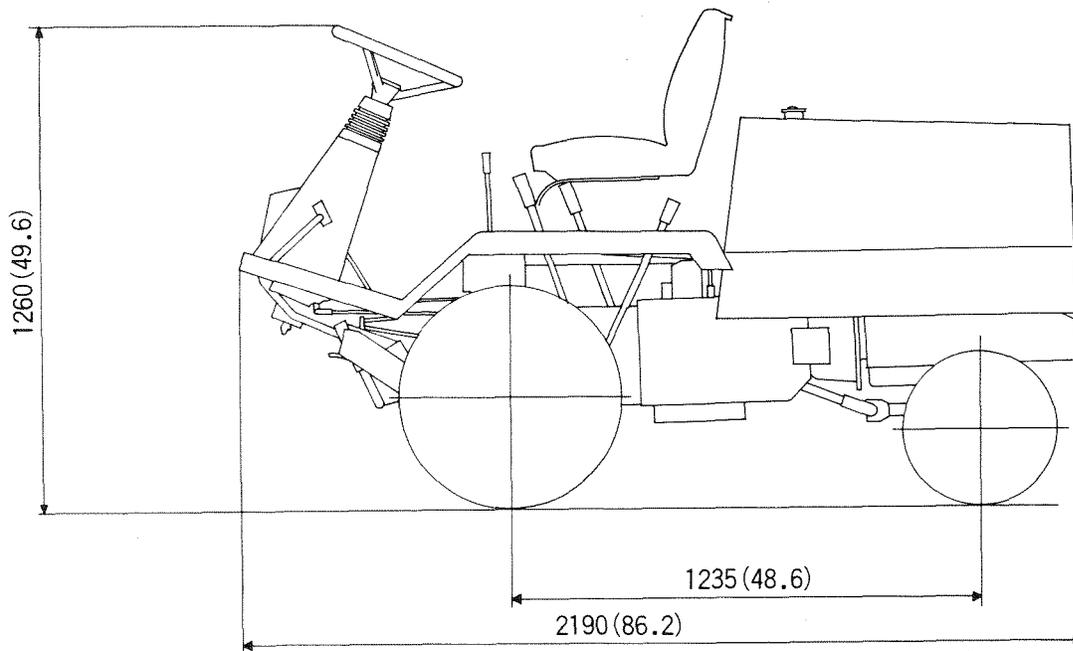
Model		F2000	
Maximum P.T.O. power		16.5 HP (12.3 kW)	
Engine gross H.P. (SAE)		20 HP (14.9 kW)	
Engine	Model		D950-FM
	Type		Vertical, water cooled, 4-cycle diesel
	Number of cylinders		3
	Bore and stroke		75 mm x 70 mm (3.0 in. x 2.8 in.)
	Total displacement		927 cm ³ (56.6 cu.in.)
	Rated revolution		2600 rpm (43.3 r/s)
	Combustion chamber		Spherical Type
	Fuel injection pump		Bosh type K mini pump (NP-PFR3KD50/2 NP4)
	Governor		Centrifugal ball mechanical governor
	Injection nozzle		"Throttle" type (ND-DN12 SD12)
	Injection timing		20° to 22° before top dead center
	Injection order		1-2-3
	Injection pressure		13.73 MPa (140 kgf/cm ² , 1991 psi)
	Compression ratio		22
	Lubricating system		Forced lubrication by trochoidal pump
	Cooling system		Water with pressurized radiator
	Lubricating oil		MIL-L-2104B or MIL-L-2104C, quality better than CC class (API)
	Starting system		Electric starter with battery, glow plug, 12V, 0.8 kW
	AC dynamo		12 V (150 W)
	Battery		12 V (65 Ah)
Fuel		Diesel fuel No.2-D [No.1 diesel fuel, if temperature is below -10°C (15°F)]	
Weight (Dry)		105 kg (232 lbs)	
Capacities	Fuel tank		34 ℓ (9.0 U.S. gals.)
	Engine crankcase		3.1 ℓ (3.3 U.S. qts.)
	Engine coolant		3.7 ℓ (3.9 U.S. qts.)
	Transmission case		12.7 ℓ (13.4 U.S. qts.)
	Rear axle diff. case		1.5 ℓ (1.6 U.S. qts.)
	Rear axle gear case		0.5 ℓ (0.5 U.S. qts.)
Tires	Front		23 x 10.50-12 (4PR) Turf
	Rear		16 x 6.50-8 (4PR) Turf
Traveling speeds	Forward	Low	0 to 7.4 m/h (4.6 mph)
		High	0 to 15.2 m/h (9.5 mph)
	Reverse	Low	0 to 4.4 m/h (2.8 mph)
		High	0 to 9.0 m/h (5.6 mph)
Dimensions	Overall length		2190 mm (86.2 in.)
	Overall width		1140 mm (44.9 in.)
	Overall height		1260 mm (49.6 in.)
	Wheel base		1235 mm (48.6 in.)
	Minimum ground clearance		175 mm (6.9 in.)
Treads	Front	875 mm (34.4 in.) 935 mm (36.8 in.)	
	Rear	870 mm (34.3 in.)	
Weight		625 kg (1380 lbs) w/o mower deck	
PTO shaft		Transmission case front	
Front PTO		Kubota 10 tooth involute spline, 2 speeds (1130 and 2550 rpm at 2600 engine rpm) (18.9 and 42.5 r/s at 43.3 engine r/s)	
Clutch		Dry single	
Steering		Power, hydrostatic	
Transmission		Main-hydrostatic transmission, High-Low gear shift (2 forward, 2 reverse)	
Minimum turning radius m (feet)		LH 0.53 m (1.7 feet) w/o brake	
Brake		Internal expanding type, right and left independent with interlocking device	
Differential		Bevel gear	

DIMENSIONS

mm (in.)



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0343F002

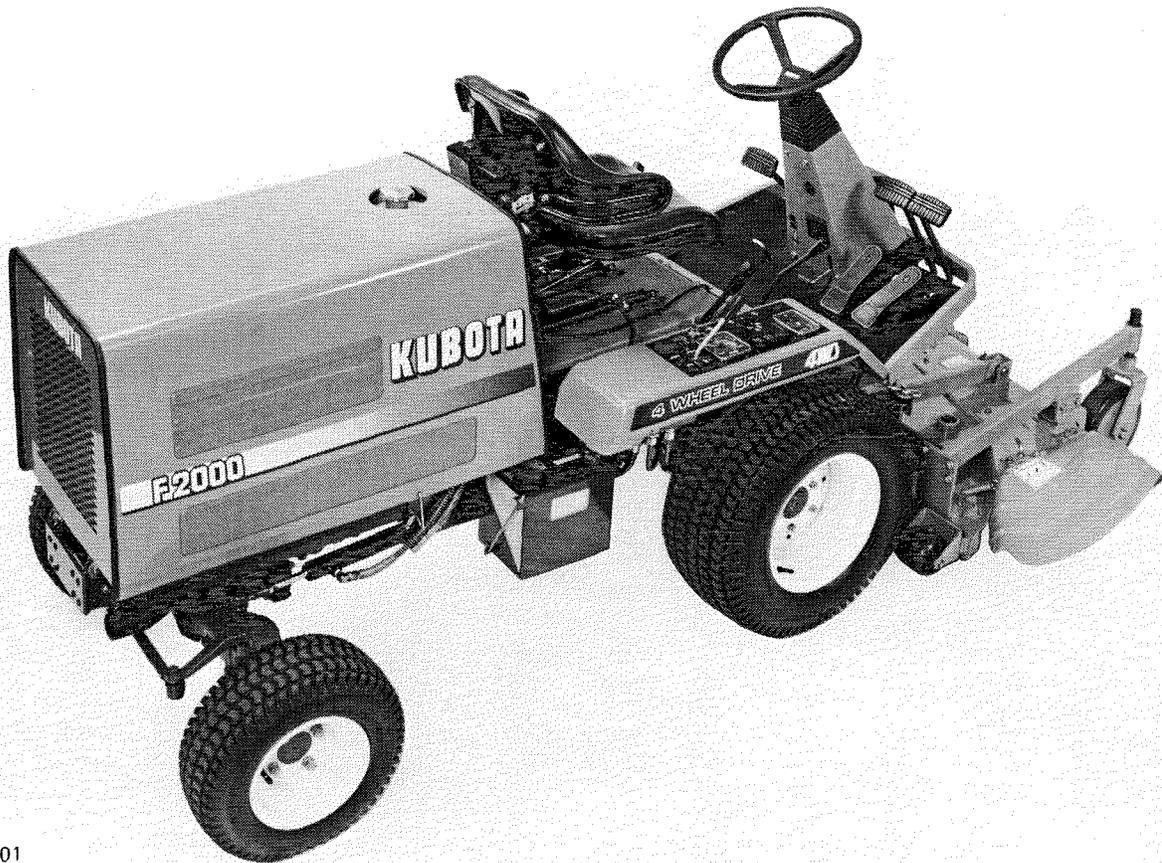
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M MECHANISM

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F FEATURES



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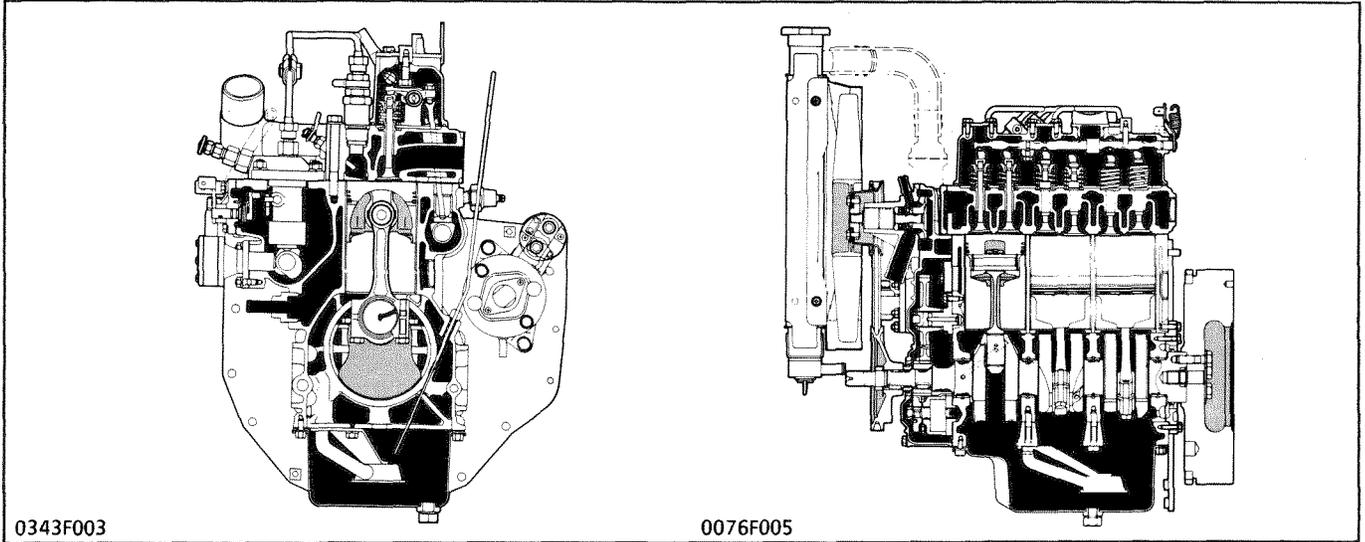
- **Vertical, Water-cooled, 3-Cylinder Diesel Engine**
The quiet Kubota water-cooled 3-cylinder diesel engine produces high torque rise, maximum work efficiency, and reduced fuel costs.
- **Hydrostatic Transmission**
The hydrostatic transmission [HST], with high-low range selection, permits matching the optimum speed to the task at hand.
- **2 Pedal System Speed Control with Cruise Control**
With the hydrostatic transmission, gear shifting is accomplished by an independent forward and rear 2 pedal system with cruise control.
- **Hydrostatic Power Steering**
Hydrostatic power steering reduces work fatigue. And the rear wheel steering, by permitting a tighter turning radius, makes cutting around trees much easier.
- **4WD**
4WD, with its greater tractive power, makes work on slopes or soft ground possible.
- **Front Wheel Differential Lock**
The front wheel differential lock is superb for assisting the negotiation of slopes and soft or slippery ground.
- **Independent Left and Right Brakes**
Independent left and right brakes enhance trimming performance
- **Front Off-set Mower**
The front off-set mower ensures easier and closer trimming.

1 ENGINE

[1] FEATURES

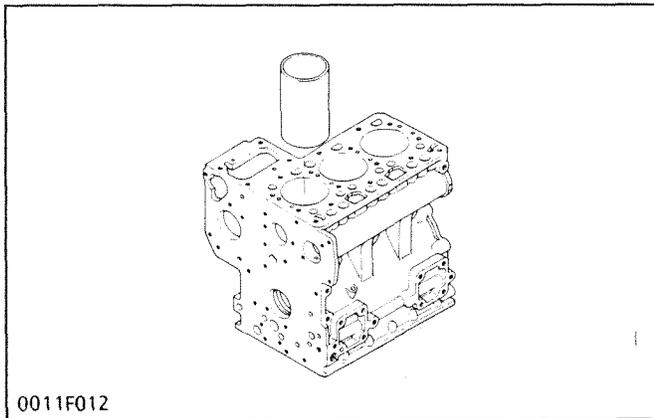
The D950-FM is a water-cooled, 4-cycle diesel engine, incorporating KUBOTA's leading-edge technology. By utilizing KUBOTA's unique spherical combustion chamber, the well-known Bosch K type

injection pump and a well-balanced design, the engine features greater power, low fuel consumption, reduced vibration and quiet operation.



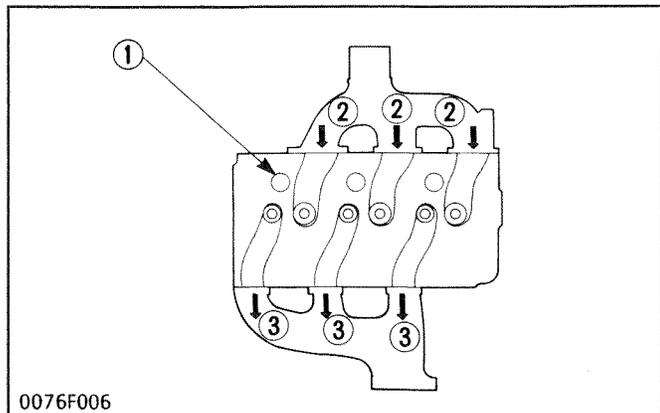
[2] ENGINE BODY

(1) Cylinder Block



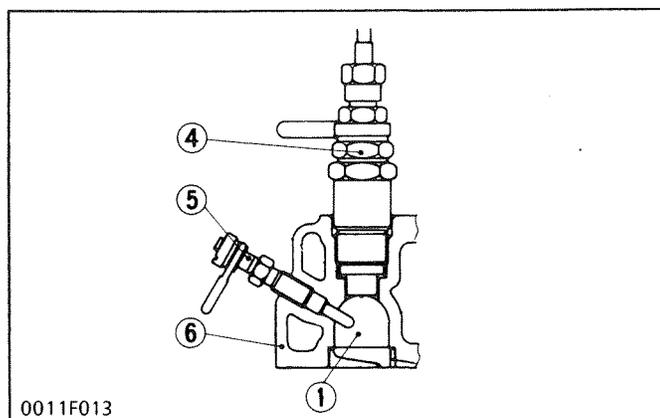
The engine features a highly durable tunnel type cylinder block containing the main bearings. Furthermore, the pressure-fitted dry type cylinder liners allow effective cooling, less distortion, higher wear-resistance qualities and, because each cylinder has its own chamber, noise is minimized.

(2) Cylinder Head



- (1) Combustion Chamber
- (2) Suction
- (3) Exhaust

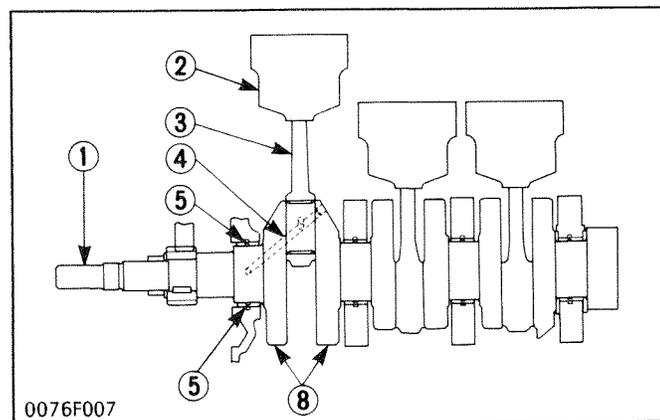
The cross-flow type inlet/exhaust ports in this engine have their openings at both sides of the cylinder head. Because the overlap between the inlet/exhaust ports is less than that of conventional types having all ports on one side, the drawn in air is prevented from being heated and expanded by the exhaust gases. The cool, high density suction air has a high voluminous efficiency and raises the power of the engine. Furthermore, distortion of the cylinder head by heated exhaust air is reduced because suction ports are arranged alternately. The combustion chamber is of KUBOTA's exclusive spherical combustion chamber type. Suction air is whirled to be mixed effectively with fuel, prompting combustion and reducing fuel consumption.



- (4) Nozzle Assembly
- (5) Glow Plug
- (6) Cylinder Head

In the combustion chamber are installed throttle type injection nozzle and rapid heating sheathed type glow plug. This glow plug assures easier than even engine starts even at -15°C (5°F).

(3) Crankshaft



- (1) Crankshaft
- (2) Piston
- (3) Connecting Rod
- (4) Oil Passage
- (5) Crankshaft Bearing 1
- (6) Crankshaft Bearing 2
- (7) Side Bearing
- (8) Counterweight

The crankshaft (1) is driven by the pistons (2) and connecting rods (3) and converts reciprocating motion into rotary motion. It also drives the oil pump, camshaft and fuel camshaft. Six counterweights (8) are integrated into one unit to minimize bearing wear and lubricating oil temperature rise.

Crankshaft journals, crankpins and oil seal sliding section are induction-hardened to increase wear resistance quality.

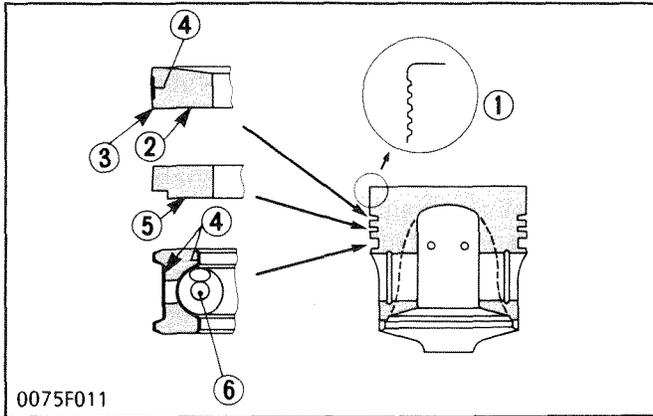
Crankshaft journals are supported by the main bearings.

Crankshaft bearing 1 (5), located at the front end, is a wind type bushing and the three other bearings 2 (6), located behind, are split type bushings.

Side bearings 1, 2 (7) are of split type and are mounted on both sides of the main bearing case 1 at the flywheel side.

Crankshaft bearings and side bearings are plated with a special alloy to increase wear resistance.

(4) Piston and Piston Rings



- (1) Rib
- (2) Top Ring
- (3) Barrel Face
- (4) Hard Chrome Plating
- (5) Second Ring
- (6) Coil Expander Ring

Each piston is machined to an ellipse. This allows for expansion and a perfect fit inside the cylinder bore when the piston becomes hot. The head of the piston is flat. Furthermore, ribs (1) are provided between the piston head and top ring (2) to reduce distortion and to help heat radiation.

The pistons are made of special low thermal expansion aluminum alloy which resist high temperatures.

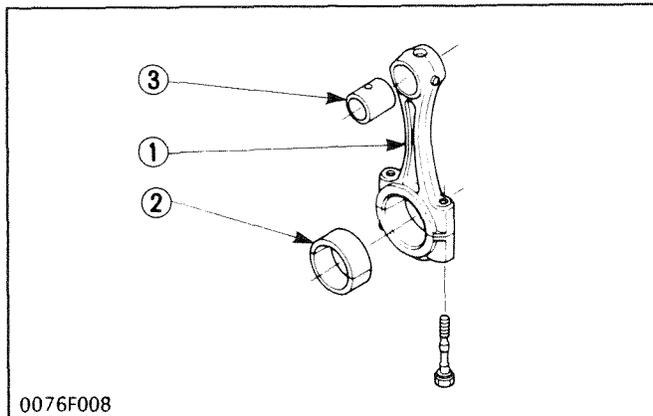
The top ring is of the key stone type which can withstand heavy loads, and the sliding surface to the cylinder wall is shaped into barrel face which is well fitted to the wall and plated with hard chrome.

Second ring (5) is of under-cut type which is effective to prevent oil rising.

Oil ring is effective to scrape oil because it is closely fitted to the cylinder wall by coil expander and the upper and lower ends of its sliding surface are cut diagonally to raise fare pressure to the cylinder walls.

A part of scraped oil is forced into the inside of piston through oil escape holes of rings and piston. The oil ring is plated with hard chrome to increase wear resistance quality.

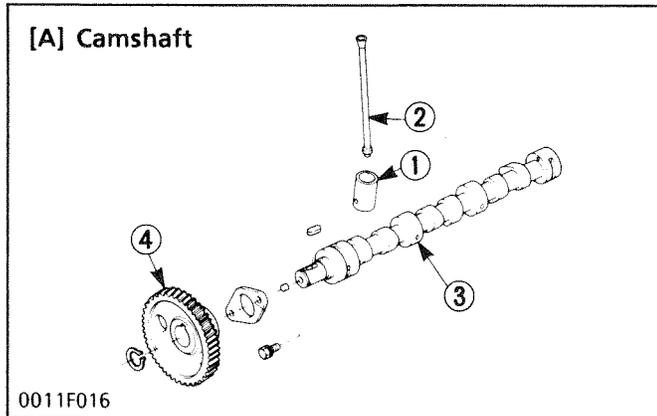
(5) Connecting Rods



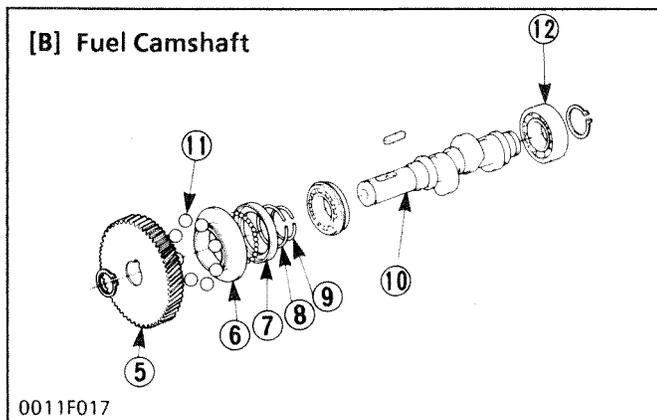
- (1) Connecting Rod
- (2) Crankpin Bearing
- (3) Bushing

Connecting rod (1) is used to connect the piston with the crankshaft. The big end of the connecting rod has crankpin bearings (2) (split type) and the small end has a bushing (Solid type).

(6) Camshaft and Fuel Camshaft

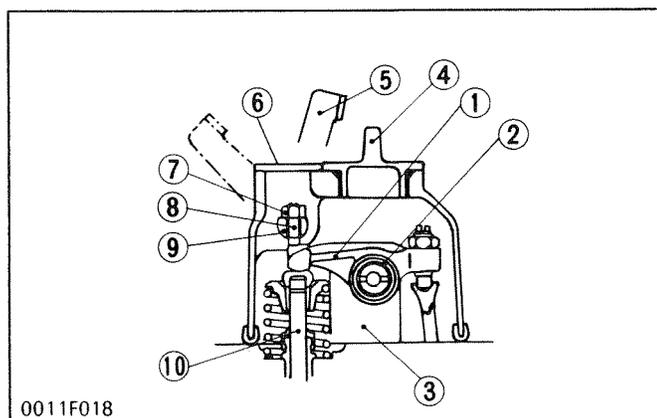


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|--------------|-------------------|
| (1) Tappet | (3) Camshaft |
| (2) Push Rod | (4) Camshaft Gear |



- | | |
|-------------------------|--------------------|
| (5) Injection Pump Gear | (9) Snap Ring |
| (6) Governor Sleeve | (10) Fuel Camshaft |
| (7) Governor Ball Case | (11) Ball |
| (8) Snap Ring | (12) Ball Bearing |

(7) Rocker Arm Assembly

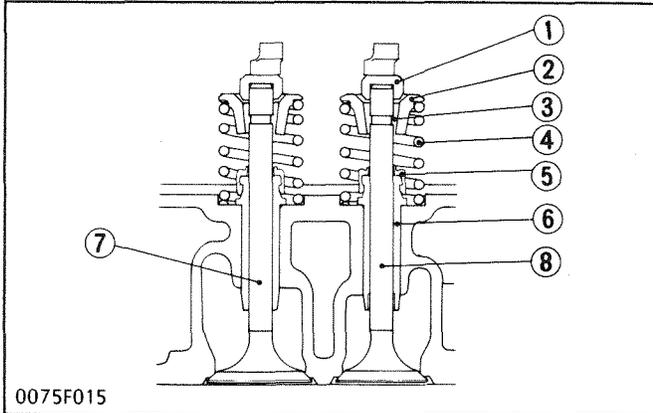


- | | |
|-------------------------|--------------------------------|
| (1) Rocker Arm | (6) Decompression Window Cover |
| (2) Rocker Arm Shaft | (7) Decompression Nut |
| (3) Rocker Arm Bracket | (8) Decompression Bolt |
| (4) Oil Filer Plug | (9) Decompression Shaft |
| (5) Decompression Lever | (10) Valve |

The camshaft (3) is made of special cast iron and the journal and cam sections are chilled to resist wear. The journal sections are force-lubricated. The fuel camshaft controls the reciprocating motion of the injection pump, and is equipped with a ball to control the governor. The fuel camshaft is made of carbon steel and cam sections are quenched and tempered to provide greater wear resistance.

The rocker arm assembly includes the rocker arms (1), rocker arm brackets (3) and rocker arm shaft (2) and converts the reciprocating motion of the push rods to an open/close movement of the inlet and exhaust valves. Valve control timing must be adjusted with screws on the rocker arms. Lubrication oil is pressure fed through the bracket to the rocker arm shaft so that the rocker arm bearings and the entire system are lubricated sufficiently.

(8) Inlet and Exhaust Valves

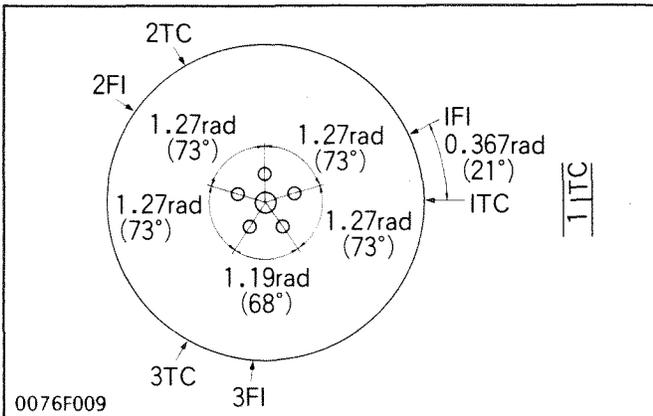


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- | | |
|---------------------------|---------------------|
| (1) Valve Cap | (5) Valve Stem Seal |
| (2) Valve Spring Retainer | (6) Valve Guide |
| (3) Valve Spring Collets | (7) Inlet Valve |
| (4) Valve Spring | (8) Exhaust Valve |

The inlet and exhaust valves (7), (8) and their guides (6) are different from each other. Other parts, such as valve springs (4), valve spring retainers (2), valve spring collets (3), valve stem seals (5), and valve caps (1) are the same for both the inlet and exhaust valves. All contact or sliding parts are quenched and tempered to resist wear.

(9) Flywheel



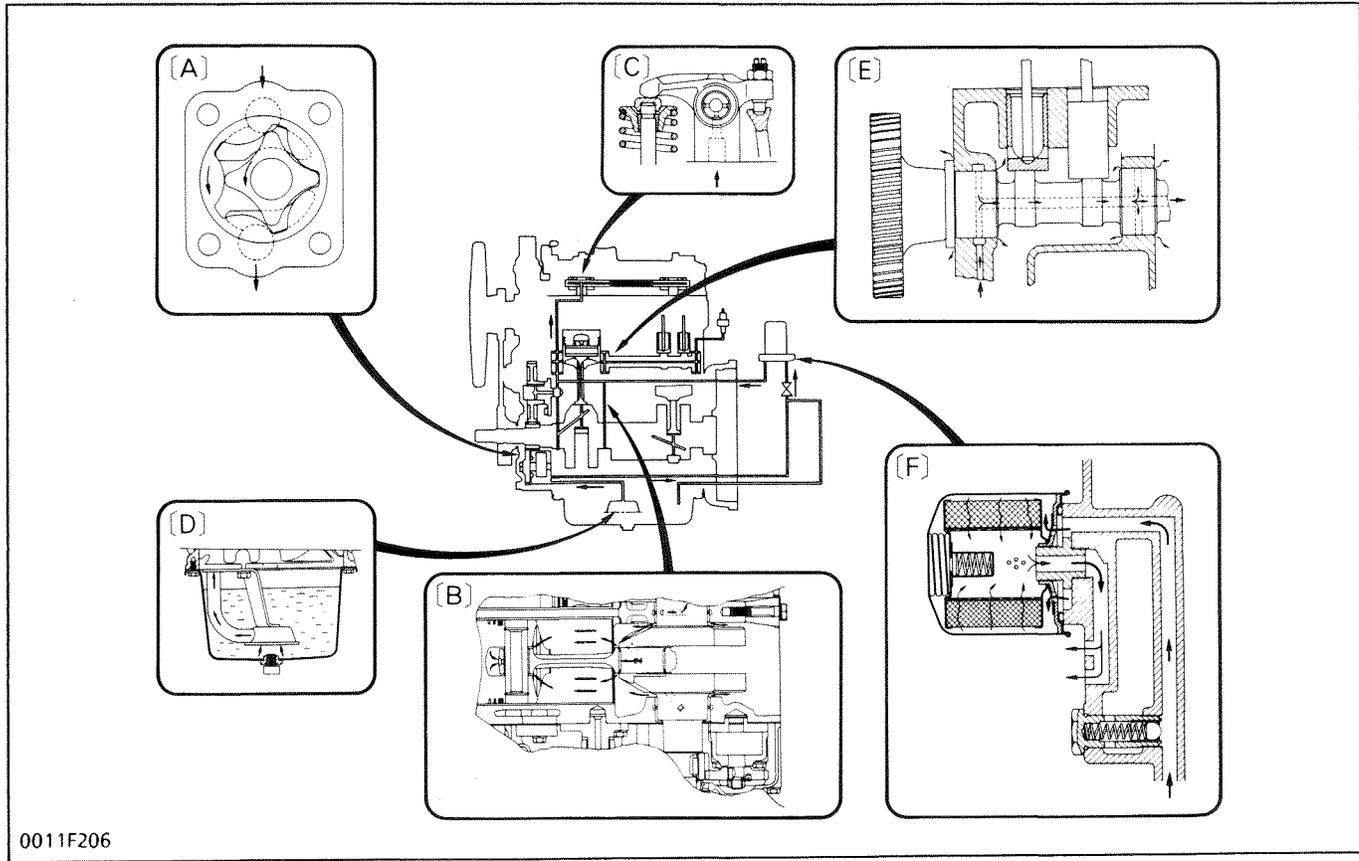
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The flywheel is connected with the crankshaft. The flywheel functions by storing the explosive force from each cylinder as an inertia force and using this force to maintain smooth rotation of the flywheel.

On the circumference of the flywheel are stamped the fuel injection timing and top dead center marks. The flywheel and crankshaft can be fixed to each other at a certain point according to the arrangement of flywheel mounting bolt hole.

- 1/TC... Mark for top dead center of 1st piston
- 1/FC... Mark for fuel injection of 1st piston

[3] LUBRICATING SYSTEM



0011F206

- [A] Oil Pump
- [B] Crankshaft and Piston
- [C] Rocker Arm and Rocker Arm Shaft
- [D] Oil Strainer
- [E] Camshaft
- [F] Oil Filter Cartridge and Relief Valve

The lubricating system within this engine consists of an oil strainer, oil pump, relief valve, oil filter cartridge and oil switch.

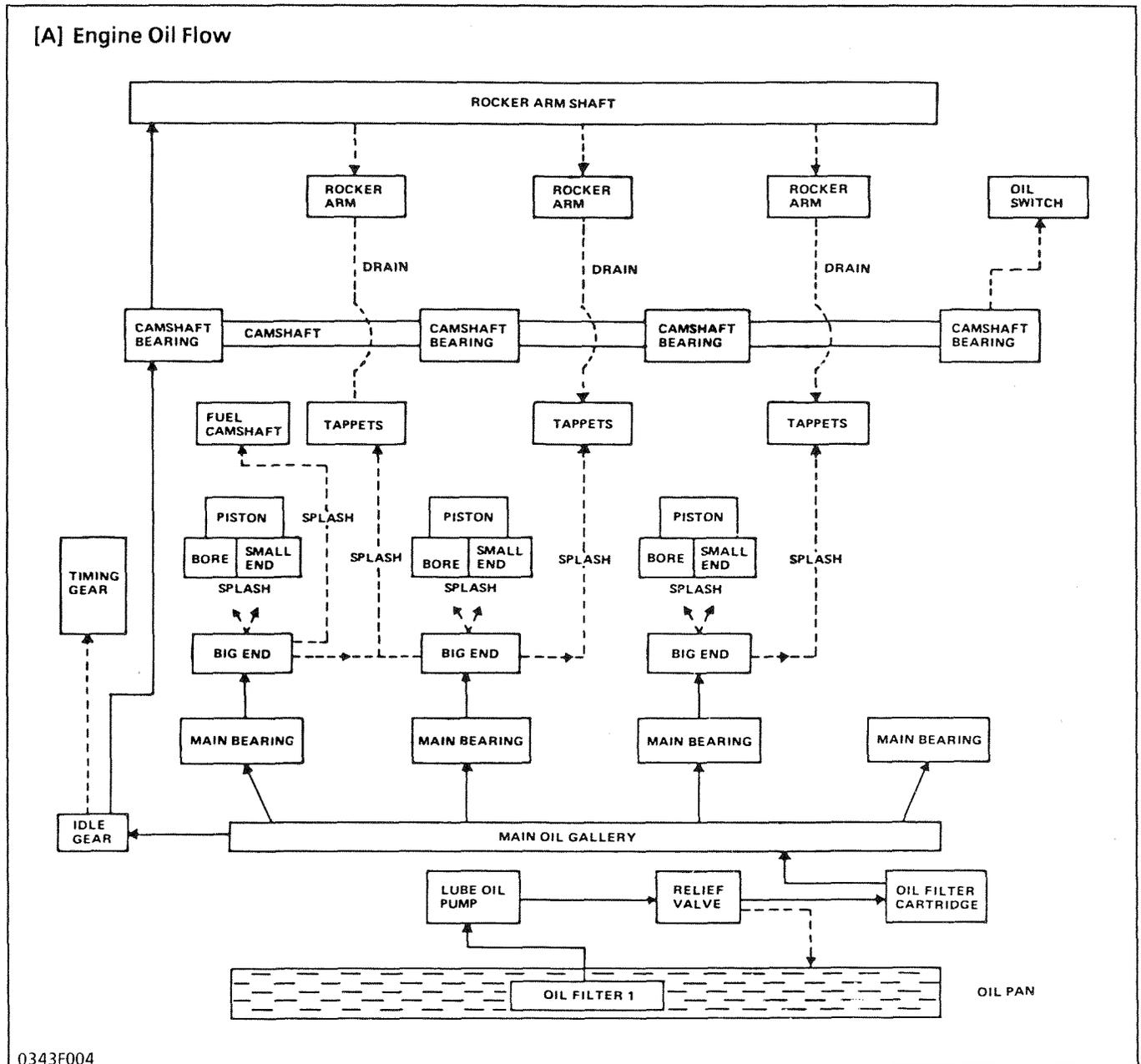
The oil pump draws in lubricating oil from the oil pan through the oil strainer. The oil flows down to the filter cartridge, where it is further filtered.

Then the oil is force-fed to the crankshaft,

connecting rods, idle gear, camshaft and rocker arm shaft and lubricates each part.

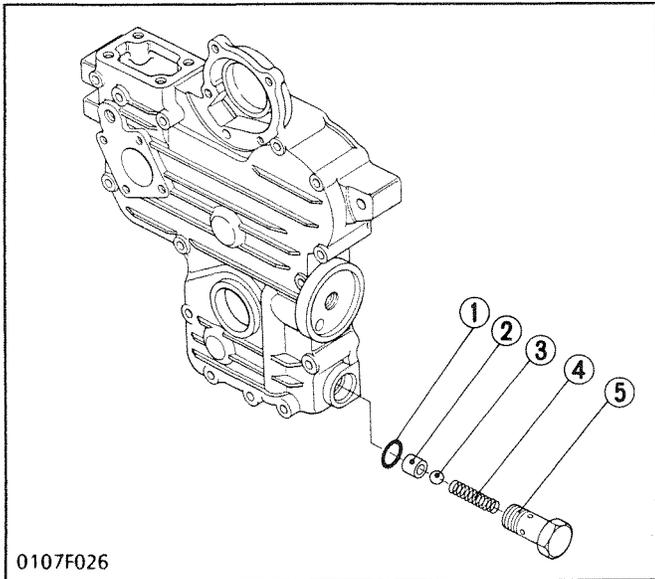
Some part of oil, splashed by the crankshaft or leaking and dropping from gaps of each part, lubricates these parts: pistons, cylinders, small ends of connecting rods, tappets, push rods, inlet and exhaust valves and timing gears.

■ Engine Oil Flow



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(1) Relief Valve



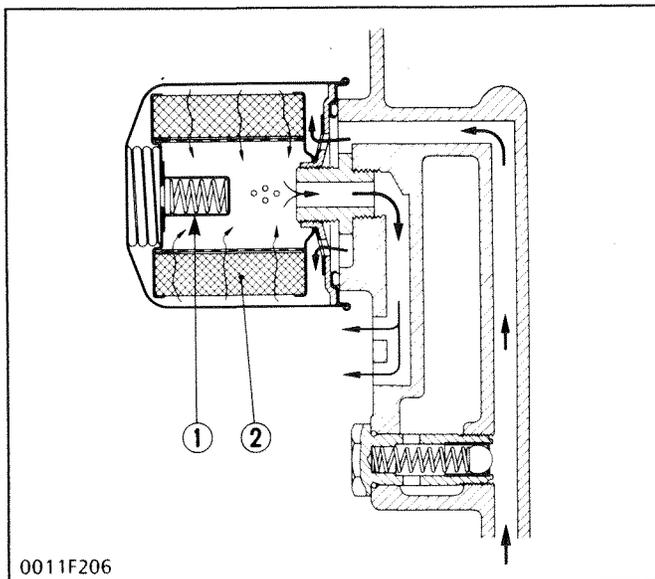
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- (1) O-ring
- (2) Valve Seat
- (3) Steel Ball
- (4) Spring
- (5) Relief Valve Body

The relief valve prevents damage to the lubricating system due to high oil pressure. This relief valve is a ball type direct acting relief valve, and is best suited for low pressures. When oil pressure exceeds the upper limit, the ball (3) is pushed back by the pressure of oil allowing the oil to drain off.

Valve opening pressure at rated speed	167 to 343 kPa 1.7 to 3.5 kgf/cm ² 24 to 49 psi
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(2) Oil Filter Cartridge



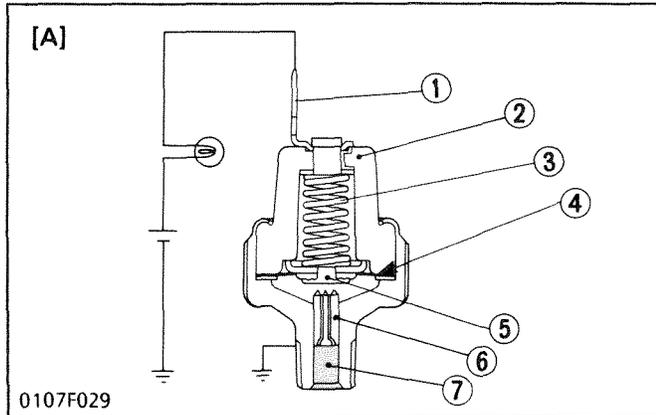
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- (1) Bypass Valve
- (2) Filter Element

Impurities (various metallic chips, and dust, carbon, etc. in the drawn in air) in engine oil can cause components to wear and seize as well as impairing the physical and chemical properties of the oil itself. Impurities contained in force-fed engine oil are absorbed by the filtering medium for removal as they pass through the filter element (2).

When the filter element is clogged and the oil pressure in the inlet line builds up to 98 kPa (1.0 kgf/cm², 14 psi) more than the outlet line, the bypass valve (1) opens and the oil flows from inlet to outlet bypassing the filter element.

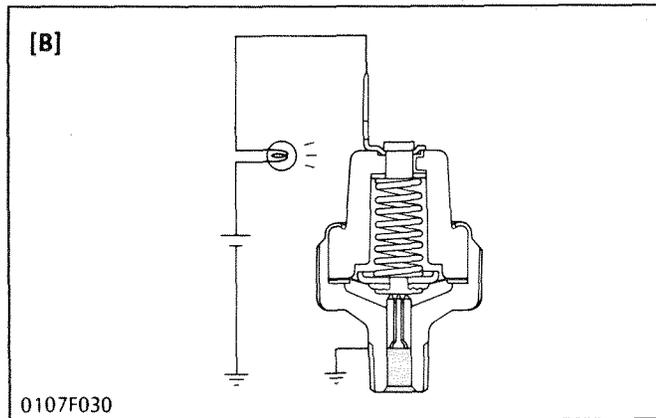
(3) Oil Switch



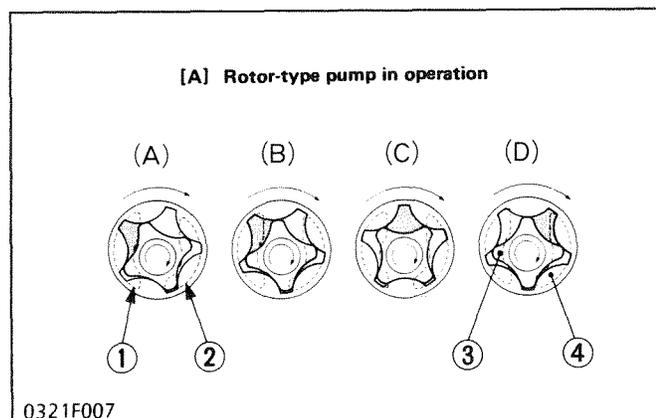
[A] At Proper Oil Pressure

[B] At Oil Pressures of 49 kPa (0.5 kgf/cm², 7 psi) or Less

- | | |
|-------------------|---------------------|
| (1) Terminal | (5) Contact Rivet |
| (2) Insulator | (6) Contact |
| (3) Spring | (7) Oil Switch Body |
| (4) Rubber Gasket | |



(4) Oil Pump



- | | |
|------------|-----------------|
| (1) Inlet | (3) Inner Rotor |
| (2) Outlet | (4) Outer Rotor |

The oil switch is mounted on the crankcase, to warn the operator that the lubricating oil pressure is poor.

If the oil pressure falls below 49 kPa (0.5 kgf/cm², 7 psi), the oil warning lamp will light up, warning the operator. In this case, stop the engine immediately and check the cause of pressure drop.

The oil pump in this engine is a trochoid pump. Inside the pump body, the 4 lobe inner rotor (3) is eccentrically engaged with the 5 lobe outer rotor (4).

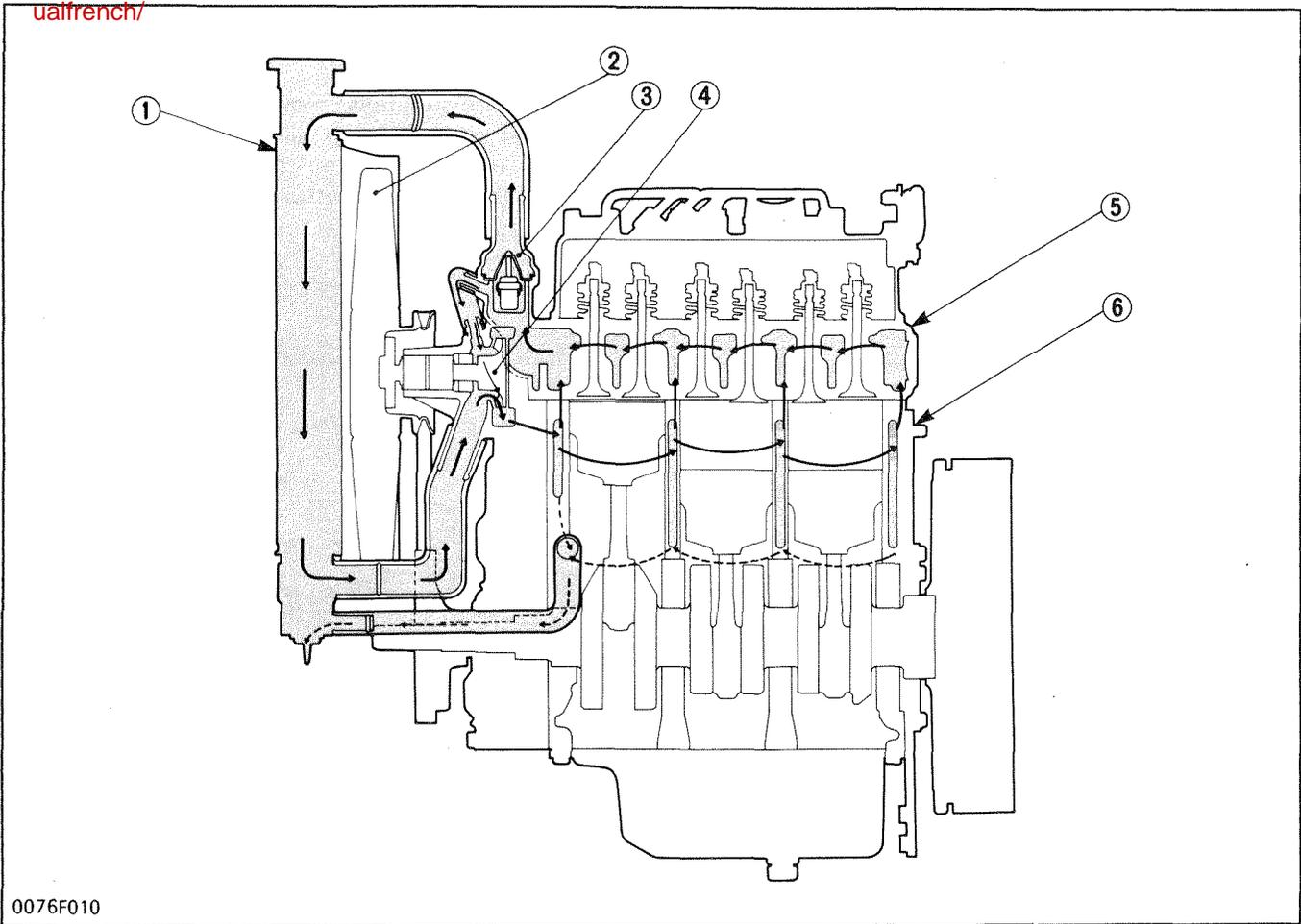
The inner rotor is driven by the crankshaft via gears, which in turn rotate the outer rotor.

When the inner rotor rotates, the outer rotor also rotates in the same direction.

The two rotors have differences in lobe number and center which generates space between lobes as shown in the figure. At position (A), there is little space between lobes in the inlet port. As the rotor rotates towards position (B), the space between the lobes becomes larger, creating a negative pressure which sucks in oil.

Outside the inlet port, as shown in position (C), the space between the lobes becomes gradually smaller, and oil pressure increases. At position (D), oil is discharged from the outlet port.

[4] COOLING SYSTEM



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

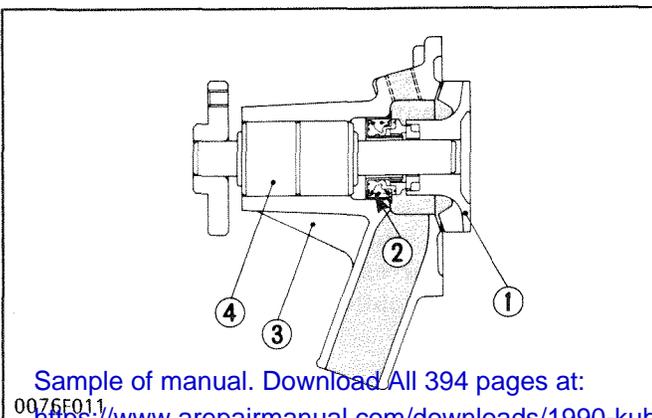
The cooling system consists of a radiator (1), centrifugal water pump (4), suction fan (2) and thermostat (3).

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. 82°C (180°F).

(1) Water Pump



35 l/min. (7.7 Imp.gals./min., 9.2 U.S.gals./min.) of water is forced into the crank case and cylinder head to cool them. The impeller, of backward type, is bent as far as possible from the center, in the opposite direction to rotation. The bearing unit prevents cooling water from entering by a special mechanical seal.

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