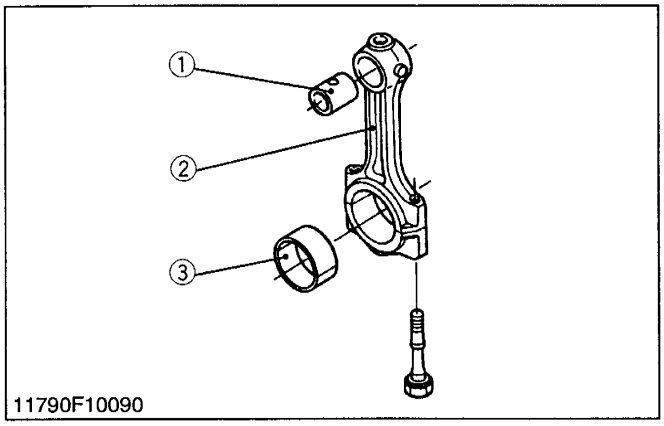
M E C H A N I S M
I N D E X

[5] CONNECTING ROD



11790F10090

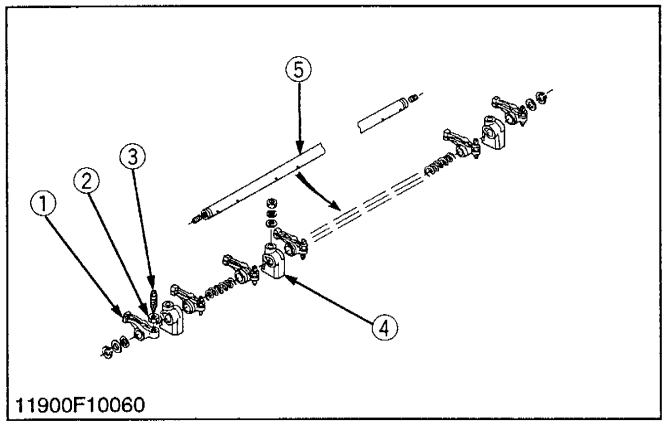
The connecting rod (2) is used to connect the piston with the crankshaft.

The big end of the connecting rod has a crankpin bearing (3) (split type) and the small end has a small end bushing (1) (solid type).

(1) Small End Bushing
(2) Connecting Rod
(3) Crankpin Bearing

11790M10060

[6] ROCKER ARM



11900F10060

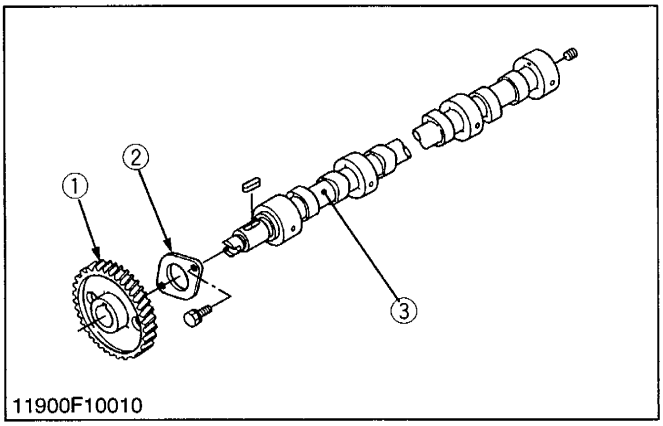
The rocker arm assembly includes the rocker arms (1), rocker arm brackets (4) and rocker arm shaft (5), and converts the reciprocating movement of the push rods to an open / close movement of the intake and exhaust valves.

Lubricating oil pressurized through the bracket to the rocker arm shaft, which serves as a fulcrum so that the rocker arm and the entire system are lubricated sufficiently.

(1) Rocker Arm
(2) Lock Nut
(3) Adjusting Screw
(4) Rocker Arm Bracket
(5) Rocker Arm Shaft

11900M10070

[7] CAMSHAFT



11900F10010

The camshaft (3) is made of special cast iron, and the journal and cam sections are chilled to resist wear.

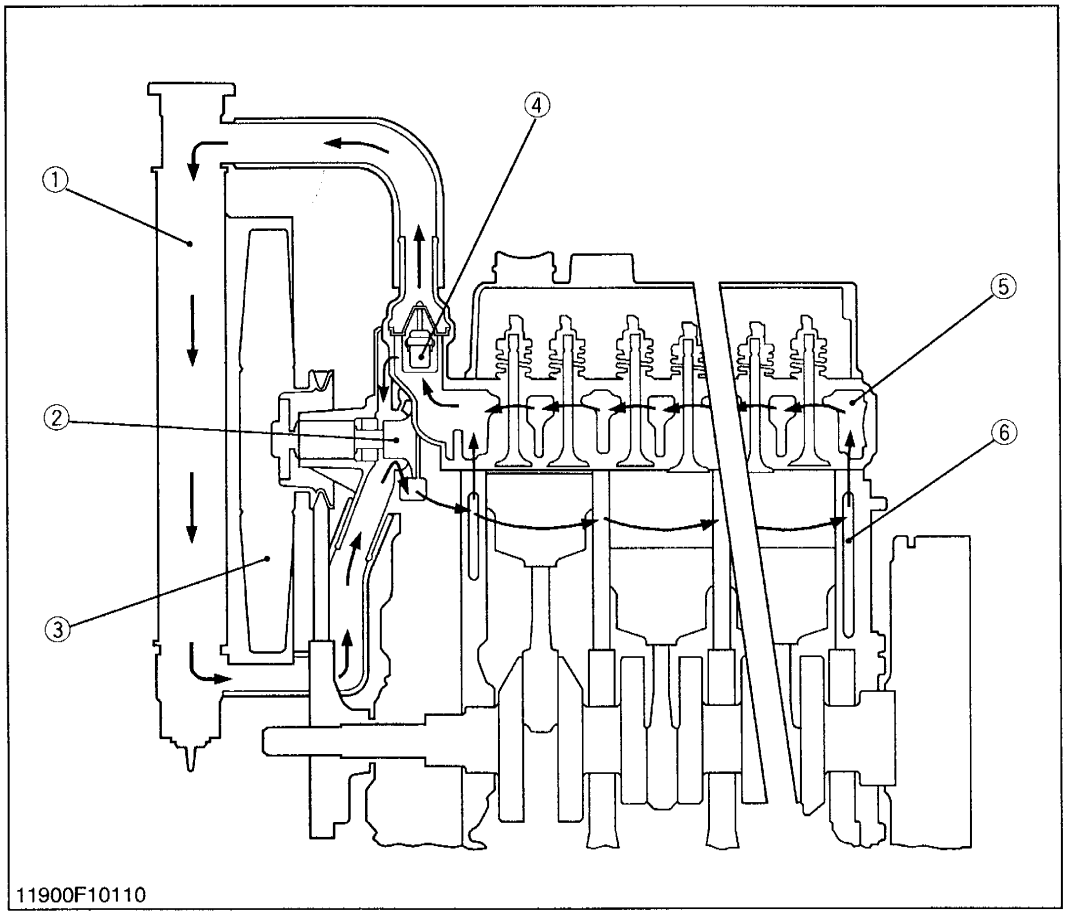
The journal sections are force-lubricated.

(1) Cam Gear
(2) Camshaft Stopper
(3) Camshaft

11900M10050

3 COOLING SYSTEM

[1] GENERAL



11900F10110

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

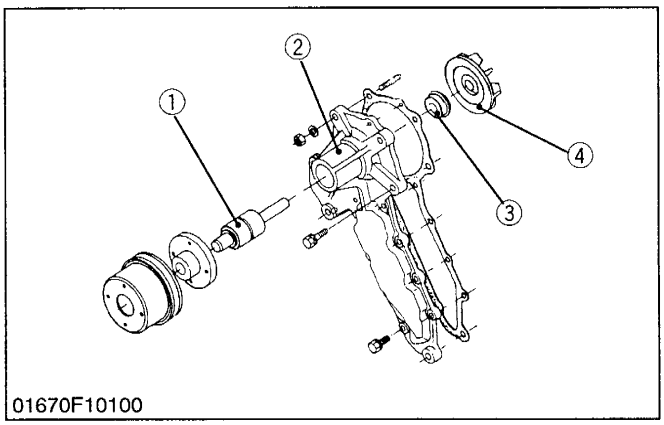
The cooling system consists of a radiator (1) (not included in the basic engine), centrifugal water pump (2), cooling fan (3) and thermostat (4).

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 thremostat 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 thremostat and water pump. The opening temperature of thermostat is approx. 71 °C (160 °F).

11900M10132

[2] WATER PUMP



01670F10100

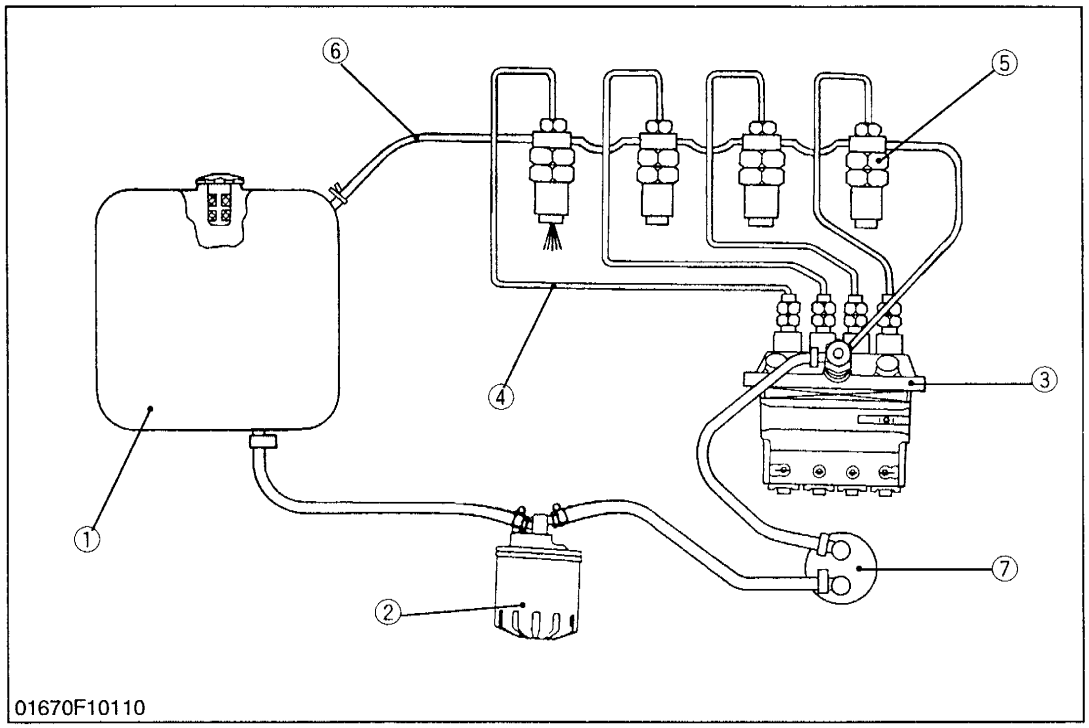
The water pump is driven by the crankshaft via a V belt. Water cooled in the radiator is sucked into the water pump from its lower portion and is sent from the center of the water pump impeller (4) radially outward into the water jacket in the crankcase.

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

11900M10142

5 FUEL SYSTEM

[1] GENERAL



01670F10110

(1) Fuel Tank
(2) Fuel Filter
(3) Injection Pump
(4) Injection Pipe
(5) Injection Nozzle
(6) Fuel Overflow Pipe
(7) Fuel Feed Pump

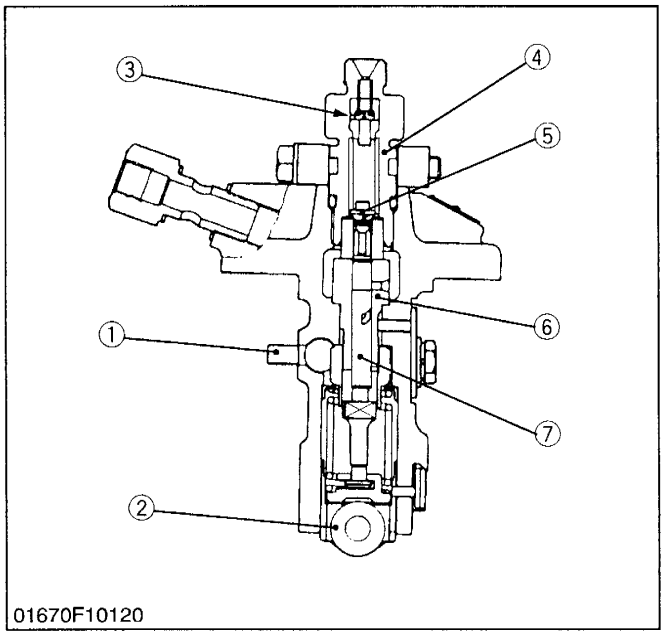
Fuel from the fuel tank (1) passes through the fuel filter (2), and then enters the injection pump (3) after impurities such as dirt, water, etc. are removed.

The fuel pressurized by the injection pump to the opening pressure (13.73 to 14.71 MPa, 140 to 150 kgf/cm^2, 1991 to 2133 psi), of the injection nozzle (5) is injected into the combustion chamber.

Part of the fuel fed to the injection nozzle (5) lubricates the moving parts of the plunger inside the nozzle, then returns to the fuel tank through the fuel overflow pipe (6) from the upper part of the nozzle holder.

11900M10152

[2] INJECTION PUMP



01670F10120

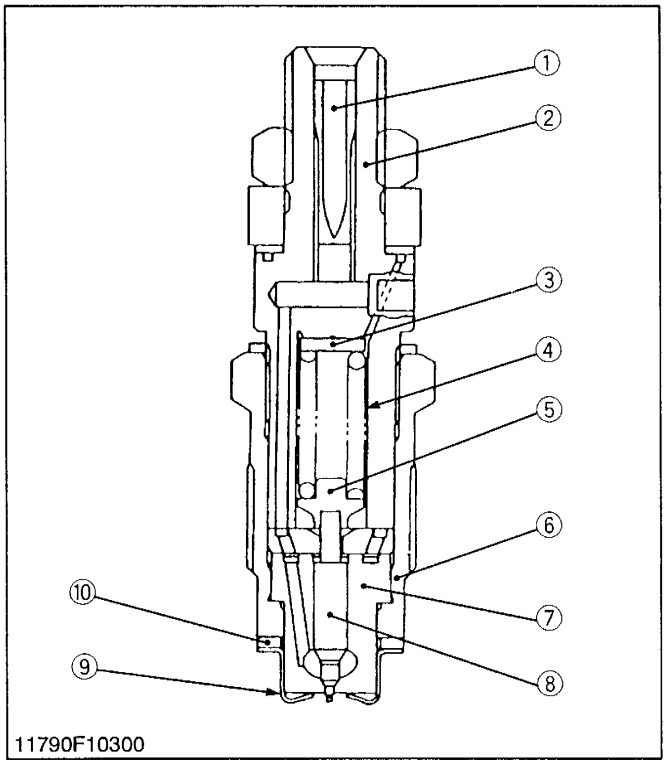
A Bosch K type mini pump is used for the injection pump. It is small, lightweight and easy to handle.

The plunger (7) with a right-hand lead reciprocates via the tappet roller (2) by means of the fuel camshaft, causing the fuel to be delivered into the injection nozzle.

(1) Control Rack
(2) Tappet Roller
(3) Dumping Valve
(4) Delivery Valve Holder
(5) Delivery Valve
(6) Cylinder
(7) Plunger

M10171

[3] INJECTION NOZZLE



11790F10300

This nozzle is throttle-type. The needle valve (8) is pushed against the nozzle body (7) by the nozzle spring via the push rod (5). Fuel pressurized by the injection pump pushes the needle valve up and then is injected into the sub-combustion chamber.

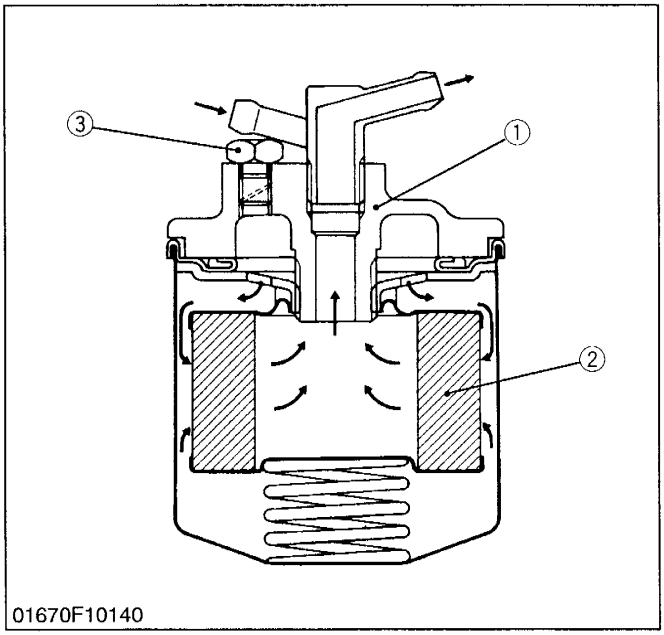
Excessive flow passes from nozzle holder center through the eye joint and the fuel overflow pipe to the fuel tank.

The injection pressure is 13.73 to 14.71 MPa (140 to 150 kgf/cm^2, 1991 to 2133 psi), and is adjusted with adjusting washers (3).

(1) Bar Filter
(2) Nozzle Holder Body
(3) Adjusting Washer
(4) Nozzle Spring
(5) Push Rod
(6) Retaining Nut
(7) Nozzle Body
(8) Needle Valve
(9) Heat Seal
(10) Gasket

11790M10272

[4] FUEL FILTER (not included in the basic model)



01670F10140

A fuel filter is used to prevent dirty fuel from reaching the injection pump and injection nozzles.

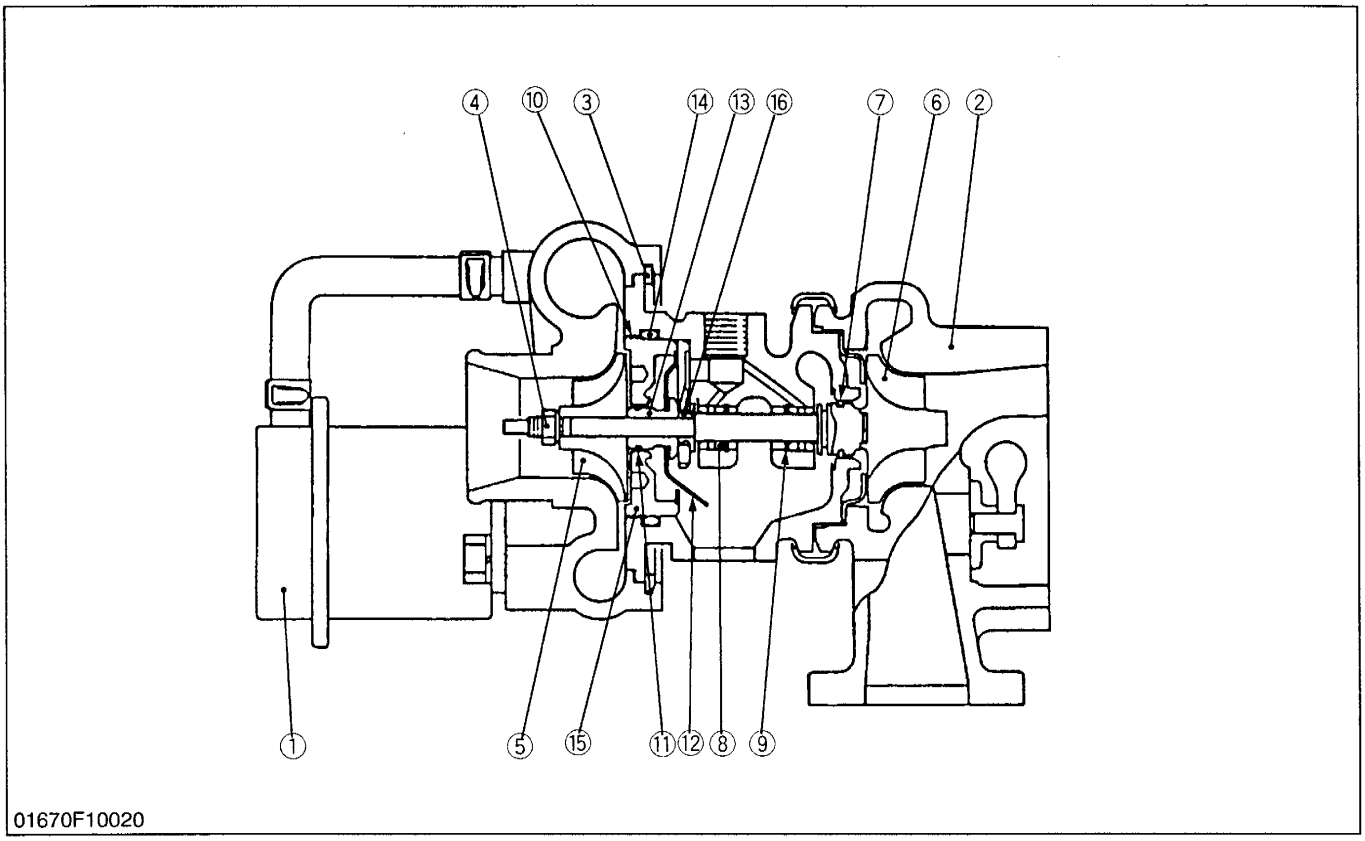
The filter cartridge will require occasional replacement to maintain an adequate flow of fuel to the injection pump. The frequency of this service will vary according to the cleanliness of available fuel and the care used in storage.

The fuel filter eliminates the foreign matter which is fed from the fuel tank and protects injection pump and injection nozzles. When fuel enters the filter, it passes from the filter element's circumference forward the center for filtering.

(1) Cover
(2) Fuel Filter Element
(3) Air Vent Plug

01670M10040

7 TURBO CHARGER SYSTEM



01670F10020

(1) Actuator
(2) Turbine Housing
(3) Snap Ring
(4) Lock Nut
(5) Compressor Wheel
(6) Turbine Wheel
(7) Piston Ring
(8) Bearing
(9) Snap Ring
(10) Snap Ring
(11) Piston Ring
(12) Oil Deflector
(13) Thrust Sleeve
(14) O-ring
(15) Thrust Bearing
(16) Thrust Ring

This turbo charger consists basically of a centrifugal compressor mounted on a common shaft with a double flow turbine driven by exhaust gas from the engine.

The turbo charger is capable of supplying far more air to the engine than for a non-supercharged engine, which is without such a charger.

In applications where the boost pressure is relatively low, the turbo charger is capable of reducing the smoke concentration, the concentration in the cylinder, fuel consumption, and deterioration in performance at elevated terrain by increasing the amount of air to the engine.

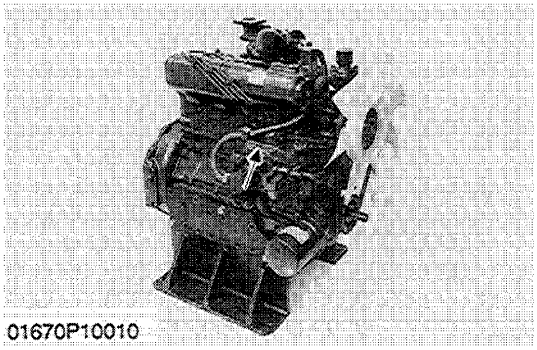
In applications where the boost pressure is high, the charger is capable of providing a large increase in engine output by increasing the amount of air into the engine, in addition to the above mentioned advantages.

01640M10071

G GENERAL

[1] ENGINE IDENTIFICATION

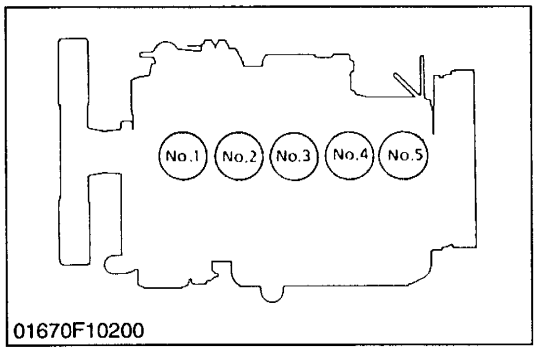
(1) Model Name and Engine Serial Number


01670P10010

When contacting the manufacturer, always specify your engine model name and serial number.

01640S10012

(2) Cylinder Number



01670F10200

The cylinder numbers of KUBOTA engine are designated as shown in the figure.

The sequence of cylinder numbers is given as No. 1, No. 2, No. 3, No. 4 and No. 5 starting from the gear case side.

01640S10021

Symptom	Probable Cause	Solution	Reference Page
Either White or Blue Exhaust Gas Is Observed	• Excessive engine oil	Reduce to specified level	S-16
	• Piston ring and liner worn or stuck	Repair or replace	S-54, 61
	• Incorrect injection timing	Adjust	S-67
Oil Leak Into Exhaust Pipe or Suction Pipe	• Waste oil pipe clogged or deformed	Repair or replace	–
	• Piston ring seal faulty	Replace the turbocharger assembly	S-29
Either Black or Dark Gray Exhaust Gas Is Observed	• Overload	Lessen load	–
	• Low grade fuel used	Use specified fuel	–
	• Fuel filter clogged	Clean or change	S-21
	• Air cleaner clogged	Clean or change	S-18
	• Deficient nozzle injection	Repair or replace nozzle	S-69
Deficient Output	• Incorrect injection timing	Adjust	S-67
	• Engine's moving parts seem to be seizing	Repair or replace	
	• Injection pump malfunctioning	Repair or replace	–
	• Deficient nozzle injection	Repair or replace nozzle	S-69
	• Compression leak	Check the compression pressure and repair	S-28
	• Gas leak from exhaust system	Repair or replace	S-29
	• Air leak from compressor discharge side	Repair or replace	S-29
	• Air cleaner dirty or clogged	Clean or replace	S-18
	• Compressor wheel turning heavily	Replace the turbocharger assembly	S-30
Excessive Lubricant Oil Consumption	• Piston ring's gap facing the same direction	Shift ring gap direction	S-54
	• Oil ring worn or stuck	Replace	S-54
	• Piston ring groove worn	Replace piston	S-54
	• Valve stem and valve guide worn	Replace	S-46
	• Carnkshaft bearing, and crank pin bearing worn	Replace	S-56, 57 58, 59
	• Oil leaking due to defective seals or packing	Replace	–
Fuel Mixed into Lubricant Oil	• Injection pump's plunger worn	Replace pump element or injection pump	–
	• Deficient nozzle injection	Repair or replace nozzle	S-69
	• Injection pump broken	Replace	–

01670S10260

Crankshaft

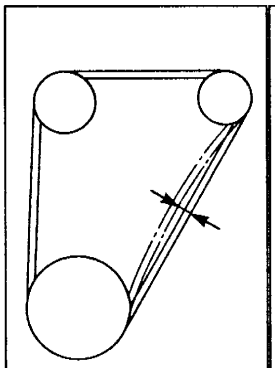
Item	Factory Specification	Allowable Limit
Crankshaft Alignment	–	0.02 mm 0.0008 in.
Oil Clearance between Crankshaft and Crankshaft Bearing 1	0.04 to 0.118 mm 0.0016 to 0.0046 in.	0.20 mm 0.0079 in.
Crankshaft O.D.	51.921 to 51.940 mm 2.0441 to 2.0449 in.	–
Crankshaft Bearing 1 I.D.	51.980 to 52.039 mm 2.0465 to 2.0488 in.	–
Oil Clearance between Crankshaft and Crankshaft Bearing 2	0.04 to 0.104 mm 0.0016 to 0.0041 in.	0.20 mm 0.0079 in.
Crankshaft O.D.	51.921 to 51.940 mm 2.0441 to 2.0449 in.	–
Crankshaft Bearing 2 I.D.	51.980 to 52.025 mm 2.0465 to 2.0482 in.	–
Oil Clearance between Crank Pin and Crank Pin Bearing	0.025 to 0.087 mm 0.0009 to 0.0034 in.	0.20 mm 0.0079 in.
Crank Pin O.D.	46.959 to 46.975 mm 1.8488 to 1.8494 in.	–
Crank Pin Bearing I.D.	47.000 to 47.046 mm 1.8504 to 1.8522 in.	–
Crankshaft Side Clearance	0.15 to 0.31 mm 0.0059 to 0.0122 in.	0.50 mm 0.0197 in.

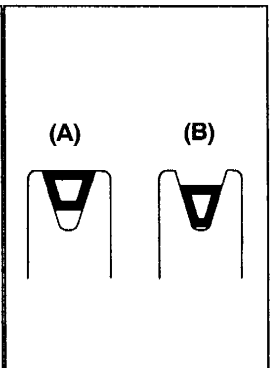
Cylinder Liner

Cylinder Liner I.D.	83.000 to 83.022 mm 3.2677 to 3.2686 in.	+ 0.15 mm 0.0059 in.
Oversized Cylinder Liner I.D.	83.500 to 83.522 mm 3.2874 to 3.2883 in.	+ 0.15 mm 0.0059 in.

01670S10400

(3) Check Point of Every 100 hours


00000F10621



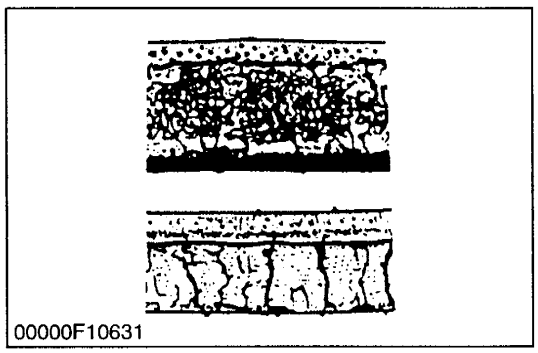
00000F10641

Checking Fan Belt Tension

1. Press the fan belt between fan pulley and pulley at force of 98 N (10 kgf, 22 lbs).
   Check if the fan belt deflection is 10 to 12 mm (0.394 to 0.472 in.).
2. If the deflection is not within the factory specifications, adjust with the tension pulley adjusting bolts.

(A) Good **(B) Bad**

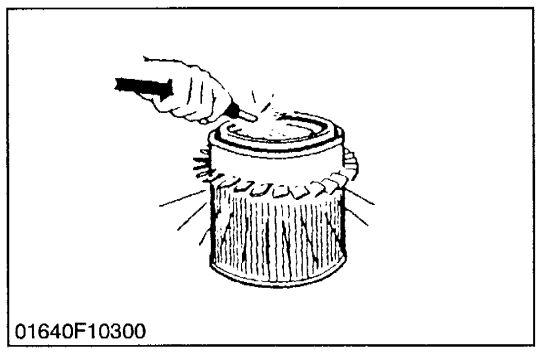
01640S10110


00000F10631

Fan Belt Damage and Wear

1. Check the fan belt for damage.
2. If the fan belt is damaged, replace it.
3. Check if the fan belt is worn and sunk in the pulley groove.
4. If the fan belt is nearly worn out and deeply sunk in the pulley groove, replace it.

00000S10461


01640F10300

Cleaning Air Cleaner

1. When dry dust adheres to the element, blow compressed air from the inside turning the element. Pressure of compressed air must be under 686 kPa (7 kgf/cm^2, 99 psi).
2. When carbon or oil adheres to the element, soak the element in detergent for 15 minutes, then wash it several times in water, rinse with clean water and dry it naturally.
   After element is fully dried, inspect in side or the element with a light and check if it is damaged or not.

■ IMPORTANT

- **Make sure the wing bolt for the element is tight enough. If it is loose, dust and dirt may be sucked, wearing down the cylinder liner and piston ring earlier and thereby resulting in poor power output.**

■ NOTE

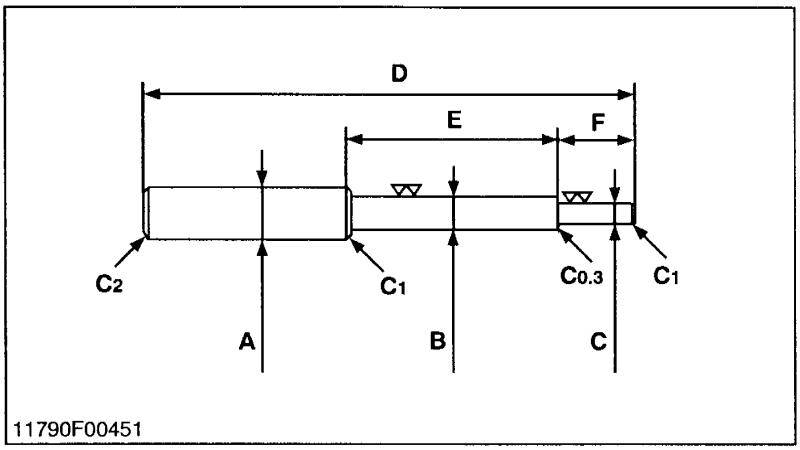
- **Change the element once a year or every 6th cleaning.**

01670S10620

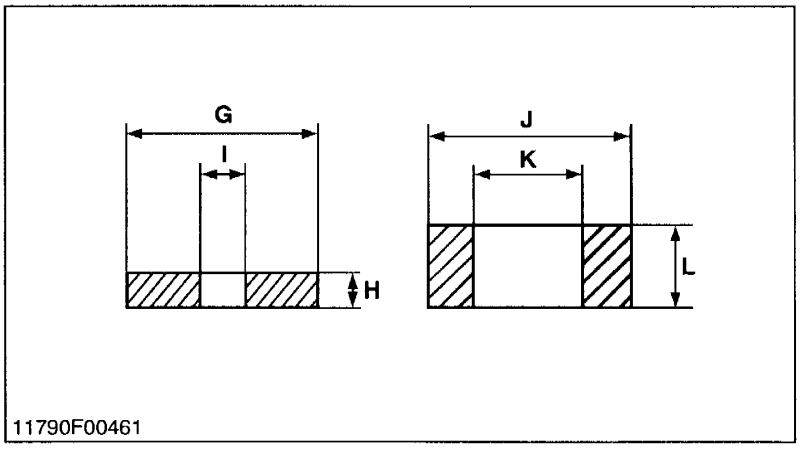
■ **NOTE**

- **The following special tools are not provided, so make them referring to the figure.**

01640S10910



11790F00451



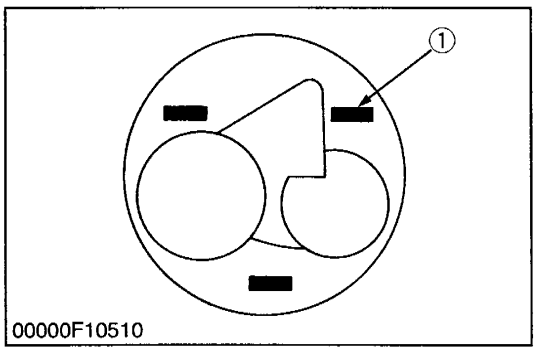
11790F00461

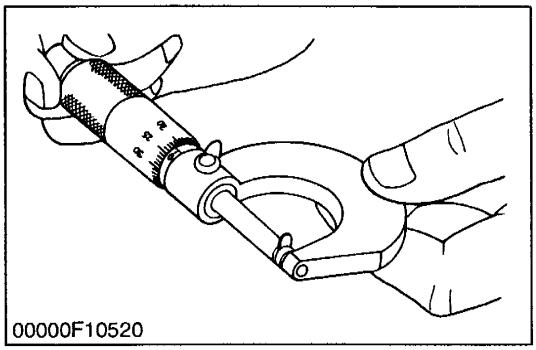
Valve Guide Replacing Tool

Application: Use to press out and press fit the valve guide.

A	20 mm dia. (0.79 in. dia.)
B	12.96 to 12.98 mm dia. 0.510 to 0.511 in. dia.
C	7.50 to 7.70 mm dia. 0.295 to 0.303 in. dia.
D	225 mm (8.86 in.)
E	70 mm (2.76 in.)
F	45 mm (1.77 in.)
G	25 mm (0.98 in.)
H	5 mm (0.197 in.)
I	8.0 to 8.1 mm dia. (0.315 to 0.319 in. dia.)
J	20 mm dia. (0.787 in. dia.)
K	13.1 to 13.2 mm dia. (0.516 to 0.520 in. dia.)
L	9.9 to 10.1 mm (0.390 to 0.400 in.)
C_1	Chamfer 1.0 mm (0.039 in.)
C_2	Chamfer 2.0 mm (0.079 in.)
$C_{0.3}$	Chamfer 0.3 mm (0.012 in.)

11790G00624





Top Clearance

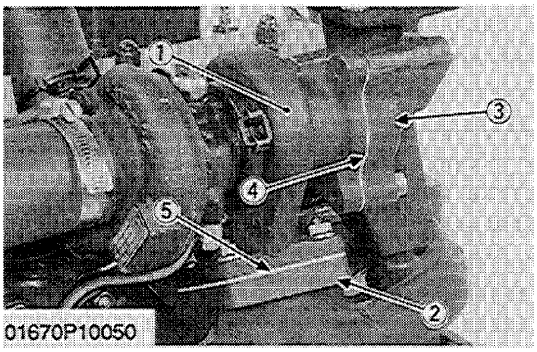
1. Remove the cylinder head (remove the cylinder head gasket completely).
2. Bring the piston to its top dead center fasten 1.5 mm dia. 5 to 7 mm long fuse wires to 3 to 4 spots on the piston top with grease so as to avoid the intake and exhaust valves and the combustion chamber ports.
3. Bring the piston to its middle position, install the cylinder head, and tighten the cylinder head bolts to specification. (Head gasket must be changed to new one.)
4. Turn the crank shaft until the piston exceeds its top dead center.
5. Remove the cylinder head, and measure squeezed fuse wires for thickness.
6. If the measurement is not within the specified value, check the oil clearance of the crankpin journal and the piston pin.

Top clearance	Factory spec.	0.55 to 0.70 mm 0.0217 to 0.0276 in.

Tightening torque	Cylinder head mounting bolts	93.1 to 98.0 N·m 9.5 to 10.0 kgf·m 68.7 to 72.3 ft-lbs

(1) Fuse

01640S10272

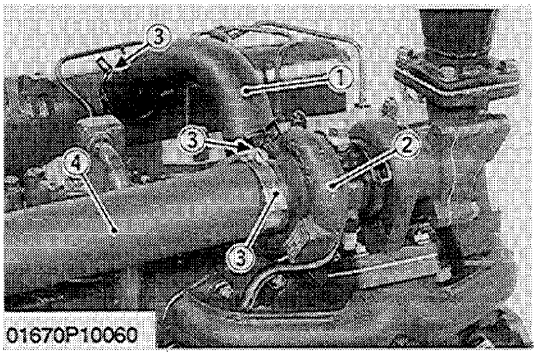


Turbine Side

1. Check the exhaust port (3) and inlet port (2) side of the turbine housing (1) to see if there is no exhaust gas leak.
2. If any gas leak is found, retighten the bolts and nuts or replace the gasket (4) / (5) with new one.

(1) Turbine Housing
(2) Inlet Port
(3) Exhaust Port
(4) Gasket
(5) Gasket

01640S10811



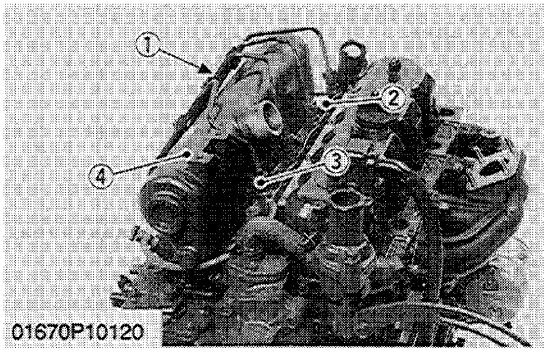
Compressor Side

1. Check the intake pipe (1) of the compressor cover (2) to see if there is no air leak.
2. Check for loose connections or cracks in the suction side of the intake pipe (4).
3. If any air leak is found, change the clamp (3) and or inlet pipes.

(1) Intake Pipe
(2) Compressor Cover
(3) Clamp
(4) Intake Pipe

01640S10821

[3] CYLINDER HEAD AND VALVES

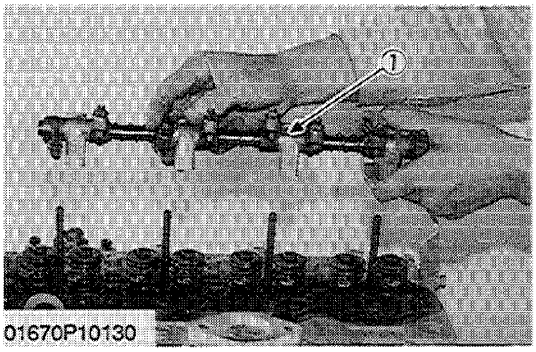


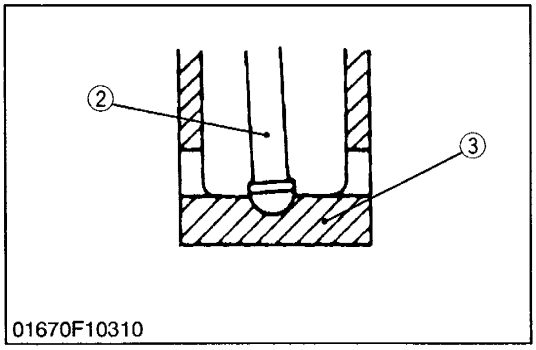
Nozzle Holder Assembly

1. Loosen the screws on the pipe clamps.
2. Remove the injection pipes.
3. Remove the In./Ex. manifold.
4. Remove the fuel overflow pipes.
5. Loosen the lock nuts, and remove the nozzle holder assemblies.
6. Remove the copper gaskets on the seats.
7. Remove the nozzle heat seal.

(1) Injection Pipe
(2) Overflow Pipe
(3) Nozzle Holder
(4) Inlet Manifold

01640S10322





Rocker Arm and Push Rod

1. Remove the cylinder head cover.
2. Remove the rocker arm bracket mounting nuts.
3. Detach the rocker arm as a unit.
4. Remove the push rods.

■ IMPORTANT

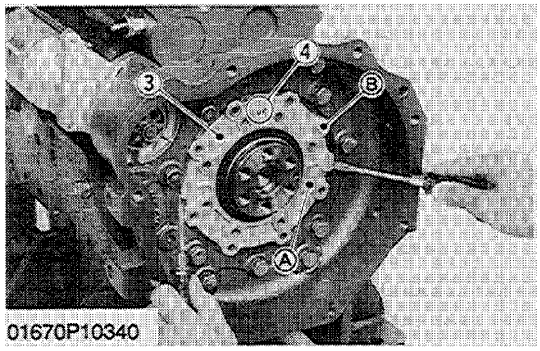
- **After reassembling the rocker arm, be sure to adjust the valve clearance.**

(When reassembling)

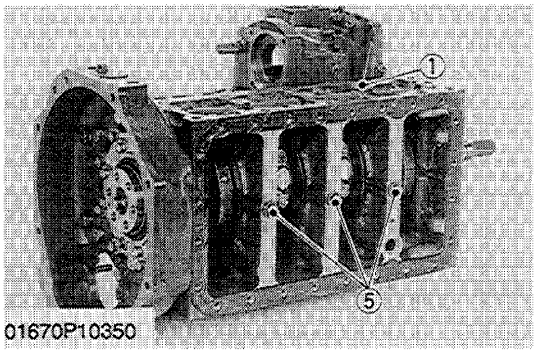
- When putting the push rods onto the tappets, check to see if their ends are properly engaged with the grooves.
- Check to see if the cylinder head cover gasket is not defective.

(1) Rocker Arm Assembly
(2) Push Rod
(3) Tappet

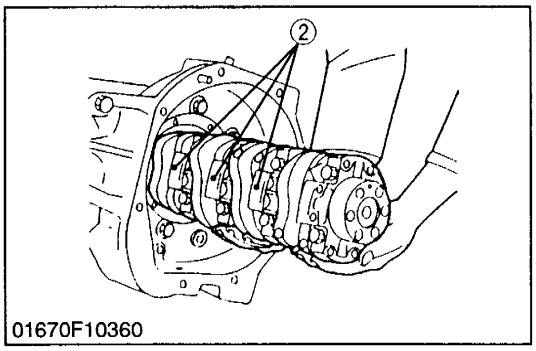
01670S10100



01670P10340



01670P10350



01670F10360

Bearing Case Cover and Crankshaft

■ **NOTE**

- **Before disassembling, check the side clearance of crankshaft. Also check it during reassembly.**

1. Remove the bearing case cover mounting screws.
2. Remove the bearing case cover (3).
3. Remove the bearing case screw 2 (5).
4. Pull out the crankshaft.

(When reassembling)

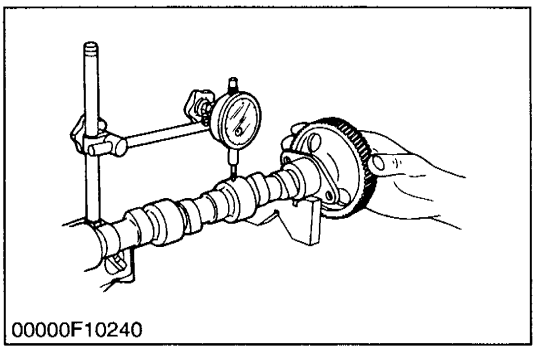
■ **IMPORTANT**

- **Install the crankshaft sub assembly, aligning the screw hole of main bearing case 2 (2) with the screw hole of cylinder block (1).**
- **Apply engine oil to the seat and thread of bearing case screw 2 (5) and tightening it.**
- **Install the bearing case cover (3) to position the casting mark "UP" (4) on it upward.**
- **Tighten the bearing case cover mounting screws with even force on the diagonal line.**

(1) Cylinder Block
(2) Main Bearing Case 2
(3) Bearing Case Cover
(4) Top Mark **"UP"**
(5) Bearing Case Screw 2

(A) Inside bolts M8-28 mm
(B) Outside bolts M8-25 mm

01640S10411

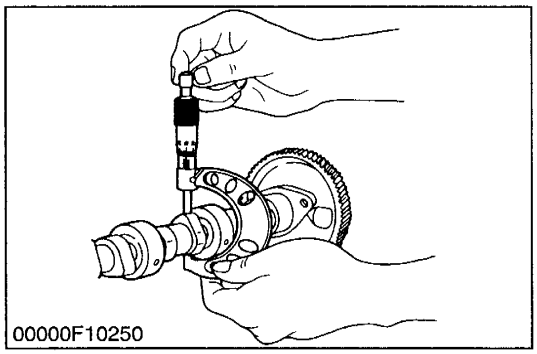

00000F10240

Camshaft Alignment

1. Support the camshaft with V blocks on the surface plate and set a dial indicator with its tip on the intermediate journal at right angle.
2. rotate the camshaft on the V blocks and get the misalignment (half of the measurement).
3. if the misalignment exceeds the allowable limit, replace the camshaft.

Camshaft alignment	Allowable limit	0.01 mm 0.00039 in.

00000S10193

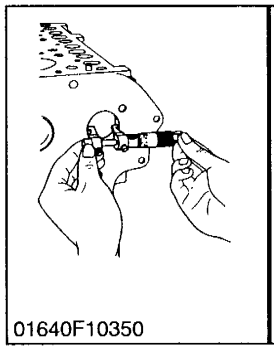

00000F10250

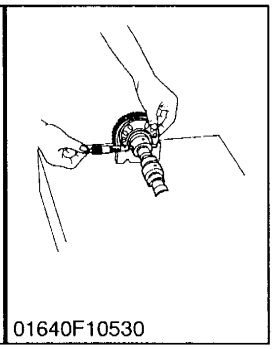
Cam Height

1. Measure the height of the cam at its highest point with an outside micrometer.
2. If the measurement is less than the allowable limit, replace the camshaft.

Intake and exhaust cam height	Factory spec.	33.47 mm 1.3177 in.
	Allowable limit	33.42 mm 1.3157 in.

00000S10204


01640F10350


01640F10530

Oil Clearance of Camshaft Journal

1. Measure the camshaft journal O.D. with an outside micrometer
2. Measure the cylinder block bore I.D. for camshaft with an inside micrometer.
   Calculate the oil clearance.
3. If the clearance exceeds the allowable limit, replace the camshaft.

Oil clearance of camshaft journal	Factory spec.	0.050 to 0.091 mm 0.0020 to 0.0036 in.
	Allowable limit	0.15 mm 0.0059 in.
Camshaft journal O.D.	Factory spec.	39.934 to 39.950 mm 1.5722 to 1.5728 in.
Camshaft bearing I.D.	Factory spec.	40.000 to 40.025 mm 1.5748 to 1.5758 in.

00000S10174