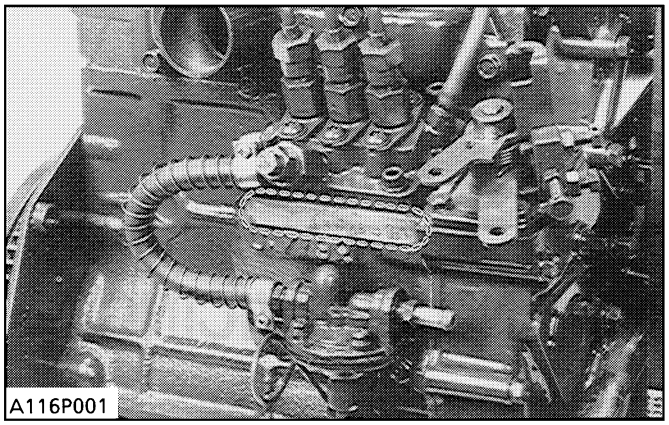
G GENERAL

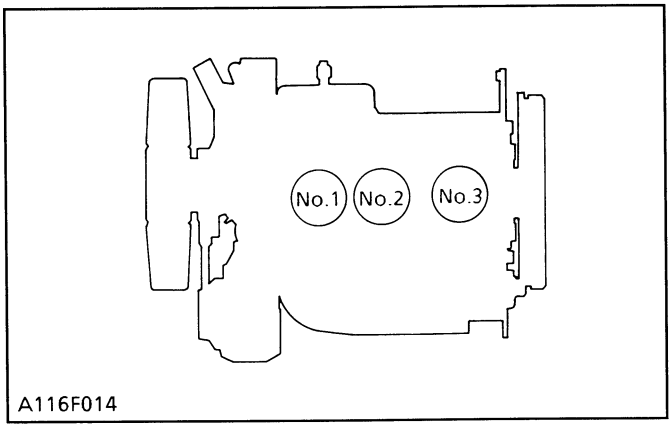
[1] ENGINE IDENTIFICATION

Model Name and Engine Serial Number



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

Cylinder Number



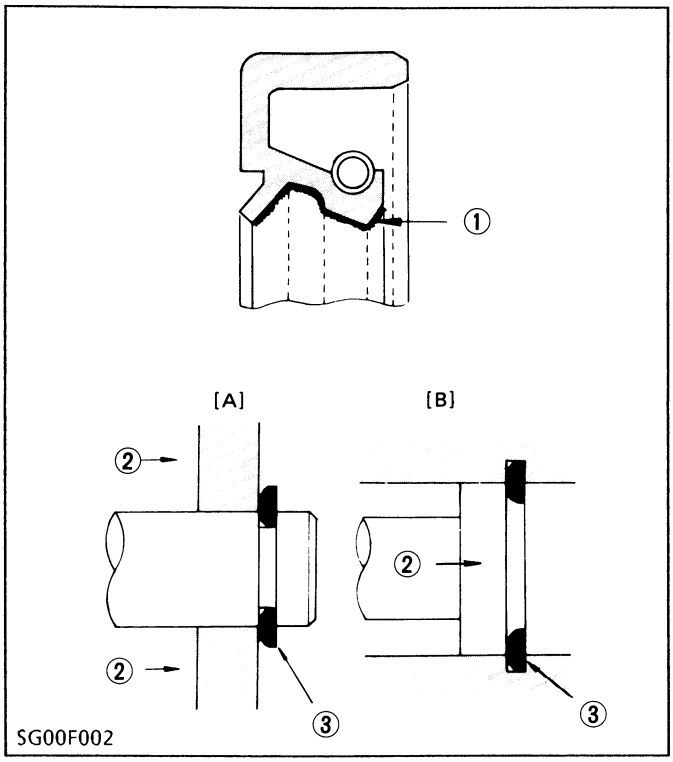
The cylinder numbers of 68 mm STROKE SERIES diesel engine are designated as shown in the figure.
The sequence of cylinder numbers is given as No.1, No.2, No.3 starting from the gear case side.

[2] GENERAL PRECAUTIONS

■ Precation at overheating

Take the following actions in the event the coolant temperature be nearly or more than the boiling point, what is called "Overheating".

(1) Stop the machine operation in a safe place and keep the engine unloaded idling.
(2) Don't stop the engine suddenly, but stop it after about 5 minutes of unloaded idling.
(3) Keep yourself well away from the machine for further 10 minutes or while the steam spout out.
(4) Checking that there gets no danger such as burn, get rid of the causes of overheating according to the manual.
And then, start again the engine.



SG00F002

- During disassembly, carefully arrange removed parts in a clean area to prevent confusion later. Screws, bolts and nuts should be replaced in their original position to prevent reassembly errors.
- When special tools are required, use Kubota's genuine special tools. Special tools which are not frequently used should be made according to the drawings provided.
- Before disassembling or servicing live wires, make sure to always disconnect the grounding cable from the battery first.
- Remove oil and dirt from parts before measuring.
- Use only Kubota genuine parts for parts replacement to maintain engine performance and to ensure safety.
- Gaskets and O-rings must be replaced during reassembly. Apply grease to new O-rings or oil seals before assembling.
- When reassembling external or internal snap rings, position them so that the sharp edge faces against the direction from which force is applied.
- Be sure to perform run-in the serviced or reassembled engine. Do not attempt to give heavy load at once, or serious damage may result to the engine.

⚠ CAUTION

- **Certain components used in this engine (cylinder head-gasket, exhaust gasket, etc.) contain asbestos. Handle with care according to safety regulation.**

(1) Grease
(2) Force
(3) Place the Sharp Edge against the Direction of Force

[A] External Snap Ring
[B] Internal Snap Ring

[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 at the proper torque.

(1) Tightening torques for special use screws, bolts and nuts

■ NOTE

- **In removing and applying the bolts and nuts marked with "*", pneumatic wrench or similar pneumatic tool, if employed, must be used with enough care not to get them seized.**
- **For "*" marked screws, bolts and nuts on the table, apply engine oil to their threads and seats before tightening.**

Item	Size x Pitch	N·m	kgf·m	ft-lbs
* Head cover cap nuts	M6 x 1.0	3.9 to 5.9	0.4 to 0.6	2.9 to 4.3
* Head bolts	M8 x 1.25	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
* Bearing case bolts 1	M6 x 1.0	12.7 to 15.7	1.3 to 1.6	9.4 to 11.6
* Bearing case bolts 2	M7 x 1.0	26.5 to 30.4	2.7 to 3.1	19.5 to 22.4
* Flywheel bolts	M10 x 1.25	53.9 to 58.8	5.5 to 6.0	39.8 to 43.4
* Connecting rod bolts	M7 x 0.75	26.5 to 30.4	2.7 to 3.1	19.5 to 22.4
* Rocker arm bracket nuts	M6 x 1.0	9.81 to 11.28	1.00 to 1.15	7.23 to 8.32
* Idle gear shaft bolts	M6 x 1.0	9.81 to 11.28	1.00 to 1.15	7.23 to 8.32
Glow plugs	M8x 1.0	7.8 to 14.7	0.8 to 1.5	5.8 to 10.8
Nozzle holder assembly	M20 x 1.5	49.0 to 68.6	5.0 to 7.0	36.2 to 50.6
Oil switch taper screw	PT 1/8	14.7 to 19.6	1.5 to 2.0	10.8 to 14.5
Injection pipe retaining nuts	M12 x 1.5	24.5 to 34.3	2.5 to 3.5	18.1 to 25.3
Starter's terminal B mounting nut	M8	8.8 to 11.8	0.9 to 1.2	6.5 to 8.7

(2) 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 (SG00F004)			Special Screw and Bolt 7		
	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs
M 6	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
M 8	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

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)

[4] TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Engine Does Not Start	• No fuel	Replenish fuel	–
	• Air in the fuel system	Bleed air	S-14
	• Water in the fuel system	Replace fuel and repair or replace fuel system	–
	• Fuel pipe clogged	Clean	–
	• Fuel filter clogged	Replace	S-16
	• Excessively high viscosity of fuel or engine oil at low temperature	Use the specified fuel or engine oil	S-15
	• Fuel with low cetane number	Use the specified fuel	–
	• Fuel leak due to loose injection pipe retaining nut	Tighten nut	S-27
	• Incorrect injection timing	Adjust	S-57
	• Fuel cam shaft worn	Replace	–
	• Injection nozzle clogged	Clean	S-56
	• Injection pump defective	Repair or replace	S-57
	• Fuel pump defective	Repair or replace	–
	• Seizure of crankshaft, camshaft, piston or bearing	Repair or replace	–
	• Compression leak from cylinder	Replace head gasket, tighten cylinder head bolt, glow plug and nozzle holder	S-24
	• Improper valve seat alignment, valve spring broken, valve seized	Repair or replace	S-39
	• Improper valve timing	Adjust	S-57
	• Piston ring worn	Replace	S-34
	• Excessive valve clearance	Adjust	S-19
[Starter Does Not Work]	• Battery discharged	Charge	–
	• Starter defective	Repair or replace	S-61
	• Main switch defective	Repair or replace	–
	• Wiring disconnected	Connect	–
Engine Revolution Is Not Smooth	• Fuel filter clogged or dirty	Replace	S-16
	• Air cleaner clogged	Clean or replace	S-15
	• Fuel leak due to loose injection pipe retaining nut	Tighten nut	S-14
	• Injection pump defective	Repair or replace	S-57
	• Incorrect nozzle opening pressure	Adjust	S-56
	• Injection nozzle suck or clogged	Repair or replace	S-56
	• Fuel over flow pipe clogged	Clean	–
	• Governor defective	Repair	–
Either White Or Blue Exhaust Gas Is Observed	• Excessive engine oil	Reduce to the specified level	–
	• Piston ring worn or stuck	Replace	S-34
	• Incorrect injection timing	Adjust	S-57
	• Deficient compression	Check the compression pressure	S-24
Either Black Or Dark Gray Exhaust Gas Is Observed	• Overload	Lessen the load	–
	• Low grade fuel used	Use the specified fuel	–
	• Fuel filter clogged	Replace	S-16
	• Air cleaner clogged	Clean or replace	S-15
Deficient Output	• Incorrect injection timing	Adjust	S-57
	• Engine's moving parts seem to be seizing	Repair or replace	–
	• Uneven fuel injection	Repair or replace the injection pump	–
	• Deficient nozzle injection	Repair or replace the nozzle	S-56
	• Compression leak	Replace head gasket, tighten cylinder head bolt, glow plug and nozzle holder	S-24

Symptom	Probable Cause	Solution	Reference Page
Excessive Lubricant Oil Consumption	• Oil ring worn or stuck • Piston ring groove worn • Valve stem and guide worn • Crankshaft bearing, and crank pin bearing worn	Replace Replace the piston Replace Replace	S-34 S-43 S-38 S-48, 49, 50
Fuel Mixed Into Lubricant Oil	• Injection pump's plunger worn	Replace pump element or pump	–
Water Mixed Into Lubricant Oil	• Head gasket defective • Crank case or cylinder head flawed	Replace Replace	S-28 S-37
Low Oil Pressure	• Engine oil insufficient • Oil strainer clogged • Oil filter cartridge clogged • Relief valve stuck with dirt • Relief valve spring weaken or broken • Excessive oil clearance of crankshaft bearing • Excessive oil clearance of rocker arm boss. • Oil passage clogged • Different type of oil • Oil pump defective	Replenish Clean Replace Clean Replace Replace Replace Clean Use the specified type of oil Repair or replace	– S-32 S-16 – – S-48, 49, 50 S-41 – S-15 S-52, 53
High Oil Pressure	• Different type of oil • Relief valve defective	Use the specified type of oil Replace	S-15 –
Engine Overheated	• Engine oil insufficient • Fan belt broken or tensioned improperly • Coolant insufficient • Radiator net and radiator fin clogged with dust • Inside of radiator corroded • Coolant flow route corroded • Radiator cap defective • Radiator hose damaged • Thermostat defective • Water pump defective • Overload running	Replenish Replace or adjust Replenish Clean Clean or replace Clean or replace Replace Replace Replace Replace Loosen the load	– S-15 – – S-17 S-17 S-54 S-16 S-55 S-55 –
Battery Quickly Discharge	• Battery electrolyte insufficient • Fan belt slips • Wiring disconnected • Regulator defective • AC dynamo defective • Battery defective	Replenish distilled water and charge Adjust belt tension or replace Connect Replace Replace Replace	– S-54 – – S-60 –

[5] SERVICING SPECIFICATIONS

(1) ENGINE BODY

Cylinder Head

Item		Factory Specification	Allowable Limit
Cylinder Head Surface Flatness		–	0.05 mm 0.0020 in.
Top Clearance		0.50 to 0.70 mm 0.0197 to 0.0276 in.	–
Cylinder Head Gasket Thickness (Grommet Section)	Free	1.15 to 1.30 mm 0.04153 to 0.0512 in.	–
	Tightened	1.05 to 1.15 mm 0.0413 to 0.0453 in.	–
Compression Pressure		2.84 to 3.24 MPa 29 to 33 kgf/cm^2 412 to 469 psi	2.26 MPa 23 kgf/cm^2 327 psi

Valves

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	0.785 rad. 45°	–
Valve Face Angle	0.785 rad. 45°	–
Valve Recessing	-0.10 to 0.10 mm -0.0039 to 0.0039 in.	0.30 mm 0.0118 in.
Clearance between Valve Stem and Valve Guide	0.030 to 0.057 mm 0.00118 to 0.00224 in.	0.10 mm 0.0039 in.
Valve Stem O.D.	5.968 to 5.980 mm 0.23496 to 0.23543 in.	–
Valve Guide I.D.	6.010 to 6.025 mm 0.23661 to 0.23720 in.	–

Valve Timing

Inlet Valve	Open	0.35 rad. (20°) before T.D.C.	–
	Close	0.79 rad. (45°) after B.D.C.	–
Exhaust Valve	Open	0.87 rad. (50°) before B.D.C.	–
	Close	0.26 rad. (15°) after T.D.C.	–

Valve Spring

Item	Factory Specification	Allowable Limit
Free Length	31.6 mm 1.244 in.	28.4 mm 1.118 in.
Setting Load/Setting Length	64.7 N/27 mm 6.6 kgf/27 mm 14.6 lbs/1.063 in.	54.9 N/27 mm 5.6 kgf/27 mm 12.3 lbs/1.063 in.
Tilt	–	1.2 mm 0.047 in.

Rocker Arm

Clearance between Rocker Arm Shaft and shaft Hole	0.016 to 0.045 mm 0.00063 to 0.00177 in.	0.15 mm 0.0059 in.
Rocker Arm Shaft O.D.	10.473 to 10.484 mm 0.41232 to 0.41276 in.	–
Rocker Arm Shaft Hole I.D.	10.500 to 10.518 mm 0.41339 to 0.41410 in.	–

Tappet

Clearance between Tappet and Guide	0.016 to 0.052 mm 0.00063 to 0.00205 in.	0.10 mm 0.0039 in.
Tappet O.D.	17.966 to 17.984 mm 0.70732 to 0.70803 in.	–
Tappet Guide I.D.	18.000 to 18.018 mm 0.70866 to 0.70937 in.	–

Camshaft

Camshaft Side Clearance	0.15 to 0.31 mm 0.0059 to 0.01220 in.	0.5 mm 0.020 in.
Camshaft alignment	–	0.01 mm 0.0004 in.
Cam height (IN., EX.)	26.88 mm 1.0583 in.	26.83 mm 1.0563 in.
Oil clearance of camshaft	0.050 to 0.091 mm 0.0020 to 0.0036 in.	0.15 mm 0.0059 in.
Camshaft journal O.D.	32.934 to 32.950 mm 1.2966 to 1.2972 in.	–
Camshaft bearing I.D.	33.000 to 33.025 mm 1.2992 to 1.3002 in.	–

Timing Gear

Item	Factory Specification	Allowable Limit
Timing gear backlash		
Crank gear – Oil Pump Drive Gear	0.041 to 0.123 mm 0.00161 to 0.00484 in.	0.15 mm 0.0059 in.
Idle gear – Cam gear	0.047 to 0.123 mm 0.00185 to 0.00484 in.	0.15 mm 0.0059 in.
Idle gear – Injection pump gear	0.046 to 0.124 mm 0.00181 to 0.00488 in.	0.15 mm 0.0059 in.
Idel gear – Crank gear	0.043 to 0.124 mm 0.00169 to 0.00488 in.	0.15 mm 0.0059 in.
Idle gear Side clearance	0.20 to 0.51 mm 0.0079 to 0.0201 in.	0.60 mm 0.0236 in.
Clearance between idle gear shaft and idle gear bushing	0.020 to 0.084 mm 0.00079 to 0.00331 in.	0.10 mm 0.0039 in.
Idle Gear shaft O.D.	19.967 to 19.980 mm 0.78610 to 0.78661 in.	–
Idle Gear Bushing I.D.	20.000 to 20.051 mm 0.78740 to 0.78941 in.	–

Cylinder Liner

Cylinder liner I.D.	Z442-B (E) D662-B (E)	64.000 to 64.019 mm 2.51968 to 2.52043 in.	64.169 mm 2.52634 in.
	Z482-B (E) D722-B (E)	67.000 to 67.019 mm 2.63779 to 2.63854 in.	67.169 mm 2.64444 in.
Oversized cylinder liner I.D.	Z442-B (E) D662-B (E)	64.250 to 64.269 mm 2.52953 to 2.53028 in.	64.419 mm 2.53618 in.
	Z482-B (E) D722-B (E)	67.250 to 67.269 mm 2.64764 to 2.64839 in.	67.419 mm 2.65429 in.

Crankshaft

Crankshaft alignment	–	0.02 mm 0.0031 in.
Oil clearance between crankshaft and crankshaft bearing 1	0.034 to 0.106 mm 0.00134 to 0.00417 in.	0.20 mm 0.0079 in.
Crankshaft O.D.	39.934 to 39.950 mm 1.57221 to 1.57284 in.	–
Crankshaft bearing 1 I.D.	39.984 to 40.040 mm 1.57418 to 1.57638 in.	–
Oil clearance between crankshaft and crankshaft bearing 2	0.034 to 0.092 mm 0.00134 to 0.00362 in.	0.20 mm 0.0079 in.
Crankshaft O.D.	43.934 to 43.950 mm 1.72969 to 1.73032 in.	–
Crankshaft bearing 2 I.D.	43.984 to 44.026 mm 1.73166 to 1.73331 in.	–

Crankshaft

Item	Factory Specification	Allowable Limit
Oil clearance between crankshaft and crankshaft bearing 3	0.034 to 0.092 mm 0.00134 to 0.00362 in.	0.20 mm 0.0079 in.
Crankshaft O.D.	39.934 to 39.950 mm 1.57221 to 1.57284 in.	–
Crankshaft bearing 3 I.D.	39.984 to 40.026 mm 1.57418 to 1.57583 in.	–
Oil clearance between crank pin and crank pin bearing	0.019 to 0.081 mm 0.00075 to 0.00319 in.	0.15 mm 0.0059 in.
Crankshaft O.D.	33.959 to 33.975 mm 1.33697 to 1.33759 in.	–
Crank pin bearing I.D.	33.994 to 34.040 mm 1.33835 to 1.34016 in.	–
Crankshaft side clearance	0.15 to 0.31 mm 0.0059 to 0.0122 in.	0.5 mm 0.0197 in.

Connecting Rod

Connecting rod alignment	–	0.05 mm 0.0020 in.
Clearance between piston pin and small end bushing	0.014 to 0.038 mm 0.00055 to 0.00150 in.	0.10 mm 0.0039 in.
Piston pin O.D.	20.002 to 20.011 mm 0.78748 to 0.78783 in.	–
Small end bushing I.D.	20.025 to 20.040 mm 0.78839 to 0.78897 in.	–

Piston/Piston Ring

Piston pin hole I.D.		20.000 to 20.013 mm 0.78740 to 0.78791 in.	20.05 mm 0.7894 in.
Piston ring clearance	Second compression ring 2	0.085 to 0.115 mm 0.0033 to 0.0045 in.	0.15 mm 0.0059 in.
	Oil ring	0.02 to 0.06 mm 0.0008 to 0.0024 in.	0.15 mm 0.0059 in.
Ring gap	Top compression ring and oil ring	0.15 to 0.30 mm 0.0059 to 0.0118 in.	1.2 mm 0.0472 in.
	Second compression ring	0.30 to 0.45 mm 0.0118 to 0.0177 in.	1.2 mm 0.0472 in.
Oversize of piston rings		+ 0.25 mm + 0.0098 in.	–

(2) LUBRICATING SYSTEM

Oil Pump

Item		Factory Specification	Allowable Limit
Engine oil pressure	At idle speed	98 kPa 1.0 kgf/cm^2, 14 psi	–
	At rated speed	196 to 441 kPa 2.0 to 4.5 kgf/cm^2 28 to 64 psi	98 kPa 1.0 kgf/cm^2 14 psi
Clearance between inner rotor and outer rotor		0.03 to 0.14 mm 0.012 to 0.0055 in.	–
Clearance between outer rotor and pump body		0.07 to 0.15 mm 0.0028 to 0.0059 in.	–
End clearance between inner rotor and cover		0.075 to 0.135 mm 0.0029 to 0.0053 in.	–

(3) COOLING SYSTEM

Thermostat

Thermostat's valve opening temperature	69.5 to 72.5°C 157.1 to 162.5°F	–
Temperature at which thermostat completely opens	85°C 185°F	–

Radiator

Radiator water tightness	Water tightness at specified pressure 157 kPa 1.6 kgf/cm^2, 23 psi	–
Radiator cap air leakage	10 seconds or more 88 → 59 kPa 0.9 → 0.6 kgf/cm^2 13→9 psi	–
Fan belt tension	Approx. 10 mm/98 N 0.39 in./10 kgf (22.1 lbs.)	–

(4) FUEL SYSTEM

Injection Pump

Injection timing	0.35 to 0.38 rad. before T.D.C. (20° to 22°)	–
Fuel tightness of pumpe element	–	14.71 MPa 150 kgf/cm^2, 2133 psi
Fuel tightness of delivery valve	–	5 seconds 14.7 → 13.7 MPa 150 → 140 kgf/cm^2 2133 → 1990 psi

Injection Nozzle

Item	Factory Specification	Allowable Limit
Fuel Injection pressure	13.73 to 14.71 MPa 140 to 150 kgf/cm^2 1991 to 2133 psi	–
Fuel tightness of nozzle valve seat	When the pressure is 12.75 MPa (130 kgf/cm^2, 1849 psi), the valve seat must be fuel tightness.	–

(5) ELECTRICAL SYSTEM

Starter

Commutator O.D.	28.0 mm 1.102 in.	27.0 mm 1.063 in.
Mica undercut	0.5 to 0.8 mm 0.020 to 0.031 in.	0.2 mm 0.008 in.
Brush length	16.0 mm 0.630 in.	10.5 mm 0.413 in.

Dynamo

No-load voltage	AC20V or more at 5200 rpm	–

Glow Plug

Glow plug resistance	Approx. 0.9 Ω	–

[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.

Item		Service Interval										
		Every 50 hours	Every 75 hours	Every 100 hours	Every 150 hours	Every 200 hours	Every 400 hours	Every 500 hours	Every 800 hours	Every 1500 hours	Every one year	Every two years
Checking fuel pipes and clamps		☆										
* Changing engine oil	(1) Oil pan depth (101 mm) (3.98 in.)		☆									
	(2) Oil pan depth (121 mm) (4.76 in.)			☆								
Cleaning air filter element				☆								
Cleaning fuel filter				☆								
Checking fan belt tension and damage				☆								
Checking water pipes and clamps						☆						
* Changing oil filter cartridge	(1) Oil pan depth (101 mm) (3.98 in.)				☆							
	(2) Oil pan depth (121 mm) (4.76 in.)					☆						
Changing fuel filter cartridge							☆					
Cleaning radiator interior								☆				
Changing radiator cleaner and coolant												☆
Changing air filter element											☆	
Checking valve clearance									☆			
** Checking injection nozzle pressure										☆		
Changing water pipes and clamps												☆
Changing fuel pipes and clamps												☆

* Change engine oil and oil cartridge after the first 50 hours of operation.
** Maintenance interval as per EPA instructions.

CAUTION

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

■ NOTE

Lubricating Oil

With the emission control now in effect, the CF-4 and CG-4 lubricating oils have been developed for use of a low-sulfur fuel on-road vehicle engines. When an off-road vehicle engine runs on a high-sulfur fuel, it is advisable to employ the CF, CD or CE lubricating oil with a high total base number. If the CF-4 or CG-4 lubricating oil is used with a high-sulfur fuel, change the lubricating oil at shorter intervals.

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

Fuel / Lubricating oil class	Low sulfur	High sulfur	Remarks
CF	❍	❍	TBN ≥ 10
CF-4	❍	X	
CG-4	❍	X	

❍ : Recommendable X : Not recommendable

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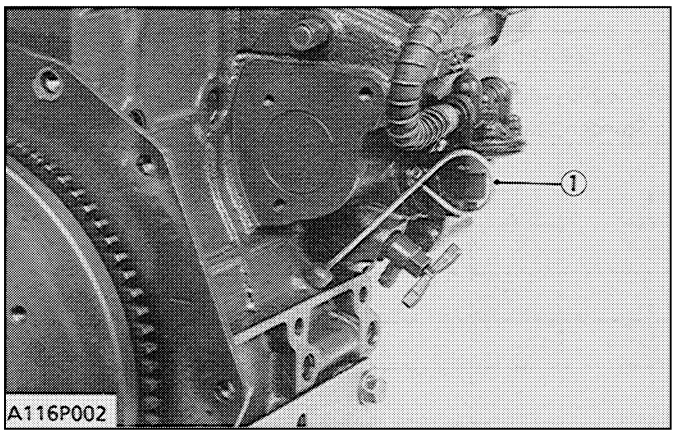
[7] CHECK AND MAINTENANCE

(1) Daily Check Points



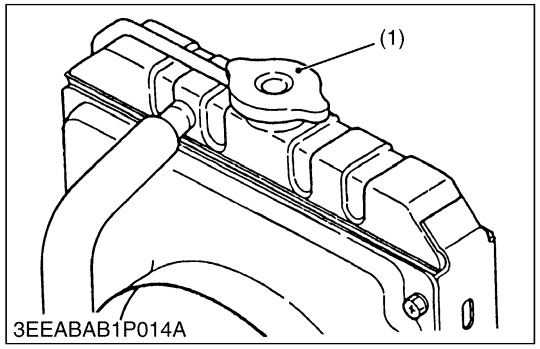
Checking Engine Oil Level

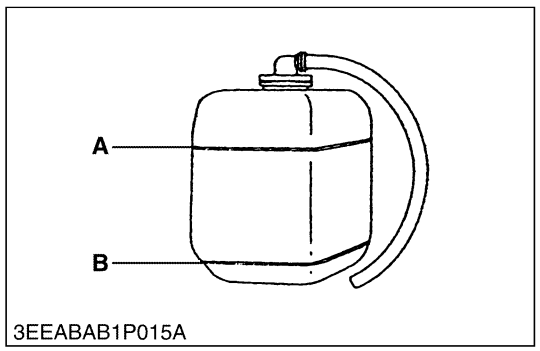
1. Level the engine.
2. To check the oil level, draw out the dipstick, (1) wipe it clean, reinsert it, and draw it out again. Check to see that the oil level lies between the two notches.
3. If the level is too low, add new oil to the specified level.

■ IMPORTANT

- **When using an oil of different maker or viscosity from the previous one, drain old oil. Never mix two different types of oil.**

(1) Dipstick





Checking and Replenish Coolant

1. Without recovery tank ;
   Remove the radiator cap (1) and check to see that the coolant level is just below the port.
   With recovery tank :
   Check to see that the coolant level lies between **FULL** (**A**) and **LOW** (**B**).
2. If coolant level is too low, check the reason for decreasing coolant.
   Case 1) If coolant is decreasing by evaporation, replenish only fresh, soft water.
   Case 2) If coolant is decreasing by leak, replenish coolant of the same manufacture and type in the specified mixture ratio (fresh, soft water and L.L.C.).
   If the coolant brand cannot be identified, drain out all of the remaining coolant and refill with a totally new brand of coolant mix.

⚠ CAUTION

- **Do not remove the radiator cap until coolant temperature is below its boiling point. Then loosen the cap slightly to relieve any excess pressure before removing the cap completely.**

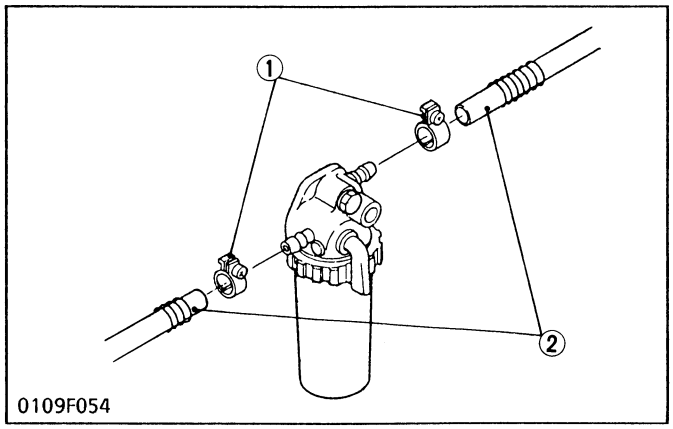
■ IMPORTANT

- **During filling the coolant, air must be vented from the engine coolant passages. The air vents by jiggling the radiator upper and lower hoses.**
- **Be sure to close the radiator cap securely. If the cap is loose or improperly closed, coolant may leak out and the engine could overheat.**
- **Do not use an antifreeze and scale inhibitor at the same time.**
- **Never mix the different type or brand of L.L.C..**

(1) Radiator Cap
(A) FULL
(B) LOW

W1035779

(2) Check Point of Every 50 hours



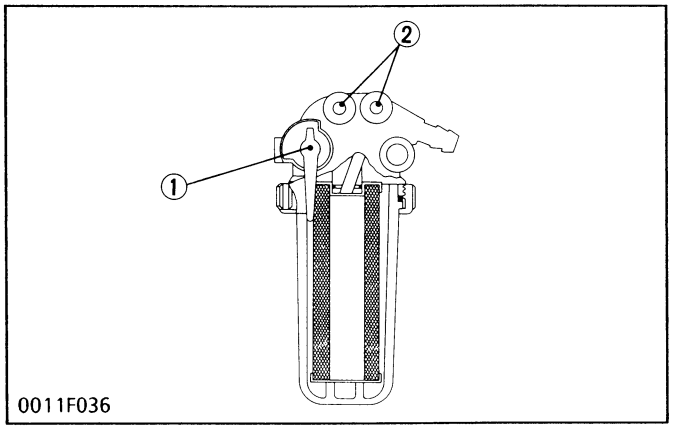
Checking Fuel Pipe

1. If the clamp (1) is loose, apply oil to the threads and securely retighten it.
2. The fuel pipe (2) is made of rubber and ages regardless of the period of service.
   Change the fuel pipe together with the clamp every two years.
3. However, if the fuel pipe and clamp are found to be damaged or deteriorate earlier than two years, then change or remedy.
4. After the fuel pipe and the clamp have been changed, bleed the fuel system.

⚠ CAUTION

- **Stop the engine when attempting the check and change prescribed above.**

(1) Clamp
(2) Fuel Pipe



(When bleeding fuel system)

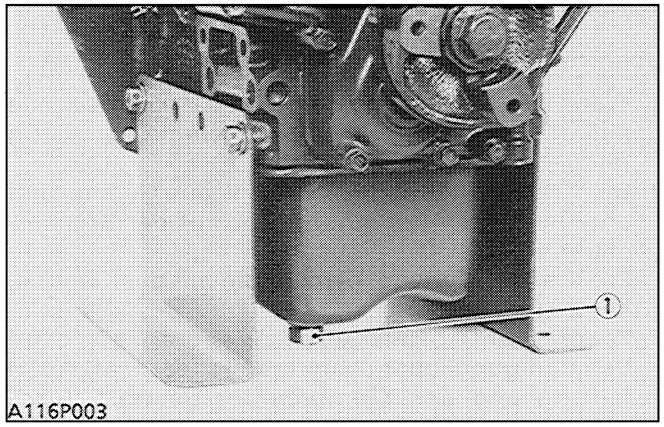
1 Fill the fuel tank with fuel, and open the fuel cock (1).
2. Loosen the air vent plug (2) of the fuel filter a few turns.
3. Screw back the plug when bubbles do not come up any more.
4. Open the air vent cock on top of the fuel injection pump.
5. Retighten the plug when bubbles do not come up any more.

■ NOTE

- **Always keep the air vent plug on the fuel injection pump closed except when air is vented, or it may cause the engine to stop.**

(1) Fuel Cock
(2) Air Vent Plug

(3) Check Point of Every 100 hours



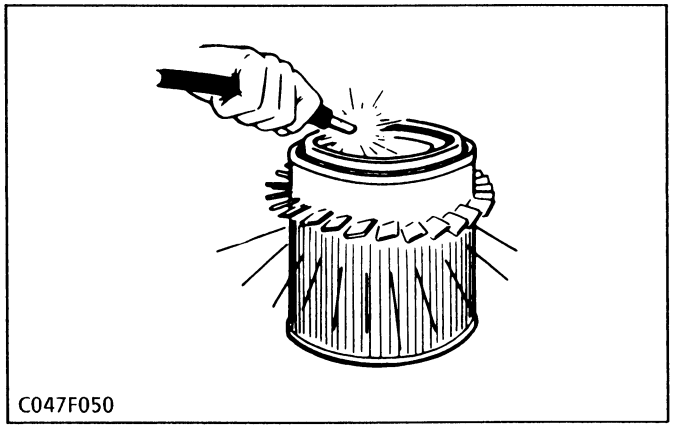
Changing Engine Oil

1. After warming up, stop the engine.
2. To change the used oil, remove the drain plug at the bottom of the engine and drain off the oil completely.
3. Reinstall the drain plug.
4. Fill the new oil up to the upper notch on the dipstick.

■ IMPORTANT

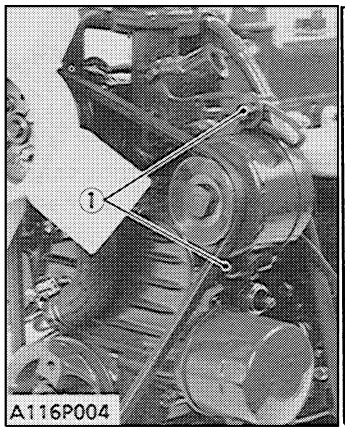
- **Change the type of engine oil according to the ambient temperature.**
  Above 25°C (77°F)---------- SAE 30 or 10W-30
  0°C to 25°C (32°F to 77°F)------ SAE 20 or 10W-30
  Below 0°C (32°F)---------- SAE 10 W or 10W-30

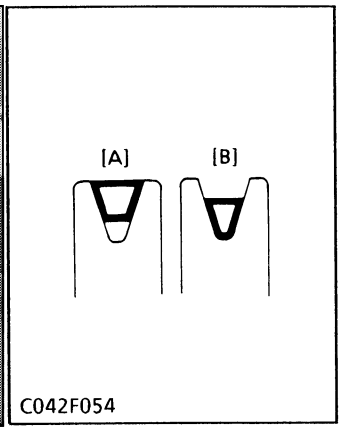
(1) Drain Plug



Cleaning Air Filter Element

- **When dry dust adheres**
  Use clean dry compressed air on the inside of the element.
  Air pressure at the nozzle must no exceed 205 kPa (2.1 kgf/cm^2, 30 psi).
  Maintain reasonable distance between the nozzle and the filter.



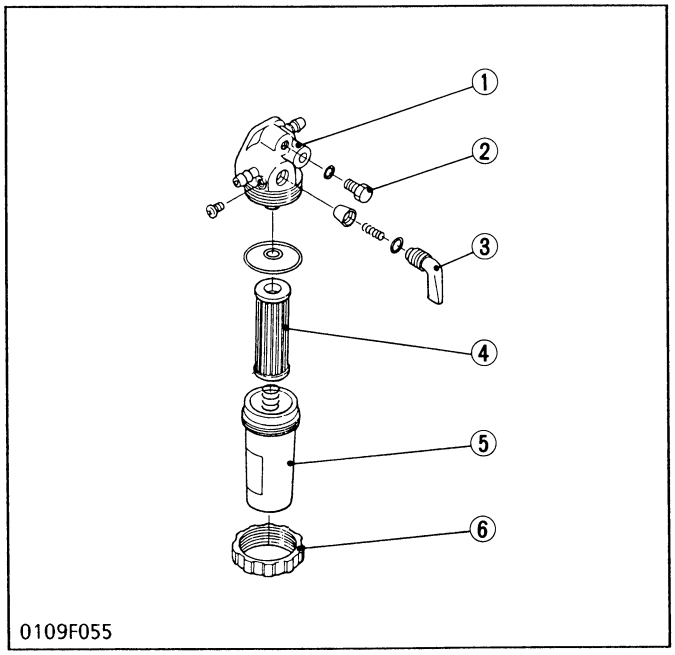


Checking Fan Belt Tension

1. Measure the deflection, depressing the belt halfway between the fan drive pulley and the AC dynamo pulley at 98 N (10kgf, 22 lbs) of force.
2. If the measurement is not the specified value, loosen the bolts and the nuts, and relocate the AC dynamo to adjust.

Fan belt tension	Factory spec.	approx. 10 mm 0.39 in.

[A] Good
[B] Bad
(1) Tension Pulley Adjusting Bolts



0109F055

Cleaning Fuel Filter

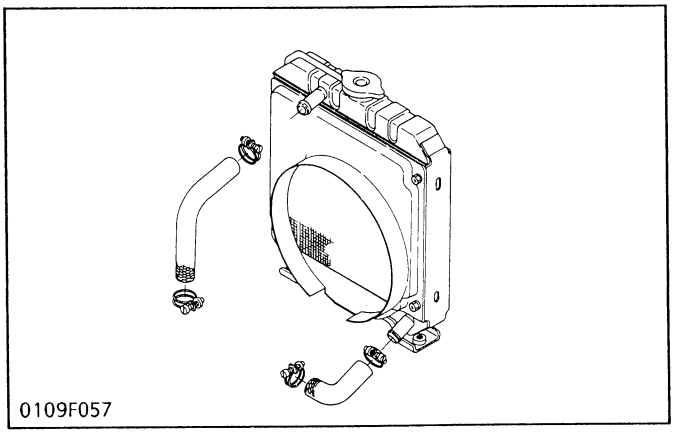
1. Close the fuel filter cock (3).
2. Unscrew the screw ring (6) and remove the cup (5), and rinse the inside with kerosene.
3. Take out the element (4) and dip it in the kerosene to rinse.
4. After cleaning, reassemble the fuel filter, keeping out dust and dirt.
5. Bleed the fuel system.

■ IMPORTANT

- **If dust and dirt enter the fuel, the fuel injection pump and injection nozzle will wear quickly. To prevent this, be sure to clean the fuel filter cup periodically.**

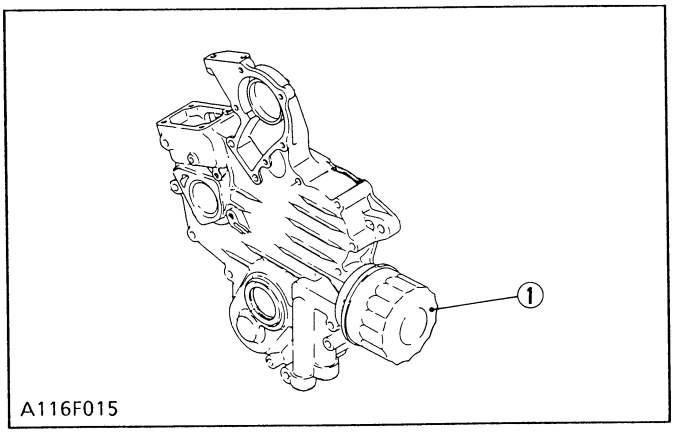
(1) Cock Body
(2) Air Vent Plug
(3) Filter Cock
(4) Filter Element
(5) Filter Cup
(6) Screw Ring

(4) Changing of Every 200 hours


0109F057

Checking radiator hoses (water pipes)

1. Check to see if the water pipes are properly fixed every 200 hours of operation or every six months, whichever comes first.
2. If clamp bands are loose or water leaks, tighten bands securely. Replace hoses and tighten clamp bands securely, if radiator hoses are swollen, hardened or cracked.
3. Replace hoses and clamp bands every 2 years or ealier if checked and found that hoses are swollen, hardened or cracked.



A116F015

Changing Engine Oil Filter Cartridge

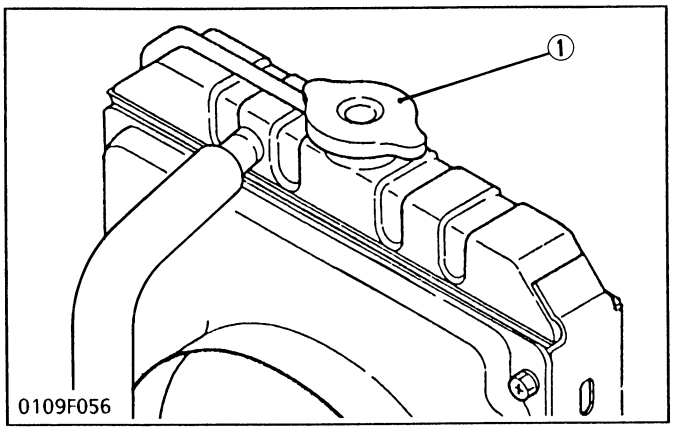
1. Remove the oil filter cartridge with a filter wrench.
2. Apply engine oil to the rubber gasket on the new cartridge.
3. Screw the new cartridge in by hand.

■ NOTE

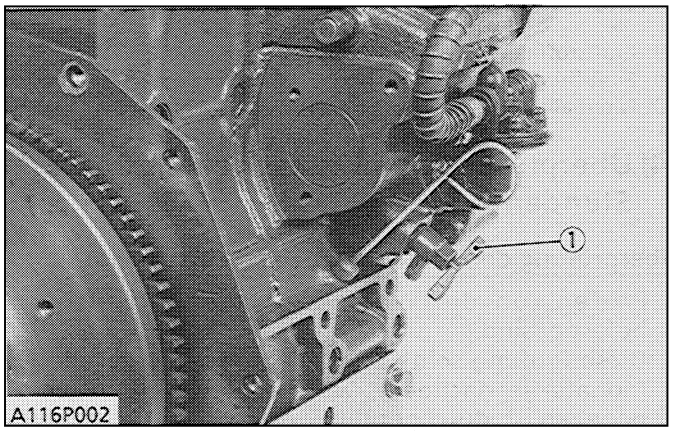
- **Over-tightening may cause deformation of rubber gasket.**
- **After cartridge has been replaced, engine oil normally decreases a little.**
  Check the oil level and add new oil to the specified level.

(1) Filter Cartridge

(5) Check Point of Every 500 hours



(1) Radiator Cap



(2) Drain Cock

Cleaning of water jacket (radiator interior)

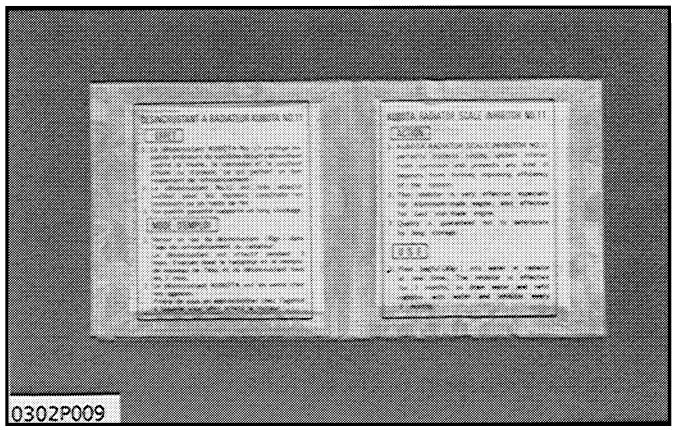
1. The cooling system should be cleaned on the following occasions:
   - Every 500service hours.
   - When adding antifreeze.
   - When changing from water containing antifreeze to pure water.
2. When cleaning the cooling system, Kubota Detergent No. 20 is recommended to effectively wash away the rust build-up.

⚠ CAUTION

- **Do not remove the radiator cap until cooling water temperature is enoughly cooled. Then loosen the cap sightly to relieve any excess pressure before removing the cap completely.**

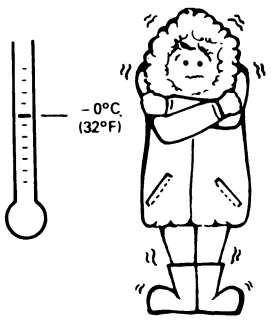
■ IMPORTANT

- **Use clean, fresh water to fill the radiator.**
- **To drain the used coolant completely, open the radiator drain cocks and remove the radiator cap.**
- **Do not use the antifreeze during hot weather to maintain engine performance since the boiling point of coolant rises.**
- **The radiator should be filled with part antifreeze and part water at all times as recommended by the antifreeze manufacturer.**
- **Do not use an antifreeze and scale inhibitor at the same time.**



Kubota Scale Inhibitor No. 11

1. Kubota Scale Inhibitor No.11 prevents scale formation in the cooling water. Scale build-up in either hard or soft water sharply reduces cooling efficiency.
2. The Scale Inhibitor is effective for 3 months so cooling water must be completely changed every 3 months.



0203F015

Antifreeze

If the cooling water freezes, the engine cylinder block, cylinder head and radiator may crack. In cold weather, before the temperature drops below 0°C (32°F), drain out the water after operating or add a proper amount of antifreeze.

- There are two types of antifreeze solutions: permanent type (PT) and semi-permanent type (SPT). For the KUBOTA engines, be sure to use the permanent type.
- When antifreeze is used for the first time, fill and drain clean water twice or three times so as to completely clean the inside of the radiator.
- The procedure for mixing water and antifreeze differs according to the make of the antifreeze and the ambient temperature. Basically, it should be refered to SAE J1034 standard, more specifically also to SAE J814c.
- Mix the antifreeze and water, then pour the mixture into the radiator.

Vol % antifreeze	Freezing point		Boiling point	
	°C	°F	°C	°F
40	–24	–12	106	222
50	–37	–34	108	226
60	–52	–62	111	232
70	–64	–84	114	238

*At 760mmHg pressure (atmospheric). A higher boiling point is obtained by using a radiator pressure cap which permits the development of pressure within the cooling system.

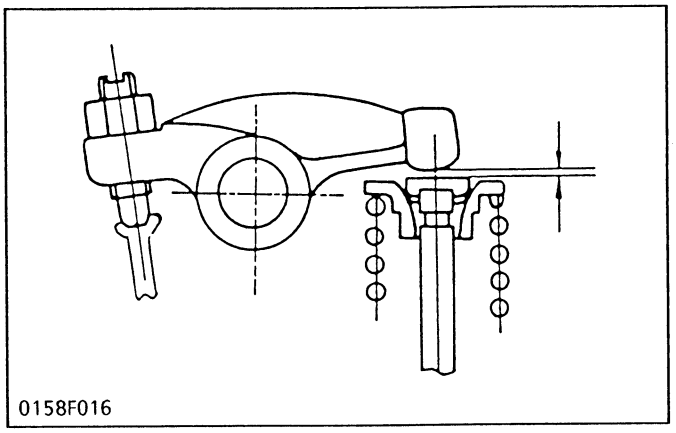
■ IMPORTANT

- **When the anti-freeze is mixed with water, the anti-freeze mixing ratio must be less than 50%.**
- **Do not use antifreeze during hot weather to keep the engine performance since the cooling water boiling point rises.**

■ NOTE

- **The above data represents industrial standards that necessitate a minimum glycol content in the concentrated antifreeze.**
- **When the cooling water level drops due to evaporation, add water only. In case of leakage, add antifreeze and water in the specified mixing ratio.**
- **Antifreeze absorbs moisture. Keep unused antifreeze in a tightly sealed container.**
- **Do not use radiator cleaning agents when antifreeze has been added to the cooling water. (Antifreeze contains an anticorrosive agent, which will react with the radiator cleaning agent forming sludge which will affect the engine parts.)**

(6) Check Point of Every 800 hours



Valve Clearance

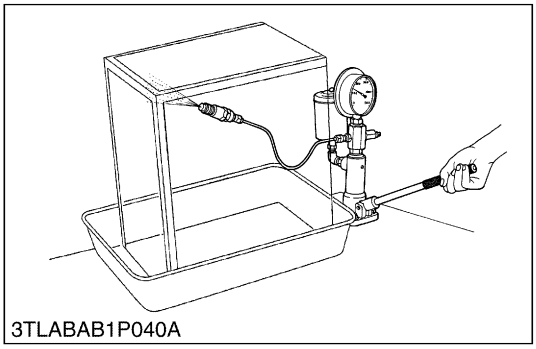
See page S-25.

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

(7) Check Points of 1500 hours

CAUTION

- **Check the injection pressure and condition after confirming that there is nobody standing in the direction the fume goes.**
  If the fume from the nozzle directly contacts the human body, cells may be destroyed and blood poisoning may be caused.

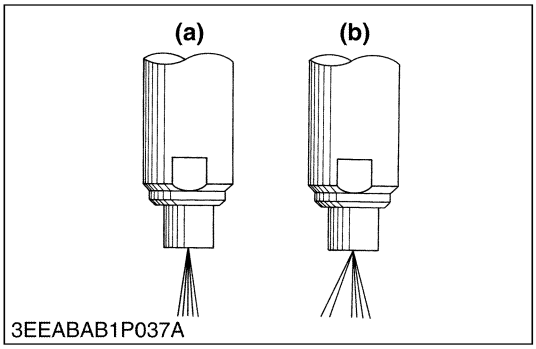


Fuel Injection Pressure

1. Set the injection nozzle to a nozzle tester (Code No. 07909-31361).
2. Slowly move the tester handle to measure the pressure at which fuel begins jetting out from the nozzle.
3. If the measurement is not within the factory specifications, replace the injection nozzle assembly.

Fuel injection pressure	Factory spec.	13.7 to 14.7 MPa 140 to 150 kgf/cm^2 1990 to 2130 psi

W10408820

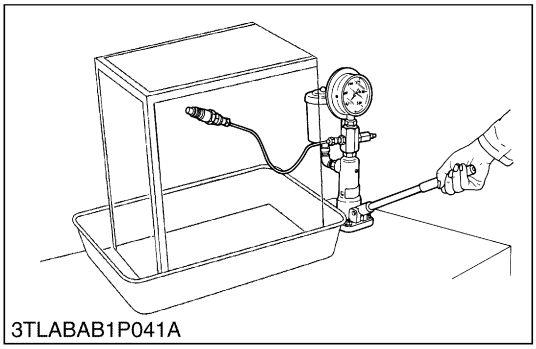


Nozzle Spraying Condition

1. Set the injection nozzle to a nozzle tester (Code No. 07909-31361), and check the nozzle spraying condition.
2. If the spraying condition is defective, replace the injection nozzle assembly.

(a) Good **(b) Bad**

W10411400



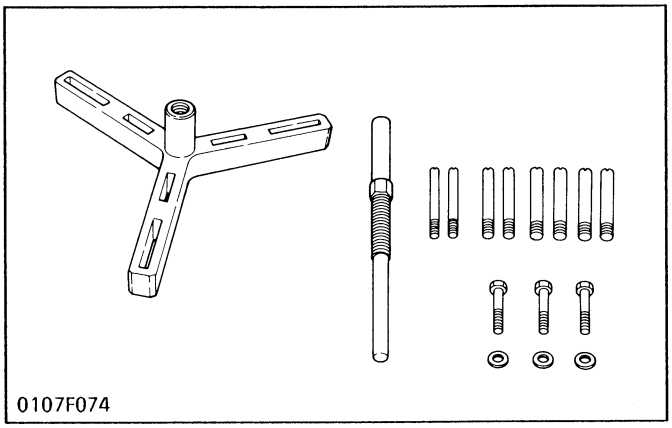
Valve Seat Tightness

1. Set the injection nozzle to a nozzle tester (Code No. 07909-31361).
2. Raise the fuel pressure, and keep at 12.7 MPa (130 kgf/cm^2, 1850 psi) for 10 seconds.
3. If any fuel leak is found, replace the injection nozzle assembly.

Valve seat tightness	Factory spec.	No fuel leak at 12.7 MPa 130 kgf/cm^2 1850 psi

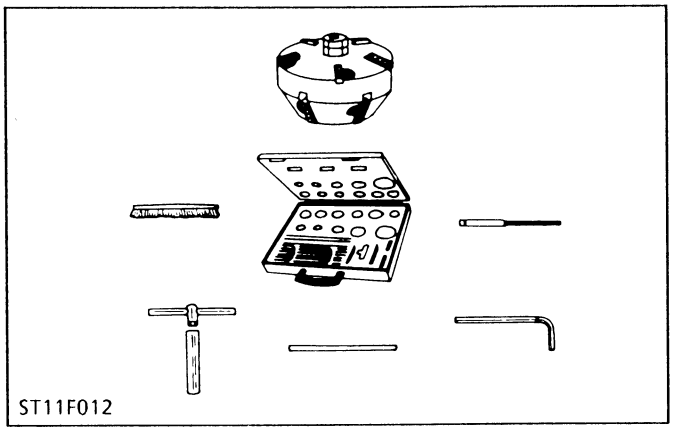
W10412730

[8] SPECIAL TOOLS


0107F074

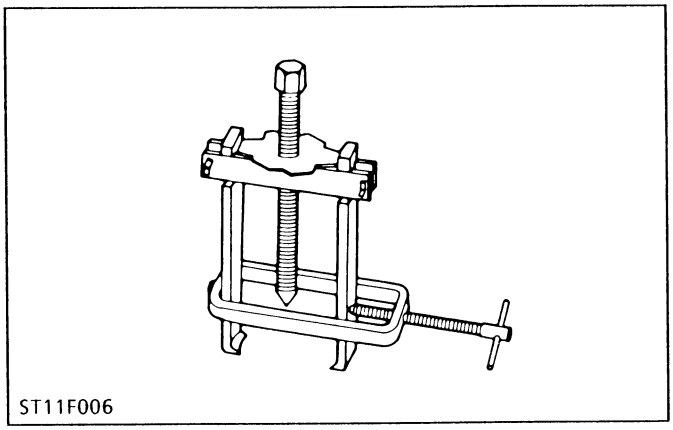
Flywheel Puller (For vertical type diesel engines)

Code No: 07916-32011
Application: Use exclusively to take off the flywheel of all vertical type diesel engines safely and easily.


ST11F012

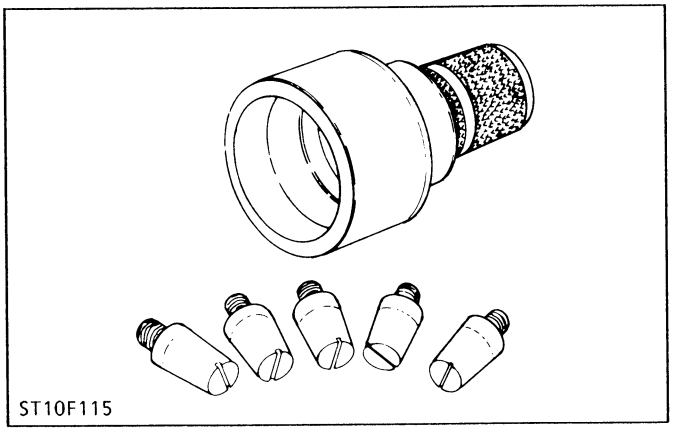
Valve Seat Cutter Set

Code No: 07909-33102
Application: Use for correcting valve seats.


ST11F006

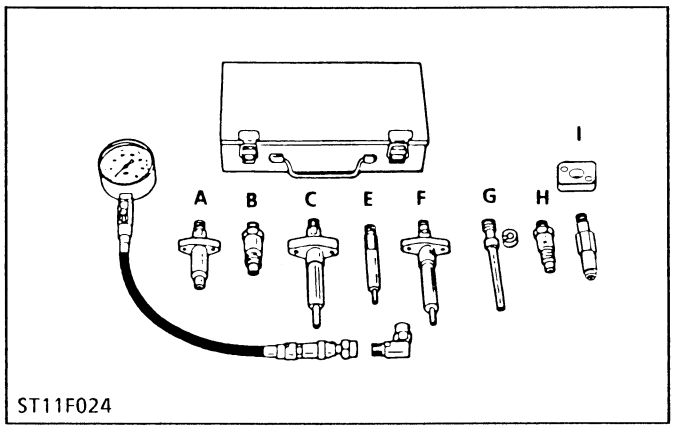
Special-use Puller Set

Code No: 07916-09032
Application: Use for pulling out bearings, gears and other parts.


ST10F115

Crank Sleeve Setter

Code No: 07916-34041
Application: Use to fix the crankshaft sleeve of the engine models Z442-B (E), Z482-B (E), D662-B (E), D722-B (E).

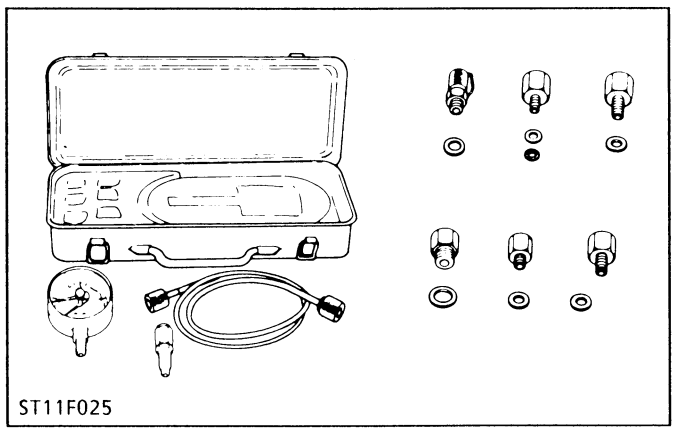


ST11F024

Diesel Engine Compression Tester

Code No: 07909-30208 (Assembly)
07909-30934 (A to F)
07909-31211 (E and F)
07909-31251 (G)
07909-31231 (H)
07909-31271 (I)

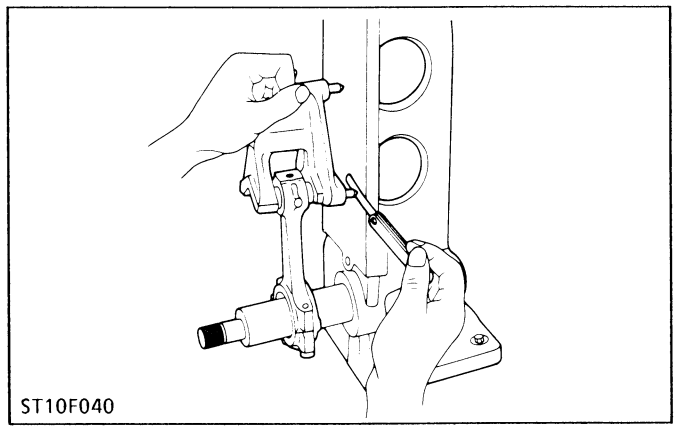
Application: Use for measuring diesel engine compression pressure.


ST11F025

Oil Pressure Tester

Code No: 07916-32032

Application: Use for measuring lubricating oil pressure.

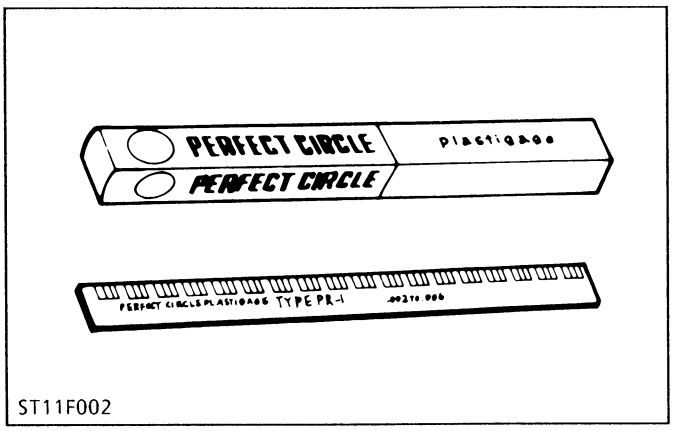

ST10F040

Connecting Rod Alignment Tool

Code No: 07909-31661

Application: Use for checking the connecting rod alignment.

Applicable: range: Connecting rod big end I.D. 30 to 75 mm (1.18 to 2.95 in. dia.) Connecting rod length 65 to 330 mm (2.56 to 12.99 in.)



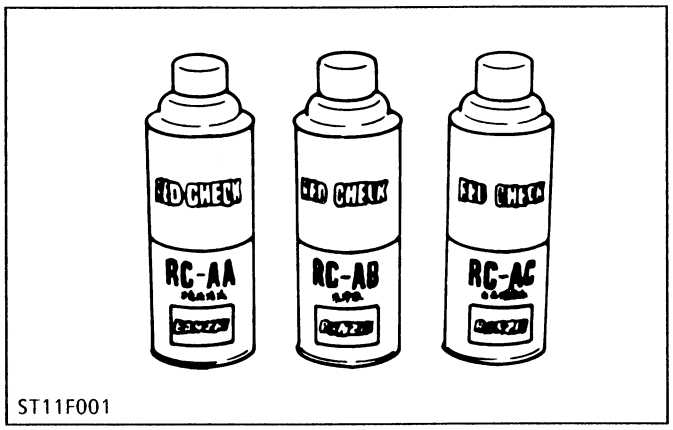
ST11F002

Plastigage

Code No: 07909-30241

Application: Use for checking the oil clearance between crankshaft and bearing, etc.

Measuring range:
Green — 0.025 to 0.076 mm (0.001 to 0.003 in.)
Red — 0.051 to 0.152 mm (0.002 to 0.006 in.)
Blue — 0.102 to 0.229 mm (0.004 to 0.009 in.)



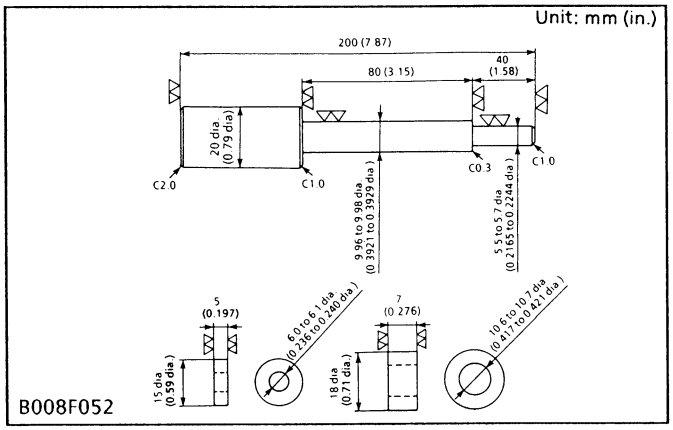
ST11F001

Red Check (Crack check liquid)

Code No: 07909-31371
Application: Use for checking cracks on cylinder head, cylinder block, etc.

■ **NOTE**

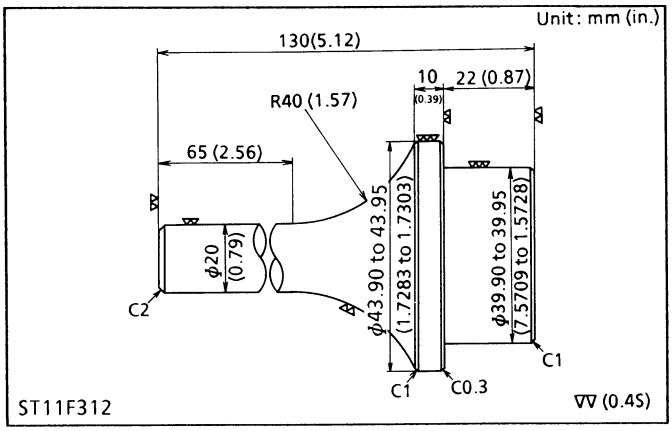
- **The following special tools are not provided, so make them referring to the figures.**



B008F052

Valve Guide Replacing Tool

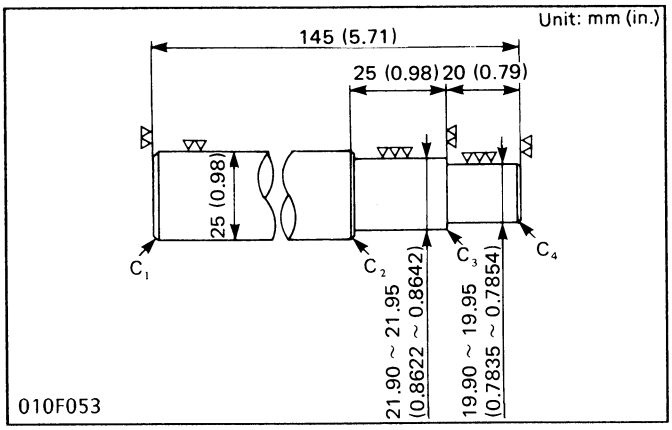
Application: Use to press out and press fit the valve guide.



ST11F312

Crankshaft Bearing 1 Replacing Tool

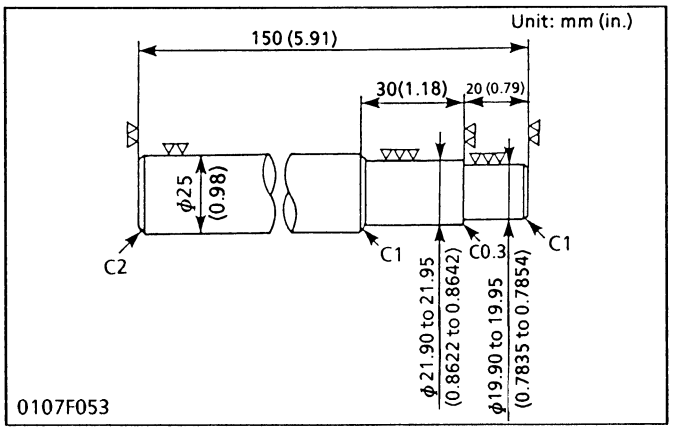
Application: Use to press out and press fit the crankshaft bearing 1.



010F053

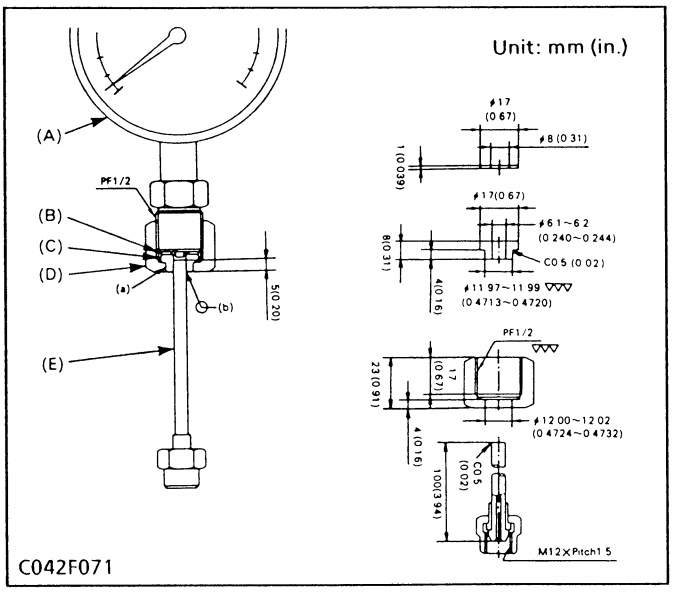
Connecting Rod Small End Bushing Tool

Application: Use to press out and press fit the connecting rod small end bushing.



Idle Gear Bushing Replacing Tool

Application: Use to press out and press fit the idle gear bushing.



Injection Pump Pressure Tester

Application: Use to check the fuel tightness.

[A] Pressure Gauge, Full scale: more than 24.9 MPa (300 kgf/cm², 4267 psi)
[B] Copper Gasket
[C] Flange (Material: Steel)
[D] Hex. Nut, 27 mm (1.06 in.) across the flat (Material: Steel)
[E] Injection Pipe

(a) Adhesive application
(b) Fillet welding on the enter circumference