GENERAL

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SAFETY FIRST

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

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

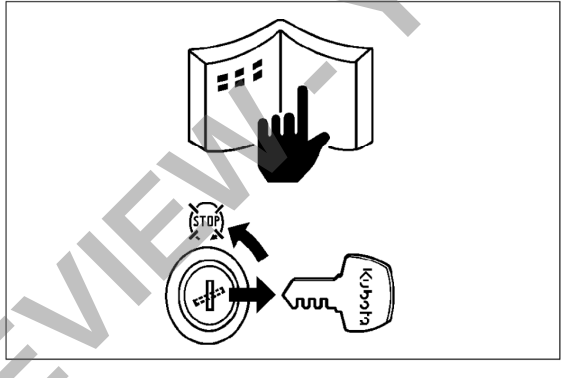
DANGER : **Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.**

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

CAUTION : **Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.**

■ **IMPORTANT** : **Indicates that equipment or property damage could result if instructions are not followed.**

■ **NOTE** : **Gives helpful information.**



BEFORE SERVICING AND REPAIRING

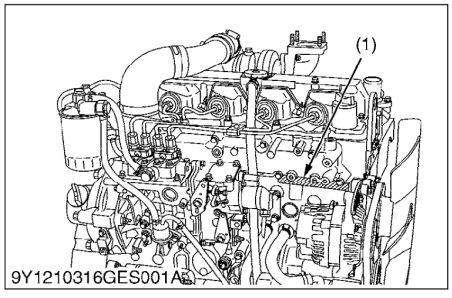
- Read all instructions and safety instructions in this manual and on your engine safety decals.
- Clean the work area and engine.
- Park the machine on a firm and level ground.
- Allow the engine to cool before proceeding.
- Stop the engine, and remove the key.
- Disconnect the battery negative cable.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

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1. ENGINE IDENTIFICATION

[1] MODEL NAME AND OLD ENGINE SERIAL NUMBER



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

The engine model and its serial number need to be identified before the engine can be serviced or parts replaced.

■ Engine Serial Number

The engine serial number is an identified number for the engine. It is marked after the engine model number.

It indicates month and year of manufacture as follows.

- **Year of manufacture**

Alphabet or Number	Year	Alphabet or Number	Year
1	2001	F	2015
2	2002	G	2016
3	2003	H	2017
4	2004	J	2018
5	2005	K	2019
6	2006	L	2020
7	2007	M	2021
8	2008	N	2022
9	2009	P	2023
A	2010	R	2024
B	2011	S	2025
C	2012	T	2026
D	2013	V	2027
E	2014		

(1) Engine Model Name and Serial Number

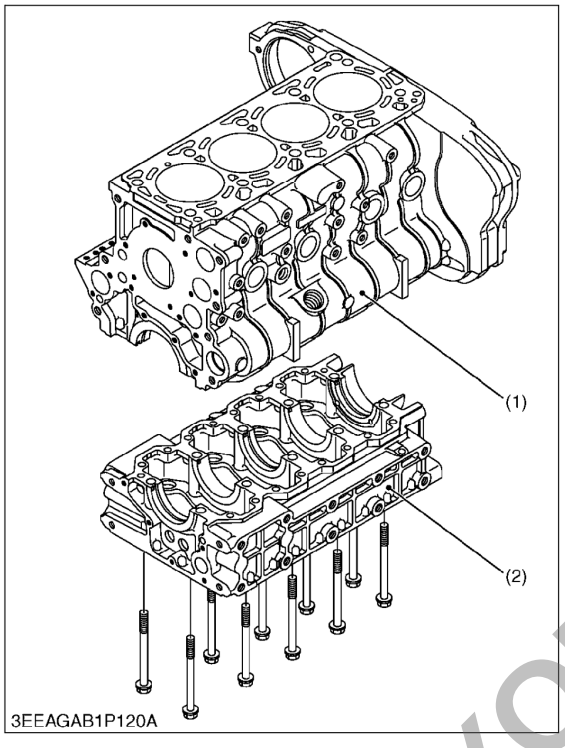
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2. ENGINE BODY

[1] CYLINDER BLOCK



The 07 series DI engine employs ladder frame structure type crankcases - the crankcase 1 (1) with combustion part and the crankcase 2 (2) which supports the crankcase 1 (1).

The following benefits are in the ladder frame structure.

1. Minimizing parts.
2. Noise reduction.
3. Reduction of loss and dispersion on friction thanks to accuracy of axial concentricity.

The cylinder is a linerless type which enables good cooling operation, less strain and good abrasion resistance.

(1) Crankcase 1 (2) Crankcase 2

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[2] TIGHTENING TORQUES FOR SPECIAL USE SCREWS, BOLTS AND NUTS

■ **NOTE**

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

Item	Size x Pitch	N·m	kgf·m	lbf·ft
Glow lead mounting nut	M4 x 0.7	0.98 to 1.7	0.10 to 0.18	0.73 to 1.3
Glow plug	M8 x 1.0	7.7 to 9.3	0.78 to 0.95	5.7 to 6.8
Cylinder head cover screw	M6 x 1.0	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31
Injection pipe retaining nut	M12 x 1.5	23 to 36	2.3 to 3.7	17 to 26
Oil switch taper screw	R 1/8	15 to 19	1.5 to 2.0	11 to 14
Injection pump unit mounting nut	M8 x 1.25	18 to 20	1.8 to 2.1	13 to 15
Drain plug	M22 x 1.5	45 to 53	4.5 to 5.5	33 to 39
Oil pipe 1 mounting screw	M10 x 1.25	16 to 19	1.6 to 2.0	12 to 14
Nozzle holder clamp screw	M8 x 1.25	24 to 27	2.4 to 2.8	18 to 20
Overflow pipe assembly retaining screw	M6 x 1.0	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31
*Lubricating oil pipe mounting screw	M10 x 1.25	16 to 19	1.6 to 2.0	12 to 14
Governor housing mounting screw	M6 x 1.0	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31
Lock nut	M5 x 0.8	2.9 to 4.0	0.29 to 0.41	2.1 to 2.9
Injection pump assembly mounting screw	M8 x 1.25	24 to 27	2.4 to 2.8	18 to 20
Injection pump assembly mounting nut	M8 x 1.25	18 to 20	1.8 to 2.1	13 to 15
Governor weight mounting nut	M12 x 1.25	63 to 72	6.4 to 7.4	47 to 53
Fuel camshaft stopper mounting screw	M6 x 1.0	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31
Fuel camshaft bearing stopper mounting screw	M6 x 1.0	3.9 to 4.2	0.39 to 0.43	2.9 to 3.1
*Crankshaft screw	M16 x 1.5	255 to 274	26.0 to 28.0	188 to 202
Relief valve retaining screw	M22 x 1.5	69 to 78	7.0 to 8.0	51 to 57
*Flywheel screw	M12 x 1.25	98.1 to 107	10.0 to 11.0	72.4 to 79.5
Camshaft set screw	M8 x 1.25	24 to 27	2.4 to 2.8	18 to 20
Balancer shaft set screw	M8 x 1.25	24 to 27	2.4 to 2.8	18 to 20
Starter's terminal **B** mounting nut	M8 x 1.25	9.8 to 11	1.0 to 1.2	7.3 to 8.6
Alternator pulley nut	M24	58.4 to 78.9	5.95 to 8.05	43.1 to 58.2
Oil pump cover screw	M6	7.9 to 9.3	0.80 to 0.95	5.8 to 6.8

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1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Engine Does Not Start	No fuel	Replenish fuel	G-12
	Air in the fuel system	Vent air	G-12
	Water in the fuel system	Change fuel and repair or replace fuel system	–
	Fuel hose clogged	Clean or replace	G-12, 28
	Fuel filter clogged	Replace	G-14, 16
	Excessively high viscosity of fuel or engine oil at low temperature	Use specified fuel or engine oil	G-7, 10
	Fuel with low cetane number	Use specified fuel	G-7
	Fuel leak due to loose injection pipe retaining nut	Tighten retaining nut	S-31
	Incorrect injection timing	Adjust	S-20
	Fuel camshaft worn	Replace	S-41
	Injection nozzle clogged	Repair or replace	S-22, 32
	Injection pump malfunctioning	Repair or replace	S-21, 43
	Seizure of crankshaft, camshaft, piston, cylinder or bearing	Repair or replace	–
	Compression leak from cylinder	Replace head gasket, tighten cylinder head screw, glow plug and nozzle holder	S-31 to 34
	Improper valve timing	Correct or replace timing gear	S-50
	Piston ring and cylinder worn	Replace	S-52, 53, 69, 74
	Excessive valve clearance	Adjust	S-16
	Stop solenoid malfunctioning	Replace	S-26
Starter Does Not Run	Battery discharged	Charge	G-19, 20
	Starter malfunctioning	Repair or replace	S-25, 56, 76
	Key switch malfunctioning	Replace	–
	Wiring disconnected	Connect	–

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2. SERVICING SPECIFICATIONS

ENGINE BODY

Item		Factory Specification	Allowable Limit
Compression Pressure		3.92 MPa / 250 min^{-1} (rpm) 40.0 kgf/cm^2 / 250 min^{-1} (rpm) 569 psi / 250 min^{-1} (rpm)	2.90 MPa / 250 min^{-1} (rpm) 29.6 kgf/cm^2 / 250 min^{-1} (rpm) 421 psi / 250 min^{-1} (rpm)
Variance Among Cylinders		–	10 % or less
Valve Clearance (Cold)		0.13 to 0.17 mm 0.0052 to 0.0068 in.	–
Top Clearance		0.60 to 0.80 mm 0.024 to 0.031 in.	–
Cylinder Head Surface	Flatness	–	0.05 mm 0.002 in.
Valve Recessing (Intake and Exhaust)		0.65 to 0.85 mm 0.026 to 0.033 in.	1.20 mm 0.0472 in.
Valve Stem to Valve Guide (Intake and Exhaust)	Clearance	0.055 to 0.085 mm 0.0022 to 0.0033 in.	0.10 mm 0.0039 in.
Valve Stem	O.D.	6.960 to 6.975 mm 0.2741 to 0.2746 in.	–
Valve Guide	I.D.	7.030 to 7.045 mm 0.2768 to 0.2773 in.	–
Valve Face (Intake and Exhaust)	Angle	0.79 rad (45 °)	–
Valve Seat (Intake and Exhaust)	Angle	0.79 rad (45 °)	–
	Width	3.3 to 3.6 mm 0.13 to 0.14 in.	–
Intake Valve Timing	Open	0.24 rad (14 °) before T.D.C.	–
	Close	0.70 rad (40 °) after B.D.C.	–
Exhaust Valve Timing	Open	0.87 rad (50 °) before B.D.C.	–
	Close	0.24 rad (14 °) after T.D.C.	–
Valve Spring (Intake and Exhaust)	Tilt	–	1.0 mm 0.039 in.
	Free Length	35.1 to 35.6 mm 1.39 to 1.40 in.	34.6 mm 1.36 in.

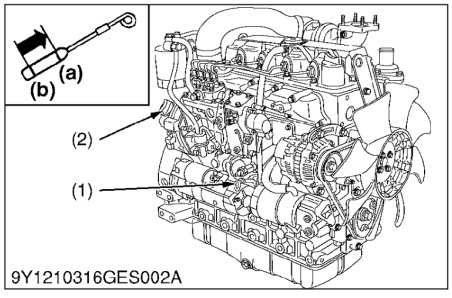
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4. CHECK AND MAINTENANCE

[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.**

■ **NOTE**

- **Be sure to inspect the engine, locating it on a horizontal place. If placed on gradients, accurately, oil quantity may not be measured.**
- **Be sure to keep the oil level between upper and lower lines of the dipstick (1). Too much oil may cause a drop in output or excessive blow-by gas. On the closed breather type engine in which mist is sucked through port, too much oil may caused oil hammer. While too little oil, may seize the engine's rotating and sliding parts.**

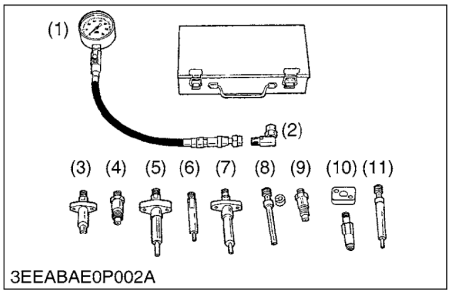
(1) Dipstick
(2) Oil Filler Plug
(a) Upper Line
(b) Lower Line

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5. SPECIAL TOOLS



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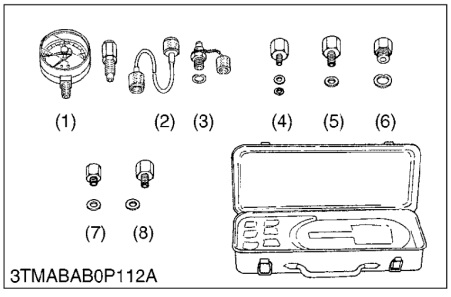
Diesel Engine Compression Tester

Code No : 07909-30208 (Assembly)

Application : Use to measure diesel engine compression and diagnostics of need for major overhaul.

(1) Gauge
(2) **L** Joint
(3) Adaptor **A**
(4) Adaptor **B**
(5) Adaptor **C**
(6) Adaptor **E**
(7) Adaptor **F**
(8) Adaptor **G**
(9) Adaptor **H**
(10) Adaptor **I**
(11) Adaptor **J**

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3TMABAB0P112A

Oil Pressure Tester

Code No : 07916-32032

Application : Use to measure lubricating oil pressure.

(1) Gauge
(2) Cable
(3) Threaded Joint
(4) Adaptor **1**
(5) Adaptor **2**
(6) Adaptor **3**
(7) Adaptor **4**
(8) Adaptor **5**

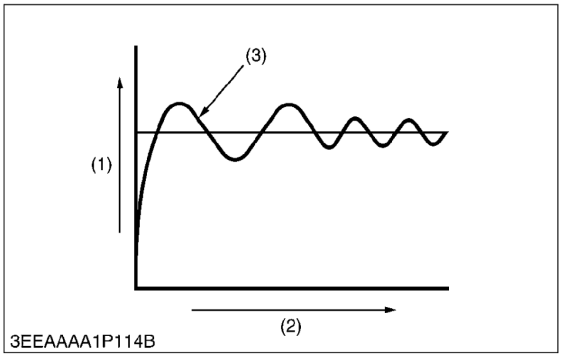
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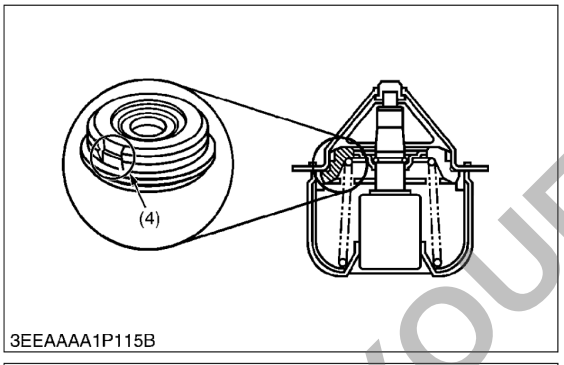
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4. COOLING SYSTEM

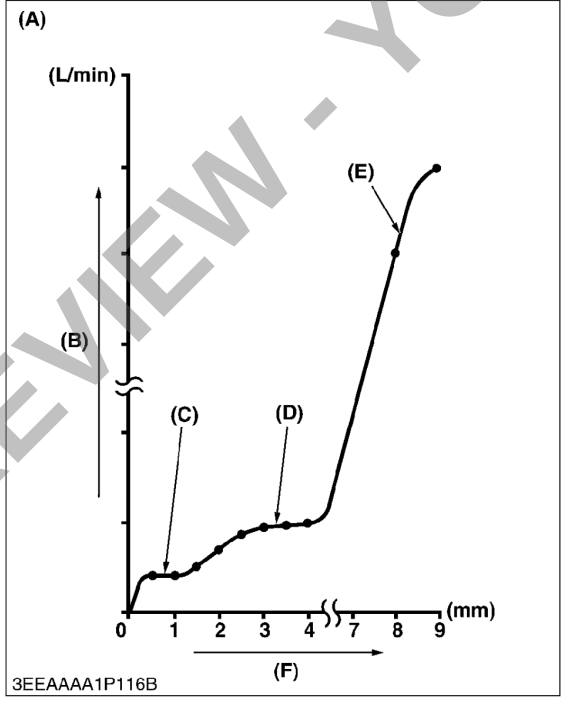
[1] THERMOSTAT



3EEAAAA1P114B



3EEAAAA1P115B



3EEAAAA1P116B

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

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

A repeated cycle of such overshoot (3) and undershoot phenomena is called the water temperature hunting. This hunting problem may adversely affect the cooling system parts, and also the engine and its related components.

To cope with this trouble, the 07 series engine is equipped with the flow control thermostat. The valve has a notch (4) to control the coolant flow-rate smoothly in small steps.

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

(A) Valve Lift Versus Flow-rate
(B) Flow-rate
(C) At Short Valve Lift
(D) At Medium Valve Lift
(E) At High Valve Lift
(F) Valve Lift

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Symptom	Probable Cause	Solution	Reference Page
High Oil Pressure	Different type of oil	Use specified type of oil	G-7, 10
	Relief valve defective	Replace	S-46, 76
Engine Overheated	Engine oil insufficient	Replenish	G-8, 10
	Fan belt broken or elongated	Replace or adjust	G-13, 16
	Coolant insufficient	Replenish	G-9, 16
	Radiator net and radiator fin clogged with dust	Clean	–
	Inside of radiator corroded	Clean or replace	G-16
	Coolant flow route corroded	Clean or replace	G-16
	Radiator cap defective	Replace	S-18
	Overload running	Reduce the load	–
	Head gasket defective	Replace	S-33, 34
	Incorrect injection timing	Adjust	S-20
	Unsuitable fuel used	Use specified fuel	G-7
Battery Quickly Discharged	Battery electrolyte insufficient	Replenish distilled water and charge	G-19, 20
	Fan belt slips	Adjust belt tension or replace	G-13, 16
	Wiring disconnected	Connect	–
	Rectifier defective	Replace	S-26, 56
	Alternator defective	Replace	S-26, 56
	Battery defective	Replace	G-28, S-23, 24

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