WSM

WORKSHOP MANUAL
DIESEL ENGINE

SM-E3B SERIES



KiSC issued 03, 2011 A

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Model		D722-E3B	D782-E3B	D902-E3B
Number of Cylinders		3		
Type		Vertical, Water-cooled, 4 cycle IDI diesel engine		
Bore × Stroke		67.0 × 68.0 mm (2.64 × 2.68 in.)	67.0 × 73.6 mm (2.64 × 2.90 in.)	72.0 × 73.6 mm (2.83 × 2.90 in.)
Total Displacement		719.0 cm^3 (43.88 cu.in.)	778.0 cm^3 (47.48 cu.in.)	898.0 cm^3 (54.80 cu.in.)
ISO Net Continuous		12.0 kW / 3600 min^{-1} (rpm) (16.4 HP / 3600 min^{-1} (rpm))	11.7 kW / 3200 min^{-1} (rpm) (15.7 HP / 3200 min^{-1} (rpm))	15.2 kW / 3600 min^{-1} (rpm) (20.4 HP / 3600 min^{-1} (rpm))
ISO / SAE Net Intermittent		14.0 kW / 3600 min^{-1} (rpm) (18.8 HP / 3600 min^{-1} (rpm))	13.5 kW / 3200 min^{-1} (rpm) (18.1 HP / 3200 min^{-1} (rpm))	17.5 kW / 3600 min^{-1} (rpm) (23.5 HP / 3600 min^{-1} (rpm))
SAE Gross Intermittent		14.9 kW / 3600 min^{-1} (rpm) (20.0 HP / 3600 min^{-1} (rpm))	14.1 kW / 3200 min^{-1} (rpm) (18.9 HP / 3200 min^{-1} (rpm))	18.5 kW / 3600 min^{-1} (rpm) (24.8 HP / 3600 min^{-1} (rpm))
Maximum Bare Speed		3800 min^{-1} (rpm)	3450 min^{-1} (rpm)	3800 min^{-1} (rpm)
Minimum Bare Idling Speed		900 to 1000 min^{-1} (rpm)		
Combustion Chamber		Spherical type (E-TVCS)		
Fuel Injection Pump		Bosch MD type mini pump		
Governor		All speed mechanical governor		
Direction of Rotation		Counter-clockwise (viewed from flywheel side)		
Injection Nozzle		Bosch "Throttle" type		
Injection Timing		0.37 rad (21 °) before T.D.C.	0.30 rad (17 °) before T.D.C.	0.35 rad (20 °) before T.D.C.
Firing Order		1-2-3		
Injection Pressure		13.73 MPa (140.0 kgf/cm^2, 1991 psi)		
Compression Ratio		23.5 : 1	24 : 1	
Lubricating System		Forced lubrication by trochoid pump		
Oil Pressure Indicating		Electrical type switch		
Lubricating Filter		Full flow paper filter (Cartridge type)		
Cooling System		Pressurized radiator, forced circulation with water pump (not included in the basic engine)		
Starting System		Electric Starting with Starter		
Starting Motor		12 V, 0.8 kW	12 V, 1.0 kW	12 V, 1.2 kW
Starting Support Device		By glow plug in combustion chamber		
EGR		None		
Battery		12 V, 36 AH equivalent		12 V, 52 AH equivalent
Charging Alternator		12 V, 150 W		12 V, 480 W
Fuel		Diesel Fuel No.2-D (ASTM D975)		
Lubricating Oil		Class CF lubricating oil as per API classification is recommended. For details on recommended lubricating oils, see page G-6, 9		
Lubricating Oil Capacity	Oil Pan Depth 101 mm (3.98 in.)	3.2 L (0.85 U.S.gals)	–	3.7 L (0.98 U.S.gals)
	Oil Pan Depth 121 mm (4.76 in.)	3.8 L (1.0 U.S.gals)	3.6 L (0.95 U.S.gals)	–
Weight (Dry)	kg (lbs)	63.0 (139)	63.5 (140)	72.0 (159)

* The specification described above is of the standard engine of each model.
* Conversion Formula : HP = 0.746 kW, PS = 0.7355 kW

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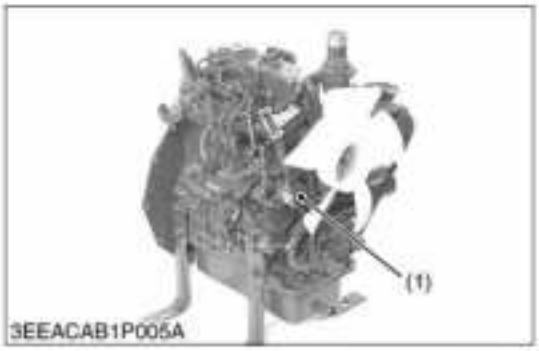
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1. TROUBLESHOOTING

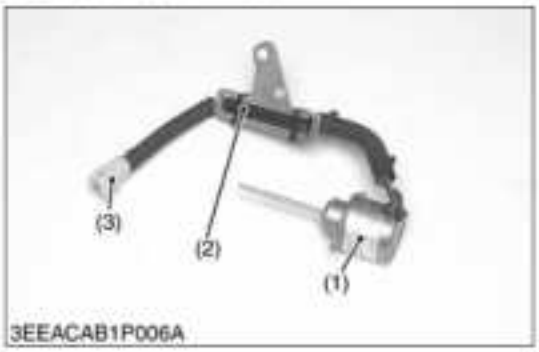
Symptom	Probable Cause	Solution	Reference Page
Engine Does Not Start	No fuel	Replenish fuel	G-11
	Air in the fuel system	Bleed	G-11
	Water in the fuel system	Change fuel and repair or replace fuel system	–
	Fuel hose clogged	Clean or replace	G-11
	Fuel filter clogged	Replace	G-17
	Excessively high viscosity of fuel or engine oil at low temperature	Use specified fuel or engine oil	5, G-9
	Fuel with low cetane number	Use specified fuel	5
	Fuel leak due to loose injection pipe retaining nut	Tighten retaining nut	S-29
	Incorrect injection timing	Adjust	S-17, 18
	Fuel camshaft worn	Replace	S-41
	Injection nozzle clogged	Clean or replace	S-20, 21
	Injection pump malfunctioning	Repair or replace	S-19, 35, 36, 37
	Seizure of crankshaft, camshaft, piston, cylinder or bearing	Repair or replace	S-40 to 48 S-64 to 71
	Compression leak from cylinder	Replace head gasket, tighten cylinder head screw, glow plug and nozzle holder	S-30, 31, 32
	Improper valve timing	Correct or replace timing gear	S-40
	Piston ring and cylinder worn	Replace	S-43, 44, 63
	Excessive valve clearance	Adjust	S-14
	Stop solenoid malfunctioning	Replace	S-26, 27, 29, 36
Starter Does Not Run	Battery discharged	Charge	G-20
	Starter malfunctioning	Repair or replace	S-29, 72 to 75
	Wiring disconnected	Connect	–
Engine Revolution Is Not Smooth	Fuel filter clogged or dirty	Replace	G-17
	Air cleaner clogged	Clean or replace	G-14, 17, 22
	Fuel leak due to loose injection pipe retaining nut	Tighten retaining nut	S-29
	Injection pump malfunctioning	Repair or replace	S-19, 35, 36, 37
	Incorrect nozzle injection pressure	Adjust	S-20
	Injection nozzle stuck or clogged	Repair or replace	S-20, 21
	Governor malfunctioning	Repair	S-41

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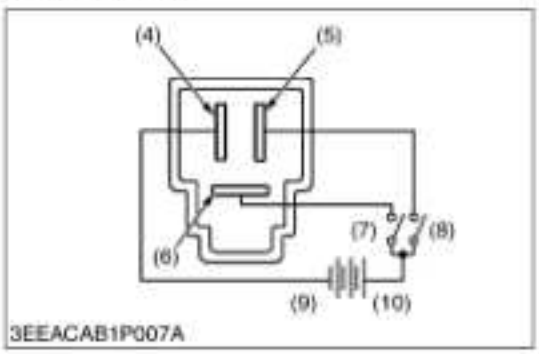
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3EEACAB1P005A



3EEACAB1P006A



3EEACAB1P007A

Engine Stop Solenoid Test (Energize to Run Type)

1. Disconnect the **3P** connector (3) from the engine stop solenoid (1) wiring harness.
2. Remove the engine stop solenoid (1) from the engine.
3. Connect the jumper leads from the pulling coil terminal (6) to the switch (7), and from switch (7) to the battery positive terminal (10).
4. Connect the jumper leads from the holding coil terminal (5) to the switch (8), and from switch (8) to the battery positive terminal (10).
5. Connect the jumper leads from the ground terminal (4) to the battery negative terminal (9).
6. When the switch (7) is turn on, the plunger pull into the solenoid body and then the plunger comes out within approximately 1.2 seconds.
7. Turn on the switch (8) then turn on the switch (7), the plunger pull into the solenoid body and it keeps in holding position after turn off the switch (7),
8. If the plunger is not attracted, the engine stop solenoid is faulty.

■ **NOTE**

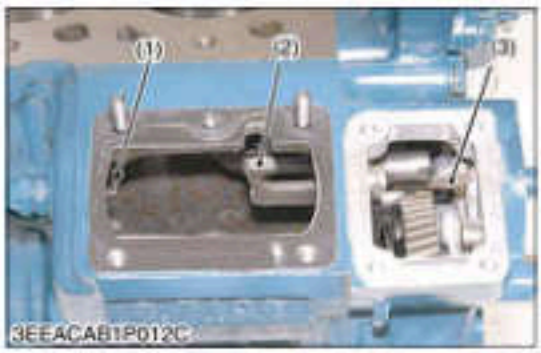
- **This solenoid assembly includes reverse polarity protected pulling coil timer module (2) to prevent solenoid burnout due to engine over crank or misadjustment of linkage by limiting the pull coil ON time.**

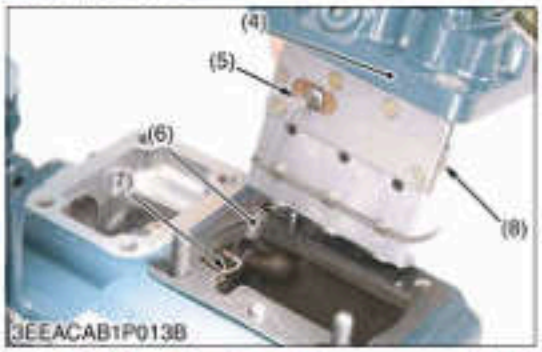
Pull coil energized time	Factory spec.	0.52 to 1.20 seconds

(1) Engine Stop Solenoid
(2) Pulling Coil Timer Module
(3) **3P** Connector
(4) Ground Terminal
(5) Holding Coil Terminal
(6) Pulling Coil Terminal
(7) Switch for Pulling Coil
(8) Switch for Holding Coil
(9) Battery Negative Terminal
(10) Battery Positive Terminal

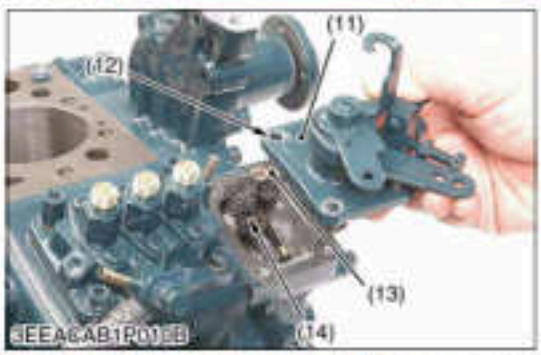
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Injection Pump, Fuel Feed Pump and Speed Control Plate (for Energize to Run Type Engine Stop Solenoid) (Continued)

(When reassembling)

1. Move the fork lever (2) to the gear case side.
2. Hook the start spring (6) to the injection pump control rack pin (5).
3. Put the specific tool (7) through the fork lever hole of cylinder block (9) and hook the start spring (6).
4. Keep this spring slightly extended and install the injection pump (4). Make sure the control rod (8) should be pushed by the idling adjusting spring (1) and the pin (5) on the rod engages with the fork lever (2).
5. Hook the start spring (6) to the bracket (3) using the specific tool (7).
6. Hook the governor springs (small and large) (14) to the governor lever (13) using the specific tool (7) and install the speed control plate (11). Be sure to place the copper washers underneath two screws (12) in the upper of the speed control plate.
7. Install the engine stop solenoid rod (15) to the guide hole of cylinder block (10) and fix the engine stop solenoid (16) with socket head screws.

■ **NOTE**

- **Be careful not to stretch the start spring (6) too long. Otherwise it may get deformed permanently.**
- **Make sure the start spring (6) is tight on the bracket (3).**
- **The sealant is applied to both sides of the soft metal gasket shim. The liquid gasket is not required for assembling.**
- **Addition or reduction of shim (0.05 mm, 0.002 in.) delays or advances the injection timing by approx. 0.009 rad (0.5 °).**
- **In disassembling and replacing, be sure to use the same number of new gasket shims with the same thickness.**

(1) Idling Adjusting Spring
(2) Fork Lever
(3) Bracket
(4) Injection Pump
(5) Injection Pump Control Rack Pin
(6) Start Spring
(7) Specific Tool
(8) Injection Pump Control Rod
(9) Fork Lever Hole of Cylinder Block
(10) Guide Hole of Cylinder Block
(11) Speed Control Plate
(12) Screw and Copper Washer
(13) Governor Lever
(14) Governor Spring
(15) Engine Stop Solenoid Rod
(16) Engine Stop Solenoid

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[6] CHECK POINT OF EVERY 150 HOURS





Replacing Oil Filter Cartridge (for Optional Depth Oil Pans)

CAUTION

- **Be sure to stop the engine before changing filter cartridge.**

1. Remove the oil filter cartridge (1) with the filter wrench.
2. Apply a slight coat of oil onto the new cartridge gasket.
3. To install the new cartridge, screw it in by hand. Over tightening may cause deformation of rubber gasket.
4. After the new cartridge has been replaced, the engine oil normally decrease a little. Thus see that the engine oil does not leak through the seal and be sure to read the oil level on the dipstick. Then, replenish the engine oil up to the specified level.

■ IMPORTANT

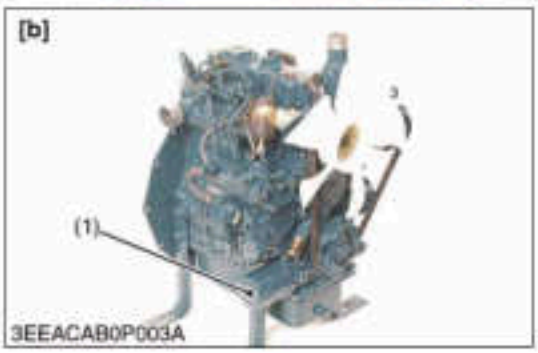
- **To prevent serious damage to the engine, replacement element must be highly efficient. Use only a KUBOTA genuine filter or its equivalent.**

(1) Engine Oil Filter Cartridge
[a] Standard Type
[b] One-side Maintenance Type

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[7] CHECK POINTS OF EVERY 200 HOURS





Replacing Oil Filter Cartridge (for Standard Depth Oil Pans)

CAUTION

- **Be sure to stop the engine before changing filter cartridge.**

1. Remove the oil filter cartridge (1) with the filter wrench.
2. Apply a slight coat of oil onto the new cartridge gasket.
3. To install the new cartridge, screw it in by hand. Over tightening may cause deformation of rubber gasket.
4. After the new cartridge has been replaced, the engine oil normally decrease a little. Thus see that the engine oil does not leak through the seal and be sure to read the oil level on the dipstick. Then, replenish the engine oil up to the specified level.

■ IMPORTANT

- **To prevent serious damage to the engine, replacement element must be highly efficient. Use only a KUBOTA genuine filter or its equivalent.**

(1) Engine Oil Filter Cartridge
[a] Standard Type
[b] One-side Maintenance Type

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