SERVICING

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1. SAFETY FIRST

⚠ 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 try to repair or use this unit.**

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

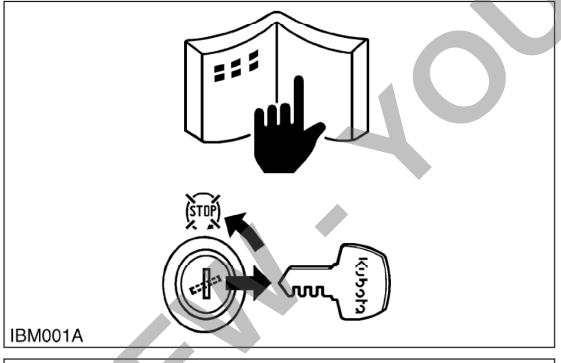
⚠ WARNING
- **Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.**

⚠ 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.**

WSM000001INI0001US0



IBM001A


IBM011A

BEFORE YOU START SERVICE

- 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 stable and level ground.
- Let the temperature of the engine decrease before you start a job.
- Stop the engine, then remove the key.
- Disconnect the battery negative cable.
- Hang a **"DO NOT OPERATE"** tag in the operator station.

WSM000001INI0002US0

START SAFELY

- Do not do the procedures below when you start the engine.
  - short across starter terminals
  - bypass the safety start switch
- Do not make unauthorized modifications to the engine. This can cause damage and decrease the engine life.

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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	Vent air	G-11
	Water in the fuel system	Change fuel and repair or replace fuel system	–
	Fuel pipe clogged	Clean or replace	G-11
	Fuel filter clogged	Replace	G-16
	Excessively high viscosity of fuel or engine oil at low temperature	Use specified fuel or engine oil	I-5, I-6, G-9
	Fuel with low cetane number	Use specified fuel	–
	Fuel leak due to loose injection pipe retaining nut	Tighten retaining nut	–
	Incorrect injection timing	Adjust	1-S19
	Fuel camshaft worn	Replace	1-S35
	Injection nozzle clogged	Clean or replace	1-S21, 1-S22
	Injection pump malfunctioning	Repair or replace	1-S20, 1-S34
	Seizure of crankshaft, camshaft, piston, cylinder or bearing	Repair or replace	1-S35, 1-S36, 1-S37, 1-S38, 1-S56, 1-S57, 1-S58, 1-S59, 1-S60, 1-S61, 1-S62
	Compression leak from cylinder	Replace head gasket, tighten cylinder head screw, glow plug and nozzle holder	1-S28, 1-S29, 1-S30
	Improper valve timing	Correct or replace timing gear	1-S35
	Piston ring and cylinder worn	Replace	1-S36, 1-S37, 1-S38
	Excessive valve clearance	Adjust	1-S15
	Stop solenoid malfunctioning	Replace	1-S33
Starter Does Not Run	Battery discharged	Charge	–
	Starter malfunctioning	Repair or replace	1-S26, 1-S63, 1-S64, 1-S65
	Key switch malfunctioning	Replace	–
	Wiring disconnected	Connect	–

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3. MAINTENANCE CHECK LIST

To make sure that the engine operates safely for a long time, refer to the table below to do regular inspections.

	Item	Service Interval										
		Every										
		50 hrs	100 hrs	200 hrs	400 hrs	500 hrs	1 or 2 months	1 year	800 hrs	1500 hrs	3000 hrs	2 years
*	Checking fuel hoses and clamp bands	☆										
*	Changing engine oil (Oil pan depth: 110 mm (4.33 in.), 125 mm (4.92 in.), 130 mm (5.12 in.))	★		☆								
*	Cleaning air cleaner element (Replace the element after 6 times cleaning)		☆									
	Cleaning fuel filter element		☆									
	Check fan belt tension and damage		☆									
	Checking battery electrolyte level		☆									
*	Replacing oil filter cartridge (Oil pan depth: 110 mm (4.33 in.), 125 mm (4.92 in.), 130 mm (5.12 in.))	★		☆								
	Checking radiator hoses and clamp bands			☆								
*	Checking intake air line			☆								
	Replacing fuel filter cartridge				☆							
	Cleaning water jacket and radiator interior					☆						
	Replacing fan belt					☆						
	Recharging battery						☆					
*	Replacing air cleaner element							☆				
	Checking valve clearance								☆			
*	Checking injection nozzle pressure									☆		
	Checking injection pump										☆	
	Checking injection timing										☆	
	Changing radiator coolant (L.L.C.)											☆
	Replacing radiator hoses and clamp bands											☆
*	Replacing fuel hoses and clamps											☆
*	Replacing intake air line											☆
	Replacing battery											☆

★ Change engine oil and replace oil filter cartridge after the first 50 hours of operation.

* The items listed above (* marked) are registered as emission related critical parts by KUBOTA in the U.S. EPA nonroad emission regulation. As the engine owner, you are responsible for the performance of the required maintenance on the engine according to the above instruction.
Please see the emission Warranty Statement in detail.

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2. SPECIFICATIONS

Model	D1005-E4B	D1105-E4B
Number of Cylinder	3	
Engine Type	Vertical, water-cooled, 4-cycle diesel engine	
Bore × Stroke	76.0 × 73.6 mm (2.99 × 2.90 in.)	78.0 × 78.4 mm (3.07 × 3.09 in.)
Total Displacement	1001 cm^3 (61.08 cu.in.)	1123 cm^3 (68.53 cu.in.)
ISO Net Continuous	15.4 kW / 3200 min^{-1} (rpm) (20.6 HP / 3200 min^{-1} (rpm))	15.4 kW / 3000 min^{-1} (rpm) (20.7 HP / 3000 min^{-1} (rpm))
ISO/SAE Net Intermittent	17.7 kW / 3200 min^{-1} (rpm) (23.7 HP / 3200 min^{-1} (rpm))	17.8 kW / 3000 min^{-1} (rpm) (23.9 HP / 3000 min^{-1} (rpm))
SAE Gross Intermittent	18.5 kW / 3200 min^{-1} (rpm) (24.8 HP / 3200 min^{-1} (rpm))	18.5 kW / 3000 min^{-1} (rpm) (24.8 HP / 3000 min^{-1} (rpm))
Maximum Bare Speed	3420 min^{-1} (rpm)	3220 min^{-1} (rpm)
Minimum Bare Idling Speed	1300 min^{-1} (rpm)	900 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	Mini Nozzle (DNOPD)	
Injection Timing	0.3491 rad (20.00 °) before T.D.C.	0.3142 rad (18.00 °) before T.D.C.
Firing Order	1-2-3	
Injection Pressure	13.73 MPa (140.0 kgf/cm^2, 1991 psi)	
Compression Ratio	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	
Starting System	Electric Starting with Starter	
Starter Motor	12 V, 1.2 kW	
Starting Support Device	By glow plug in combustion chamber	
EGR	None	
Battery	12 V, 65 AH, equivalent	
Charging Alternator	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, G-9.	
Lubricating Oil Capacity	5.1 L (1.3 U.S.gals)	
Weight (Dry)	93.0 kg (205 lbs)	

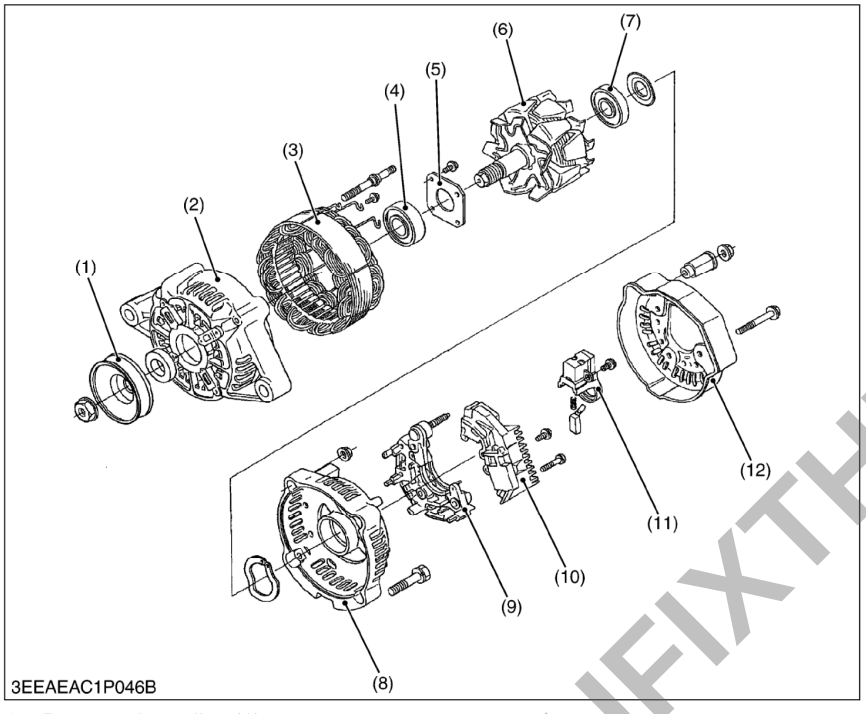
- The specification described above is of the standard engine of each model.
- Conversion Formula: HP = 0.746 kW, PS = 0.7355 kW

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(7) Alternator



(1) Pulley
(2) Drive End Frame
(3) Stator
(4) Bearing
(5) Retainer Plate
(6) Rotor
(7) Bearing
(8) Rear End Frame
(9) Rectifier
(10) IC Regulator
(11) Brush Holder
(12) Rear End Cover

1. Remove the pulley (1).
2. Remove the rear end cover (12).
3. Remove the brush holder (11).
4. Remove the IC regulator (10).
5. Remove the four screws holding the stator lead wires.
6. Remove the rectifier (9).
7. Remove the rear end frame (8).
8. Press out the rotor (6) from drive end frame (2).
9. Remove the retainer plate (5).
10. Press out the bearing (4) from drive end frame (2) with a press and jig.
11. Lightly secure the rotor with a vise to prevent damage, and remove the bearing (7) with a puller.

(When reassembling)

Tightening torque	Pulley nut	58.4 to 78.9 N·m 5.95 to 8.05 kgf·m 43.1 to 58.2 lbf·ft

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

■ **NOTE**

- **For the screws, bolts and nuts with the mark "*", apply engine oil to their threads and seats before you tighten.**
- **The alphabet "M" in Dimension × Pitch shows that the screw, bolt or nut dimensions are in the metric system. The dimension is the nominal external diameter in mm of the threads. The pitch is the nominal distance in mm between 2 threads.**

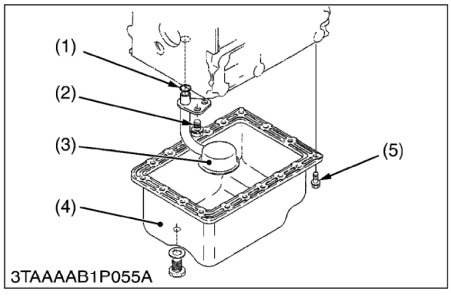
Item	Dimension × Pitch	N·m	kgf·m	lbf·ft
Cylinder head cover screw **[D1005-E4B, D1105-E4B, V1505-E4B]**	M7 × 1.0	7 to 8	0.7 to 0.9	5 to 6
Cylinder head cover screw **[D1305-E4B]**	M6 × 1.0	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31
Cylinder head screw	M10 × 1.25	64 to 68	6.5 to 7.0	47 to 50
*Main bearing case screw 1	M8 × 1.25	30 to 34	3.0 to 3.5	22 to 25
*Main bearing case screw 2	M9 × 1.25	49 to 53	5.0 to 5.5	37 to 39
*Flywheel screw	M10 × 1.25	54 to 58	5.5 to 6.0	40 to 43
*Connecting rod screw	M8 × 1.0	42 to 46	4.2 to 4.7	31 to 33
*Rocker arm bracket nut **[D1005-E4B, D1105-E4B, V1505-E4B]**	M7 × 1.0	22 to 26	2.2 to 2.7	16 to 19
*Rocker arm bracket screw **[D1305-E4B]**	M7 × 1.0	22 to 26	2.2 to 2.7	16 to 19
*Idle gear shaft screw	M6 × 1.0	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31
*Fan drive pulley screw	M14 × 1.5	236 to 245	24.0 to 25.0	174 to 180
Bearing case cover mounting screw	M6 × 1.0	10.8 to 12.2	1.10 to 1.25	7.96 to 9.04
Glow plug	M8 × 1.0	7.9 to 14	0.80 to 1.5	5.8 to 10
Nozzle holder assembly	M20 × 1.5	49 to 68	5.0 to 7.0	37 to 50
Nozzle holder	–	35 to 39	3.5 to 4.0	26 to 28
Oil pressure switch	PT 1/8	15 to 19	1.5 to 2.0	11 to 14
Injection pipe retaining nut	M12 × 1.5	25 to 34	2.5 to 3.5	18 to 25
Overflow pipe retaining nut (Serial No.: below BTZ999)	M12 × 1.5	20 to 24	2.0 to 2.5	15 to 18
Overflow pipe retaining nut (Serial No.: above BU0001)	M12 × 1.5	35 to 39	3.5 to 4.0	26 to 28
Starter's **B** terminal nut	M8	5.88 to 11.8	0.600 to 1.20	4.34 to 8.70
Alternator's pulley nut	–	58.4 to 78.9	5.95 to 8.05	43.1 to 58.2
Drain plug with copper gasket	M12 × 1.25	33 to 37	3.3 to 3.8	24 to 27
Drain plug with rubber coated gasket	M22 × 1.5	45 to 53	4.5 to 5.5	33 to 39

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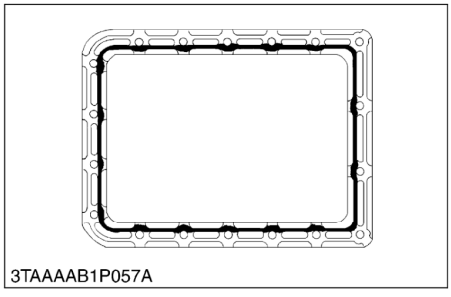
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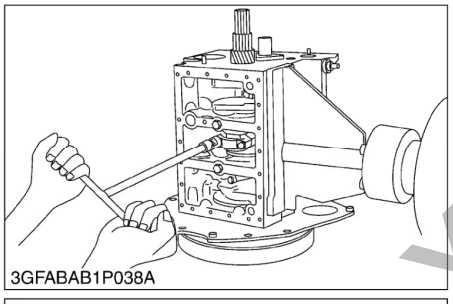
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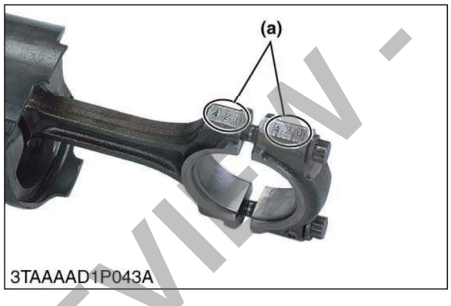
(5) Piston and Connecting Rod



3TAAAAB1P055A


3TAAAAB1P057A


3GFABAB1P038A



3TAAAAD1P043A

Oil Pan and Oil Strainer (for Standard Oil Pan)

1. Remove the oil pan mounting screws (5).
2. Remove the oil pan (4).
3. Remove the oil strainer (3).

(When reassembling)

- After cleaning the oil strainer, check to see that the filter mesh in clean, and install it.
- Visually check the O-ring (1), apply engine oil, and install it.
- Securely fit the O-ring to the oil strainer.
- To avoid uneven tightening, tighten oil pan mounting screws in diagonal order form the center.

■ **IMPORTANT**

- **Scrape off the old adhesive completely. Wipe the sealing surface clean using waste cloth soaked with gasoline.**
- **Apply "liquid gasket" (Three Bond 1207D or equivalent) about 3.0 to 5.0 mm (0.12 to 0.19 in.) thick. Within 20 minutes after the application of liquid gasket, reassemble the components.**

(1) O-ring
(2) Screw
(3) Oil Strainer
(4) Oil Pan
(5) Oil Pan Mounting Screw

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Connecting Rod

1. Remove the connecting rod cap.

(When reassembling)

- Align the marks **(a)** with each other. (Face the marks toward the injection pump.)
- Apply engine oil to the connecting rod screws and lightly screw it in by hand, then tighten it to the specified torque.
  If the connecting rod screw won't be screwed in smoothly, clean the threads.
  If the connecting rod screw is still hard to screw in, replace it.

Tightening torque	Connecting rod screw	42 to 46 N·m 4.2 to 4.7 kgf·m 31 to 33 lbf·ft

(a) Mark

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2. SERVICING SPECIFICATIONS

ENGINE BODY

Item		Factory Specification	Allowable Limit
Valve Clearance (Cold)		0.145 to 0.185 mm 0.00571 to 0.00728 in.	–
Compression Pressure	D1005-E4B D1105-E4B D1305-E4B V1505-E4B	3.73 to 4.11 MPa 38.0 to 42.0 kgf/cm^2 541 to 597 psi	2.26 MPa 23.0 kgf/cm^2 327 psi
• Difference among Cylinders		–	10 % or less
Top Clearance	D1005-E4B D1105-E4B V1505-E4B	0.55 to 0.75 mm 0.022 to 0.029 in.	–
	D1305-E4B	0.80 to 1.0 mm 0.032 to 0.039 in.	–
Cylinder Head Surface	Flatness	–	0.05 mm 0.002 in.
Valve Recessing	Intake and Exhaust	−0.050 to 0.25 mm −0.0020 to 0.0098 in.	0.40 mm 0.016 in.
Valve Stem to Valve Guide	Clearance	0.035 to 0.065 mm 0.0014 to 0.0025 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.	7.010 to 7.025 mm 0.2760 to 0.2765 in.	–
Valve Face	Angle (Intake)	1.0 rad 60 °	–
	Angle (Exhaust)	0.79 rad 45 °	–
Valve Seat	Angle (Intake)	1.0 rad 60 °	–
	Angle (Exhaust)	0.79 rad 45 °	–
	Width	2.12 mm 0.0835 in.	–
Valve Spring	Free Length	37.0 to 37.5 mm 1.46 to 1.47 in.	36.5 mm 1.44 in.
	Tilt	–	1.0 mm 0.039 in.
	Setting Load	117.4 N / 31.0 mm 11.97 kgf / 31.0 mm 26.39 lbf / 1.22 in.	100.0 N / 31.0 mm 10.20 kgf / 31.0 mm 22.48 lbf / 1.22 in.

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INFORMATION

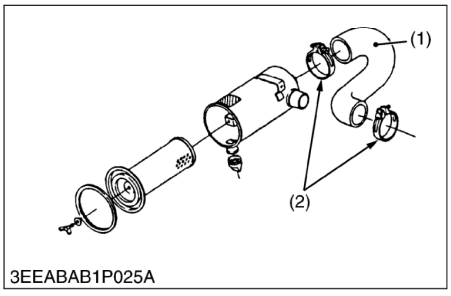
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3. PERFORMANCE CURVES I-7
4. DIMENSIONS I-11

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[13] CHECK POINTS OF EVERY 2 YEARS



3EEABAB1P025A

Replacing Intake Air Line

1. Loosen the clamp (2).
2. Remove the intake air hose (1) and clamp (2).
3. Replace new intake air hose (1) and new clamp (2).
4. Tighten the clamp (2).

■ **NOTE**

- **To prevent serious damage to the engine, keep out any dust inside the intake air line.**

(1) Intake Air Hose (2) Clamp

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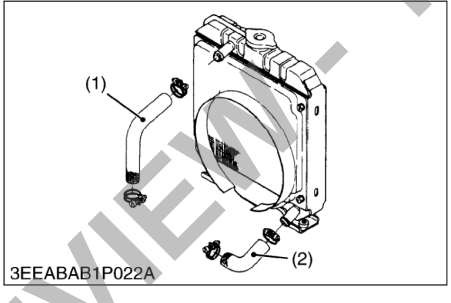
Replacing Battery

CAUTION

- **When the battery is being activated, hydrogen and oxygen gases in the battery are extremely explosive. Keep open sparks and flames away from the battery at all times, especially when charging the battery.**
- **When charging battery, remove battery vent plugs.**
- **When disconnecting the cable from the battery, start with the negative terminal first. When connecting the cable to the battery, start with the positive terminal first.**
- **Never check battery charge by placing a metal object across the posts.**

1. Disconnect the negative terminal and positive terminal.
2. Remove the battery holder.
3. Remove the used battery.
4. Replace the new battery.
5. Tighten the battery holder.
6. Connect the positive terminal.
7. Connect the negative terminal.

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Replacing Radiator Hoses and Clamp Bands

CAUTION

- **Do not remove the radiator cap when the engine is hot. Then loosen cap slightly to the stop to relieve any excess pressure before removing cap completely.**

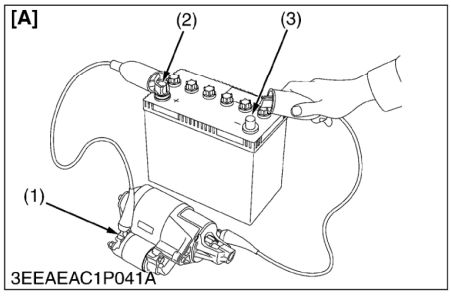
1. Drain the coolant.
2. Loosen the clamp bands.
3. Remove the upper hose (1) and lower hose (2).
4. Replace new upper / lower hose (1), (2) and clamp bands.
5. Tighten the clamp bands.
6. Fill with clean water and anti-freeze until the coolant level is just below the port. Install the radiator cap securely.

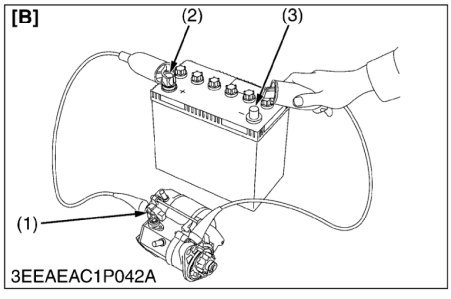
(1) Upper Hose (2) Lower Hose

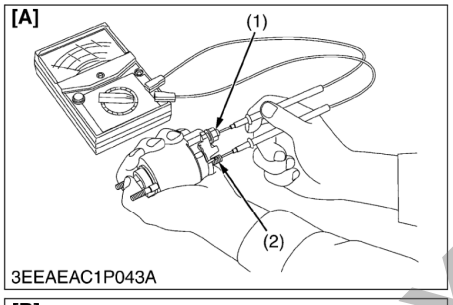
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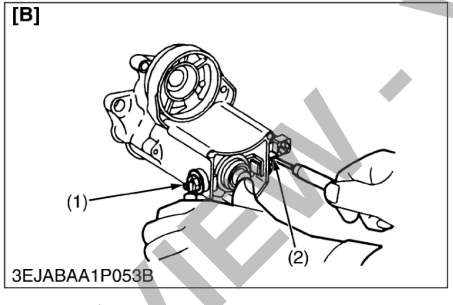
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Magnetic Switch Test

1. Disconnect the battery negative cable from the battery.
2. Disconnect the battery positive cable from the battery.
3. Disconnect the leads from the starter **B** terminal.
4. Remove the starter from the engine.
5. Connect a jumper lead from the starter **S** terminal (1) to the battery positive terminal (2).
6. Connect a jumper lead momentarily between the starter's body and the battery negative terminal (3).
7. If the pinion gear does not pop out, the magnetic switch is failure.
   Repair or replace the starter.

■ **NOTE**

- **B terminal: It is the terminal which connects the cable from the battery to the starter.**
- **S terminal: It is the terminal which connects the cable from the starter switch to the magnet switch.**

(1) **S** Terminal
(2) Positive Terminal
(3) Negative Terminal

[A] Electromagnetic Drive Type
[B] Planetary Gear Reduction Type

9Y1210784ENS0021US0

Magnet Switch Continuity Test

1. Check the continuity across the **C** terminal (1) and the **B** terminal (2) with a circuit tester, pushing in the plunger.
2. If not continuous or if a certain value is indicated, replace the magnet switch.

(1) **C** Terminal
(2) **B** Terminal

[A] Electromagnetic Drive Type
[B] Gear Reduction Type

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