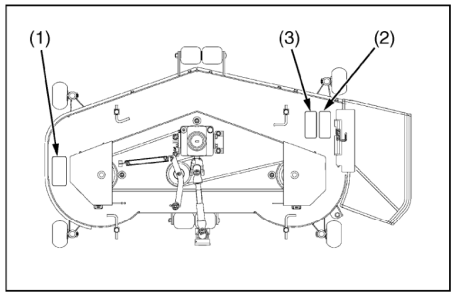
WSM

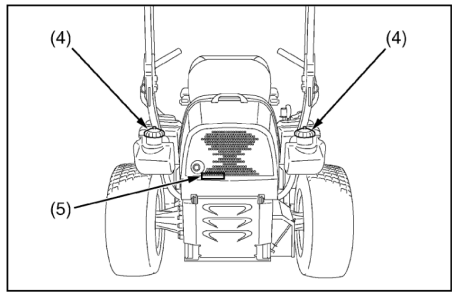
WORKSHOP MANUAL

ZD321,ZD323,ZD326,ZD331

Kubota

KiSC issued 08, 2016 A





(1) Part No. K5681-7312-1

1BDACAEAP015B

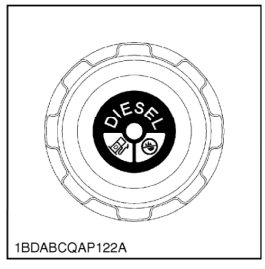
(2) Part No. K5681-7311-1

1BDACAEAP016B

(3) Part No. K5681-7310-1

1BDACAEAP017B

(4) Part No. K3181-2491-3



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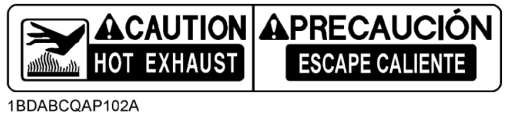
(5) Part No. K3181-6532-1



1BDABCQAP102A

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CARE OF DANGER, WARNING AND CAUTION LABELS

1. Keep danger, warning and caution labels clean and free from obstructing material.
2. Clean danger, warning and caution labels with soap and water, dry with a soft cloth.
3. Replace damaged or missing danger, warning and caution labels with new labels.
4. If a component with danger, warning and caution label(s) affixed is replaced with new part, make sure new label(s) is (are) attached in the same location(s) as the replace component.
5. Mount new danger, warning and caution labels by applying on a clean dry surface and pressing any bubbles to outside edge.

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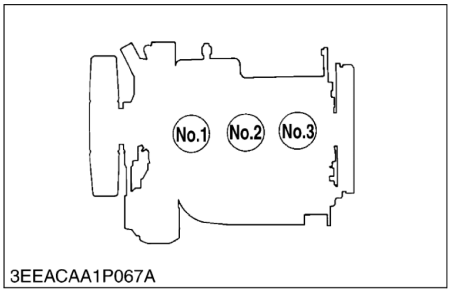
3. CYLINDER NUMBER



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

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

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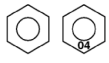
6. TIGHTENING TORQUES

[1] GENERAL USE SCREWS, BOLTS AND NUTS

Tighten screws, bolts and nuts whose tightening torques are not specified in this Workshop Manual according to the table below.

Indication on top of bolt	 No-grade or 4T						 7T						 9T		
Indication on top of nut	 No-grade or 4T												 6T		
Material of opponent part	Ordinariness			Aluminum			Ordinariness			Aluminum			Ordinariness		
Unit	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft
M6	7.9 to 9.3	0.80 to 0.95	5.8 to 6.8	7.9 to 8.8	0.80 to 0.90	5.8 to 6.5	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31	7.9 to 8.8	0.80 to 0.90	5.8 to 6.5	12.3 to 14.2	1.25 to 1.45	9.05 to 10.4
M8	18 to 20	1.8 to 2.1	13 to 15	17 to 19	1.7 to 2.0	13 to 14	24 to 27	2.4 to 2.8	18 to 20	18 to 20	1.8 to 2.1	13 to 15	30 to 34	3.0 to 3.5	22 to 25
M10	40 to 45	4.0 to 4.6	29 to 33	32 to 34	3.2 to 3.5	24 to 25	48 to 55	4.9 to 5.7	36 to 41	40 to 44	4.0 to 4.5	29 to 32	61 to 70	6.2 to 7.2	45 to 52
M12	63 to 72	6.4 to 7.4	47 to 53	–	–	–	78 to 90	7.9 to 9.2	58 to 66	63 to 72	6.4 to 7.4	47 to 53	103 to 117	10.5 to 12.0	76.0 to 86.7
M14	108 to 125	11.0 to 12.8	79.6 to 92.5	–	–	–	124 to 147	12.6 to 15.0	91.2 to 108	–	–	–	167 to 196	17.0 to 20.0	123 to 144
M16	167 to 191	17.0 to 19.5	123 to 141	–	–	–	197 to 225	20.0 to 23.0	145 to 166	–	–	–	260 to 304	26.5 to 31.0	192 to 224
M18	246 to 284	25.0 to 29.0	181 to 209	–	–	–	275 to 318	28.0 to 32.5	203 to 235	–	–	–	344 to 402	35.0 to 41.0	254 to 296
M20	334 to 392	34.0 to 40.0	246 to 289	–	–	–	368 to 431	37.5 to 44.0	272 to 318	–	–	–	491 to 568	50.0 to 58.0	362 to 419

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[2] STUD BOLTS

Material of opponent part	Ordinariness			Aluminum		
Unit	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft
M8	12 to 15	1.2 to 1.6	8.7 to 11	8.9 to 11	0.90 to 1.2	6.5 to 8.6
M10	25 to 31	2.5 to 3.2	18 to 23	20 to 25	2.0 to 2.6	15 to 18
M12	30 to 49	3.0 to 5.0	22 to 36	31	3.2	23
M14	62 to 73	6.3 to 7.5	46 to 54	–	–	–
M16	98.1 to 112	10.0 to 11.5	72.4 to 83.1	–	–	–
M18	172 to 201	17.5 to 20.5	127 to 148	–	–	–

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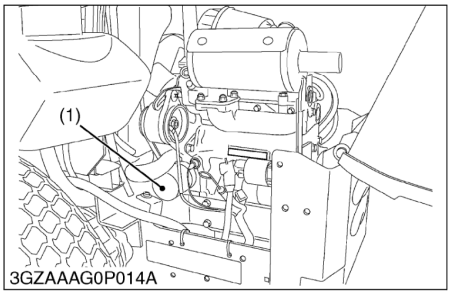

Replacing Engine Oil Filter Cartridge

CAUTION

- **Be sure to stop the engine before changing the oil filter cartridge.**
- **Allow engine to cool down sufficiently, oil can be hot and may cause burns.**

1. Remove the engine oil filter cartridge (1) with the filter wrench.
2. Apply a slight coat of oil onto the rubber gasket of new cartridge.
3. To install the new cartridge, screw it in by hand. Over tightening may cause deformation of rubber gasket.
4. After the cartridge has been replaced, the engine oil level normally lowers a little. Add engine oil to proper level. Check for oil leaks around filter gasket.

IMPORTANT

- **To prevent serious damage to the engine, element of recommended type must be used. Use only a genuine KUBOTA filter or its equivalent.**

(1) Engine Oil Filter Cartridge

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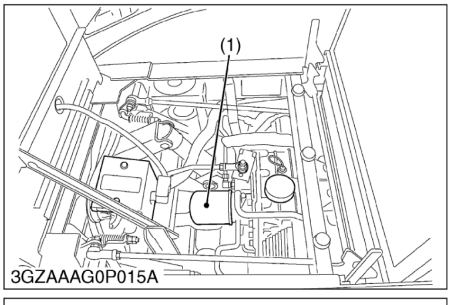

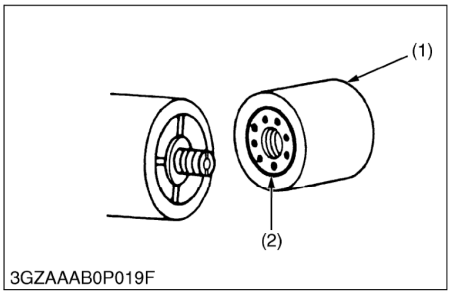

Replacing HST Transmission Oil Filter Cartridge

CAUTION

- **Be sure to stop the engine before changing the oil filter cartridge.**
- **Allow transmission case to cool down sufficiently; oil can be hot and may cause burns.**

1. The HST transmission oil filter cartridge must be changed every 200 service hours.
2. Place an oil pan underneath the oil filter cartridge. (Do not drain oil.)
3. Remove the oil filter cartridge by using the filter wrench.
4. Apply a slight coat of oil onto the cartridge gasket.
5. Tighten the filter quickly until it contacts the mounting surface. Tighten filter by hand an additional 1/2 turn only.
6. After the new cartridge has been replaced, the transmission fluid level normally lowers a little. Add fluid to proper level. Check for oil leaks around filter gasket.

IMPORTANT

- **To prevent serious damage or premature failure to the hydraulic system, use only a KUBOTA genuine filter.**

(1) HST Transmission Oil Filter Cartridge (2) Gasket

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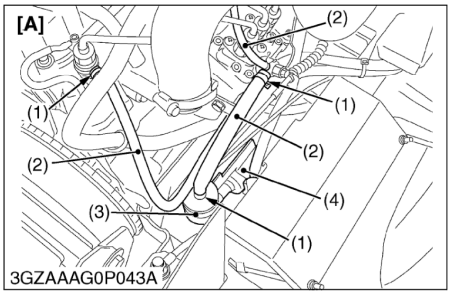

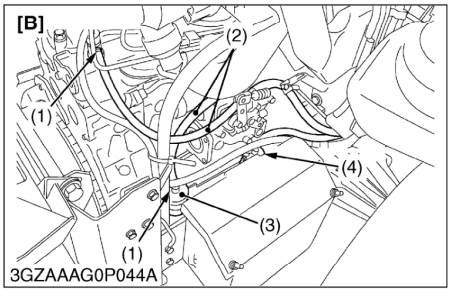

Checking Fuel Lines and Fuel Filter

CAUTION

- **Be sure to stop the engine and remove the key when attempting to make the following checks and changes.**
- **Never fail to check the fuel lines periodically. The fuel lines are subject to wear and age. Fuel may leak out onto the running engine, causing a fire.**

The fuel line connections should be checked annually or every 100 service hours, whichever comes first.

1. The fuel lines is made of rubber and ages regardless of service period.
2. If the fuel line and clamps are found damages or deteriorated, replace them.
3. Check fuel filter, if it is clogged by debris, and replace it.

IMPORTANT

- **When the fuel line is disconnected for maintenance or repair, close both ends of the fuel line with a piece of clean cloth or paper to prevent dust and dirt from entering. In addition, particular care must be taken not to admit dust and dirt into the fuel pump. Entrance of dust and dirt causes malfunction of the fuel pump and injector components.**

(1) Pipe Clamps
(2) Fuel Line
(3) Fuel Filter
(4) Fuel Pump

[A] ZD321, ZD323
[B] ZD326, ZD331

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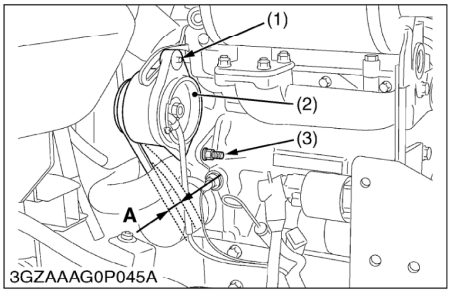

Adjusting Fan Belt Tension

CAUTION

- **Be sure to stop the engine and remove the key before checking belt tension.**

1. If the fan drive belt becomes loose, the engine may overheat.
2. To adjust, loosen bolts and turn the alternator to tighten the belt.
3. After adjustment, securely tighten the bolts.

Moderate belt tension:

The belt deflect approx. 10 mm (0.4 in.) when the center of the belt is depressed with finger pressure of 98 N (10 kgf, 22 lbf).

Fan belt tension (**A**)	Factory specification	Approx. 10 mm 0.4 in.

IMPORTANT

- **When replacing fan belt, be careful not to catch it on the cap under the water pump. See the illustration to the left.**

(1) Tension Bolt
(2) Alternator
(3) Adjustment Bolt

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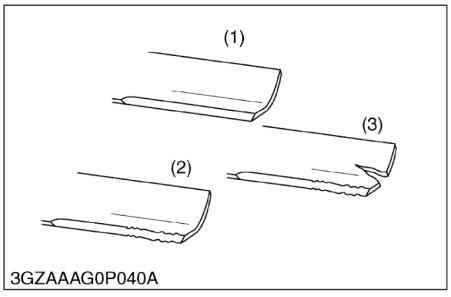

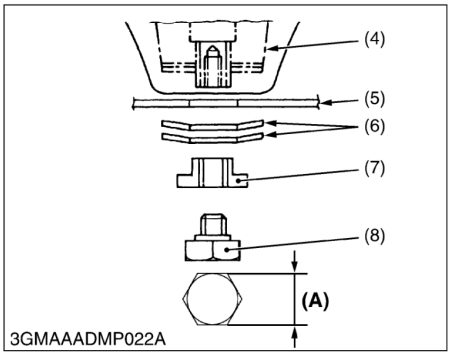

Checking Mower Blade and Replacing Mower Blade

1. Check the cutting edge of mower blade.
2. Sharpen the cutting edges, if the mower blades are as shown in figure (2).
3. Replace the mower blades, if they are as shown in figure (3).

■ **NOTE**

- **To sharpen the mower blades by yourself, clamp the mower blade securely in a vise and use a large mill file along the original bevel.**
- **To balance the mower blade, place a small rod through the center hole and check to see if the blade balances evenly. File heavy side of the blade until it balance out even.**

4. Tilt up the mower deck.
5. Wedge a wooden block securely between the mower blade and mower deck or use a box wrench over the pulley nut to prevent the spindle from rotating while removing the blade bolts; then loosen the blade bolts.
6. Pass the spline boss through the blade (5) and 2 cup washers (6), and tighten the bolt (8).

■ **NOTE**

- **Make sure that the cup washer is not flattened out or worn; this cause blade to slip excessively.Replace the 2 cup washers if either is damaged.**

(1) New Blade
(2) Worn Blade
(3) Cracked Blade
(4) Spindle Holder
(5) Blade
(6) 2 Cup Washers
(7) Lock Washer
(8) Bolt
(A) 30 mm (1-3/16 in.)

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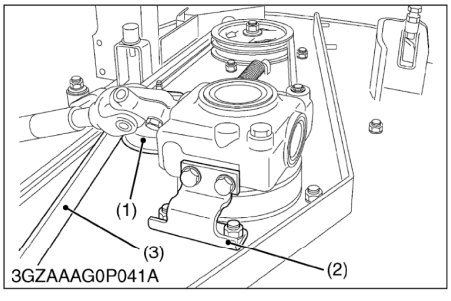

Replacing Mower Belt

1. Remove the mower deck from the machine.
2. Remove the left and right hand shield from the mower deck.
3. Clean around the gear box.
4. Remove the belt from the tension pulley.
5. Remove the right hand bracket which mounts the gear box to the mower deck and slip the belt over the top of the gear box.
6. To install a new belt, reverse the above procedure.

Tightening torque	Bracket mounting screw	27.6 to 90.2 N·m 8.0 to 9.2 kgf·m 57.1 to 66.5 lbf·ft

(1) Tension Pulley
(2) Bracket (RH)
(3) Belt

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Bleeding Fuel System

Air must be removed:

1. When the fuel filter or lines are removed.
2. When tank is completely empty.
3. After the tractor has not been used for a long period of time.

Bleeding procedure is as follows:

1. Fill the fuel tank with fuel.
2. Turn the key switch to **"ON"** position for about 30 seconds. Doing so allows fuel pump to work and pump air out of the fuel system.
3. Start the engine and run for about 30 seconds, and then stop the engine.

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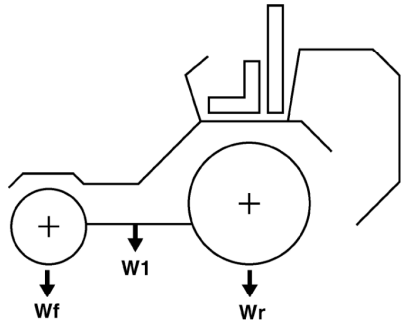
10. IMPLEMENT LIMITATIONS

The KUBOTA Tractor has been thoroughly tested for proper performance with implements sold or approved by KUBOTA. Use with implements which are not sold or approved by KUBOTA and which exceed the maximum specifications listed below, or which are otherwise unfit for use with the KUBOTA Tractor may result in malfunctions or failures of the tractor, damage to other property and injury to the operator or others. [Any malfunctions or failures of the tractor resulting from use with improper implements are not covered by the warranty.]

	Maximum loading weight		Implement weight W_1	Maximum total weight
	Front axle Wf	Rear axle Wr		
ZD321N, ZD321	200 kg (440 lbs)	920 kg (2028 lbs)	200 kg (440 lbs)	1120 kg (2468 lbs)
ZD323				
ZD326S, ZD326P, ZD326RP, ZD326HL				
ZD331P, ZD331RP, ZD331LP				



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SERVICING

CONTENTS

FUEL SYSTEM

Item		Factory Specification	Allowable Limit
Injection Pump [D782-E2]	Injection Timing (3200 min^{-1} (rpm))	0.28 to 0.31 rad (16 to 18 °) before T.D.C.	–
Injection Pump [D782-E3]	Injection Timing (3200 min^{-1} (rpm))	0.2837 to 0.3097 rad (16.25 to 17.75 °) before T.D.C.	–
Injection Pump [D902-E3/E4]	Injection Timing (3200 min^{-1} (rpm))	0.3011 to 0.3272 rad (17.25 to 18.75 °) before T.D.C.	–
Pump Element	Fuel Tightness	–	13.73 MPa 140.0 kgf/cm^2 1991 psi
Delivery Valve	Fuel Tightness	10 seconds 13.73 → 12.75 MPa 140.0 → 130.0 kgf/cm^2 1991 → 1849 psi	5 seconds 13.73 → 12.75 MPa 140.0 → 130.0 kgf/cm^2 1991 → 1849 psi
Injection Nozzle	Injection Pressure	13.73 to 14.70 MPa 140.0 to 149.8 kgf/cm^2 1992 to 2132 psi	–
Injection Nozzle Valve Seat	Valve Seat Tightness	When the pressure is 12.75 MPa (130.0 kgf/cm^2, 1849 psi), the valve seat must be fuel tightness.	–

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4. CHECKING, DISASSEMBLING AND SERVICING

[1] CHECKING AND ADJUSTING

(1) Engine Body

Compression Pressure

1. Run the engine until it is warmed up.
2. Stop the engine.
3. Remove the air cleaner, the muffler and all glow plugs (or nozzles).
4. Set a compression tester with the adaptor to the glow plug hole (or nozzle hole).
   Nozzle hole: Adaptor **H** (07909-31231)
   Glow plug hole: Adaptor **L** (07909-31301)
5. After making sure that the stop lever is set at the stop position (non-injection), run the engine with the starter and measure the compression pressure.
6. Repeat steps 4 and 5 for each cylinder.
7. If the measurement is below the allowable limit, apply a small amount of oil to the cylinder wall through the glow plug hole (or nozzle hole) and measure the compression pressure again.
8. If the compression pressure is still less than the allowable limit, check the top clearance, valve clearance and cylinder head.
9. If the compression pressure increases after applying oil, check the cylinder wall and piston rings.

■ **NOTE**

- **Check the compression pressure with the specified valve clearance.**
- **Always use a fully charged battery for performing this test.**
- **Variances in cylinder compression values should be under 10 %.**

[D782-E2/E3]

Compression pressure	Factory specification	2.85 to 3.23 MPa 29.1 to 32.9 kgf/cm^2 414 to 468 psi
	Allowable limit	2.26 MPa 23.0 kgf/cm^2 328 psi

[D902-E3/E4]

Compression pressure	Factory specification	3.53 to 4.02 MPa 36.0 to 40.9 kgf/cm^2 512 to 583 psi
	Allowable limit	2.55 MPa 26.0 kgf/cm^2 370 psi

[D1005-E2/E3/E4, D1105-E4, D1305-E3]

Compression pressure	Factory specification	3.73 to 4.11 MPa 38.1 to 41.9 kgf/cm^2 541 to 596 psi
	Allowable limit	2.26 MPa 23.0 kgf/cm^2 328 psi

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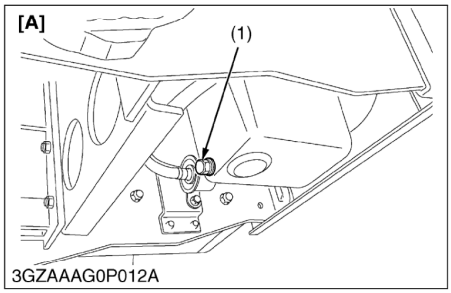
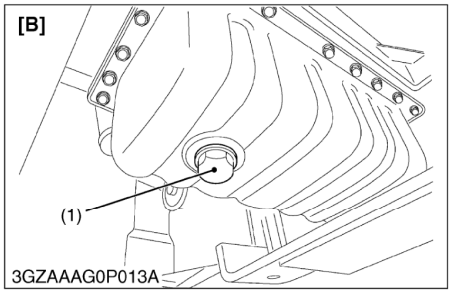
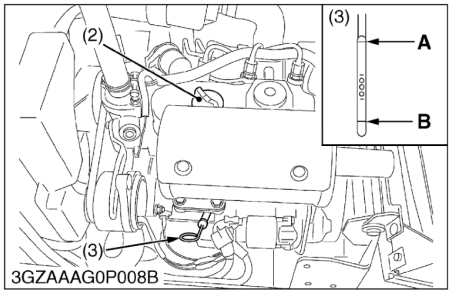
[2] SEPARATING ENGINE







Draining Engine Oil

1. Park the machine on level ground.
2. Start and warm up the engine for approx. 5 minutes.
3. Place an oil pan underneath the engine.
4. Remove the drain plug (1) to drain oil.
5. After draining, screw in the drain plug (1).

(When refilling)

- Fill the engine oil up to the upper line on the dipstick (3).

Engine oil capacity	ZD321 ZD323	3.5 L 3.70 U.S.qts 3.08 Imp.qts
	ZD326	3.9 L 4.1 U.S.qts 3.4 Imp.qts
	ZD331	5.7 L 6.0 U.S.qts 5.0 Imp.qts

■ **IMPORTANT**

- **Never mix two different type of oil.**
- **Use the proper SAE Engine Oil according to ambient temperatures.**
  Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-9.)

(1) Drain Plug
(2) Oil Inlet Plug
(3) Dipstick

[A] ZD321, ZD323
[B] ZD326, ZD331
A: Upper Level
B: Lower Level

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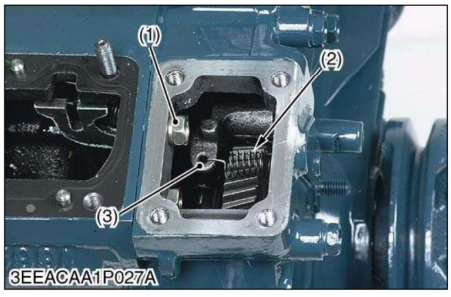

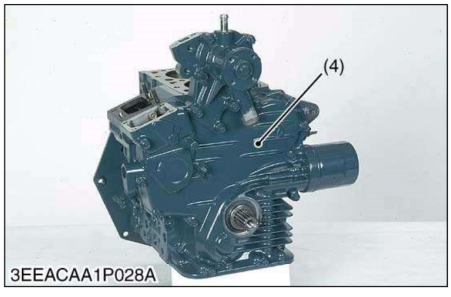

Gear Case

1. Disconnect the start spring (2) from the fork lever 1 (3).
2. Remove the screw (1) of inside the gear case and outside screws.
3. Remove the gear case (4).

(When reassembling)

- Apply a liquid gasket (Three Bond 1215 or equivalent) to both sides of the gear case gasket.
- Be sure to set three O-rings inside the gear case.

(1) Screw (Inside)
(2) Start Spring
(3) Fork Lever 1
(4) Gear Case

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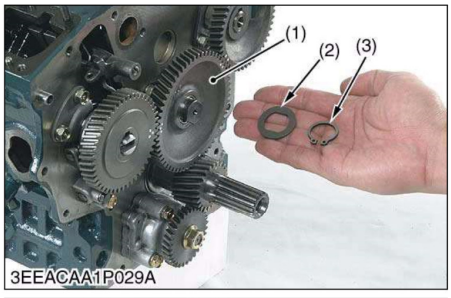


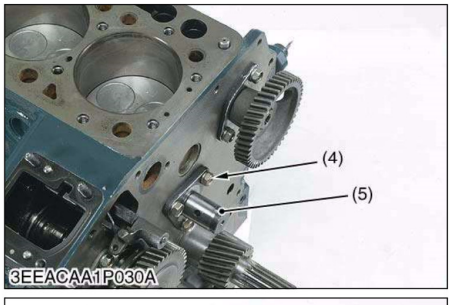
Idle Gear

1. Remove the external snap ring (3), the collar (2) and the idle gear (1).
2. Remove the idle gear shaft mounting screws (4).
3. Remove the idle gear shaft (5) (if necessary).

(When reassembling)

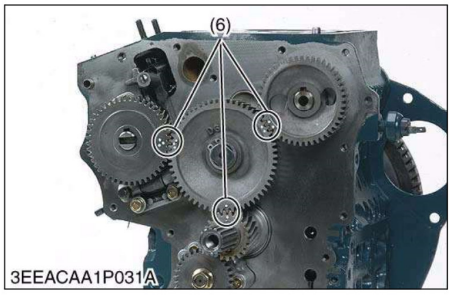
- Apply engine oil to the idle gear shaft mounting screw (4). And tighten them.
- Install the idle gear, aligning the mark (6) on the gears referring to the photo.

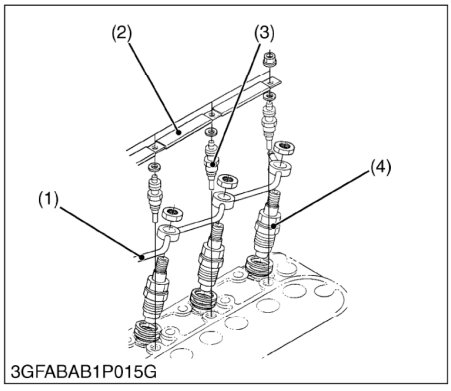
Tightening torque	Idle gear shaft mounting screw	9.81 to 11.2 N·m 1.00 to 1.15 kgf·m 7.24 to 8.31 lbf·ft



(1) Idle Gear
(2) Idle Gear Collar
(3) External Snap Ring
(4) Idle Gear Shaft Mounting Screw
(5) Idle Gear Shaft
(6) Alignment Mark

9Y1210265ENS0039US0





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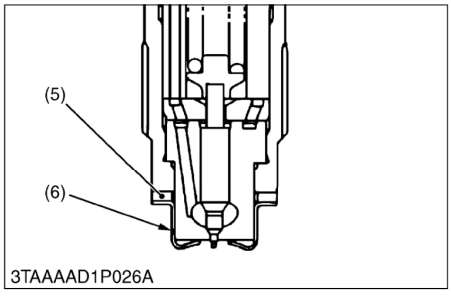

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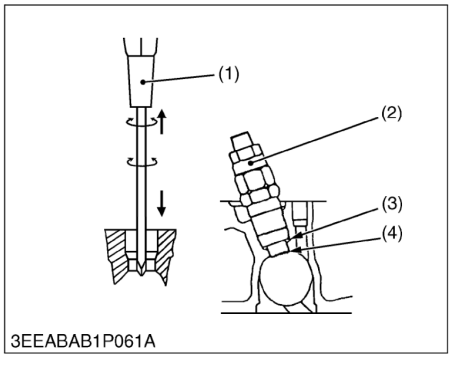

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Nozzle Holder Assembly and Glow Plug

1. Remove the overflow pipe (1).
2. Remove the nozzle holder assemblies (4).
3. Remove the copper gasket (5) and heat seal (6).
4. Remove the lead (2) from the glow plugs (3).
5. Remove the glow plugs (3).

(When reassembling)

- Replace the copper gasket and heat seal with new one.

Tightening torque	Overflow pipe retaining nut (Serial No.: below BTZ999)	20 to 24 N·m 2.0 to 2.5 kgf·m 15 to 18 lbf·ft
	Overflow pipe retaining nut (Serial No.: above BU0001)	35 to 39 N·m 3.5 to 4.0 kgf·m 26 to 28 lbf·ft
	Nozzle holder assembly	49 to 68 N·m 5.0 to 7.0 kgf·m 37 to 50 lbf·ft
	Glow plug	7.9 to 14 N·m 0.80 to 1.5 kgf·m 5.8 to 10 lbf·ft

(1) Overflow Pipe
(2) Lead
(3) Glow Plug
(4) Nozzle Holder Assembly
(5) Copper Gasket
(6) Heat Seal

9Y1210265ENS0053US0

Nozzle Heat Seal Service Removal Procedure

■ **IMPORTANT**

- **Use a plus (phillips head) screw driver (1) of which diameter is bigger than the heat seal hole (Approx. 6 mm (1/4 in.)).**

1. Drive screw driver (1) lightly into the heat seal hole.
2. Turn screw driver three or four times each way.
3. While turning the screw driver, slowly pull the heat seal (4) out together with the injection nozzle gasket (3).
4. If the heat seal drops, repeat the above procedure.

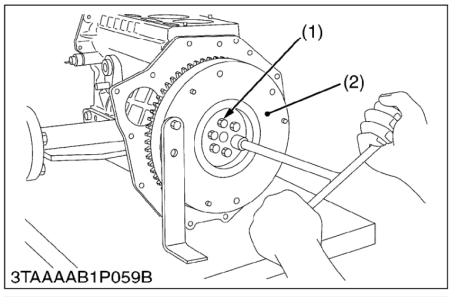
(When reassembling)

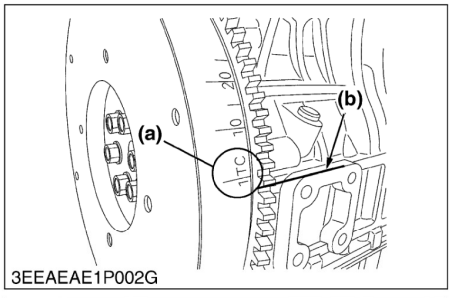
- Heat seal and injection nozzle gasket must be changed when the injection nozzle is removed for cleaning or for service.

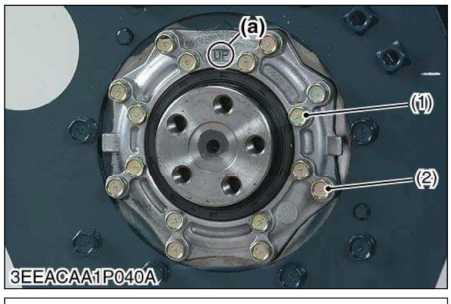
(1) Plus Screw Driver
(2) Nozzle Holder
(3) Injection Nozzle Gasket
(4) Heat Seal

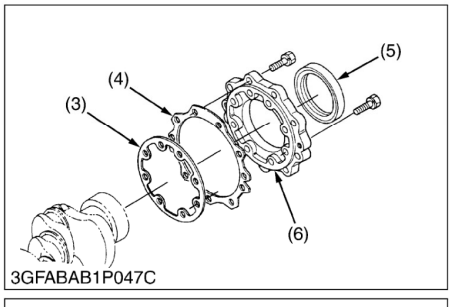
9Y1210265ENS0054US0

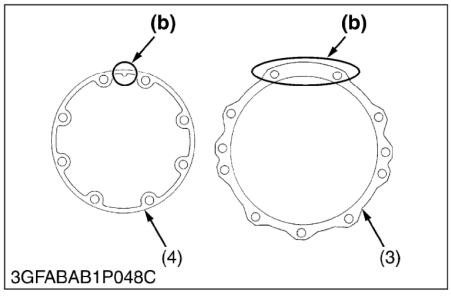
[D] Flywheel and Crankshaft











Flywheel

1. Secure the flywheel to keep it from turning, using a flywheel stopper.
2. Remove all flywheel screws (1) and then remove the flywheel (2).

(When reassembling)

- Align the **"1TC"** mark **(a)** on the outer surface of the flywheel horizontally with the alignment mark **(b)** on the rear end plate. Now fit the flywheel in position.
- Apply engine oil to the threads and the undercut surface of the flywheel screw and fit the screw.

Tightening torque	Flywheel screw	54 to 58 N·m 5.5 to 6.0 kgf·m 40 to 43 lbf·ft

(1) Flywheel Screw
(2) Flywheel
(a) 1TC Mark
(b) Alignment Mark

9Y1210265ENS0070US0

Bearing Case Cover

1. Remove the bearing case cover mounting screws.
2. Remove the bearing case cover (6).

■ **IMPORTANT**

- **The length of inside screws (1) and outside screws (2) are different. Do not take a mistake using inside screws and outside screws.**

(When reassembling)

- Fit the bearing case gasket (3) and the bearing case cover gasket (4) with correct directions.
- Install the bearing case cover (6) to position the casting mark **"UP"** on it upward.
- Apply engine oil to the oil seal (5) lip and be careful that it is not rolled when installing.
- Tighten the bearing case cover mounting screws with even force on the diagonal line.

Tightening torque	Bearing case cover mounting screw	10.8 to 12.2 N·m 1.10 to 1.25 kgf·m 7.96 to 9.04 lbf·ft

(1) Bearing Case Cover Mounting Screw (Inside) (Long)
(2) Bearing Case Cover Mounting Screw (Outside) (Short)
(3) Bearing Case Gasket
(4) Bearing Case Cover Gasket
(5) Oil Seal
(6) Bearing Case Cover
(a) Top Mark "UP"
(b) Upside

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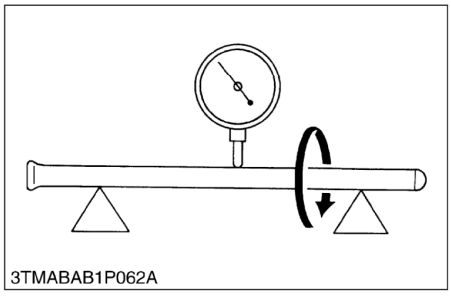
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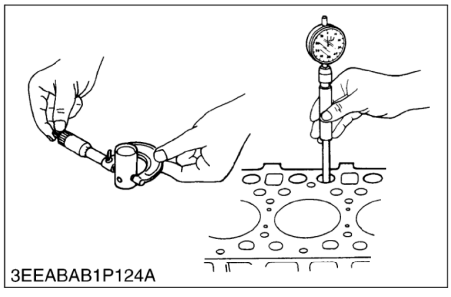
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Push Rod Alignment

1. Place the push rod on V blocks.
2. Measure the push rod alignment.
3. If the measurement exceeds the allowable limit, replace the push rod.

Push rod alignment	Allowable limit	0.25 mm 0.0098 in.

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Oil Clearance between Tappet and Tappet Guide Bore

1. Measure the tappet O.D. with an outside micrometer.
2. Measure the I.D. of the tappet guide bore with a cylinder gauge, and calculate the oil clearance.
3. If the oil clearance exceeds the allowable limit or the tappet is damaged, replace the tappet.

[D782-E2/E3, D902-E3/E4]

Oil clearance between tappet and tappet guide bore	Factory specification	0.016 to 0.052 mm 0.00063 to 0.0020 in.
	Allowable limit	0.10 mm 0.0039 in.

Tappet O.D.	Factory specification	17.966 to 17.984 mm 0.70733 to 0.70803 in.
Tappet guide bore I.D.	Factory specification	18.000 to 18.018 mm 0.70866 to 0.70937 in.

[D1005-E2/E3/E4, D1105-E4, D1305-E3]

Oil Clearance between tappet and tappet guide bore	Factory specification	0.020 to 0.062 mm 0.00079 to 0.0024 in.
	Allowable limit	0.07 mm 0.003 in.

Tappet O.D.	Factory specification	19.959 to 19.980 mm 0.78579 to 0.78661 in.
Tappet guide bore I.D.	Factory specification	20.000 to 20.021 mm 0.78741 to 0.78822 in.

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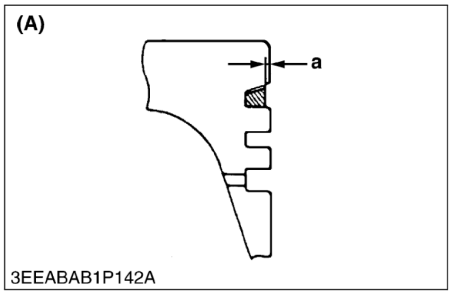

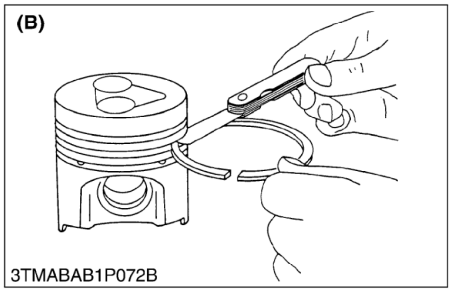

Clearance between Piston ring and Piston Ring Groove

1. Clean the rings and the ring grooves, and install each ring in its groove.
2. Measure the clearance between the ring and the groove with a feeler gauge or depth gauge.
3. If the clearance exceeds the allowable limit, replace the piston ring.
4. If the clearance still exceeds the allowable limit with new ring, replace the piston.

[D782-E2/E3, D902-E3/E4]

Clearance between piston ring and piston ring groove	Second ring	Factory specification	0.090 to 0.120 mm 0.0036 to 0.00472 in.
		Allowable limit	0.15 mm 0.0059 in.
	Oil ring	Factory specification	0.040 to 0.080 mm 0.0016 to 0.0031 in.
		Allowable limit	0.15 mm 0.0059 in.

[D1005-E2/E3]

Clearance between piston ring and piston ring groove	Second ring	Factory specification	0.085 to 0.112 mm 0.0034 to 0.00440 in.
		Allowable limit	0.20 mm 0.0079 in.
	Oil ring	Factory specification	0.020 to 0.055 mm 0.00079 to 0.0021 in.
		Allowable limit	0.15 mm 0.0059 in.

[D1305-E3]

Clearance between piston ring and piston ring groove	Second ring	Factory specification	0.095 to 0.122 mm 0.0038 to 0.00480 in.
		Allowable limit	0.20 mm 0.0079 in.
	Oil ring	Factory specification	0.020 to 0.060 mm 0.00079 to 0.0024 in.
		Allowable limit	0.15 mm 0.0059 in.

[D1005-E4, D1105-E4]

Clearance between piston ring and piston ring groove	Second ring	Factory specification	0.085 to 0.112 mm 0.0034 to 0.00440 in.
		Allowable limit	0.20 mm 0.0079 in.
	Oil ring	Factory specification	0.02 to 0.06 mm 0.0008 to 0.002 in.
		Allowable limit	0.15 mm 0.0059 in.

Factory specification : **a**	More than 0.2 mm 0.008 in.

(A) Top Ring (Key Stone Type) **(B) 2nd, Oil Ring**

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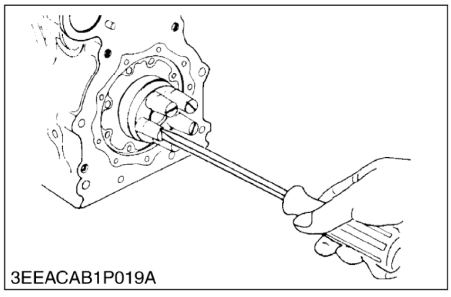
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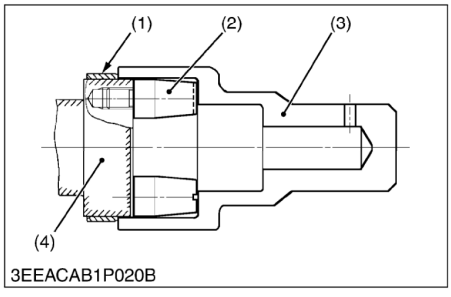

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Replacing Crankshaft Sleeve

1. Remove the used crankshaft sleeve.
2. Set the sleeve guide (2) to the crankshaft.
3. Heat a new sleeve to a temperature between 150 and 200 °C (302 and 392 °F), and fix the sleeve to the crankshaft as shown in figure.
4. Press fit the sleeve using the auxiliary socket for pushing (3).

■ **NOTE**

- **Mount the sleeve with its largely chamfered surface facing outward.**
- **Should heating is not enough, a sleeve might stop halfway, so careful.**

(1) Crankshaft Sleeve
(2) Sleeve Guide
(3) Auxiliary Socket for Pushing
(4) Crankshaft

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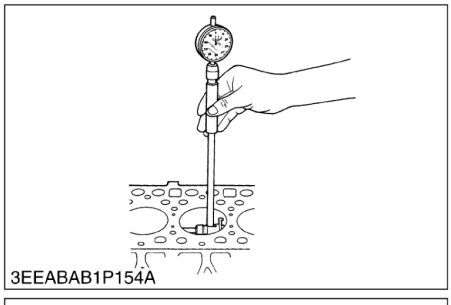
(5) Cylinder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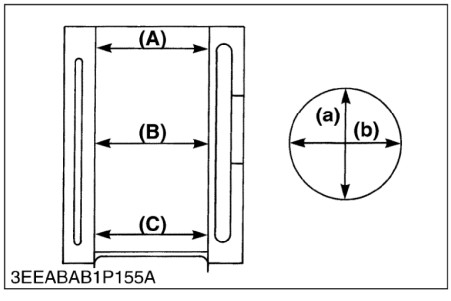

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Cylinder Wear

1. Measure the I.D. of the cylinder at the six positions (see figure) with a cylinder gauge to find the maximum and minimum I.D.'s.
2. Get the difference (Maximum wear) between the maximum and the minimum I.D.'s.
3. If the wear exceeds the allowable limit, bore and hone to the oversize dimension. (Refer to "Correcting Cylinder".)
4. Visually check the cylinder wall for scratches. If deep scratches are found, the cylinder should be bored. (Refer to "Correcting Cylinder".)

[D782-E2/E3]

Cylinder liner I.D.	Factory specification	67.000 to 67.019 mm 2.6378 to 2.6385 in.
	Allowable limit	67.150 mm 2.6437 in.

[D902-E3/E4]

Cylinder liner I.D.	Factory specification	72.000 to 72.019 mm 2.8347 to 2.8353 in.
	Allowable limit	72.150 mm 2.8406 in.

[D1005-E2/E3/E4]

Cylinder I.D.	Factory specification	76.000 to 76.019 mm 2.9922 to 2.9928 in.
	Allowable limit	76.15 mm 2.998 in.

[D1105-E4, D1305-E3]

Cylinder I.D.	Factory specification	78.000 to 78.019 mm 3.0709 to 3.0716 in.
	Allowable limit	78.15 mm 3.077 in.

(A) Top
(B) Middle
(C) Bottom (Skirt)
(a) Right-angled to Piston Pin
(b) Piston Pin Direction

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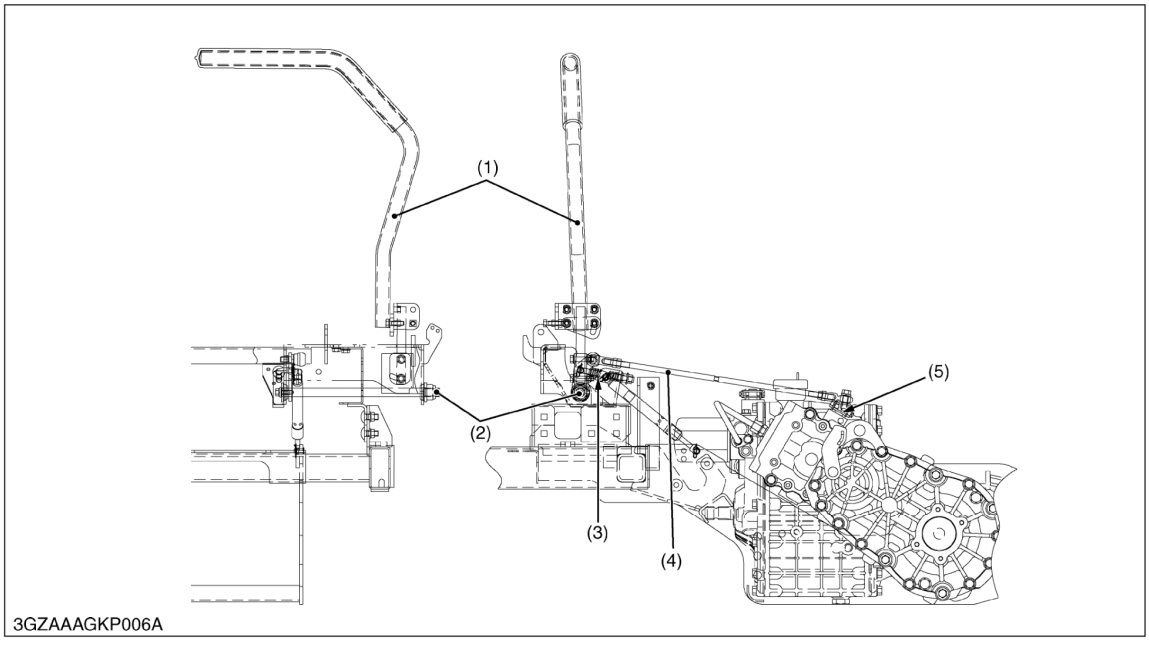
(5) Control Linkage



(1) Motion Control Lever (2) Speed Shaft (3) Speed Limit Spring (4) Speed Control Rod (5) Trunnion Arm

The motion control lever (1) and the trunnion shaft of variable swashplate are linked with the speed shaft (2), speed control rod (4) and the trunnion arm (5). As the motion control lever (1) is pushed, the swashplate rotates and forward travelling speed increases. Pulling the motion control lever (1) increases reverse speed.

Moreover, it is possible to fix to a neutral position by putting the motion control lever (1) in the neutral slot. The motion control lever (1) is pushed by the speed limit spring's (3) working when the motion control lever (1) is removed from the neutral slot. As the result, the machine synchronizes with the movement of the motion control lever (1) and begins to move slowly. (The machine is set like this.) The damper connected to the speed shaft (2) restricts the movement of the linkage to prevent abrupt operation or reversing.

■ **Steering**

The Zero-Turn Mower does not have a separate steering system. Steering is controlled by varying the wheel motor speeds. This gives the machine a zero-turn capability.

As the control levers are moved to a full left turn position, the right hydraulic pump is moved to the full-speed forward position and the left pump is moved to the full-speed reverse position. This will allow the machine to pivot around its center.

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3. TIGHTENING TORQUES

Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts: See page G-13.)

Item	N·m	kgf·m	lbf·ft
Motion control lever mounting bolt and nut	18 to 20	1.8 to 2.1	13 to 15
Hydrostatic transmission mounting screw (M10, 7T, Aluminum)	40 to 44	4.0 to 4.5	29 to 32
Universal joint mounting screw	26.5 to 28.4	2.7 to 2.9	19.6 to 20.9
Rear axle gear case mounting assembly screw (M12, 7T)	85 to 90	8.7 to 9.2	63 to 66
Rear axle gear case mounting screw (M10, 7T, Aluminum)	40 to 44	4.0 to 4.5	29 to 32
Hydraulic pump mounting screw	40 to 44	4.0 to 4.5	29 to 32
Center case rear cover mounting screw	40 to 44	4.0 to 4.5	29 to 32
Center section mounting hex. socket head screw	25 to 29	2.6 to 3.0	18 to 21
Check and high pressure relief valve plug	59 to 78	6.0 to 8.0	44 to 58
Engine mounting nut	24 to 27	2.4 to 2.8	18 to 20
ROPS mounting screw (M10, 7T)	48 to 55	4.9 to 5.7	36 to 41
Rear wheel mounting screw	108.5 to 130.2	11.1 to 13.3	80 to 96
Center case front cover mounting screw (M10, 7T, Aluminum)	40 to 44	4.0 to 4.5	29 to 32
Hydrostatic transmission and rear axle gear case assembly mounting screw (M10, 7T, Aluminum)	48 to 56	4.9 to 5.7	35 to 41
ROPS connecting plate mounting screw (M8, 7T)	24 to 27	2.4 to 2.8	18 to 20
ROPS connecting plate under mounting screw (M10, 7T)	48 to 55	4.9 to 5.7	36 to 41

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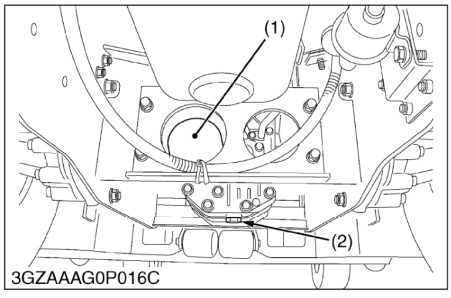
5. DISASSEMBLING AND ASSEMBLING

[1] SEPARATING TRANSAXLE ASSEMBLY



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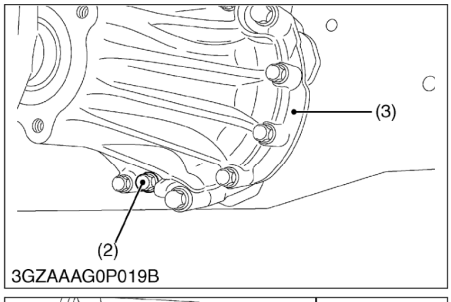

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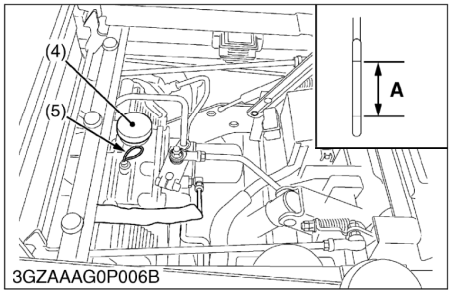

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Draining Transmission Fluid

CAUTION

To avoid personal injury:

- **Be sure to stop the engine and remove the key before changing or checking the oil.**
- **Allow transmission case to cool down sufficiently; oil can be hot and may cause burns.**

The fluid in the transmission case is also used for the hydrostatic drive system.

1. To drain the transmission oil, place oil pan underneath the transmission case and the rear axle gear case (RH and LH) and remove the drain plug at the bottom of the transmission case and the rear axle gear case (RH and LH).
2. After draining, reinstall the drain plugs.
3. Fill with new fluid from filling port after removing the filling plug (4) up the upper notch on the dipstick.

■ IMPORTANT

- **It takes time to pour the oil from the transmission case to the rear axle case RH and LH. Pour the regulated amount of oil slowly.**

4. After running the engine for a few minutes, stop it and check the oil level again; add oil to the prescribed level.

■ IMPORTANT

- **Operate only at low RPM's immediately after changing the transmission fluid and filter cartridge.**
  Keep the engine at medium speed for a few minutes to ensure proper lubrication of all parts so there is no damage to transmission.
- **Use only multi-grade transmission oil. Use of other oils may damage the transmission of hydraulic system.**
  Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-9.)
- **Do not mix different brands oil together.**

Transmission fluid capacity	12.1 L 12.8 U.S.qts 10.6 Imp.qts

(1) Transmission Oil Filter
(2) Drain Plug
(3) Rear Axle Gear Case LH
(4) Oil Plug and Breather Cup
(5) Dipstick

A : Oil level acceptable within this range.

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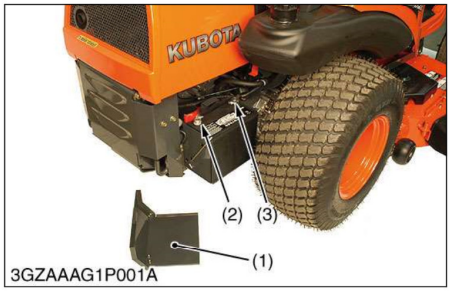

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Battery

CAUTION

- **When disconnecting the battery cables, disconnect the negative cable from the battery first. When connecting, connect the positive cable to the battery first.**

1. Remove the battery cover (1).
2. Disconnect the negative cable (3) from the battery.
3. Disconnect the positive cable (2) from the battery.

(1) Battery Cover
(2) Positive Cable
(3) Negative Cable

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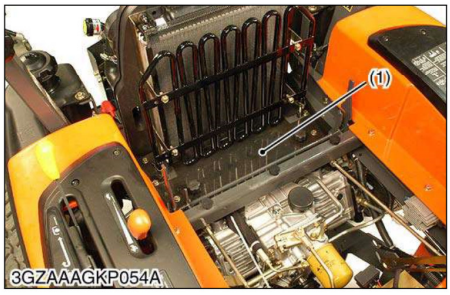

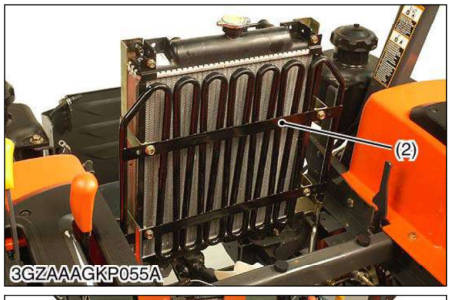

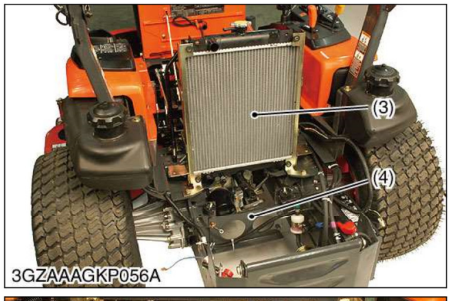

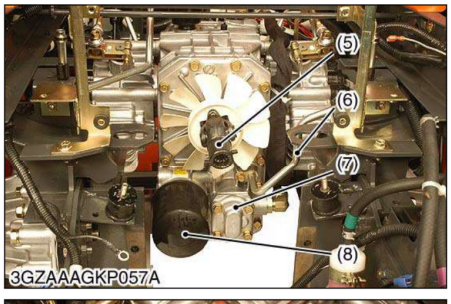

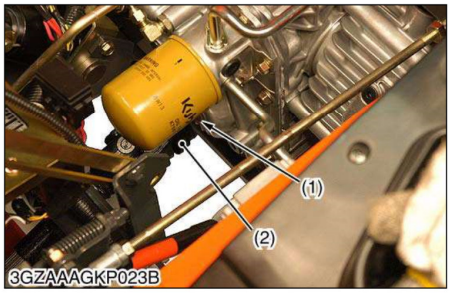

Oil Cooler, Radiator, Universal Joint and Others

1. Remove the bonnet cover (1) and ROPS connecting plate.
2. Remove the oil cooler (2).
3. Remove the radiator (3).
4. Remove the ROPS connecting plate under (4).
5. Remove the universal joint (5).
6. Remove the oil cooler pipe (6).
7. Remove the hydraulic pump assembly (7).
8. Remove the oil filter cartridge (8).

(When reassembling)

■ **NOTE**

- **Make sure to mount the cushion rubber on the oil cooler pipe.**

Tightening torque	ROPS connecting plate mounting screw (M8)	24 to 27 N·m 2.4 to 2.8 kgf·m 18 to 20 lbf·ft
	ROPS connecting plate under mounting screw (M10)	48 to 55 N·m 4.9 to 5.7 kgf·m 36 to 41 lbf·ft
	Hydraulic pump mounting screw	40 to 44 N·m 4.0 to 4.5 kgf·m 29 to 32 lbf·ft

(1) Bonnet Cover
(2) Oil Cooler
(3) Radiator
(4) ROPS Connecting Plate, Under
(5) Universal Joint
(6) Oil Cooler Pipe
(7) Hydraulic Pump Assembly
(8) Oil Filter Cartridge

9Y1210265TXS0036US0

Universal Joint and PTO Shaft Oil Seal

1. Disconnect the universal joint (2).
2. Remove the PTO shaft oil seal (1).

(When reassembling)

- Replace the PTO shaft oil seal with new one.

(1) PTO Shaft Oil Seal
(2) Universal Joint

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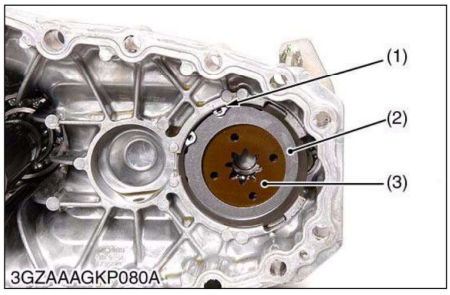

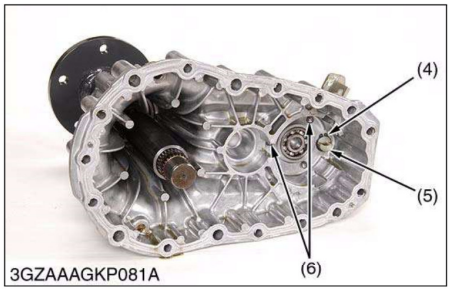

Parking Brake

1. Remove the internal snap ring (1), friction plates (2) and brake discs (3).
2. Remove the external snap ring (4), brake cam (5) and balls (6).

(When reassembling)

- Align splines of brake shaft and brake discs (3).
- Do not damage brake discs (3).
- Apply transmission fluid to brake discs (3).

(1) Internal Snap Ring
(2) Friction Plate
(3) Brake Disc
(4) External Snap Ring
(5) Brake Cam
(6) Ball

9Y1210265TXS0053US0

1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Front Wheels Wander to Right or Left	Clearance between center pin and front axle excessive	Check the clearance and replace the center pin or front axle	3-S6
	Tightening torque of locking nut for the wheel bracket weak	Adjust	3-S5
	Clearance between front axle and front axle support excessive	Adjust	3-S4

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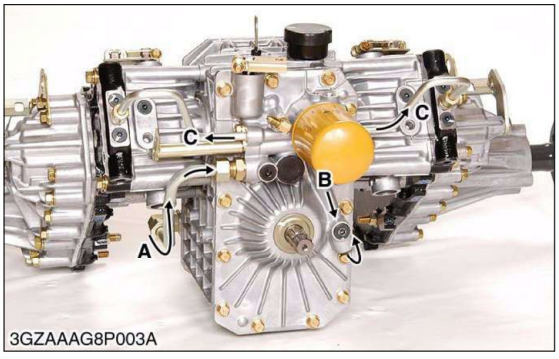
3. HYDRAULIC CONTROL VALVE



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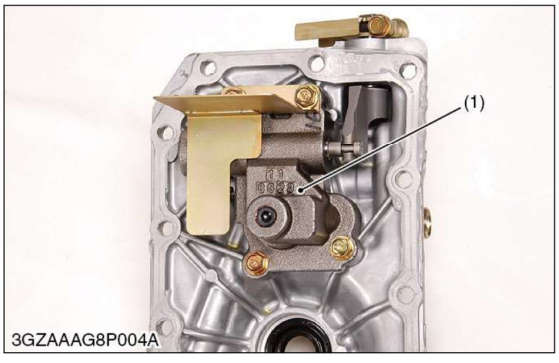

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The hydraulic system is composed of the transmission case (oil tank), cushion oil filter, hydraulic pump, control valve, hydraulic cylinder and etc..

The new series product is provided with a built-in control valve in the case.

The oil flows through the oil filter, and then the oil is sent to the control valve by the pump.

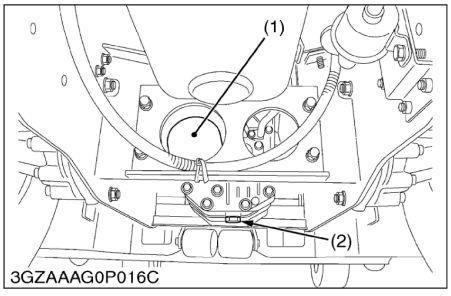
After flowing through the control valve, the oil is sent to the PTO clutch and the HST charge circuit.

(1) Control Valve

A : From Hydraulic Pump
B : To PTO Clutch
C : To Hydrostatic Transmission

9Y1210265HYM0003US0

(2) Disassembling and Assembling the Hydraulic Control Valve



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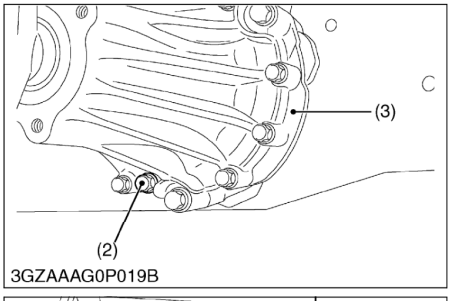

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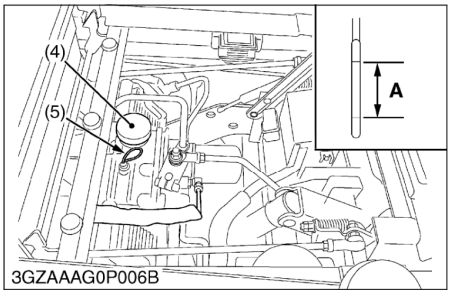

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Draining Transmission Fluid

CAUTION

To avoid personal injury:

- **Be sure to stop the engine and remove the key before changing or checking the oil.**
- **Allow transmission case to cool down sufficiently; oil can be hot and may cause burns.**

The fluid in the transmission case is also used for the hydrostatic drive system.

1. To drain the transmission oil, place oil pan underneath the transmission case and the rear axle gear case (RH and LH) and remove the drain plug at the bottom of the transmission case and the rear axle gear case (RH and LH).
2. After draining, reinstall the drain plugs.
3. After removing the oil plug (4), up the upper notch on the dipstick fill with new fluid from filling port.

■ **IMPORTANT**

- **It takes time to pour the oil from the transmission case to the rear axle case RH and LH. Pour the regulated amount of oil slowly.**

4. After running the engine for a few minutes, stop it and check the oil level again; add oil to the prescribed level.

■ **IMPORTANT**

- **Operate only at low RPM's immediately after changing the transmission fluid and filter cartridge.**
  Keep the engine at medium speed for a few minutes to ensure proper lubrication of all parts so there is no damage to transmission.
- **Use only multi-grade transmission oil. Use of other oils may damage the transmission of hydraulic system.**
  Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-9.)
- **Do not mix different brands oil together.**

Transmission fluid capacity	12.1 L 12.8 U.S.qts 10.6 Imp.qts

(1) Transmission Oil Filter
(2) Drain Plug
(3) Rear Axle Gear Case LH
(4) Oil Plug and Breather Cup
(5) Dipstick

A : Oil level acceptable within this range.

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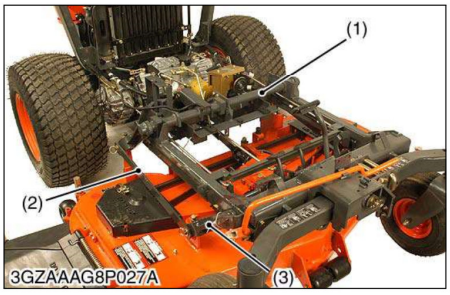

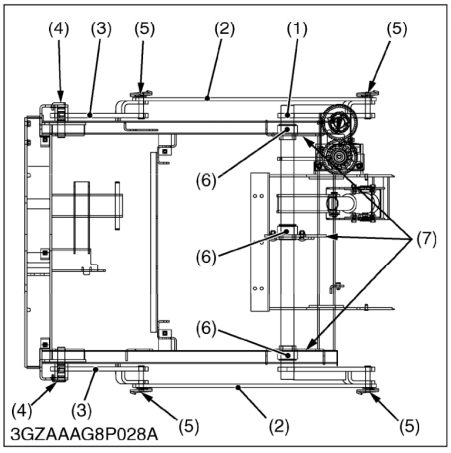

Mower Linkage

1. Remove the clevis pins (5) and horizon plate (2).
2. Remove the front pin (4) and front arm (3).
3. Remove the clevis pin, and disconnect the lift shaft (1) and lift cylinder.
4. Remove the plates (7) and lift shaft (1) with bushings (6).

(When reassembling)

- Apply grease to front pins (4).

(1) Lift Shaft
(2) Horizon Plate
(3) Front Arm
(4) Front Pin
(5) Clevis Pin
(6) Bushing
(7) Plate

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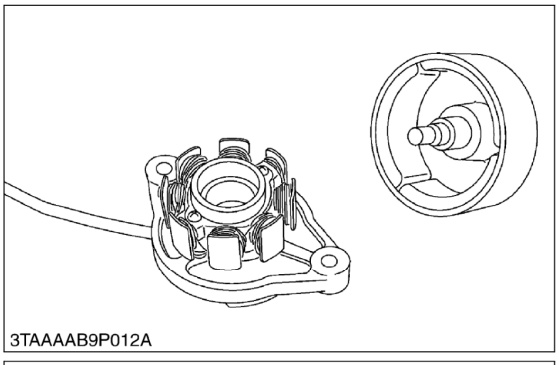
[1] AC DYNAMO



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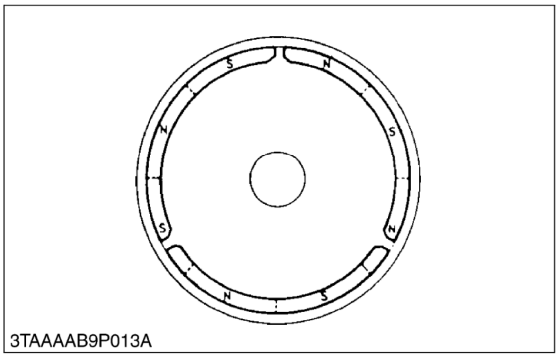

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The dynamo is an 8-8 pole rotating magnet type generator. It is simple in construction, consisting of a stator and rotor. The rotor is made up of eight permanent magnet pole pieces assembled on a shaft and rotates on the center of the stator around which eight electromagnetic coils are provided for.

This dynamo produces higher voltage in slow speed rotation, and charges electric current to the battery during engine idling.

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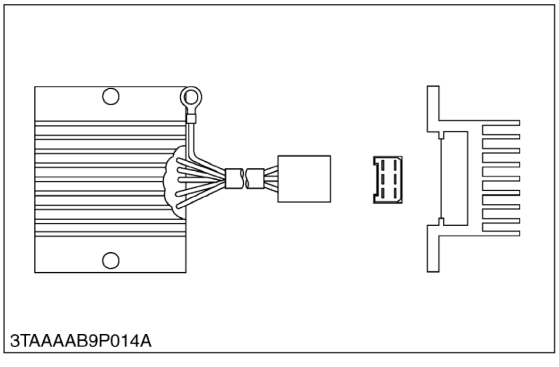
[2] REGULATOR



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The regulator performs rectification and voltage regulation.

The regulator converts AC into DC which flows through the power consuming circuits and the battery, and also charges the battery.

If however, the battery voltage exceeds a certain level, the DC current is cut off from the charging circuit to prevent overcharging.

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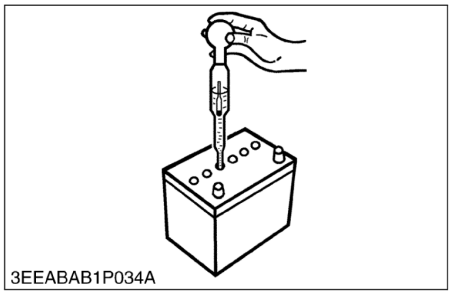
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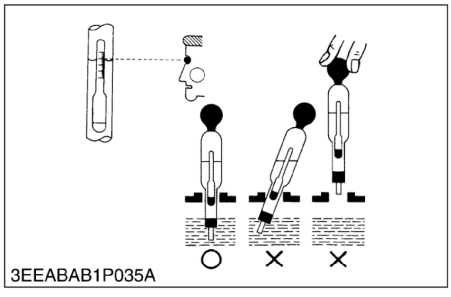
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Battery Specific Gravity

1. Check the specific gravity of the electrolyte in each cell with a hydrometer.
2. When the electrolyte temperature differs from that at which the hydrometer was calibrated, correct the specific gravity reading following the formula mentioned in (Reference).
3. If the specific gravity is less than 1.215 (after it is corrected for temperature), charge or replace the battery.
4. If the specific gravity differs between any two cells by more than 0.05, replace the battery.

■ **NOTE**

- **Hold the hydrometer tube vertical without removing it from the electrolyte.**
- **Do not suck too much electrolyte into the tube.**
- **Allow the float to move freely and hold the hydrometer at eye level.**
- **The hydrometer reading must be taken at the highest electrolyte level.**

(Reference)

- Specific gravity slightly varies with temperature. To be exact, the specific gravity decreases by 0.0007 with an increase of 1 °C (0.0004 with an increase of 1 °F) in temperature, and increases by 0.0007 with a decreases of 1 °C (0.0004 with a decrease of 1 °F).
  Therefore, using 20 °C (68 °F) as a reference, the specific gravity reading must be corrected by the following formula:
  – Specific gravity at 20 °C = Measured value + 0.0007 × (electrolyte temperature – 20 °C)
  – Specific gravity at 68 °F = Measured value + 0.0004 × (electrolyte temperature – 68 °F)

Specific Gravity	State of Charge
1.260 Sp. Gr.	100 % Charged
1.230 Sp. Gr.	75 % Charged
1.200 Sp. Gr.	50 % Charged
1.170 Sp. Gr.	25 % Charged
1.140 Sp. Gr.	Very Little Useful Capacity
1.110 Sp. Gr.	Discharged

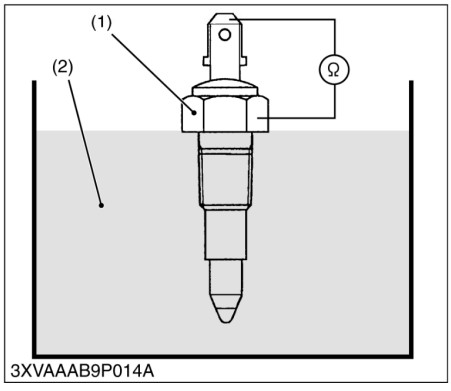
At an electrolyte temperature of 20 °C (68 °F)

9Y1210265ELS0007US0

Coolant Temperature Switch

1. Measure the resistance with an ohmmeter across the switch terminal and the switch body.
2. If 0 ohm is not indicated in the coolant temperature at 194 °C (201 °F) or more, the sensor is faulty.
3. If infinity is not indicated in the coolant temperature at lower than 90 °C (194 °F), the sensor is faulty.

Resistance (Switch terminal – Switch body)	At coolant temperature lower than 116 °C (241 °F)	Infinity
	At coolant temperature more than 120 to 126 °C (248 to 258 °F)	0 Ω

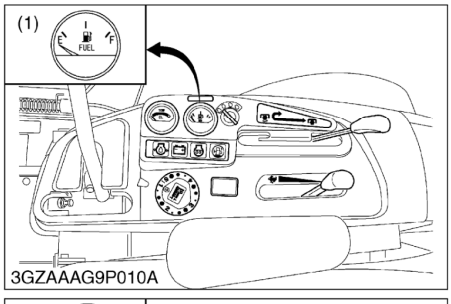


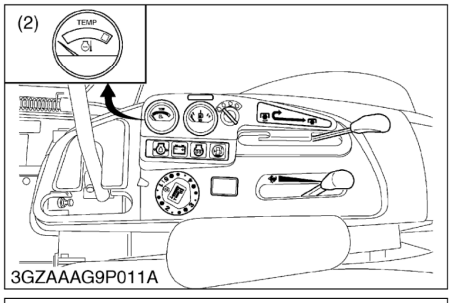
(1) Coolant Temperature Sensor (2) Coolant

9Y1210265ELS0027US0

Fuel Gauge and Coolant Temperature Gauge Operation

1. Remove the under panel.
2. Turn the main switch to **ON** position. Measure the voltage with a voltmeter across the **I** terminal (5) and **GND** terminal (3) of the gauge.
3. If approx. battery voltage is indicated, the ignition and ground lead connections are good.
4. Turn the main switch to **OFF** position. Connect a jumper lead between **S** terminal (4) and **GND** terminal (3) of the gauge.
5. Turn the main switch to **ON** position. If the gauge resisters a full scale reading under those conditions, the gauge is good. If less than full scale reading is indicated, the gauge is damaged and should be replaced.





(1) Fuel Gauge
(2) Temperature Gauge
(3) **GND** Terminal
(4) **S** Terminal
(5) **I** Terminal

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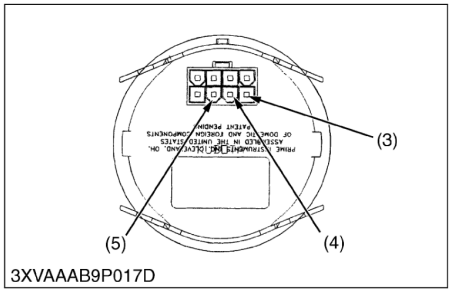

1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Blade Does Not Turn	PTO system malfunctioning	Check transmission	2-S11, 2-S21, 2-S39
	Broken mower belt	Replace mower belt	6-S8
Blade Speed Is Slow	Loosen mower belt	Replace mower belt or tension spring	6-S8
	Clogged grass	Remove grass	–
	Flattened out or worn cup washer	Replace cup washer	6-S7
	Engine rpm too low	Mow at full throttle, check and reset engine rpm	1-S32
Cutting Is Poor	Worn or bent mower blade	Sharpen or replace mower blade	6-S7
	Loosen mower blade screw	Retighten mower blade screw	6-S7
	Cutting height improper	Adjust cutting height	6-S5
	Ground speed too fast	Slow-down	–
	Low wheel inflation	Add air to correct	6-S4
	Anti-scalp rollers not adjusted correctly	Adjust anti-scalp rollers	6-S4
Mower Is Not Lifted	Broken linkage system	Replace linkage system	4-S14 to 4-S15
	Trouble of hydraulic system	Check hydraulic system	4-S4, 4-S5

9Y1210265MOS0001US0