

WSM

WORKSHOP MANUAL
TRACTOR

ST α -30, ST α -35

Kubota

TO THE READER

This Workshop Manual has been prepared to provide servicing personnel with information on the mechanism, service and maintenance of KUBOTA Tractor ST α -30 and ST α -35. It is divided into two parts, "Mechanism" and "Servicing" for each section.

■ Mechanism

Information on the construction and function are included. This part should be understood before proceeding with troubleshooting, disassembling and servicing.

■ Servicing

Under the heading "General" section comes general precautions, check and maintenance and special tools. Other section, there are troubleshooting, servicing specification lists, checking and adjusting, disassembling and assembling, and servicing which cover procedures, precautions, factory specifications and allowable limits.

All information illustrations and specifications contained in this manual are based on the latest production information available at the time of publication.

The right is reserved to make changes in all information at any time without notice

September 2000

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SAFETY FIRST

This symbol, the industry's "Safety Alert Symbol", is used throughout this manual and decals 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.



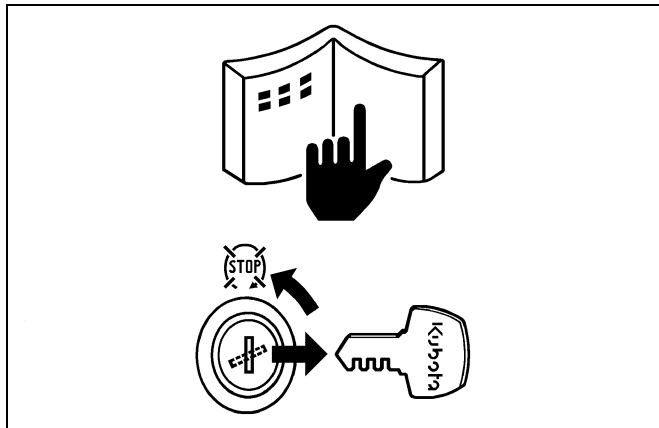
IMPORTANT

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



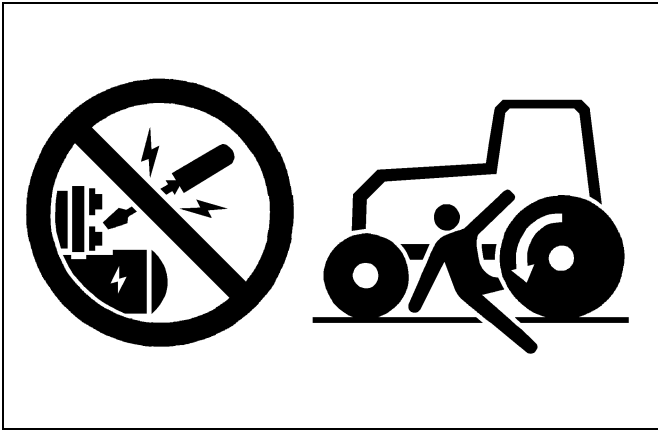
NOTE

: Gives helpful information.



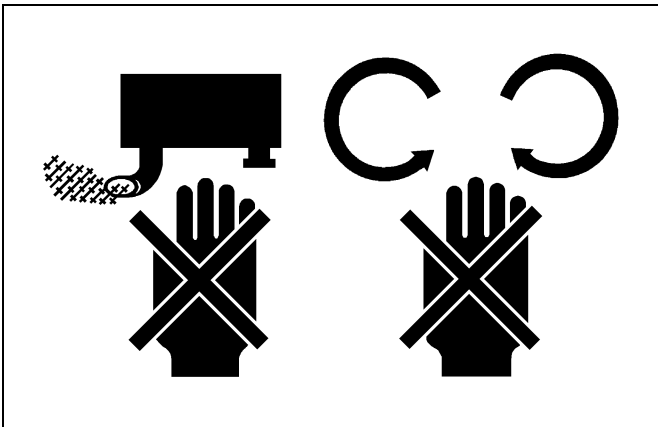
BEFORE SERVICING AND REPAIRING

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



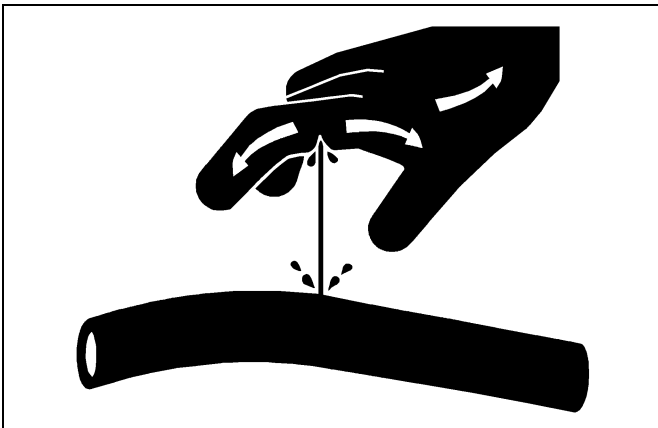
SAFETY STARTING

- Do not start the engine by shorting across starter terminals or bypassing the safety start switch.
- Do not alter or remove any part of machine safety system.
- Before starting the engine, make sure that all shift levers are in neutral positions or in disengaged positions.
- Never start the engine while standing on ground. Start the engine only from operator's seat.



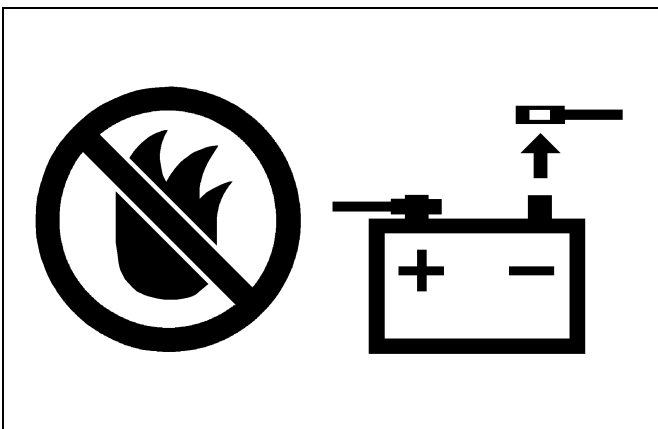
SAFETY WORKING

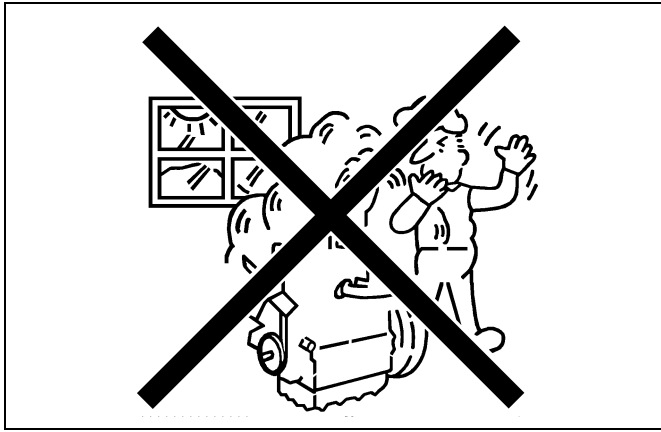
- Do not work on the machine while under the influence of alcohol, medication, or other substances or while fatigued.
- Wear close fitting clothing and safety equipment appropriate to the job.
- Use tools appropriate to the work. Markshift tools, parts, and procedures are not recommended.
- When servicing is performed together by two or more persons, take care to perform all work safely.
- Do not work under the machine that is supported solely by a jack. Always support the machine by safety stands.
- Do not touch the rotating or hot parts while the engine is running.
- Never remove the radiator cap while the engine is running, or immediately after stopping. Otherwise, hot water will spout out from radiator. Only remove radiator cap when cool enough to touch with bare hands. Slowly loosen the cap to first stop to relieve pressure before removing completely.
- Escaping fluid (fuel or hydraulic oil) under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic or fuel lines. Tighten all connections before applying pressure.



AVOID FIRES

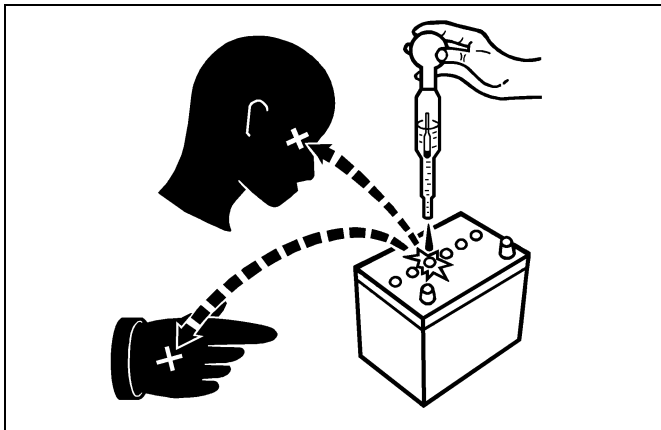
- Fuel is extremely flammable and explosive under certain conditions. Do not smoke or allow flames or sparks in your working area.
- To avoid sparks from an accidental short circuit, always disconnect the battery negative cable first and connect it last.
- Battery gas can explode. Keep sparks and open flame away from the top of battery, especially when charging the battery.
- Make sure that no fuel has been spilled on the engine.





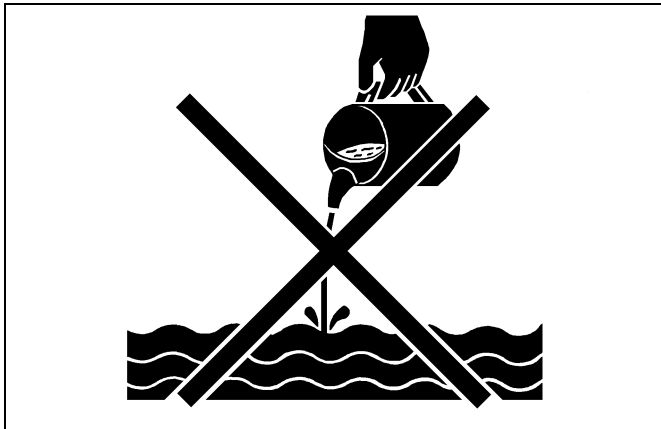
VENTILATE WORK AREA

- If the engine must be running to do some work, make sure the area is well ventilated. Never run the engine in a closed area. The exhaust gas contains poisonous carbon monoxide.



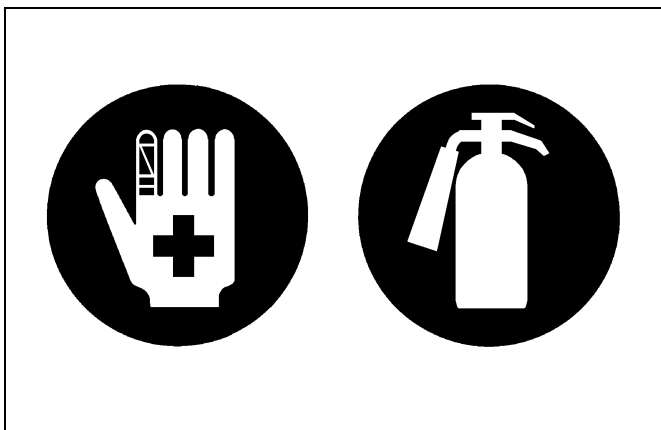
PREVENT ACID BURNS

- Sulfuric acid in battery electrolyte is poisonous. It is strong enough to burn skin, clothing and cause blindness if splashed into eyes. Keep electrolyte away from eyes, hands and clothing. If you spill electrolyte on yourself, flush with water, and get medical attention immediately.



DISPOSE OF FLUIDS PROPERLY

- Do not pour fluids into the ground, down a drain, or into a stream, pond, or lake. Observe relevant environmental protection regulations when disposing of oil, fuel, coolant, electrolyte and other harmful waste.



PREPARE FOR EMERGENCIES

- Keep a first aid kit and fire extinguisher handy at all times.
- Keep emergency numbers for doctors, ambulance service, hospital and fire department near your telephone.

SAFETY DECALS

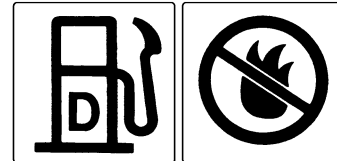
The following safety decals are installed on the machine.

If a decal becomes damaged, illegible or is not on the machine, replace it. The decal part number is listed in the parts list.

(1) Part No. TA240-4933-2

WARNING	<p>BEFORE DISMOUNTING TRACTOR:</p> <ol style="list-style-type: none"> 1. ALWAYS SET PARKING BRAKE. Leaving transmission in gear with the engine stopped will not prevent tractor from rolling. 2. PARK ON LEVEL GROUND WHENEVER POSSIBLE. If parking on a slope, position tractor across the slope. 3. LOWER ALL IMPLEMENTS TO THE GROUND. Failure to comply to this warning may allow the wheels to slip, and could cause injury or death. 4. STOP THE ENGINE.

(2) Part No. TA040-4956-2
Diesel fuel only No fire

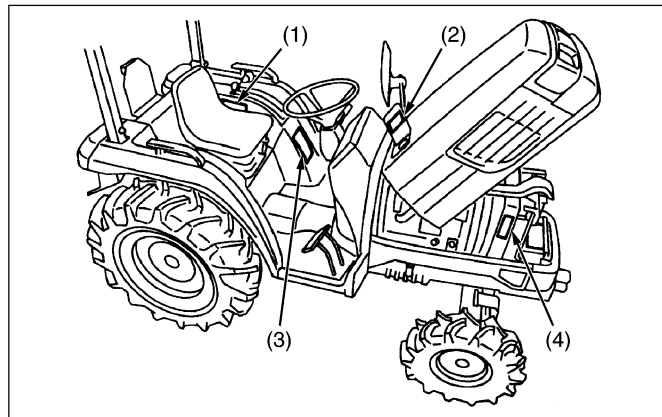


(4) Part No. 32751-4958-1
Stay clear of engine fan and fanbelt.



(3o) Part No. 6C040-4742-1

CAUTION
<p>TO AVOID PERSONAL INJURY:</p> <ol style="list-style-type: none"> 1. Read and understand the operator's manual before operation. 2. Before starting the engine, make sure that everyone is at a safe distance from the tractor and that the PTO is OFF. 3. Do not allow passengers on the tractor at any time. 4. Before allowing other people to use the tractor, have them read the operator's manual. 5. Check the tightness of all nuts and bolts regularly. 6. Keep all shields in place and stay away from all moving parts. 7. Lock the two brake pedals together before driving on the road. 8. Slow down for turns, or rough roads, or when applying individual brakes. 9. On public roads use SMV emblem and hazard lights, if required by local traffic and safety regulations. 10. Pull only from the drawbar. 11. Before dismounting, lower the implement, set the parking brake, stop the engine and remove the key.



(1) Part No. TA040-4965-2

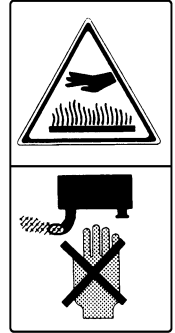


⚠ DANGER

TO AVOID POSSIBLE INJURY OR DEATH FROM A MACHINE RUNAWAY.

1. Do not start engine by shorting across starter terminals or bypassing the safety start switch. Machine may start in gear and move if normal starting circuitry is bypassed.
2. Start engine only from operator's seat with transmission and PTO OFF. Never start engine while standing on the ground.

(4) Part No. TA040-4958-1
Do not touch hot surface like muffler, etc.



(2) Part No. TA044-4932-1

⚠ WARNING


TO AVOID PERSONAL INJURY OR DEATH FROM ROLL-OVER:

1. Kubota recommends the use of a Roll-Over Protective Structures (ROPS) in almost all applications.
2. Remove the ROPS only when it substantially interferes with operation or itself presents a safety risk. (Examples include work in orchards and vineyards.) ALWAYS REINSTALL IT BEFORE USING THE TRACTOR IN OTHER APPLICATIONS.
3. For further details, consult your Operator's Manual or your local dealer.

(5) Part No. 32751-4958-1
Stay clear of engine fan and fanbelt.

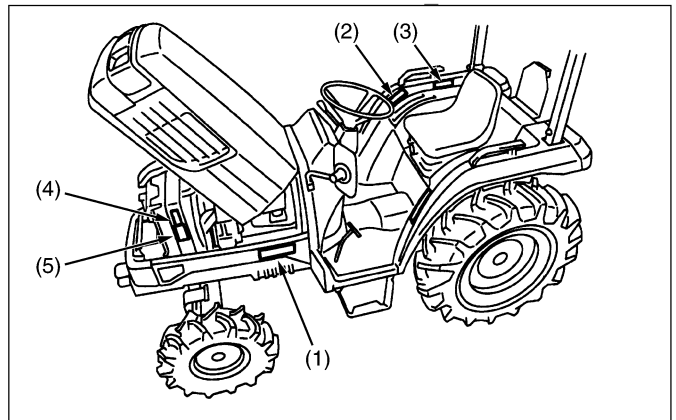


(3) Part No. 3F240-4905-2



⚠ WARNING

To avoid personal injury :
Use "Bi-speed Turn" only in low gears and slow speed. Do not use "Bi-speed Turn" in high gears or road speed.



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(1) Part No. TC020-3012-1

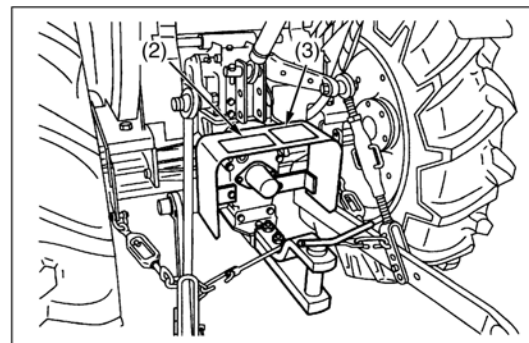
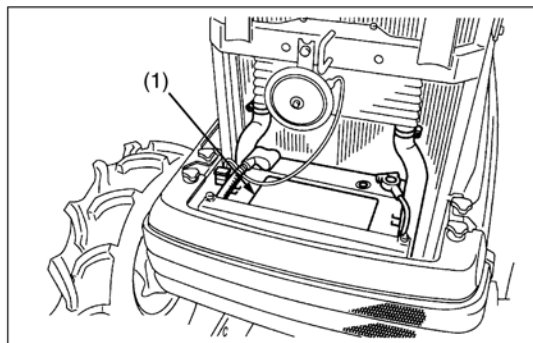
 NS70LMF	 FLAMMABLES	 SHIELD EYES	 KEEP OUT OF THE REACH OF CHILDREN	 CAUTIONS OF SULFURIC ACID	 READ INSTRUCTION MANUAL CAREFULLY	 EXPLOSIVE	HYDROMETER OK CHARGE BATTERY REPLACE BATTERY																					
12V AMP. HR (20HR) 65 RESERVE CAPACITY (MIN) 110 COLD CRANKING AMPS (-18°C) 550	DANGER • DUE TO HYDROGEN GAS GENERATED FROM BATTERY, HANDLING WITHOUT CARE CAN CAUSE FIRE AND EXPLOSION. • THIS 12V BATTERY ONLY FOR STARTING ENGINE. DO NOT APPLY THIS PRODUCT FOR OTHER USES. • CHANGE THIS BATTERY ONLY AT WELL VENTILATED PLACES, AND AVOID SHORTS OR SPARKS. • REFER TO THE INSTRUCTION MANUAL OF VEHICLE OR BATTERY BEFORE USING BOOSTER CABLE. • SULFURIC ACID MAY CAUSE BLINDNESS OR SEVERE BURN. IN CASE EYES, SKIN, CLOTHES OR ANY ARTICLES ARE STAINED WITH ACID, FLUSH OBJECTS IMMEDIATELY WITH WATER. IF ACID BEING SWALLOWED, DRINK PLENTY OF WATER PROMPTLY. IN CASE OF ACCIDENTAL CONTACT, CONSULT A DOCTOR IMMEDIATELY. • BATTERY FILLED WITH ACID (DO NOT TILT OR SPILL) • FLAMMABLE DO NOT CHARGE NEAR FIRE OR SPARKS • DO NOT CHARGE RAPIDLY • DO NOT DISASSEMBLE THE BATTERY (SEALED TYPE)																											
<h1>NS70LMF</h1>			<h1>75D26L</h1>																									
			FITTING DATE <table border="1" style="display: inline-table;"><tr><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td></tr></table> YEAR <table border="1" style="display: inline-table;"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td></tr></table> MONTH				0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	10	11	12
0	1	2	3	4	5	6	7	8	9																			
1	2	3	4	5	6	7	8	9	10	11	12																	
DANGER EXPLOSIVE GASES Cigarettes, flames or sparks could cause battery to explode. Always shield eyes and face from battery. Do not charge or use booster cables or adjust post connections without proper instruction and training.			POISON CAUSES SEVERE BURNS Contains sulfuric acid. Avoid contact with skin, eyes or clothing. In event of accident flush with water and call a physician immediately. KEEP OUT OF REACH OF CHILDREN																									

(2) Part No. TA040-4959-3

	WARNING TO AVOID PERSONAL INJURY. 1. Keep PTO shield in place at all times. 2. Do not operate the PTO at speeds faster than the speed recommended by the implement manufacturer 3. For trailing PTO-driven implements, set drawbar at towing position. (see operator's manual)
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(3) Part No. TA040-4935-1

	WARNING TO AVOID PERSONAL INJURY: 1. Attach pulled or towed loads to the drawbar only. 2. Use the 3-point hitch only with equipment designed for 3-point hitch usage.
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9. 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 from your local KUBOTA Distributor.
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 replaced 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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SPECIFICATIONS

Model		ST α -30			ST α -35		
PTO power		17.3 kW (23.5 PS)			21.0 kW (28.5 PS)		
Engine	Maker	KUBOTA					
	Model	D1463-M-ST			D1703-M-ST		
	Type	ETVCS, Indirect Injection. Vertical, water-cooled, 4-cycle diesel					
	Number of cylinders	3					
	Bore and stroke	82 × 92.4 mm (3.23 × 3.64 in.)			87 × 92.4 mm (3.43 × 3.64 in.)		
	Total displacement	1463 cm ³ (89.28 cu.in.)			1647 cm ³ (100.51 cu.in.)		
	Engine net power (ECE-R24)	21.2 kW			25.5 kW		
	SAE gross	22.4 kW (30 HP)			26.8 kW (35.9 HP)		
	Rated revolution	45 r/s (2700 min ⁻¹ (rpm))					
	Maximum torque	96.5 N·m (9.85 kgf·m) / 1500 min ⁻¹ (rpm))			111 N·m (11.3 kgf·m) / 1500 min ⁻¹ (rpm))		
	Battery	12 V, RC : 110 min, CCA : 550 A					
	Starting system	Electric starting with cell starter 12 V, 1.4 kW					
	Lubricating system	Forced lubrication by trochoidal pump					
	Cooling system	Pressurized radiator, forced circulation with water pump					
Fuel	Diesel fuel No. 2-D [above -10 °C (14 °F)], Diesel fuel No. 1 [below -10 °C (14 °F)]						
Capacities	Fuel tank	29.5 L (7.79 U.S.gals., 6.49 Imp.gals.)					
	Engine crankcase (with filter)	4.5 L (1.19 U.S.gals., 0.99 Imp.gals.)					
	Engine coolant (with recovery tank)	5.8 L (1.56 U.S.gals., 1.28 Imp.gals.)					
	Transmission case	18.5 L (4.89 U.S.gals., 4.07 Imp.gals.)					
	Front axle case	4.0 L (1.06 U.S.gals., 0.88 Imp.gals.)					
Tires	Front	Farm 6-12	Farm 6.00-12	Turf 24 × 8.50-14	Farm 6-12	Farm 6.00-12	Turf 24 × 8.50-14
	Rear	12.4-16	9.5-22	13.6-16	12.4-16	9.5-22	13.6-16
Dimensions	Overall length (with 3P)	2870 mm (113 in.)					
	Overall width (minimum tread)	1465 mm (57.7 in.)	1220 mm (48.1 in.)	1310 mm (51.6 in.)	1465 mm (57.7 in.)	1220 mm (48.1 in.)	1310 mm (51.6 in.)
	Overall height (with ROPS)	2330 mm (91.7 in.)	2350 mm (92.5 in.)	2345 mm (92.3 in.)	2330 mm (91.7 in.)	2350 mm (92.5 in.)	2345 mm (92.3 in.)
	Wheel base	1610 mm (63.4 in.)					
	Minimum ground clearance (Mid-PTO case)	215 mm (8.5 in.)	235 mm (9.3 in.)	230 mm (9.1 in.)	215 mm (8.5 in.)	235 mm (9.3 in.)	230 mm (9.1 in.)
	Tread	Front	1020 mm (40.2 in.)				
Rear		1148 mm (45.2 in.)	950, 1070 mm (37.4, 42.1 in.)	965, 1055 mm (38.0, 41.5 in.)	1148 mm (45.2 in.)	950, 1070 mm (37.4, 42.1 in.)	965, 1055 mm (38.0, 41.5 in.)
Weight (with ROPS)		975 kg (2150 lbs)	965 kg (2130 lbs)	985 kg (2170 lbs)	975 kg (2150 lbs)	965 kg (2130 lbs)	985 kg (2170 lbs)
Minimum turning radius (with bi-speed turn)	with brake	2.2 m (7.2 feet)					
	without brake	2.5 m (8.2 feet)					
Clutch		Dry single plate					

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Model		ST α -30	ST α -35
Travelling system	Steering	Hydrostatic power steering	
	Pump capacity (power steering)	14.0 L/min. (3.7 U.S.gals./min., 3.1 Imp.gals./min.)	
	Transmission	Main-hydrostatic transmission, range gear shift (3 forward and 3 reverse)	
	Brake	Wet disk type	
	Differential	Bevel gear	
Hydraulic system	Hydraulic control system	Position control	
	Pump capacity	23 L/min. (6.1 U.S.gals./min., 5.1 Imp.gals./min.)	
	Three point hitch	SAE Category I	
	Max. lift force	At lift points	1150 kg (2535 lbs)
24 in. behind lift points		890 kg (1962 lbs)	
PTO system	Rear	PTO shaft	SAE 1-3/8, 6 splines
		Revolution	540 / 2673 min ⁻¹ (rpm), 800 / 2738 min ⁻¹ (rpm)
	Mid.	PTO shaft	USA No. 5 (KUBOTA 10-tooth) involute spline
		Revolution	1700 / 2710 min ⁻¹ (rpm), 2500 / 2755 min ⁻¹ (rpm)

Note : * Manufacture's estimate the company reserves the right to change the specifications without notice.

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TRAVELLING SPEED

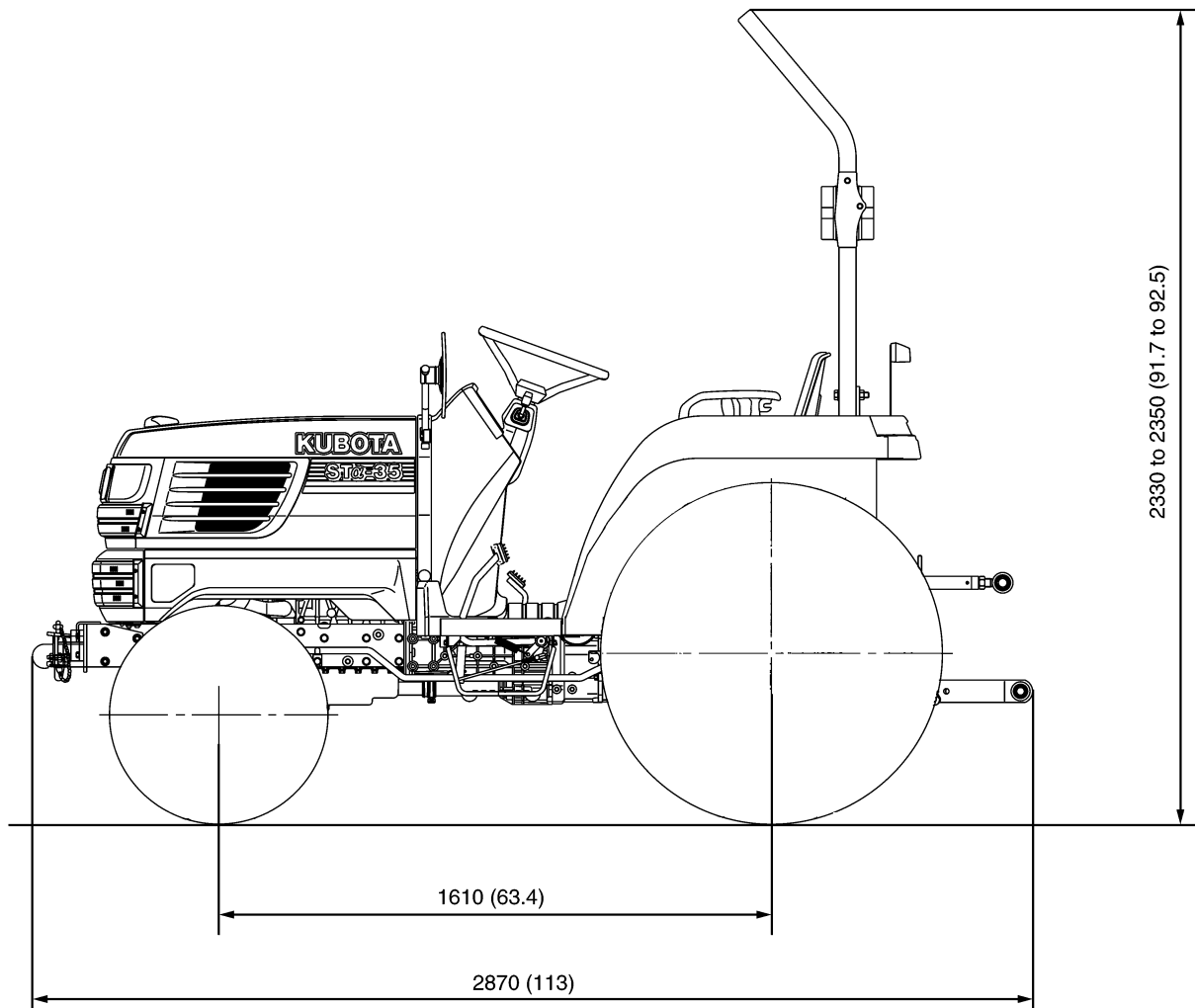
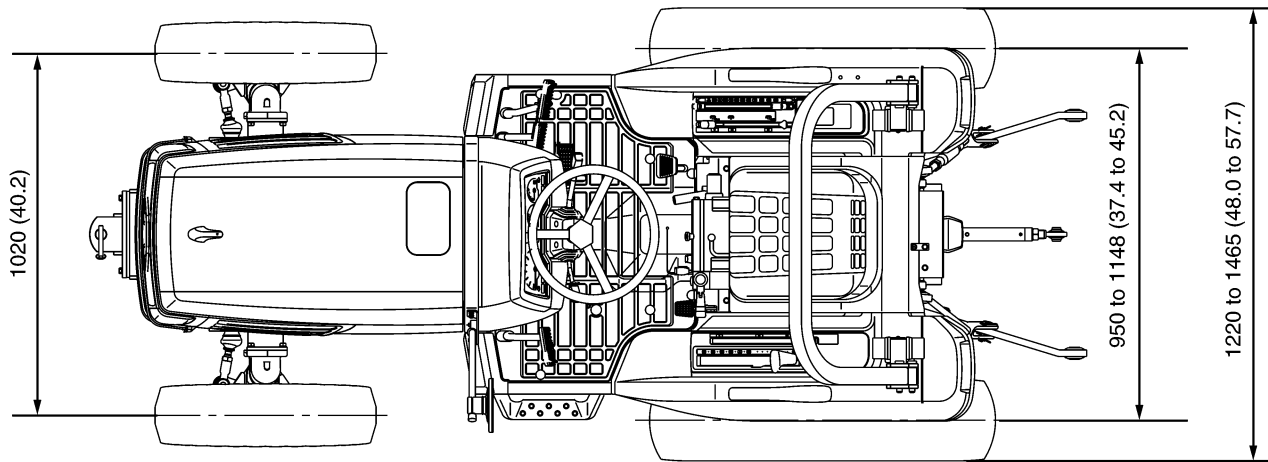
Model		ST α -30 · ST α -35		
Tire size (Rear)		9.5-22	12.4-16	13.6-16
Range gear shift lever		km/h (mile/h)	km/h (mile/h)	km/h (mile/h)
Forward (At rated engine rpm)	1 (Low)	0 to 6.6 (0 to 4.1)	0 to 6.3 (0 to 3.9)	0 to 6.5 (0 to 4.0)
	2 (Middle)	0 to 12.7 (0 to 7.9)	0 to 12.2 (0 to 7.6)	0 to 12.6 (0 to 7.8)
	3 (High)	0 to 28.4 (0 to 17.6)	0 to 27.2 (0 to 17.0)	0 to 28.2 (0 to 17.5)
	Max. Speed (at 2850 engine rpm)	29.9 (18.6)	28.7 (17.8)	29.8 (18.5)
Reverse (At rated engine rpm)	1 (Low)	0 to 4.8 (0 to 3.0)	0 to 4.6 (0 to 2.9)	0 to 4.7 (0 to 2.9)
	2 (Middle)	0 to 9.2 (0 to 5.7)	0 to 8.8 (0 to 5.5)	0 to 9.2 (0 to 5.7)
	3 (High)	0 to 20.6 (0 to 12.8)	0 to 19.7 (0 to 12.2)	0 to 20.4 (0 to 12.7)
	Max. Speed (at 2850 engine rpm)	21.7 (13.5)	20.8 (12.9)	21.6 (13.4)

The company reserves the right to change the specifications without notice.

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DIMENSIONS

Unit : mm (in.)



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G GENERAL

GENERAL

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1. FEATURES



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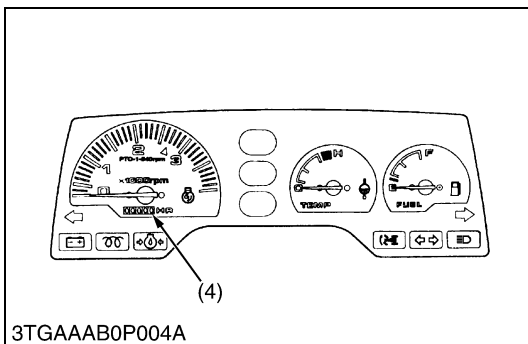
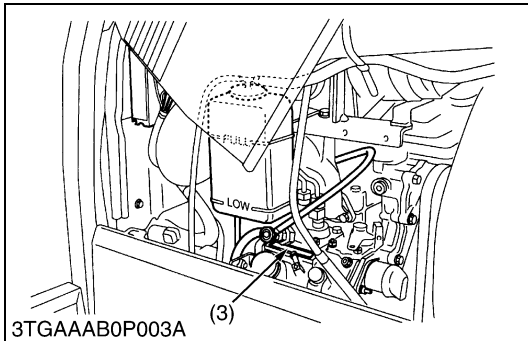
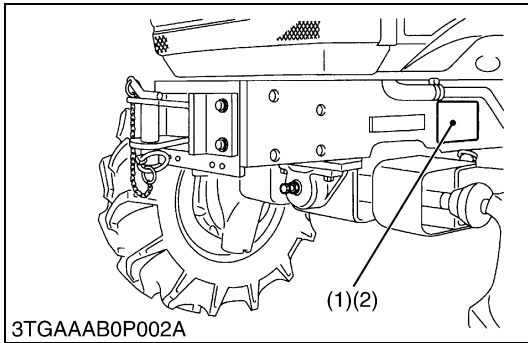
1. Hydraulic Power Steering
2. E-TVCS (Three Vortex Combustion System) Diesel Engine
3. Engine Key Shut-Off System
4. Hydrostatic Transmission (HST)
5. 3 Range of Speed
6. Bi-speed Turn
7. Cruise Control
8. Wet Disc Brake
9. Standard mid-PTO
10. Simultaneous Mounting of Both the Mid. Mount Mower and Front Loader
11. Combination Panel of Easy Checker
12. Large Hydraulic Pump
13. Position Control Valve
14. Hydraulic Block Type Outlet
15. Foldable ROPS

2. TRACTOR IDENTIFICATION

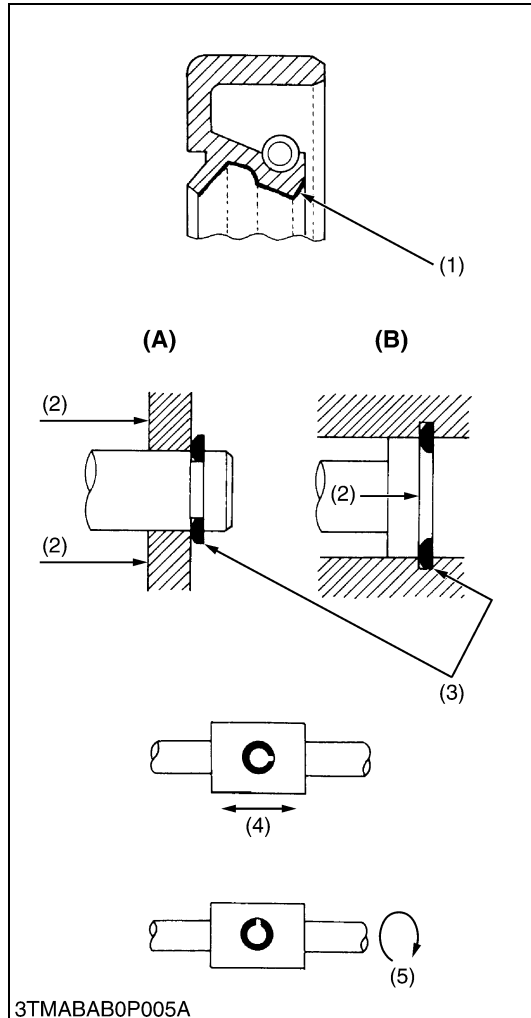
When contacting your local KUBOTA distributor, always specify engine serial number, tractor serial number and hour meter reading.

- | | |
|----------------------------------|--------------------------|
| (1) Tractor Identification Plate | (3) Engine Serial Number |
| (2) Tractor Serial Number | (4) Hour Meter |

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3. GENERAL PRECAUTIONS



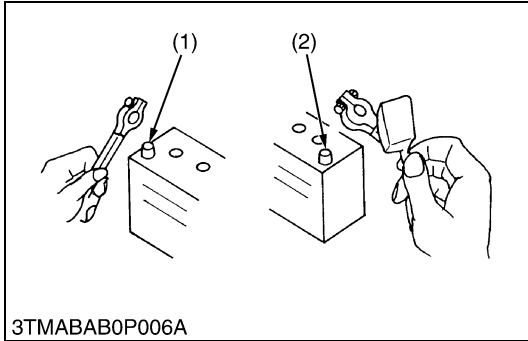
- During disassembly, carefully arrange removed parts in a clean area to prevent confusion later. Screws, bolts and nuts should be installed in their original position to prevent reassembly errors.
- When special tools are required, use KUBOTA genuine special tools. Special tools which are not frequently used should be made according to the drawings provided.
- Before disassembling or servicing electrical wires, always disconnect the ground cable from the battery first.
- Remove oil and dirt from parts before measuring.
- Use only KUBOTA genuine parts for parts replacement to maintain machine performance and to assure safety.
- Gaskets and O-rings must be replaced during reassembly. Apply grease to new O-rings or oil seals before assembling. See the figure left side.
- When reassembling external snap rings or internal snap rings, they must be positioned so that sharp edge faces against the direction from which a force is applied. See the figure left side.
- When inserting spring pins, their splits must face the direction from which a force is applied. See the figure left side.
- To prevent damage to the hydraulic system, use only specified fluid or equivalent.

- (1) Grease
- (2) Force
- (3) Sharp Edge
- (4) Axial Force
- (5) Rotating Movement

(A) External Snap Ring
(B) Internal Snap Ring

W1010904

4. HANDLING PRECAUTIONS FOR ELECTRICAL PARTS AND WIRING



3TMABAB0P006A

To ensure safety and prevent damage to the machine and surrounding equipment, heed the following precautions in handling electrical parts and wiring.

■ IMPORTANT

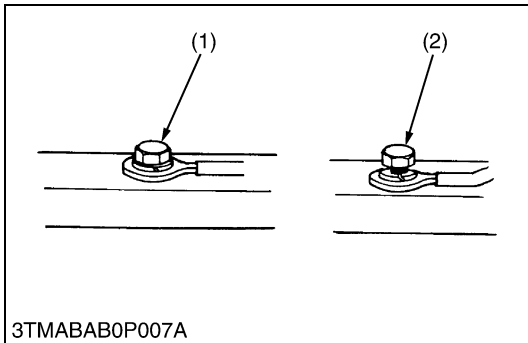
- Check electrical wiring for damage and loosened connection every year. To this end, educate the customer to do his or her own check and at the same time recommend the dealer to perform periodic check for a fee.
- Do not attempt to modify or remodel any electrical parts and wiring.
- When removing the battery cables, disconnect the negative cable first. When installing the battery cables, connect the positive cable first.

(1) Negative Terminal

(2) Positive Terminal

W1011114

[1] WIRING



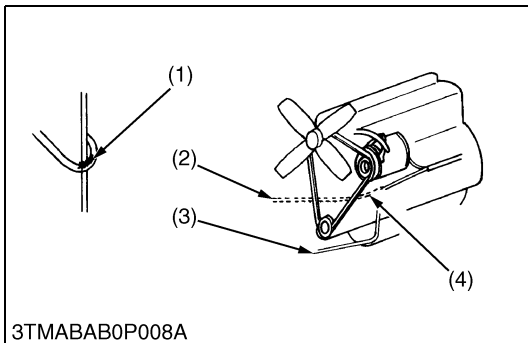
3TMABAB0P007A

- Securely tighten wiring terminals.

(1) Correct
(Securely Tighten)

(2) Incorrect
(Loosening Leads to Faulty Contact)

W1011216



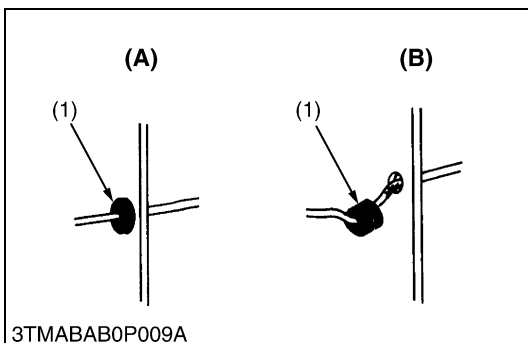
3TMABAB0P008A

- Do not let wiring contact dangerous part.

(1) Wiring (Correct)
(2) Wiring (Incorrect)

(3) Dangerous Part
(4) Dangerous Part

W1011313



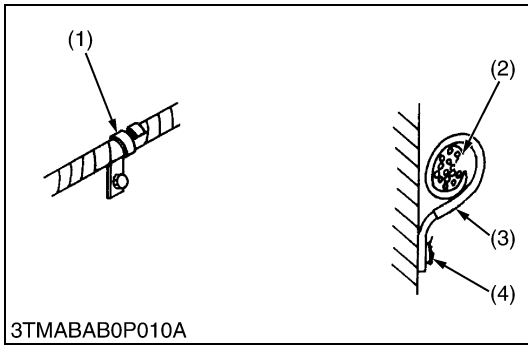
3TMABAB0P009A

- Securely insert grommet.

(1) Grommet

(A) Correct
(B) Incorrect

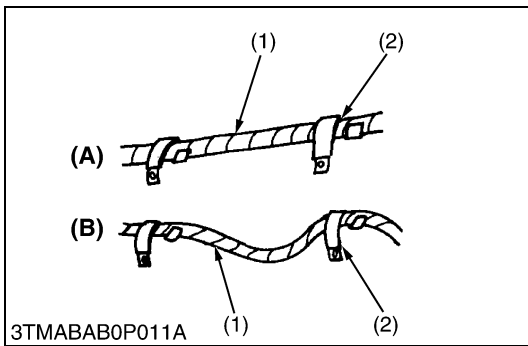
W1011388



- Securely clamp, being careful not to damage wiring.

- (1) Clamp
 - Wind Clamp Spirally
- (2) Wire Harness
- (3) Clamp
- (4) Welding Dent

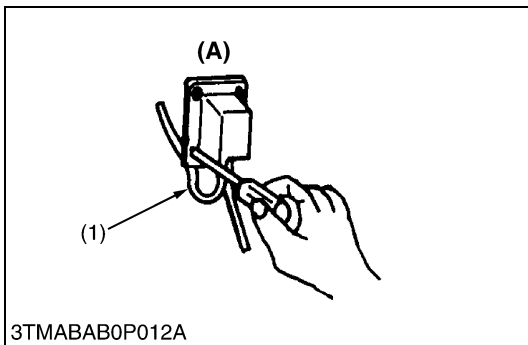
W1011458



- Clamp wiring so that there is no twist, unnecessary sag, or excessive tension, except for movable part, where sag be required.

- (1) Wiring
- (2) Clamp
- (A) Correct
- (B) Incorrect

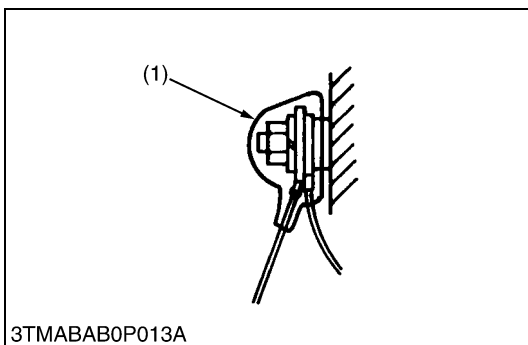
W1011587



- In installing a part, take care not to get wiring caught by it.

- (1) Wiring
- (A) Incorrect

W1011670

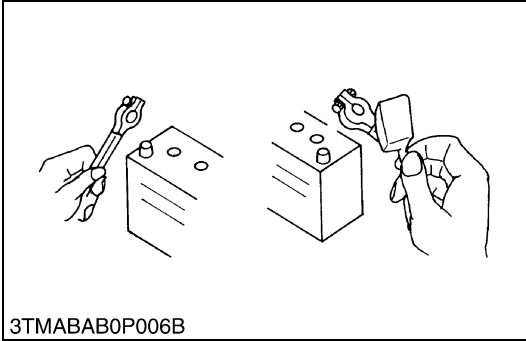


- After installing wiring, check protection of terminals and clamped condition of wiring, only connect battery.

- (1) Cover
 - Securely Install Cover

W1011735

[2] BATTERY



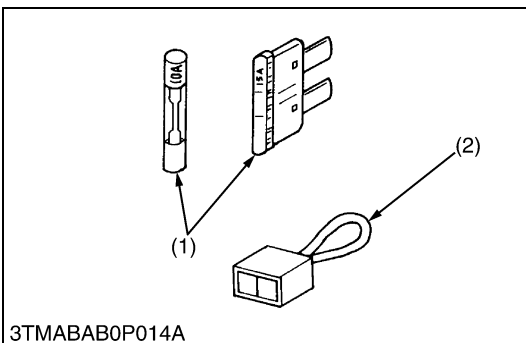
- Take care not to confuse positive and negative terminal posts.
- When removing battery cables, disconnect negative cable first. When installing battery cables, check for polarity and connect positive cable first.
- Do not install any battery with capacity other than is specified (Ah).
- After connecting cables to battery terminal posts, apply high temperature grease to them and securely install terminal covers on them.
- Do not allow dirt and dust to collect on battery.

⚠ CAUTION

- Take care not to let battery liquid spill on your skin and clothes. If contaminated, wash it off with water immediately.
- Before recharging the battery, remove it from the machine.
- Before recharging, remove cell caps.
- Do recharging in a well-ventilated place where there is no open flame nearby, as hydrogen gas and oxygen are formed.

W1011816

[3] FUSE



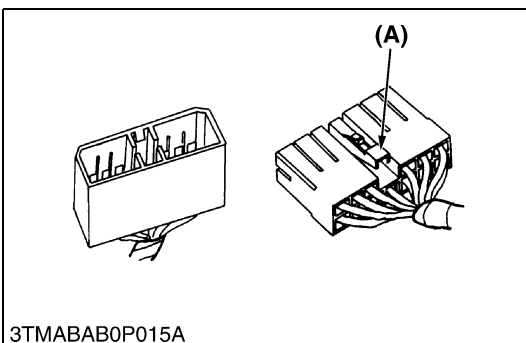
- Use fuses with specified capacity. Neither too large or small capacity fuse is acceptable.
- Never use steel or copper wire in place of fuse.
- Do not install working light, radio set, etc. on machine which is not provided with reserve power supply.
- Do not install accessories if fuse capacity of reserve power supply is exceeded.

(1) Fuse

(2) Slow Blow Fuse

W1012092

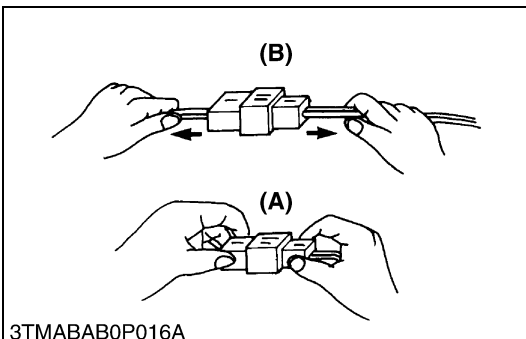
[4] CONNECTOR



- For connector with lock, push lock to separate.

(A) Push

W1012211

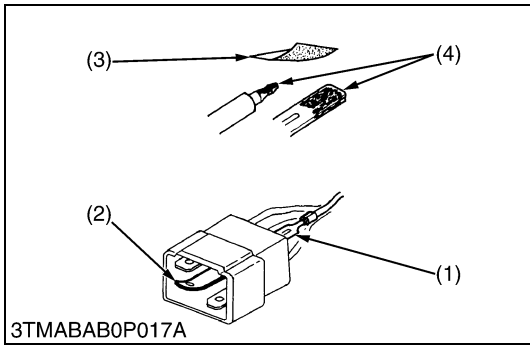


- In separating connectors, do not pull wire harnesses.
- Hold connector bodies to separate.

(A) Correct

(B) Incorrect

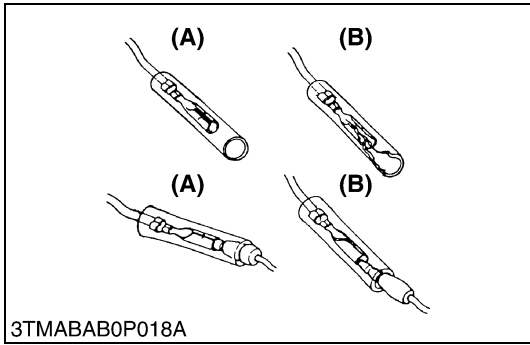
W1012272



- Use sandpaper to remove rust from terminals.
- Repair deformed terminal. Make certain there is no terminal being exposed or displaced.

(1) Exposed Terminal (3) Sandpaper
 (2) Deformed Terminal (4) Rust

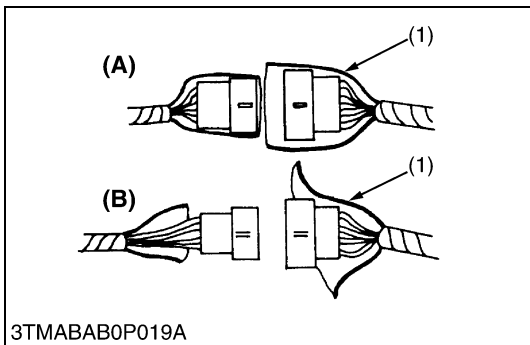
W1012346



- Make certain that there is no female connector being too open.

(A) Correct (B) Incorrect

W1012430

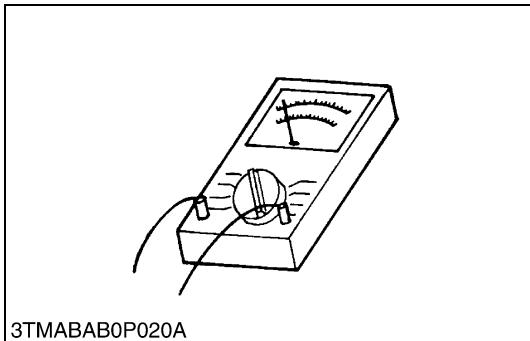


- Make certain plastic cover is large enough to cover whole connector.

(1) Cover (A) Correct (B) Incorrect

W1012519

[5] HANDLING OF CIRCUIT TESTER



- Use tester correctly following manual provided with tester.
- Check for polarity and range.

W1012684

5. LUBRICANTS FUEL AND COOLANT

	Place	Capacity		Lubricants, fuel and coolant
		ST α -30	ST α -35	
1	Fuel tank	29.5 L 7.79 U.S.gals. 6.49 Imp.gals.		No. 2-D diesel fuel No. 1-D diesel fuel if temperature is below -10 °C (14 °F)
2	Coolant (with recovery tank)	5.8 L 1.56 U.S.gals. 1.28 Imp.gals.		Fresh clean water (soft water) with anti-freeze
3	Engine crankcase (with filter)	4.5 L 1.19 U.S.gals. 0.99 Imp.gals.		Engine oil : API service CC or CD class Below 0 °C (32 °F) : SAE10W, 10W-30 or 10W-40 0 to 25 °C (32 to 77 °F): SAE20, 10W-30 or 10W-40 Above 25 °C (77 °F): SAE30, 10W-30 or 10W-40
4	Transmission case	18.5 L 4.89 U.S.gals. 4.07 Imp.gals.		KUBOTA SUPER UDT fluid*
5	Front axle case	4.0 L 1.06 U.S.gals. 0.88 Imp.gals.		KUBOTA SUPER UDT fluid* or SAE80, 90 gear oil
Grease				
	Place	No. of greasing point	Capacity	Type of grease
6	Brake pedal shaft	1	Until grease overflows	Multipurpose type grease
	Clutch pedal shaft	1		
	Top link	2		
	Lift rod	1		
	Battery terminal	2	Moderate amount	

* KUBOTA original transmission hydraulic fluid.

6. TIGHTENING TORQUES

Screws, bolts and nuts whose tightening torques are not specified in this Workshop Manual should be tightened according to the table below.

[1] GENERAL USE SCREWS, BOLTS AND NUTS

Indication on top of bolt	4 No-grade or 4T						7 7T						9 9T		
Material of bolt	SS400, S20C						S43C, S48C						SCr435, SCM435		
Material of opponent part	Ordinariness			Aluminum			Ordinariness			Aluminum			Ordinariness		
Unit															
Diameter	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs
M6 (6 mm, 0.24 in.)	7.85 to 9.31	0.80 to 0.95	5.79 to 6.87	7.85 to 8.82	0.80 to 0.90	5.79 to 6.50	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31	7.85 to 8.82	0.80 to 0.90	5.79 to 6.50	12.3 to 14.2	1.25 to 1.45	9.05 to 10.4
M8 (8 mm, 0.31 in.)	17.7 to 20.5	1.8 to 2.1	13.1 to 15.1	16.7 to 19.6	1.7 to 2.0	12.3 to 14.4	23.6 to 27.4	2.4 to 2.8	17.4 to 20.2	17.7 to 20.5	1.8 to 2.1	13.1 to 15.1	29.5 to 34.3	3.0 to 3.5	21.7 to 25.3
M10 (10 mm, 0.39 in.)	39.3 to 45.1	4.0 to 4.6	29.0 to 33.2	31.4 to 34.3	3.2 to 3.5	23.2 to 25.3	48.1 to 55.8	4.9 to 5.7	35.5 to 41.2	39.3 to 44.1	4.0 to 4.5	29.0 to 32.5	60.9 to 70.6	6.2 to 7.2	44.9 to 52.0
M12 (12 mm, 0.47 in.)	62.8 to 72.5	6.4 to 7.4	46.3 to 53.5	-	-	-	77.5 to 90.2	7.9 to 9.2	57.2 to 66.5	62.8 to 72.5	6.4 to 7.4	46.3 to 53.5	103 to 117	10.5 to 12.0	76.0 to 86.8
M14 (14 mm, 0.55 in.)	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 (16 mm, 0.63 in.)	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 (18 mm, 0.71 in.)	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 (20 mm, 0.79 in.)	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

W1034542

[2] STUD BOLTS

Material of opponent part	Ordinariness			Aluminum		
Unit						
Diameter	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs
M8 (8 mm, 0.31 in.)	11.8 to 15.6	1.2 to 1.6	8.68 to 11.5	8.82 to 11.8	0.90 to 1.2	6.51 to 8.67
M10 (10 mm, 0.39 in.)	24.6 to 31.3	2.5 to 3.2	18.1 to 23.1	19.7 to 25.4	2.0 to 2.6	14.5 to 18.8
M12 (12 mm, 0.47 in.)	29.5 to 49.0	3.0 to 5.0	21.7 to 36.1	31.4	3.2	23.1

W1048139

7. MAINTENANCE

No.	Item		Period	Service Time Interval						Important	Reference page
				50	100	200	400	600	800		
1	Engine oil		Change	★	☆						G-12
2	Engine oil filter		Replace	★		☆					G-12
3	Transmission fluid		Change	★			☆				G-13
4	Hydraulic oil filter (for HST)		Replace	★		☆					G-13
5	Hydraulic oil filter		Replace	★		☆					G-13
6	Front axle case oil		Change	★			☆				G-14
7	Front axle pivot		Adjust					☆			G-24
8	Engine start system		Check	☆							G-16
9	Greasing		–	☆							G-15
10	Wheel bolt torque		Check	☆							G-16
11	Battery condition		Check		☆						G-21
12	Air cleaner element [Single type]		Clean		☆						G-17
			Replace					☆			G-17
13	Air cleaner element [Double type]	Primary element	Clean		☆					*	G-17
			Replace					☆		**	G-17
		Secondary element	Replace						☆		
14	Fuel filter element		Clean		☆						G-18
			Replace				☆				G-18
15	Fan belt		Adjust		☆						G-19
16	Clutch		Adjust	★	☆						G-14
17	Brake		Adjust		☆						G-19
18	Parking brake		Adjust		☆						G-20
19	Fuel line		Check		☆						G-18
			Replace						☆		G-18
20	Radiator hose and clamp		Check			☆					G-23
			Replace						☆		G-23
21	HST oil line		Check			☆					G-23
			Replace						☆		G-23
22	Power steering oil line		Check			☆					G-23
			Replace						☆		G-23
23	Toe-in		Adjust			☆					G-24
24	Engine valve clearance		Adjust						☆		1-S21
25	Cooling system		Flash						☆		G-26
26	Coolant		Change						☆		G-26
27	Fuel system		Bleed							Service as required	G-28
28	Fuse		Replace								G-29
29	Light bulb		Replace								G-29

■ IMPORTANT

- The jobs indicated by ★ must be done after the first 50 hours of operation.
- * : Air cleaner should be cleaned more often in dusty conditions than in normal conditions.
- ** : Every year or every 6 times of cleaning.

W1035769

8. CHECK AND MAINTENANCE



CAUTION

- **Be sure to check and service the tractor on a flat place with engine shut off, the parking brake on and chock the wheels.**

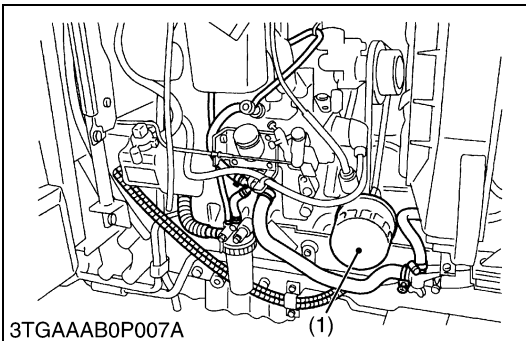
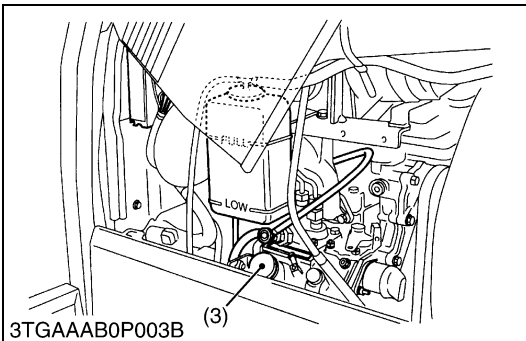
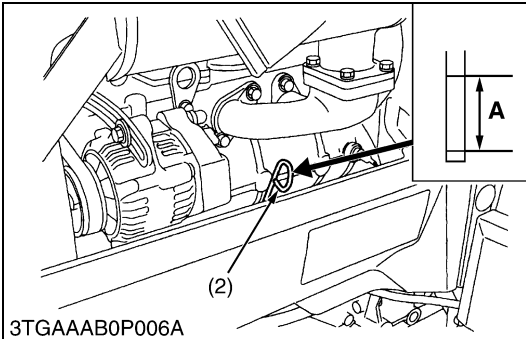
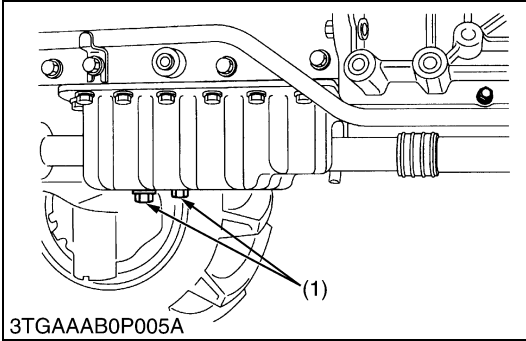
[1] DAILY CHECK

To prevent trouble from occurring, it is important to know the condition of the tractor. Check the following items before starting.

Checking

- Check areas where previous trouble was experienced.
 - Walk around the tractor.
1. Check the tire pressure, and check for wear and damage.
 2. Check for oil and water leaks.
 3. Check the engine oil level.
 4. Check the transmission fluid level.
 5. Check the coolant level.
 6. Check the condition of seat belt and ROPS attaching hardware.
 7. Check and clean the radiator screen and grill.
 8. Check the screws and nuts of tires are tight.
 9. Check the number plate.
 10. Care of danger, warning and caution labels.
 11. Clean around the exhaust manifold and the muffler of the engine.
 - While sitting in the operator's seat.
 - 1. Check the HST pedal, brake pedals and clutch pedal.
 - 2. Check the parking brake.
 - 3. Check the steering wheel.
 - Turning the key switch.
 - 1. Check the performance of the easy checker lights.
 - 2. Check head lights, turn signal lights, hazard lights and other light equipment. Clean if necessary.
 - 3. Check the performance of the meters and gauges.
 - Starting the engine.
 - 1. Check to see that the lights on the easy checker go off.
 - 2. Check the color of the exhaust gas.
 - 3. Check the brakes for proper operation.

[2] CHECK POINTS OF INITIAL 50 HOURS



Changing Engine Oil

⚠ CAUTION

- Before changing oil, be sure to stop the engine.
- Allow engine to cool down sufficiently, oil can be hot and can burn.

1. Start and warm up the engine for approx. 5 minutes.
2. Place an oil pan underneath the engine.
3. To drain the used oil, remove the both drain plug (1) at the bottom of the engine and drain the oil completely.
4. Screw in the both drain plug (1).
5. Fill new oil up to upper line on the dipstick (2).

■ IMPORTANT

- When using an oil of different manufacture or viscosity from the previous one, remove all of the old oil.
- Never mix two different types of oil.
- Use the proper SAE Engine Oil according to ambient temperatures.
- Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-8.)

Engine oil capacity	4.5 L 1.19 U.S.qts. 0.99 Imp.qts.
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- (1) Drain Plug
- (2) Dipstick
- (3) Oil Inlet

A : Oil level is acceptable within this range.

W1014533

Replacing Engine Oil Filter Cartridge

⚠ CAUTION

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

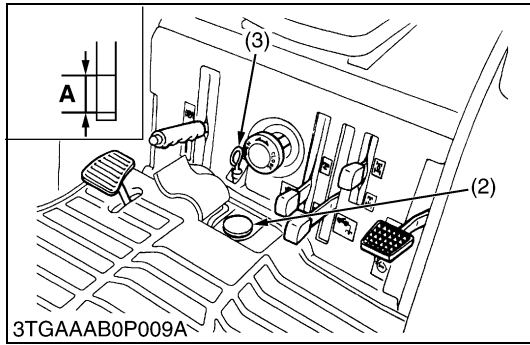
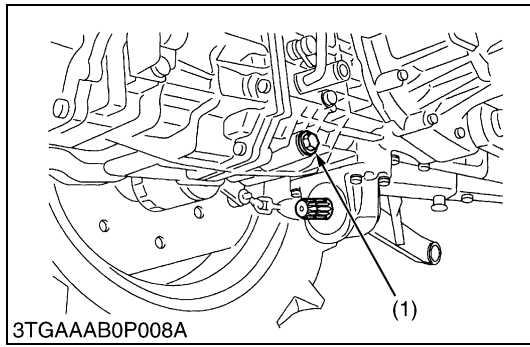
1. Remove the oil filter cartridge with the filter wrench.
2. Apply a slight coat of oil onto the new cartridge gasket.
3. To install the new cartridge, screw it in by hand. Over tightening may cause deformation of rubber gasket.
4. After the new cartridge has been replaced, the engine oil normally decrease 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

W1014892



Changing Transmission Fluid

⚠ CAUTION

- Be sure to stop the engine checking and changing the transmission fluid.
 - Allow engine to cool down sufficiently, oil can be hot and can burn.
1. Place an oil pan under the tractor.
 2. Remove the drain plug (1) at the bottom of the transmission case.
 3. Drain the transmission fluid.
 4. After draining, screw in the drain plug.
 5. Fill new oil from filling port after removing the filling plug (2) up to the upper notch on the dipstick.
 6. After running the engine for a few minutes, stop it and check the oil level again, if low, add oil prescribed level.

■ IMPORTANT

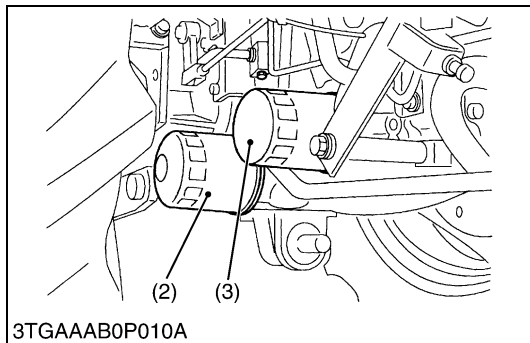
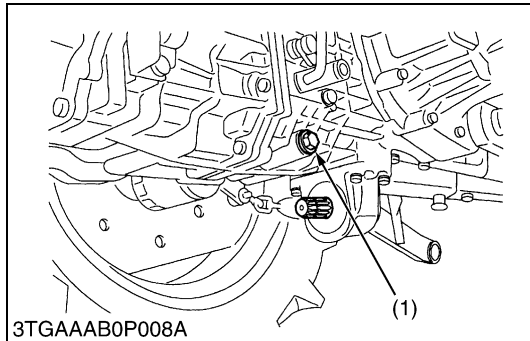
- Use only multi-grade transmission oil. Use of other oils may damage the transmission or hydraulic system. Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-8.)
- Never work the tractor immediately after changing the transmission oil. Keeping the engine at medium speed for a few minutes to prevents damage to the transmission.
- Do not mix different blands oil together.

Transmission fluid capacity	18.5 L 4.89 U.S.gals. 4.07 Imp.gals.
-----------------------------	--

- (1) Drain Plug
(2) Filling Plug
(3) Dipstick

A : Oil level is acceptable within this range.

W1015055



Replacing Hydraulic Oil Filter Cartridge and Transmission Oil Filter (HST) Cartridge

⚠ CAUTION

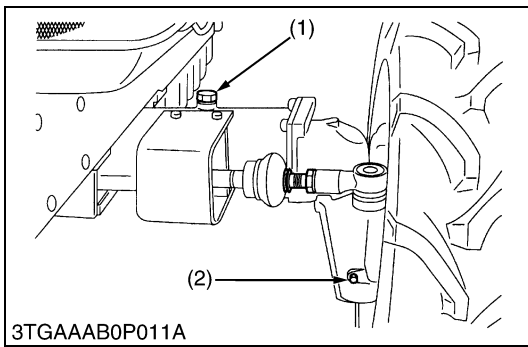
- Be sure to stop the engine before changing the oil filters.
 - Allow engine to cool down sufficiently, oil can be hot and can burn.
1. Drain the transmission fluid.
 2. Remove the both oil filter cartridges by using a filter wrench.
 3. Apply a slight coat of oil onto the new cartridge gasket.
 4. To install the new cartridge, screw it in by hand. Over tightening may cause deformation of rubber gasket.
 5. After the new cartridge has been replaced, the transmission fluid level will normally decrease slightly. Make sure that the transmission fluid does not leak through the seal. Check the fluid level.

■ IMPORTANT

- To prevent serious damage to the hydraulic system. Use only a genuine KUBOTA filter or its equivalents.

- (1) Drain Plug
(2) Hydraulic Oil Filter
(3) Hydraulic Oil Filter (for HST)

W1015586



3TGAAAB0P011A

Replacing Front Axle Case Oil

⚠ CAUTION

- Be sure to stop the engine before changing the front axle case oil.
- Allow engine to cool down sufficiently, oil can be hot and can burn.

1. Remove the both right and left drain plugs (1) at bottom of the bevel gear case.
2. Drain the front axle case oil.
3. After draining, screw in the two drain plugs.
4. Fill new oil from filling port with specified amount of oil.

■ IMPORTANT

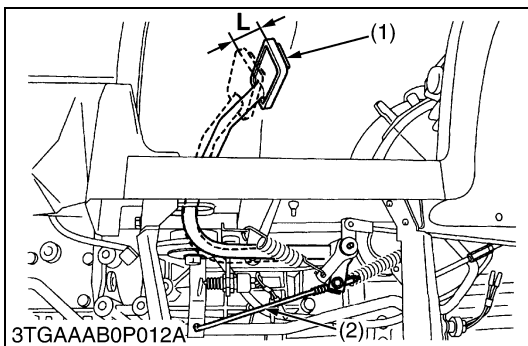
- Use **KUBOTA SUPER UDT fluid or SAE 80, 90 gear oil.** Refer to “LUBRICANTS, FUEL AND COOLANT”. (See page G-8.)

Front axle case oil capacity	4.0 L 1.06 U.S.gals. 0.88 Imp.gals.
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(1) Drain Plug

(2) Filling Plug

W1015816



3TGAAAB0P012A

Checking Clutch Pedal Free Travel

⚠ CAUTION

- When checking, park the tractor on flat ground, apply the parking brake, stop the engine and remove the key.

1. Slightly depress the clutch pedal (1) and measure free travel “L” at top of clutch pedal.
2. If the measurement is not within the factory specifications, loosen the lock nut and adjust the clutch rod (2) length.

■ IMPORTANT

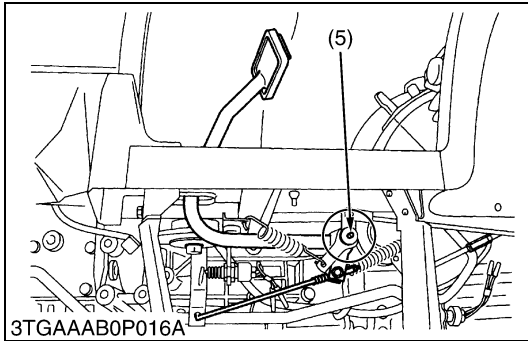
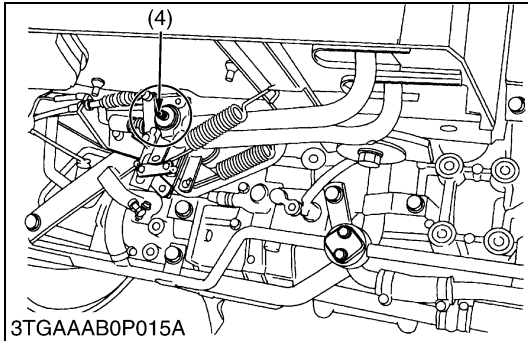
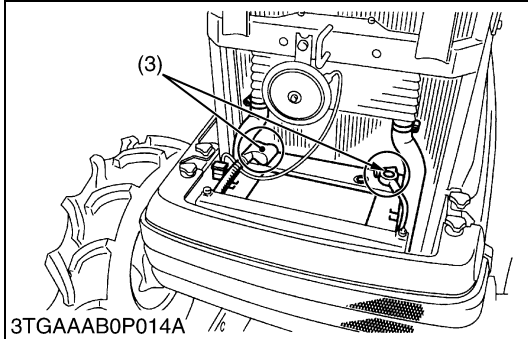
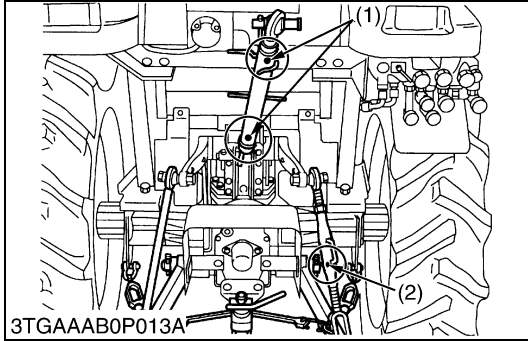
- After adjustment, be sure to check that engine does not start without depressing the clutch pedal but engine start when depressing the clutch pedal.

Clutch pedal free travel on top of clutch pedal “L”	Factory spec.	20.0 to 30.0 mm 0.78 to 1.18 in.
---	---------------	-------------------------------------

(1) Clutch Pedal

(2) Clutch Rod

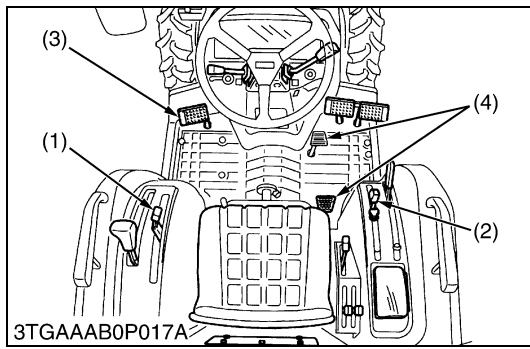
W1016124

[3] CHECK POINTS OF EVERY 50 HOURS**Greasing**

1. Apply a grease to the following position as figures.

- | | |
|-------------------------------------|---|
| (1) Grease Fitting (Top Link) | (4) Grease Fitting (Brake Pedal Shaft) |
| (2) Grease Fitting (Lifting Rod RH) | (5) Grease Fitting (Clutch Pedal Shaft) |
| (3) Battery Terminal | |

W1016347



Checking Engine Start System

CAUTION

- Do not allow anyone near the tractor while testing.
- If the tractor does not pass the test do not operate the tractor.

Preparation before testing.

1. Sit on operator’s seat.
2. Set the parking brake and stop the engine.
3. Shift the range gear shift lever in “NEUTRAL” position.
4. Shift the PTO gear shift lever in “NEUTRAL” position.
5. Fully depress the clutch pedal.

Test 1 : for safety switch on the clutch pedal

1. Release the clutch pedal.
2. Turn the key to “START” position.
3. The engine must not crank.

Test 2 : for safety switch on the speed control pedal

1. Fully depress the clutch pedal again.
2. Depress the pedal to Forward or Reverse.
3. Turn the key to “START” position.
4. The engine must not crank.

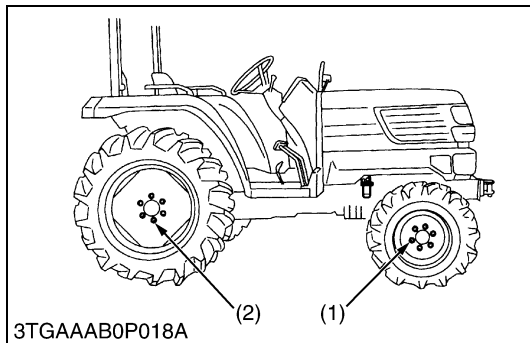
Test 3 : for safety switch on the PTO gear shift lever.

1. Engage the PTO gear shift lever.
2. Fully depress the clutch pedal again.
3. Turn the key to “START” position.
4. The engine must not crank.

After testing : If crank any test of the above, adjust or replace the required safety switch.

- (1) Range Gear Shift Lever
- (2) PTO Gear Shift Lever
- (3) Clutch Pedal
- (4) Speed Control Pedal

W1016474



Checking Wheel Mounting Screws and Nuts Tightening Torque

CAUTION

- Never operate tractor with a loose rim, wheel, or axle.
- Any time bolts and nuts are loosened, retighten to specified torque.
- Check all screws and nuts frequently and keep them tight.

1. Check wheel screws and nuts regularly especially when new. If there are loosened, tighten as follows.

Tightening torque	Front wheel mounting screws and nuts	77 to 90 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
	Rear wheel mounting screws and nuts	196.1 to 225.6 N·m 20.0 to 23.0 kgf·m 145 to 166 ft-lbs

- (1) Front Wheel Mounting Screw and Nut
- (2) Rear Wheel Mounting Screw and Nut

W1016937

[4] CHECK POINTS OF EVERY 100 HOURS

Changing Engine Oil

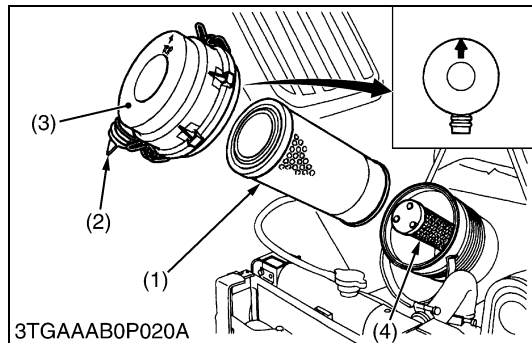
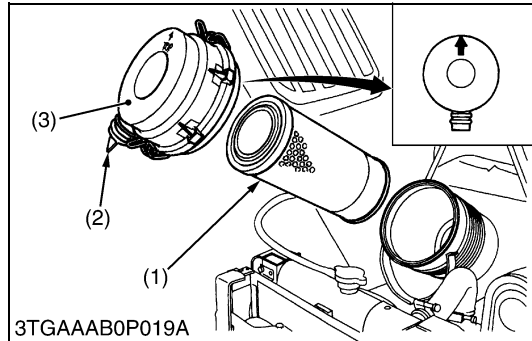
1. See page G-12.

W1017133

Checking Clutch Pedal Free Travel

1. See page G-14.

W1017188



Cleaning Air Cleaner Element

[Single Element and Double Element Type]

1. Remove the air cleaner cover (3) and element (primary) (1).
2. Clean the element (primary) (1) if:
 - When dry dust adheres to the element, blow compressed air from the inside turning the element. Pressure of compressed air must be under 490 kPa (5 kgf/cm², 71 psi).
 - When carbon or oil adheres to the element, soak the element in detergent for 15 minutes then wash it several times in water, rinse with clean water and dry it naturally. After element is fully dried, inspect inside of the element with a light and check if it is damaged or not.
3. When replacing the air cleaner element (primary) (1), replace the secondary element (4) as well :
Once a year or after every six times of cleaning, whichever comes first.

■ IMPORTANT

- The air cleaner uses a dry element, never apply oil.
- Do not run the engine with filter element removed.
- Be sure to refit the dust cup with the arrow ↑ (on the rear of cup) upright. If the dust cup is improperly fitted, evacuator valve will not function and dust will adhere to the element.
- Do not touch the secondary element except in cases where replacing is required.

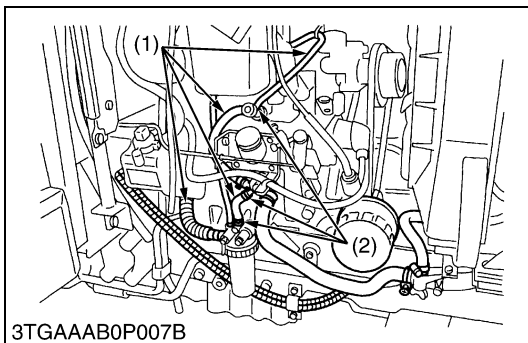
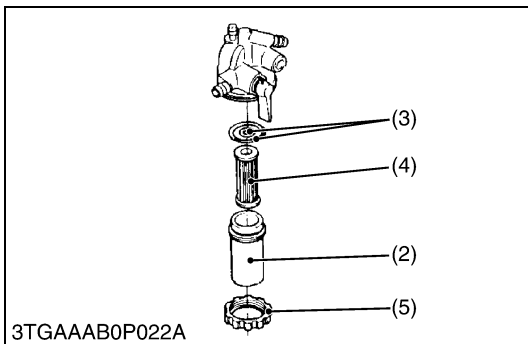
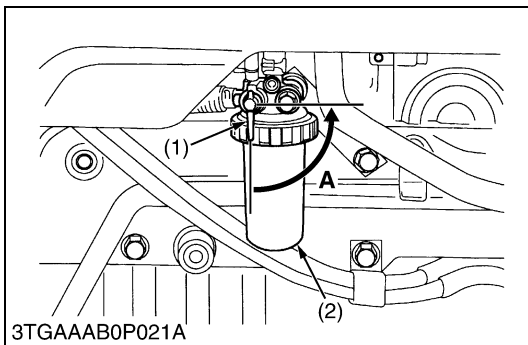
■ Evacuator Valve

Open the evacuator valve (2) once a week under ordinary conditions or daily when used in a dusty place to get rid of large particles of dust and dirt.

- (1) Element (Primary)
(2) Evacuator Valve

- (3) Cover
(4) Secondary Element (Safety)

W1017226



Cleaning Fuel Filter

This job should not be done in the field, but in a clean place.

1. Close the fuel filter cock (1).
2. Unscrew the screw ring and remove the fuel filter bowl (2), and rinse the inside with kerosene.
3. Take out the filter element (4) and dip it in the kerosene to rinse.
4. After cleaning, reassemble the fuel filter, keeping out dust and dirt.
5. Bleed the fuel system. (See page G-28.)

■ IMPORTANT

- **If dust and dirt enters the fuel system the fuel pump and injection nozzles are subject to premature wear. To prevent this, be sure to clean the fuel filter bowl periodically.**

- | | |
|----------------------|--------------------|
| (1) Fuel Cock | (4) Filter Element |
| (2) Fuel Filter Bowl | (5) Screw Ring |
| (3) O-ring | A : Close |

W1017467

Checking Fuel Line

⚠ CAUTION

- **Stop the engine when attempting the check and change prescribed below.**
- **Remember to check the fuel line periodically. The fuel line is subject to wear and aging, fuel may leak out onto the running engine, causing a fire.**

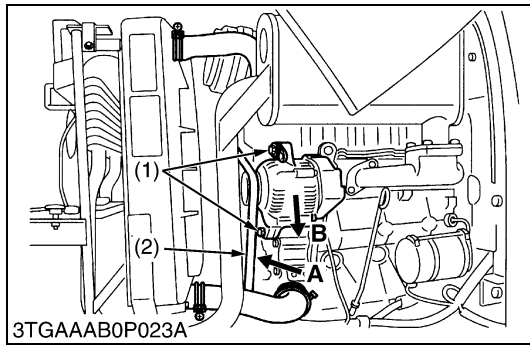
1. Check to see that all line and hose clamps are tight and not damaged.
2. If hoses and clamps are found worn or damaged, replace or repair them at once.
3. The fuel line is made of rubber and ages regardless of period of service. Replace the fuel pipe together with the clamp every two years and securely tighten.
4. However if the fuel pipe and clamp are found damaged or deteriorated earlier than two years, then change or remedy.
5. After the fuel line and clamp have been changed, bleed the fuel system. (See page G-28.)

■ IMPORTANT

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

- | | |
|---------------|-----------|
| (1) Fuel Hose | (2) Clamp |
|---------------|-----------|

W1017739



Checking Fan Belt Tension

⚠ CAUTION

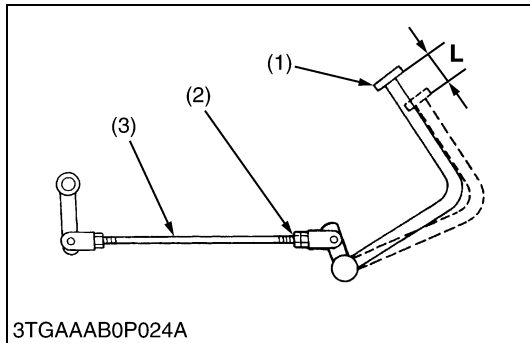
- **Be sure to stop engine before checking belt tension.**
1. Stop the engine and remove the key.
 2. Apply moderate thumb pressure to belt between pulleys.
 3. If tension is incorrect, loosen the alternator mounting bolts and using a lever placed between the alternator and the engine block, pull the alternator out until the deflection of the belt falls within acceptable limits.
 4. Replace fan belt if it is damaged.

Fan belt tension	Factory spec.	A deflection of between 7 to 9 mm (0.28 to 0.34 in.) when the belt is pressed in the middle of the span.
------------------	---------------	--

- (1) Adjusting Screw
- (2) Tension Bolt

A : Check the belt tension
B : To tighten

W1017926



Checking Brake Pedal Free Travel

⚠ CAUTION

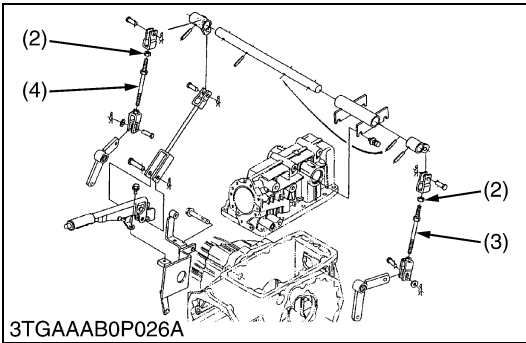
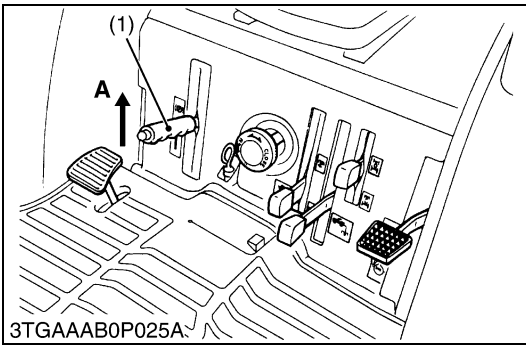
- **Stop the engine and chock the wheels before checking brake pedal.**
 - **The difference between the right and left pedal plays must be less than 5.0 mm (0.19 in.).**
1. Release the parking brake.
 2. Slightly depress the brake pedals (1) and measure free travel (L) at top of pedal stroke.
 3. If the measurement is not within the factory specifications, loosen the lock nut (2) and turn the brake rod (3).
 4. Retighten the lock nut (2) securely.
- Keep the free travel in the right and left brake pedals equal.

Brake pedal free travel "L"	Factory spec.	25 to 30 mm 0.98 to 1.18 in.
-----------------------------	---------------	---------------------------------

- (1) Brake Pedal
- (2) Lock Nut
- (3) Brake Rod

L : Free Travel

W1018154



Checking Parking Brake

⚠ CAUTION

- **Be sure to stop engine before checking parking brake.**
1. Slowly raise the parking brake lever (1) to the ratchet sound made by the parking brake lever.
 2. If the No. of notch is not within the factory specifications, loosen the lock nut (2) and turn the brake rod LH (3) and RH (4) to adjust within acceptable limits.
 3. Retighten the lock nut (2) securely.

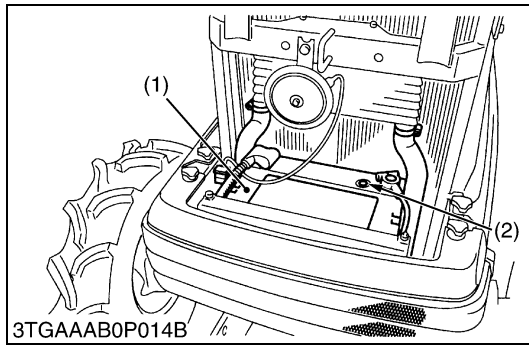
Parking brake lever free travel	2 notches (Ratchet sound 2)
---------------------------------	--------------------------------

■ IMPORTANT

- **Check the brake pedal free travel after checking the parking brake.**

- | | |
|------------------|------------------|
| (1) Brake Lever | (4) Brake Rod RH |
| (2) Lock Nut | |
| (3) Brake Rod LH | |
- A : Pull**

W1018378



Checking Battery Condition

⚠ DANGER

To avoid the possibility of battery explosion:

For the refillable type battery, follow the instructions below.

- Do not use or charge the refillable type battery if the fluid level is below the LOWER (lower limit level) mark. Otherwise, the battery component parts may prematurely deteriorate, which may shorten the battery's service life or cause an explosion. Check the fluid level regularly and add distilled water as required so that the fluid level is between the UPPER and LOWER levels.

⚠ CAUTION

- Never remove the vent plugs while the engine is running.
 - Keep electrolyte away from eyes, hands and clothes. If you are spattered with it, wash it away completely with water immediately and get medical attention.
 - Wear eye protection and rubber gloves when working around battery.
1. Mishandling the battery shortens the service life and adds to maintenance costs.
 2. The original battery is maintenance free type battery, but need some servicing.
If the battery is weak, the engine is difficult to start and the lights become dim. It is important check the battery periodically.

■ NOTE

- The factory-installed battery is of non-refillable type. If the indicator turns white, do not charge the battery but replace it with new one.

■ How to read the indicator

Check the battery condition by reading the indicator.

State of indicator display	
Green	Specific gravity of electrolyte and quality of electrolyte are both in good condition.
Black	Needs charging battery.
White	Needs changing battery.

(1) Battery

(2) Indicator

W1018707

■ Battery Charging

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.

Use a voltmeter or hydrometer.

1. To slow charge the battery, connect the battery positive terminal to the charger positive terminal and the negative to the negative, then recharge in the standard fashion.
2. The battery is charged if the indicator display turns green from black.

■ IMPORTANT

- Do not charge rapidly.
3. When exchanging an old battery into new one, use battery of equal specification shown in table 1.

Table 1

Battery Type	Volts (V)	Capacity at 20 H.R. (A.H.)	CCA (SAE)	Normal Charging Rate
75D26L-MF	12	65	550	–

■ Direction for Storage

1. When storing the tractor for long periods of time, remove the battery from tractor, adjust the electrolyte to the proper level and store in a dry place out of direct sunlight.
2. The battery self-discharges while it is stored.
Recharge it once every three months in hot seasons and once every six months in cold seasons.

(1) Highest Level

(2) Lowest Level

W1019057

[5] CHECK POINTS OF EVERY 200 HOURS

Replacing Engine Oil Filter Cartridge

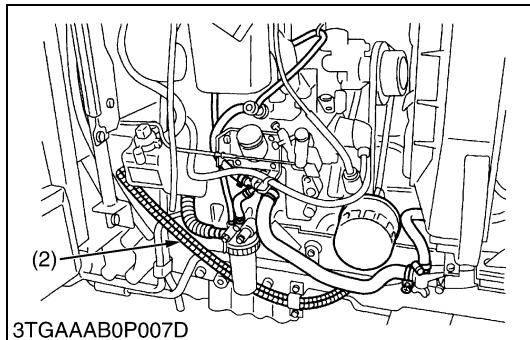
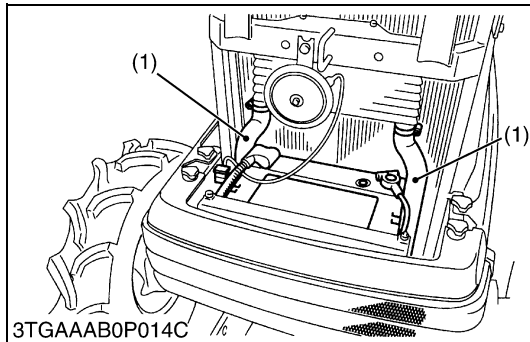
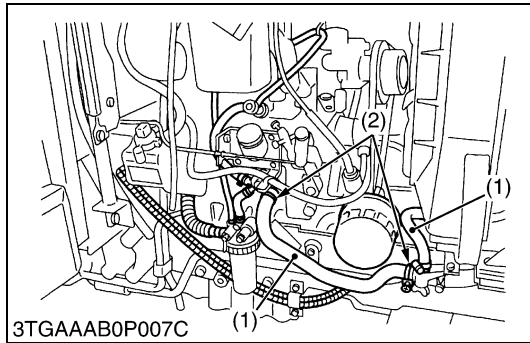
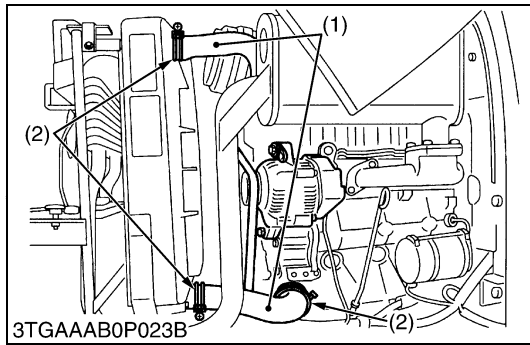
1. See page G-12.

W1019450

Replacing Hydraulic Oil Filter Cartridge and Transmission Oil Filter (HST) Cartridge

1. See page G-13.

W1019516



Checking Radiator Hose and Hose Clamp

Check to see if radiator hoses are properly fixed every 200 hours of operation or six months, whichever comes first.

1. If hose clamps are loose or water leaks, tighten bands securely.
2. Replace hoses and tighten hose clamps securely, if radiator hoses are swollen, hardened or cracked.

Replace hoses and hose clamps every 2 years or earlier if checked and found that hoses are swollen, hardened or cracked.

■ **Precaution at Overheating**

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

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

(1) Radiator Hose

(2) Clamp

W1019561

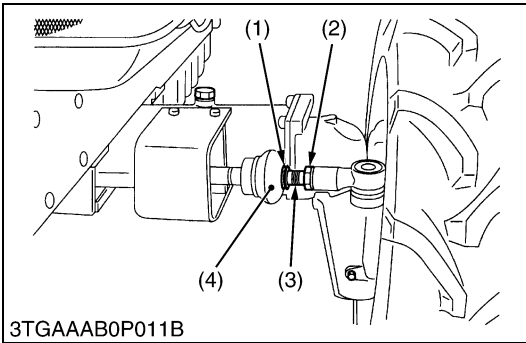
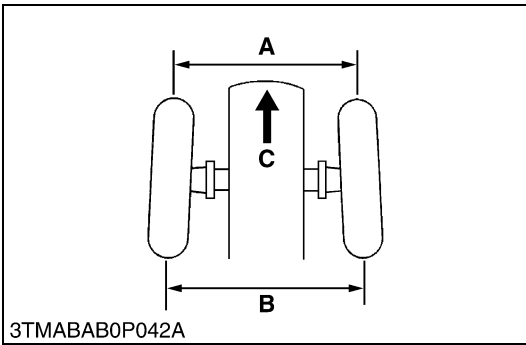
Checking HST Oil Line and Power Steering Line

1. Check to see that all lines (1), (2) and hose clamps are tight and not damaged.
2. If hoses and clamps are found worn or damaged, replace or repair them at once.

(1) HST Oil Line

(2) Power Steering Hose

W1019910



Adjusting Toe-in

1. Park the tractor on the flat place.
2. Inflate the tires to the specified pressure.
3. Turn steering wheel so front wheels are in the straight ahead position.
4. Lower the implement, lock the parking brake and stop the engine.
5. Measure distance between tire beads at front of tire, hub height.
6. Measure distance between tire beads at rear of tire, hub height.
7. Front distance should be 2 to 8 mm (0.079 to 0.315 in.) less than rear distance.
8. If the measurement is not within the factory specifications, adjust by changing the tie-rod length.

Toe-in (B – A)	Factory spec.	2 to 8 mm 0.079 to 0.315 in.
----------------	---------------	---------------------------------

Adjusting

1. Detach the snap ring (1) from the dust cover (4).
2. Loosen the tie-rod lock nut (2) and turn the tie-rod joint (3) to adjust the tie-rod length until the proper toe-in measurement is obtained.
3. Retighten the tie-rod lock nut (2).
4. Attach the snap ring (1) to the dust cover (4).

Tightening torque	Tie-rod lock nut	117 to 137 N·m 12 to 14 kgf·m 86.1 to 101.3 ft·lbs
-------------------	------------------	--

IMPORTANT

- A right and left tie-rod joint is adjusted to the same length.

- (1) Snap Ring
(2) Tie-rod Lock Nut
(3) Tie-rod Joint
(4) Dust Cover

- (A) Wheel to Wheel Distance at front
(B) Wheel to Wheel Distance at rear
(C) Front

W1020026

[6] CHECK POINTS OF EVERY 400 HOURS

Changing Transmission Fluid

1. See page G-13.

W1020659

Replacing Fuel Filter Element

1. See page G-18.

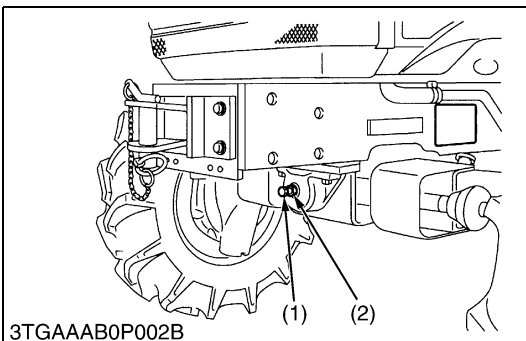
W1020714

Changing Front Axle Case Oil

1. See page G-14.

W1020752

[7] CHECK POINTS OF EVERY 600 HOURS



Adjusting Front Axle Pivot

1. Loosen the lock nut (2), tighten the adjusting screw (1) all the way, and then loosen the adjusting screw (1) by 1/6 turn.
2. Retighten the lock nut (2).

NOTE

- If the axle pivot pin adjustment is not correct, front wheel vibration can occur causing vibration in the steering wheel.

- (1) Adjusting Screw

- (2) Lock Nut

W1020797

[8] CHECK POINTS OF EVERY 800 HOURS**Checking Valve Clearance**

1. See page 1-S21.

W1021033

[9] CHECK POINTS OF EVERY 1 YEAR**Replacing Air Cleaner Element (Primary) and Secondary Element**

1. See page G-17.

W1021125

[10] CHECK POINTS OF EVERY 2 YEARS**Replacing Radiator Hose (Water Pipes)**

1. Replace the hoses and clamps.
Refer to “**Checking Radiator Hose and Hose Clamp**”. (See page G-23.)

W1021176

Replacing Fuel Hose

1. Replace the fuel hoses and clamps, if necessary.
Refer to “**Checking Fuel Line**”. (See page G-18.)

W1021231

Replacing Power Steering Hose

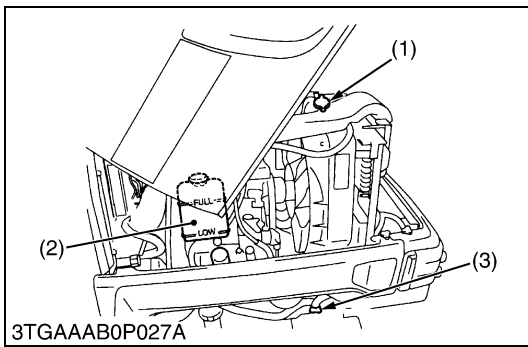
1. Replace the hoses and clamps.
Refer to “**HST Oil Line and Power Steering Line**”. (See page G-23.)

W1021269

Replacing HST Oil Line

1. Replace the hoses and clamps.
Refer to “**HST Oil Line and Power Steering Line**”. (See page G-23.)

W1021597



Flushing Cooling System and Changing Coolant

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. Stop the engine and let cool down.
 2. To drain the coolant, open the radiator drain plug (3) and remove radiator cap (1). The radiator cap (1) must be removed to completely drain the coolant.
 3. After all coolant is drained, close the drain plug (3).
 4. Fill with clean water and cooling system cleaner.
 5. Follow directions of the cleaner instruction.
 6. After flushing, fill with clean water and anti-freeze until the coolant level is just below the port. Install the radiator cap (1) securely.
 7. Fill with coolant up to “**FULL**” mark on the recovery tank (2).
 8. Start and operate the engine for few minutes.
 9. Stop the engine and let cool. Check coolant level of recovery tank (2) and add coolant if necessary.

IMPORTANT

- **Do not start engine without coolant.**
- **Use clean, fresh water and anti-freeze to fill the radiator and recovery tank.**
- **When the anti-freeze is mixed with water, the anti-freeze mixing ratio must be less than 50 %.**
- **Securely tighten radiator cap. If the cap is loose or improperly fitted, water may leak out and the engine could overheat.**
- **Refer to “LUBRICANTS, FUEL AND COOLANT”. (See page G-8.)**

Coolant capacity (with recovery tank)	5.8 L
	1.56 U.S.qts.
	1.28 Imp.qts.

(1) Radiator Cap
(2) Recovery Tank

(3) Drain Plug

W1021307

Flashing Cooling system and Changing Coolant (Continued)**■ Anti-Freeze**

If coolant freezes, it can damage the cylinders and radiator. It is necessary, if the ambient temperature falls below 0 °C (32 °F), to remove coolant after operating or to add anti-freeze to it.

1. There are two types of anti-freeze available; use the permanent type (PT) for this engine.
2. Before adding anti-freeze for the first time, clean the radiator interior by pouring fresh water and draining it a few times.
3. The procedure for mixing of water and anti-freeze differs according to the make of the anti-freeze and the ambient temperature, basically it should be referred to SAE J1034 standard, more specifically also to SAE J814c.
4. Mix the anti-freeze with water, and then fill in to the radiator.

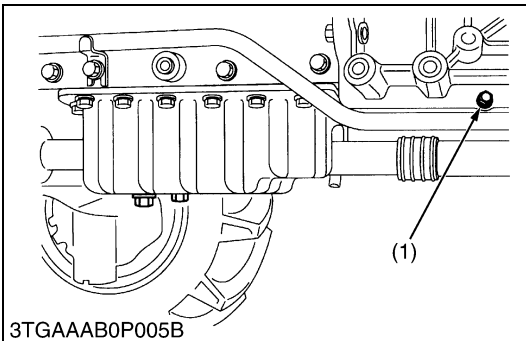
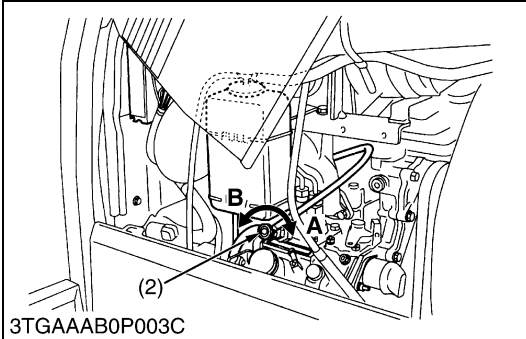
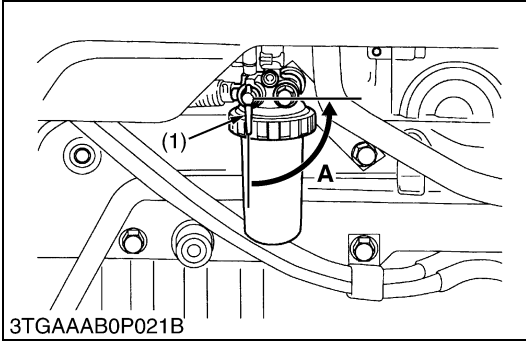
Vol % Anti-freeze	Freezing Point		Boiling Point*	
	°C	°F	°C	°F
40	-24	-12	106	222
50	-37	-34	108	226

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

■ NOTE

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

W1022492

[11] OTHERS**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, and open the fuel cock (1).
2. Open the air vent cock (2) on the fuel injection pump.
3. Start the engine and run for about 30 seconds, and then stop the engine.
4. Close the air vent cock.

■ IMPORTANT

- **Always close the air vent cock except for bleeding fuel lines. Otherwise, engine runs irregularly or stalls frequently.**

- | | |
|-------------------|-----------|
| (1) Fuel Cock | A : Close |
| (2) Air Vent Cock | B : Open |

W1022935

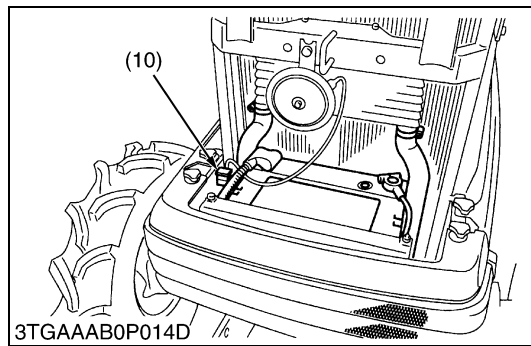
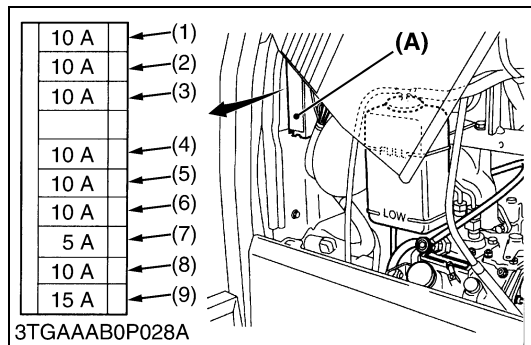
Draining Clutch Housing Water**■ NOTE**

- **The tractor is equipped with drain plug (1) under the clutch housing.**
- **After operating in rain, snow or tractor has been washed, water may get into the clutch housing.**

1. Remove the drain plug (1) and drain the water, then install the plug again.

- | |
|----------------------|
| (1) Water Drain Plug |
|----------------------|

W1023306



Replacing Fuse

1. The tractor electrical system is protected from potential damage by fuses.

A blown fuse indicates that there is an overload or short somewhere in the electrical system.

2. If any of the fuses should blow, replace with a new one of the same capacity.

■ IMPORTANT

- Before replacing a blown fuse, determine why the fuse blew and make any necessary repairs. Failure to follow this procedure may result in serious damage to the tractor electrical system. Refer to troubleshooting section of this manual or your local KUBOTA distributor for specific information dealing with electrical problems.

If any of them should blow, replace with a new one of the same capacity.

■ Protected Circuit

Fuse No.	Capacity (A)	Protected circuit
1	10	Work light
2	10	Bi-speed
3	10	Brake light
4	10	Flasher lights
5	10	Hazard lights
6	10	Position lights
7	5	Panel instrument
8	10	Alternator, key stop
9	15	Head light, Horn
10	Slow blow fuse 50 A	Check circuit against wrong battery connection

(A) Fuse Box

W1023430

Replacing Light Bulb

1. Head lights and rear combination lights:

Take the bulb out of the light body and replace with a new one.

2. Other lights:

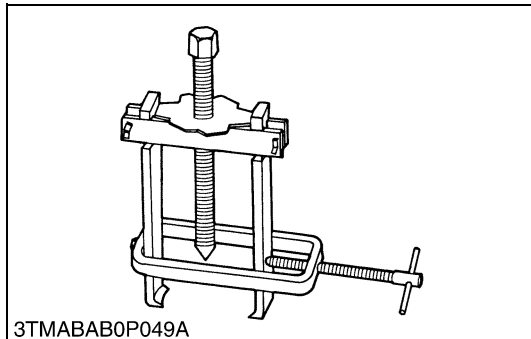
Detach the lens and replace the bulb.

Light	Capacity
Head light	45 W / 40 W
Tail light	10 W
Brake stop light	21 W
Turn signal / Hazard light	21 W
Front position light	10 W
Instrument panel light	1.7 W
Number plate light	10 W

W1023802

9. SPECIAL TOOLS

[1] SPECIAL TOOLS FOR ENGINE

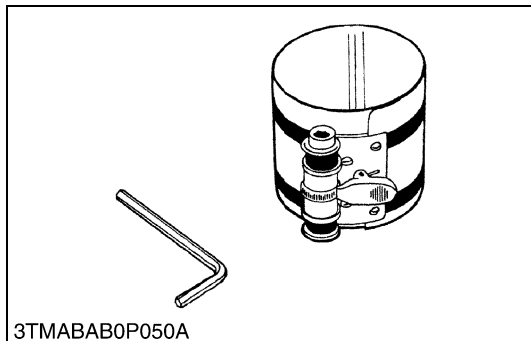


Special Use Puller Set

Code No: 07916-09032

Application: Use exclusively for pulling out bearing, gears and other parts with ease.

W1024050

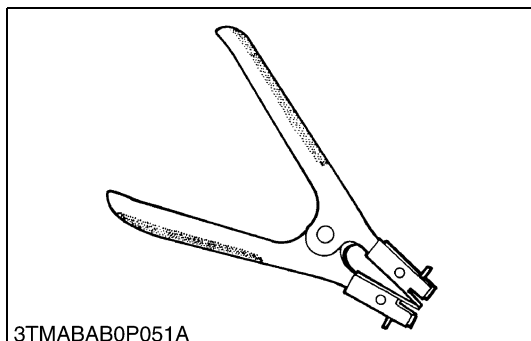


Piston Ring Compressor

Code No: 07909-32111

Application: Use exclusively for pushing in the piston with piston rings into the cylinder.

W1024100

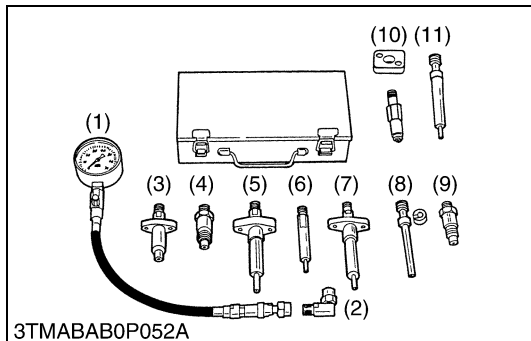


Piston Ring Tool

Code No: 07909-32121

Application: Use exclusively for removing or installing the piston ring with ease.

W1024150



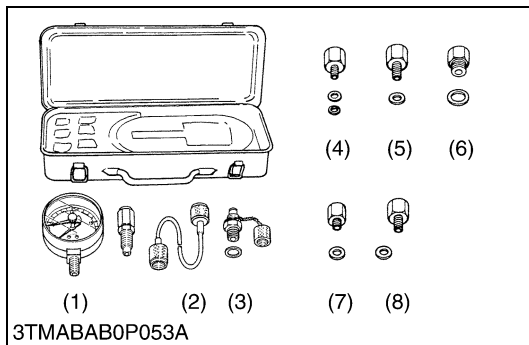
Diesel Engine Compression Tester

Code No: 07909-30208 (Assembly) 07909-31251 (G)
 07909-30934 (A to F) 07909-31271 (I)
 07909-31211 (E and F) 07909-31281 (J)
 07909-31231 (H)

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

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

W1024200

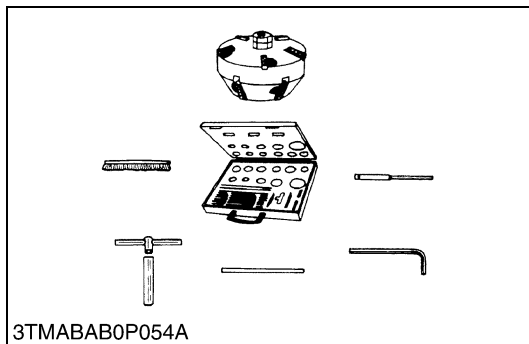
**Oil Pressure Tester**

Code No: 07916-32032

Application: Use to measure lubricating oil pressure.

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

W1024318

**Valve Seat Cutter**

Code No: 07909-33102

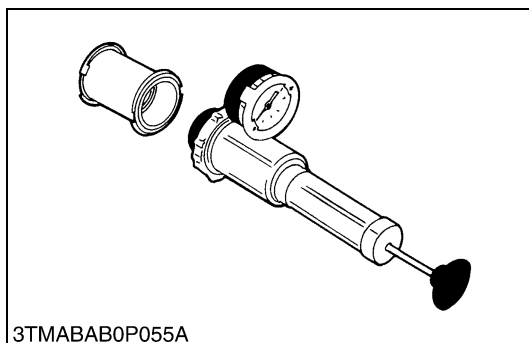
Application: Use to reseat valves.

Angle: 0.785 rad. (45°)

0.262 rad. (15°)

Diameter: 28.6 mm (1.126 in.)	38.0 mm (1.496 in.)
31.6 mm (1.244 in.)	41.3 mm (1.626 in.)
35.0 mm (1.378 in.)	50.8 mm (2.000 in.)

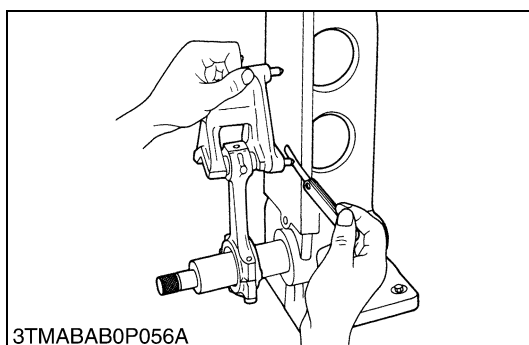
W1024458

**Radiator Tester**

Code No: 07909-31551

Application: Use to check of radiator cap pressure, and leaks from cooling system.

W1024532

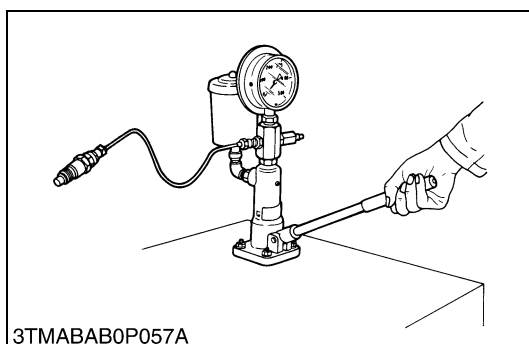
**Connecting Rod Alignment Tool**

Code No: 07909-31661

Application: Use to check the connecting rod alignment.

Applicable: Connecting rod big end I.D.
range 30 to 75 mm (1.18 to 2.95 in.) dia.Connecting rod length
65 to 300 mm (2.56 to 11.81 in.)

W1024583

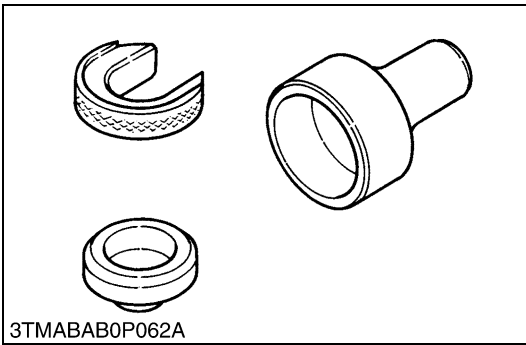
**Nozzle Tester**

Code No: 07909-31361

Application: Use to check the fuel injection pressure and spray pattern of nozzle.

Measuring: 0 to 50 MPa
range (0 to 500 kgf/cm², 0 to 7000 psi)

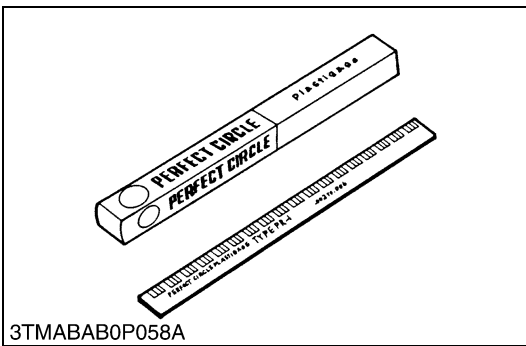
W1024653

**Auxiliary Socket For Fixing Crankshaft Sleeve**

Code No: 07916-32091

Application: Use to fix the crankshaft sleeve of the diesel engine.

W1077114

**Plastigage**

Code No: 07909-30241

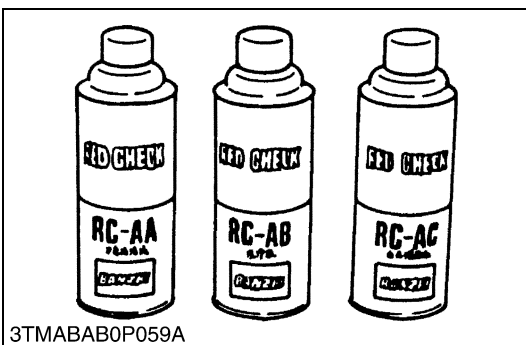
Application: Use to check the oil clearance between crankshaft and bearing, etc.

Measuring: Green 0.025 to 0.076 mm (0.001 to 0.003 in.)

range Red 0.051 to 0.152 mm (0.002 to 0.006 in.)

Blue 0.102 to 0.229 mm (0.004 to 0.009 in.)

W1024719

**Red Check**

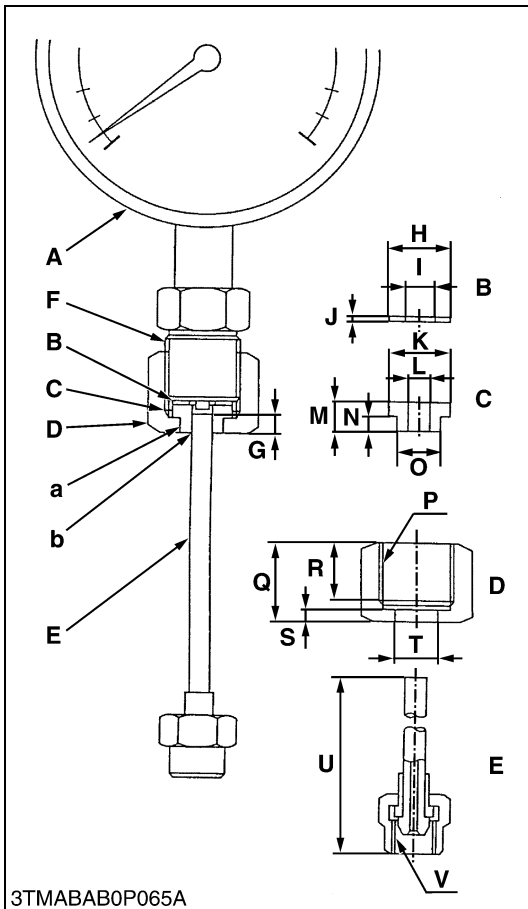
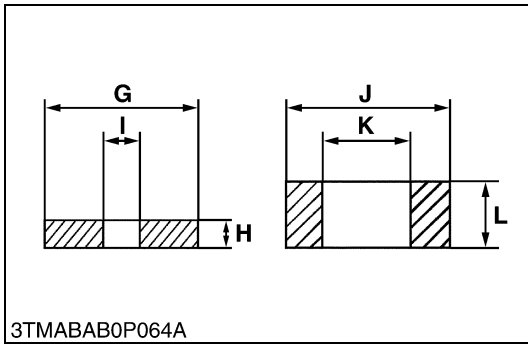
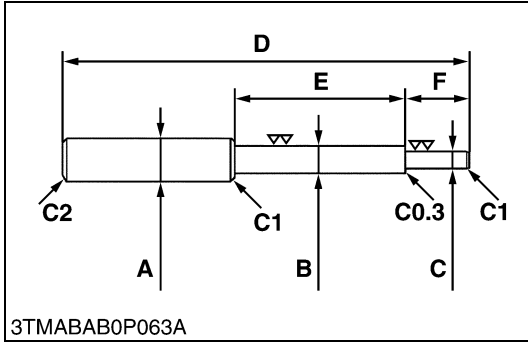
Code No: 07909-31371

Application: Use to check cracks on cylinder head, cylinder block, etc.

W1024909

■ NOTE

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



Valve Guide Replacing Tool

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

A	20 mm dia. (0.79 in. dia.)
B	11.7 to 11.9 mm dia. (0.460 to 0.468 in. dia.)
C	6.5 to 6.6 mm dia. (0.256 to 0.259 in. dia.)
D	225 mm (8.86 in.)
E	70 mm (2.76 in.)
F	45 mm (1.77 in.)
G	25 mm (0.98 in.)
H	5 mm (0.197 in.)
I	6.7 to 7.0 mm dia. (0.263 to 0.275 in. dia.)
J	20 mm dia. (0.787 in. dia.)
K	12.5 to 12.8 mm dia. (0.492 to 0.504 in. dia.)
L	8.9 to 9.1 mm (0.350 to 358 in.)
C1	Chamfer 1.0 mm (0.039 in.)
C2	Chamfer 2.0 mm (0.079 in.)
C0.3	Chamfer 0.3 mm (0.012 in.)

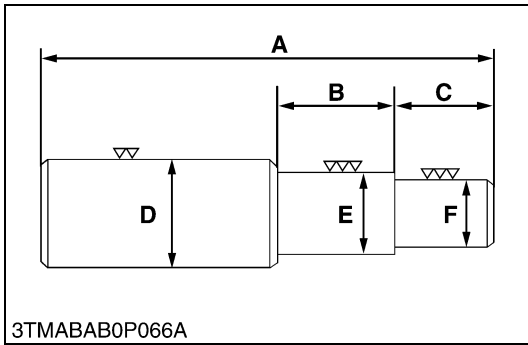
W1025017

Injection Pump Pressure Tester

Application: Use to check fuel tightness of injection pumps.

A	Pressure gauge full scale : More than 29.4 MPa (300 kg/cm ² , 4267 psi)
B	Copper gasket
C	Flange (Material : Steel)
D	Hex. nut 27 mm (1.06 in.) across the plat
E	Injection pipe
F	PF 1/2
G	5 mm (0.20 in.)
H	17 mm dia. (0.67 in. dia.)
I	8 mm dia. (0.31 in. dia.)
J	1.0 mm (0.039 in.)
K	17 mm dia. (0.67 in. dia.)
L	6.10 to 6.20 mm dia. (0.2402 to 0.2441 in. dia.)
M	8 mm (0.31 in.)
N	4 mm (0.16 in.)
O	11.97 to 11.99 mm dia. (0.4713 to 0.4721 in. dia.)
P	PF 1/2
Q	23 mm (0.91 in.)
R	17 mm (0.67 in.)
S	4 mm (0.16 in.)
T	12.00 to 12.02 mm dia. (0.4724 to 0.4732 in. dia.)
U	100 mm (3.94 in.)
V	M12 x P1.5
a	Adhesive application
b	Fillet welding on the enter circumference

W1025240



Bushing Replacing Tools

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

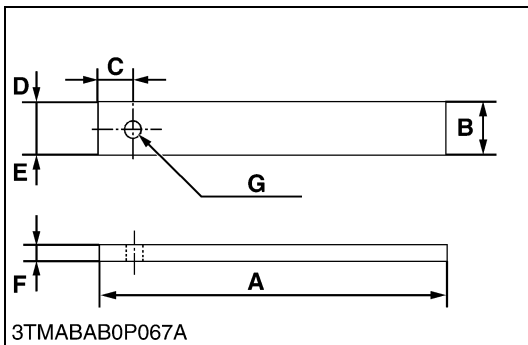
(1) For small end bushing

A	162 mm (6.38 in.)
B	35 mm (1.38 in.)
C	27 mm (1.06 in.)
D	35 mm dia. (1.38 in. dia.)
E	27.90 to 27.95 mm dia. (1.098 to 1.100 in. dia.)
F	25.00 to 25.01 mm dia. (0.984 to 0.985 in. dia.)

(2) For idle gear bushing

A	175 mm (6.89 in.)
B	40 mm (1.57 in.)
C	38 mm (1.49 in.)
D	45 mm dia. (1.77 in. dia.)
E	41.90 to 41.95 mm dia. (1.650 to 1.652 in. dia.)
F	37.95 to 37.97 mm dia. (1.494 to 1.495 in. dia.)

W1025500

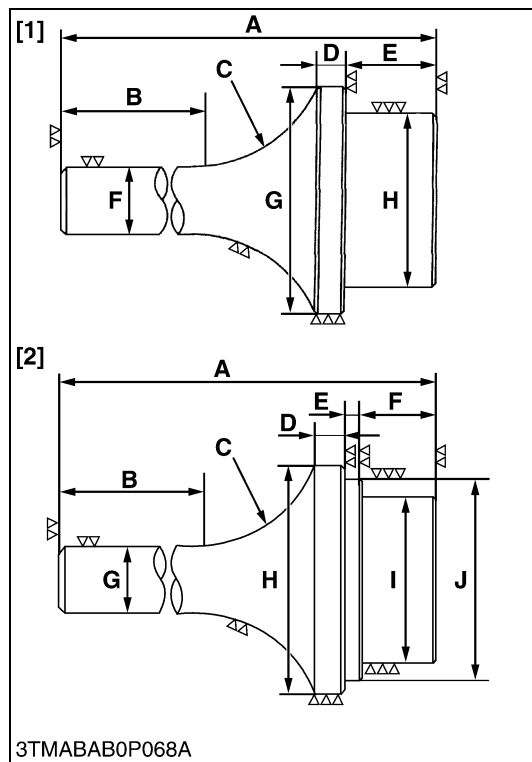


Flywheel Stopper

Application: Use to loosen and tighten the flywheel screw.

A	200 mm (7.87 in.)
B	30 mm (1.18 in.)
C	20 mm (0.79 in.)
D	15 mm (0.59 in.)
E	15 mm (0.59 in.)
F	8 mm (0.31 in.)
G	10 mm dia. (0.39 in. dia.)

W1025948



Crankshaft Bearing 1 Replacing Tool

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

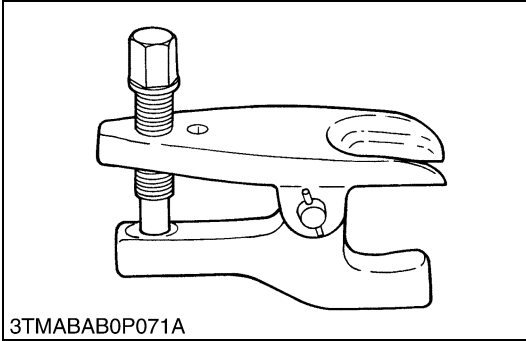
1. Extracting tool

A	135 mm (5.31 in.)
B	72 mm (2.83 in.)
C	R40 mm (R1.57 in.)
D	10 mm (0.39 in.)
E	20 mm (0.79 in.)
F	20 mm dia. (0.79 in. dia.)
G	56.8 to 56.9 mm dia. (2.236 to 2.240 in. dia.)
H	51.8 to 51.9 mm dia. (2.039 to 2.043 in. dia.)

2. Inserting tool

A	130 mm (5.12 in.)
B	72 mm (2.83 in.)
C	R40 mm (R1.57 in.)
D	9 mm (0.35 in.)
E	4 mm (0.16 in.)
F	20 mm (0.79 in.)
G	20 mm dia. (0.79 in. dia.)
H	68 mm dia. (2.68 in. dia.)
I	51.8 to 51.9 mm dia. (2.039 to 2.043 in. dia.)
J	56.8 to 56.9 mm dia. (2.236 to 2.240 in. dia.)

W1026139

[2] SPECIAL TOOLS FOR TRACTOR

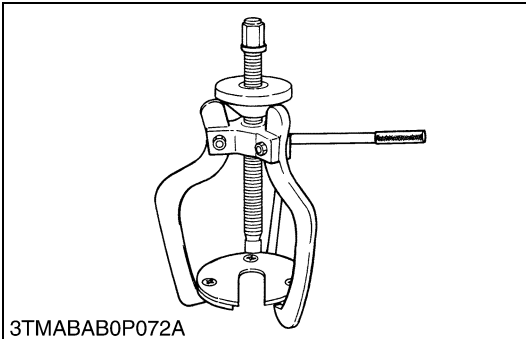
3TMABAB0P071A

Tie-rod End Lifter

Code No: 07909-39051

Application: Use for removing the tie-rod end with ease.

W1026472



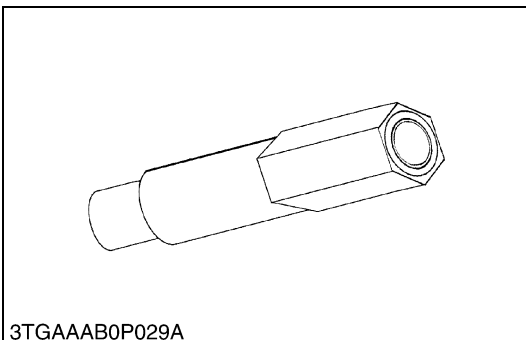
3TMABAB0P072A

Steering Wheel Puller

Code No: 07916-51090

Application: Use for removing the steering wheel without damaging the steering shaft.

W1026533



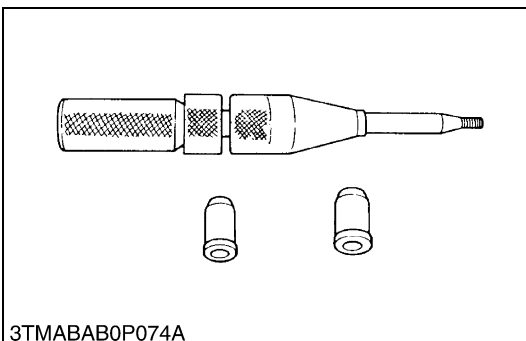
3TGAAAB0P029A

Long Connector (HST Measurement Kit for B7100HST)

Code No: 07916-60831

Application: Use for checking HST charge relief pressure.

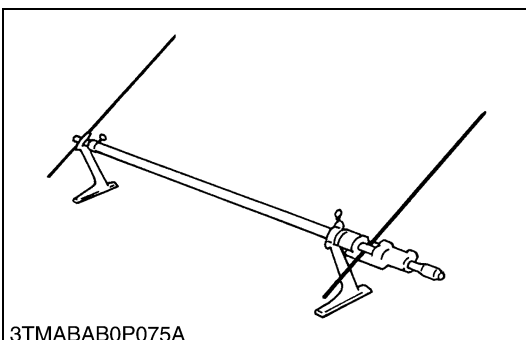
W1026585



3TMABAB0P074A

Clutch Center Tool (For B and L Series Tractors)Application: The clutch center tool can be used for all **B** and **L** series tractors with a diaphragm clutch by changing tip guides. Center piece diameter is 20 mm (0.79 in.).

W1026637



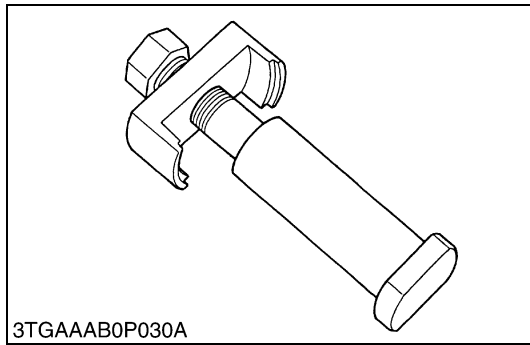
3TMABAB0P075A

Toe-in Gauge

Code No: 07909-31681

Application: This allows easy measurement of toe-in for all machine models.

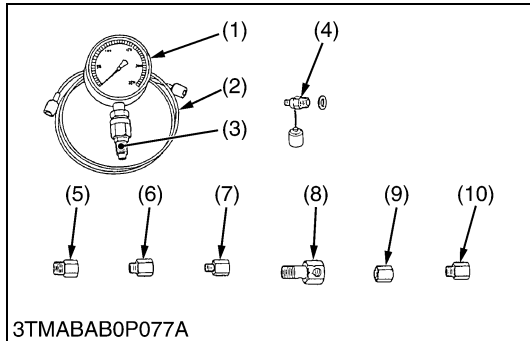
W1026689

**Clutch Pack Disassembly Tool**

Code No: 07916-53741

Application: This allows easy installation of bi-speed clutch pack spring.

W1073259

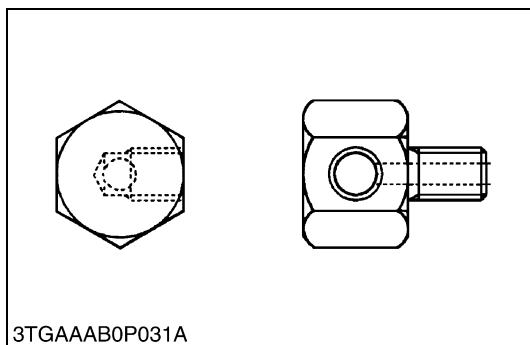
**Relief Valve Pressure Tester**

Code No: 07916-50045

Application: This allows easy measurement of relief set pressure.

- | | |
|----------------------------------|---------------------------------------|
| (1) Gauge (07916-50322) | (6) Adaptor C (PS3/8) (07916-50371) |
| (2) Cable (07916-50331) | (7) Adaptor D (PT1/8) (07916-50381) |
| (3) Threaded Joint (07916-50401) | (8) Adaptor E (PS3/8) (07916-50392) |
| (4) Threaded Joint (07916-50341) | (9) Adaptor F (PF1/2) (07916-62601) |
| (5) Adaptor B (M18 × P1.5) | (10) Adaptor 58 (PT1/4) (07916-52391) |
| | (07916-50361) |

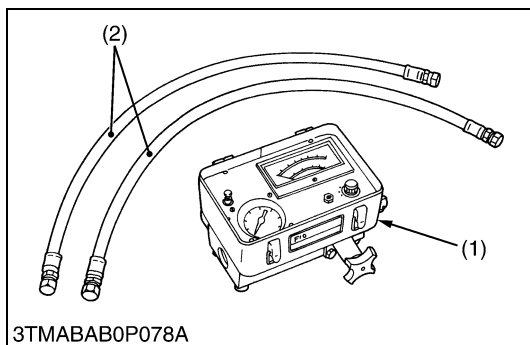
W1026741

**Adaptor 7**

Code No: 07916-32951

Application: Use for testing the hydraulic relief pressure.

W1077047

**Flow Meter**

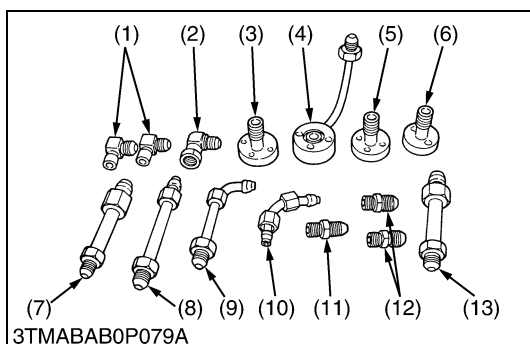
Code No: 07916-52791 (Flow Meter)

07916-52651 (Hydraulic Test Hose)

Application: This allows easy testing of hydraulic system.

- | | |
|----------------|-------------------------|
| (1) Flow Meter | (2) Hydraulic Test Hose |
|----------------|-------------------------|

W1031318

**Adaptor Set for Flow Meter**

Code No: 07916-54031

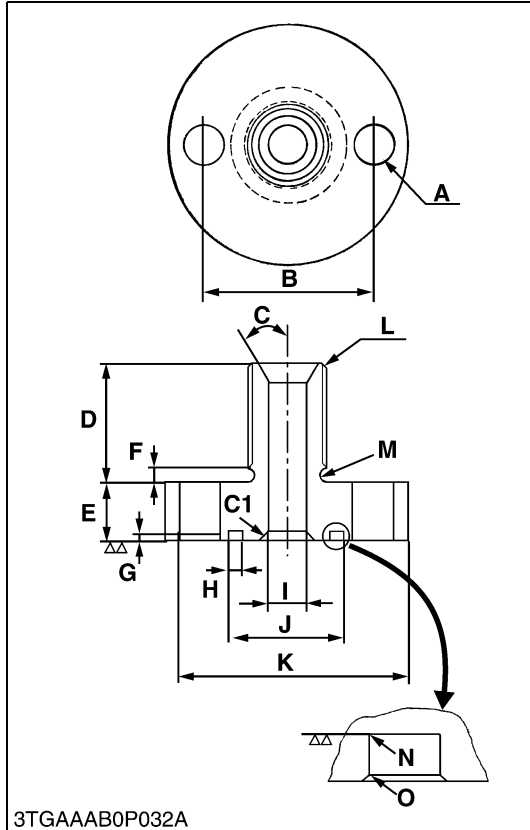
Application: Use for testing the hydraulic system.

- | | |
|----------------|--------------------------|
| (1) Adaptor 52 | (8) Adaptor 65 |
| (2) Adaptor 53 | (9) Adaptor 66 |
| (3) Adaptor 54 | (10) Adaptor 67 |
| (4) Adaptor 61 | (11) Adaptor 68 |
| (5) Adaptor 62 | (12) Adaptor 69 |
| (6) Adaptor 63 | (13) Hydraulic Adaptor 1 |
| (7) Adaptor 64 | |

W1031396

■ NOTE

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



Adaptor for Flow Meter

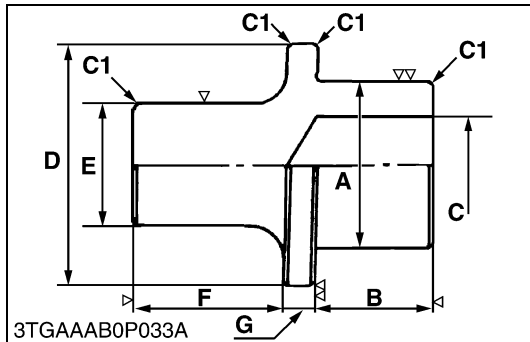
Application: Use for checking the hydraulic pump for 3P linkage.

■ NOTE

- When using, attach with following parts.
O-ring : 04811-00180

A	2-8.5 mm dia. (2-0.334 in.dia.)
B	40 mm (1.57 in.)
C	0.52 rad. (30 °)
D	25 mm (0.98 in.)
E	15 mm (0.59 in.)
F	3 mm (0.118 in.)
G	1.7 to 1.9 mm (0.067 to 0.075 in.)
H	3.0 to 3.25 mm (0.118 to 0.128 in.)
I	8.0 mm dia. (0.315 in. dia.)
J	23.9 to 24.1 mm dia. (0.941 to 0.945 in. dia.)
K	60 mm dia. (2.36 in. dia.)
L	PS 3/8
M	1.5 mm Round (0.059 in. Round)
N	0.3 mm Round (0.012 in. Round)
O	0.2 mm Chamfer (0.0078 in. Chamfer)

W1031593

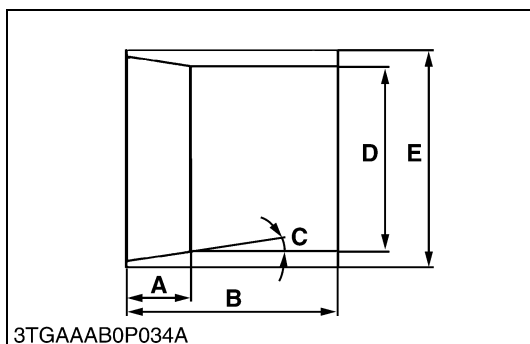


Hydraulic Arm Shaft Bushing Replacing Tool

Application: Use for replacing the hydraulic arm shaft bushing in the hydraulic cylinder block.

	Right	Left
A	37.90 to 37.95 mm dia. (1.492 to 1.494 in. dia.)	34.90 to 34.95 mm dia. (1.374 to 1.376 in. dia.)
B	40 mm (1.575 in.)	35 mm (1.378 in.)
C	28 mm dia. (1.102 in. dia.)	25 mm dia. (0.984 in. dia.)
D	44.5 mm dia. (1.7 5 in. dia.)	
E	30 mm dia. (1.18 in. dia.)	
F	50 mm (1.97 in.)	
G	10 mm (0.39 in.)	

W1031655



Piston Gasket Correcting Tool

Application: Compress the power steering cylinder piston gasket to the correct side when install the cylinder rod to the cylinder tube with ease.

A	13.97 mm (0.55 in.)
B	35.052 mm (1.38 in.)
C	0.122 rad. (7 °)
D	40.000 to 40.039 mm dia. (1.57 to 1.58 in. dia.)
E	46 mm dia. (1.82 in. dia.)

W1073871

10. TIRES

[1] TIRE PRESSURE



CAUTION

- Do not attempt mount a tire. This should be done by a qualified person with the proper equipment.
- Always maintain the correct tire pressure.
Do not inflate tires above the recommended pressure as shown below.

IMPORTANT

- Do not use tires larger than specified.
- When you intend to mount different size of tires from equipped ones, consult your distributor about front drive gear ratio for detail.
Excessive wear of tires may occur due to improper gear ratio.

Type		Tire sizes	Inflation pressure
Farm	Front	6 – 12 4PR	200 kPa 2.0 kgf/cm ² 28.4 psi
		6.00 – 12 4PR	180 kPa 1.8 kgf/cm ² 25.6 psi
	Rear	9.5 – 22 4PR	140 kPa 1.4 kgf/cm ² 19.9 psi
		12.4 – 16 4PR	120 kPa 1.2 kgf/cm ² 17.1 psi
Turf	Front	24 × 8.50 – 14 4PR	160 kPa 1.6 kgf/cm ² 22.8 psi
	Rear	13.6 – 16 4PR	96.5 kPa 1.0 kgf/cm ² 14 psi

Though the tire pressure is factory-set to the prescribed level, it naturally drops slowly in the course of time. Thus, check it everyday and inflate as necessary.

[2] TREAD

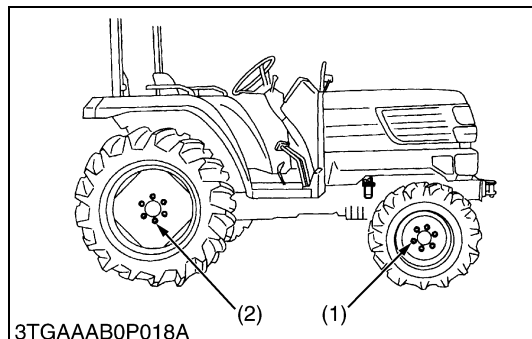


CAUTION

- Support tractor securely on stands before removing a wheel.
- Never operate tractor with a loose rim, wheel or axle.

IMPORTANT

- Always attach tires as shown in the figure. (See page G-40.)
- If not attached as the figure, transmission parts may be damaged.
- Do not use tires larger than specified.



Wheel Tightening Screws and Nuts

1. When refitting or adjusting a wheel, tighten the screws and nuts with specified tightening torque.
2. Recheck after driving the tractor 200 m (200 yards) and therefore according to service interval.

Tightening torque	Front wheel mounting screw and nut	85 N·m 9.0 kgf·m 65.1 ft·lbs
	Rear wheel mounting screw and nut	215 N·m 22.0 kgf·m 159.1 ft·lbs

(1) Front Wheel

(2) Rear Wheel

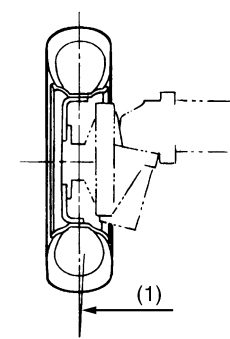
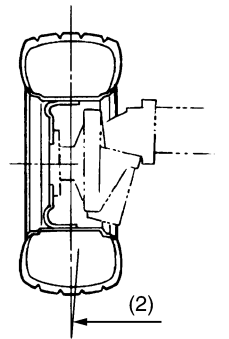
W1032716

(1) Front Wheels

Front wheel tread cannot be adjusted.

■ **IMPORTANT**

- **Do not turn front discs to obtain wider tread. In setting up the front wheels, make sure that the inflation valve stem of the tires face outward.**

Tires	6 – 12 Farm 6.00 – 12 Farm	24 × 8.50 – 14 Turf
Tread	 <p>3TGAAAB0P035A</p>	 <p>3TGAAAB0P036A</p>

(1) 1020 mm (40.16 in.)

(2) 1020 mm (40.16 in.)

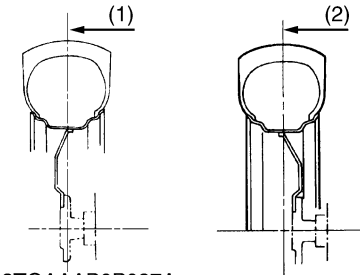
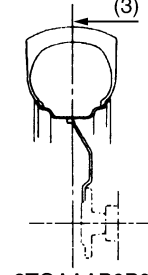
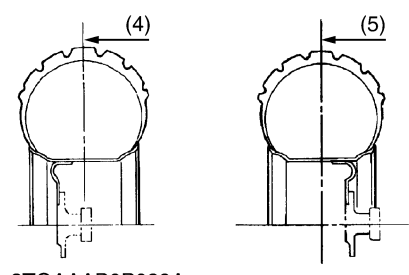
(2) Rear Wheels

CAUTION

- **When working on slopes or working with trailer, set the wheel tread as wide as practical for the job for maximum stability.**

Rear tread can be adjusted as shown with the standard equipped tires. To change the tread.

1. Change the position of the right and left tires.

Tires	9.5 – 22 Farm	12.4 – 16 Farm	13.6 – 16 Turf
Tread	 <p>3TGAAAB0P037A</p>	 <p>3TGAAAB0P038A</p>	 <p>3TGAAAB0P039A</p>

(1) 950 mm (37.40 in.)

(3) 1148 mm (45.20 in.)

(4) 965 mm (37.99 in.)

(5) 1055 mm (41.5 in.)

(2) 1070 mm (42.13 in.)

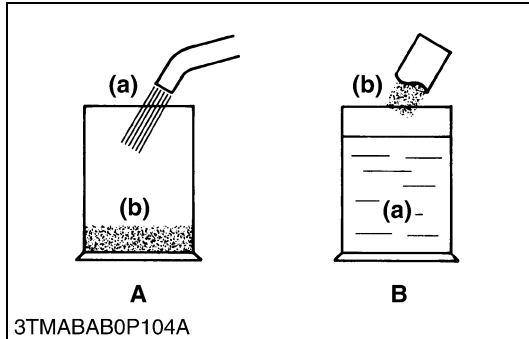
[3] TIRE LIQUID INJECTION

Auxiliary weights can be used to increase traction force for plowing in fields or clayey ground.

Another way is to inject water or another liquid, such as a calcium chloride solution in the tires. Water must not be used in winter since it freezes at 0 °C (32 °F). The calcium chloride solution will not freeze and moreover, affords higher effect than water since its specific gravity is higher than that of water by about 20 %. Below is an explanation of calcium chloride solution injection.

■ IMPORTANT

- Do not fill the front tires with liquid.



Preparation of Calcium Chloride Solution

⚠ CAUTION

- When making a calcium chloride solution, do not pour water over calcium chloride since this results in chemical reaction which will cause high temperature. Instead add a small amount of calcium chloride to the water at a time until the desired solution is achieved.

Freezing temp.	Weight of CaCl ₂ to be dissolved in 100 L (26.5 U.S.gals., 22.0 Imp.gals.) of water
-5 °C (23 °F)	12 kg (26.4 lbs)
-10 °C (14 °F)	21 kg (46.3 lbs)
-15 °C (5 °F)	28 kg (61.7 lbs)
-20 °C (-4 °F)	34 kg (75.0 lbs)
-25 °C (-13 °F)	40 kg (88.2 lbs)
-30 °C (-22 °F)	44 kg (97.0 lbs)
-35 °C (-31 °F)	49 kg (108 lbs)
-40 °C (-40 °F)	52 kg (114.6 lbs)
-45 °C (-49 °F)	56 kg (123.5 lbs)
-50 °C (-58 °F)	61 kg (134.5 lbs)

(a) Water

(b) CaCl₂ (Calcium Chloride)

W1033083

Attaching Injector

1. Lift the rear tires off the ground.
2. Turn the tire so that the air valve is at the top.
3. Remove the air valve, and attach the injector. (Code No. 07916-52511)

(1) Injector

(2) Hose

W1033331

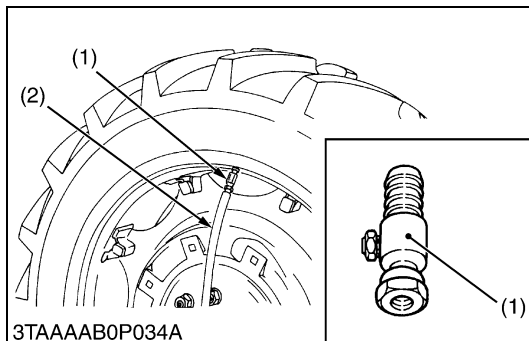


Fig. 1

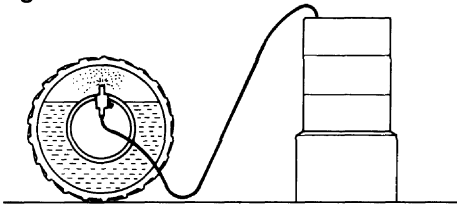


Fig. 2

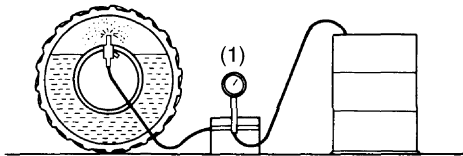
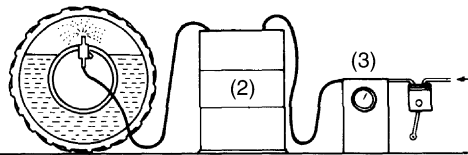


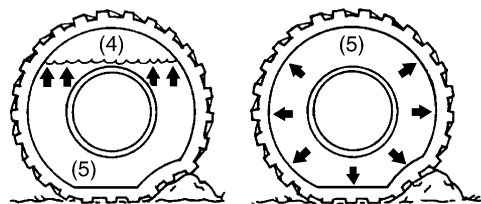
Fig. 3



3TMABAB0P111A

(A)

(B)



3TMABAB0P107A

Injection

CAUTION

- When a calcium chloride solution is used, cool it before pouring it into the tire.
- Do not fill tires with water or solution more than 75 % of full capacity (to the valve stem level).

The following four ways can be used to inject water or a calcium chloride solution into tires.

1. Gravity injection (Fig. 1)
2. Pump injection (Fig. 2)
3. Pressure tank injection (Fig. 3)
4. Injection directly from tap (only when water is being used).

NOTE

- Once injection is completed, reset the air valve, and pump air into the tire to the specified pressure.

Weight of Calcium Chloride Solution Filling 75 % of Full Capacity of a Tire

Tire sizes	9.5-22	12.4-16
Slush free at -10 °C (14 °F) Solid at -30 °C (-22 °F) [Approx. 1 kg (2 lbs.) CaCl ₂ per 4 L (1 gal.) of water]	68 kg (150 lbs)	85 kg (187 lbs)
Slush free at -24 °C (-11 °F) Solid at -47 °C (-53 °F) [Approx. 1.5 kg (3.5 lbs.) CaCl ₂ per 4 L (1 gal.) of water]	72 kg 159 lbs	89 kg (196 lbs)
Slush free at -47 °C (-53 °F) Solid at -52 °C (-62 °F) [Approx. 2.25 kg (5 lbs.) CaCl ₂ per 4 L (1 gal.) of water]	76 kg (168 lbs)	94 kg (207 lbs)

- (1) Pump
- (2) Pressure Tank
- (3) Compressor
- (4) Air
- (5) Water

- (A) Correct : 75 %
Air Compresses Like A Cushion
- (B) Incorrect : 100 % Full
Water Can Not Be Compressed

W1033435

11. IMPLEMENT LIMITATIONS

The KUBOTA Tractor has been thoroughly tested for proper performance with implements sold or approved by KUBOTA. Use with implements 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.]

	Max. width of tire tread				Lower link end max. lifting capacity W_0
	Front		Rear		
ST α -30 ST α -35	6 – 12 Farm 6.00 – 12 Farm	1020 mm (401.57 in.)	9.5-22 Farm	1070 mm (421.26 in.)	1150 kg (2535 lbs)
	24 × 8.50 – 14 Turf		12.4-16 Farm (Option)	1148 mm (451.97 in.)	
			13.6-16 Turf	1055 mm (415.35 in.)	
	Actual figures				
	Lift capacity 24 inches behind lower link end W_1	Max. Drawbar Load W_2		Trailer loading weight W_3 Max. capacity	
ST α -30 ST α -35	890 kg (1962 lbs)	Drawbar	500 kg (1102 lbs)	1500 kg (3300 lbs)	
		High-hitch	490.5 kg (1081 lbs)		
<p>W_0 :Lower link end max. hydraulic lifting capacity W_1 :The implement's weight which can be put on the lower link (Implement weight) W_2 :Max. drawbar load W_3 :The max. loading weight for trailer (without trailer's weight) (Trailer loading weight)</p>					
3TMABAB0P109A					

■ NOTE

- Implement size may vary depending on soil operating conditions.

1 ENGINE

MECHANISM

CONTENTS

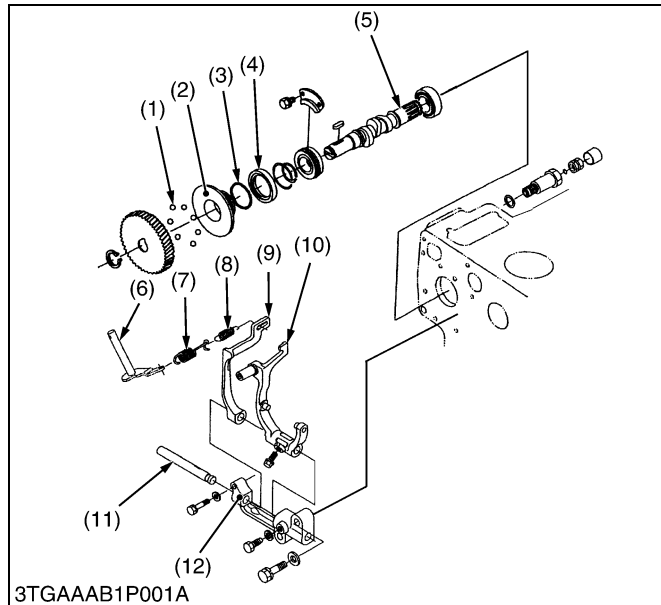
1. FUEL SYSTEM	1-M1
[1] GOVERNOR	1-M1

NOTICE

For not above-mentioned engine mechanism information, please refer ENGINE MECHANISM WSM (97897-01871).

1. FUEL SYSTEM

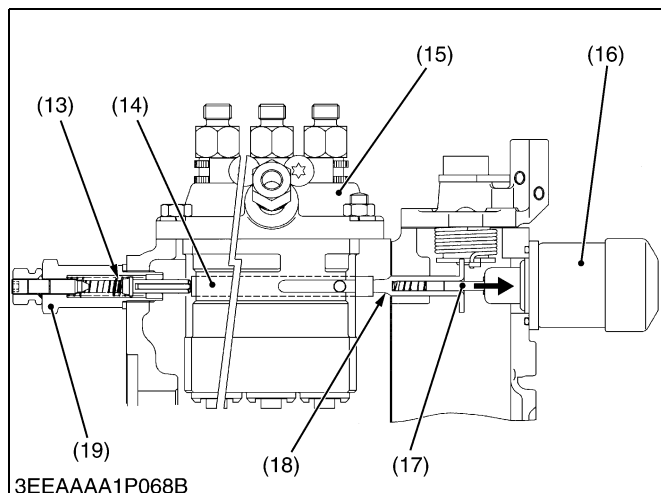
[1] GOVERNOR



The governor serves to keep engine speed constant by automatically adjusting the amount of fuel supplied to the engine according to changes in the load. This engine employs an all-speed governor which controls the centrifugal force of the steel ball (1) weight, produced by rotation of the fuel camshaft (5), and the tension of the governor spring 1 (7) and 2 (8) are balanced.

- | | |
|------------------------|------------------------|
| (1) Steel Ball | (7) Governor Spring 1 |
| (2) Governor Sleeve | (8) Governor Spring 2 |
| (3) Steel Ball | (9) Fork Lever 2 |
| (4) Governor Ball Case | (10) Fork Lever 1 |
| (5) Fuel Camshaft | (11) Fork Lever Shaft |
| (6) Governor Lever | (12) Fork Lever Holder |

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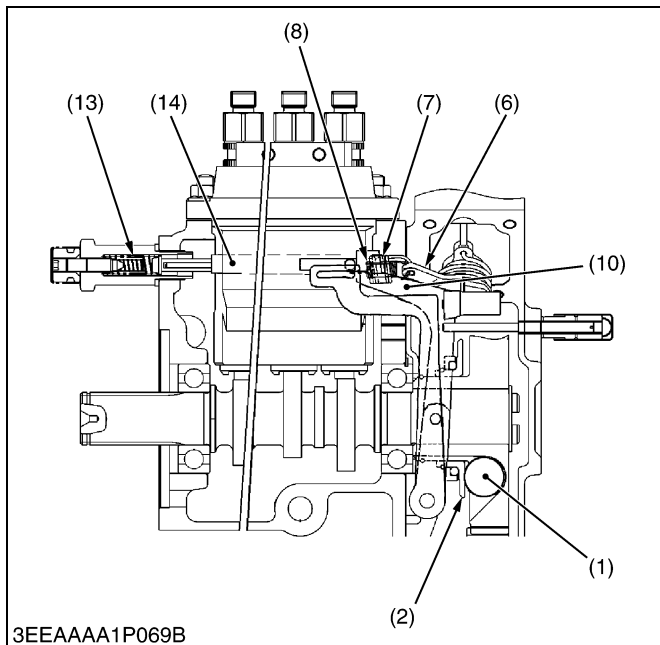
■ At Start

Flowing of the battery current into the engine stop solenoid (16), the plunger (17) is actuated to arrow direction.

Since the steel ball (1) have no centrifugal force, the control rack (14) is pushed to the right by the start spring (13). Accordingly, the control rack (14) moves to the maximum injection position to assure easy starting.

- | | |
|---------------------------|-----------------------|
| (13) Start Spring | (17) Plunger |
| (14) Control Rack | (18) Guide |
| (15) Injection Pump | (19) Idling Apparatus |
| (16) Engine Stop Solenoid | |

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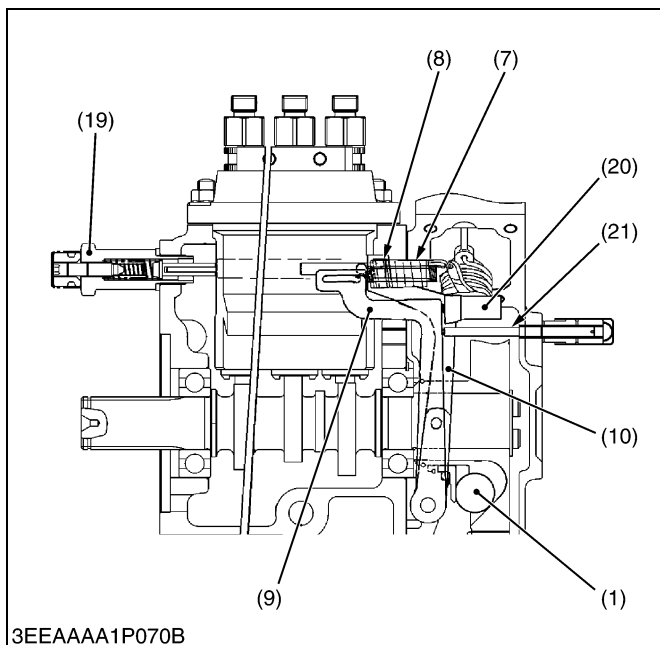
■ At Idling

When the speed control lever is set at the idling position after the engine starts, the governor spring 1 (7) does not work at all and the governor spring 2 (8) does only act slightly. The governor sleeve (2) is pushed leftward by a centrifugal force of steel ball (1).

Therefore, the fork lever 1 (10) and control rack (14) are moved to the left by the governor sleeve (2) and then the start spring (13) is compressed by the control rack. As a result, the control rack is kept at a position where a centrifugal force of steel ball and forces of start spring (13), governor spring 2 (8) are balanced, providing stable idling.

- | | |
|-----------------------|-----------------------|
| (1) Steel Ball | (8) Governor Spring 2 |
| (2) Governor Sleeve | (10) Fork Lever 1 |
| (6) Governor Lever | (13) Start Spring |
| (7) Governor Spring 1 | (14) Control Rack |

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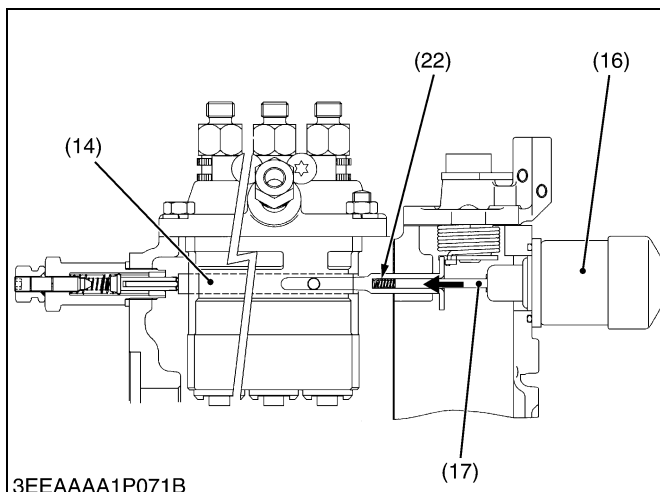
■ At High Speed Running with Overload

When an overload is applied to the engine running at a high speed, the centrifugal force of steel ball (1) becomes small as the engine speed is dropped, and fork lever 2 (9) is pulled to the right by the governor springs 1 (7) and 2 (8), increasing fuel injection. Though, fork lever 2 (9) becomes ineffective in increasing fuel injection when it is stopped by the adjusting screw (21).

After that, when the force of torque spring (20) becomes greater than the centrifugal force of the steel ball, fork lever 1 (10) moves rightward to increase fuel injection, causing the engine to run continuously at a high torque.

- | | |
|-----------------------|-----------------------|
| (1) Steel Ball | (10) Fork Lever 1 |
| (7) Governor Spring 1 | (19) Idling Apparatus |
| (8) Governor Spring 2 | (20) Torque Spring |
| (9) Fork Lever 2 | (21) Adjusting Screw |

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■ To Stop Engine

When the battery current stops, the plunger (17) of engine stop solenoid (16) is returned to the original position, the spring (22) to keep the control rack (14) in "No fuel injection" position.

- | | |
|---------------------------|--------------|
| (14) Control Rack | (17) Plunger |
| (16) Engine Stop Solenoid | (22) Spring |

W1018007

SERVICING

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1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Engine Does Not Start	<ul style="list-style-type: none"> No fuel Air in the fuel system Water in the fuel system Fuel pipe clogged Fuel filter clogged Excessively high viscosity of fuel or engine oil at low temperature Fuel with low cetane number Fuel leak due to loose injection pipe retaining nut Incorrect injection timing Fuel camshaft worn Injection nozzle clogged Injection pump malfunctioning Seizure of crankshaft, camshaft, piston, cylinder or bearing Compression leak from cylinder Improper valve timing Piston ring and cylinder worn Excessive valve clearance 	<ul style="list-style-type: none"> Replenish fuel Bleed Change fuel and repair or replace fuel system Clean Change Use the specified fuel or engine oil Use the specified fuel Tighten nut Adjust Replace Clean Repair or replace Repair or replace Replace head gasket, tighten cylinder head screw, glow plug and nozzle holder Correct or replace timing gear Replace Adjust 	<ul style="list-style-type: none"> G-8 G-28 – – G-18 G-8 G-8 – 1-S50 – – – – – 1-S20 – 1-S40, S47 1-S21
Starter Does Not Run	<ul style="list-style-type: none"> Battery discharged Starter malfunctioning Main switch malfunctioning Clutch safety switch, HST safety switch or PTO safety switch improperly adjusted or defective Starter relay defective Wiring disconnected 	<ul style="list-style-type: none"> Charge Repair or replace Repair or replace Repair or replace Replace Connect 	<ul style="list-style-type: none"> G-22 10-S8 10-S7 2-S4, 3-S7, 10-S10 10-S8 –
Engine Revolution is Not Smooth	<ul style="list-style-type: none"> Fuel filter clogged or dirty Air cleaner clogged Fuel leak due to loose injection pipe retaining nut Injection pump malfunctioning Incorrect nozzle injection pressure Injection nozzle stuck or clogged Governor malfunctioning 	<ul style="list-style-type: none"> Change Clean or change Tighten nut Repair or replace Adjust Repair or replace Repair 	<ul style="list-style-type: none"> G-18 G-17 – – 1-S53 1-S54 1-S24
Either White or Blue Exhaust Gas is Observe	<ul style="list-style-type: none"> Excessive engine oil Piston ring and cylinder worn or stuck Incorrect injection timing Deficient compression 	<ul style="list-style-type: none"> Reduce to the specified level Repair or replace Adjust Adjust top clearance 	<ul style="list-style-type: none"> G-12 1-S40, S47 1-S51 1-S22

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Symptom	Probable Cause	Solution	Reference Page
Either Black or Dark Gray Exhaust Gas is Observe	<ul style="list-style-type: none"> • Overload • Low grade fuel used • Fuel filter clogged • Air cleaner clogged • Deficient nozzle injection 	Reduce the load Use the specified fuel Change Clean or change Repair or replace the nozzle	– G-8 G-18 G-17 1-S53
Deficient Output	<ul style="list-style-type: none"> • Incorrect injection timing • Engine's moving parts seem to be seizing • Uneven fuel injection • Deficient nozzle injection • Compression leak 	Adjust Repair or replace Repair or replace the injection pump Repair or replace the nozzle Replace head gasket, tighten cylinder head bolt, glow plug and nozzle holder	1-S51 – – 1-S53 1-S20
Excessive Lubricant Oil Consumption	<ul style="list-style-type: none"> • Piston ring's gap facing the same direction • Oil ring worn or stuck • Piston ring groove worn • Valve stem and guide worn • Oil leaking due to defective seals or packing 	Shift ring gap direction Replace Replace the piston Replace Replace	1-S29 1-S40 1-S41 1-S33 –
Fuel Mixed into Lubricant Oil	<ul style="list-style-type: none"> • Injection pump's plunger worn • Deficient nozzle injection • Injection pump broken 	Replace pump element or pump Repair or replace the nozzle Replace	– 1-S52 1-S52
Water Mixed into Lubricant Oil	<ul style="list-style-type: none"> • Head gasket defective • Cylinder block or cylinder head flawed 	Replace Replace	1-S24 –
Low Oil Pressure	<ul style="list-style-type: none"> • Engine oil insufficient • Oil strainer clogged • Relief valve stuck with dirt • Relief valve spring weaken or broken • Excessive oil clearance of crankshaft bearing • Excessive oil clearance of crankpin bearing • Excessive oil clearance of rocker arm • Oil passage clogged • Different type of oil • Oil Pump defective 	Replenish Clean Clean Replace Replace Replace Replace Clean Use the specified type of oil Repair or replace	G-8 1-S28 – – 1-S44 1-S43 1-S36 – G-8 1-S48
High Oil Pressure	<ul style="list-style-type: none"> • Difference type oil • Relief valve defective 	Use the specified type of oil Replace	G-8 1-S48

W1014322

Symptom	Probable Cause	Solution	Reference Page
Engine Overheated	<ul style="list-style-type: none"> • Engine oil insufficient • Fan belt broken or elongated • Coolant insufficient • Radiator net and radiator fin clogged with dust • Inside of radiator corroded • Coolant flow route corroded • Radiator cap defective • overload running • Head gasket defective • Incorrect injection timing • Unsuitable fuel used 	Replenish Change or adjust Replenish Clean Clean or replace Clean or replace Replace Reduce the load Replace Adjust Use the specified fuel	G-8 1-S49 G-26 – G-26 – 1-S50 – 1-S24 1-S51 G-8

W1014322

2. SERVICING SPECIFICATIONS

ENGINE BODY

Item		Factory Specification	Allowable Limit
Cylinder Head Surface	Flatness	–	0.05 mm / 500 mm 0.0020 in. / 19.69 in.
Compression Pressure (When Cranking with Starting Motor)		3.53 to 4.02 MPa / 290 rpm 36 to 41 kgf/cm ² / 290 rpm 512 to 583 psi / 290 rpm	2.55 MPa / 290 rpm 26 kgf/cm ² / 290 rpm 370 psi / 290 rpm
Difference among Cylinders		–	10 % or less
Top Clearance		0.55 to 0.70 mm 0.0217 to 0.0276 in.	–
Valve Clearance (At Engine Cold)		0.18 to 0.22 mm 0.0071 to 0.0087 in.	–
Valve Seat	Width (Intake)	2.12 mm 0.0835 in.	–
	Width (Exhaust)	2.12 mm 0.0835 in.	–
Valve Seat	Angle (Intake)	1.047 rad. 60 °	–
	Angle (Exhaust)	0.785 rad. 45 °	–
Valve Face	Angle (Intake)	1.047 rad. 60 °	–
	Angle (Exhaust)	0.785 rad. 45 °	–
Valve Stem to Valve Guide	Clearance	0.040 to 0.070 mm 0.00157 to 0.00276 in.	0.1 mm 0.0039 in.
Valve Stem	O.D.	7.960 to 7.975 mm 0.31339 to 0.31398 in.	–
Valve Guide	I.D.	8.015 to 8.030 mm 0.31555 to 0.31614 in.	–
Valve Recessing	Protrusion	0.05 mm 0.0020 in.	–
	Recessing	0.15 mm 0.0059 in.	0.4 mm 0.0157 in.

W1013874

ENGINE BODY (Continued)

Item			Factory Specification	Allowable Limit
Valve Timing (Intake Valve)	D1463-M	Open	0.14 rad. (8 °) before T.D.C.	–
		Close	0.35 rad. (20 °) after B.D.C.	–
	D1703-M	Open	0.21 rad. (12 °) before T.D.C.	–
		Close	0.63 rad. (36 °) after B.D.C.	–
Valve Timing (Exhaust Valve)	D1463-M	Open	1.05 rad. (60 °) before B.D.C.	–
		Close	0.21 rad. (12 °) after T.D.C.	–
	D1703-M	Open	1.00 rad. (57 °) before B.D.C.	–
		Close	0.21 rad. (12 °) after T.D.C.	–
Valve Spring		Free Length	41.7 to 42.2 mm 1.6417 to 1.6614 in.	41.2 mm 1.6220 in.
		Setting Load	117.6 N 12.0 kgf 26.4 lbs	100.0 N 10.2 kgf 22.5 lbs
		Setting Length	35.0 mm 1.3780 in.	–
		Tilt	–	1.0 mm 0.039 in.
Rocker Arm Shaft to Rocker Arm		Clearance	0.016 to 0.045 mm 0.00063 to 0.00177 in.	0.15 mm 0.0059 in.
Rocker Arm Shaft		O.D.	13.973 to 13.984 mm 0.55012 to 0.55055 in.	–
Rocker Arm		I.D.	14.000 to 14.018 mm 0.55118 to 0.55189 in.	–
Push Rod		Alignment	–	0.25 mm 0.0098 in.
Tappet to Tappet Guide		Clearance	0.020 to 0.062 mm 0.00079 to 0.00244 in.	0.07 mm 0.0028 in.
Tappet		O.D.	23.959 to 23.980 mm 0.94327 to 0.94410 in.	–
Tappet Guide		I.D.	24.000 to 24.021 mm 0.94488 to 0.94571 in.	–

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ENGINE BODY (Continued)

Item		Factory Specification	Allowable Limit
Timing Gear Crank Gear to Idle Gear	Backlash	0.0415 to 0.1122 mm 0.00163 to 0.00442 in.	0.15 mm 0.0059 in.
Idle Gear to Cam Gear	Backlash	0.0415 to 0.1154 mm 0.00163 to 0.00454 in.	0.15 mm 0.0059 in.
Idle Gear to Injection Pump Gear	Backlash	0.0415 to 0.1154 mm 0.00163 to 0.00454 in.	0.15 mm 0.0059 in.
Crank Gear to Oil Pump Gear	Backlash	0.0415 to 0.1090 mm 0.00163 to 0.00429 in.	0.15 mm 0.0059 in.
Idle Gear	Side Clearance	0.12 to 0.48 mm 0.0047 to 0.0189 in.	0.9 mm 0.0354 in.
Idle Gear Shaft to Idle Gear Bushing	Clearance	0.025 to 0.066 mm 0.00098 to 0.00260 in.	0.1 mm 0.0039 in.
Idle Gear Shaft	O.D.	37.959 to 37.975 mm 1.49445 to 1.49508 in.	–
Idle Gear Bushing	I.D.	38.000 to 38.025 mm 1.49606 to 1.49704 in.	–
Camshaft	Side Clearance	0.07 to 0.22 mm 0.0028 to 0.0087 in.	0.3 mm 0.0118 in.
Camshaft	Alignment	–	0.01 mm 0.0004 in.
Cam	Height (Intake / Exhaust)	33.90 mm 1.3346 in.	33.85 mm 1.3327 in.
Camshaft Journal to Cylinder Block Bore	Clearance	0.050 to 0.091 mm 0.00197 to 0.0358 in.	0.15 mm 0.0059 in.
Camshaft Journal	O.D.	39.934 to 39.950 mm 1.57221 to 1.57284 in.	–
Cylinder Block Bore	I.D.	40.000 to 40.025 mm 1.57480 to 1.57579 in.	–

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ENGINE BODY (Continued)

Item			Factory Specification	Allowable Limit
Piston Pin Bore		I.D.	25.000 to 25.013 mm 0.98425 to 0.98476 in.	25.05 mm 0.9862 in.
Second Ring to Ring Groove	D1463-M	Clearance	0.093 to 0.120 mm 0.00366 to 0.00472 in.	0.2 mm 0.0079 in.
	D1703-M	Clearance	0.093 to 0.128 mm 0.00366 to 0.00504 in.	0.2 mm 0.0079 in.
Oil Ring to Ring Groove		Clearance	0.020 to 0.060 mm 0.00079 to 0.00205 in.	0.15 mm 0.0059 in.
Top Ring	D1463-M	Ring Gap	0.20 to 0.35 mm 0.00787 to 0.01378 in.	1.25 mm 0.0492 in.
	D1703-M	Ring Gap	0.25 to 0.40 mm 0.0098 to 0.0157 in.	1.25 mm 0.0492 in.
Second Ring		Ring Gap	0.30 to 0.45 mm 0.0118 to 0.0177 in.	1.25 mm 0.0492 in.
Oil Ring		Ring Gap	0.25 to 0.45 mm 0.0098 to 0.0177 in.	1.25 mm 0.0492 in.
Connecting Rod		Alignment	–	0.05 mm 0.0020 in.
Piston Pin to Small End Bushing		Clearance	0.014 to 0.038 mm 0.00055 to 0.00150 in.	0.15 mm 0.0059 in.
	Piston Pin	O.D.	25.002 to 25.011 mm 0.98433 to 0.98468 in.	–
	Small End Bushing	I.D.	25.025 to 25.040 mm 0.98523 to 0.98582 in.	–
Crankshaft		Alignment	–	0.02 mm 0.00079 in.
Crankshaft Journal to Crankshaft Bearing 1		Oil Clearance	0.040 to 0.118 mm 0.00157 to 0.00465 in.	0.2 mm 0.0079 in.
	Crankshaft Journal	O.D.	51.921 to 51.940 mm 2.04413 to 2.04488 in.	–
	Crankshaft Bearing 1	I.D.	51.980 to 52.039 mm 2.04646 to 2.04878 in.	–
Crankshaft Journal to Crankshaft Bearing 2		Oil Clearance	0.040 to 0.104 mm 0.00157 to 0.00409 in.	0.2 mm 0.0079 in.
	Crankshaft Journal	O.D.	51.921 to 51.940 mm 2.04413 to 2.04488 in.	–
	Crankshaft Bearing 2	I.D.	51.980 to 52.025 mm 2.04646 to 2.04823 in.	–

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ENGINE BODY (Continued)

Item		Factory Specification	Allowable Limit
Crankpin to Crankpin Bearing	Oil Clearance	0.025 to 0.087 mm 0.00098 to 0.00343 in.	0.2 mm 0.0079 in.
	Crankpin O.D.	46.959 to 46.975 mm 1.84878 to 1.84941 in.	–
	Crankpin Bearing I.D.	47.000 to 47.046 mm 1.85039 to 1.85220 in.	–
Crankshaft		Side Clearance	0.15 to 0.35 mm 0.0059 to 0.0138 in.
Crankshaft Sleeve		Wear	– 0.1 mm 0.0039 in.
Cylinder Bore	D1463-M	I.D. (Standard)	82.000 to 82.022 mm 3.22835 to 3.22921 in.
		I.D. (Oversize)	82.250 to 82.272 mm 3.23819 to 3.23906 in.
	D1703-M	I.D. (Standard)	87.000 to 87.022 mm 3.42519 to 3.42606 in.
		I.D. (Oversize)	87.250 to 87.272 mm 3.43503 to 3.43590 in.

W1013874

LUBRICATING SYSTEM

Engine Oil Pressure	At Idle Speed	98 kPa or more 1.0 kgf/cm ² or more 14 psi or more	49 kPa 0.5 kgf/cm ² 7 psi
	At Rated Speed	294 to 441 kPa 3.0 to 4.5 kgf/cm ² 43 to 64 psi	245 kPa 2.5 kgf/cm ² 36 psi
Engine Oil Pressure Switch	Working Pressure	49 kPa 0.5 kgf/cm ² 7 psi	–
Inner Rotor to Outer Rotor	Clearance	0.03 to 0.14 mm 0.0012 to 0.0055 in.	0.2 mm 0.0079 in.
Outer Rotor to Pump Body	Clearance	0.11 to 0.19 mm 0.0043 to 0.0075 in.	0.25 mm 0.0098 in.
Inner Rotor to Cover	End Clearance	0.105 to 0.150 mm 0.00413 to 0.00591 in.	0.2 mm 0.0079 in.

W1013973

COOLING SYSTEM

Item		Factory Specification	Allowable Limit
Fan Belt	Tension	7.0 to 9.0 mm (0.28 to 0.35 in.) deflection at 98 N (10 kgf, 22 lbs) of force	–
Thermostat	Valve Opening Temperature (At Beginning)	69.5 to 72.5 °C 157.1 to 162.5 °F	–
	Valve Opening Temperature (Opened Completely)	85 °C 185 °F	–
Radiator	Water Tightness	No leaks at 137 kPa 1.4 kgf/cm ² 20 psi	–
Radiator Cap	Pressure Falling Time	10 seconds or more for pressure falling from 88 to 59 kPa from 0.9 to 0.6 kgf/cm ² from 13 to 9 psi	–

W1013874

FUEL SYSTEM

Injection Pump	Injection Timing	0.30 to 0.33 rad. (17 to 19 °) before T.D.C.	–
Pump Element	Fuel Tightness	–	14.7 MPa 150 kgf/cm ² 2133 psi
Delivery Valve	Fuel Tightness	10 seconds or more for pressure falling from 14.7 to 13.7 MPa from 150 to 140 kgf/cm ² from 2133 to 1990 psi	5 seconds for pressure falling from 14.7 to 13.7 MPa from 150 to 140 kgf/cm ² from 2133 to 1990 psi
Injection Nozzle	Injection Pressure	13.73 to 14.71 MPa 140 to 150 kgf/cm ² 1991 to 2133 psi	–
Injection Nozzle Valve Seat	Valve Seat Tightness	When the pressure is 12.75 MPa (130 kgf/cm ² , 1849 psi), the valve seat must be fuel tightness.	–

W1013973

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-9.)

Item	N-m	kgf-m	ft-lbs
Steering wheel mounting nut	48.0 to 56.0	4.9 to 5.7	35.4 to 41.22
Power steering delivery hose retaining nut	50 to 60	5.0 to 6.0	36.16 to 43.39
Steering hose LH and RH retaining nut	25 to 30	2.5 to 3.0	18.08 to 21.69
Engine mounting M10 screw, bolt and nut	48.1 to 55.8	4.9 to 5.7	35.5 to 41.2
Engine mounting M12 nut	77.5 to 90.2	7.9 to 9.2	57.2 to 66.5
Clutch cover mounting screw	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3

W1012736

Item	Size x Pitch	N-m	kgf-m	ft-lbs
Cylinder head cover screw	M6 × 1.0	6.9 to 11.3	0.7 to 1.15	5.1 to 8.32
* Cylinder head screw	M11 × 1.25	93.1 to 98.0	9.5 to 10.0	68.7 to 72.3
* Main bearing case screw 1	M9 × 1.25	46.1 to 50.9	4.7 to 5.2	34.0 to 37.6
* Main bearing case screw 2	M10 × 1.25	68.6 to 73.5	7.0 to 7.5	50.6 to 54.2
* Flywheel screw	M12 × 1.25	98.0 to 107.8	10.0 to 11.0	72.3 to 79.5
* Connecting rod screw	M8 × 1.0	44.1 to 49.0	4.5 to 5.0	32.5 to 36.2
* Rocker arm bracket screw	M8 × 1.25	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
* Idle gear shaft screw	M8 × 1.25	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
Fan drive pulley mounting nut	–	137.3 to 156.9	14.0 to 16.0	101.3 to 115.7
* Bearing case cover screw	M8 × 1.25	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
Glow plug	M10 × 1.25	19.6 to 24.5	2.0 to 2.5	14.5 to 18.1
Nozzle holder assembly	M20 × 2.0	49.0 to 68.6	5.0 to 7.0	36.2 to 50.6
Nozzle holder	–	34.3 to 39.2	3.5 to 4.0	25.3 to 28.9
Oil Switch taper screw	PT 1/8	14.7 to 19.6	1.5 to 2.0	10.8 to 14.5
Injection pipe retaining nut	M12 × 1.5	24.5 to 34.3	2.5 to 3.5	18.1 to 25.3
Overflow pipe assembly retaining nut	–	19.6 to 24.5	2.0 to 2.5	14.5 to 18.1
Camshaft set screw	M8 × 1.25	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
Hi-idling body	–	44.1 to 49.0	4.5 to 5.0	32.6 to 36.3

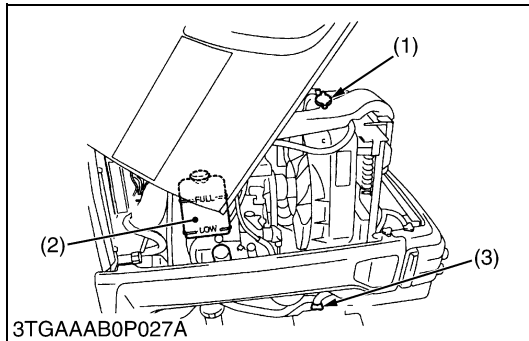
■ NOTE

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

W1013236

4. CHECKING, DISASSEMBLING AND SERVICING

[1] SEPARATING ENGINE FROM TRACTOR



Draining Coolant



CAUTION

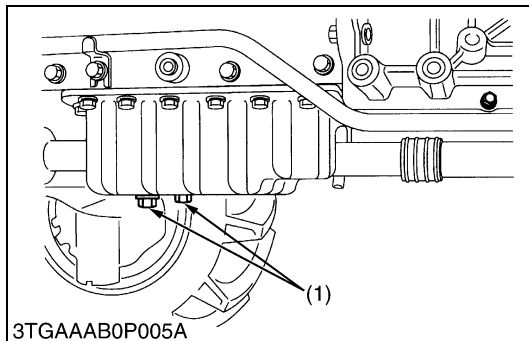
- Do not remove the radiator cap when the engine is hot. Then loosen cap slightly to the stop to relieve any excess pressure before removing cap completely.
- Stop the engine and let cool down.
 - To drain the coolant, open the radiator drain plug (3) and remove radiator cap (1). The radiator cap (1) must be removed to completely drain the coolant.
 - After all coolant is drained, close the drain plug (3).

Coolant capacity (with recovery tank)	5.8 L 1.56 U.S.qts. 1.28 Imp.qts.
---------------------------------------	---

- (1) Radiator Cap
(2) Recovery Tank

(3) Drain Plug

W1048932



Draining Engine Oil

- Place an oil pan underneath the engine.
- To drain the oil, remove the both drain plug (1) at the bottom of the engine and drain the oil completely.
- Screw in the both drain plug (1).

(When refilling)

- Fill the engine oil up to the upper line on the dipstick (2).

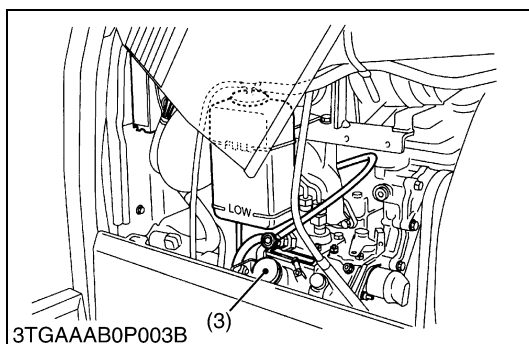
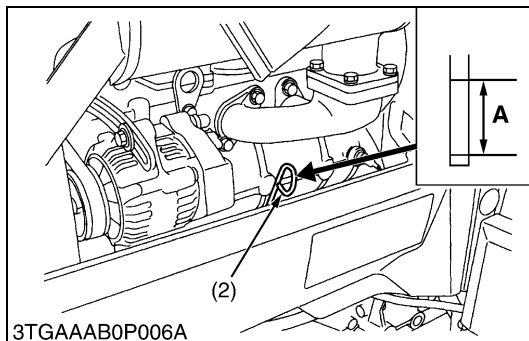
■ IMPORTANT

- When using an oil of different manufacture or viscosity from the previous one, remove all of the old oil.
- Never mix two different types of oil.
- Use the proper SAE Engine Oil according to ambient temperatures.
- Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-8.)

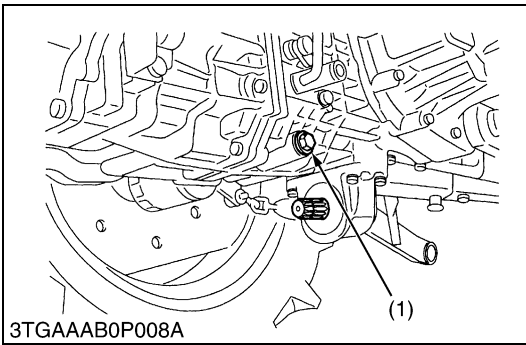
Engine oil capacity	4.5 L 1.19 U.S.qts. 0.99 Imp.qts.
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- (1) Drain Plug
(2) Dipstick
(3) Oil Inlet

(A) Oil level is acceptable within this range.



W1050040



Draining Transmission Fluid

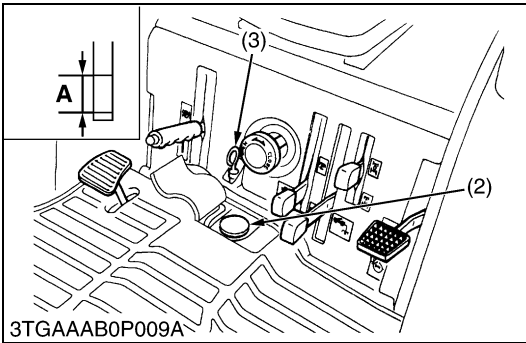
1. Place oil pan underneath the transmission case, and remove the drain plugs (1).
2. Drain the transmission fluid.
3. Reinstall the drain plug (1).

(When refilling)

- Fill new oil from filling port after remaining the filling plug (2) up to the upper notch on the dipstick (3).
- After running the engine for few minutes, stop it and check the oil level again, if low, add oil prescribed level.

■ IMPORTANT

- Use only **KUBOTA SUPER UDT fluid**-Use of other oils may damage the transmission or hydraulic system. Refer to “LUBRICANTS, FUEL AND COOLANT”. (See page G-8.)
- Never work the tractor immediately after changing the transmission oil. Keeping the engine at medium speed for a few minutes to prevents damage to the transmission.
- Do not mix different brands oil together.

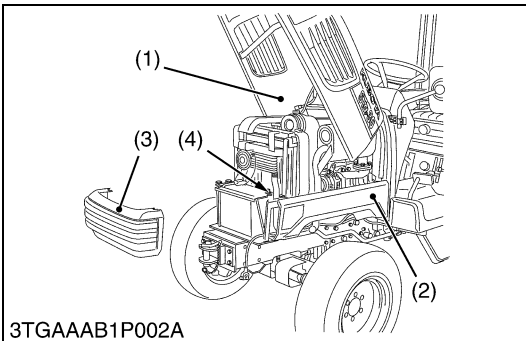


Transmission fluid capacity	18.5 L 4.89 U.S.gals. 4.07 Imp.gals.
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- (1) Drain Plug
- (2) Filling Plug
- (3) Dipstick

A : Oil level is acceptable within this range.

W1012748



Hood, Side Cover and Battery Cord

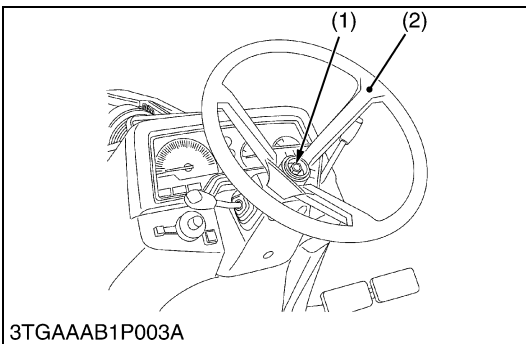
1. Open the hood (1) and remove the front grille (3).
2. Disconnect the battery grounding cord (4).
3. Disconnect the head light connectors and remove the side covers (2) and hood (1).

■ NOTE

- When disconnecting the battery cords, disconnect the grounding cord first. When connecting, positive cord first.

- (1) Hood
- (2) Side Cover
- (3) Front Grille
- (4) Battery Cord

W1012749



Steering Wheel

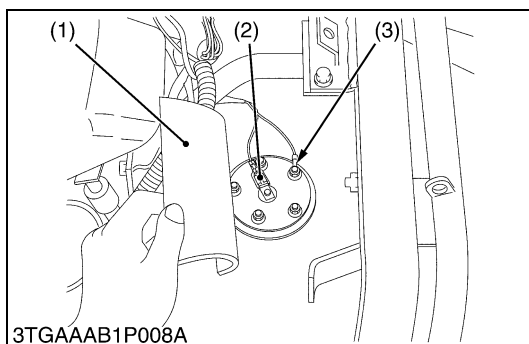
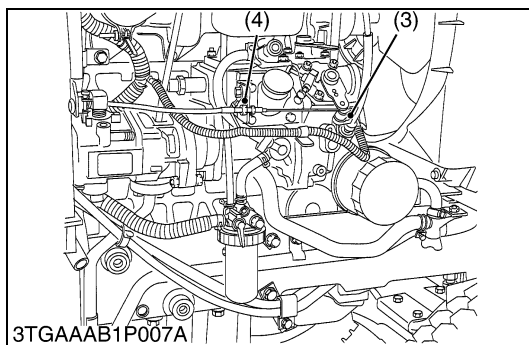
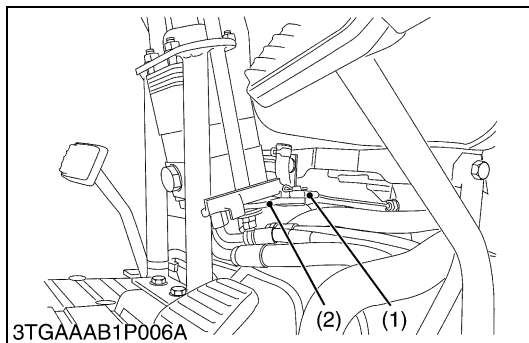
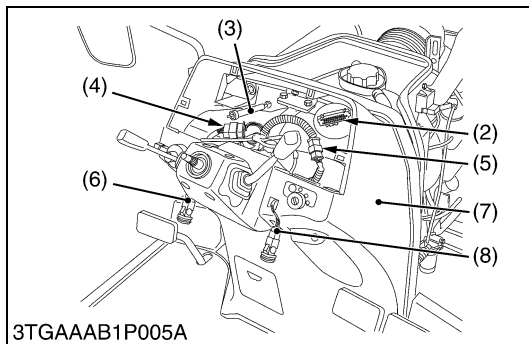
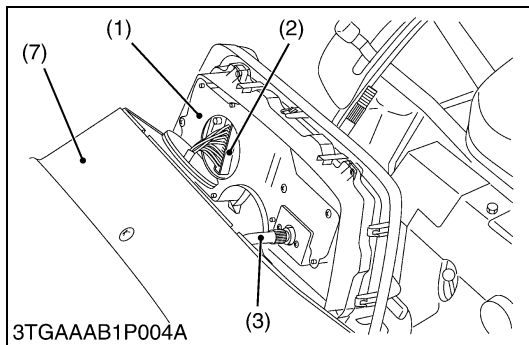
1. Remove the steering wheel cap.
2. Remove the steering wheel mounting nut (1) and remove the steering wheel (2) with a steering wheel puller (Code No. 07916-51090).

(When reassembling)

Tightening torque	Steering wheel mounting nut	48.04 to 56.0 N·m 4.9 to 5.7 kgf·m 35.4 to 41.22 ft·lbs
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- (1) Nut
- (2) Steering Wheel

W1012884



Meter Panel and Panel Under Cover

1. Open the meter panel (1) and disconnect the meter panel connector (2) and hour-meter cable (3). Then remove the meter panel.
2. Remove the sponge.
3. Disconnect the combination switch connector (4), main switch connector (5), hazard switch connector (6) and position lamp switch connector (8).
4. Remove the panel under cover (7).

- | | |
|----------------------------------|------------------------------------|
| (1) Meter Panel | (5) Main Switch Connector |
| (2) Meter Panel Connector | (6) Hazard Switch connector |
| (3) Hour-meter Cable | (7) Panel Under Cover |
| (4) Combination Switch Connector | (8) Position Lamp Switch Connector |

W1013015

Accelerator Wire

1. Remove the accelerator wire (1) from hand accelerator lever arm (2).
2. Remove the accelerator wire (1) from speed control lever (3) and holder (4).

■ IMPORTANT

- After assembling, be sure to adjust the accelerator wire to speed control lever to operate the engine maximum speed.
- Be sure to check the accelerator wire is not interfere with power steering any hoses.

- | | |
|---------------------------|-------------------------|
| (1) Accelerator Wire | (3) Speed Control Lever |
| (2) Accelerator Lever Arm | (4) Holder |

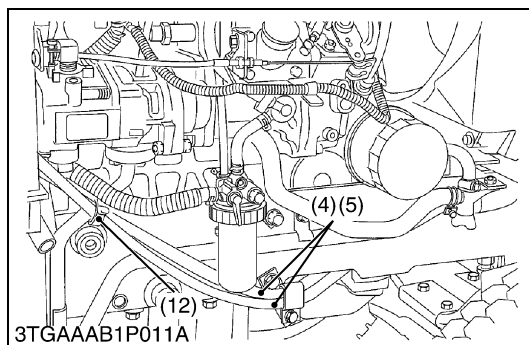
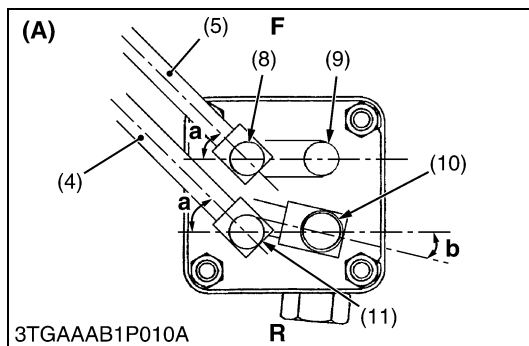
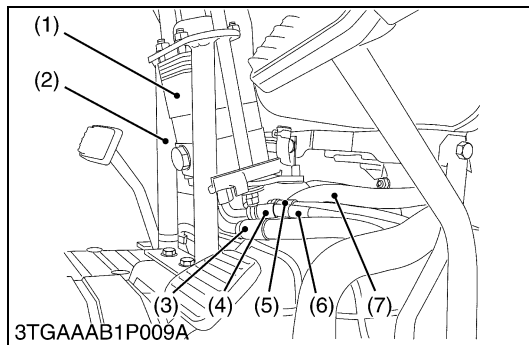
W1013265

Fuel Sensor Wire

1. Turn over the fuel sensor cover (1).
2. Disconnect the 1P connector (2) and ground wire (3) from the fuel sensor.

- | | |
|-----------------------|-----------------|
| (1) Fuel Sensor Cover | (3) Ground Wire |
| (2) 1P Connector | |

W1052606



Power Steering Controller

1. Disconnect the draining hose (7), power steering delivery hose (3), steering hose RH (4) and steering hose LH (5).
2. Remove the power steering controller (1) with steering pillar (2).

(When reassembling)

- Connect the steering hose LH (5) to **LT** port (8).
- Connect the steering hose RH (4) with white tape (6) to **RT** port (11).
- Make arrangement the hose as figure and routing to original.
- When reassembling the controller with steering pillar to the panel under frame and under frame, temporarily screw in the four screws then tighten first to panel under frame (upper side) side in parallel between panel under frame and screw plate of steering pillar.
- Be sure to clamp the delivery hoses (4) and (5) to position hydraulic delivery pipe with clamp band (12).
- Be sure to check the hoses are not interfere with accelerator wire.

Tightening torque	Power steering delivery hose retaining nut	50 to 60 N·m 5.0 to 6.0 kgf·m 36.16 to 43.39 ft·lbs
	Steering hose LH and RH retaining nut	25 to 30 N·m 2.5 to 3.0 kgf·m 18.08 to 21.69 ft·lbs

- | | |
|----------------------------------|--------------------|
| (1) Power Steering Controller | (10) Delivery Port |
| (2) Steering Pillar | (11) RT Port |
| (3) Power Steering Delivery Hose | (12) Clamp Band |
| (4) Steering Hose RH | |
| (5) Steering Hose LH | |
| (6) White Tape | |
| (7) Drain Hose | |
| (8) LT Port | |
| (9) Drain Port | |

(A) Viewed from Bottom Side

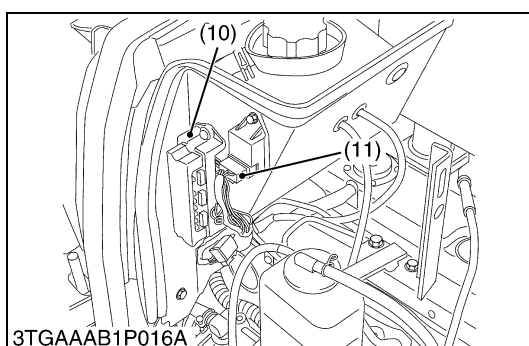
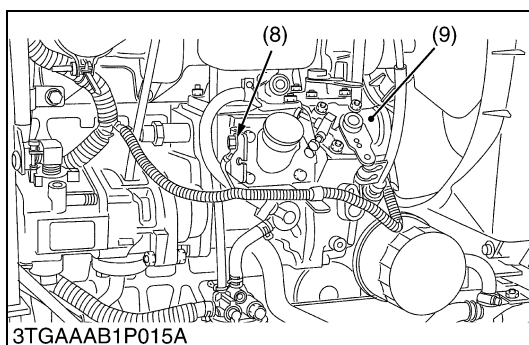
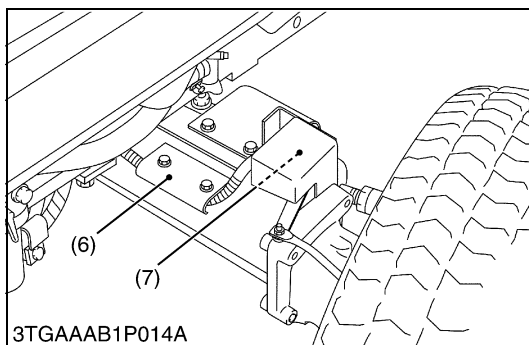
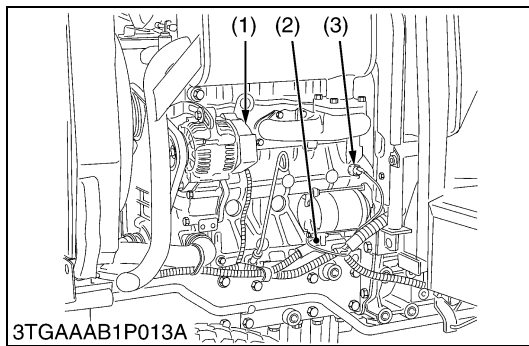
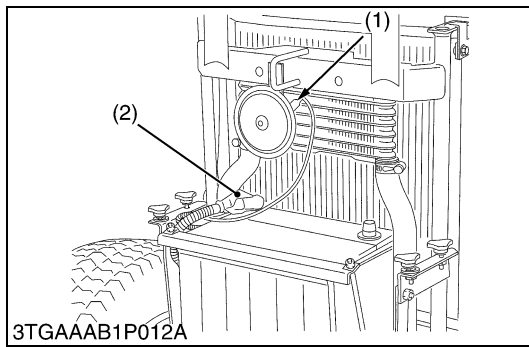
F : Front

R : Rear

a : 0.785 rad. (45 °)

b : 0.174 to 0.262 rad. (10 to 15 °)

W1052855

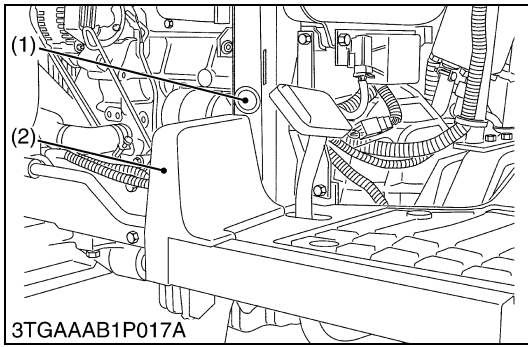


Wire Connectors

1. Remove or disconnect the connectors, terminals as listed below and figures.
2. Remove the harness from each harness clamp.
3. Remove the fuse box mounting screws, and remove the fuse box assembly (10).

- | | |
|--------------------------------|--------------------------------------|
| (1) Horn | (7) Front Wheel Turning Angle Sensor |
| (2) Battery Positive Code | (8) Ground Terminal |
| (3) Alternator | (9) Stop Solenoid |
| (4) Starter | (10) Fuse Box Assembly |
| (5) Engine Oil Pressure Switch | (11) Timer Relay |
| (6) Harness Guide | |

W1045601



Panel Under Frame

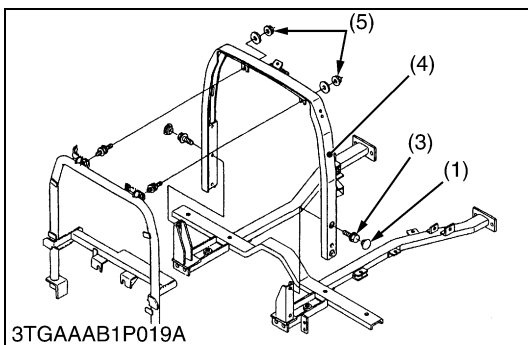
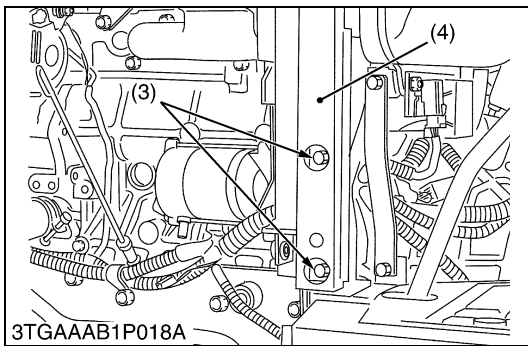
1. Remove the foot cover (2), step stay and plug (1).
2. Remove the panel under frame mounting screw (3) and nut, pull up the panel under frame (4) to remove it.

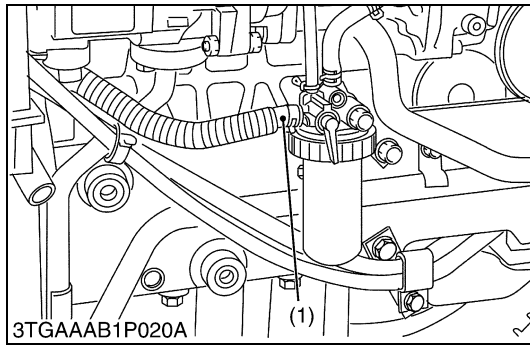
(When reassembling)

- When reassembling the panel under frame, tighten the two nuts (5) for insulation rubber first.

- | | |
|----------------|-----------------------|
| (1) Plug | (4) Panel Under Cover |
| (2) Foot Cover | (5) Nut |
| (3) Screw | |

W1055726





Fuel Tank

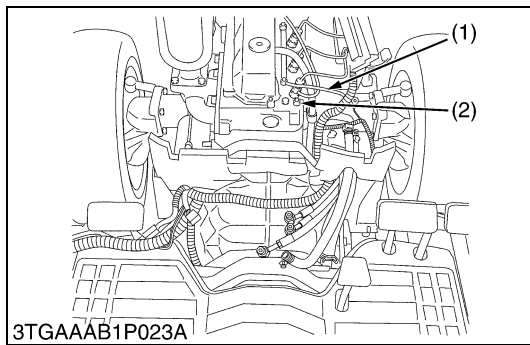
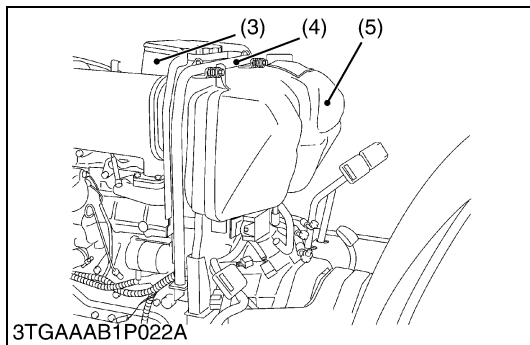
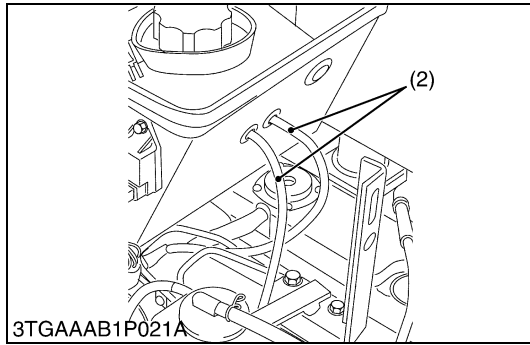
1. Disconnect the fuel hose (1) at the fuel filter side, then drain fuel completely.
2. Remove the air cleaner assembly.
3. Disconnect the overflow hoses (2) of fuel line.
4. Remove the bonnet rear support (4), shutter plate (3) with fuel tank (5).

(When reassembling)

- Be sure to fix the sponges to the original position.

- | | |
|-------------------|-------------------------|
| (1) Fuel Hose | (4) Bonnet Rear Support |
| (2) Overflow Hose | (5) Fuel Tank |
| (3) Shutter Plate | |

W1055997

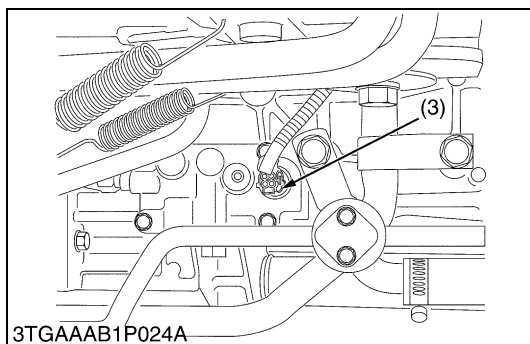


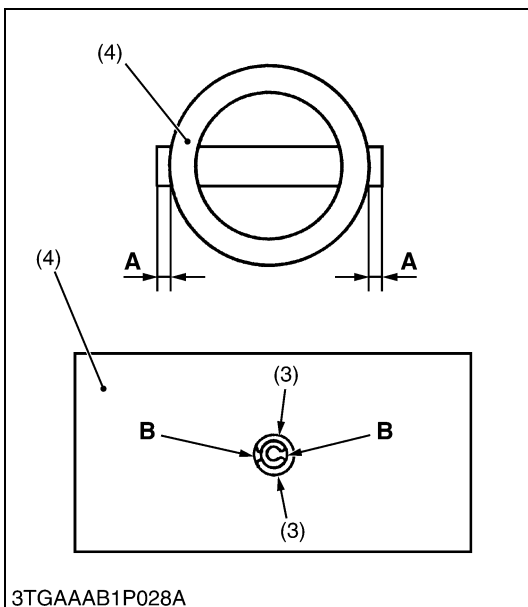
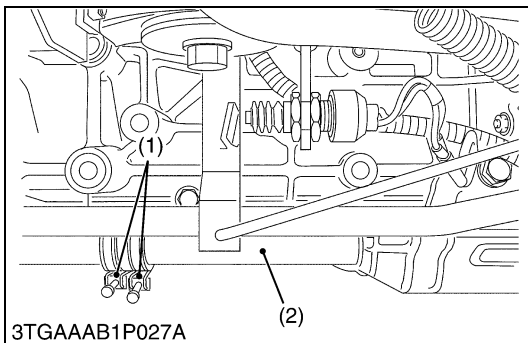
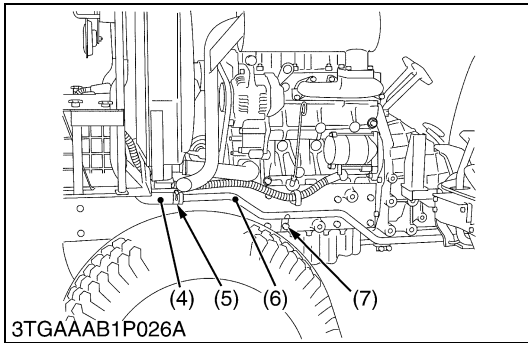
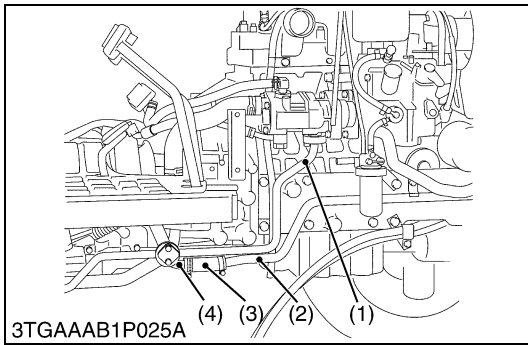
Wire Harness

1. Remove the glow plug cable (1).
2. Disconnect the 1P connector from the coolant temperature sensor (2).
3. Disconnect the coupler from bi-speed solenoid (3).
4. Remove the wire harness assembly.

- | | |
|--------------------------------|-----------------------|
| (1) Glow Plug Code | (3) Bi-speed Solenoid |
| (2) Coolant Temperature Sensor | |

W1057013





Hydraulic Pipe

1. Remove the hydraulic delivery pipe (1) from the 3P hydraulic pump.
2. Loosen the hose band of the joint hose (3) and slide the joint hose (3) to separating the HST drain pipe (2) and inlet pipe (4).
3. Remove the pipe clamping screws.
4. Loosen the hose band (5) and separate the HST pipe (6) from the HST drain hose (4).
5. Remove the HST pipe (6) clamping screw (7).

- | | |
|-----------------------------|--------------------|
| (1) Hydraulic Delivery Pipe | (5) Hose Band |
| (2) HST Drain Pipe | (6) HST Pipe |
| (3) Joint Hose | (7) Clamping Screw |
| (4) Inlet Pipe | |

W1057369

Propeller Shaft

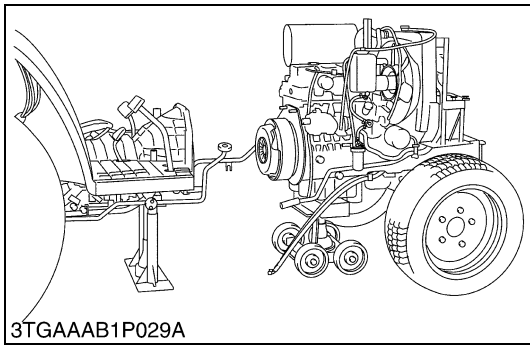
1. Loosen the clamp (1) and slide the propeller shaft cover (2).
2. Tap out the spring pin (3) and then slide the coupling (4).
3. Remove the propeller shaft with cover.

(When reassembling)

- Apply grease to the splines of the propeller shaft and couplings.
- When inserting the spring pins (3), face their splits in the direction parallel to the universal joint as shown in the figure.

- | | |
|---------------------------|---------------------------------------|
| (1) Clamp | A : Approx. 1.0 mm (0.039 in.) |
| (2) Propeller Shaft Cover | B : Split Portion |
| (3) Spring Pin | |
| (4) Coupling | |

W1014306



Separating the Engine from Clutch Housing

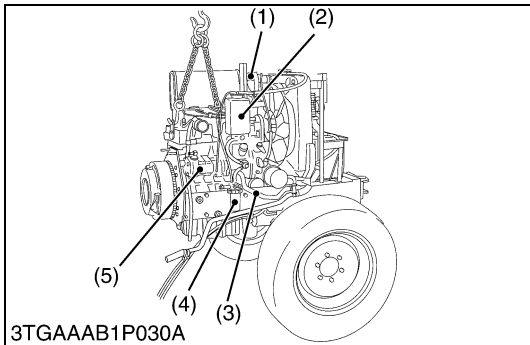
1. Place the jack under the center frame and engine oil pan.
2. Remove the engine mounting screws, bolts and nuts, and separate the engine from the clutch housing.

(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the engine and clutch housing.

Tightening torque	Engine mounting M10 screw, bolt and nut	48.1 to 55.8N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft·lbs
	Engine mounting M12 nut	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft·lbs

W1056610

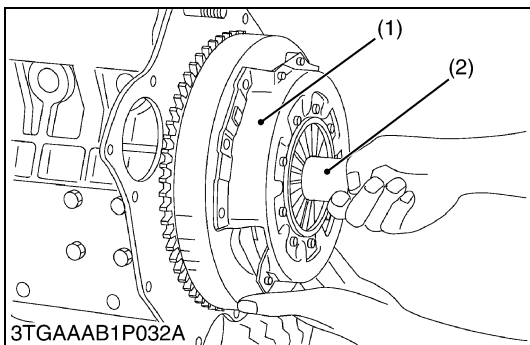
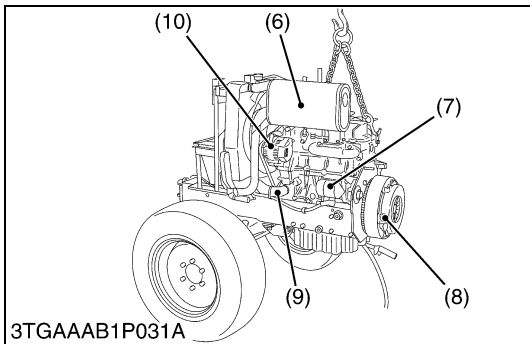


Separating Front Axle Assembly and Outer Parts

1. Disconnect the radiator hoses (1), (3) and (9).
2. Remove the muffler (6).
3. Remove the recovery tank (2).
4. Remove the stator motor (7) and alternator (10).
5. Remove the fuel filter (4) and hydraulic pump (5).
6. Remove the engine mounting screws and separate the front axle assembly from engine.

- | | |
|--------------------|---------------------|
| (1) Radiator Hose | (6) Muffler |
| (2) Recovery Tank | (7) Stator Motor |
| (3) Radiator Hose | (8) Clutch Assembly |
| (4) Fuel Filter | (9) Radiator Hose |
| (5) Hydraulic Pump | (10) Alternator |

W1058184



Clutch Assembly

1. Remove the clutch assembly (1).

(When reassembling)

- Direct the shorter end of the clutch disc boss toward the flywheel.
- Apply molybdenum disulphide (Three Bond 1901 or equivalent) to the splines of clutch disc boss.
- Make sure of reamer screws position and after two reamer bolts are tightened, other screws are tightened.

■ IMPORTANT

- **Be sure to align the center of disc and flywheel by inserting the clutch center tool (2).**

■ NOTE

- **Do not allow grease and oil on the clutch disc facing.**

Tightening torque	Clutch cover mounting screws	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.5 to 20.3 ft·lbs
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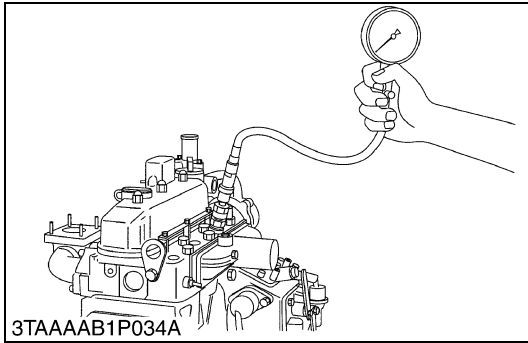
(1) Clutch Assembly

(2) Clutch Center Tool

W1017588

[2] ENGINE BODY

(1) Checking and Adjusting



Compression Pressure

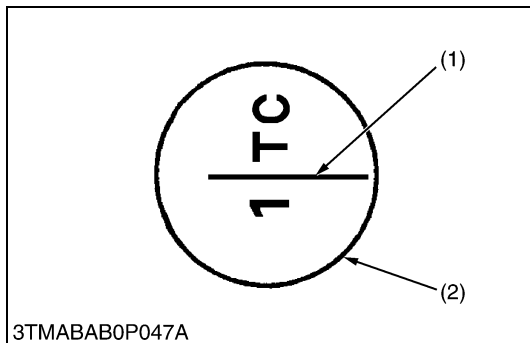
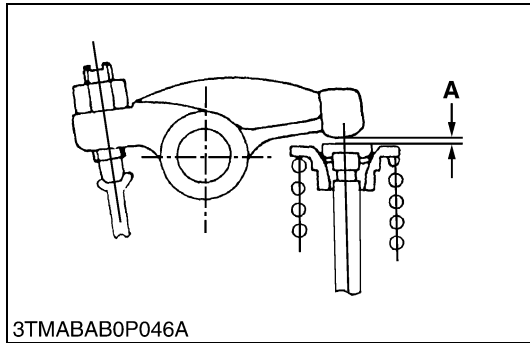
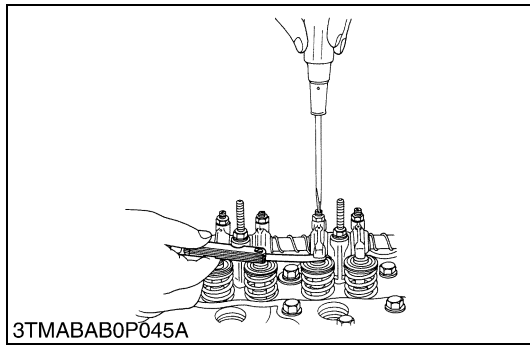
1. Run the engine until it is warmed up.
2. Stop the engine and disconnect the **2P** connector from the fuel pump.
3. Remove the air cleaner, the muffler and all injection nozzles.
4. Set a compression tester (Code No. 07909-30208) with the adaptor to the nozzle hole.
5. Keep the engine stop lever at “**Stop Position**”.
6. While cranking the engine with the starter, measure the compression pressure.
7. Repeat steps 4 through 6 for each cylinder.
8. If the measurement is below the allowable limit, apply a small amount of oil to the cylinder wall through the nozzle hole and measure the compression pressure again.
9. If the compression pressure is still less than the allowable limit, check the top clearance, valve and cylinder head.
10. 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 %**.

Compression pressure	Factory spec.	3.53 to 4.02 MPa 36 to 41 kgf/cm ² 512 to 583 psi
	Allowable limit	2.55 MPa 26 kgf/cm ² 370 psi

W1018639



Valve Clearance

■ IMPORTANT

- Valve clearance must be checked and adjusted when engine is cold.
1. Remove the head cover, the glow plugs and the timing window cover on the clutch housing.
 2. Align the “1TC” mark line on the flywheel and center of timing window so that the No. 1 piston comes to the compression or overlap top dead center.
 3. Check the following valve clearance marked with “☆” using a feeler gauge.
 4. If the clearance is not within the factory specifications, adjust with the adjusting screw.

Valve clearance	Factory spec.	0.18 to 0.22 mm 0.0071 to 0.0087 in.
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■ NOTE

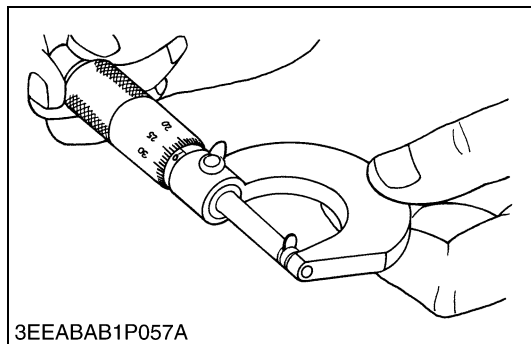
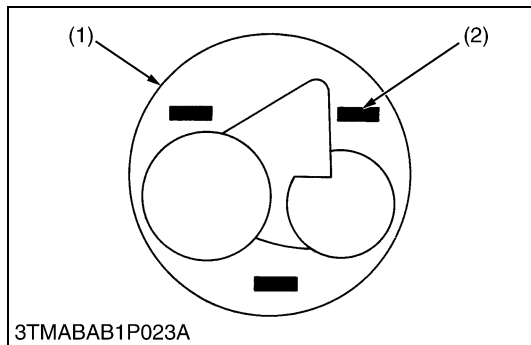
- The “TC” marking line on the flywheel is just for No. 1 cylinder. There is no “TC” marking for the other cylinders.
- No. 1 piston comes to the T.D.C. position when the “TC” marking is aligned with center of timing window on clutch-housing. Turn the flywheel 0.26 rad. (15 °) clockwise and counterclockwise to see if the piston is at the compression top dead center or the overlap position. Now referring to the table below, readjust the valve clearance. (The piston is at the compression top dead center when both the IN. and EX. valves do not move; it is at the overlap position when both the valves move.)
- Finally turn the flywheel 6.28 rad. (360 °) and align the “TC” marking line and the center of timing window. Adjust all the other valve clearance as required.
- After turning the flywheel counterclockwise twice or three times, recheck the valve clearance, firmly tighten the lock nut of the adjusting screw.

Condition	No. of cylinder	IN. Valve	EX. Valve
When No. 1 piston is compression top dead center	1st	☆	☆
	2nd		☆
	3rd	☆	
When No. 1 piston is overlap position	1st		
	2nd	☆	
	3rd		☆

- (1) TC Mark Line
(2) Timing Window

A : Valve Clearance

W1018974



Top Clearance

1. Remove the cylinder head.
2. Move the piston up and stick a strip of fuse on the piston head at three position with grease.
3. Lower the piston and install the cylinder head. (Use a new cylinder head gasket and tighten with a specified tightening torque.)
4. Turn the flywheel until the piston passes through the T.D.C..
5. Remove the cylinder head and measure the thickness of the fuses.
6. If the measurement is not within the factory specifications, check the oil clearances between the crankpin and bearing and between the piston pin and bushing.

Top clearance	Factory spec.	0.55 to 0.70 mm 0.0217 to 0.0276 in.
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Tightening torque	Cylinder head screws	93.1 to 98.0 N·m 9.5 to 10.0 kgf·m 68.7 to 72.3 ft-lbs
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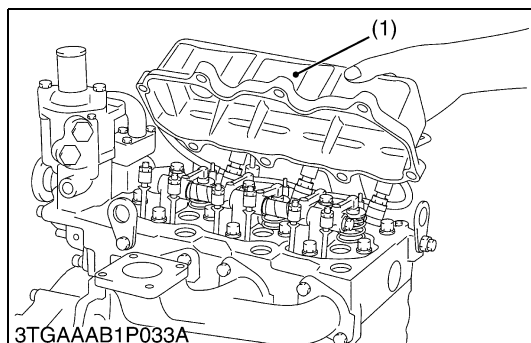
(1) Piston

(2) Fuse

W1020190

(2) Disassembling and Assembling

(A) Cylinder Head and Valves



Cylinder Head Cover

1. Remove the breather hose.
2. Remove the head cover screws.
3. Remove the cylinder head cover (1).

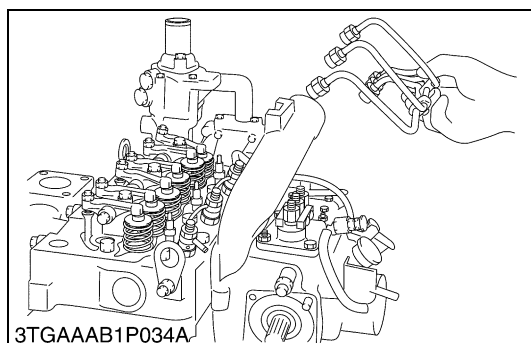
(When reassembling)

- Check to see if the cylinder head cover gasket is not defective.

Tightening torque	Cylinder head cover screw	6.9 to 11.3 N·m 0.7 to 1.15 kgf·m 5.1 to 8.32 ft-lbs
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(1) Cylinder Head Cover

W1020618



Injection Pipes

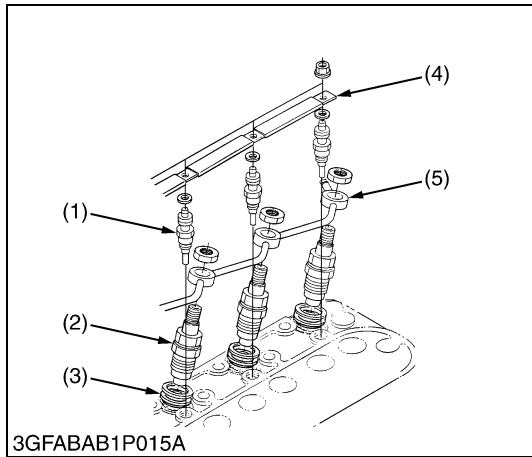
1. Loosen the screws on the pipe clamps.
2. Detach the injection pipes.

(When reassembling)

- Sent compressed air into the pipes to blow out dust. Then, reassemble the pipes in the reverse order.

Tightening torque	Injection pipe retaining nut	24.5 to 34.3 N·m 2.5 to 3.5 kgf·m 18.1 to 25.3 ft-lbs
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W1020811



Nozzle Holder Assembly and Glow Plug

1. Remove the overflow pipe assembly (5).
2. Remove the nozzle holder assemblies (2) using a 21 mm deep socket wrench.
3. Remove the copper gasket and heat seal (3).
4. Remove the glow plugs (1).

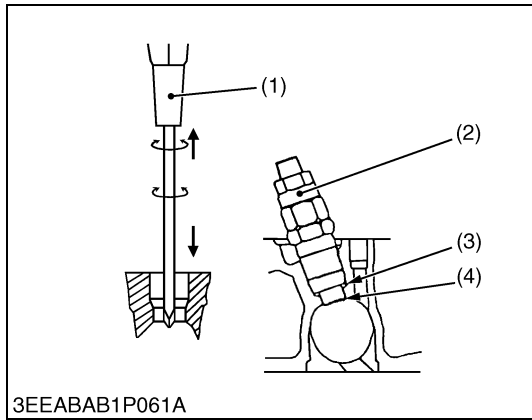
(When reassembling)

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

Tightening torque	Nozzle holder assembly	49.0 to 68.6 N·m 5.0 to 7.0 kgf·m 36.2 to 50.6 ft-lbs
	Overflow pipe assembly retaining nut	19.6 to 24.5 N·m 2.0 to 2.5 kgf·m 14.5 to 18.1 ft-lbs
	Glow plug	19.6 to 24.5 N·m 2.0 to 2.5 kgf·m 14.5 to 18.1 ft-lbs

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

W1020917



Nozzle Heat Seal Service Removal Procedure

■ IMPORTANT

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

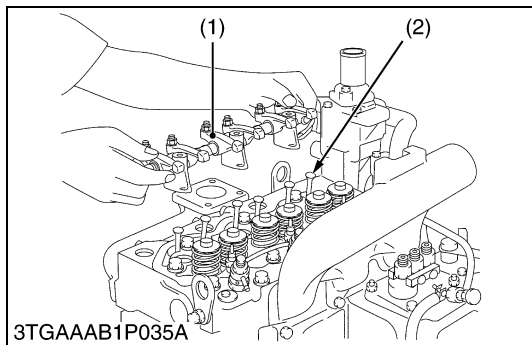
1. Drove screw drive (1) lightly into the heat seal hole.
2. Turn screw driver three or four times each way.
3. While turning the screw driver, slowly pull the heat seal (4) out together with the copper gasket (3).
4. If the heat seal drops, repeat the above procedure.

(When reassembling)

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

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

W1021255



Rocker Arm and Push Rod

1. Remove the rocker arm bracket mounting bolts.
2. Detach the rocker arm assembly (1).
3. Remove the push rods (2).

(When reassembling)

- When putting the push rods (2) onto the tappets (3), check to see if their ends are properly engaged with the grooves.

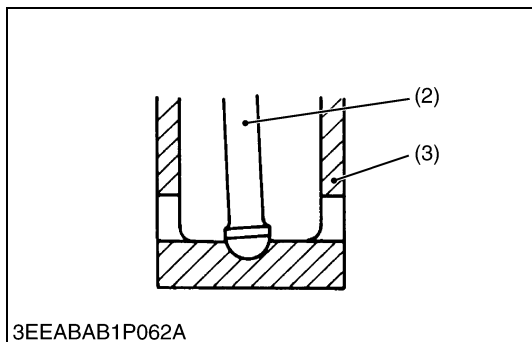
■ IMPORTANT

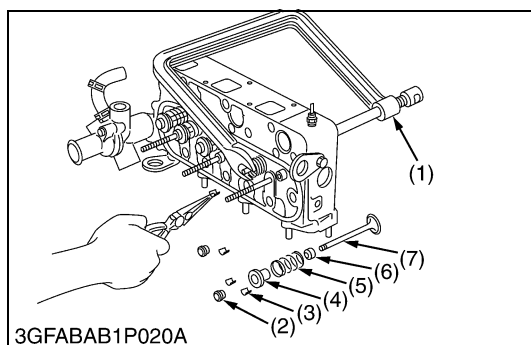
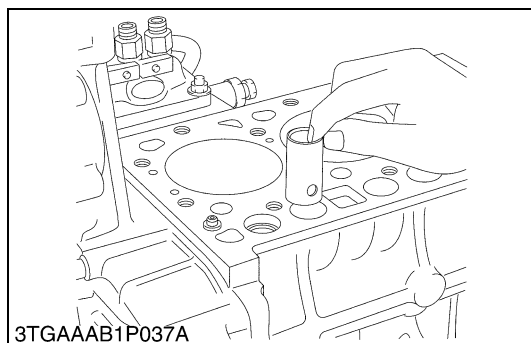
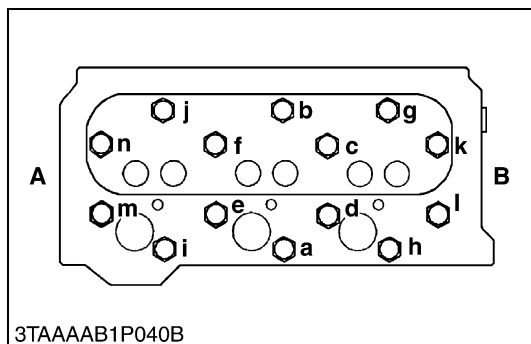
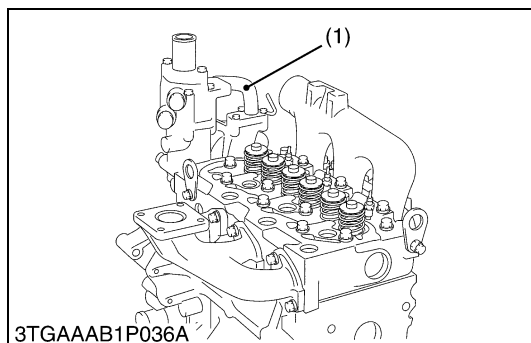
- After installing the rocker arm, be sure to adjust the valve clearance.

Tightening torque	Rocker arm bracket mounting bolt	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft-lbs
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- (1) Rocker Arm Assembly (3) Tappet
 (2) Push Rod

W1021437





Cylinder Head

1. Loosen the pipe clamp, and remove the water return pipe (1).
2. Remove the cylinder head screw in the order of (n) to (a).
3. Lift up the cylinder head to detach.
4. Remove the cylinder head gasket.

(When reassembling)

- Replace the cylinder head gasket with a new on.
- Tighten the cylinder head screws after applying sufficient oil.
- Tighten the cylinder head screws in diagonal sequence starting from the center.
- Tighten them uniformly, or the head may deform in the long run.

Tightening torque	Cylinder head screw	93.1 to 98.0 N·m 9.5 to 10.0 kgf·m 68.7 to 72.3 ft-lbs
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(1) Return Pipe

(n) to (a): To Loosen
(a) to (n): To Tighten
(A) Gear Case Side
(B) Flywheel Side

W1021755

Tappets

1. Remove the tappets from the crankcase.

(When reassembling)

- Visually check the contact between tappets and cams for proper rotation. If defect is found, replace tappets.
- Before installing the tappets, apply engine oil thinly around them.

■ IMPORTANT

- **Do not change the combination of tappet and tappet guide.**

W1022001

Valves

1. Remove the valve caps (2).
2. Remove the valve spring collet (3), pushing the valve spring retainer (4) by valve spring replacer (1).
3. Remove the valve spring retainer (4), valve spring (5) and valve stem seal (6).
4. Remove the valve (7).

(When reassembling)

- Wash the valve stem and valve guide hole, and apply engine oil sufficiently.
- After installing the valve spring collets, lightly tap the stem to assure proper fit with a plastic hammer.

■ IMPORTANT

- **Don't change the combination of valve and valve guide.**

(1) Valve Spring Replacer

(2) Valve Cap

(3) Valve Spring Collet

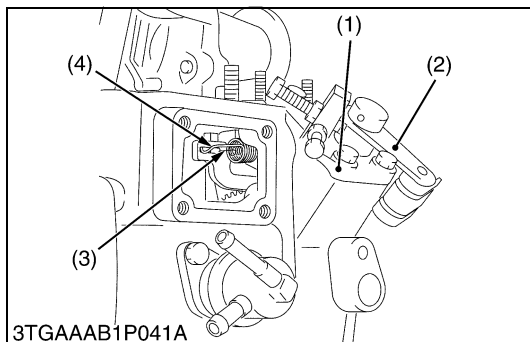
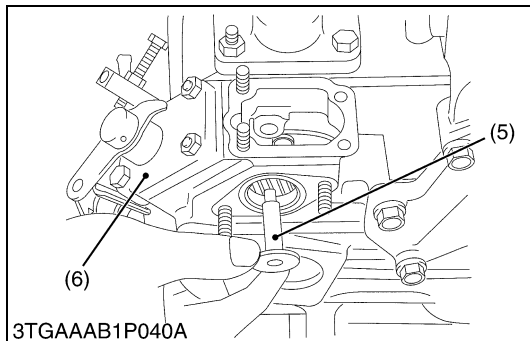
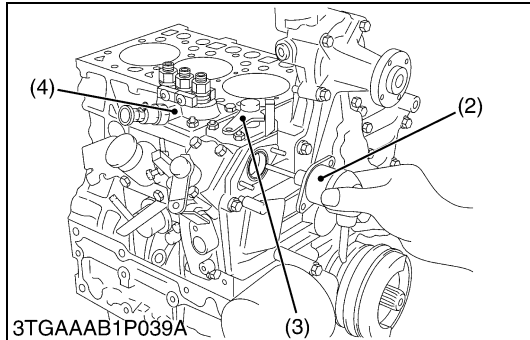
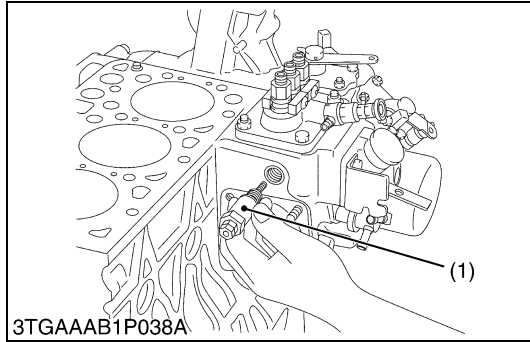
(4) Valve Spring Retainer

(5) Valve Spring

(6) Valve Stem Seal

(7) Valve

W1022102

(B) Timing Gears, Camshaft and Fuel Camshaft**Injection Pump**

1. Remove the stop solenoid (2) and hi-idling body (1).
2. Remove the engine stop lever (3) and stop solenoid guide (5).
3. Remove the cover (6).
4. Remove the fuel injection pump assembly (4).

■ IMPORTANT

- **Before removing the injection pump assembly, be sure to remove the stop solenoid, hi-idling body, engine stop lever and stop solenoid guide (5).**

(When reassembling)

- Before attaching the stop solenoid, hi-idling body and solenoid guide, install the injection pump first into position.
- Replace the hi-idling body gasket with a new one.
- Before fitting the stop lever to the gear case, install the solenoid guide first into position. Then attach the stop lever and use it to see if it functions well.
- Before fitting the idling limiter in place, attach the solenoid guide and the engine stop lever in their respective positions.
- When installing the stop solenoid, be careful to keep the O-ring in place.
- Be sure to insert the push rod of the stop solenoid into the hole at the center of the solenoid guide.

Tightening torque	Hi-idling body	44.1 to 49.0 N·m 4.5 to 5.0 kgf·m 32.6 to 36.3 ft·lbs
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- (1) Hi-idling Body
(2) Stop Solenoid
(3) Stop Lever

- (4) Injection Pump Assembly
(5) Solenoid Guide
(6) Cover

W1023686

Speed Control Plate

1. Disconnect the governor spring (3), (4).
2. Remove the speed control plate (1).

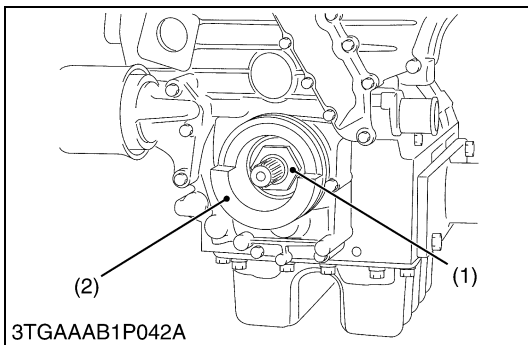
(When reassembling)

- Check that the speed control lever (2) positions low idle, after assembling governor spring.
- Check that the speed control lever returns to the high idle position rather than the low idle position, after moving the lever to the maximum speed position.
- After assembling the engine, check the idling speed referring to Adjusting Idling Speed. (950 to 1000 rpm)

- (1) Speed Control Plate
(2) Speed Control Lever

- (3) Governor Spring 1
(4) Governor Spring 2

W1024090

**Fan Drive Pulley**

1. Lock the flywheel not to turn using the flywheel stopper.
2. Remove the fan drive pulley mounting nut.
3. Remove the fan drive pulley (2) with gear puller.

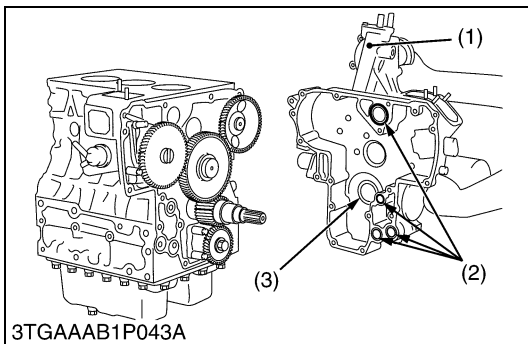
(When reassembling)

Tightening torque	Fan drive pulley mounting nut	137.3 to 156.9 N·m 14.0 to 16.0 kgf·m 101.3 to 115.7 ft·lbs
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(1) Nut

(2) Fan Drive Pulley

W1024348

**Gear Case**

1. Remove the hour meter gear case.
2. Remove the gear case (1).
3. Remove the O-rings (2).

(When reassembling)

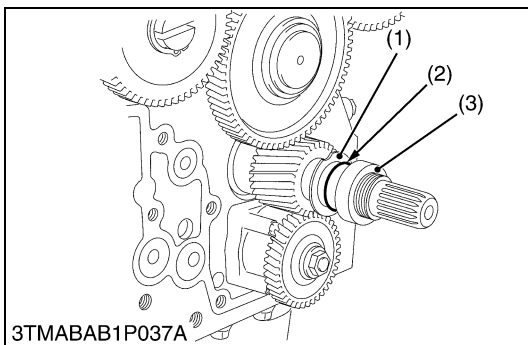
- Apply liquid gasket (Three Bond 1215 or equivalent) to both side of hour meter gear case gasket.
- Check to see if there are four O-rings (2) inside the gear case (1).
- Apply a thin film of engine oil to the oil seal (3), and install it, noting the lip come off.
- Before installing the gear case gasket, apply a non-drying adhesive.

(1) Gear Case

(3) Oil Seal

(2) O-ring

W1024531

**Crankshaft Oil Slinger**

1. Remove the feather key.
2. Remove the crankshaft collar (3).
3. Remove the O-ring (2).
4. Detach the crankshaft oil slinger (1).

(When reassembling)

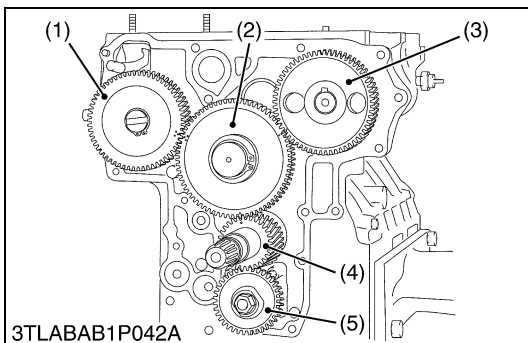
- Insert the crankshaft collar (3) after install the gear case to cylinder body

(1) Crankshaft Oil Slinger

(3) Crankshaft Collar

(2) O-ring

W1024731

**Idle Gear**

1. Remove the external snap ring.
2. Detach the idle gear collar.
3. Detach the idle gear (2).

(When reassembling)

- Check to see each gear is aligned with its aligning mark:
 - (1) Idle gear and crank gear
 - (2) Idle gear and camshaft gear
 - (3) Idle gear and injection pump gear

(1) Injection Pump Gear

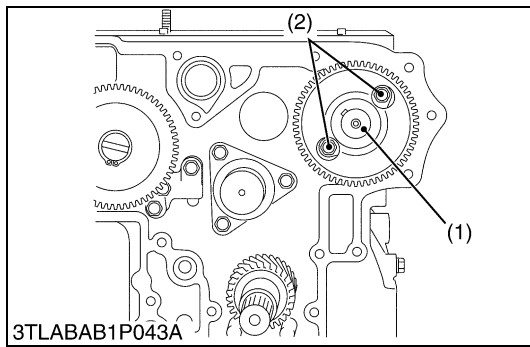
(4) Crank Gear

(2) Idle Gear

(5) Oil Pump Drive Gear

(3) Cam Gear

W1024941

**Camshaft**

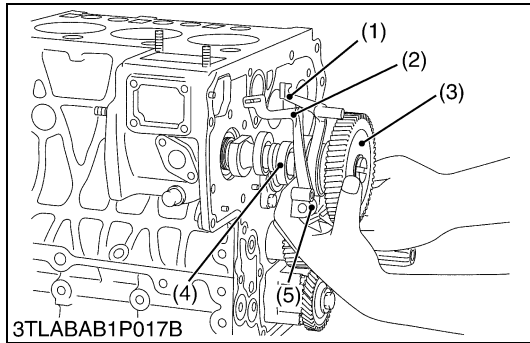
1. Remove the camshaft set bolts and draw out the camshaft (1).
- (When reassembling)**
- When installing the idle gear, be sure to align the alignment marks on gears.

Tightening torque	Camshaft set bolt	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft·lbs
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(1) Camshaft

(2) Camshaft Set Bolt

W1025098

**Fuel Camshaft and Fork Lever Assembly**

1. Remove the hydraulic pump drive gear from fuel camshaft.
2. Remove the fuel feed pump.
3. Detach the fuel camshaft stopper.
4. Remove the three fork lever holder mounting screws.
5. Draw out the fuel camshaft assembly (3), (4) and fork lever assembly (1), (2), (5) at the same time.

(When reassembling)

- After installation, check to see that the fork lever 1 (1) and (2) are fixed to the fork lever shaft, and that they can turn smoothly in the holder (5).

(1) Fork Lever 1

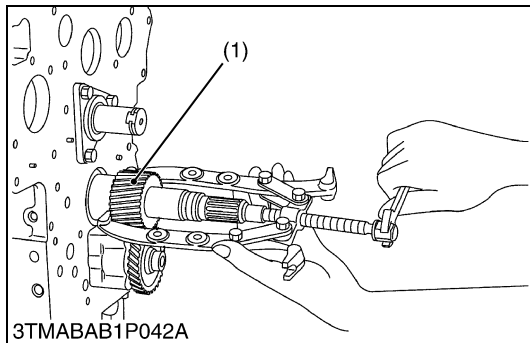
(4) Fuel Camshaft

(2) Fork Lever 2

(5) Fork Lever Holder

(3) Injection Pump Gear

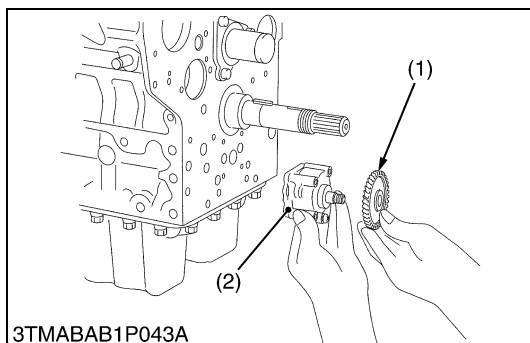
W1025309

**Crank Gear**

1. Draw out the crank gear (1) with gear puller.
2. Remove the feather key.

(1) Crank Gear

W1025476

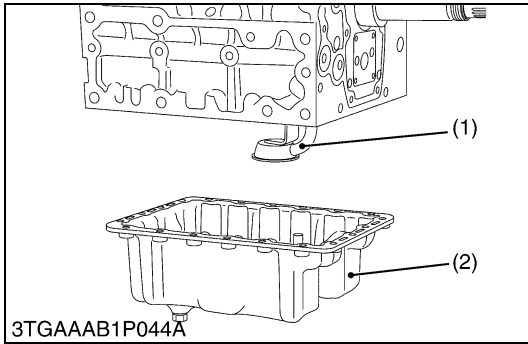
**Oil Pump**

1. Remove the nut.
2. Draw out the oil pump drive gear (1) with gear puller.
3. Remove the four oil pump mounting screws. Detach the oil pump (2).

(1) Oil Pump Drive Gear

(2) Oil Pump

W1025581

(C) Piston and Connecting Rod**Oil Pan and Oil Strainer**

1. Remove the oil pan mounting screws.
2. Remove the oil pan (2) by lightly tapping the rim of the pan with a wooden hammer.
3. Remove the oil strainer (1).

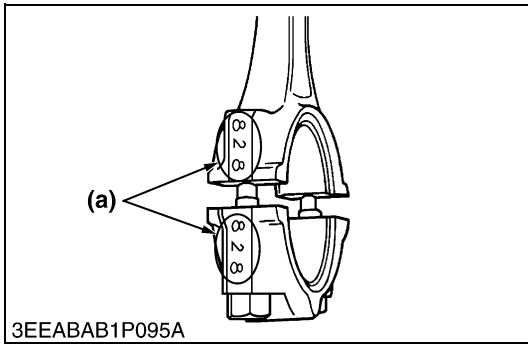
(When reassembling)

- After cleaning the oil strainer, check to see that the filter mesh is clean, and install it.
- Visually check the O-ring, apply engine oil, and install it.
- Securely fit the O-ring to the oil strainer.
- Apply a liquid gasket (Three Bond 1215 or equivalent) to the oil pan side of the oil pan gasket.
- To avoid uneven tightening, tighten oil pan mounting screws in diagonal order from the center.

(1) Oil Strainer

(2) Oil Pan

W1025687

**Connecting Rod Cap**

1. Remove the connecting rod caps.

(When reassembling)

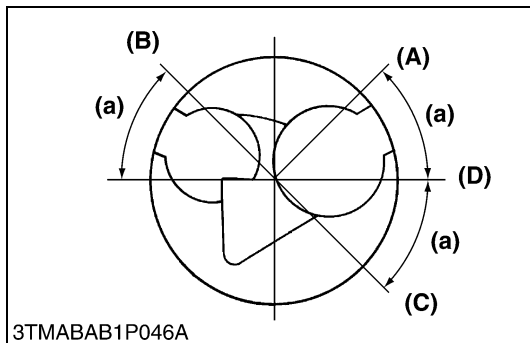
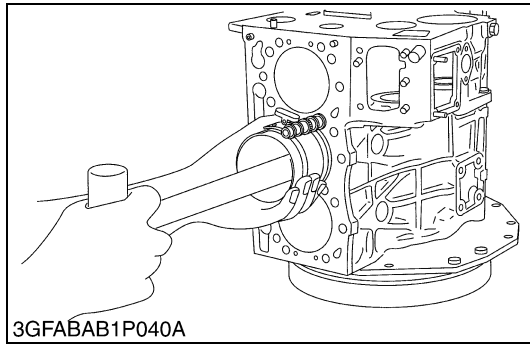
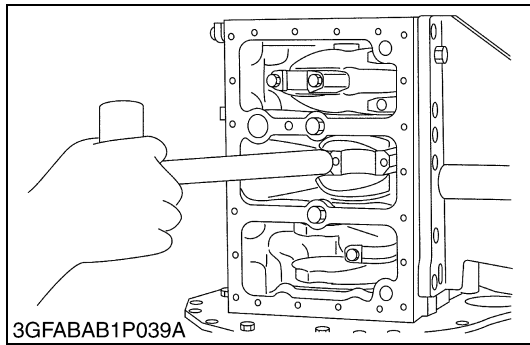
- Align the marks **(a)** with each other. (Face the marks toward the injection pump.)
- Apply engine oil to the connecting rod screws and lightly screw it in by hand, then tighten it to the specified torque.
If the connecting rod screw won't be screwed in smoothly, clean the threads.

If the connecting rod screw is still hard to screw in, replace it.

Tightening torque	Connecting rod screw	44.1 to 49.0 N·m 4.5 to 5.0 kgf·m 32.5 to 36.2 ft·lbs
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(a) Mark

W1025878



Pistons

1. Turn the flywheel and bring the piston to top dead center.
2. Draw out the piston upward by lightly tapping it from the bottom of the crankcase with the grip of a hammer.
3. Draw out the other piston in the same method as above.

(When reassembling)

- Before inserting piston into the cylinder, apply enough engine oil to the piston.
- When inserting the piston into the cylinder, face the mark on the connecting rod to the injection pump.

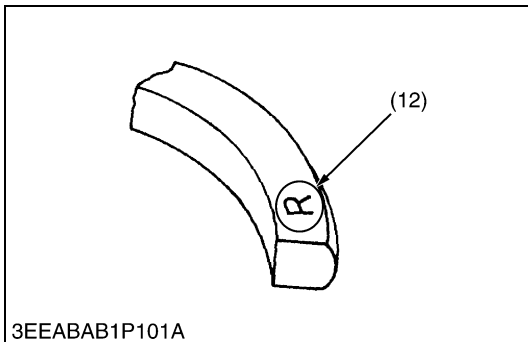
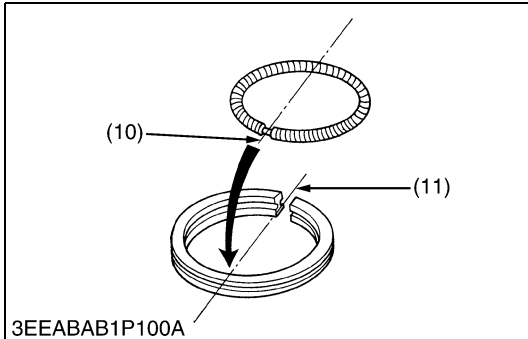
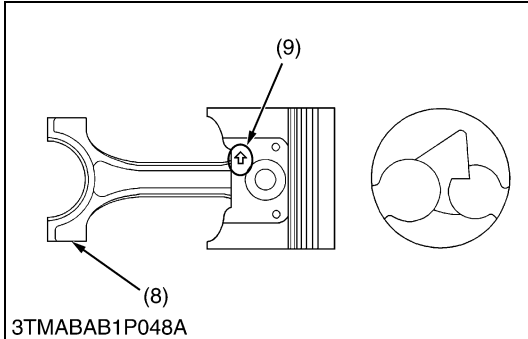
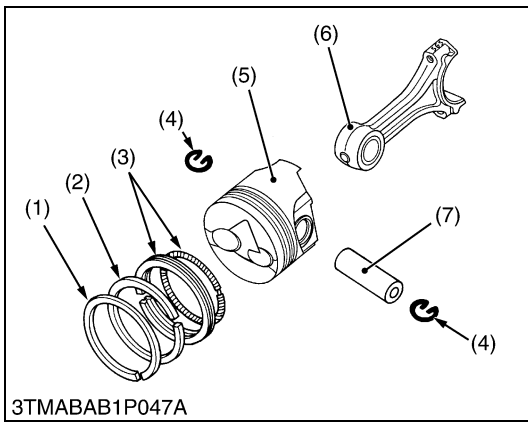
■ IMPORTANT

- Do not change the combination of cylinder and piston. Make sure of the position of each piston by marking. For example, mark "1" on the No. 1 piston.
- Place the piston rings with their gaps at 0.79 rad. (45°) from the piston pin's direction as shown in the figure.
- Carefully insert the pistons using a piston ring compressor.
- When inserting the piston in place, be careful not to get the molybdenum disulfide coating torn off its skirt. This coating is useful in minimizing the clearance with the cylinder liner. Just after the piston pin has been press-fitted, in particular, the piston is still hot and the coating is easy to peel off. Wait until the piston cools down.

- (A) Top Ring Gap
 (B) Second Ring Gap
 (C) Oil Ring Gap

- (D) Piston Pin Hole
 (a) 0.79 rad. (45°)

W1026141



Piston Ring and Connecting Rod

1. Remove the piston rings using a piston ring tool (Code No. 07909-32121).
2. Remove the piston pin (7), and separate the connecting rod (6) from the piston (5).

(When reassembling)

- When installing the ring, assemble the rings so that the manufacturer's mark (12) near the gap faces the top of the piston.
- When installing the oil ring onto the piston, place the expander joint (10) on the opposite side of the oil ring gap (11).
- Apply engine oil to the piston pin.
- When installing the connecting rod to the piston, immerse the piston in 80 °C (176 °F) oil for 10 to 15 minutes and insert the piston pin to the piston.

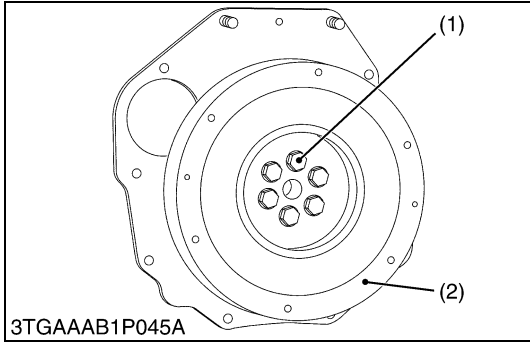
■ NOTE

- Assemble the piston to the connecting rod with the ↑ mark (9) and the connecting rod mark (8) facing the opposite side.
- Mark the same number on the connecting rod and the piston so as not to change the combination.

- | | |
|--------------------------|--------------------------|
| (1) Top Ring | (7) Piston Pin |
| (2) Second Ring | (8) Mark |
| (3) Oil Ring | (9) Casting Mark |
| (4) Piston Pin Snap Ring | (10) Expander Joint |
| (5) Piston | (11) Oil Ring Gap |
| (6) Connecting Rod | (12) Manufacturer's Mark |

W1026376

(D) Crankshaft



Flywheel

1. Lock the flywheel not to turn using the flywheel stopper.
2. Remove the flywheel screws (1) and flywheel (2).

(When reassembling)

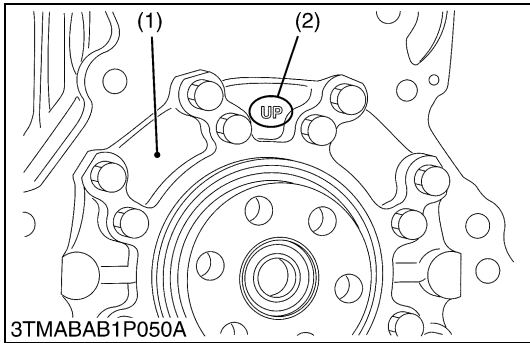
- Apply engine oil to the flywheel screws.
- Check to see that there are no metal particles left on the flywheel mounting surfaces.

Tightening torque	Flywheel screws	98.0 to 107.8 N·m 10.0 to 11.0 kgf·m 72.3 to 79.5 ft-lbs
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(1) Flywheel Screw

(2) Flywheel

W1026863



Bearing Case Cover

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

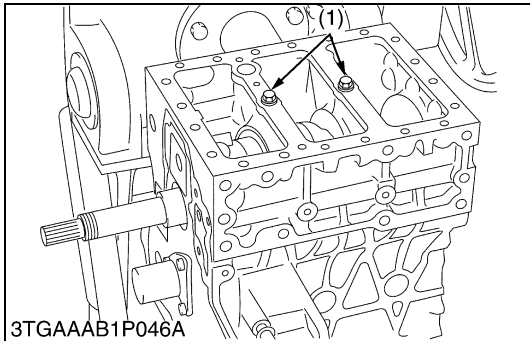
(When reassembling)

- Apply grease the oil seal lip, be careful not to peel the lip off.
- Install the bearing case cover (1) to position the casting mark “UP” (2) on it upward.
- Tighten the bearing case cover mounting screws with even force on the diagonal line.

(1) Bearing Case Cover

(2) Casting Mark

W1027062



Crankshaft

1. Remove the main bearing case screws 2 (1).
2. Pull out the crankshaft assembly (2), taking care not to damage the crankshaft bearing 1.

(When reassembling)

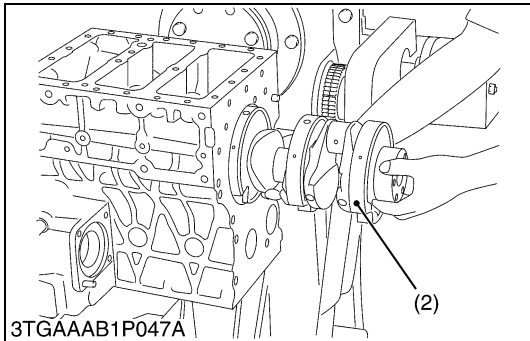
- Apply oil to the main bearing case screws 2.
- Clean the oil passage of the crankshaft with compressed air.
- Install the crankshaft assembly (2), aligning the screw hole of main bearing case with the screw hole of crankcase.

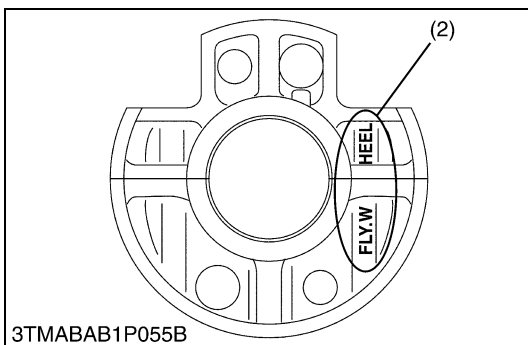
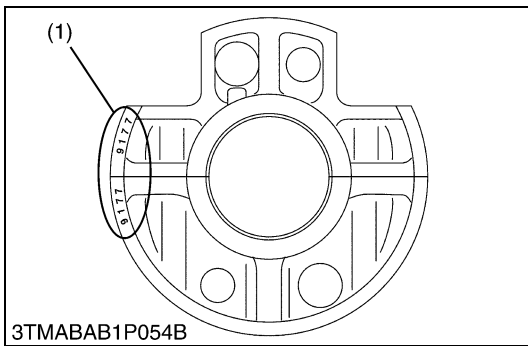
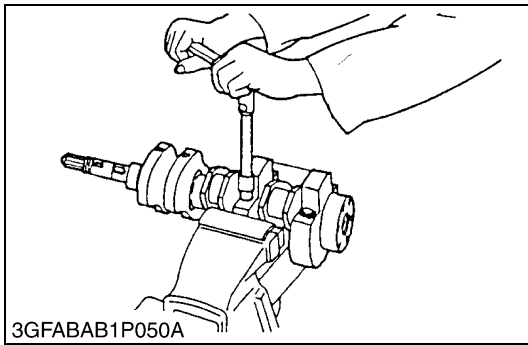
Tightening torque	Main bearing case screws 2	68.6 to 73.5 N·m 7.0 to 7.5 kgf·m 50.6 to 54.2 ft-lbs
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(1) Main Bearing Case Screw 2

(2) Crankshaft Assembly

W1027231





Main Bearing Case Assembly

1. Remove the two main bearing case screws 1, and remove the main bearing case assembly being careful with thrust bearing and crankshaft bearing 2.
2. Remove the main bearing case 1, 2 as above.

(When reassembling)

- Clean the oil passage in the main bearing case.
- Apply clean engine oil on the bearings.
- Install the main bearing case assemblies in the original positions. Since diameters of main bearing cases vary, install them in order of makings (A, B) from the gear case side.
- Match the alignment numbers (1) and mark (2) on the main bearing case.
- When installing the main bearing case 1 and 2, face the mark "FLYWHEEL" to the flywheel.
- Install the thrust bearing with its oil groove facing outward.
- Confirm that the main bearing case moves smoothly after tightening the main bearing case screw 1 to the specified torque.

Tightening torque	Main bearing case screw 1	46.1 to 50.9 N·m 4.7 to 5.2 kgf·m 34.0 to 37.6 ft·lbs
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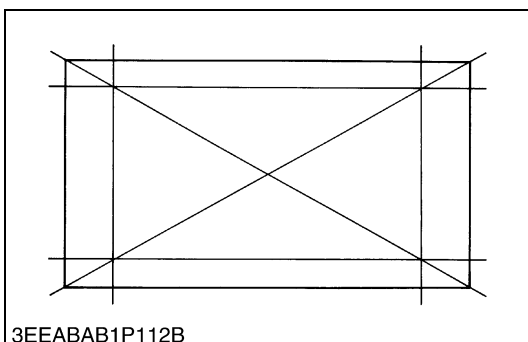
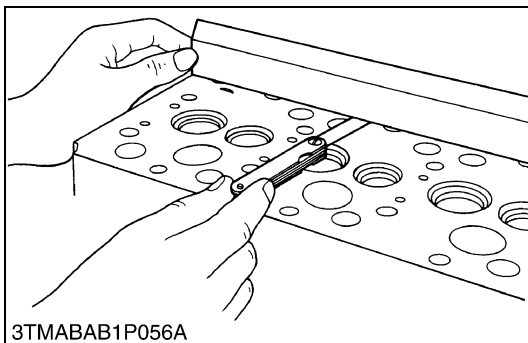
(1) Alignment Number

(2) Alignment Mark

W1027366

(3) Servicing

(A) Cylinder Head and Valves



Cylinder Head Surface Flatness

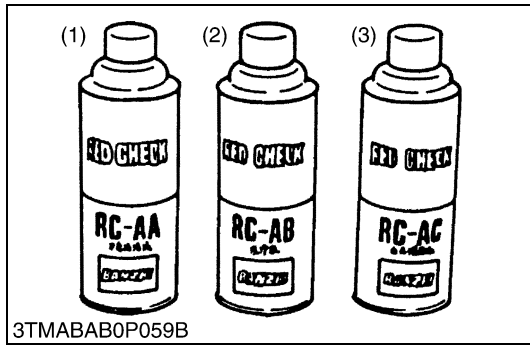
1. Clean the cylinder head surface.
2. Place a straightedge on the cylinder head's four sides and two diagonal as shown in the figure.
3. Measure the clearance with a feeler gauge.
4. If the measurement exceeds the allowable limit, correct it with a surface grinder.

■ IMPORTANT

- Do not place the straightedge on the combustion chamber.
- Be sure to check the valve recessing after correcting.

Cylinder head surface flatness	Factory spec.	0.05 mm / 500 mm 0.0020 in. / 19.69 in.
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W1027737

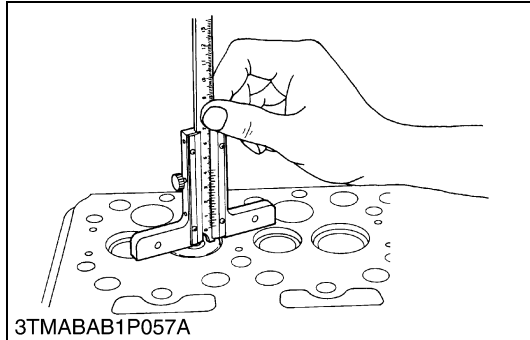


Cylinder Head Flaw

1. Prepare an air spray red check (Code No. 07909-31371).
2. Clean the surface of the cylinder head with detergent (2).
3. Spray the cylinder head surface with the read permeative liquid (1). Leave it five to ten minutes after spraying.
4. Wash away the read permeative liquid on the cylinder head surface with the detergent (2).
5. Spray the cylinder head surface with white developer (3).
6. If flawed, it can be identified as red marks.

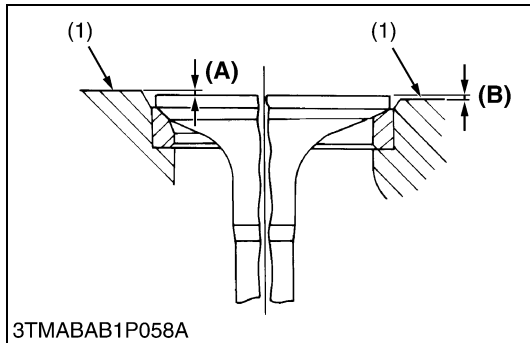
- (1) Red Permeative Liquid (3) White Developer
 (2) Detergent

W1076542



Valve Recessing

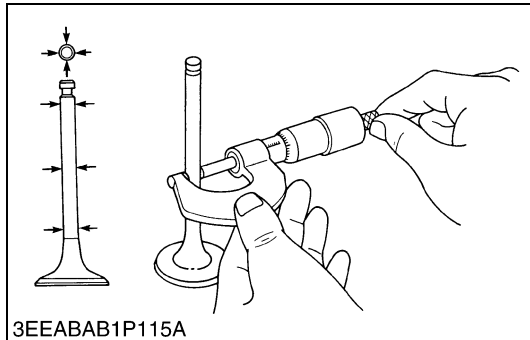
1. Clean the cylinder head surface, valve face and valve seat.
2. Insert the valve into the valve guide.
3. Measure the valve recessing with a depth gauge.
4. If the measurement exceeds the allowable limit, replace the valve.
5. If it still exceeds the allowable limit after replacing the valve, correct the valve seat face of the cylinder head with a valve seat cutter (Code No. 07909-33102) or valve seat grinder.
6. Then, correct the cylinder head surface with a surface grinder, or replace the cylinder head.



Valve recessing	Factory spec.	0.05 (protrusion) to 0.15 (recessing) mm 0.0020 (protrusion) to 0.0059 (recessing) in.
	Allowable limit	0.40 (recessing) mm 0.0157 (recessing) in.

- (1) Cylinder Head Surface **(A) Recessing**
(B) Protrusion

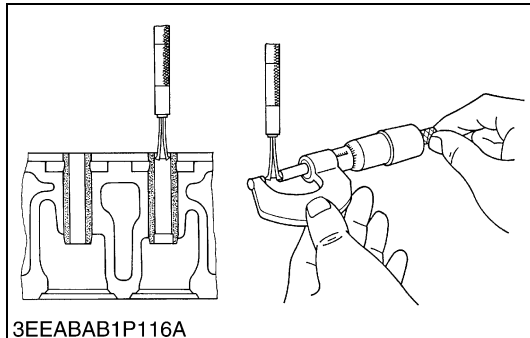
W1076880



Clearance between Valve Stem and Valve Guide

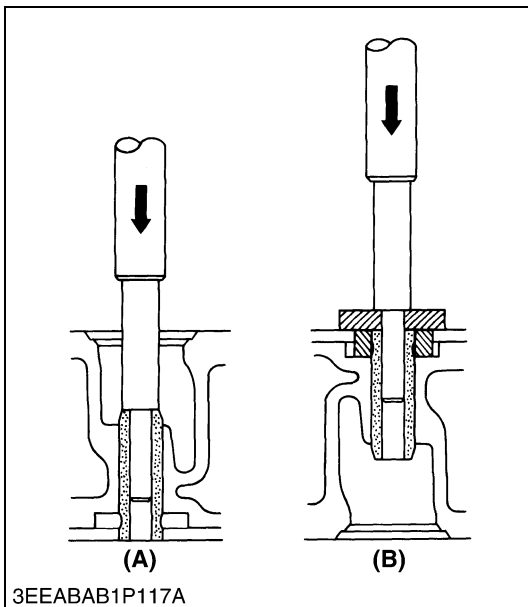
1. Remove carbon from the valve guide section.
2. Measure the valve stem O.D. with an outside micrometer.
3. Measure the valve guide I.D. with a small hole gauge, and calculate the clearance.
4. If the clearance exceeds the allowable limit, replace the valves. If it still exceeds the allowable limit, replace the valve guide.

Clearance between valve stem and guide	Factory spec.	0.040 to 0.070 mm 0.00157 to 0.00276 in.
	Allowable limit	0.1 mm 0.0039 in.



Valve stem O.D.	Factory spec.	7.960 to 7.975 mm 0.31339 to 0.314398 in.
Valve guide I.D.	Factory spec.	8.015 to 8.030 mm 0.31555 to 0.31614 in.

W1077495



Replacing Valve Guide

(When removing)

1. Press out the used valve guide using a valve guide replacing tool.

(When installing)

1. Clean a new valve guide and valve guide bore, and apply engine oil to them.
2. Press in a new valve guide using a valve guide replacing tool.
3. Ream precisely the I.D. of the valve guide to the specified dimension.

Valve guide I.D. (Intake and exhaust)	Factory spec.	8.015 to 8.030 mm 0.31555 to 0.31614 in.
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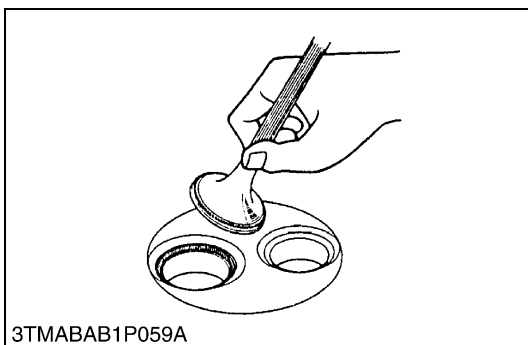
■ IMPORTANT

- Do not hit the valve guide with a hammer during replacement.

(A) When Removing

(B) When Installing

W1027889



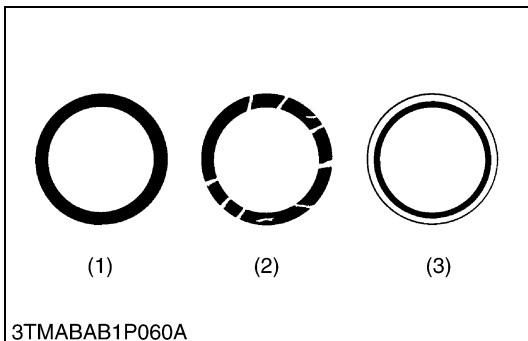
Valve Seating

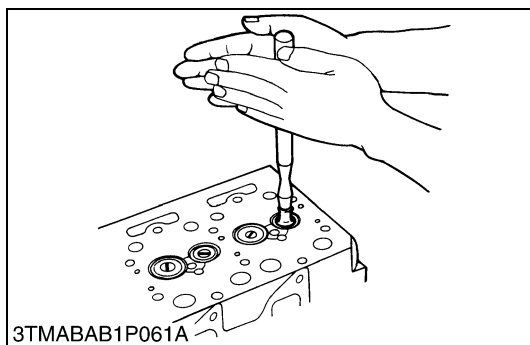
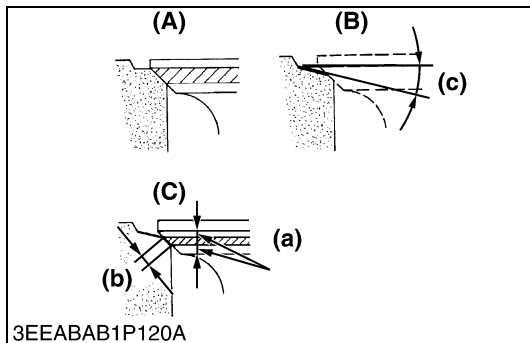
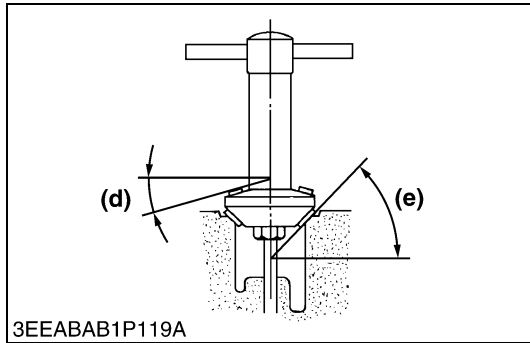
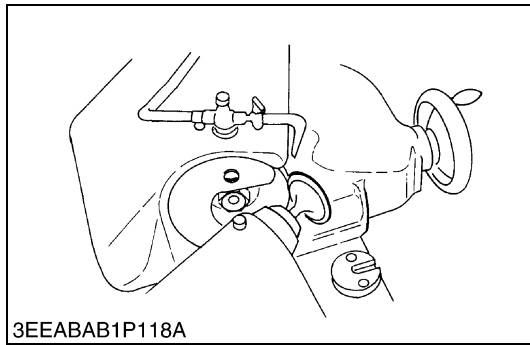
1. Coat the valve face lightly with prussian blue and put the valve on its seat to check the contact.
2. If the valve does not seat all the way around the valve seat or the valve contact is less than 70 %, correct the valve seating as follows.
3. If the valve contact does not comply with the reference value, replace the valve or correct the contact of valve seating.

(1) Correct
(2) Incorrect

(3) Incorrect

W1028219





Correcting Valve and Valve Seat

■ NOTE

- Before correcting the valve and seat, check the valve stem and the I.D. of valve guide section, and repair them if necessary.
- After correcting the valve seat, be sure to check the valve recessing.

1) Correcting Valve

1. Correct the valve with a valve refacer.

2) Correcting Valve Seat

1. Slightly correct the seat surface with a 1.047 rad. (60 °) (intake valve) or 0.785 rad. (45 °) (exhaust valve) seat cutter (Code No. 07909-33102).
2. Resurface the seat surface with a 0.523 rad. (30 °) valve seat cutter to intake valve seat and with a 0.262 rad. (15 °) valve seat cutter to exhaust valve seat so that the width is close to specified valve seat width (2.12 mm, 0.0835 in.)
3. After resurfacing the seat, inspect for even valve seating, apply a thin film of compound between the valve face and valve seat, and fit them with valve lapping tool.
4. Check the valve seating with prussian blue. The valve seating surface should show good contact all the way around.

(a) Identical Dimensions

(A) Check Correct

(b) Valve Seat Width

(B) Correct Seat Width

(c) 0.523 rad. (30 °) or 0.262 rad. (15 °)

(C) Check Contact

(d) 0.262 rad. (15 °) or 0.523 rad. (30 °)

(e) 0.785 rad. (45 °) or 1.047 rad. (60 °)

W1028350

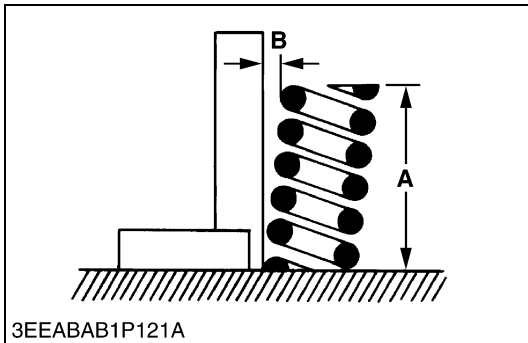
Valve Lapping

1. Apply compound evenly to the valve lapping surface.
2. Insert the valve into the valve guide. Lap the valve onto its seat with a valve flapper or screwdriver.
3. After lapping the valve, wash the compound away and apply oil, then repeat valve lapping with oil.
4. Apply prussian blue to the contact surface to check the seated rate. If it is less than 70 %, repeat valve lapping again.

■ IMPORTANT

- When valve lapping is performed, be sure to check the valve recessing and adjust the valve clearance after assembling the valve.

W1028814



3EEABAB1P121A

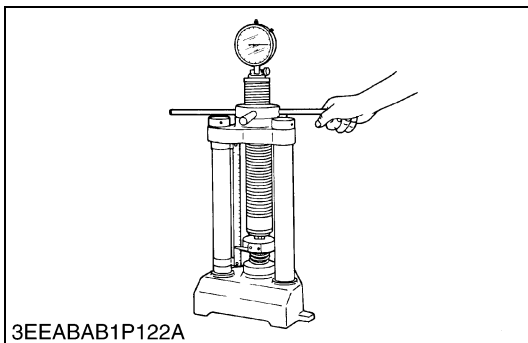
Free Length and Tilt of Valve Spring

1. Measure the free length (**A**) of valve spring with vernier calipers. If the measurement is less than the allowable limit, replace it.
2. Put the valve spring on a surface plate, place a square on the side of the valve spring.
3. Check to see if the entire side is in contact with the square. Rotate the valve spring and measure the maximum tilt (**B**). Check the entire surface of the valve spring for scratches. If there is any defect, replace it.

Free length (A)	Factory spec.	41.7 to 42.2 mm 1.6417 to 1.6614 in.
	Allowable limit	41.2 mm 1.6220 in.

Tilt (B)	Allowable limit	1.0 mm 0.039 in.
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W1028935



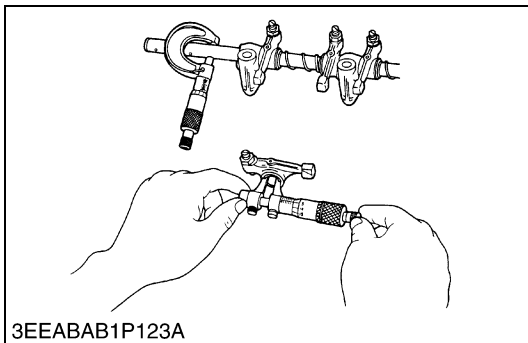
3EEABAB1P122A

Valve Spring Setting Load

1. Place the valve spring on a tester and compress it to the same length it is actually compressed in the engine.
2. Read the compression load on the gauge.
3. If the measurement is less than the allowable limit, replace it.

Setting load / Setting length	Factory spec.	117.6 N / 35 mm 12.0 kgf / 35 mm 26.4 lbs / 1.3780 in.
	Allowable limit	100.0 N / 35 mm 10.2 kgf / 35 mm 22.5 lbs / 1.3780 in.

W1078436



3EEABAB1P123A

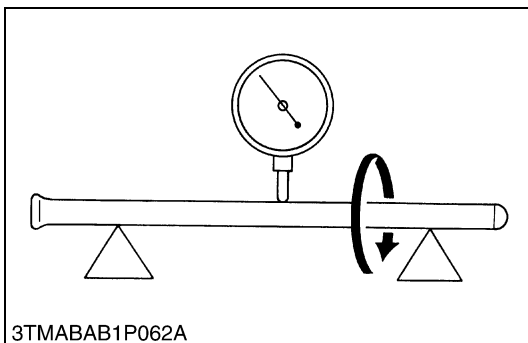
Oil Clearance between Rocker Arm and Rocker Arm Shaft

1. Measure the rocker arm shaft O.D. with an outside micrometer.
2. Measure the rocker arm I.D. with an inside micrometer, and then calculate the oil clearance.
3. If the oil clearance exceeds the allowable limit, replace the rocker arm and measure the oil clearance again. If it still exceeds the allowable limit, replace also the rocker arm shaft.

Oil clearance between rocker arm and rocker arm shaft	Factory spec.	0.016 to 0.045 mm 0.00063 to 0.00177 in.
	Allowable limit	0.10 mm 0.0039 in.

Rocker arm shaft O.D.	Factory spec.	13.973 to 13.984 mm 0.55012 to 0.55055 in.
Rocker arm I.D.	Factory spec.	14.000 to 14.018 mm 0.55118 to 0.55189 in.

W1029150



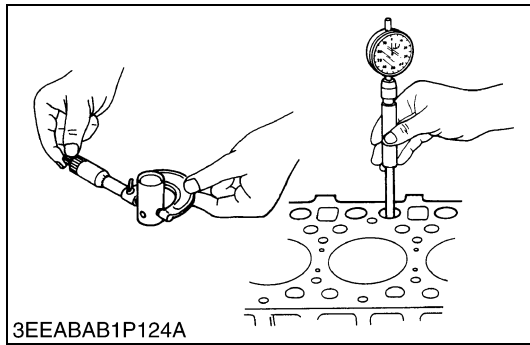
3TMABAB1P062A

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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W1029290



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.

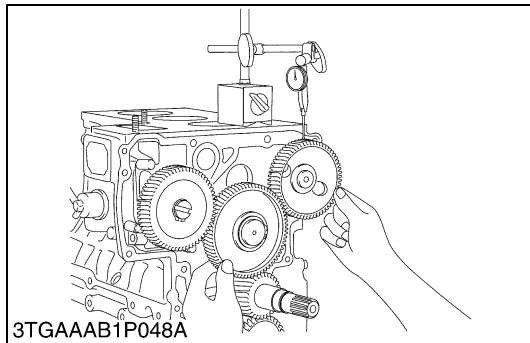
Oil Clearance between tappet and tappet guide bore	Factory spec.	0.020 to 0.062 mm 0.00079 to 0.00244 in.
	Allowable limit	0.07 mm 0.0028 in.

Tappet O.D.	Factory spec.	23.959 to 23.980 mm 0.94327 to 0.94410 in.
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Tappet guide bore I.D.	Factory spec.	24.000 to 24.021 mm 0.94488 to 0.94571 in.
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W1029366

(B) Timing Gears, Camshaft and Fuel Camshaft



Timing Gear Backlash

1. Set a dial indicator (lever type) with its tip on the gear tooth.
2. Move the gear to measure the backlash, holding its mating gear.
3. If the backlash exceeds the allowable limit, check the oil clearance of the shafts and the gear.
4. If the oil clearance is proper, replace the gear.

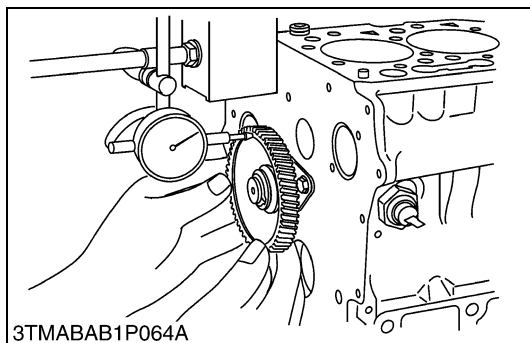
Backlash between idle gear and crank gear	Factory spec.	0.0415 to 0.1122 mm 0.00163 to 0.00442 in.
	Allowable limit	0.15 mm 0.0059 in.

Backlash between idle gear and cam gear	Factory spec.	0.0415 to 0.1154 mm 0.00163 to 0.00454 in.
	Allowable limit	0.15 mm 0.0059 in.

Backlash between idle gear and injection pump gear	Factory spec.	0.0415 to 0.1154 mm 0.00163 to 0.00454 in.
	Allowable limit	0.15 mm 0.0059 in.

Backlash between crank gear and oil pump gear	Factory spec.	0.0415 to 0.1090 mm 0.00163 to 0.00429 in.
	Allowable limit	0.15 mm 0.0059 in.

W1029564

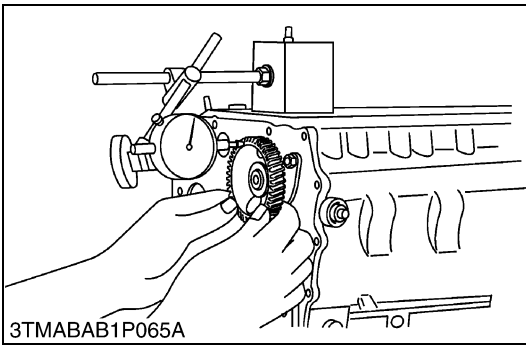


Idle Gear Side Clearance

1. Set a dial indicator with its tip on the idle gear.
2. Measure the side clearance by moving the idle gear to the front and rear.
3. If the measurement exceeds the allowable limit, replace the idle gear collar.

Idle gear side clearance	Factory spec.	0.12 to 0.48 mm 0.0047 to 0.0189 in.
	Allowable limit	0.9 mm 0.0354 in.

W1029843

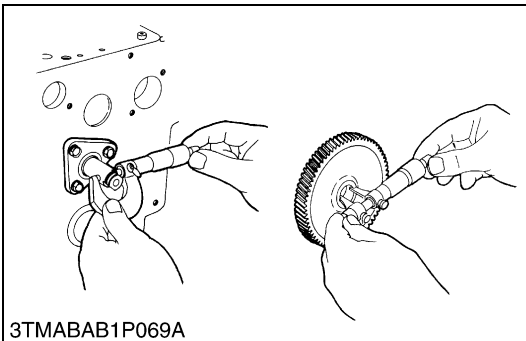


Camshaft Side Clearance

1. Set a dial indicator with its tip on the camshaft.
2. Measure the side clearance by moving the cam gear to the front and rear.
3. If the measurement exceeds the allowable limit, replace the camshaft stopper.

Camshaft side clearance	Factory spec.	0.07 to 0.22 mm 0.0028 to 0.0087 in.
	Allowable limit	0.30 mm 0.0118 in.

W1030012



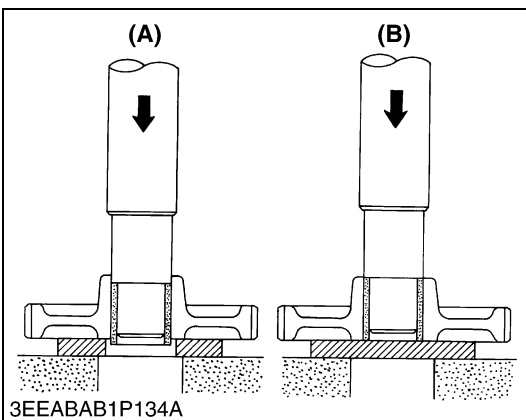
Oil Clearance between Idle Gear Shaft and Idle Gear Bushing

1. Measure the idle gear shaft O.D. with an outside micrometer.
2. Measure the idle gear bushing I.D. with an inside micrometer, and calculate the oil clearance.
3. If the oil clearance exceeds the allowable limit, replace the bushing.

Clearance between idle gear shaft and idle gear bushing	Factory spec.	0.025 to 0.066 mm 0.0010 to 0.0026 in.
	Allowable limit	0.1 mm 0.0039 in.

Idle gear shaft O.D.	Factory spec.	37.959 to 37.975 mm 1.49445 to 1.49508 in.
Idle gear bushing I.D.	Factory spec.	38.000 to 38.025 mm 1.49606 to 1.49704 in.

W1030933



Replacing Idle Gear Bushing

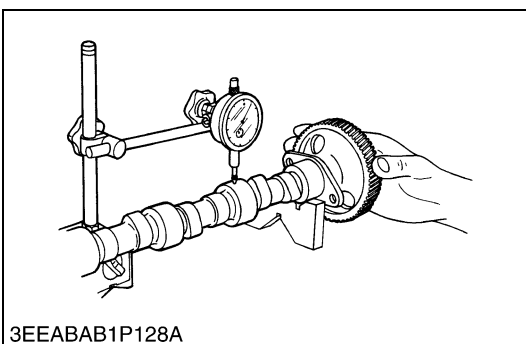
(A) (When removing)

1. Using an idle gear bushing replacing tool, press out the used bushing.

(B) (When installing)

1. Clean a new idle gear bushing and idle gear bore, and apply engine oil to them.
2. Using an idle gear bushing replacing tool, press in a new bushing (service parts) to the specified dimension. (See figure.)

W1031083

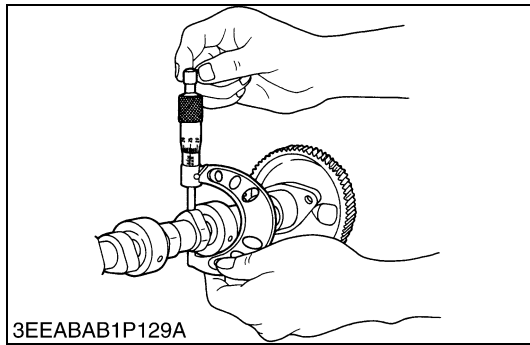


Camshaft Alignment

1. Support the camshaft with V blocks on the surface plate at both end journals.
2. Set a dial indicator with its tip on the intermediate journal.
3. Measure the camshaft alignment.
4. If the measurement exceeds the allowable limit, replace the camshaft.

Camshaft alignment	Allowable limit	0.01 mm 0.0004 in.
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W1031413



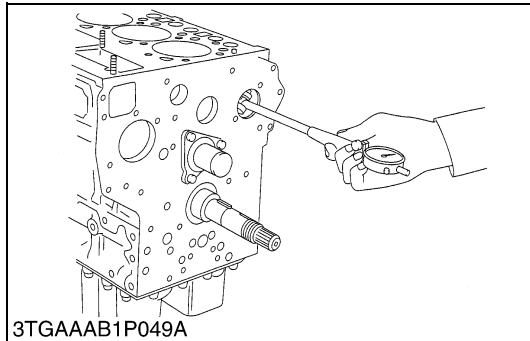
Cam Height

1. Measure the height of the cam at its highest point with an outside micrometer.
2. If the measurement is less than the allowable limit, replace the camshaft.

Cam height of intake	Factory spec.	33.90 mm 1.3346 in.
	Allowable limit	33.85 mm 1.3327 in.

Cam height of exhaust	Factory spec.	33.90 mm 1.3346 in.
	Allowable limit	33.85 mm 1.3327 in.

W1031532



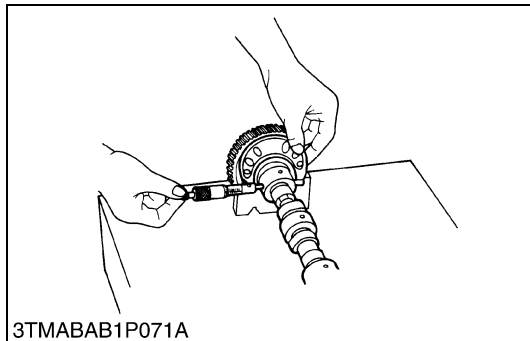
Oil Clearance of Camshaft Journal

1. Measure the camshaft journal O.D. with an outside micrometer.
2. Measure the cylinder block bore I.D. for camshaft with a cylinder gauge, and calculate the oil clearance.
3. If the oil clearance exceeds the allowable limit, replace the camshaft.

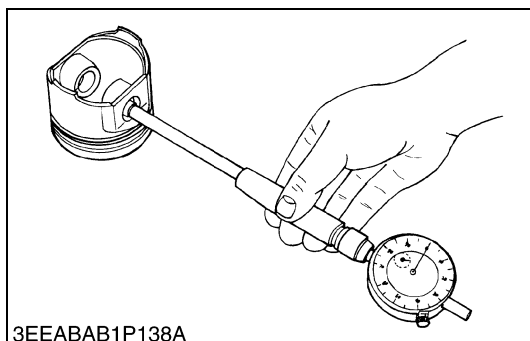
Oil clearance of camshaft journal	Factory spec.	0.050 to 0.091 mm 0.00197 to 0.00358 in.
	Allowable limit	0.15 mm 0.0059 in.

Camshaft journal O.D.	Factory spec.	39.934 to 39.950 mm 1.57221 to 1.57284 in.
Cylinder block bore I.D.	Factory spec.	40.000 to 40.025 mm 1.57480 to 1.57579 in.

W1031662



(C) Piston and Connecting Rod

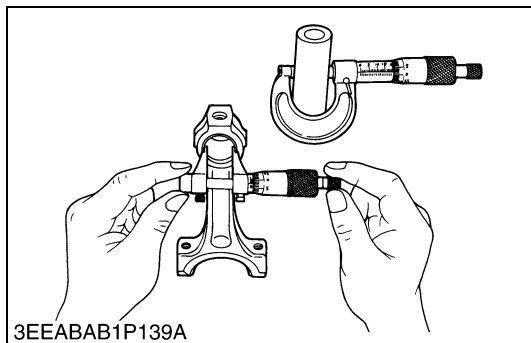


Piston Pin Bore I.D.

1. Measure the piston pin bore I.D. in both the horizontal and vertical directions with a cylinder gauge.
2. If the measurement exceeds the allowable limit, replace the piston.

Piston pin bore I.D.	Factory spec.	25.000 to 25.013 mm 0.98425 to 0.98476 in.
	Allowable limit	25.05 mm 0.9862 in.

W1031817



3EEABAB1P139A

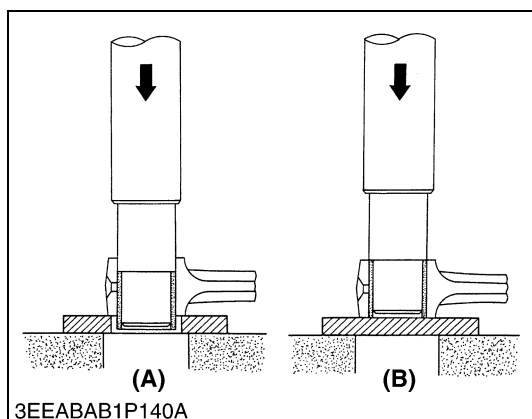
Oil Clearance between Piston Pin and Small End Bushing

1. Measure the piston pin O.D. where it contacts the bushing with an outside micrometer.
2. Measure the small end bushing I.D. with an inside micrometer, and calculate the oil clearance.
3. If the oil clearance exceeds the allowable limit, replace the bushing. If it still exceeds the allowable limit, replace the piston pin.

Oil clearance between piston pin and small end bushing	Factory spec.	0.014 to 0.038 mm 0.00055 to 0.00150 in.
	Allowable limit	0.15 mm 0.0059 in.

Piston pin O.D.	Factory spec.	25.002 to 25.011 mm 0.98433 to 0.98468 in.
	Factory spec.	25.025 to 25.040 mm 0.98523 to 0.98582 in.

W1031982



3EEABAB1P140A

Replacing Connecting Rod Small End Bushing

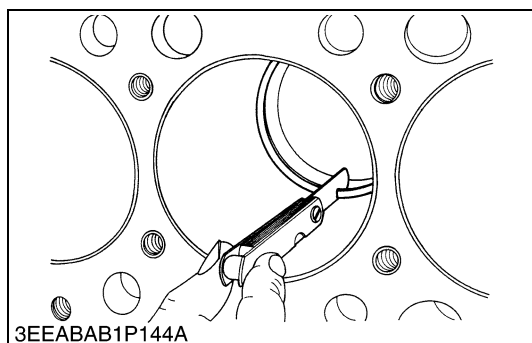
(When removing)

1. Press out the small end bushing with a connecting rod small end bushing replacing tool.

(When installing)

1. Clean a new small end bushing and bore, and apply engine oil to them.
2. Press fit a new bushing, taking due care to see that the connecting rod hole matches the bushing hole.

W1032140



3EEABAB1P144A

Piston Ring Gap

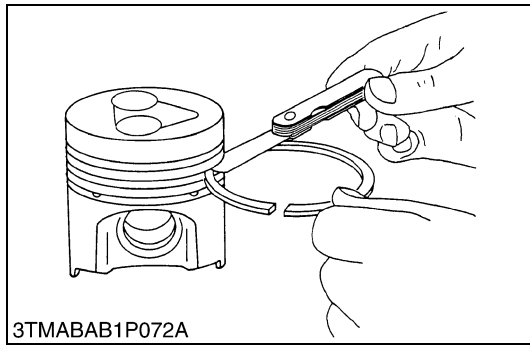
1. Insert the piston ring into the lower part of the liner (the least worn out part) with the piston.
2. Measure the ring gap with a feeler gauge.
3. If the gap exceeds the allowable limit, replace the ring.

Top ring	D1463-M	Factory spec.	0.20 to 0.35 mm 0.0079 to 0.0138 in.
		Allowable limit	1.25 mm 0.0492 in.
	D1703-M	Factory spec.	0.25 to 0.40 mm 0.0098 to 0.0157 in.
		Allowable limit	1.25 mm 0.0492 in.

Second ring	Factory spec.	0.30 to 0.45 mm 0.0118 to 0.0179 in.
	Allowable limit	1.25 mm 0.0492 in.

Oil ring	Factory spec.	0.25 to 0.45 mm 0.0098 to 0.0177 in.
	Allowable limit	1.25 mm 0.0492 in.

W1032246



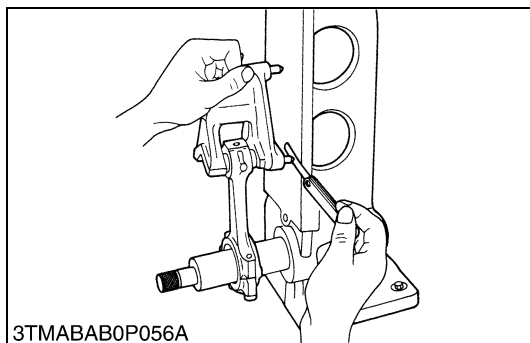
Clearance between Piston Ring and Groove

1. Remove carbon from the ring grooves.
2. Measure the clearance between the ring and the groove with a feeler gauge or depth gauge.
3. If the clearance exceeds allowable limit, replace the ring since compression leak and oil shortage result.
4. If the clearance still exceeds the allowable limit after replacing the ring, replace the piston.

Second ring	D1463-M	Factory spec.	0.093 to 0.120 mm 0.00366 to 0.00472 in.
		Allowable limit	0.2 mm 0.0079 in.
	D1703-M	Factory spec.	0.093 to 0.128 mm 0.00366 to 0.00504 in.
		Allowable limit	0.2 mm 0.0079 in.

Oil ring	Factory spec.	0.020 to 0.060 mm 0.00079 to 0.00205 in.
	Allowable limit	0.15 mm 0.0059 in.

W1032489



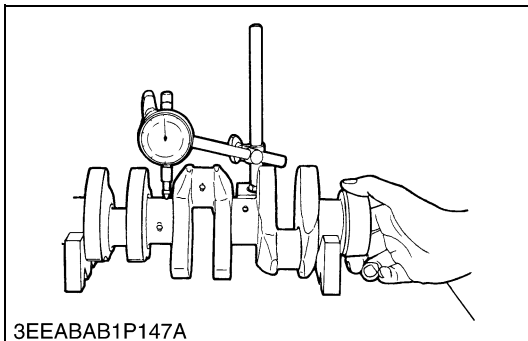
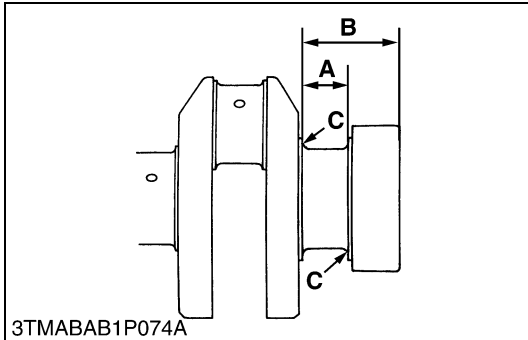
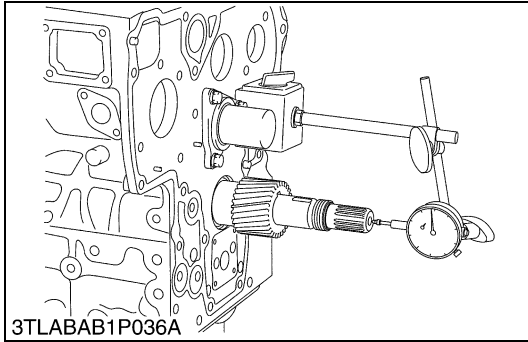
Connecting Rod Alignment

■ NOTE

- **Since the I.D. of the connecting rod small end bushing is the basis of this check, check bushing for wear beforehand.**
1. Install the piston pin into the connecting rod.
 2. Install the connecting rod on the connecting rod alignment tool.
 3. Put a gauge over the piston pin and move it against the face plate.
 4. If the gauge does not fit squarely against the face plate, measure the space between the pin of the gauge and the face plate.
 5. If the measurement exceeds the allowable limit, replace the connecting rod.

Connecting rod alignment	Allowable limit	0.05 mm 0.0020 in.
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W1032720

(D) Crankshaft**Side Clearance of Crankshaft**

1. Move the crankshaft to the flywheel side.
2. Set a dial indicator to the crankshaft.
3. Measure the end play by pulling the crankshaft toward the crank gear.
4. If the measurement exceeds the allowable limit, replace the thrust bearing 1 and 2.

Crankshaft side clearance	Factory spec.	0.15 to 0.35 mm 0.0059 to 0.0138 in.
	Allowable limit	0.5 mm 0.0197 in.

(Reference)

- Oversize thrust bearing

Oversize	Bearing	Code Number	Marking
0.2 mm 0.008 in.	Thrust bearing 1 02	15521-23950	020 OS
	Thrust bearing 2 02	19202-23970	020 OS
0.4 mm 0.016 in.	Thrust bearing 1 04	15521-23960	040 OS
	Thrust bearing 2 04	19202-23980	040 OS

- Oversize dimensions of crankshaft journal

Oversize Dimension	0.2 mm 0.008 in.	0.4 mm 0.016 in.
	A	26.20 to 26.25 mm 1.0315 to 1.0335 in.
B	54.5 to 54.7 mm 2.1456 to 2.1535 in.	54.6 to 54.8 mm 2.1496 to 2.1574 in.
C	2.8 to 3.2 mm radius 0.1102 to 0.1260 in. radius	2.8 to 3.2 mm radius 0.1102 to 0.1260 in. radius
(0.8-S) The crankshaft journal must be fine-finished to higher than $\nabla\nabla\nabla\nabla$		

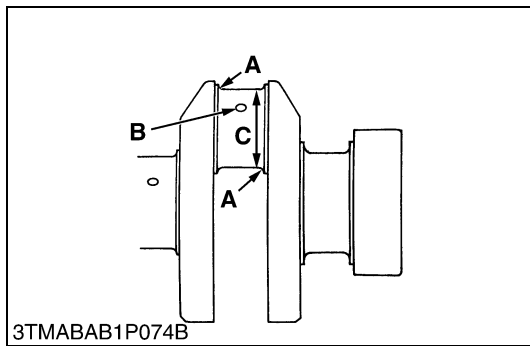
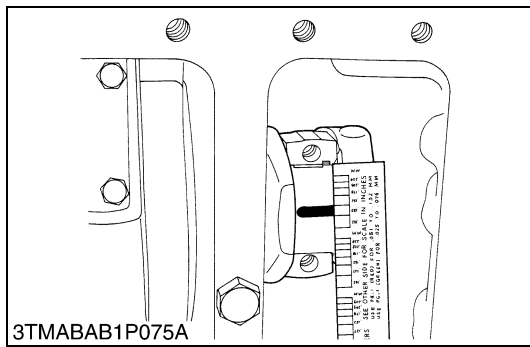
W1032880

Crankshaft Alignment

1. Support the crankshaft with V blocks on the surface plate and set a dial indicator with its tip on the intermediate journal at right angle.
2. Rotate the crankshaft on the V blocks and get the misalignment (half of the measurement).
3. If the misalignment exceeds the allowable limit, replace the crankshaft.

Crankshaft alignment	Allowable limit	0.02 mm 0.00079 in.
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W1033001



Oil Clearance between Crankpin and Crankpin Bearing

1. Clean the crankpin and crankpin bearing.
2. Put a strip of plastigage (Code No.: 07909-30241) on the center of the crankpin in each direction as shown in the figure.
3. Install the connecting rod cap and tighten the connecting rod screws to the specified torque, and remove the cap again.
4. Measure the amount of the flattening with the scale, and get the oil clearance.
5. If the oil clearance exceeds the allowable limit, replace the crankpin bearing.
6. If the same size bearing is useless because of the crankpin wear, replace it with an undersize one referring to the table and figure.

NOTE

- Never insert the plastigage into the crankpin oil hole.
- Be sure not to move the crankshaft while the connecting rod screws are tightened.

Oil clearance between crankpin and crankpin bearing	Factory spec.	0.025 to 0.087 mm 0.00098 to 0.00343 in.
	Allowable limit	0.2 mm 0.0079 in.

Crankpin O.D.	Factory spec.	46.959 to 46.975 mm 1.84878 to 1.84941 in.
Crankpin bearing I.D.	Factory spec.	47.000 to 47.046 mm 1.85039 to 1.85220 in.

(Reference)

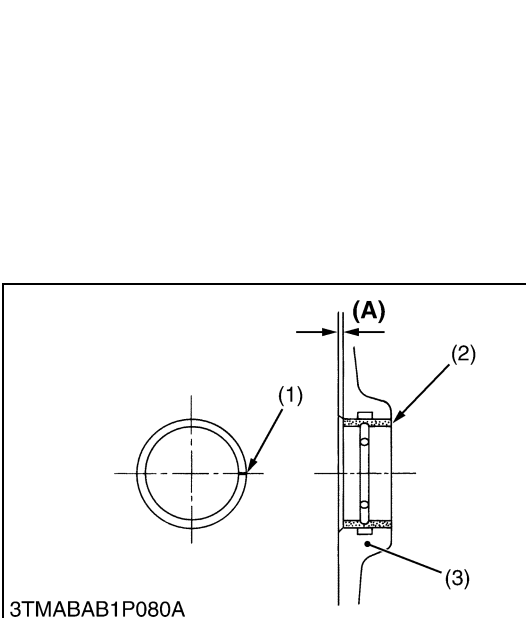
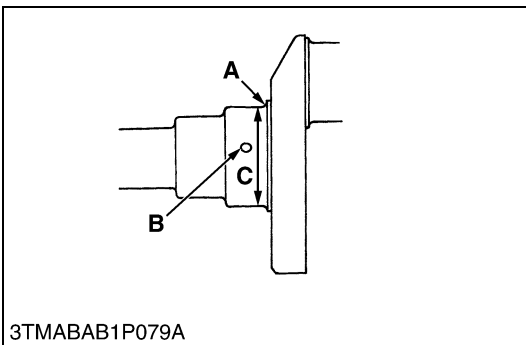
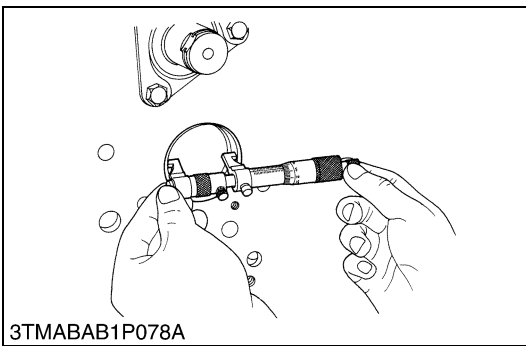
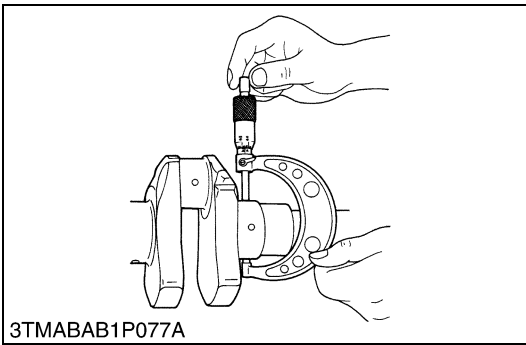
- Undersize crankpin bearing

Undersize	Bearing	Code Number	Marking
0.2 mm 0.008 in.	Crankpin bearing 02	17331-22970	020 US
0.4 mm 0.016 in.	Crankpin bearing 04	17331-22980	040 US

- Undersize dimensions of crankpin

Undersize Dimension	0.2 mm 0.008 in.	0.4 mm 0.016 in.
	A	3.3 to 3.7 mm radius 0.1299 to 0.1457 in. radius
B	1.0 to 1.5 mm radius 0.0394 to 0.0591 in. radius	1.0 to 1.5 mm radius 0.0394 to 0.0591 in. radius
C	46.759 to 46.775 mm 1.84091 to 1.84154 in.	46.559 to 46.575 mm 1.83303 to 1.83366 in.
(0.8-S)		
The crankpin must be fine-finished to higher than ∇∇∇∇		

W1033106



Oil Clearance between Crankshaft Journal and Crankshaft Bearing 1

1. Measure the O.D. of the crankshaft journal with an outside micrometer.
2. Measure the I.D. of the crankshaft bearing 1 with an inside micrometer, and calculate oil clearance.
3. If the clearance exceeds the allowable limit, replace the crankshaft bearing 1.
4. If the same size bearing is useless because of the crankshaft journal wear, replace it with an undersize one referring to the table and figure.

Oil clearance between crankshaft journal and crankshaft bearing 1	Factory spec.	0.040 to 0.118 mm 0.00157 to 0.00465 in.
	Allowable limit	0.2 mm 0.0079 in.

Crankshaft journal O.D.	Factory spec.	51.921 to 51.940 mm 2.04413 to 2.04488 in.
Crankshaft bearing 1 I.D.	Factory spec.	51.980 to 52.039 mm 2.04646 to 2.04878 in.

(Reference)

- Undersize crankshaft bearing 1

Undersize	Bearing	Code Number	Marking
0.2 mm 0.008 in.	Crankshaft bearing 1 02	17311-23910	020 US
0.4 mm 0.016 in.	Crankshaft bearing 1 04	17311-23920	040 US

- Undersize dimensions of crankshaft journal

Undersize Dimension	0.2 mm 0.008 in.	0.4 mm 0.016 in.
	A	2.8 to 3.2 mm radius 0.1102 to 0.1260 in. radius
B	1.0 to 1.5 mm radius 0.0394 to 0.0591 in. radius	1.0 to 1.5 mm radius 0.0394 to 0.0591 in. radius
C	51.721 to 51.740 mm 2.03626 to 2.03701 in.	51.521 to 51.540 mm 2.02839 to 2.02913 in.

(0.8-S)
The crankshaft journal must be fine-finished to higher than ∇∇∇∇

W1033717

Replacing Crankshaft Bearing 1

(When removing)

1. Press out the used crankshaft bearing 1 using a crankshaft bearing 1 replacing tool.

(When installing)

1. Clean a new crankshaft bearing 1 and crankshaft journal bore, and apply engine oil to them.
2. Using a crankshaft bearing 1 replacing tool, press in a new bearing 1 (2) so that its seam (1) directs toward the exhaust manifold side.

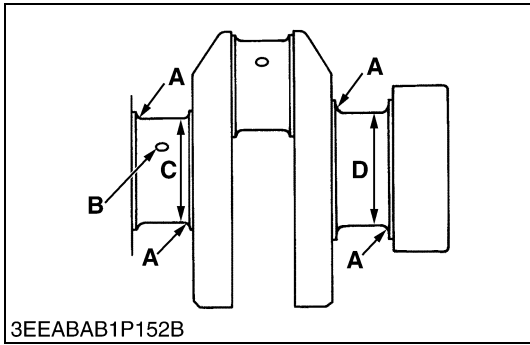
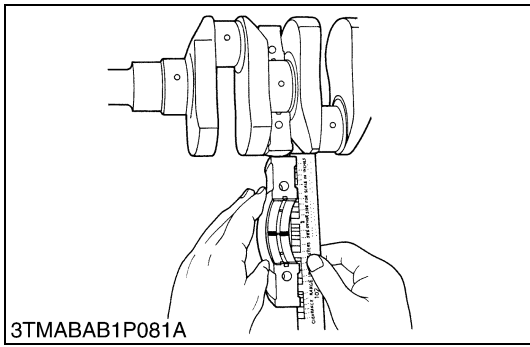
Dimension (A)	Factory spec.	4.2 to 4.5 mm 0.1654 to 0.1772 in.
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(1) Seam

(3) Cylinder Block

(2) Crankshaft Bearing 1

W1033946



Oil Clearance between Crankshaft Journal and Crankshaft Bearing 2

1. Put a strip of plastigage on the center of the journal.
2. Install the bearing case and tighten the bearing case screws 1 to the specified torque, and remove the bearing case again.
3. Measure the amount of the flattening with the scale and get the oil clearance.
4. If the clearance exceeds the allowable limit, replace the crankshaft bearing 2.
5. If the same size bearing is useless because of the crankshaft journal wear, replace it with an undersize one referring to the table and figure.

NOTE

- Be sure not to move the crankshaft while the bearing case screws are tightened.

Oil clearance between crankshaft and crankshaft bearing 2	Factory spec.	0.040 to 0.104 mm 0.00157 to 0.00409 in.
	Allowable limit	0.20 mm 0.0079 in.

Crankshaft O.D.	Factory spec.	51.921 to 51.940 mm 2.04413 to 2.04488 in.
Crankshaft bearing 2 I.D.	Factory spec.	51.980 to 52.025 mm 2.04646 to 2.04823 in.

(Reference)

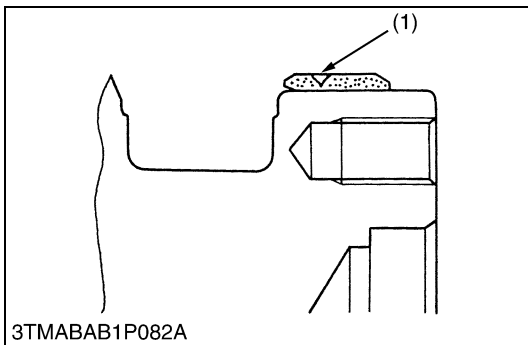
- Undersize crankshaft bearing 2

Undersize	Bearing	Code Number	Marking
0.2 mm 0.008 in.	Crankshaft bearing 2	17311-23930	020 US
0.4 mm 0.016 in.	Crankshaft bearing 2	17311-23940	040 US

- Undersize dimensions of crankshaft journal

Undersize Dimension	0.2 mm 0.008 in.	0.4 mm 0.016 in.
	A	2.8 to 3.2 mm radius 0.1102 to 0.1260 in. radius
B	1.0 to 1.5 mm radius 0.0394 to 0.0591 in. radius	1.0 to 1.5 mm radius 0.0394 to 0.0591 in. radius
C, D	51.721 to 51.740 mm 2.03626 to 2.03701 in.	51.521 to 51.540 mm 2.02839 to 2.02913 in.

W1034075



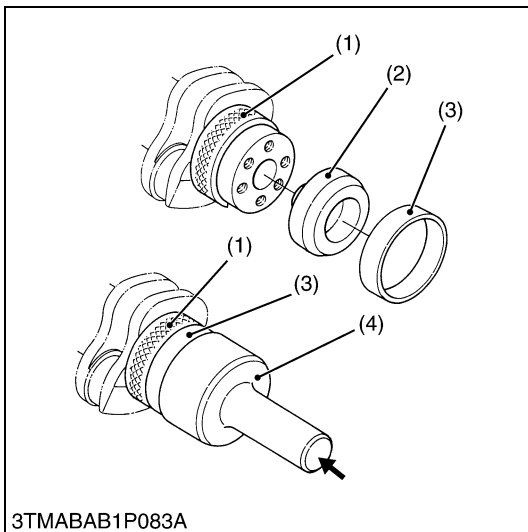
Crankshaft Sleeve Wear

1. Check the wear on the crankshaft sleeve (1).
2. If the wear exceeds the allowable limit or when the engine oil leaks, replace the crankshaft sleeve.

Wear of sleeve	Allowable limit	0.1 mm 0.0004 in.

(1) Crankshaft Sleeve

W1033354



Replacing Crankshaft Sleeve

1. Remove the used crankshaft sleeve using a special-use puller set (Code No.: 07916-32091).
2. Set the sleeve guide (2) to the crankshaft.
3. Set the stopper (1) to the crankshaft as shown in figure.
4. Heat a new sleeve to a temperature between 150 and 200 °C (302 to 392 °F), and fix the sleeve to the crankshaft as shown in figure.
5. Press fit the sleeve using the auxiliary socket for pushing (4).

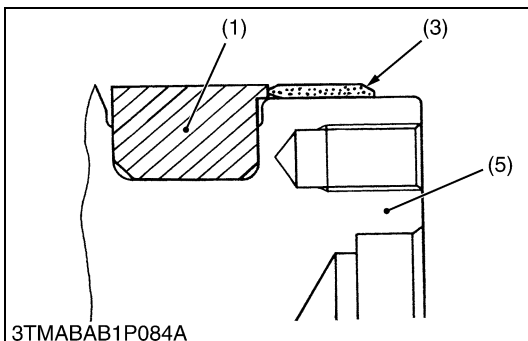
■ NOTE

- Mount the sleeve with its largely chamfered surface facing outward.

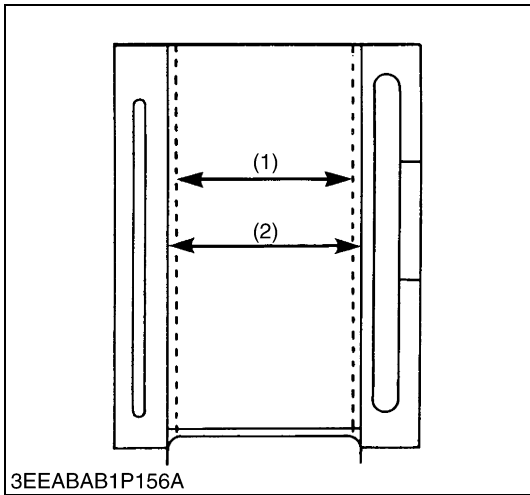
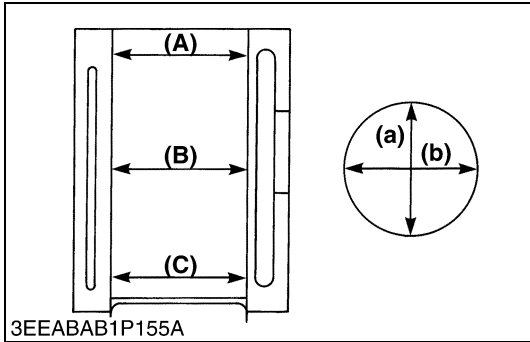
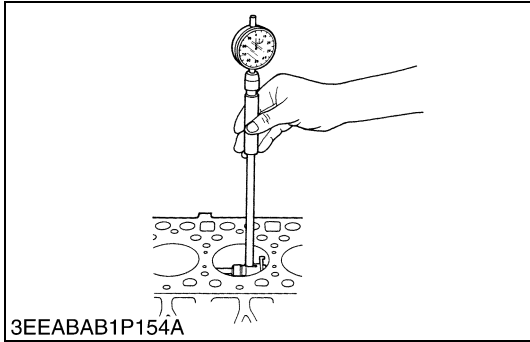
(1) Stopper
 (2) Sleeve Guide
 (3) Crankshaft Sleeve

(4) Auxiliary Socket for Pushing
 (5) Crankshaft

W1033503



(E) Cylinder



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 bores. (Refer to **“Correcting Cylinder”**.)

Cylinder I.D.	Factory spec.	D1463-M	82.000 to 82.0022 mm 3.22835 to 3.22921 in.
		D1703-M	87.000 to 87.022 mm 3.42519 to 3.42606 in.
Maximum wear	Allowable limit	D1463-M	+0.15 mm +0.0059 in.
		D1703-M	+0.15 mm +0.0059 in.

- (A) Top
- (B) Middle
- (C) Bottom (Skirt)

- (a) Right-angled to Piston Pin
- (b) Piston Pin Direction

W1034389

Correcting Cylinder (Oversize +0.25 mm)

1. When the cylinder is worn beyond the allowable limit, bore and hone it to the specified dimension.

Oversize cylinder I.D.	Factory spec.	D1463-M	82.250 to 82.272 mm 3.23819 to 3.23906 in.
		D1703-M	87.250 to 87.272 mm 3.43503 to 3.43590 in.
Maximum wear	Allowable limit	D1463-M	+0.15 mm +0.0059 in.
		D1703-M	+0.15 mm +0.0059 in.
Finishing	Hone to 2.2 to 3.0 mm μR max. ▽▽▽ (0.00087 to 0.00118 in. μR max.)		

2. Replace the piston and piston rings with oversize (+0.25 mm) ones.

Parts Name	Model	Code Number	Marking
Piston	D1463-M	1A011-21900	0.25 OS
	D1703-M	1A091-21901	0.25 OS
Piston ring assembly	D1463-M	1A011-21090	0.25 OS
	D1703-M	1A091-21091	0.25 OS

NOTE

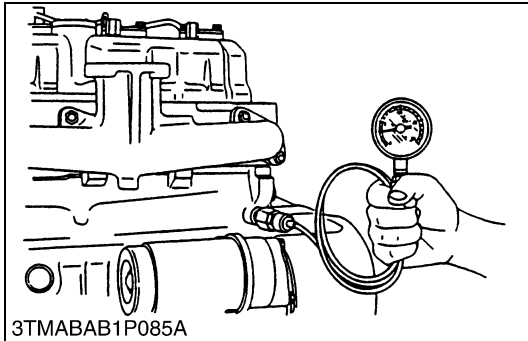
- When the oversize cylinder is worn beyond the allowable limit, replace the cylinder block with a new one.

(1) Cylinder I.D. (Before Correction) (2) Oversize Cylinder I.D.

W1034448

[3] LUBRICATING SYSTEM

(1) Checking



Engine Oil Pressure

1. Remove the engine oil pressure switch, and set a oil pressure tester (Code No.: 07916-32032).
2. Start the engine. After warming up, measure the oil pressure of both idling and rated speeds.
3. If the oil pressure is less than the allowable limit, check the following.
 - Engine oil insufficient.
 - Oil pump defective
 - oil strainer clogged
 - Oil filter cartridge clogged
 - Oil gallery clogged
 - Excessive oil clearance
 - Foreign matter in the relief valve

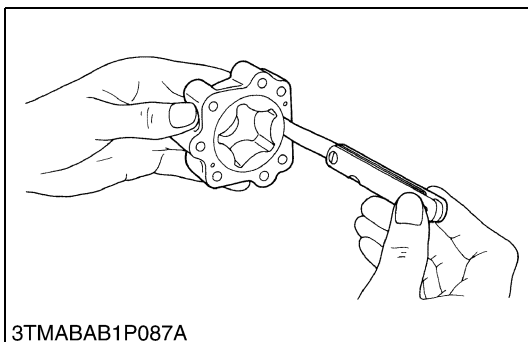
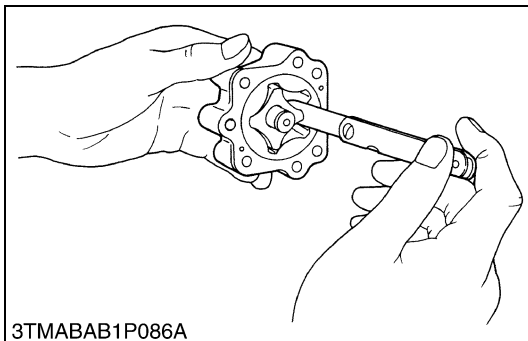
Engine oil pressure	At idle speed	Factory spec.	More than 98 kPa 1.0 kgf/cm ² 14 psi
	At rated speed	Factory spec.	294.2 to 441 kPa 3.0 to 4.5 kgf/cm ² 42.7 to 64 psi
		Allowable limit	245 kPa 2.5 kgf/cm ² 36 psi

(When reassembling)

- After checking the engine oil pressure, tighten the engine oil pressure switch to the specified torque.

W1034952

(2) Servicing



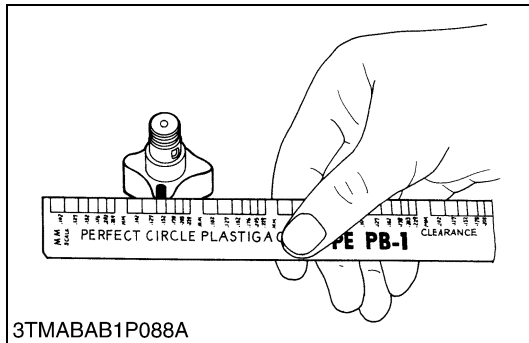
Rotor Lobe Clearance

1. Measure the clearance between lobes of the inner rotor and the outer rotor with a feeler gauge.
2. Measure the clearance between the outer rotor and the pump body with a feeler gauge.
3. If the clearance exceeds the factory specifications, replace the oil pump rotor assembly.

Clearance between inner rotor and outer rotor	Factory spec.	0.03 to 0.14 mm 0.0012 to 0.0055 in.
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Clearance between outer rotor and pump body	Factory spec.	0.11 to 0.19 mm 0.0043 to 0.0075 in.
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W1035296



Clearance between Rotor and Cover

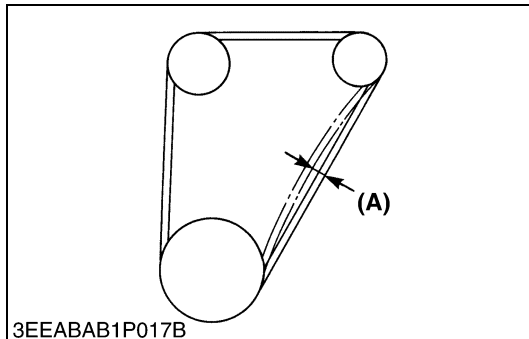
1. Put a strip of plastigage (Code No.: 07909-30241) onto the rotor face with grease.
2. Install the cover and tighten the screws.
3. Remove the cover carefully, and measure the width of the press gauge with a sheet of gauge.
4. If the clearance exceeds the factory specifications, replace oil pump rotor assembly.

End clearance between inner rotor and cover	Factory spec.	0.105 to 0.150 mm 0.00413 to 0.00591 in.
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W1035444

[4] COOLING SYSTEM

(1) Checking and Adjusting

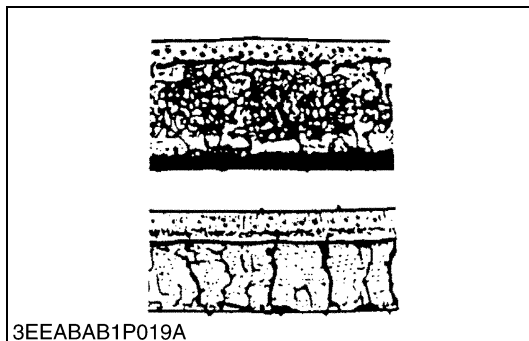


Fan Belt Tension

1. Measure the deflection (A), depressing the belt halfway between the fan drive pulley and alternator pulley at specified force (98 N, 10 kgf, 22 lbs).
2. If the measurement is not within the factory specifications, loosen the alternator mounting screws and relocate the alternator to adjust.

Deflection (A)	Factory spec.	7.0 to 9.0 mm 0.28 to 0.35 in.
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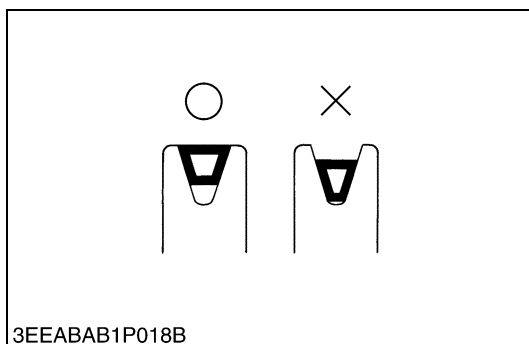
W1035667

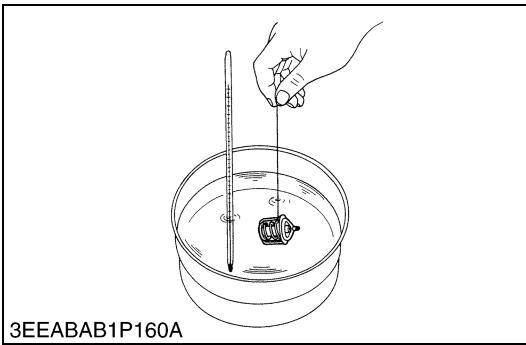


Fan Belt Damage and Wear

1. Check the fan belt for damage.
2. If the fan belt is damaged, replace it.
3. Check if the fan belt is worn and sunk in the pulley groove.
4. If the fan belt is nearly worn out and deeply sunk in the pulley groove, replace it.

W1035758





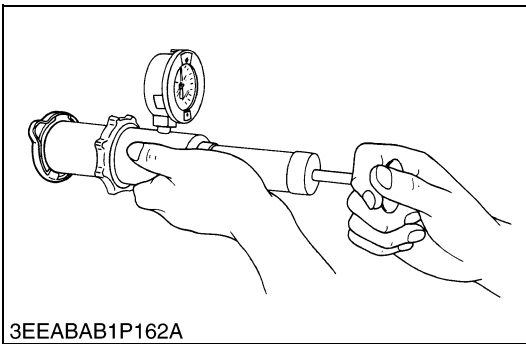
3EEABAB1P160A

Thermostat Valve Opening Temperature

1. Suspend the thermostat in the water by a string with its end inserted between the valve and seat.
2. Heating the water gradually, read the temperature when the valve opens and leaves the string.
3. Continue heating and read the temperature when the valve opens approx. 6 mm (0.236 in.).
4. If the measurement is not within the factory specifications, replace the thermostat.

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

W1035849



3EEABAB1P162A

Radiator Cap Air Leakage

CAUTION

- **When removing the radiator cap, wait at least ten minutes after the engine has stopped and cooled down. Otherwise, hot water may gush out, scalding nearby people.**
1. Set a radiator tester (Code No.: 07909-31551) on the radiator cap.
 2. Apply the specified pressure (88 kPa, 0.9 kgf/cm², 13 psi), and measure the time for the pressure to fall to 59 kPa (0.6 kgf/cm², 9 psi).
 3. If the measurement is less than the factory specification, replace the radiator cap.

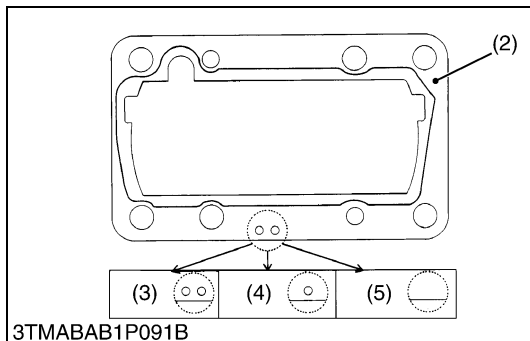
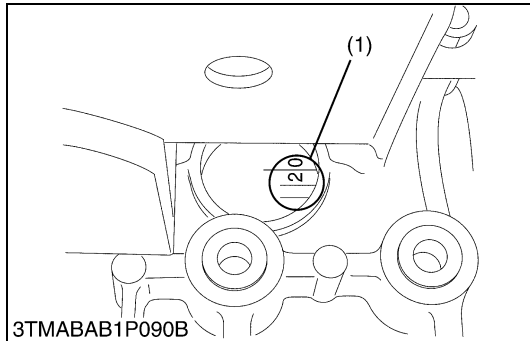
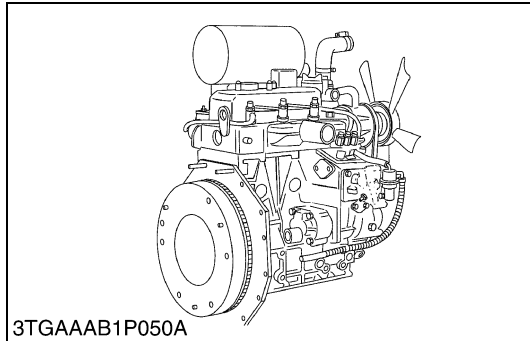
Pressure falling time	Factory spec.	More than 10 seconds for pressure fall from 88 to 59 kPa (from 0.9 to 0.6 kgf/cm ² , from 13 to 9 psi)
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W1036090

[5] FUEL SYSTEM

(1) Checking and Adjusting

(A) Injection Pump



Injection Timing

1. Remove the injection pipes and stop solenoid.
2. Set the speed control lever to maximum fuel discharge position.

(Reference)

- Remove the starter motor and turn the flywheel with screwdriver.
3. Turn the flywheel counterclockwise (facing the flywheel) until the fuel fills up to the hole of the delivery valve holder for 1st cylinder.
 4. Turn the flywheel further and stop turning when the fuel begins to flow over, to get the present injection timing.
 5. (The flywheel has mark 1TC and four lines indicating every 0.087 rad. (5 °) of crank angle from 0.175 rad. (10 °) to 0.436 rad. (25 °) before mark 1TC) Calculate the angle which the center of the window points out. If the calculation differs from specified injection timing, add or remove the shim (2) to adjust.

(Injection Timing)

0.14 to 0.27 rad. (17 ° to 19 °) B.T.D.C.

■ NOTE

- The sealant is applied to both sides of the soft metal gasket shim. The liquid gasket is not required for assembling.
- Shims are available in thickness of 0.20 mm, 0.25 mm and 0.30 mm. Combine these shims for adjustments.
- Addition or reduction of shim (0.05 mm, 0.0020 in.) delays or advances the injection timing by approx. 0.0087 rad. (0.5 °).
- In disassembling and replacing, be sure to use the same number of new gasket shims with the same thickness.

(1) Timing Mark

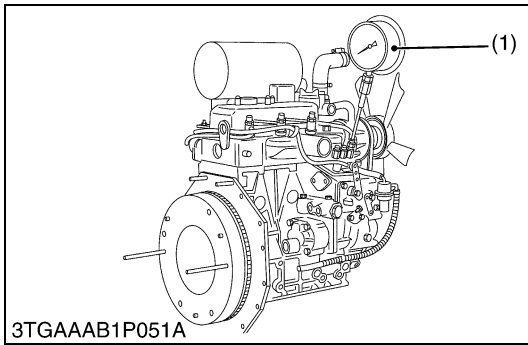
(2) Adjusting Shim

(3) 2-Holes: 0.20 mm (Shim)

(4) 1-hole: 0.25 mm (Shim)

(5) Without hole: 0.30 mm (Shim)

W1036402



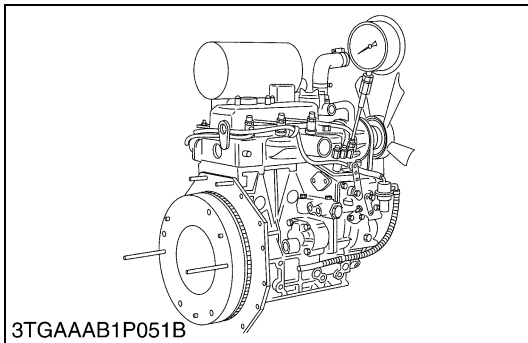
Fuel Tightness of Pump Element

1. Remove the injection pipes and glow plugs.
2. Install the injection pump pressure tester (1) to the injection pump.
3. Set the speed control lever to the maximum speed position.
4. Turn the flywheel ten times or more to increase the pressure.
5. If the pressure can not reach the allowable limit, replace the pump element or injection pump assembly.

Fuel tightness of pump element	Allowable limit	14.7 MPa 150 kgf/cm ² 2133 psi
--------------------------------	-----------------	---

(1) Injection Pump Pressure Tester

W1036694



Fuel Tightness of Delivery Valve

1. Remove the injection pipes and glow plugs.
2. Set a pressure tester to the fuel injection pump.
3. Turn the flywheel and raise the pressure to approx. 14.7 MPa (150 kgf/cm², 2133 psi).
4. Now turn the flywheel back about half a turn (to keep the plunger free). Maintain the flywheel at this position and clock the time taken for the pressure to drop from 14.7 to 13.7 MPa (from 150 to 140 kgf/cm², from 2133 to 1990 psi).
5. Measure the time needed to decrease the pressure from 14.7 to 13.7 MPa (from 150 to 140 kgf/cm², from 2133 to 1990 psi).
6. If the measurement is less than allowable limit, replace the delivery valve.

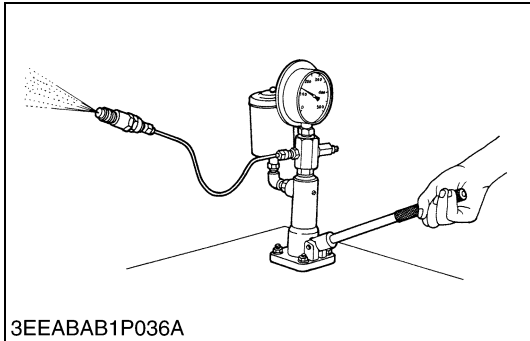
Fuel tightness of delivery valve	Factory spec.	5 seconds 14.7 → 13.7 MPa 150 → 140 kgf/cm ² 2133 → 1990 psi
----------------------------------	---------------	--

W1036852

(B) Injection Nozzle

⚠ CAUTION

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



Nozzle Injection Pressure

1. Set the injection nozzle to the nozzle tester.
2. Slowly move the tester handle to measure the pressure at which fuel begins jetting out from the nozzle.
3. If the measurement is not within the factory specifications, disassemble the injection nozzle, and change adjusting washer (1) until the proper injection pressure is obtained.

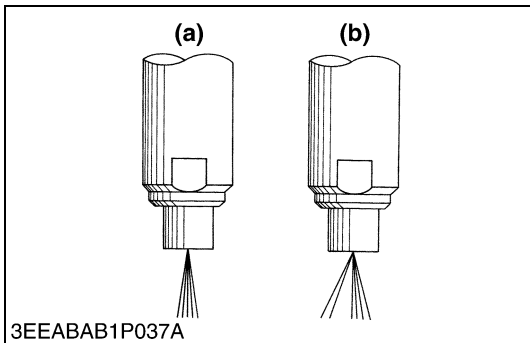
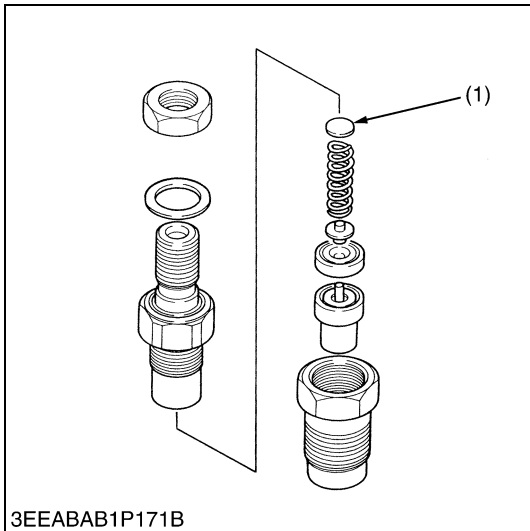
(Reference)

- Pressure variation with 0.025 mm (0.00098 in.) difference of adjusting washer thickness.
Approx. 235 kPa (3.0 kgf/cm², 43 psi)

Fuel injection pressure	Factory spec.	13.73 to 14.71 MPa 140 to 150 kgf/cm ² 1991 to 2133 psi
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(1) Adjusting Washer

W1037197



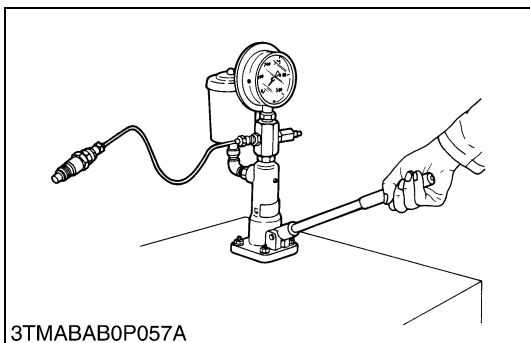
Nozzle Spraying Condition

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

(a) Good

(b) Bad

W1037394

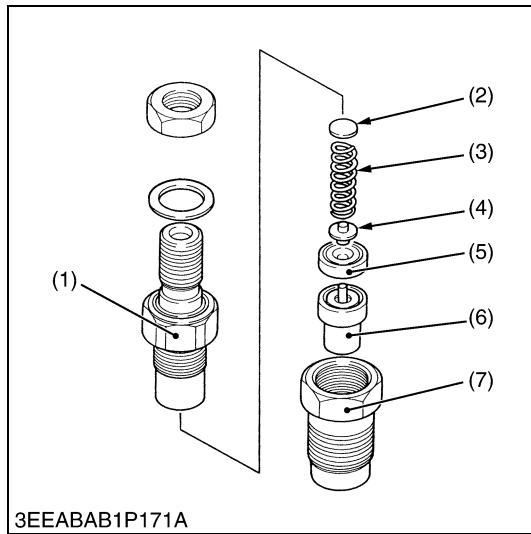


Valve Seat Tightness

1. Set the injection nozzle to a nozzle tester (Code No. 07909-31361).
2. Raise the fuel pressure, and keep at 12.75 MPa (130 kgf/cm², 1849 psi) for 10 seconds.
3. If any fuel leak is found, replace the nozzle piece.

Valve seat tightness	Factory spec.	No fuel leak at 12.75 MPa 130 kgf/cm ² 1849 psi
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W1088949

(2) Disassembling and Assembling**(A) Injection Nozzle****Nozzle Holder**

1. Secure the nozzle retaining nut (7) with a vise.
2. Remove the nozzle holder (1), and take out parts inside.

(When reassembling)

- Assemble the nozzle in clean fuel oil.
- Install the push rod (4), noting its direction.
- After assembling the nozzle, be sure to adjust the fuel injection pressure.

Tightening torque	Nozzle holder	34.3 to 39.2 N·m 3.5 to 4.0 kgf·m 25.3 to 28.9 ft-lbs
	Overflow pipe nut	19.6 to 24.5 N·m 2.0 to 2.5 kgf·m 14.5 to 18.1 ft-lbs
	Nozzle holder assembly	49.0 to 68.6 N·m 5.0 to 7.0 kgf·m 36.2 to 50.6 ft-lbs

- (1) Nozzle Holder
- (2) Adjusting Washer
- (3) Nozzle Spring
- (4) Push Rod

- (5) Distance Piece
- (6) Nozzle Piece
- (7) Nozzle Retaining Nut

W1089102

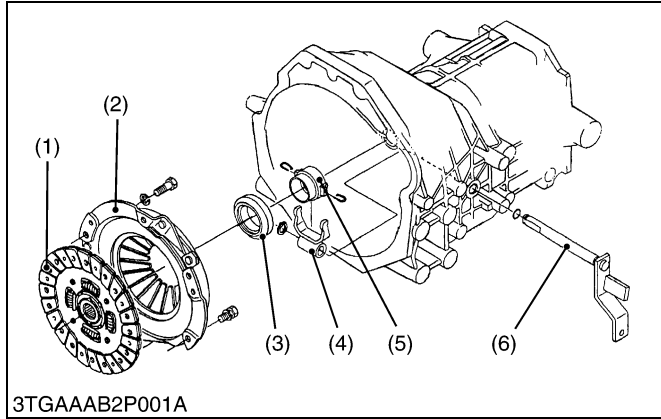
2 CLUTCH

MECHANISM

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1. FEATURES	2-M1
2. OPERATION	2-M2

1. FEATURES



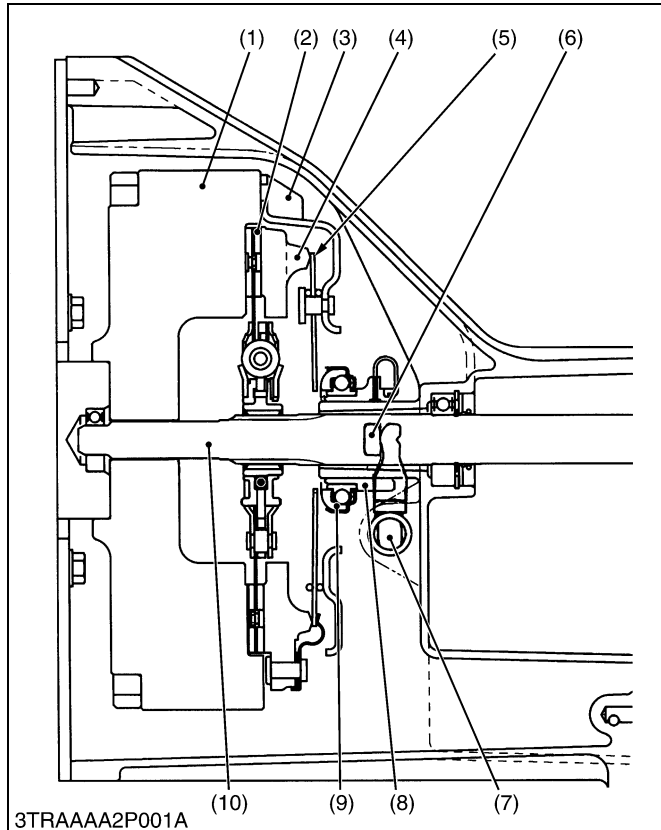
This tractor is used dry single plate type clutch.
The clutch is located between the engine and transmission and is operated by stepping on the clutch pedal.

When the clutch pedal is depressed, the clutch is disengaged and when it is released, the clutch is engaged and power from the engine is transmitted to the transmission.

- | | |
|-----------------------------|------------------|
| (1) Clutch Disc | (4) Release Fork |
| (2) Pressure Plate Assembly | (5) Release Hub |
| (3) Release Bearing | (6) Clutch Rod |

W1012575

2. OPERATION



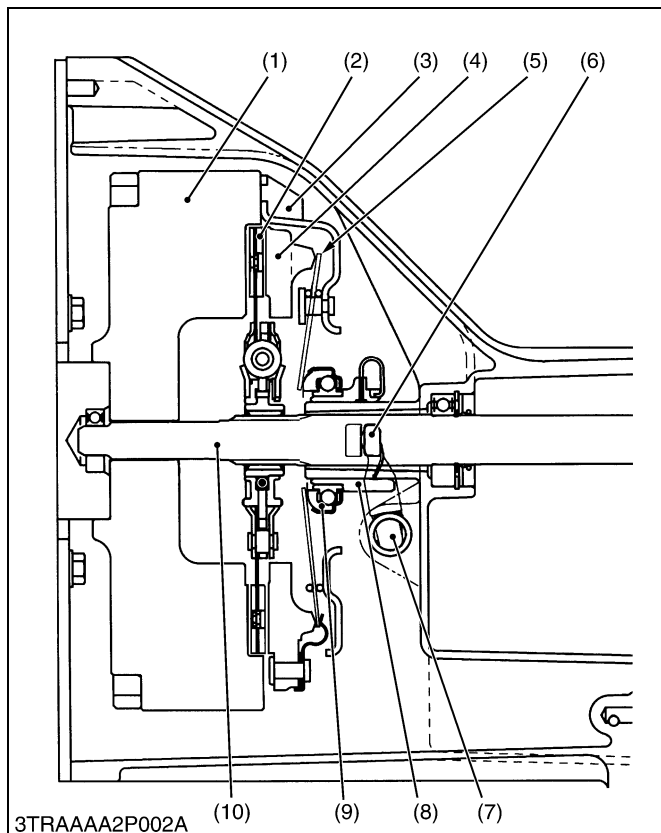
■ Clutch “Engaged”

When the clutch pedal is not depressed, the clutch release bearing (9) and the fingers of diaphragm spring (5) are not connected to each other.

Accordingly, the pressure plate (4) is tightly pressed against the flywheel (1) by the diaphragm spring (5). As a result, rotation of the flywheel (1) is transmitted to the transmission through the clutch shaft (10) due to the frictional force among the flywheel (1), clutch disc (2) and pressure plate (4).

- | | |
|----------------------|---------------------|
| (1) Flywheel | (6) Release Fork |
| (2) Clutch Disc | (7) Clutch Rod |
| (3) Clutch Cover | (8) Release hub |
| (4) Pressure Plate | (9) Release Bearing |
| (5) Diaphragm Spring | (10) Clutch Shaft |

W1012698



■ Clutch “Disengaged”

When the clutch pedal is depressed, the clutch pedal rod is pulled to move the clutch rod (7). Then, the release fork (6) pushes the release hub (8) and release bearing (9) toward the flywheel. Simultaneously, the release bearing (9) pushes the diaphragm spring (5).

As the pressure plate (4) is pulled by the diaphragm spring (5), the frictional force among the flywheel (1), clutch disc (2) and pressure plate (4) disappears.

Therefore, rotation of the flywheel (1) is not transmitted to the clutch disc (2), and then the rotation of the clutch shaft (10) stops.

- | | |
|----------------------|---------------------|
| (1) Flywheel | (6) Release Fork |
| (2) Clutch Disc | (7) Clutch Rod |
| (3) Clutch Cover | (8) Release hub |
| (4) Pressure Plate | (9) Release Bearing |
| (5) Diaphragm Spring | (10) Clutch Shaft |

W1012945

SERVICING

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1. TROUBLESHOOTING	2-S1
2. SERVICING SPECIFICATIONS	2-S2
3. TIGHTENING TORQUES	2-S3
4. CHECKING, DISASSEMBLING AND SERVICING.....	2-S4
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[2] DISASSEMBLING AND ASSEMBLING.....	2-S4
(1) Separating Engine from Clutch Housing.....	2-S4
(2) Separating Clutch Assembly.....	2-S12
(3) Disassembling Clutch Release	2-S13
[3] SERVICING	2-S13

1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Clutch Drags	<ul style="list-style-type: none"> Clutch pedal free travel excessive Dust on clutch disc generated from clutch disc facing Release fork broken Clutch disc or pressure plate warped 	Adjust Remove rust Replace Replace	2-S4 – 2-S13 2-S14
Clutch Slips	<ul style="list-style-type: none"> Clutch pedal free travel too small Clutch disc excessively worn Grease or oil on clutch disc facing Clutch disc or pressure plate warped Diaphragm spring weaken or broken 	Adjust Replace Replace Replace Replace	2-S4 2-S13 2-S12 2-S14 2-S14
Chattering	<ul style="list-style-type: none"> Grease or oil on clutch disc facing Clutch disc or pressure plate warped Clutch disc boss spline worn or rusted Clutch shaft bent Pressure plate or flywheel face cracked or scored Clutch disc boss spline and clutch shaft spline worn Diaphragm spring strength uneven or diaphragm spring broken 	Replace Replace Replace or remove rust Replace Replace Replace Replace	2-S12 2-S14 2-S13 – 2-S14 2-S13 2-S14
Rattle During Running	<ul style="list-style-type: none"> Clutch disc boss spline worn Release bearing worn or sticking 	Replace Replace	2-S13 2-S13
Clutch Squeaks	<ul style="list-style-type: none"> Release bearing sticking or dry Clutch disc excessively worn 	Replace Replace	2-S13 2-S12
Vibration	<ul style="list-style-type: none"> Clutch shaft bent Clutch disc rivet worn or broken Clutch parts broken 	Replace Replace Replace	– 2-S12 2-S12

W1014322

2. SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Clutch Pedal	Free Travel on Clutch Pedal	20 to 30 mm 0.78 to 1.18 in.	–
Safety Switch Setting Position	Distance “ B ” of Safety Switch when Clutch Pedal Released	Approx. 6.0 mm 0.236 in.	–
Clutch Disc	Disc Surface to Rivet Top (Depth)	–	0.3 mm 0.012 in.
Clutch Disc Boss to Gear Shaft	Backlash (Displacement Around Disc Edge)	–	2.0 mm 0.079 in.
Pressure Plate	Flatness	–	0.2 mm 0.008 in.
Diaphragm Spring	Mutual Difference	–	0.5 mm 0.020 in.

W1013874

3. TIGHTENING TORQUES

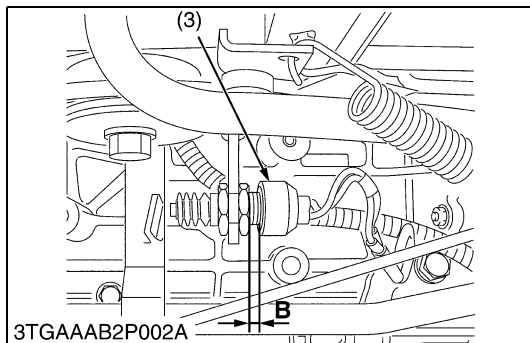
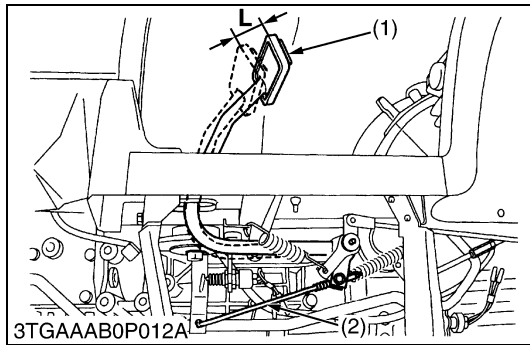
Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts : See page G-9.)

Item	N·m	kgf·m	ft-lbs
Steering wheel mounting nut	48.04 to 56.0	4.9 to 5.7	35.4 to 41.22
Steering hose RH and LH retaining nut	25 to 30	2.5 to 3.0	18.08 to 21.69
Power steering delivery hose retaining nut	50 to 60	5.0 to 6.0	36.16 to 43.39
Clutch housing and engine mounting screw and nut			
M10	48.1 to 55.8	4.9 to 5.7	35.5 to 41.2
M12	77.5 to 90.2	7.9 to 9.2	57.2 to 66.5
Clutch mounting screw	23.5 to 27.5	2.4 to 2.8	17.4 to 20.2

W1012736

4. CHECKING, DISASSEMBLING AND SERVICING

[1] CHECKING AND ADJUSTING



Checking Clutch Pedal Free Travel

⚠ CAUTION

- When checking, park the tractor on flat ground, apply the parking brake, stop the engine and remove the key.

- Slightly depress the clutch pedal (1) and measure free travel "L" at top of clutch pedal.
- If the measurement is not within the factory specification, loosen the lock nut and adjust the clutch rod (2) length.
- And at same time, check the distance "B" at safety switch (3) and clutch rod (2).

■ IMPORTANT

- After adjustment, be sure to check that engine does not start without depressing the clutch pedal but engine start when depressing the clutch pedal.

Clutch pedal free travel "L" on top of clutch pedal	20 to 30 mm 0.78 to 1.18 in.
Distance "B"	Factory spec. Approx. 6 mm 0.236 in.

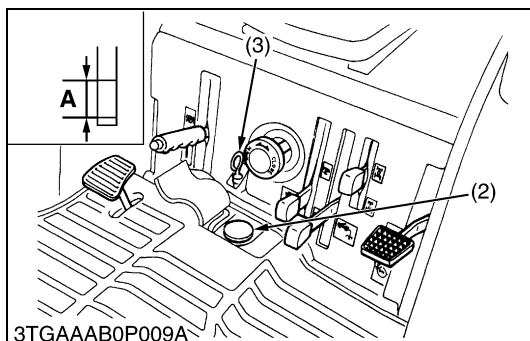
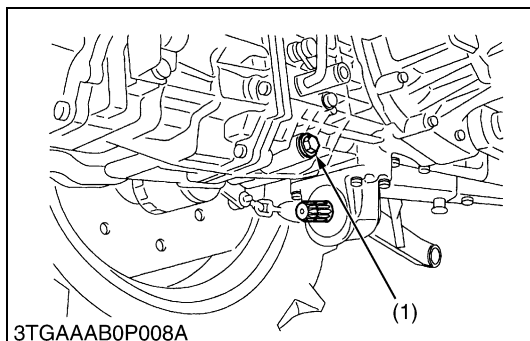
- (1) Clutch Pedal
(2) Clutch Rod

- (3) Safety Switch

W1012180

[2] DISASSEMBLING AND ASSEMBLING

(1) Separating Engine from Clutch Housing



Draining Transmission Fluid

- Place oil pan underneath the transmission case, and remove the drain plugs (1).
- Drain the transmission fluid.
- Reinstall the drain plug (1).

(When refilling)

- Fill new oil from filling port after remaining the filling plug (2) up to the upper notch on the dipstick (3).
- After running the engine for few minutes, stop it and check the oil level again, if low, add oil prescribed level.

■ IMPORTANT

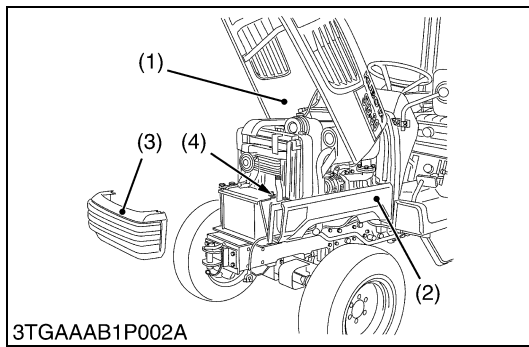
- Use only KUBOTA SUPER UDT fluid-Use of other oils may damage the transmission or hydraulic system. Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-8.)
- Never work the tractor immediately after changing the transmission oil. Keeping the engine at medium speed for a few minutes to prevents damage to the transmission.
- Do not mix different brands oil together.

Transmission fluid capacity	18.5 L 4.89 U.S.gals. 4.07 Imp.gals.
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- (1) Drain Plug
(2) Filling Plug
(3) Dipstick

A : Oil level is acceptable within this range.

W1012748



Hood, Side Cover and Battery Cord

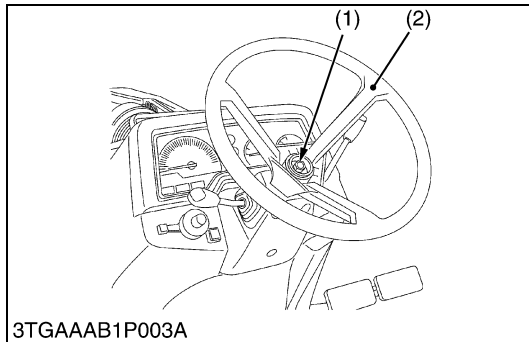
1. Open the hood (1) and remove the front grille (3).
2. Disconnect the battery grounding cord (4).
3. Disconnect the head light connectors and remove the side covers (2) and hood (1).

■ NOTE

- When disconnecting the battery cords, disconnect the grounding cord first. When connecting, positive cord first.

- | | |
|----------------|------------------|
| (1) Hood | (3) Front Grille |
| (2) Side Cover | (4) Battery Cord |

W1012749



Steering Wheel

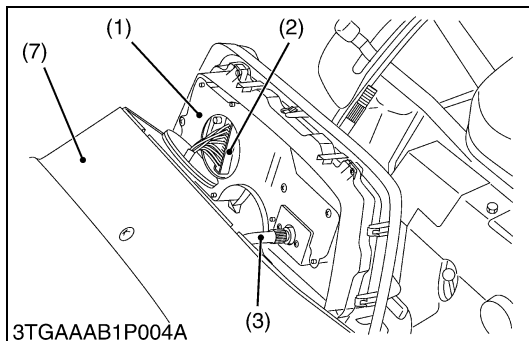
1. Remove the steering wheel cap.
2. Remove the steering wheel mounting nut (1) and remove the steering wheel (2) with a steering wheel puller (Code No. 07916-51090).

(When reassembling)

Tightening torque	Steering wheel mounting nut	48.04 to 56.0 N·m 4.9 to 5.7 kgf·m 35.4 to 41.22 ft·lbs

- | | |
|---------|--------------------|
| (1) Nut | (2) Steering Wheel |
|---------|--------------------|

W1012884

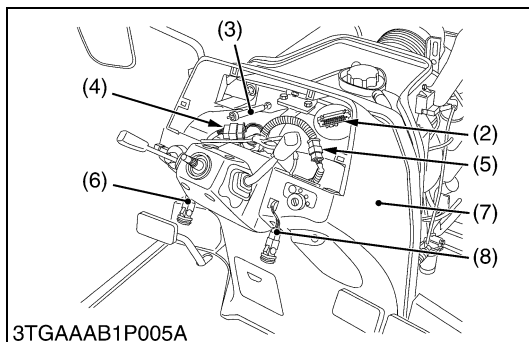


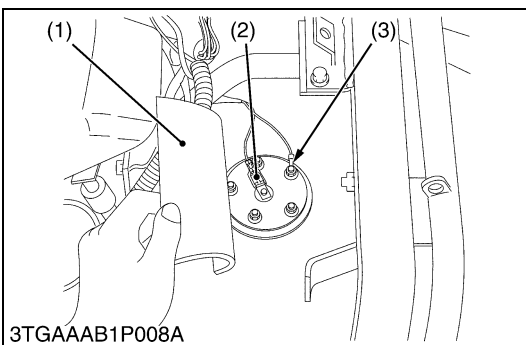
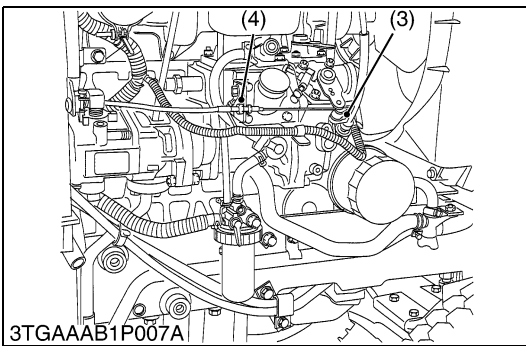
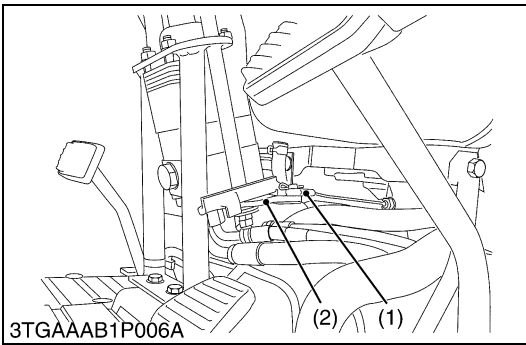
Meter Panel and Panel Under Cover

1. Open the meter panel (1) and disconnect the meter panel connector (2) and hour-meter cable (3). Then remove the meter panel.
2. Remove the sponge.
3. Disconnect the combination switch connector (4), main switch connector (5), hazard switch connector (6) and position lamp switch connector (8).
4. Remove the panel under cover (7).

- | | |
|----------------------------------|------------------------------------|
| (1) Meter Panel | (5) Main Switch Connector |
| (2) Meter Panel Connector | (6) Hazard Switch connector |
| (3) Hour-meter Cable | (7) Panel Under Cover |
| (4) Combination Switch Connector | (8) Position Lamp Switch Connector |

W1013015





Accelerator Wire

1. Remove the accelerator wire (1) from hand accelerator lever arm (2).
2. Remove the accelerator wire (1) from speed control lever (3) and holder (4).

■ IMPORTANT

- After assembling, be sure to adjust the accelerator wire to speed control lever to operate the engine maximum speed.
- Be sure to check the accelerator wire is not interfere with power steering any hoses.

- | | |
|---------------------------|-------------------------|
| (1) Accelerator Wire | (3) Speed Control Lever |
| (2) Accelerator Lever Arm | (4) Holder |

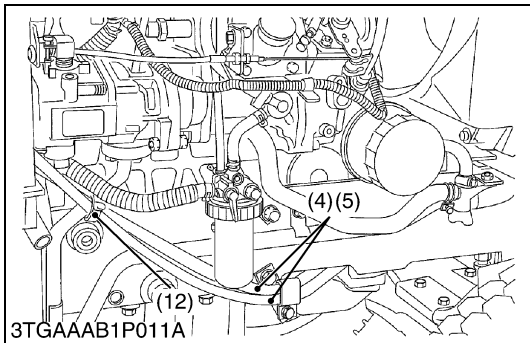
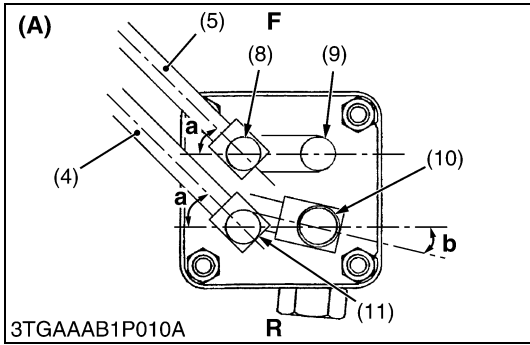
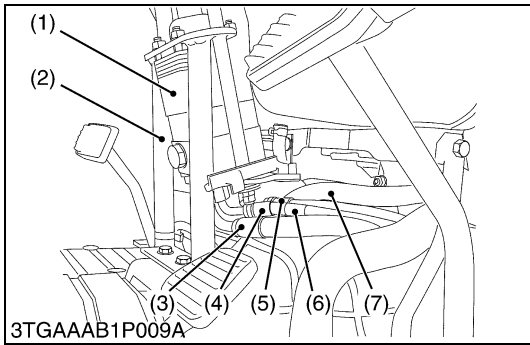
W1013265

Fuel Sensor Wire

1. Turn over the fuel sensor cover (1).
2. Disconnect the 1P connector (2) and ground wire (3) from the fuel sensor.

- | | |
|-----------------------|-----------------|
| (1) Fuel Sensor Cover | (3) Ground Wire |
| (2) 1P Connector | |

W1052606



Power Steering Controller

1. Disconnect the draining hose (7), power steering delivery hose (3), steering hose RH (4) and steering hose LH (5).
2. Remove the power steering controller (1) with steering pillar (2).

(When reassembling)

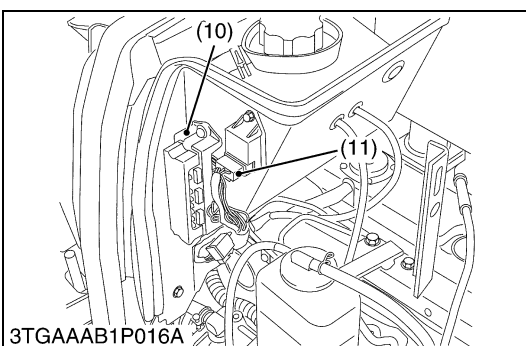
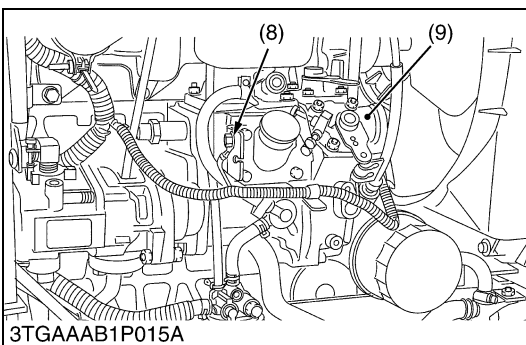
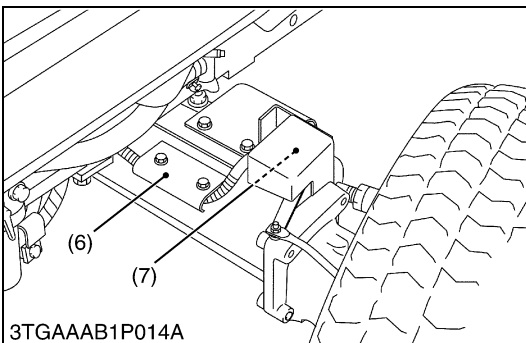
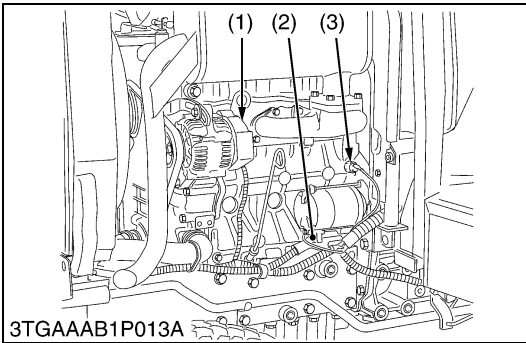
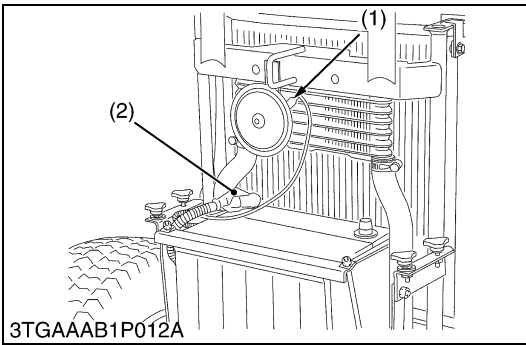
- Connect the steering hose LH (5) to **LT** port (8).
- Connect the steering hose RH (4) with white tape (6) to **RT** port (11).
- Make arrangement the hose as figure and routing to original.
- When reassembling the controller with steering pillar to the panel under frame and under frame, temporarily screw in the four screws then tighten first to panel under frame (upper side) side in parallel between panel under frame and screw plate of steering pillar.
- Be sure to clamp the delivery hoses (4) and (5) to position hydraulic delivery pipe with clamp band (12).
- Be sure to check the hoses are not interfere with accelerator wire.

Tightening torque	Power steering delivery hose retaining nut	50 to 60 N·m 5.0 to 6.0 kgf·m 36.16 to 43.39 ft·lbs
	Steering hose LH and RH retaining nut	25 to 30 N·m 2.5 to 3.0 kgf·m 18.08 to 21.69 ft·lbs

- (1) Power Steering Controller
- (2) Steering Pillar
- (3) Power Steering Delivery Hose
- (4) Steering Hose RH
- (5) Steering Hose LH
- (6) White Tape
- (7) Drain Hose
- (8) LT Port
- (9) Drain Port
- (10) Delivery Port
- (11) RT Port
- (12) Clamp Band

(A) Viewed from Bottom Side
F : Front
R : Rear
a : 0.785 rad. (45 °)
b : 0.174 to 0.262 rad. (10 to 15 °)

W1052855

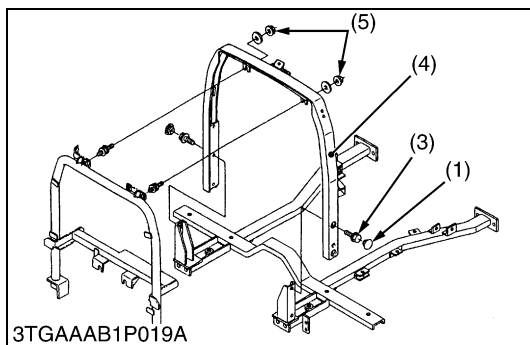
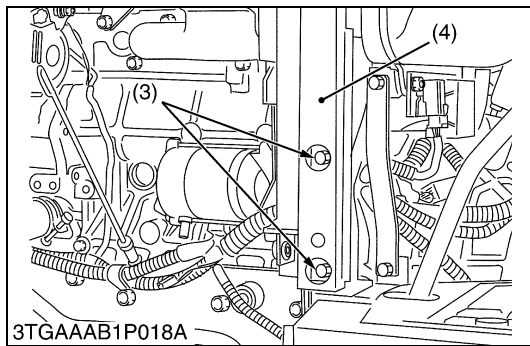
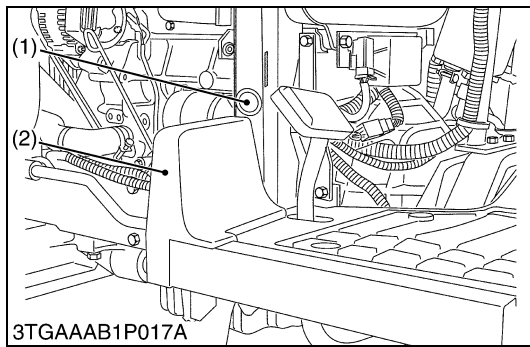


Wire Connectors

1. Remove or disconnect the connectors, terminals as listed below and figures.
2. Remove the harness from each harness clamp.
3. Remove the fuse box mounting screws, and remove the fuse box assembly (10).

- | | |
|--------------------------------|--------------------------------------|
| (1) Horn | (7) Front Wheel Turning Angle Sensor |
| (2) Battery Positive Code | (8) Ground Terminal |
| (3) Alternator | (9) Stop Solenoid |
| (4) Starter | (10) Fuse Box Assembly |
| (5) Engine Oil Pressure Switch | (11) Timer Relay |
| (6) Harness Guide | |

W1045601



Panel Under Frame

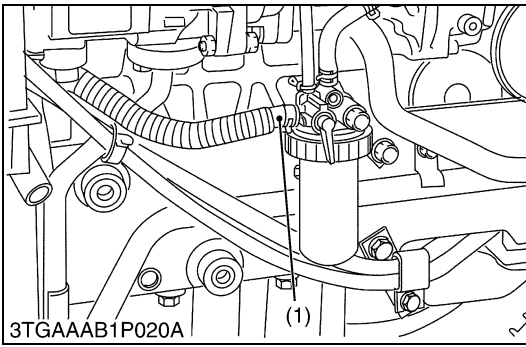
1. Remove the foot cover (2), step stay and plug (1).
2. Remove the panel under frame mounting screw (3) and nut, pull up the panel under frame (4) to remove it.

(When reassembling)

- When reassembling the panel under frame, tighten the two nuts (5) for insulation rubber first.

- | | |
|----------------|-----------------------|
| (1) Plug | (4) Panel Under Cover |
| (2) Foot Cover | (5) Nut |
| (3) Screw | |

W1055726



Fuel Tank

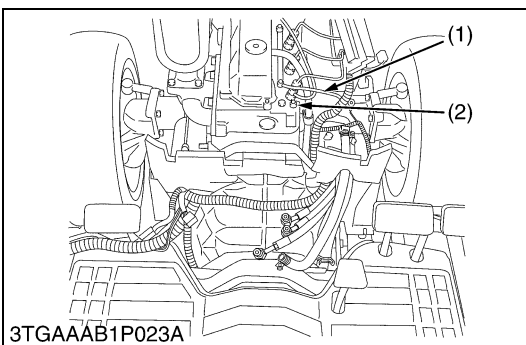
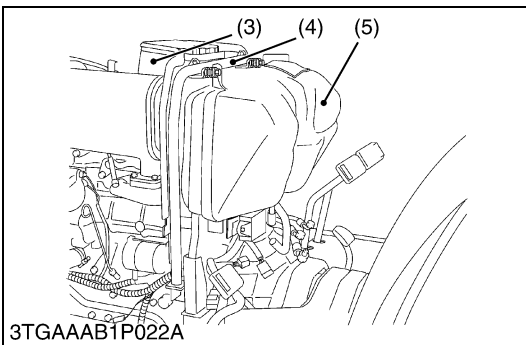
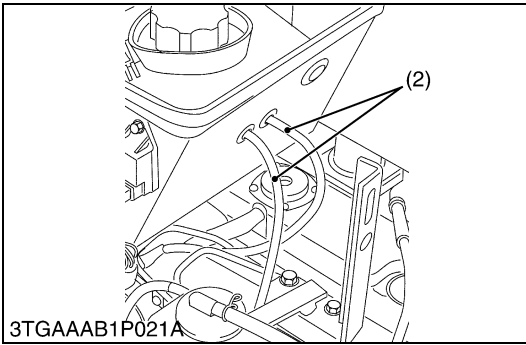
1. Disconnect the fuel hose (1) at the fuel filter side, then drain fuel completely.
2. Remove the air cleaner assembly.
3. Disconnect the overflow hoses (2) of fuel line.
4. Remove the bonnet rear support (4), shutter plate (3) with fuel tank (5).

(When reassembling)

- Be sure to fix the sponges to the original position.

- | | |
|-------------------|-------------------------|
| (1) Fuel Hose | (4) Bonnet Rear Support |
| (2) Overflow Hose | (5) Fuel Tank |
| (3) Shutter Plate | |

W1055997

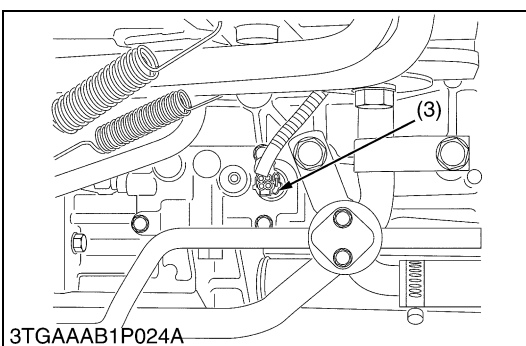


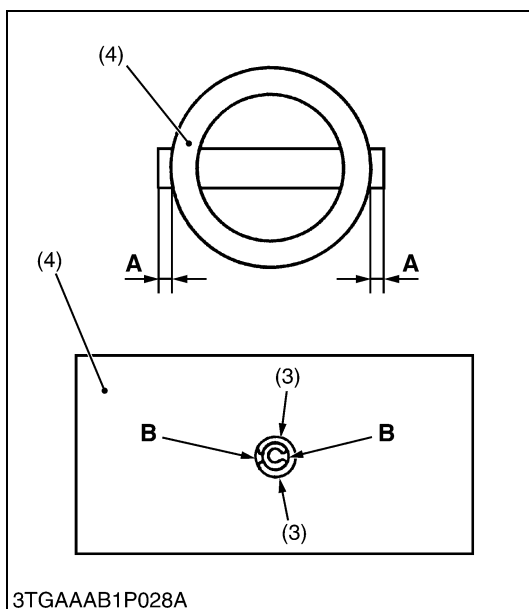
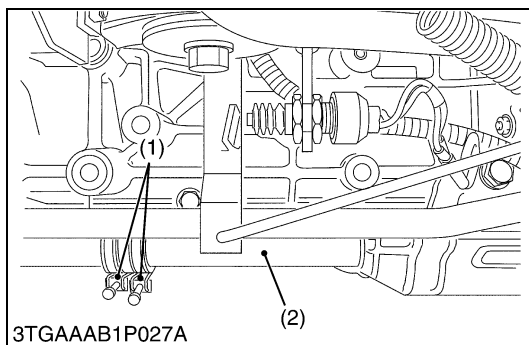
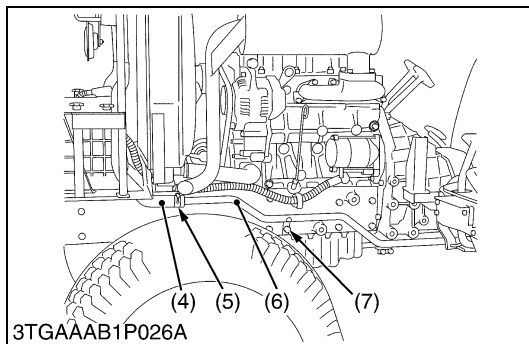
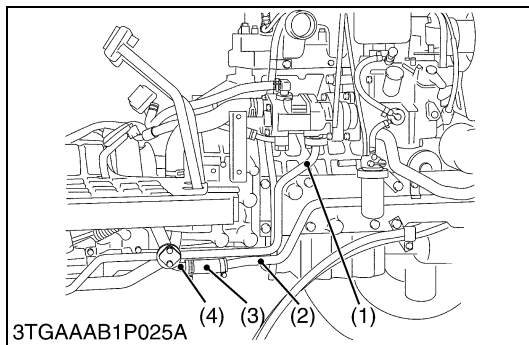
Wire Harness

1. Remove the glow plug cable (1).
2. Disconnect the **1P** connector from the coolant temperature sensor (2).
3. Disconnect the coupler from bi-speed solenoid (3).
4. Remove the wire harness assembly.

- | | |
|--------------------------------|-----------------------|
| (1) Glow Plug Code | (3) Bi-speed Solenoid |
| (2) Coolant Temperature Sensor | |

W1057013





Hydraulic Pipe

1. Remove the hydraulic delivery pipe (1) from the 3P hydraulic pump.
2. Loosen the hose band of the joint hose (3) and slide the joint hose (3) to separating the HST drain pipe (2) and inlet pipe (4).
3. Remove the pipe clamping screws.
4. Loosen the hose band (5) and separate the HST pipe (6) from the HST drain hose (4).
5. Remove the HST pipe (6) clamping screw (7).

- | | |
|-----------------------------|--------------------|
| (1) Hydraulic Delivery Pipe | (5) Hose Band |
| (2) HST Drain Pipe | (6) HST Pipe |
| (3) Joint Hose | (7) Clamping Screw |
| (4) Inlet Pipe | |

W1057369

Propeller Shaft

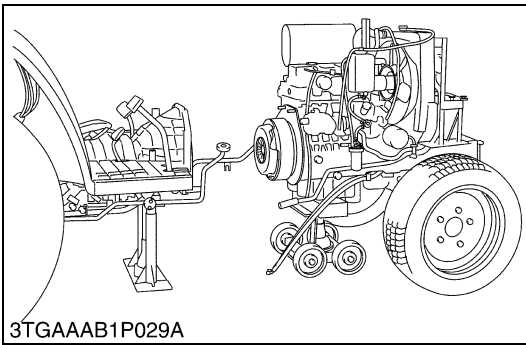
1. Loosen the clamp (1) and slide the propeller shaft cover (2).
2. Tap out the spring pin (3) and then slide the coupling (4).
3. Remove the propeller shaft with cover.

(When reassembling)

- Apply grease to the splines of the propeller shaft and couplings.
- When inserting the spring pins (3), face their splits in the direction parallel to the universal joint as shown in the figure.

- | | |
|---------------------------|---------------------------------------|
| (1) Clamp | A : Approx. 1.0 mm (0.039 in.) |
| (2) Propeller Shaft Cover | B : Split Portion |
| (3) Spring Pin | |
| (4) Coupling | |

W1014306



Separating the Engine from Clutch Housing

1. Place the jack under the center frame and engine oil pan.
2. Remove the engine mounting screws, bolts and nuts, and separate the engine from the clutch housing.

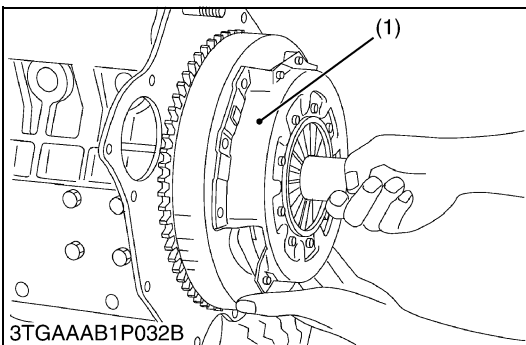
(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the engine and clutch housing.

Tightening torque	Engine mounting M10 screw, bolt and nut	48.1 to 55.8 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft·lbs
	Engine mounting M12 nut	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft·lbs

W1019870

(2) Separating Clutch Assembly



Separating the Clutch Assembly

1. Remove the clutch assembly (1) from the flywheel.

(When reassembling)

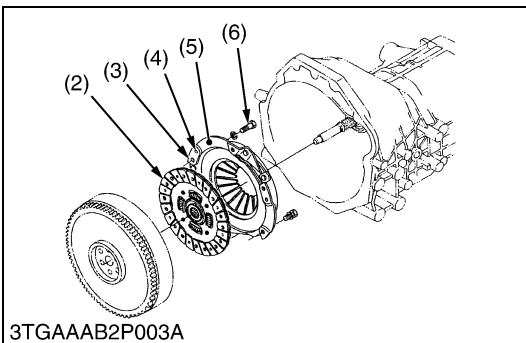
- Direct the shorter end of the clutch disc boss toward the flywheel.
- Apply molybdenum disulphide (Three Bond 1901 or equivalent) to the splines of clutch disc boss.
- Screw in the clutch mounting reamer screw (6) to beside the 5 mm (0.2 in.) dia. hole (4) and symmetry position.
- Be sure to assemble the clutch mounting reamer screw (6) to the screw hole for reamer screw (8).
- The reamer screw tighten first, then tight the other general screws.

■ IMPORTANT

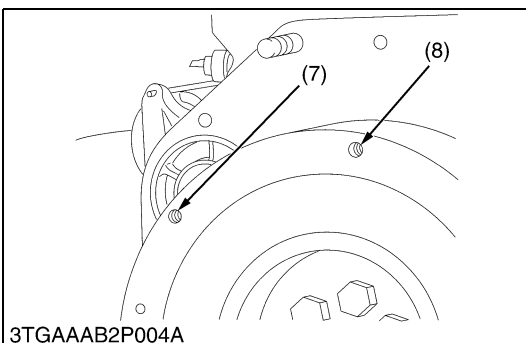
- **Align the center of clutch disc and flywheel by inserting the clutch center tool.**

■ NOTE

- **Do not allow grease and oil on the clutch disc facing.**



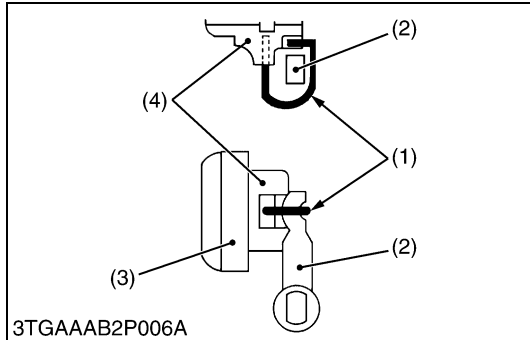
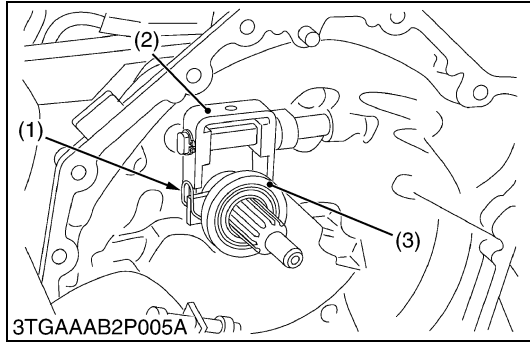
Tightening torque	Clutch mounting screw	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft·lbs
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- | | |
|---------------------------|----------------------------------|
| (1) Clutch Assembly | (5) Clutch Cover |
| (2) Clutch Disc | (6) Clutch Mounting Reamer Screw |
| (3) Hole for Reamer Screw | (7) Screw for General Screw |
| (4) 5 mm (0.2 in.) Dia. | (8) Screw for Reamer Screw |

W1014904

(3) Disassembling Clutch Release



Clutch Release Fork

1. Remove the set spring (1) from clutch release fork (2) and release hub.
2. Remove the release bearing (3) with release hub (4).

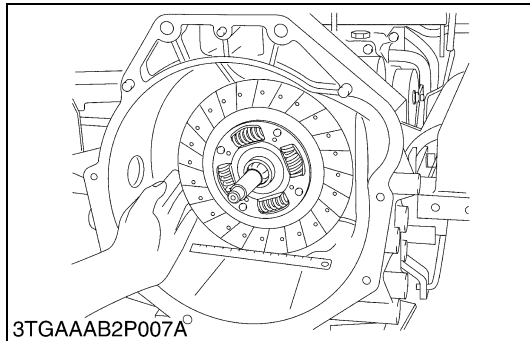
(When reassembling)

- Set the clutch release fork (2) and release hub with set spring (4) in the correct direction.

- | | |
|-------------------------|---------------------|
| (1) Set Spring | (3) Release Bearing |
| (2) Clutch Release Fork | (4) Release Hub |

W1015883

[3] SERVICING

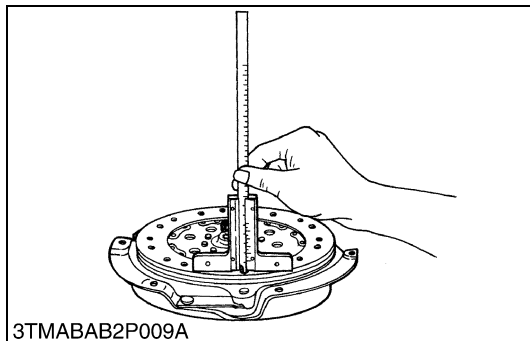


Backlash between Clutch Disc and Clutch Shaft

1. Mount the clutch disc onto the propeller shaft.
2. Hold the propeller shaft so that it does not rotate.
3. Slightly move the disc and measure the displacement around disc edge.
4. If the measurement exceeds the allowable limit, replace clutch disc.

Displacement around disc edge	Allowable limit	2.0 mm 0.079 in.
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W1016276

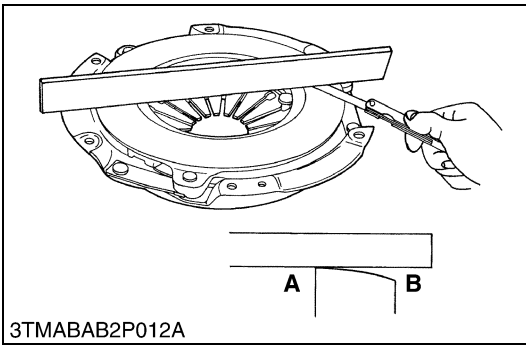


Clutch Disc Wear

1. Measure the depth from clutch disc surface to the top or rivet at least 10 points with a depth gauge.
2. If the depth is less than the allowable limit, replace the disc.
3. If oil is sticking to clutch disc, or disc surface is carbonized, replace the clutch disc.

Disc surface to rivet top (Depth)	Allowable limit	0.3 mm 0.012 in.
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W1016386



Pressure Plate Flatness

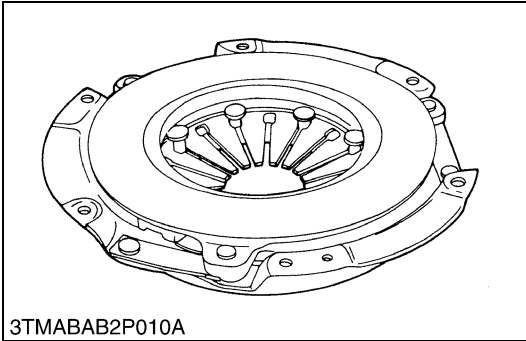
1. Place a straightedge on the pressure plate and measure clearance with a feeler gauge at several points.
2. If the clearance exceeds the allowable limit, replace it.
3. When the pressure plate is worn around its outside and its inside surface only is in contact with the straightedge, replace even if the clearance is within the allowable limit.

Clearance between pressure plate and straightedge	Allowable limit	0.2 mm 0.008 in.
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A : Inside

B : Outside

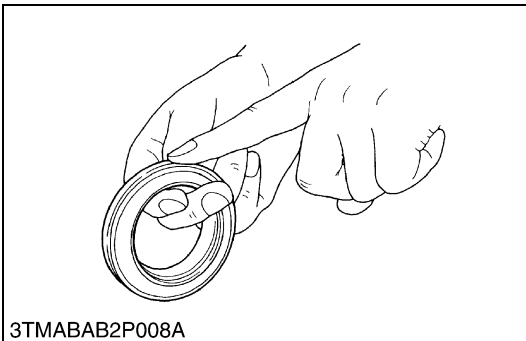
W1016482



Checking Pressure Plate and Diaphragm

1. Check the pressure plate and if scratched on its surface, correct with sandpaper or replace it.
2. Check the diaphragm for crack and scratches. If defects are found, replace it.

W1016614



Checking Clutch Release Bearing

1. Check the clutch release bearing. If surface is worn excessively, or abnormal sounds occur, replace it.

W1016685

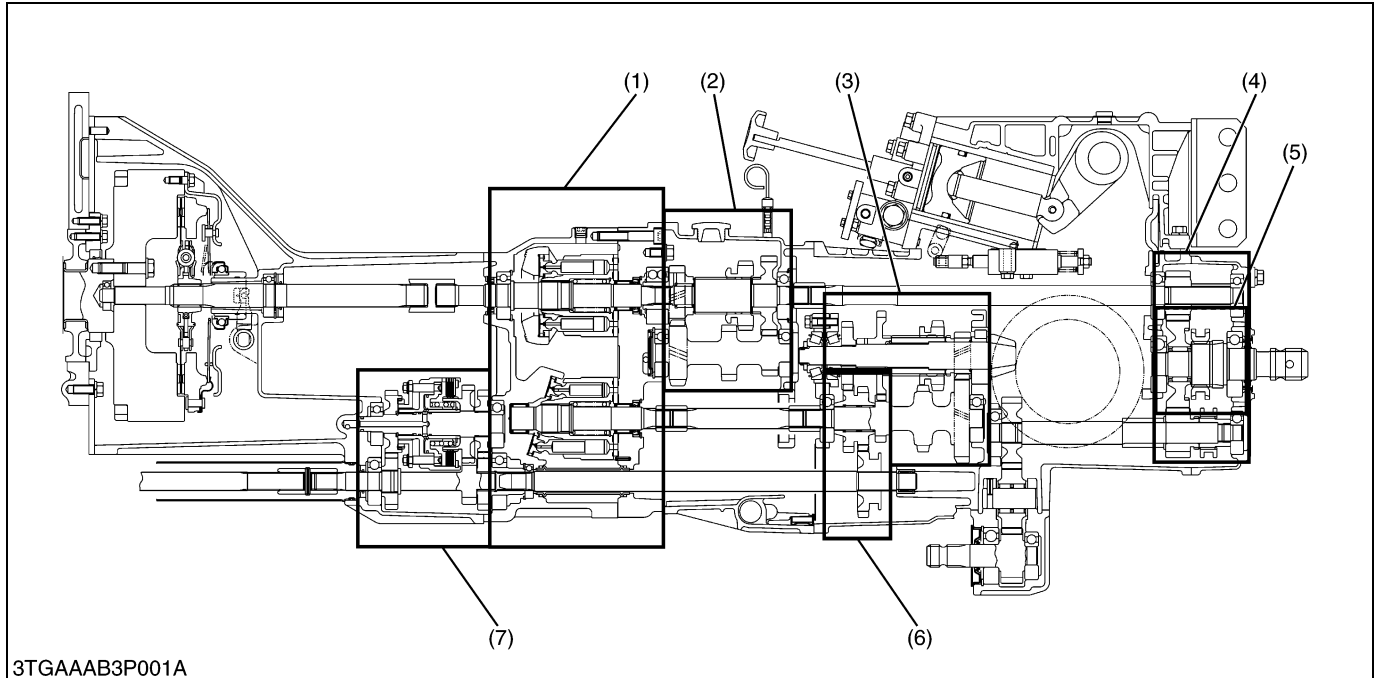
3 TRANSMISSION

MECHANISM

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1. STRUCTURE

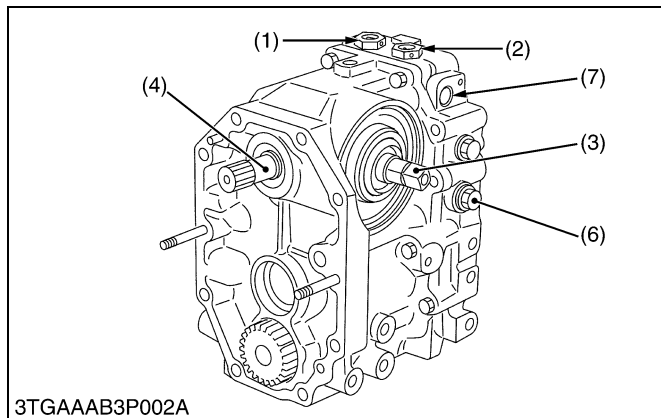


- | | | | |
|--------------------------------------|------------------------------|-------------------------------|---------------------------|
| (1) Hydrostatic Transmission Section | (3) Range Gear Shift Section | (5) Mid-PTO Shift Section | (7) Bi-speed Turn Section |
| (2) PTO Gear Shift Section | (4) Rear PTO Shift Section | (6) Front Wheel Drive Section | |

2. TRAVELLING SYSTEM

[1] HYDROSTATIC TRANSMISSION

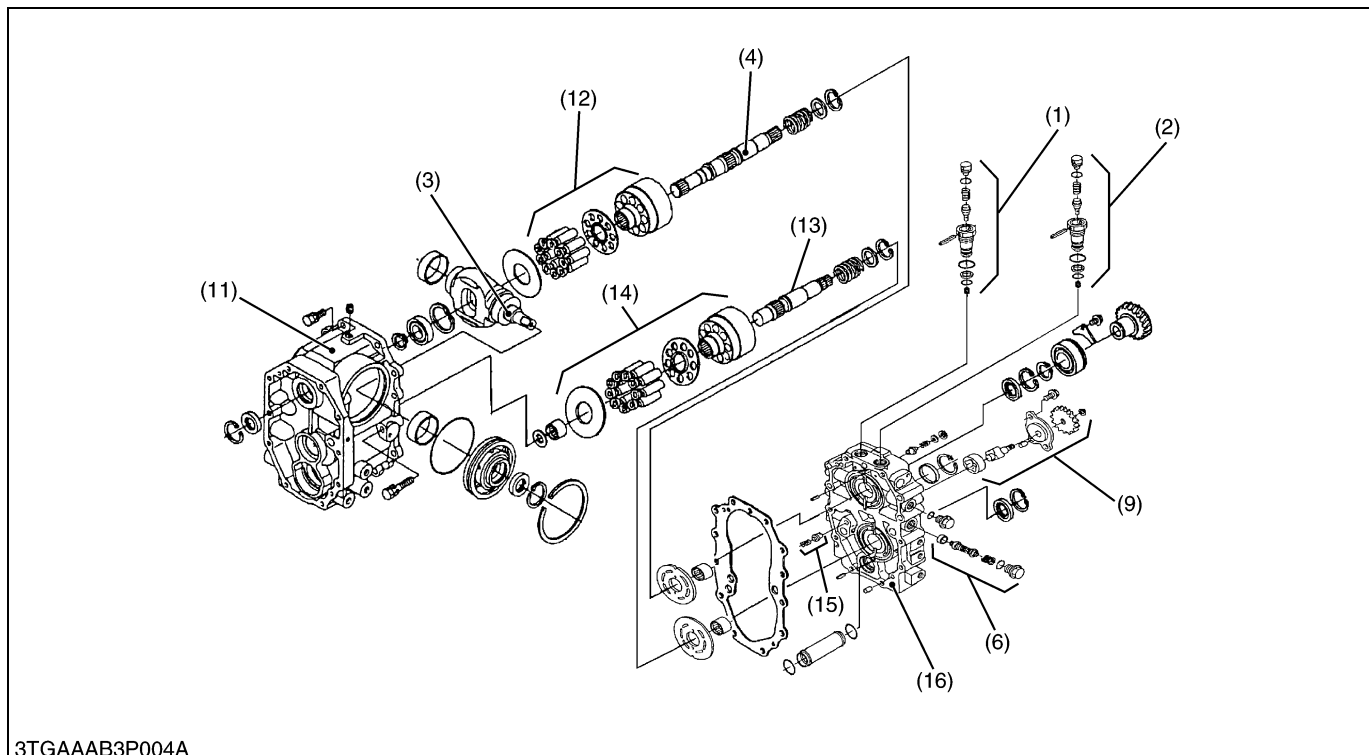
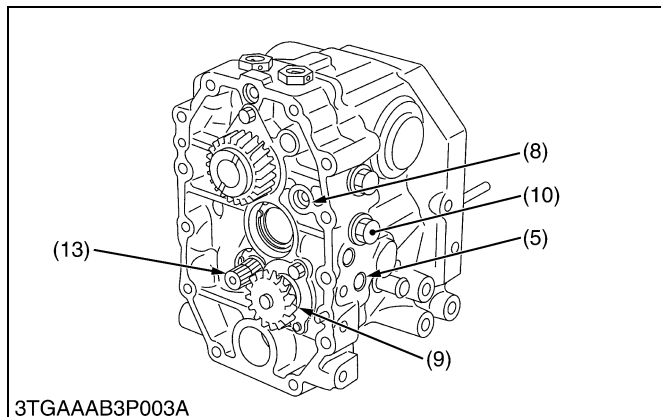
(1) Structure



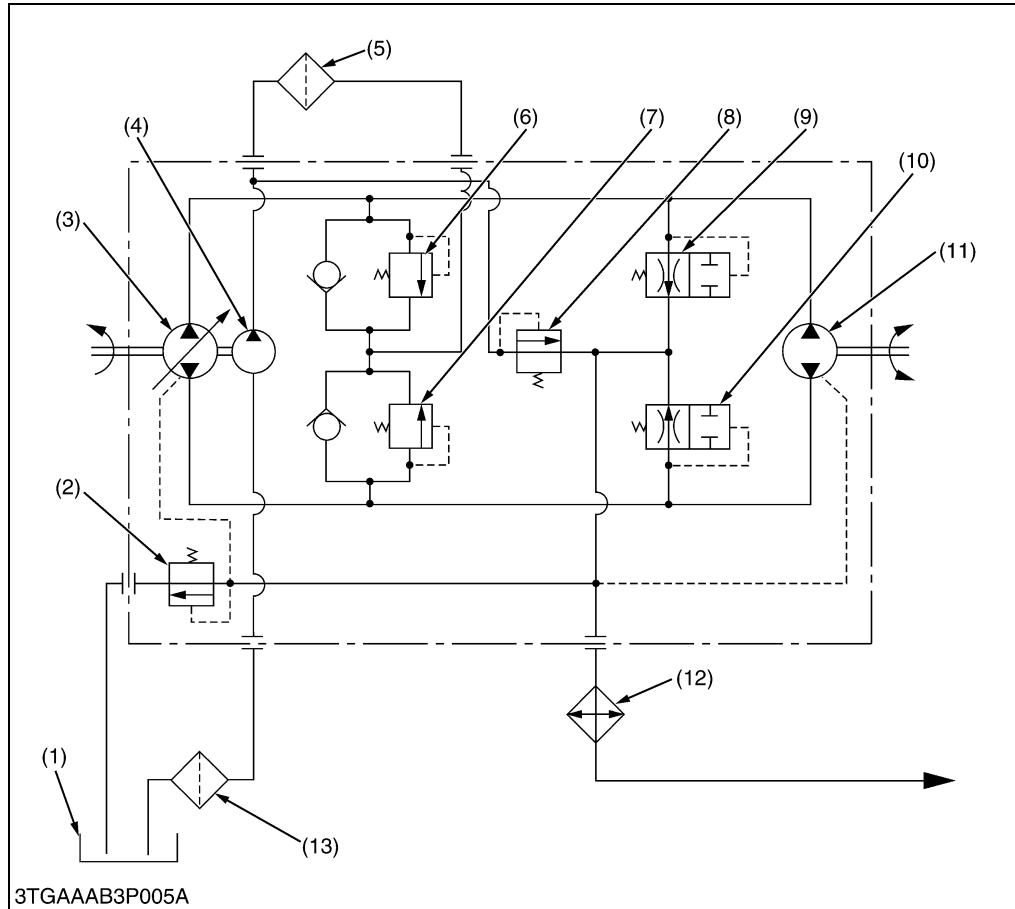
Hydrostatic transmission is composed of variable displacement piston pump, fixed displacement piston motor, charge pump and valve system.

- | | |
|--|---|
| (1) Neutral Valve (Reverse) | (10) Check and High Pressure Relief Valve (Reverse) |
| (2) Neutral Valve (Forward) | (11) Case |
| (3) Trunnion Shaft | (12) Variable Displacement Piston Pump |
| (4) Input Shaft | (13) Output Shaft |
| (5) Charge Port | (14) Fixed Displacement Piston Motor |
| (6) Check and High Pressure Relief Valve (Forward) | (15) Charge Relief Valve |
| (7) Drain Port | (16) Port Block |
| (8) Case Relief Valve | |
| (9) Charge Pump | |

W1012610



(2) Hydraulic Circuit



- (1) Oil Tank (Transmission Case)
- (2) Case Relief Valve
- (3) Variable Displacement Pump (HST Pump)
- (4) Charge Pump
- (5) Oil Filter (10 μ)
- (6) Check and High Pressure Relief Valve (Forward)
- (7) Check and High Pressure Relief Valve (Reverse)
- (8) Charge Relief Valve
- (9) Neutral Valve (Forward)
- (10) Neutral Valve (Reverse)
- (11) Fixed Displacement Motor (HST Motor)
- (12) Oil Cooler
- (13) Oil Filter

W1020746

3TGAAAB3P005A

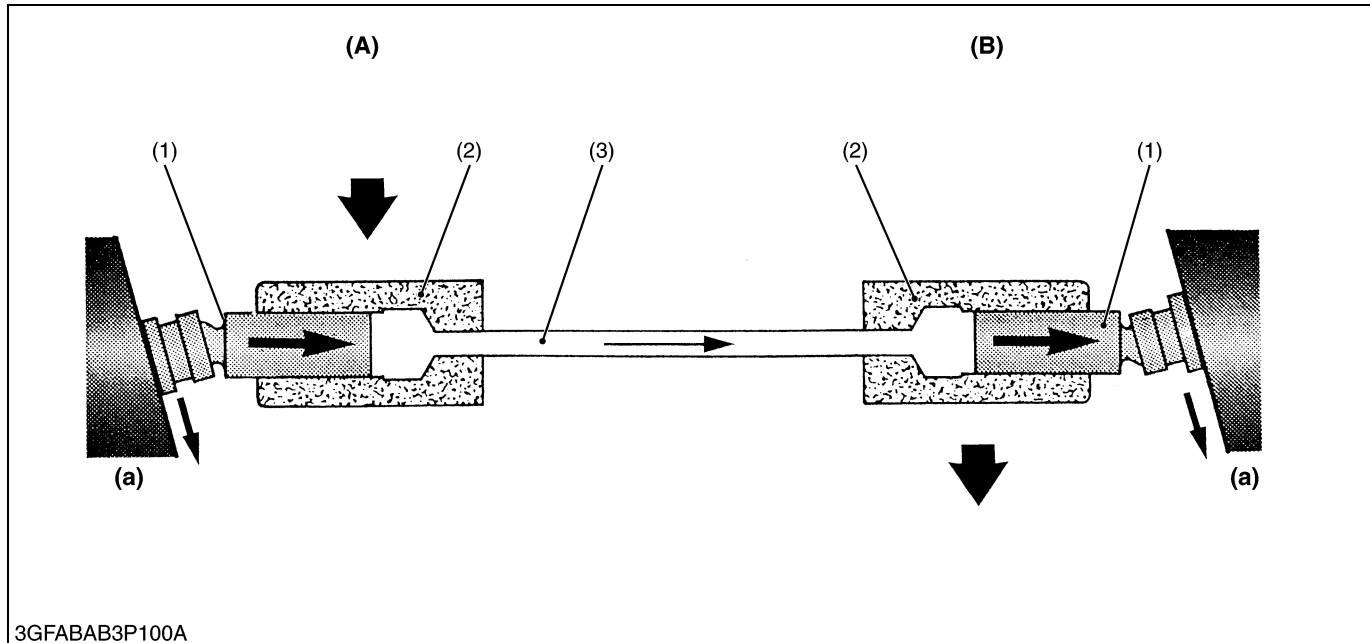
The HST pump driven by the engine output power through the clutch and the drive shaft. It is controlled oil flow volume and its direction by operating the speed change pedal or the cruise control lever, and the HST motor is controlled its output speed and direction.

The HST is structured the variable displacement pump, fixed displacement motor, oil filter charge pump, charge relief valve, neutral valve case relief valve etc.. The oil cooler is equipped on the drain circuit.

■ Valve Operating Pressure

Ref. No.	Valve	Oil Temperature	Engine Revolution	Valve Operating Pressure	
(2)	Case Relief Valve	50 °C 122 °F	1500 rpm	0.3 MPa Less than 3.0 kgf/cm ² at no-load 42.7 psi	
(6), (7)	Check and High Pressure Relief Valve (Forward and Reverse)			26.4 to 29.4 MPa 270 to 300 kgf/cm ² 3840.2 to 4266.9 psi	
(8)	Charge Relief Valve			0.4 to 0.8 MPa 4.0 to 8.0 kgf/cm ² at no-load 56.9 to 113.8 psi	
(9), (10)	Neutral Valve (Forward and Reverse)			Open	1.47 to 2.45 MPa 15.0 to 25.0 kgf/cm ² 213.3 to 355.5 psi

W1014493

(3) Pump and Motor

3GFABAB3P100A

(1) Swashplate
 (2) Piston
 (3) Cylinder

(4) Oil
 (5) Cylinder

(6) Piston
 (7) Swashplate

[A] Pump
 [B] Motor

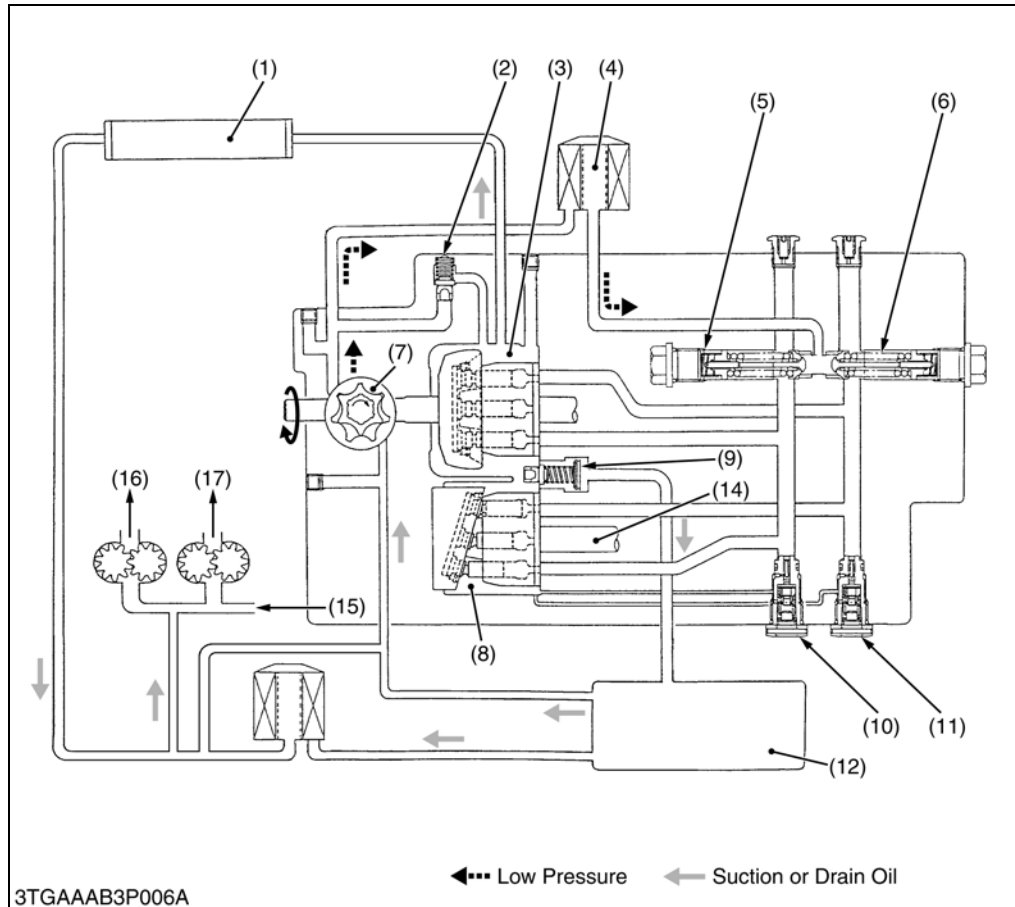
Pump and motor cylinder, each containing pistons, are connected by lines. Cylinders and lines are filled with oil. Pistons ride against swashplates (1) and (7) located in pump and motor.

In the pump, as the cylinder (3) rotates, pistons (2) move across the sloping face of swashplate (1) and slide in or out of their cylinder bores. The oil (4), forced out by the pump pistons (2), causes the motor pistons (6) to slide out of their cylinder bores.

In the motor, sliding out of the cylinder and moving across the sloping face of swashplate (7), the pistons rotate the cylinder.

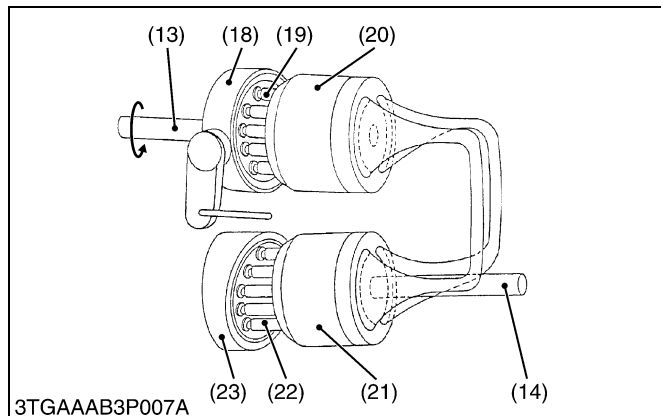
(4) Operation and Valves

■ Neutral Position



- (1) Oil Cooler
- (2) Charge Relief Valve
- (3) HST Pump (Variable Discharge Pump)
- (4) Oil Filter (10 μ)
- (5) Check and High Pressure Relief Valve (Forward)
- (6) Check and High Pressure Relief Valve (Reverse)
- (7) Charge Pump
- (8) HST Motor (Fixed Discharge Motor)
- (9) Case Relief Valve
- (10) Neutral Valve (Forward)
- (11) Neutral Valve (Reverse)
- (12) Oil Tank (Transmission Case)
- (13) Input Shaft
- (14) Output Shaft
- (15) From Power Steering
- (16) To Power Steering Circuit
- (17) To 3-Points Linkage Hydraulic Circuit
- (18) Variable Swashplate
- (19) Piston (Pump)
- (20) Cylinder Block (Pump)
- (21) Cylinder Block (Motor)
- (22) Piston (Motor)
- (23) Fixed Swashplate

W1021292



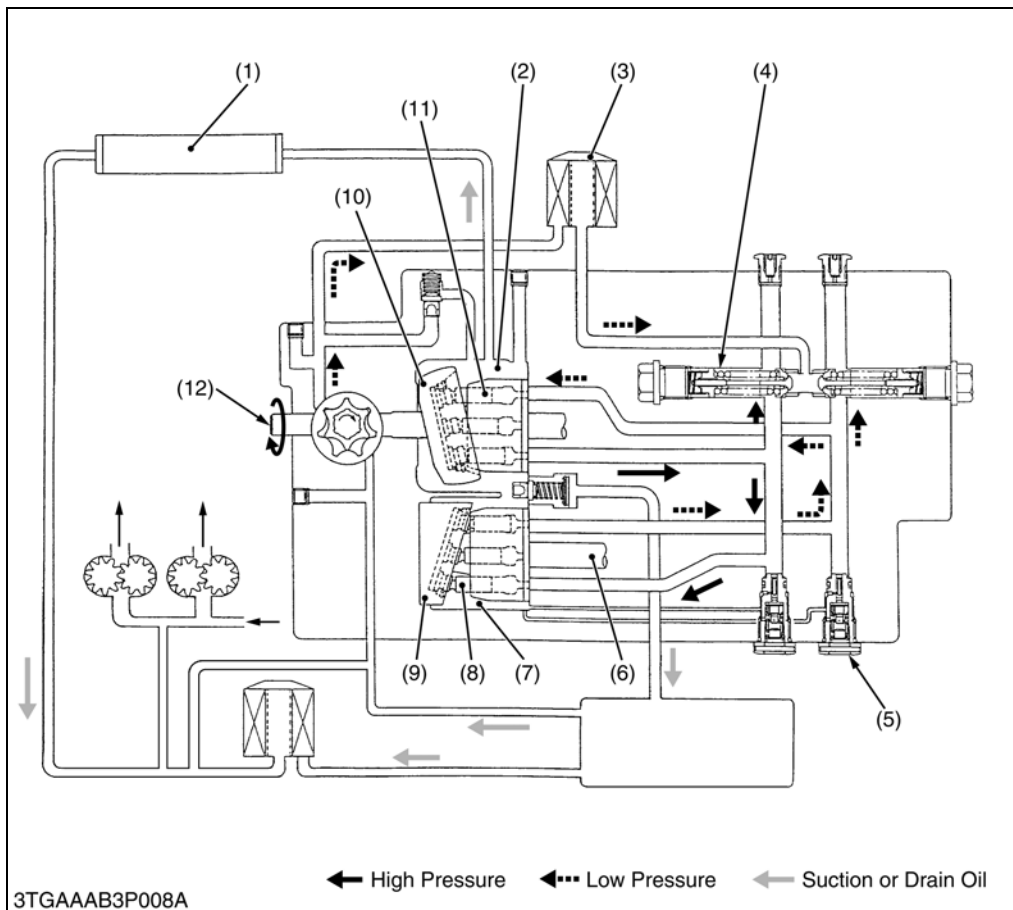
The pump (3) and motor (8) are joined in a closed hydraulic loop and most of oil circulates within the main oil circuit. A little oil lubricates and oozes out from the clearance between the moving parts of the case.

The charge oil aids smooth operation of piston pump (3) and motor (8). The rest of the oil passes through the charge relief valve (2) into the case. Then the oil return to the tank (13) through a cooler.

When the speed control pedal is in neutral, the variable swashplate (18) is at right angles to the pump pistons (19) and they only rotate with cylinder block (20) without reciprocating. Since the oil is not being pumped to the motor (8). The cylinder block (21) in the motor (8) is stationary and the output shaft (14) does not move.

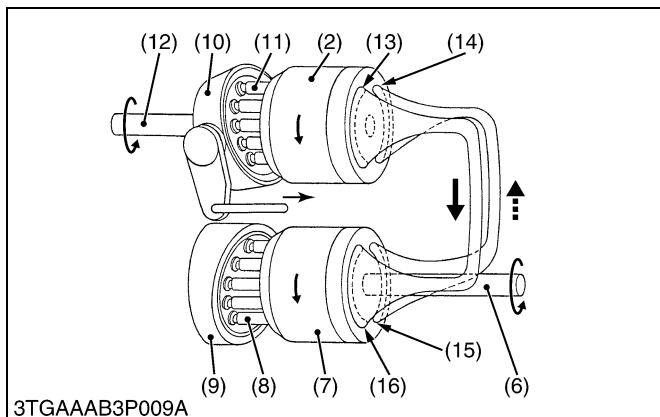
W1015470

■ Forward Position



- (1) Oil Cooler
- (2) Cylinder Block (Pump)
- (3) Oil Filter (10 μ)
- (4) Check and High Pressure Relief Valve (Forward)
- (5) Neutral Valve (Forward)
- (6) Output Shaft
- (7) Cylinder Block (Motor)
- (8) Piston (Motor)
- (9) Fixed Swashplate
- (10) Variable Swashplate
- (11) Piston (Pump)
- (12) Input Shaft
- (13) Pump Kidney Port A
- (14) Pump Kidney Port B
- (15) Motor Kidney Port D
- (16) Motor Kidney Port C

W1023536



When the speed control pedal is stepped on and in forward, the variable swashplate (10) is tilted as shown in figure above.

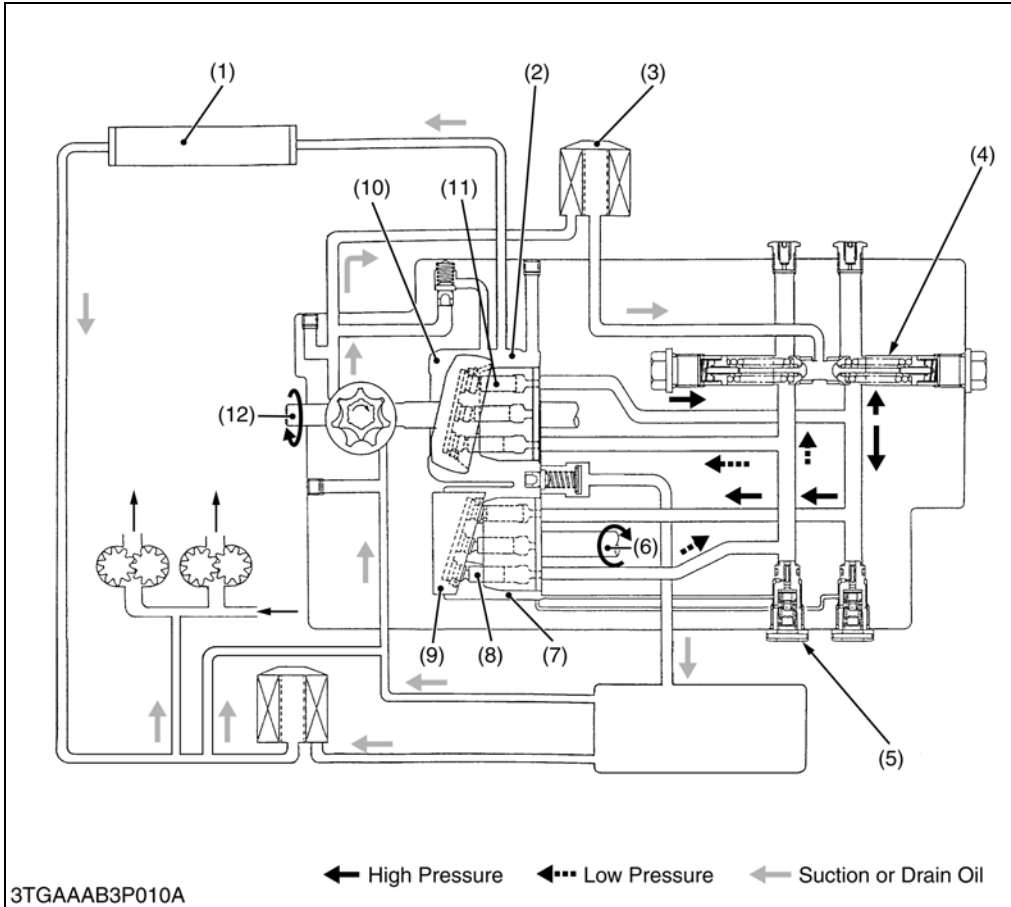
As the pump cylinder block (2) rotates with the input shaft (12), oil is forced out of pump kidney port A (13) at high pressure. As pressure oil enters motor kidney port C (16), the pistons (8), which align with port C (16), are pushed against the swashplate (9) and slide down the inclined surface.

Then the output shaft (6) rotates with the motor cylinder block (7). This drives the machine forward and the angle of pump swashplate (10) determines the output shaft speed.

As the motor cylinder block (7) continued to rotate, oil is forced out of motor kidney port D (15) at low pressure and returns to the pump.

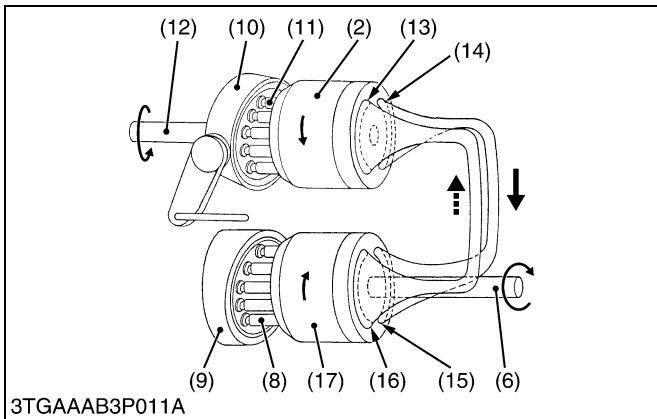
W1016009

■ Reverse Position



- (1) Oil Cooler
- (2) Cylinder Block (Pump)
- (3) Oil Filter (10 μ)
- (4) Check and High Pressure Relief Valve (Reverse)
- (5) Neutral Valve (Reverse)
- (6) Output Shaft
- (7) Cylinder Block (Motor)
- (8) Piston (Motor)
- (9) Fixed Swashplate
- (10) Variable Swashplate
- (11) Piston (Pump)
- (12) Input Shaft
- (13) Pump Kidney Port A
- (14) Pump Kidney Port B
- (15) Motor Kidney Port D
- (16) Motor Kidney Port C

W1023685



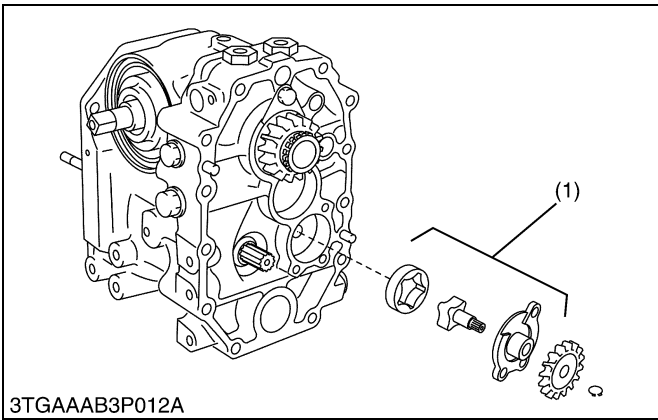
When the speed control pedal is stepped on and in reverse, the variable swashplate (10) is tilted as shown in figure above.

As the pump cylinder block (2) rotates with the input shaft (12), oil is forced out of pump kidney port B (14) at high pressure. As pressure oil enters motor kidney port D (15), the pistons (8), which align with port D (15), are pushed against the swashplate (9) and slide down the inclined surface.

Then the output shaft (6) rotates with the motor cylinder block (7). This drives the machine rearward and the angle of pump swashplate (10) determines the output shaft speed.

As the motor cylinder block (7) continued to rotate, oil is forced out of motor kidney port C (16) at low pressure and returns and returns to the pump.

W1016535

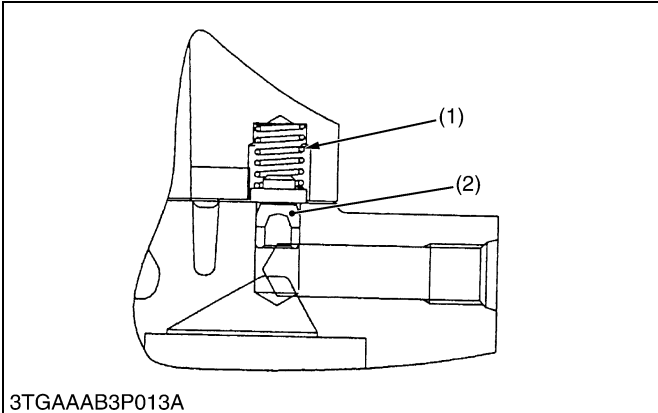


■ Charge Pump

It fills up the oil in the HST closing circuit. A part of oil fed from charge pump flows to closing circuit through the check and high pressure relief valve, and the other oil flows into the case goes to the tank through the oil cooler.

- (1) Charge Pump

W1016772

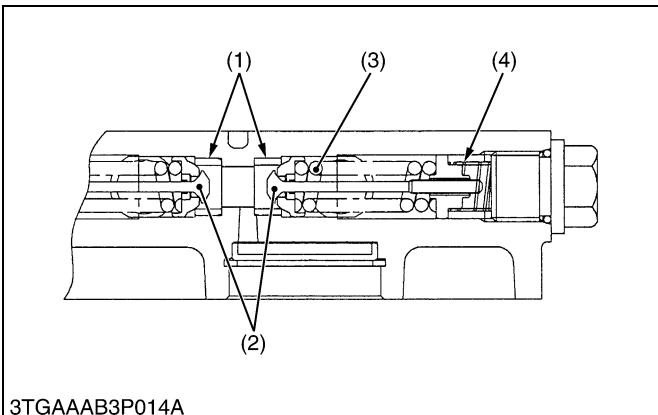


■ Charge Relief Valve

While pumped and filtered oil flows into the main oil circuit through the check valves, excessive oil passes to the case through the charge relief valve.

- (1) Spring
- (2) Poppet

W1016898



■ Check and High Pressure Relief Valve

The check and high pressure relief valves monitor the oil pressure in each line of the main oil circuit.

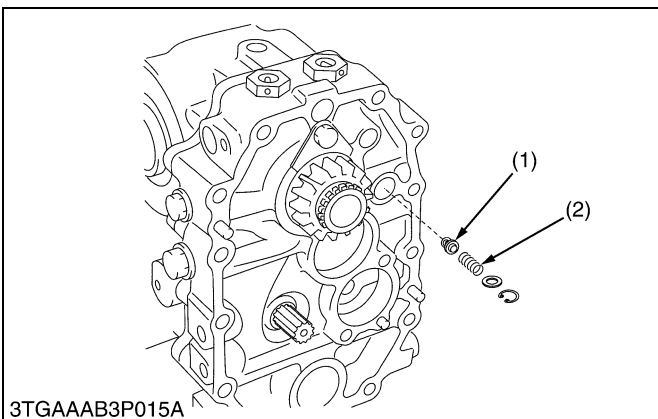
In neutral, both valves are open and charging oil enters into the main oil circuit through the valves.

At normal operation, the check valve in the high pressure side is closed and it pushes and opens the another one.

When excessively high pressure is built up in one line, the high pressure relief valve located in this line is open and the oil flows into another line.

- (1) Check Valve Sheet
- (2) Relief Poppet
- (3) Relief Spring
- (4) Check Spring

W1016970

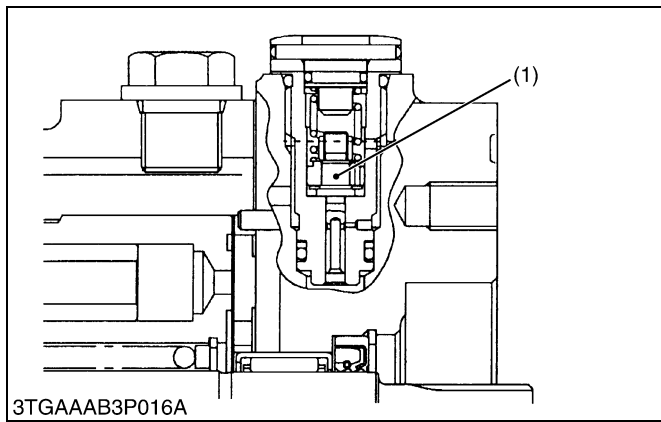


■ Case Relief Valve

The case relief valve monitors the oil pressure in the hydrostatic transmission case. When the oil pressure rises, it opens and flows the oil directly to the transmission case, so that the oil may not leak against the sealing.

- (1) Poppet
- (2) Spring

W1017082

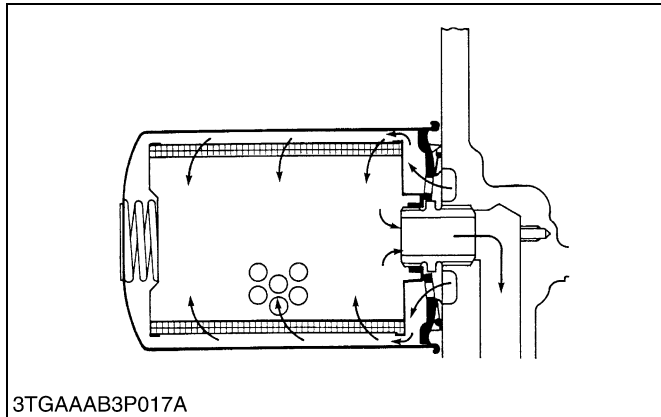


■ Neutral Valve

The neutral valves in the main oil circuit lines are open and pass the oil to the case when in neutral, and the oil pressure in their lines becomes low. And when the oil pressure in the high pressure line increases to a specified pressure, the neutral valve closes.

(1) Neutral Valve

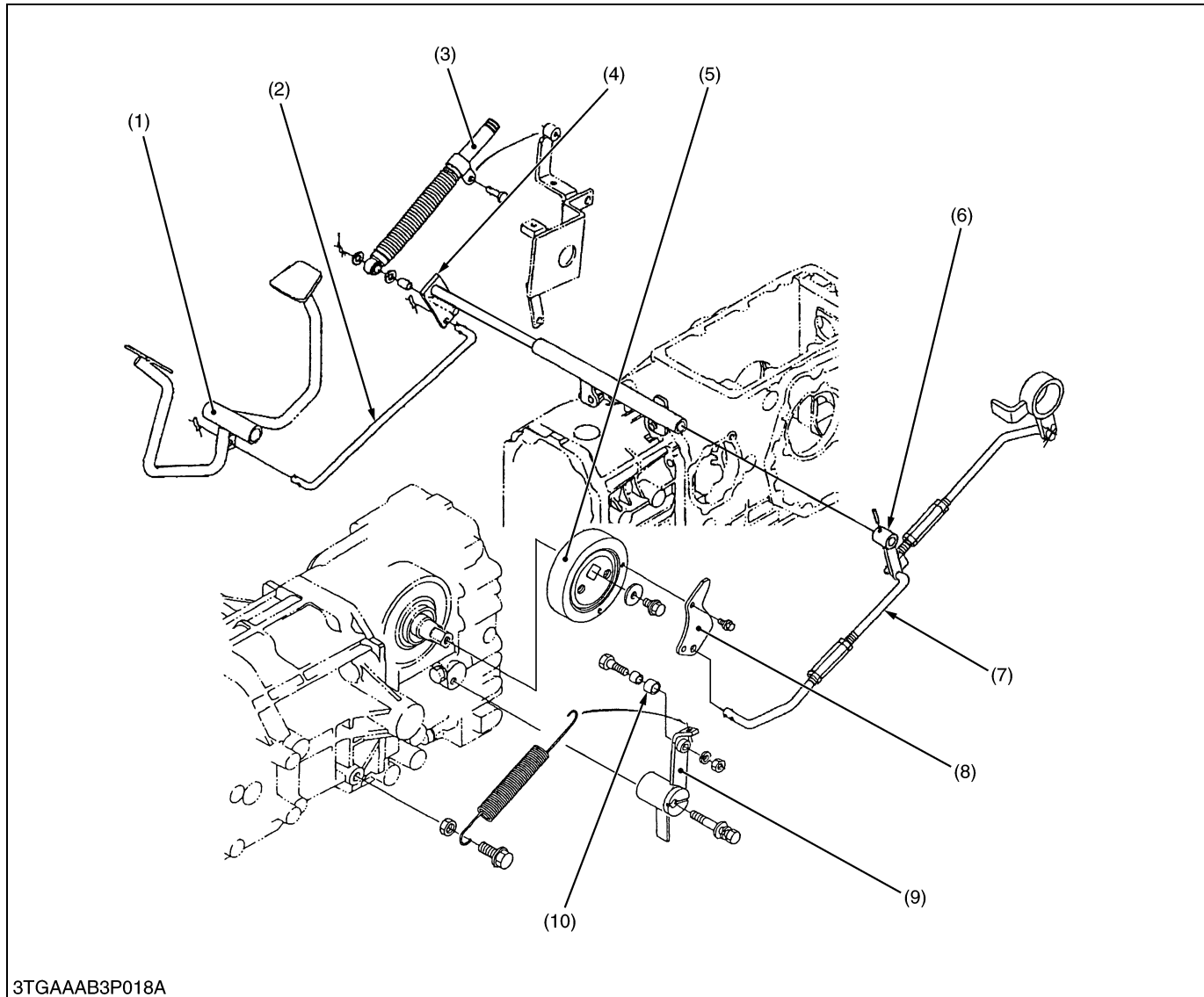
W1017148



■ Oil Filter

Impurities (various metallic chips, dust etc.) in forced transmission oil are absorbed by the filtering medium for removal as they pass through the filter element.

W1017282

(5) Control Linkage

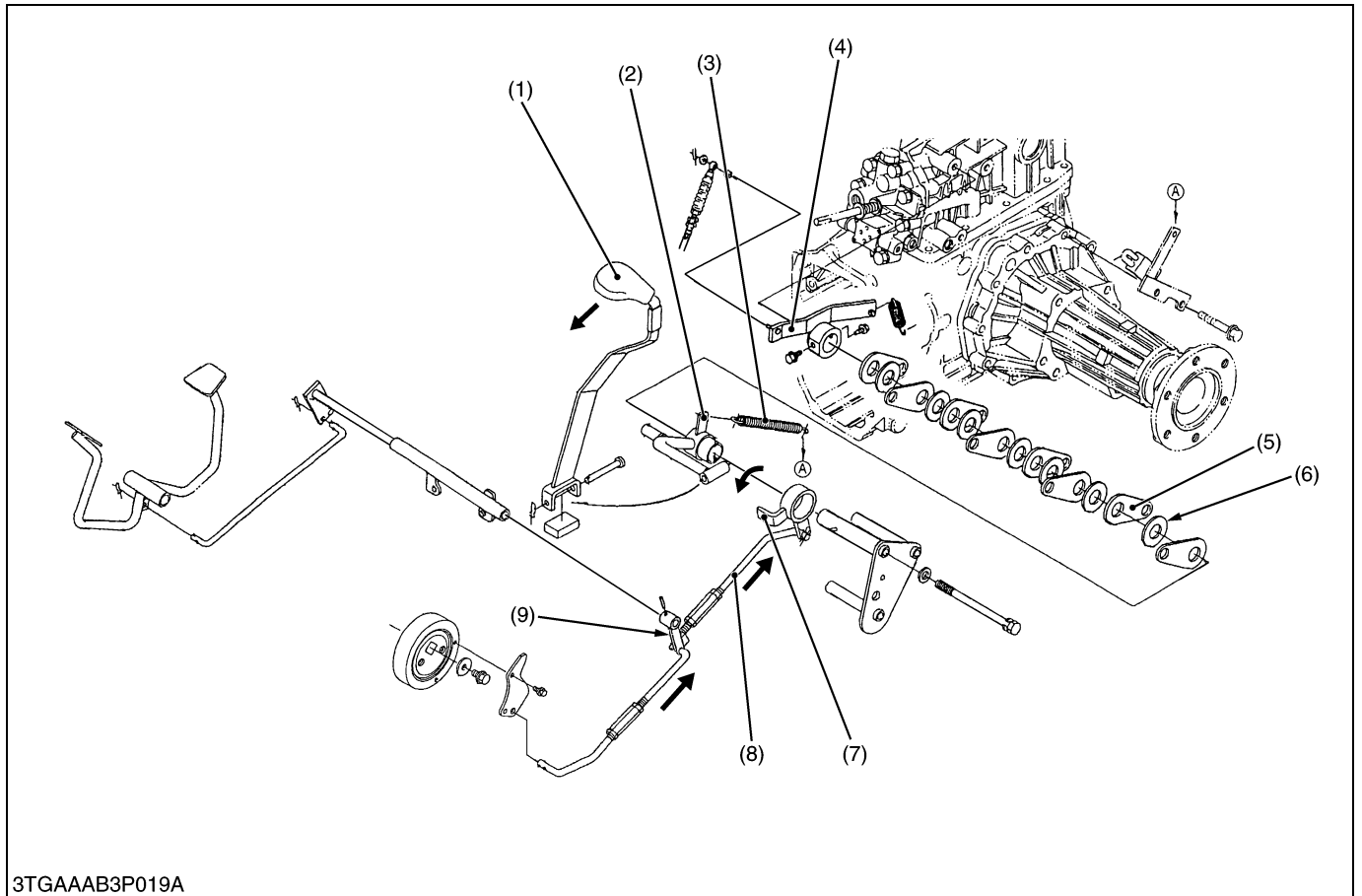
- | | | | |
|-------------------------|--------------------|------------------|--------------------|
| (1) Speed Control Pedal | (4) HST Lever RH | (7) HST Link Rod | (9) Neutral Holder |
| (2) HST Pedal Rod | (5) Trunnion Wheel | (8) Neutral Cam | (10) Roller |
| (3) Damper | (6) HST Lever LH | | |

The speed control pedal (1) and trunnion wheel (5) of variable swashplate are linked with the HST pedal rod (2), HST lever RH (4) · LH (6), HST link rod (7) and neutral cam (8). As the front footrest of pedal is depressed, the swashplate rotates and forward travelling speed increases. Depressing the rear footrest increases reverse speed.

The roller (10) on the neutral holder (9) is held with spring seats the detent of the neutral cam (8) so that the neutral cam (8) returns to neutral. Then, the swashplate is returned to neutral with the neutral cam, when the pedal is released.

The damper (3) connected to the HST lever LH (6) restricts the movement of the linkage to prevent abrupt operation or reversing.

(6) Cruise Control Linkage



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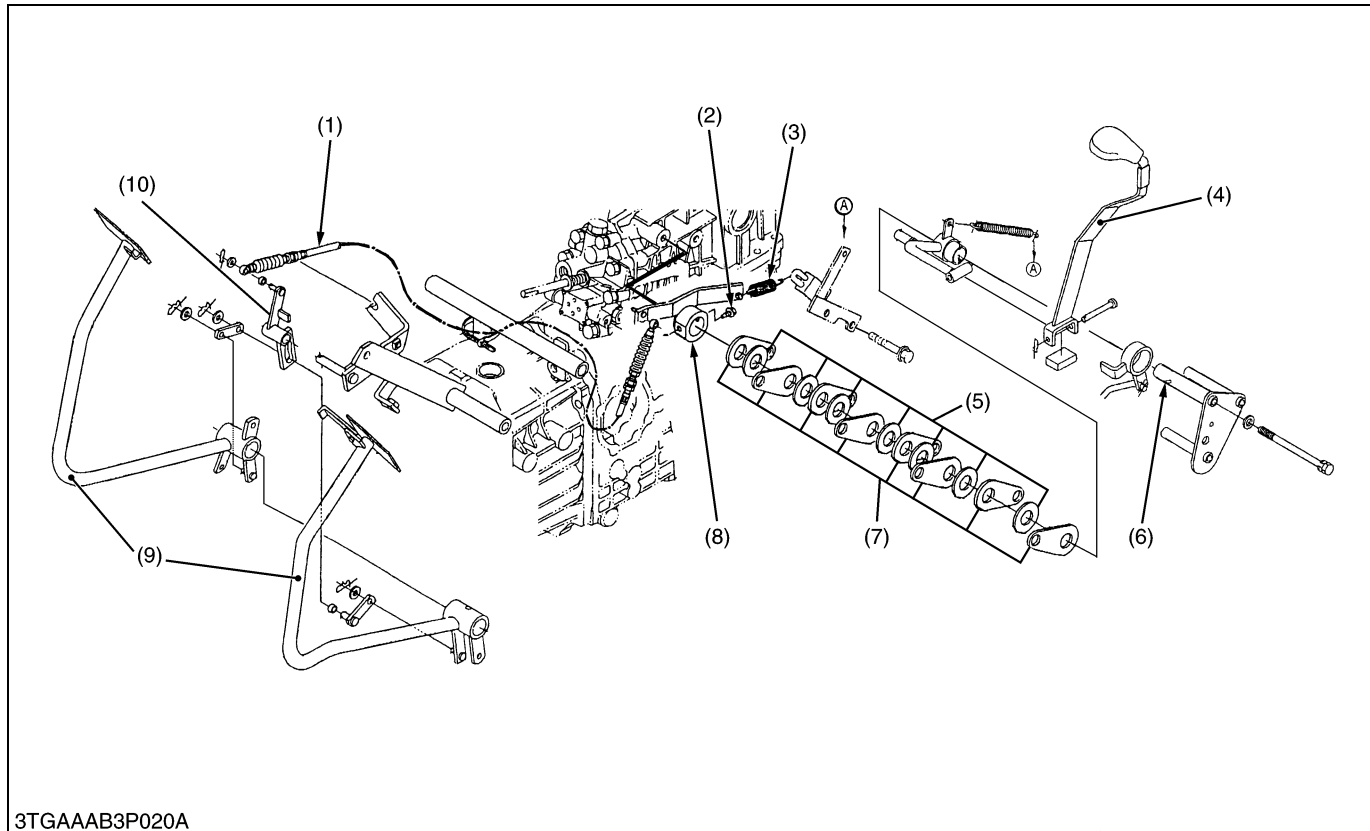
- | | | | |
|-----------------------|-------------------|--------------------|------------------|
| (1) Speed Set Lever 1 | (4) Removal Lever | (6) Rubber | (8) Cruise Rod |
| (2) Speed Set Lever 2 | (5) Plate | (7) Fix Lever Link | (9) HST Lever LH |
| (3) Return Spring | | | |

When speed set lever 1 (1) is moved to forward direction then speed set lever 2 (2), fix lever link (7), cruise rod (8) and HST lever LH (9) are moved to arrow direction. HST lever LH (9) is connected with trunnion, therefore the swashplate turns to forward position.

Speed set lever 1 is settled by the rubber (6), plate (5).

■ NOTE

- The cruise control device will not operate in reverse.

(7) Cruise Control Release System

3TGAAAB3P020A

- | | | | |
|-----------------|-----------------------|-------------------|------------------|
| (1) Brake Cable | (4) Speed Set Lever 1 | (7) Plate | (9) Brake Pedal |
| (2) Screw | (5) Rubber | (8) Removal Lever | (10) Brake Lever |
| (3) Spring | (6) Groove | | |

The cruise control return to neutral automatically when brake pedals (9) are depressed.

Speed set lever 1 (4) is set with plates (7), rubbers (5) by the removal lever (8), screw (2) and spring (3).

When brake pedals (9) are depressed, brake lever (10) to pull the removal lever (8) via brake cable (1).

The removal lever (8) is moved along grooves (6).

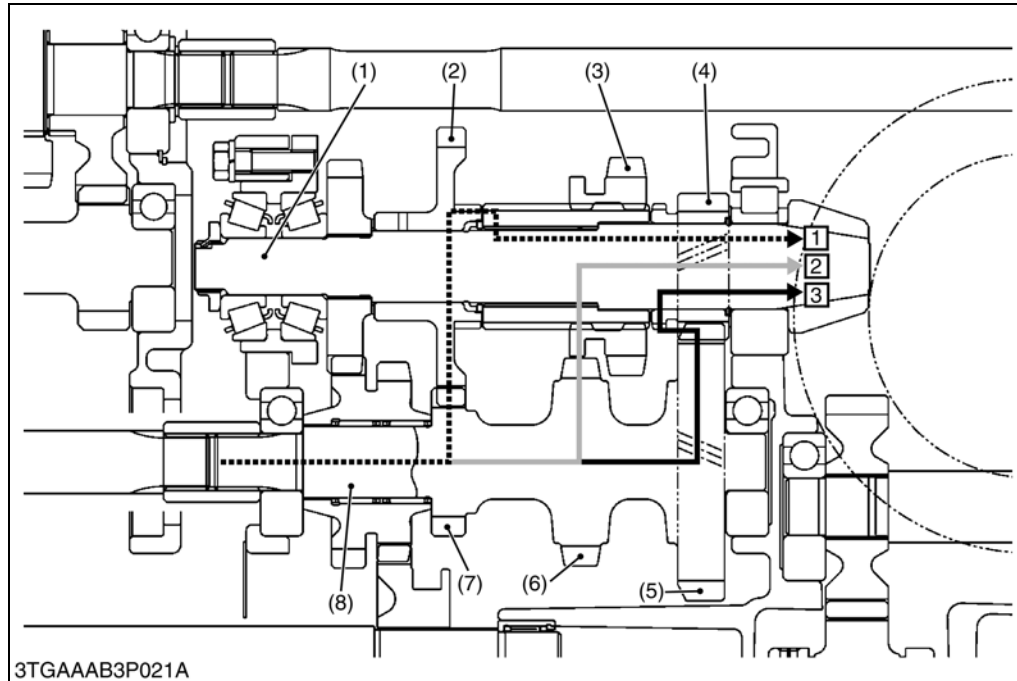
As a result, the holding force of speed set lever (4) is lost and speed set lever (4) returns to neutrality by force of the spring (3).

So that the swashplate of HST return to neutral.

NOTE

- The cruise control will release when both brake pedals are depressed.
- The cruise control does not release when the individual right or left brake is applied.

3. RANGE GEAR SHIFT SECTION



- (1) Hypoid Pinion Shaft
- (2) 29T Gear
- (3) 22T Gear
- (4) 13T Gear
- (5) 29T Gear
- (6) 22T Gear
- (7) 15T Gear
- (8) Rear Counter Shaft

W1017811

Three kind of power flow are available by operating the range shift lever to shift the gear (3) on the hypoid pinion shaft (1).

■ 1st Range

Rear Counter Shaft (8) → 15T Gear (7) → 29T Gear (2) → 22T Gear (3) → Hypoid Pinion Shaft (1).

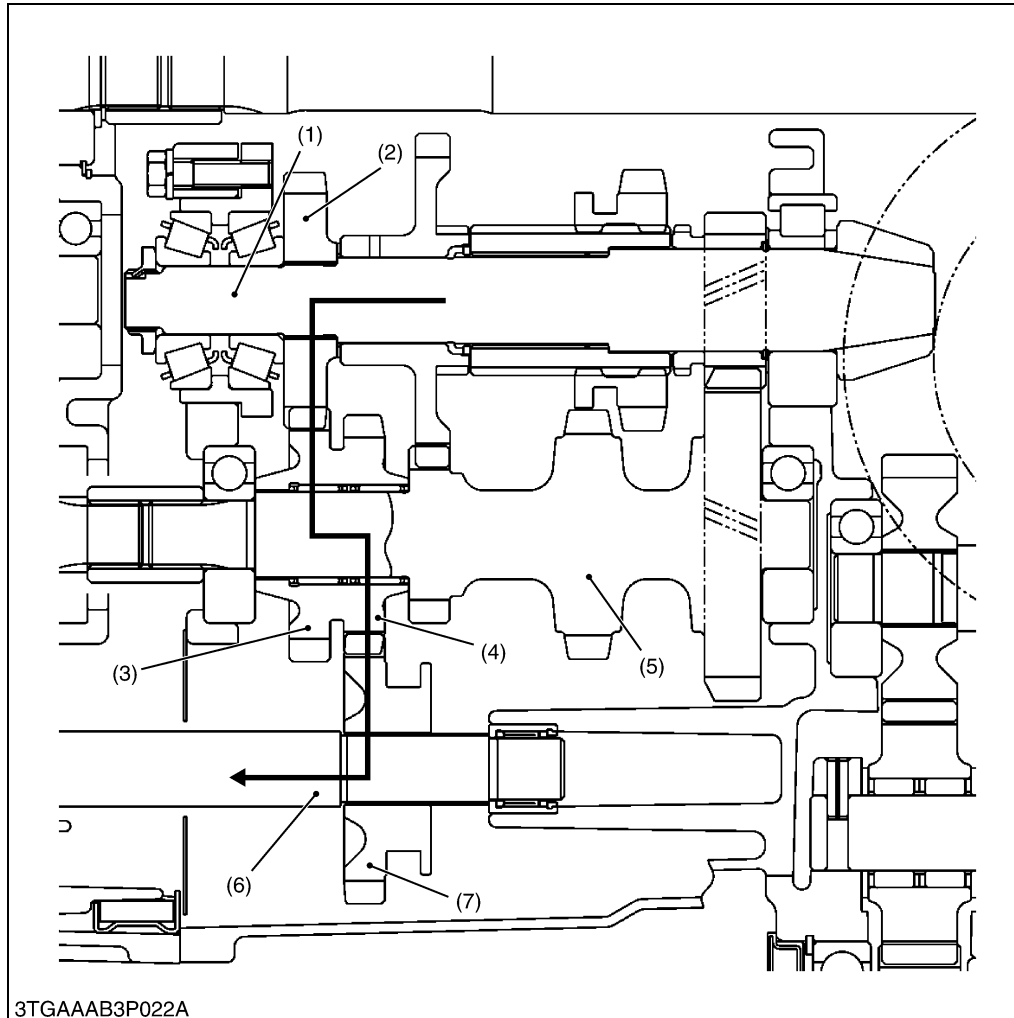
■ 2nd Range

Rear Counter Shaft (8) → 22T Gear (6) → 22 T Gear (3) → Hypoid Pinion Shaft (1).

■ 3rd Range

Rear Counter Shaft (8) → 29T Gear (5) → 13T Gear (4) → 22T Gear (3) → Hypoid Pinion Shaft (1).

4. FRONT WHEEL DRIVE SHIFT SECTION



- (1) Hypoid Pinion Shaft
- (2) 22T Gear
- (3) 22T Gear
- (4) 21T Gear
- (5) Rear Counter Shaft
- (6) Front Wheel Drive Shaft
- (7) 24T Gear

W1018104

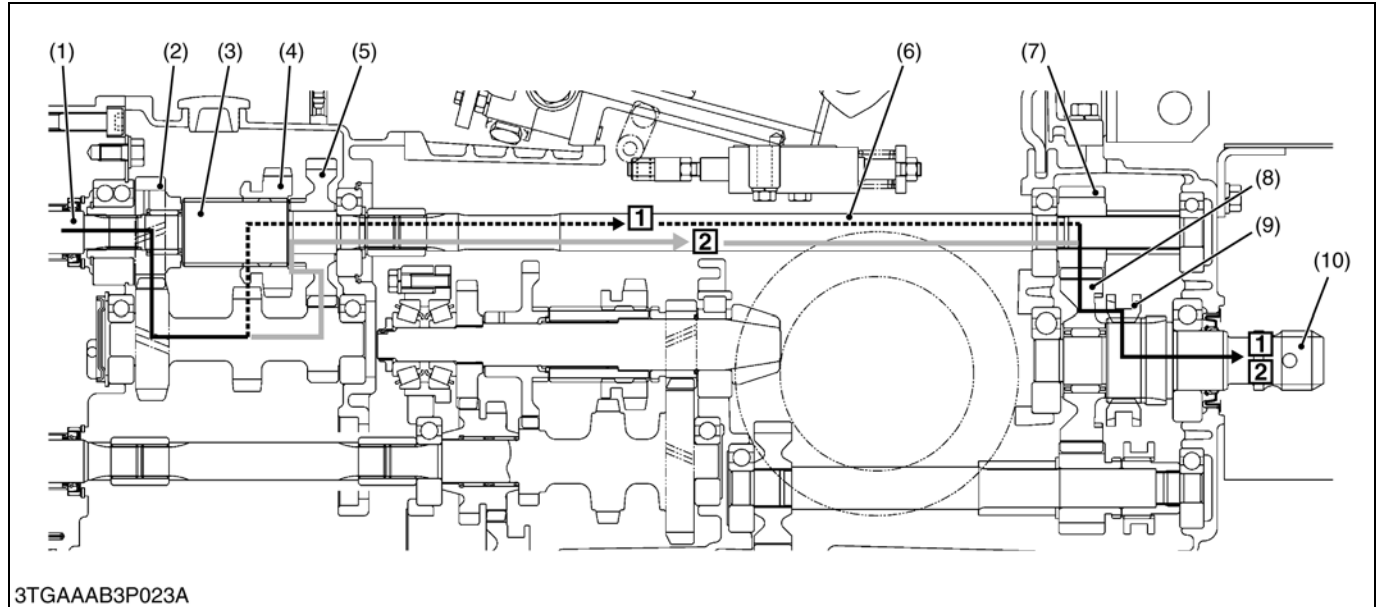
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2-wheel drive or 4-wheel drive is selected by changing the position of 24T Gear (7) with the front wheel drive lever.

■ Engage

Hypoid Pinion Shaft (1) → 22T gear (2) → 22T Gear (3) → 21T Gear (4) → 24T Gear (7) → Front Wheel Drive Shaft (6).

5. REAR PTO SHIFT SECTION



- | | | | |
|-----------------------|---------------------|----------------|---------------|
| (1) Input Shaft | (5) 27T Gear | (8) 33T Gear | (11) 14T Gear |
| (2) 18T Gear | (6) PTO Drive Shaft | (9) Shifter | (12) 18T Gear |
| (3) PTO Counter Shaft | (7) 15T Gear | (10) PTO Shaft | (13) 21T Gear |
| (4) 24T Gear | | | |

There are two parts of the rear PTO shift section. Front part is a shift change for the PTO revolution speed. Rear part is a shift change for engaged or disengaged. Therefore it may operate the two levers for using the rear PTO.

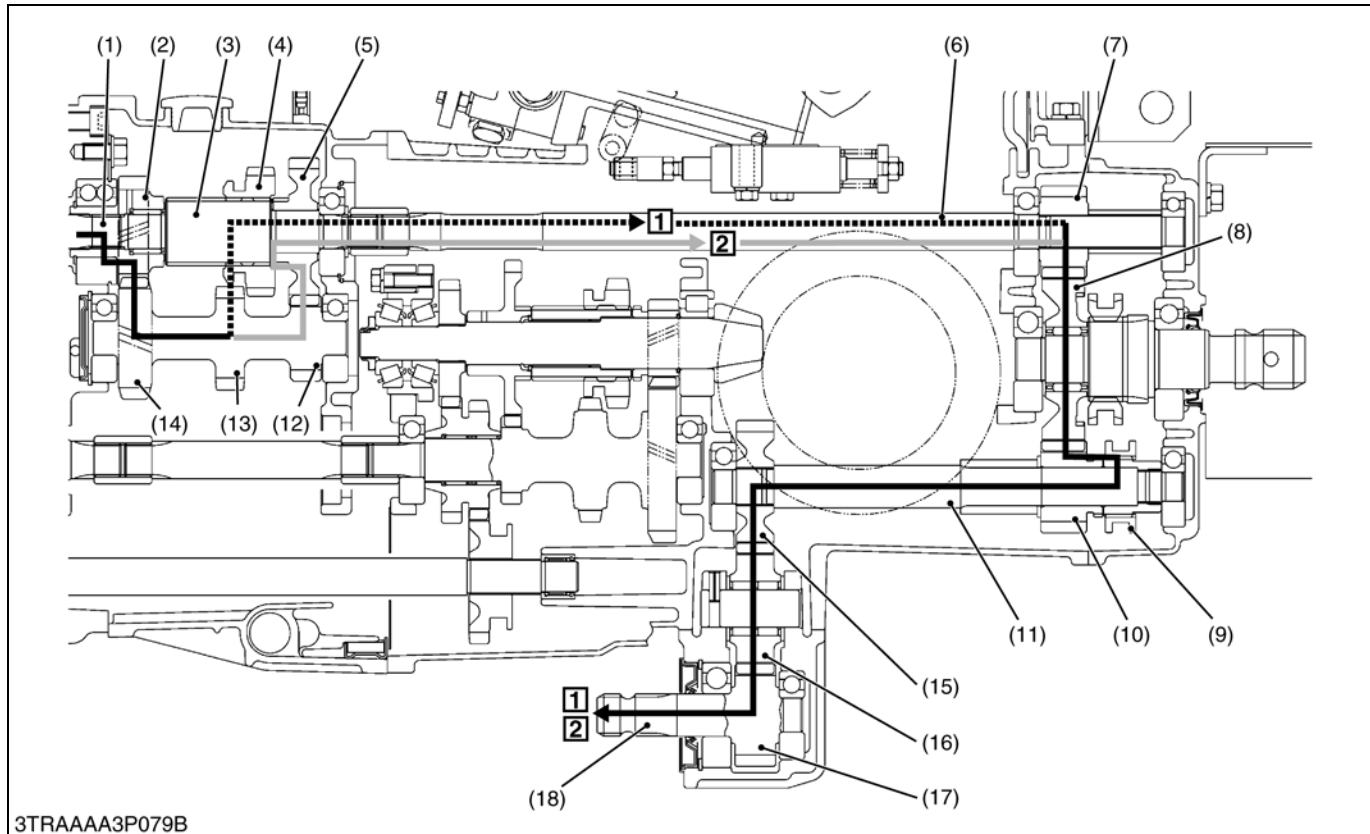
■ PTO Speed 540 rpm

Input Shaft (1) → 18T Gear (2) → 21T Gear (13) → 14T Gear (11) → 27T Gear (5) → 24T Gear (4) → PTO Counter Shaft (3) → PTO Drive Shaft (6) → 15T Gear (7) → 33T Gear (8) → Shifter (9) → PTO Shaft (10)

■ PTO Speed 800 rpm

Input Shaft (1) → 18T Gear (2) → 21T Gear (13) → 18T Gear (12) → 24T Gear (4) → PTO Counter Shaft (3) → PTO Drive Shaft (6) → 15T Gear (7) → 33T Gear (8) → Shifter (9) → PTO Shaft (10)

6. MID-PTO SHIFT SECTION



3TRAAA3P079B

- | | | | |
|-----------------------|---------------------|--------------------------|--------------------|
| (1) Input Shaft | (6) PTO Drive Shaft | (11) Mid-PTO Drive Shaft | (15) 24T Gear |
| (2) 18T Gear | (7) 15T Gear | (12) 14T Gear | (16) 23T Gear |
| (3) PTO Counter Shaft | (8) 33T Gear | (13) 18T Gear | (17) 17T Gear |
| (4) 24T Gear | (9) Shifter | (14) 21T Gear | (18) Mid-PTO Shaft |
| (5) 27T Gear | (10) 15T Gear | | |

There are two operation levers for shifting the mid-PTO shift section as same as the rear PTO shift section.

■ PTO Speed 1720 rpm

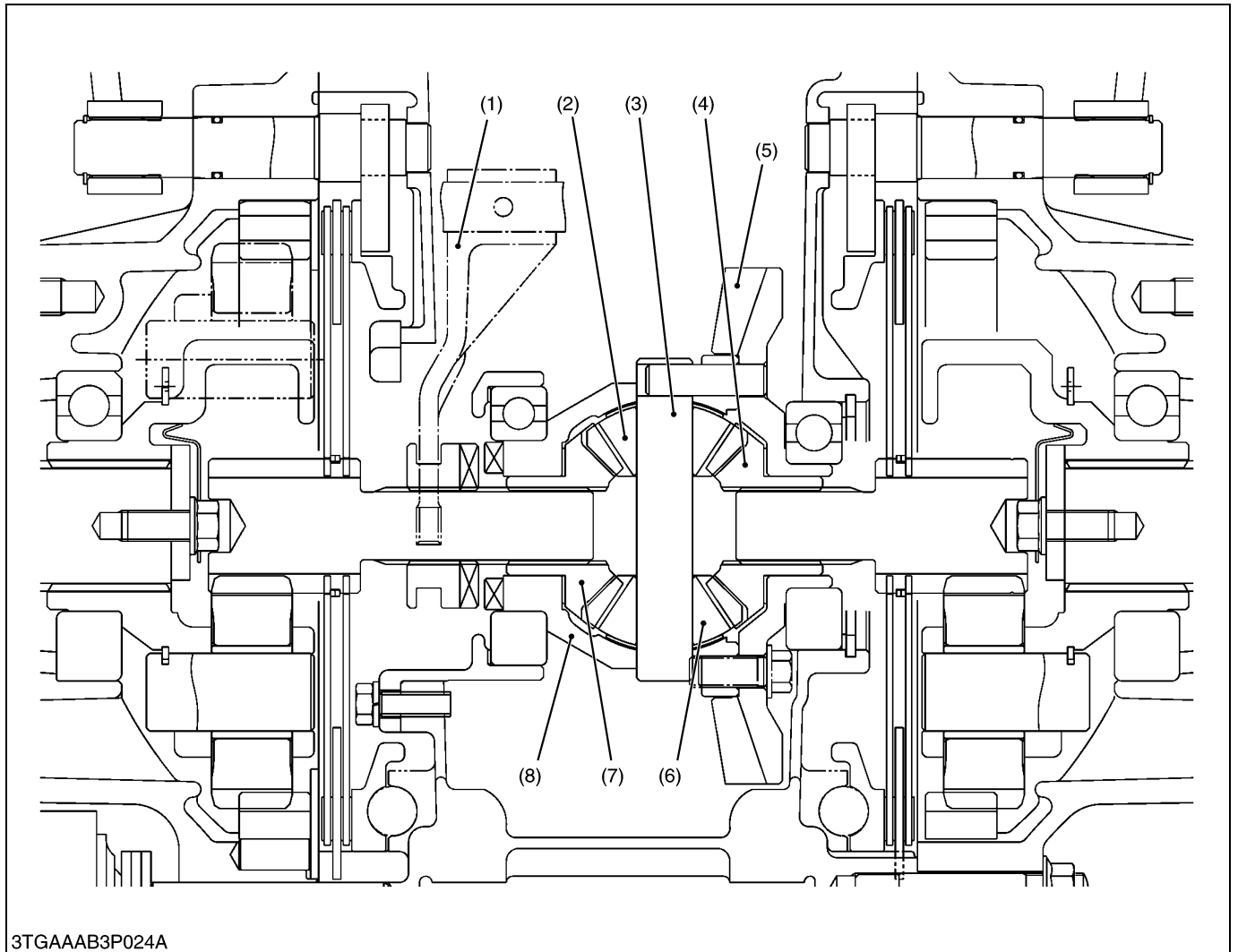
Input Shaft (1) → 18T Gear (2) → 21T Gear (14) → 14T Gear (12) → 27T Gear (5) → 24T Gear (4) → PTO Counter Shaft (3) → PTO Drive Shaft (6) → 15T Gear (7) → 33T Gear (8) → 15T Gear (10) → Shifter (9) → Mid-PTO Drive Shaft (11) → 24T Gear (15) → 23T Gear (16) → 17T Gear (17) → Mid-PTO Shaft (18)

■ PTO Speed 2490 rpm

Input Shaft (1) → 18T Gear (2) → 21T Gear (14) → 18T Gear (13) → 24T Gear (4) → PTO Counter Shaft (3) → PTO Drive Shaft (6) → 15T Gear (7) → 33T Gear (8) → 15T Gear (10) → Shifter (9) → Mid-PTO Drive Shaft (11) → 24T Gear (15) → 23T Gear (16) → 17T Gear (17) → Mid-PTO Shaft (18)

7. DIFFERENTIAL GEAR

[1] STRUCTURE



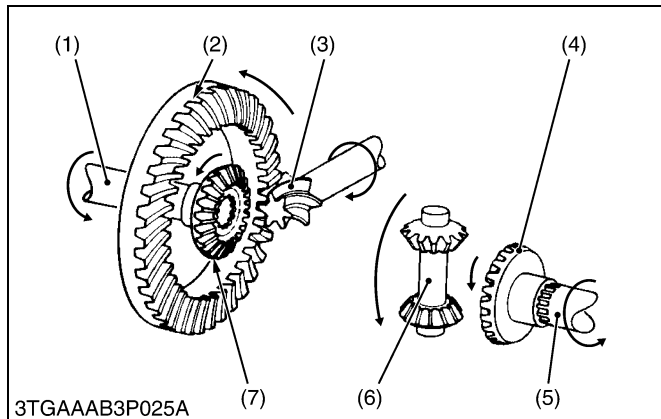
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- | | | | |
|----------------------------------|-------------------------------|-------------------------|----------------------------|
| (1) Differential Lock Shift Fork | (3) Differential Pinion Shaft | (5) Spiral Bevel Gear | (7) Differential Side Gear |
| (2) Differential Pinion | (4) Differential Side Gear | (6) Differential Pinion | (8) Differential Case |

The differential gear assembly is a mechanism to provide smooth steering. It automatically provides different optimum torques to the right and left wheels according to road resistance and braking friction at the wheels.

The differential gear assembly is composed of the differential case, differential pinions, differential side gears, differential pinion shaft, spiral bevel gear, etc..

[2] OPERATION

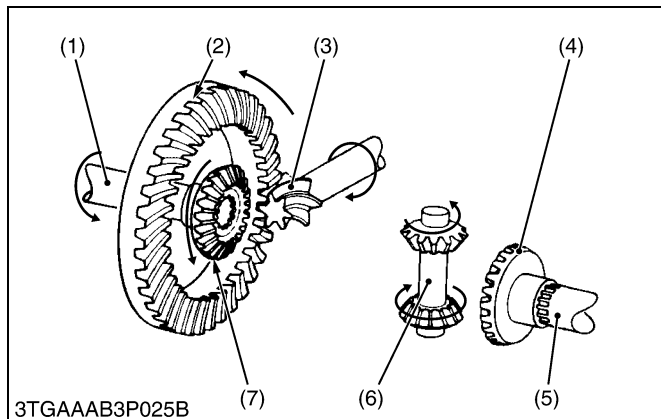


■ During Straight Running

Rotation of the spiral bevel pinion (3) is transmitted to the spiral bevel gear (2) bolted to the differential case. When road resistance to the right and left wheels are equal, the differential pinions (6), and differential side gears (4), (7) are carried around by the spiral bevel gear (2), and differential case rotate as a unit. Differential gear shaft (1), (5) receive the same rotation and both wheels travel at the same speed.

- | | |
|-----------------------------|-----------------------------|
| (1) Differential Gear Shaft | (5) Differential Gear Shaft |
| (2) Spiral Bevel Gear | (6) Differential Pinion |
| (3) Spiral Bevel Pinion | (7) Differential Side Gear |
| (4) Differential Side Gear | |

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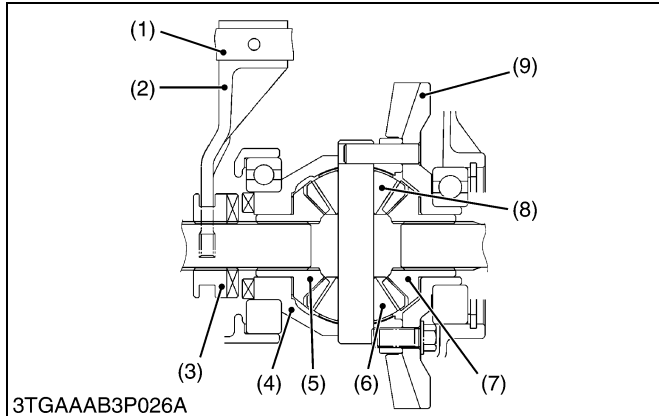
■ During Turning

The power from the engine on spiral bevel pinion (3) rotates spiral bevel gear (2). When turning a corner, the outer wheel must travel farther than the inner one. While differential pinions (6) rotate with the differential case, they spin on differential pinion (6) to transmit more rotation to one differential side gear (4) or (7) than to the other. As one differential gear shaft rotates faster, the other rotates slower by the same amount.

- | | |
|-----------------------------|-----------------------------|
| (1) Differential Gear Shaft | (5) Differential Gear Shaft |
| (2) Spiral Bevel Gear | (6) Differential Pinion |
| (3) Spiral Bevel Pinion | (7) Differential Side Gear |
| (4) Differential Side Gear | |

W1019951

[3] DIFFERENTIAL LOCK



When resistances to the right and left tires are different due to ground conditions or type of work, the wheel with less resistance slips and prevents the tractor from moving ahead. To compensate for this, the differential lock restricts the differential function and causes both rear axles to rotate as a unit.

When the differential lock pedal is stepped on, it causes the differential lock cam shaft (1), differential lock shift fork (2) and differential lock shifter (3) are moved forward the ring gear (9).

The gears on the differential lock shifter (3) meshes with the gears on the differential case (4) to cause the differential lock, differential lock shifter and differential side gear to rotate as a unit. Therefore the differential pinions (6), (8), can not rotate on their axles, and the rotation of the spiral bevel pinion is transmitted to the both rear axle s evenly. It means the tractor going straight ahead.

When the drive wheels regain equal traction, the lock will disengage automatically by the force of differential lock pedal return spring, while released differential lock pedal.

- | | |
|----------------------------------|----------------------------|
| (1) Differential Lock Cam Shaft | (6) Differential Pinion |
| (2) Differential Lock Shift Fork | (7) Differential Side Gear |
| (3) Differential Lock Shifter | (8) Differential Pinion |
| (4) Differential Case | (9) Ring Gear |
| (5) Differential Side Gear | |

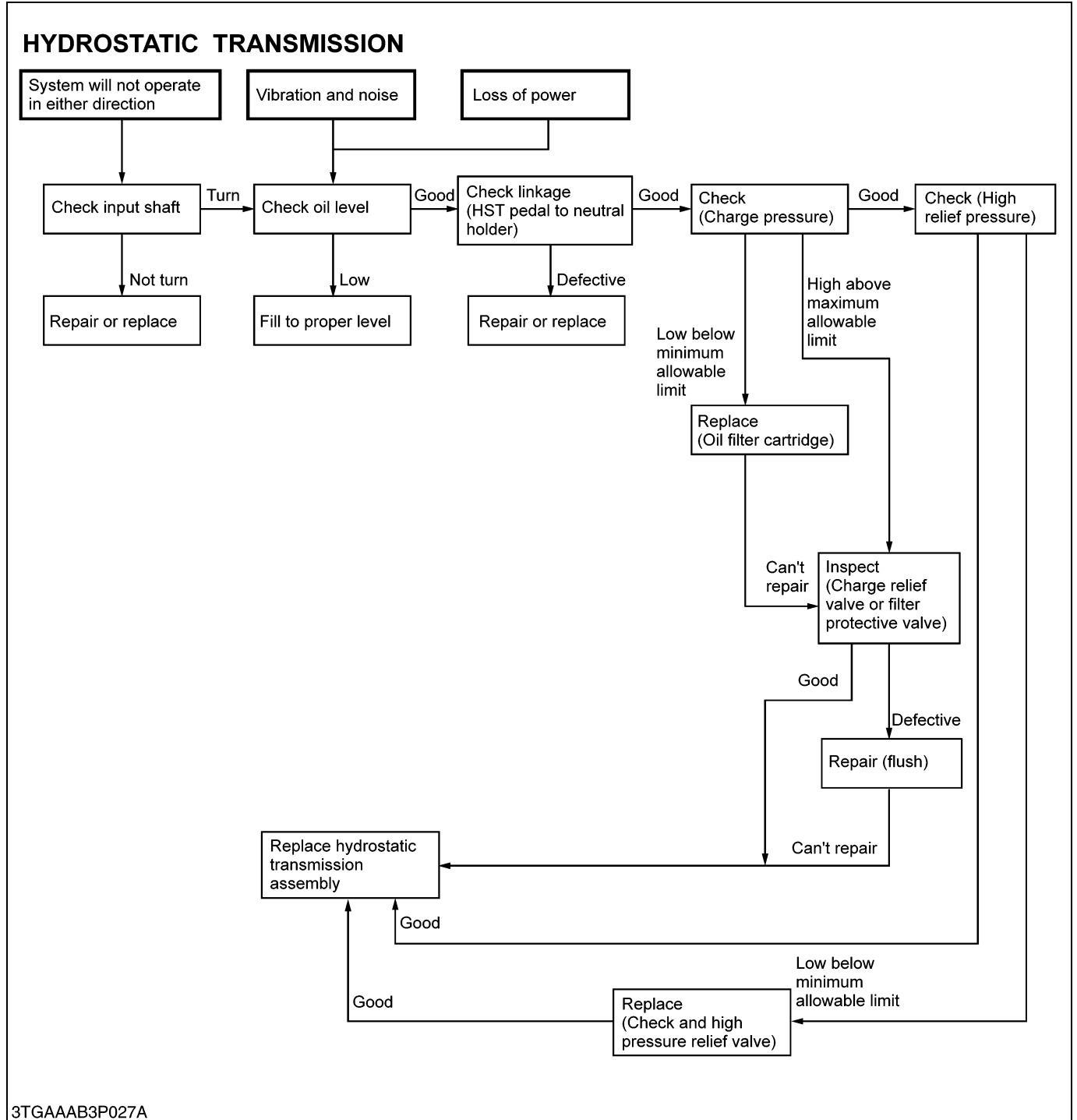
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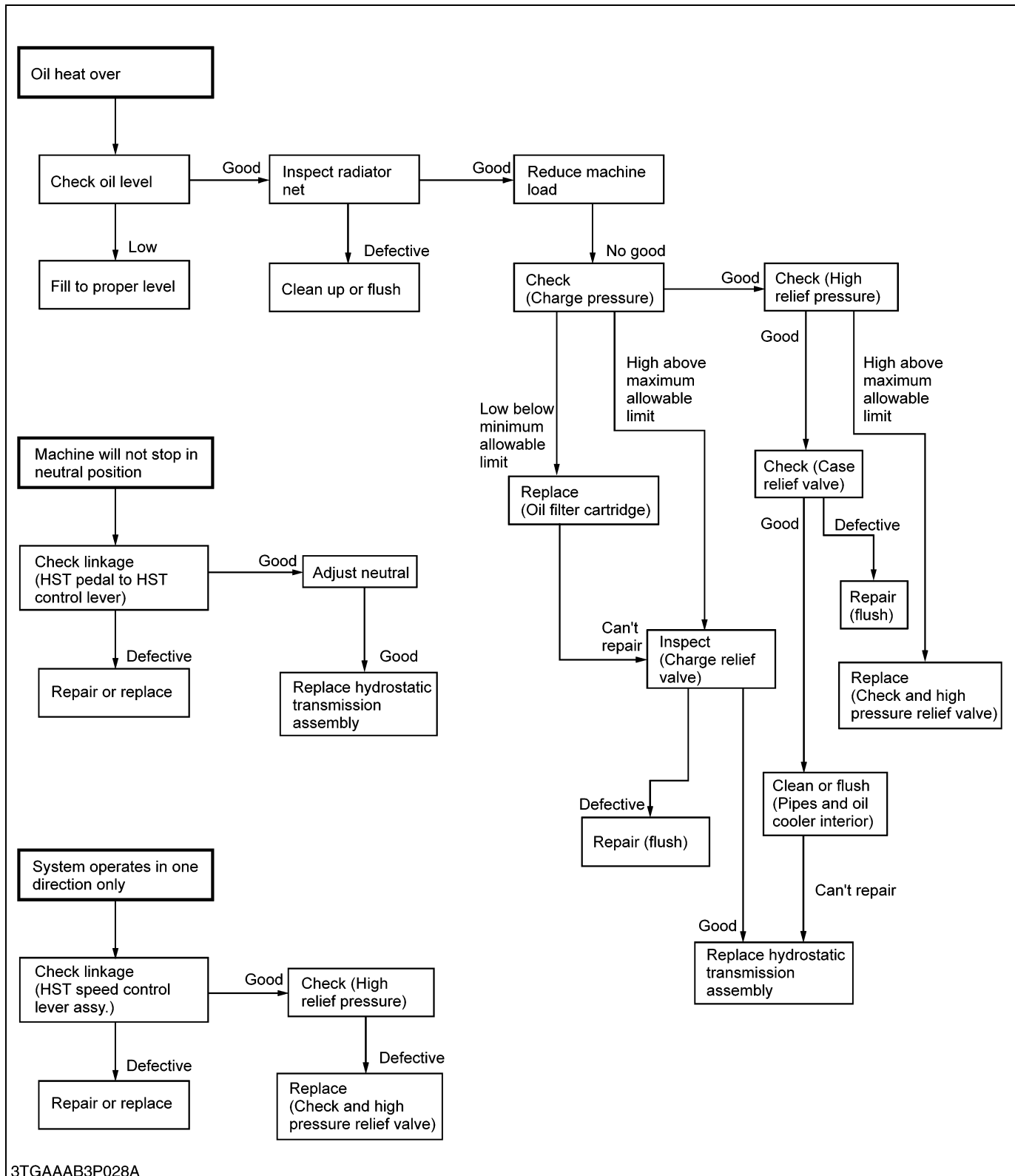
SERVICING

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1. TROUBLESHOOTING





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CLUTCH HOUSING

Symptom	Probable Cause	Solution	Reference Page
Noise from Clutch Housing	<ul style="list-style-type: none"> • Transmission oil insufficient • Bearing worn 	Refill Replace	G-8 –

W1013580

TRANSMISSION CASE SECTION

Noise from Transmission	<ul style="list-style-type: none"> • Transmission oil insufficient • Gear worn or broken • Improper backlash between spiral bevel pinion and bevel gear • Improper backlash between differential pinion and differential side gear • Bearings worn 	Refill Replace Adjust Adjust Replace	G-8 3-S29 3-S32 3-S32 3-S28
Gear Slip Out of Mesh	<ul style="list-style-type: none"> • Shift fork spring tension insufficient • Shift fork or shifter worn • Shift fork bent 	Replace Replace Replace	– 3-S29 –

W1015467

DIFFERENTIAL CASE SECTION

Excessive or Unusual Noise at All Time	<ul style="list-style-type: none"> • Improper backlash between spiral bevel pinion and bevel gear • Improper backlash between differential pinion and differential side gear • Bearing worn • Insufficient or improper type of transmission fluid used 	Adjust Adjust Replace Replenish or Replace	3-S32 3-S32 3-S28 G-8
Noise while Turning	<ul style="list-style-type: none"> • Differential pinions or differential side gears worn or damaged • Differential lock binding (does not disengage) • Bearings worn 	Replace Replace Replace	3-S31 3-S26 3-S28
Differential Lock Can Not Be Set	<ul style="list-style-type: none"> • Differential lock shift fork damaged • Differential lock shifter mounting pin damaged • Differential lock clutch damaged 	Replace Replace Replace	3-S26 3-S26 –
Differential Lock Pedal Does Not Return	<ul style="list-style-type: none"> • Differential lock pedal return spring weaken or damaged • Differential lock fork shaft rusted 	Replace Repair	– 3-S26

W1015467

2. SERVICING SPECIFICATIONS

HYDRAULIC TRANSMISSION (HST) SECTION

Item		Factory Specification	Allowable Limit
Check and High Pressure Relief Valve	Setting Pressure [Relief Valve]	26.4 to 29.4 MPa 270 to 300 kgf/cm ² 3840.2 to 4266.9 psi	–
Charge Relief Valve	Setting Pressure	0.4 to 0.8 MPa 4.0 to 8.0 kgf/cm ² 56.9 to 113.8 psi	–

TRANSMISSION CASE SECTION

Shift Fork to Shifter Groove	Clearance	0.1 to 0.4 mm 0.0039 to 0.0157 in.	0.8 mm 0.031 in.
18T Input Shaft to PTO Counter Shaft	Clearance	0.016 to 0.064 mm 0.0006 to 0.0025 in.	0.1 mm 0.0039 in.
18T Input Shaft	I.D.	26.007 to 26.028 mm 1.0238 to 1.0247 in.	–
PTO Counter Shaft	O.D.	19.973 to 19.984 mm 0.7863 to 0.7868 in.	–
Needle Bearing	O.D.	2.994 to 3.000 mm 0.1179 to 0.1181 in.	–
PTO Counter Shaft to 27T Gear	Clearance	0.020 to 0.054 mm 0.0008 to 0.0021 in.	0.1 mm 0.0039 in.
27T Gear	I.D.	25.000 to 25.021 mm 0.9843 to 0.9851 in.	–
PTO Counter Shaft	O.D.	24.967 to 24.980 mm 0.9830 to 0.9835 in.	–

TRANSMISSION GEAR CASE SECTION

Hypoid Pinion Shaft to 29T Gear	Clearance	0.020 to 0.051 mm 0.0008 to 0.0020 in.	0.1 mm 0.0039 in.
29T Gear	I.D.	25.000 to 25.018 mm 0.9843 to 0.9850 in.	–
Hypoid Pinion Shaft	O.D.	24.967 to 24.980 mm 0.9830 to 0.9835 in.	–
Hypoid Pinion Shaft to 13T Gear	Clearance	0.020 to 0.051 mm 0.0008 to 0.0020 in.	0.1 mm 0.0039 in.
13T Gear	I.D.	30.000 to 30.018 mm 1.1811 to 1.1818 in.	–
Hypoid Pinion Shaft	O.D.	29.967 to 29.980 mm 1.1798 to 1.1803 in.	–
Differential Pinion to Differential Side Gear	Backlash	0.15 to 0.30 mm 0.0059 to 0.0118 in.	0.5 mm 0.020 in.

W1013973

TRANSMISSION GEAR CASE SECTION (CONTINUE)

Item		Factory Specification	Allowable Limit
Differential Case to Differential Side Gear	Clearance	0.05 to 0.10 mm 0.0020 to 0.0039 in.	0.4 mm 0.016 in.
Differential Case Ring Gear	I.D.	32.000 to 32.025 mm 1.25984 to 1.26083 in.	–
Differential Side Gear Boss	O.D.	31.925 to 31.950 mm 1.25689 to 1.25787 in.	–
Differential Pinion to Differential Pinion Shaft	Clearance	0.048 to 0.084 mm 0.00189 to 0.00331 in.	0.2 mm 0.008 in.
Differential Pinion	I.D.	18.032 to 18.050 mm 0.70992 to 0.71063 in.	–
Differential Pinion Shaft	O.D.	17.966 to 17.984 mm 0.70732 to 0.70803 in.	–
Hypoid Pinion	Motive Force	10.9 to 16.7 N 1.1 to 1.7 kgf 2.5 to 3.7 lbs	–
	Motive Torque	0.520 to 0.559 N·m 0.053 to 0.057 kgf·m 0.383 to 0.412 ft-lbs	–
Hypoid Pinion to Hypoid Ring Gear	Backlash	0.20 to 0.30 mm 0.0078 to 0.0118 in.	–
	Tooth Contact	–	More than 25 %
	Center of Tooth Contact	–	1/3 of the entire width from the small end
PTO Drive Shaft to 15T Gear	Clearance	0.040 to 0.074 mm 0.0016 to 0.0029 in.	0.1 mm 0.0039 in.
15T Gear	I.D.	22.520 to 22.541 mm 0.8866 to 0.8874 in.	–
PTO Drive Shaft	O.D.	22.467 to 22.480 mm 0.8845 to 0.8850 in.	–

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3. TIGHTENING TORQUES

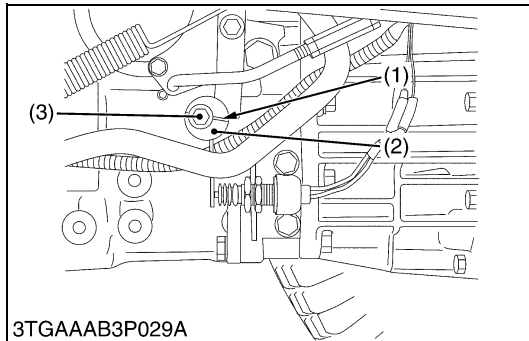
Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts : See page G-9.)

Item	N-m	kgf-m	ft-lbs
Rear wheel mounting screw and nut	196.1 to 225.6	20.0 to 23.0	145 to 166
Hydraulic hose P, PB and T retaining nut	30 to 40	3.0 to 4.0	21.7 to 28.9
Rear cross bar mounting screw	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Rubber mount screw and bolt	196.0 to 225.0	20.0 to 30.0	144.7 to 166.4
Connecting bar mounting screw	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
Rear frame mounting flange screw	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Bi-speed valve delivery pipe retaining nut	34.0 to 39.0	3.5 to 4.0	25.3 to 28.9
Delivery pipe retaining nut	88.2 to 117.6	9.0 to 12.0	65.1 to 86.8
Clutch housing mounting screw and nut	39.3 to 44.1	4.0 to 4.5	29.0 to 32.5
HST mounting screw and nut	39.3 to 44.1	4.0 to 4.5	29.0 to 32.5
Check and high pressure relief valve plug	58.8 to 68.6	6.0 to 7.0	43.4 to 50.6
Port block mounting screw	39.3 to 44.1	4.0 to 4.5	29.0 to 32.5
Transmission case mounting screw and nut	39.3 to 44.1	4.0 to 4.5	29.0 to 32.5
Drawbar bracket mounting screw (M14)	108.0 to 125.0	11.0 to 12.8	79.6 to 92.6
Detent plug screw	19.6 to 24.5	2.0 to 2.5	14.5 to 18.1
Rear PTO case mounting screw and nut	39.3 to 44.1	4.0 to 4.5	29.0 to 32.5
Mid-PTO case mounting screw	29.4 to 34.3	3.0 to 3.5	21.7 to 25.3
Top link bracket mounting screw	39.3 to 44.1	4.0 to 4.5	29.0 to 32.5
Rear axle case mounting screw	39.3 to 44.1	4.0 to 4.5	29.0 to 32.5
Differential bearing holder mounting screw	17.7 to 20.6	1.8 to 2.1	13.0 to 15.2
Ring gear mounting UBS screw	60.8 to 70.6	6.2 to 7.2	44.8 to 52.1

W1012736

4. CHECKING, DISASSEMBLING AND SERVICING

[1] CHECKING



Adjusting Neutral

1. Disengage the front wheel drive lever. (Drive only rear wheels.)
2. Lift the rear of the tractor so that the rear wheels are off the ground and run the engine at low idling and drive only rear wheels.
3. Slightly loosen the neutral holder mounting screw (3).
4. Rotate the neutral holder (2) clockwise to the rear wheels turn reverse.
5. Then rotate it counterclockwise until wheels stop completely.
6. Put a mark on the frame aligning the groove (1) on neutral holder.
7. Rotate the neutral holder (2) counterclockwise so the rear wheels turn forward.
8. Then rotate it clockwise until wheels stop completely.
9. Put mark on the frame aligning the groove (1) on neutral holder.
10. Hold the neutral adjuster so its groove is at the middle of the marks and tighten the mounting screw (3).

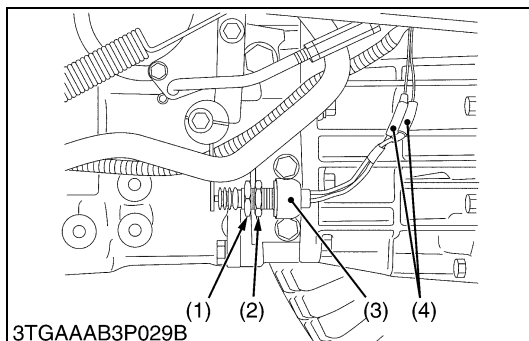
■ NOTE

- Check the rear wheel stops with range speed 3 at max. engine speed.
- When the wheels tend to turn forward, rotate neutral holder clockwise.
- When the wheels tend turn reverse, rotate neutral holder counterclockwise.

(1) Groove
(2) Neutral Holder

(3) Neutral Holder Mounting Screw

W1012386



HST Safety Switch

1. After adjust the HST neutral position, check the HST safety switch (3).
2. Disconnect the HST safety switch connector (4).
3. Connect the leads of an ohmmeter to the HST safety switch lead terminal.
4. Measure the resistance at HST is neutral position.
5. If 0 ohm is not indicated, adjust the HST safety switch setting position with lock nuts (1) and (2).

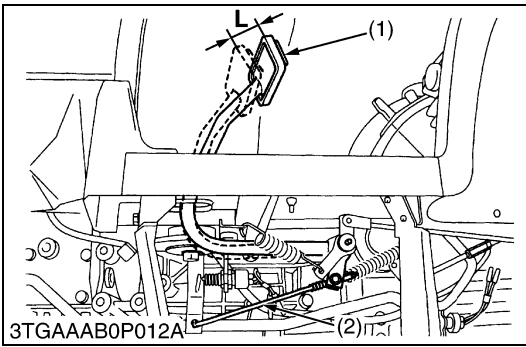
■ IMPORTANT

- Be sure to check, the ohmmeter is indicated on infinity when depress the speed control pedal for both forward and reverse.

(1) Lock Nut
(2) Lock Nut

(3) HST Safety Switch
(4) Connector

W1012629



Checking Clutch Pedal Free Travel

⚠ CAUTION

- When checking, park the tractor on flat ground, apply the parking brake, stop the engine and remove the key.

1. Slightly depress the clutch pedal (1) and measure free travel “L” at top of clutch pedal.
2. If the measurement is not within the factory specifications, loosen the lock nut and adjust the clutch rod (2) length.

■ IMPORTANT

- After adjustment, be sure to check that engine does not start without depressing the clutch pedal but engine start when depressing the clutch pedal.

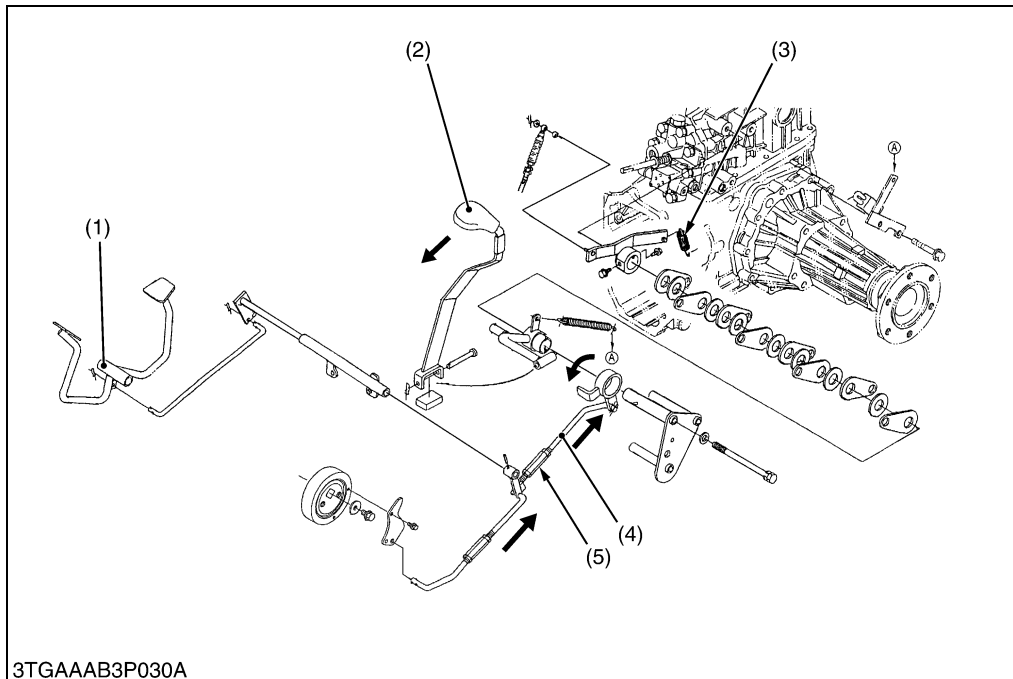
Clutch pedal free travel on top of clutch pedal “L”	Factory spec.	20.0 to 30.0 mm 0.78 to 1.18 in.
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(1) Clutch Pedal

(2) Clutch Rod

W1012849

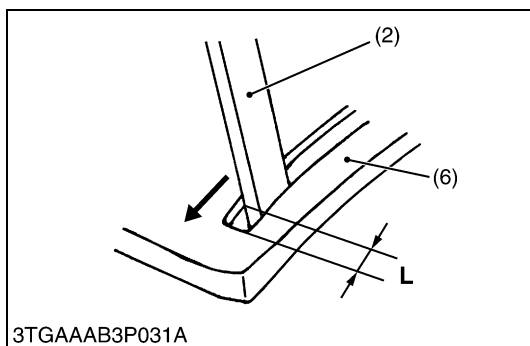
Cruise Control Linkage



- (1) Speed Control Pedal
- (2) Cruise Lever 1
- (3) Cruise Spring
- (4) Neutral Holder Rod
- (5) Turn Buckle
- (6) Lever Guide
- (7) Lock Nut

W1013041

3TGAAAB3P030A



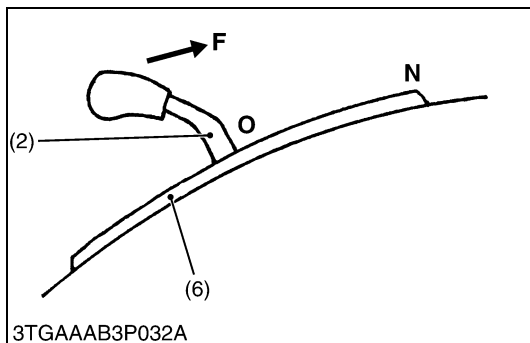
3TGAAAB3P031A

■ Adjusting Cruise Control Linkage

1. Fully depress the speed control pedal (1) for forward and set the cruise lever 1 (2) to fully forward.
2. Check the clearance **L** between cruise lever 1 (2) and lever guide (6).
3. If the measurement is not within the factory specification, adjust the length of neutral holder rod (4) with turn buckle (5).

Clearance L between cruise lever 1 and lever guide	Factory spec.	5.0 to 10.0 mm 0.197 to 0.394 in.
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W1013124



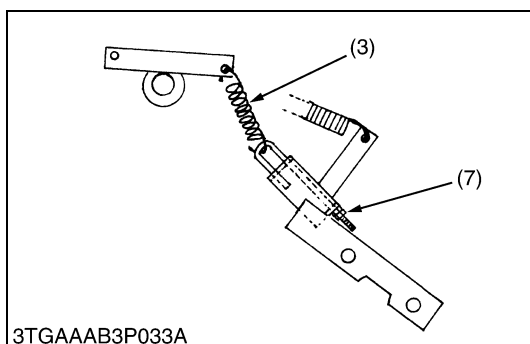
3TGAAAB3P032A

■ Cruise Control Lever

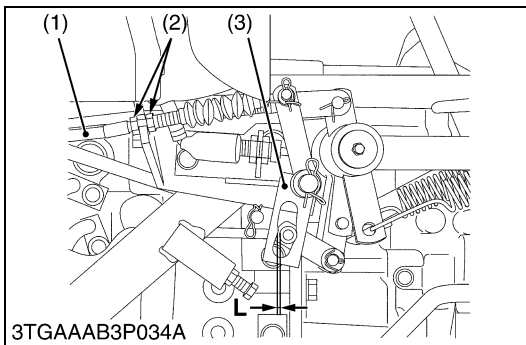
1. Measure the force to move the cruise control lever 1 (2) from **O** to **N** indicated on lever guide (6) at lever grip.
2. If the force is not within the factory specifications, loosen the lock nut (7) and adjust the tension of cruise spring (3).
3. Retighten the lock nut securely.

Force to move the lever (F)	Factory spec.	40 to 70 N 4.0 to 7.0 kgf 8.82 to 15.44 lbs
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W1013234



3TGAAAB3P033A



Adjusting Cruise Control Release Linkage

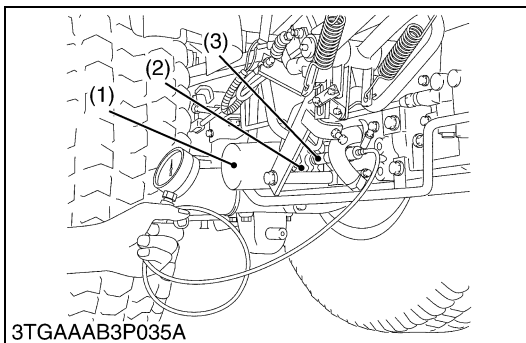
1. Adjust the brake pedals play first.
2. Step on one of the brake pedals to make sure the cruise control is not released. Also step on both the brake pedals coupled together to make sure that the cruise control is released.
3. If the cruise control is not released, loosen the lock nut (2) of release wire (1) and adjust the release wire so that the clearance **L** within the factory specification.

Clearance L of brake lever	Factory spec.	1.0 mm 0.039 in.
-----------------------------------	---------------	---------------------

(1) Release Wire
(2) Lock Nut

(3) Brake Lever

W1013375



Checking Charge Relief Pressure

1. Start the engine to warm up the transmission oil until to reach 50 °C (122 °F).
2. Remove the plug from the oil filter support (2).
3. Connect the long connector (Code No.: 07916-60831) and pressure gauge 50 (Code No.: 07916-52961).
4. Measure the pressure with shift pedal to be neutral at engine 1500 rpm. If the measurement is not within factory specification, check charge pump, charge relief valve and HST oil filter cartridge clogged.

Charge relief pressure	Factory spec.	0.4 to 0.8 MPa 4 to 8 kgf/cm ² 56.9 to 113.8 psi
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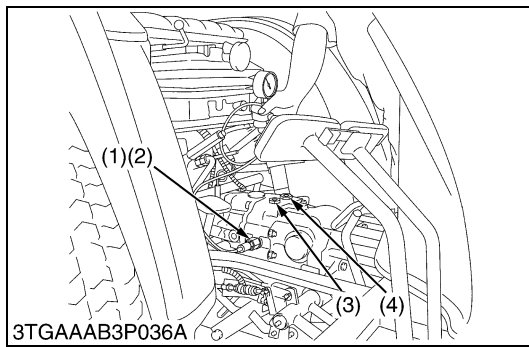
Condition

- Engine speed : 1500 rpm
- Oil temperature : 45 to 55 °C (113 to 131 °F)

(1) HST Oil Filter Cartridge
(2) Oil Filter Support

(3) Long Connector

W1013616



Checking High-pressure Relief Valve Pressure

1. Start the engine to warm up the transmission oil until to reach 50 °C (122 °F).
2. Remove the seat under cover and the step.
3. Install adaptor **C** (Code No.: 07916-50371) and pressure gauge (49.0 MPa, 500 kgf/cm², 7110 psi) after removing forward or reverse high-pressure checking port plugs (2).
4. Depress the brake pedals and set the engine rpm with 1500 rpm.
5. Shift the auxiliary shift lever to "3".
6. Depress the HST pedal to forward or reverse until relief valve functioning.

Then measure the pressure for each one.

If the measurement within factory specification, check the check and high-pressure relief valve, neutral valve and HST.

High pressure relief valve pressure	Factory spec.	26.4 to 29.4 MPa 270 to 300 kgf/cm ² 3840.2 to 4266.9 psi
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Condition

- Engine speed : 1500 rpm
- Oil temperature : 45 to 55 °C (113 to 131 °F)

(Reference)

- Check and high-pressure relief valves for forward and reverse are interchangeable.

- (1) Adaptor **C** (3) Neutral Valve for Reverse
 (2) High-pressure Checking Port Plug (4) Neutral Valve for Forward for Reverse

W1013810

[2] DISASSEMBLING AND ASSEMBLING

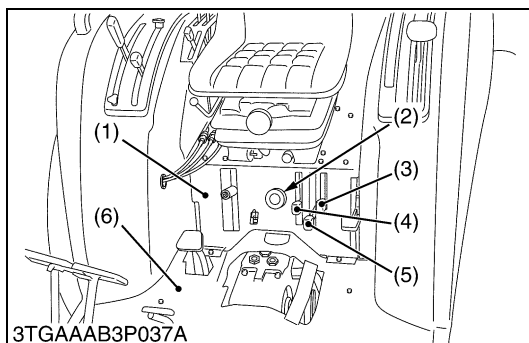
(1) Separating Engine from Clutch Housing

Engine Separating from Clutch Housing

1. See clutch section page from 2-S4 to 2-S12.

W1014134

(2) Step, Seat Under Cover and Seat



Step and Seat Under Cover

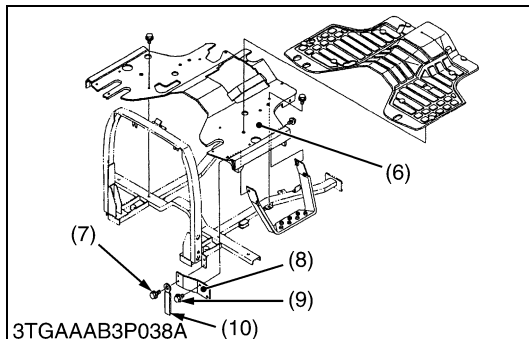
1. Remove the step mat.
2. Detach the grips for front wheel drive lever (3), rear PTO lever (5) and mid-PTO lever (4).
3. Remove the 3P lowering speed knob (2).
4. Remove the seat under cover (1).
5. Remove the auxiliary step then remove step (6).

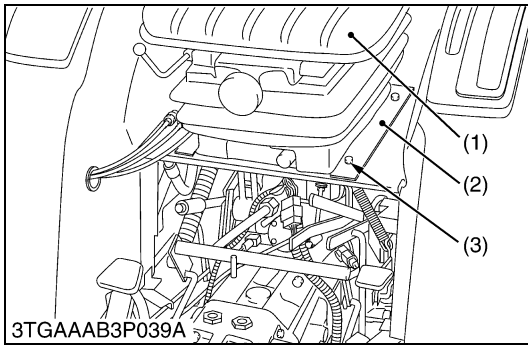
(When reassembling)

- Do not confuse the grips.
 - Grip (Yellow) for rear PTO lever and mid-PTO lever
 - Grip (Orange) for front wheel drive lever
- Be sure to fix the code clamp (10) with L = 20 mm (0.79 in.) screw (7).

- (1) Seat Under Cover (6) Step
 (2) 3P Lowering Speed Knob (7) Screw : L = 20 mm (0.79 in.)
 (3) Front Wheel Drive Lever (8) Step Stay
 (4) Mid-PTO Lever (9) Screw : L = 16 mm (0.63 in.)
 (5) Step (10) Code Clamp

W1014190

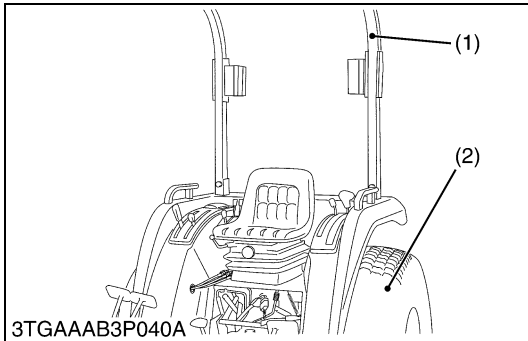


**Seat**

1. Unscrew the seat support mounting screw (3).
2. Remove the seat (1) with seat support (2).

(1) Seat
(2) Seat Support
(3) Seat Support Mounting Screw

W1014446

(3) Fender Assembly**Rear Wheels**

1. Unscrew the ROPS mounting bolt and nut, then remove the ROPS (1).
2. Place a jack under the transmission case.
3. Loosen the rear wheel mounting screw and nut.
4. Take out the rear wheel (2).

■ IMPORTANT

- When re-fitting or adjusting a wheel, tighten the screws and nuts to the following torques and then recheck them after driving the tractor approximately 200 m (200 yard).

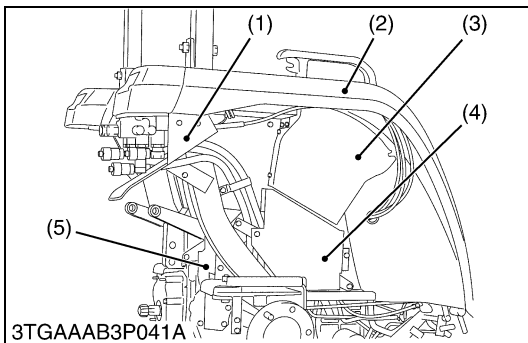
(When reassembling)

Tightening torque	Rear wheel mounting screw and nut	196.1 to 225.6 N·m 20.0 to 23.0 kgf·m 145 to 166 ft-lbs
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(1) ROPS

(2) Rear Wheel

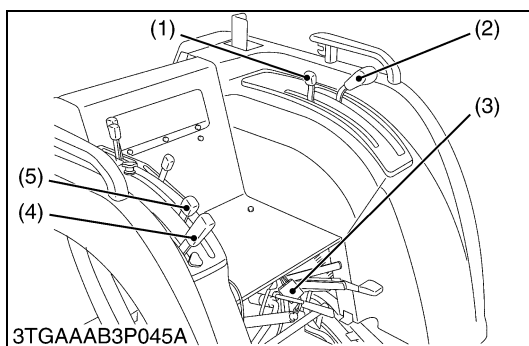
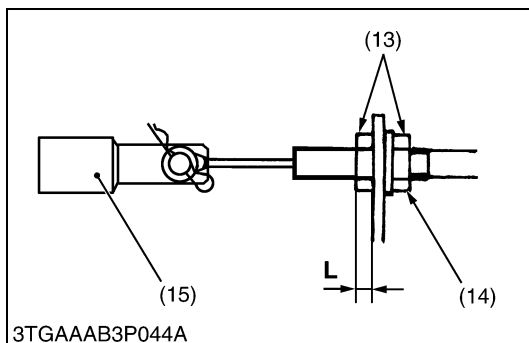
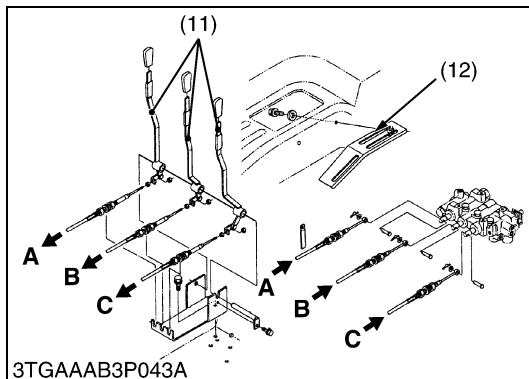
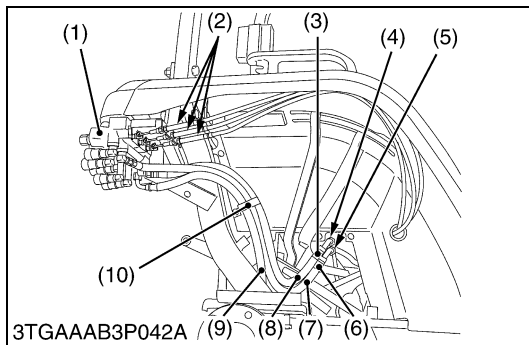
W1014617

**Fender Cover and Auxiliary Hydraulic Cover**

1. Remove the fender cover (3) and fender front cover (4) at both side of fender (2).
2. Remove the auxiliary hydraulic valve cover (1).
3. Remove the fender rear covers (5).
4. Disconnect the harness connectors regard with fender.

(1) Auxiliary Hydraulic Valve Cover
(2) Fender
(3) Fender Cover
(4) Fender Front Cover
(5) Fender Rear Cover

W1014912



Auxiliary Hydraulic Valve

1. Disconnect the three control wire cables (2) from valve spool (15).
2. Disconnect the three hydraulic hoses (7), (8) and (9).
3. Remove the hydraulic hose clamp (10).
4. Remove the auxiliary hydraulic valve assembly (1).

(When reassembling)

- Connect the control cables as shown in figure.
- Adjust the cable set position with cable mounting nut (13), so that the control levers (11) comes center of lever guide (12).
- Connect the hose P (8) with white tape (3) to the **P** port (4).
- Connect the hose PB (7) with blue tape (6) to the **PB** port (5).
- Both P and PB hose fix to **P** and **PB** port, make 0.785 rad. (45 °) angle as shown in figure.

Tightening torque	Hydraulic hoses P, PB and T retaining nut	30 to 40 N·m 3.0 to 4.0 kgf·m 21.7 to 28.9 ft·lbs
Control wire cable adjusting reference : L		5.0 to 10.0 mm 0.20 to 0.39 in.

- | | |
|------------------------------|-------------------------|
| (1) Auxiliary Valve Assembly | (10) Clamp |
| (2) Control Wire Cable | (11) Control Lever |
| (3) White Tape | (12) Lever Guide |
| (4) P Port | (13) Cable Mounting Nut |
| (5) PB Port | (14) Plane Washer |
| (6) Blue Tape | (15) Valve Spool |
| (7) Hydraulic Hose PB | |
| (8) Hydraulic Hose P | L : Reference |
| (9) Hydraulic Hose T | |

W1015132

Fender Assembly

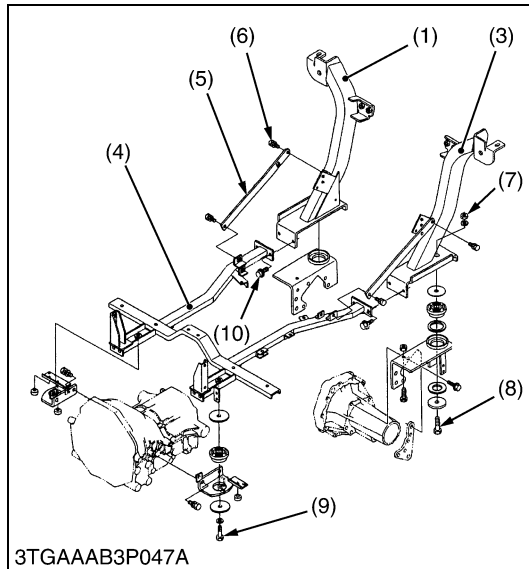
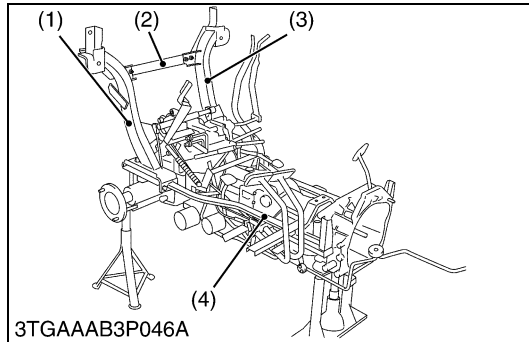
1. Detach the grips (1), (2), (4) and (5).
2. Remove the ground wire cable from under frame LH.
3. Disconnect the connector (3).
4. Unscrew the fender mounting screws and remove the fender assembly (both RH and LH fender).

(When reassembling)

- Be sure to fix the grip to original position.
- Be sure to fix the ground wire cable to original position.

- | | |
|-------------------------------------|--|
| (1) Range Shift Lever Grip : Orange | (4) Hydraulic Lever Grip : Black |
| (2) Cruise Lever Grip : Orange | (5) PTO Speed Change Lever Grip : Yellow |
| (3) Connector | |

W1015817

(4) Frame**Rear Frame and Under Frame**

1. Remove the rear cross bar (2).
2. Remove the rubber mount screw (9), connecting bar (5) and rear frame mounting flange screw (10) then detach the rear frame (4).
3. Remove the rubber mounting bolt (9) and nut (7), then detach the under frame (1), (3).

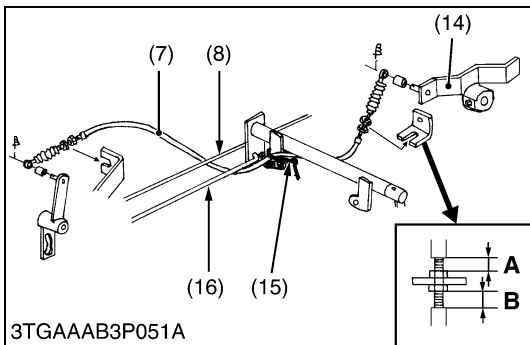
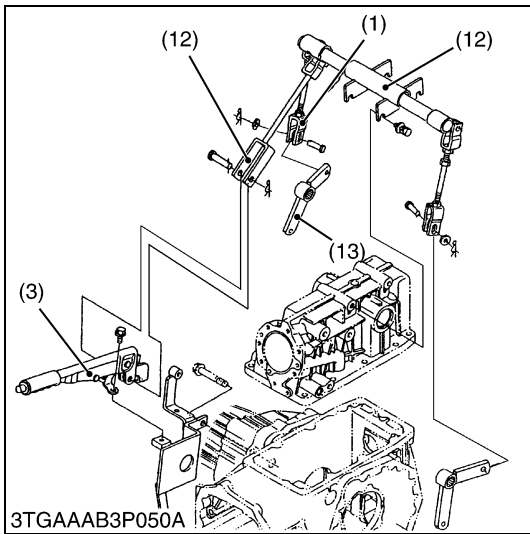
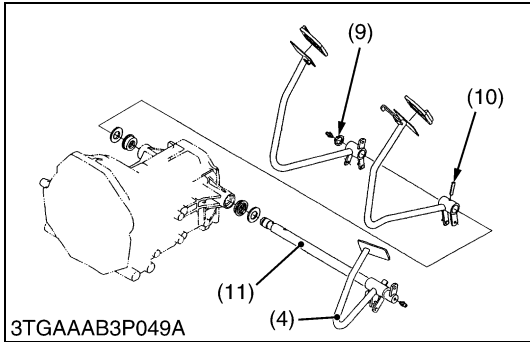
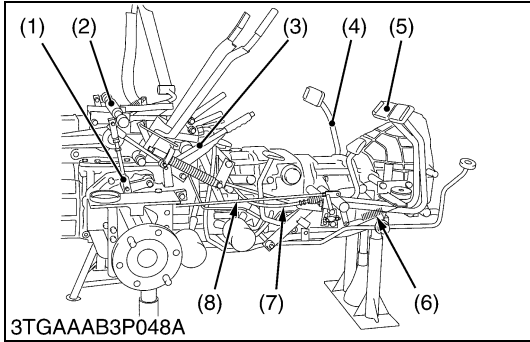
(When reassembling)

Tightening torque	Rear cross bar mounting screw	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
	Rubber mount screw and bolt	196.0 to 225.0 N·m 20.0 to 23.0 kgf·m 144.7 to 166.4 ft-lbs
	Connecting bar mounting screw	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft-lbs
	Rear frame mounting flange screw	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs

- | | |
|--------------------|-----------------------------------|
| (1) Under Frame RH | (6) Connecting Bar Mounting Screw |
| (2) Rear Cross Bar | (7) Rubber Mount Nut |
| (3) Under Frame LH | (8) Rubber Mount Bolt |
| (4) Rear Frame | (9) Rubber Mount Screw |
| (5) Connecting Bar | (10) Rear Frame Mounting Screw |

W1016102

(5) Linkage and Hydraulic Pipes



Clutch and Brake Linkage

1. Remove the brake springs (6), cruise release wire (7) and brake rod 1 (8).
2. Remove the clutch pedal spring and clutch rod.
3. Detach the external snap ring (9) and tap out the spring pin (10) from the brake shaft (11).
4. Remove the brake pedals and draw out the clutch pedal (4) with brake shaft (11).
5. Disconnect the parking brake rod (12) from parking brake lever (3).
6. Disconnect the brake rod 2 (1) from brake lever (13) and remove the parking brake shaft (2) assembly from the hydraulic cylinder block.
7. Remove the parking brake lever (3).

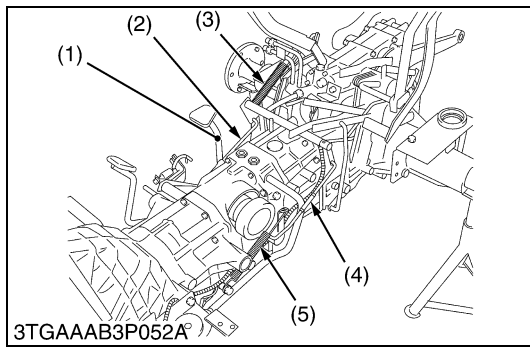
(When reassembling)

- Adjust the brake pedal free play with brake rod 1 (See page G-19).
- Adjust the parking brake free play after adjusted the brake free play.
 - Adjust the brake rod 2 (1) length so that the no free play at brake lever (13) and brake rod (2).
 - Operate the parking brake lever and lock the both RH and LH rear wheels with second notch of parking brake operate. Do not lock the rear wheels at first notch.
- The cruise release wire (7) of removal lever (14) side, set the center of thread to the holder and routing the cruise release wire with clamp (15) as shown in figure.
- Check the cruise release system to properly operation. If not, adjust the cruise release wire (See page 3-S16).
- Adjust the clutch pedal free play (See page 3-S8).

Clutch pedal free play	Factory spec.	20.0 to 30.0 mm 0.78 to 1.18 in.
Brake pedal free play	Factory spec.	25.0 to 30.0 mm 0.98 to 1.18 in.
Parking brake lever free play	Factory spec.	2 notches
Release wire set position	Factory spec.	A = B

- | | |
|-------------------------|--------------------------|
| (1) Brake Rod 2 | (9) External Snap Ring |
| (2) Parking Brake Shaft | (10) Spring Pin |
| (3) Parking Brake Lever | (11) Brake Shaft |
| (4) Clutch Pedal | (12) Parking Brake Shaft |
| (5) Brake Pedal | (13) Brake Lever |
| (6) Brake Spring | (14) Removal Lever |
| (7) Cruise Release Wire | (15) Clamp |
| (8) Brake Rod 1 | (16) HST Rod |

W1016756

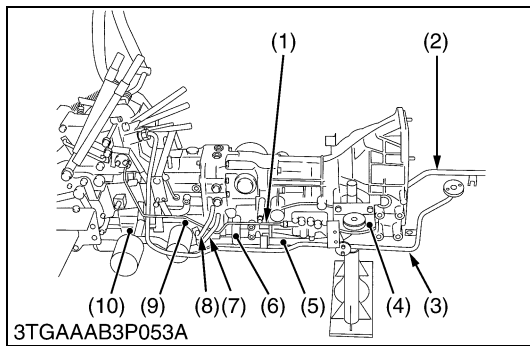


HST Linkage

1. Detach the return spring (5).
2. Remove the HST link rod (4).
3. Remove the HST pedal rod (2) and speed control pedal (1).
4. Remove the HST damper (3).

- | | |
|-------------------------|-------------------|
| (1) Speed Control Pedal | (4) HST Link Rod |
| (2) HST Pedal Rod | (5) Return Spring |
| (3) HST Damper | |

W1017738



Hydraulic Pipes

1. Remove the HST drain pipe (2) from the HST unit.
2. Remove the front bracket RH (4).
3. Disconnect the HST inlet hose (6) from the HST unit and detach the inlet pipe (5).
4. Remove the charge pipes (7) and (8).
5. Remove the bi-speed valve delivery pipe (1) and delivery pipe (3).
6. Remove the HST filter bracket (9) and transmission oil filter bracket (10) with an each filter.

(When reassembling)

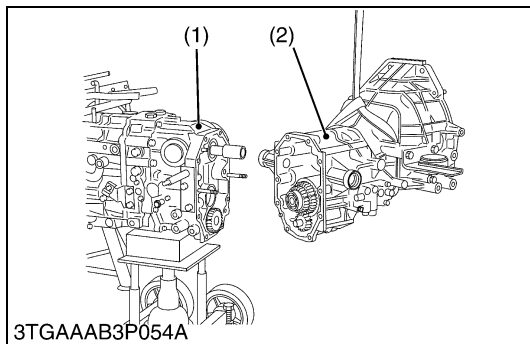
- Be sure to fix the O-ring for the charge pipes. They employ two O-rings to each connecting port.

Tightening torque	Bi-speed valve delivery pipe retaining nut	34.0 to 39.0 N-m 3.5 to 4.0 kgf-m 25.3 to 28.9 ft-lbs
	Delivery pipe retaining nut	88.2 to 117.6 N-m 9.0 to 12.0 kgf-m 65.1 to 86.8 ft-lbs

- | | |
|----------------------------------|--|
| (1) Bi-speed Valve Delivery Pipe | (6) HST Inlet Pipe |
| (2) HST Drain Pipe | (7) Charge Pipe |
| (3) Delivery Pipe | (8) Charge Pipe |
| (4) Front Bracket RH | (9) Filter Bracket (HST) |
| (5) Inlet Pipe | (10) Filter Bracket (Transmission Oil) |

W1017963

(6) Clutch Housing Case



Separating Clutch Housing Case from Hydrostatic Transmission (HST)

1. Separate clutch housing case (2) and hydrostatic transmission (1).

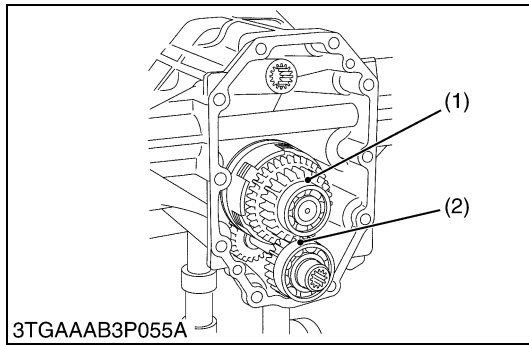
(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the HST and clutch housing case.

Tightening torque	Clutch housing mounting screw and nut	39.3 to 44.1 N-m 4.0 to 4.5 kgf-m 29.0 to 32.5 ft-lbs
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- | | |
|------------------------------------|-------------------------|
| (1) Hydrostatic Transmission (HST) | (2) Clutch Housing Case |
|------------------------------------|-------------------------|

W1018233



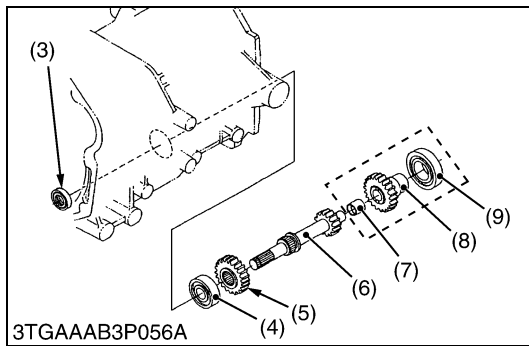
18T Gear Shaft

1. Take out the bi-speed turn hydraulic clutch assembly (1) with 18T gear shaft (2) from the clutch housing case.

(When reassembling)

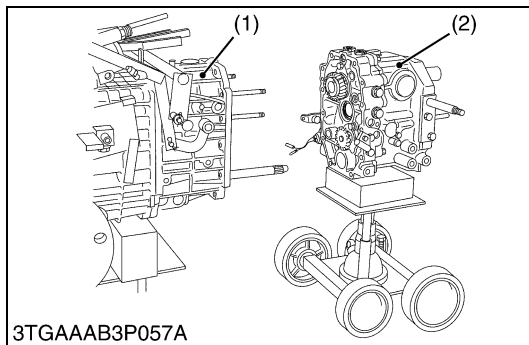
- Apply grease to the oil seal (3) of the clutch housing.

- | | |
|---|--------------------|
| (1) Bi-speed Turn Hydraulic Clutch Assembly | (5) 22T Gear |
| (2) 18T Gear Shaft | (6) 18T Gear Shaft |
| (3) Oil Seal | (7) Bushing |
| (4) Ball Bearing | (8) 19T Gear |
| | (9) Ball Bearing |



W1018377

(7) Hydrostatic Transmission (HST)



Separating Hydrostatic Transmission (HST) from Transmission Case

1. Separate hydrostatic transmission (2) and transmission case (1).

(When reassembling)

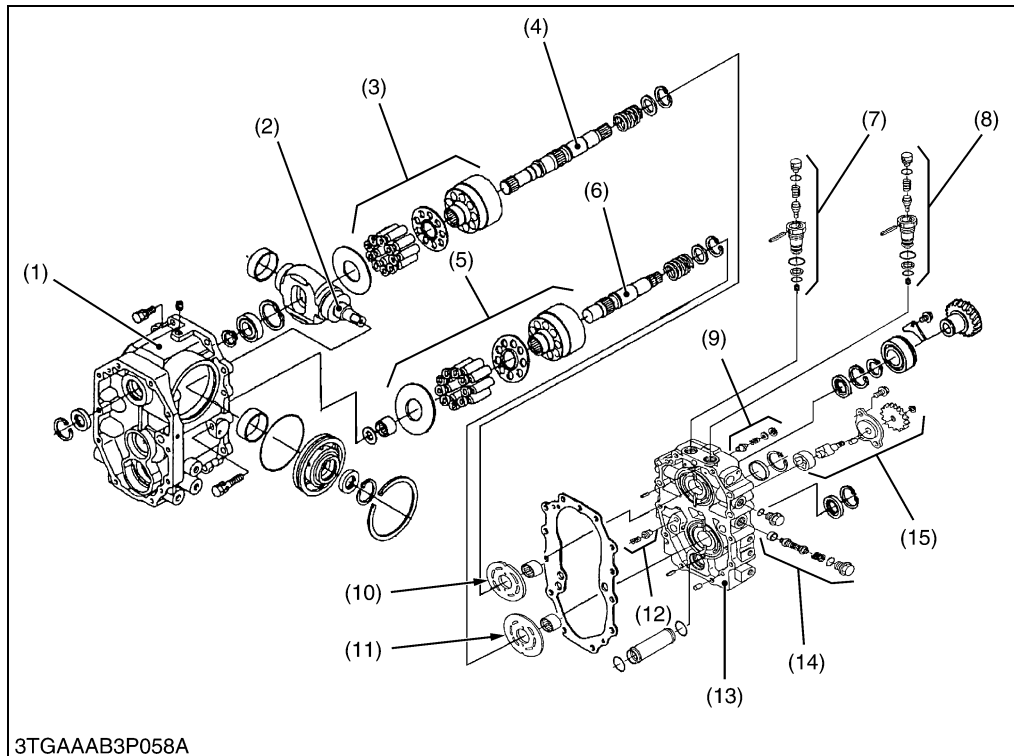
- Apply liquid gasket (Three Bod 1208D or equivalent) to joint face of the HST and transmission case.

Tightening torque	HST mounting screw and nut	39.3 to 44.1 N·m 4.0 to 4.5 kgf·m 29.0 to 32.5 ft-lbs
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(1) Transmission Case

(2) Hydrostatic Transmission (HST)

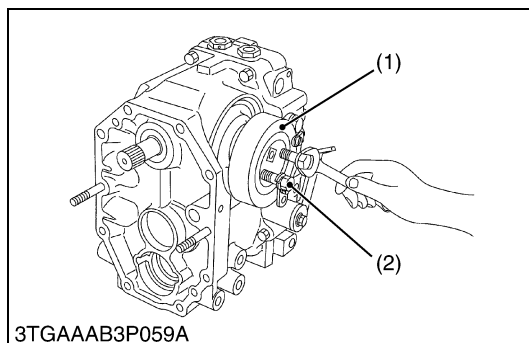
W1018767

Hydrostatic Transmission (HST)

- (1) Case
- (2) Trunnion Shaft
- (3) Variable Displacement Piston Pump
- (4) Input Shaft
- (5) Fixed Displacement Piston Motor
- (6) Output Shaft
- (7) Neutral Valve (Reverse)
- (8) Neutral Valve (Forward)
- (9) Case Relief Valve
- (10) Valve Plate (Pump)
- (11) Valve Plate (Motor)
- (12) Charge Relief Valve
- (13) Port Block
- (14) Check and High Pressure Relief Valve (Forward)
- (15) Charge Pump

W1018886

3TGAAAB3P058A

**Trunnion Wheel**

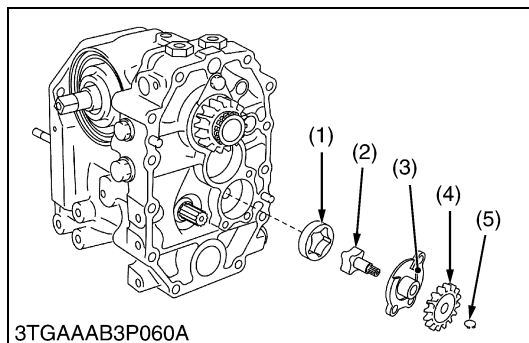
1. Remove the trunnion wheel mounting screw.
2. Remove the trunnion wheel using a screw (M12 × Pitch 1.25 mm)

(1) Trunnion Wheel

(2) Screw (M12 × Pitch 1.25 mm)

W1019245

3TGAAAB3P059A

**Charge Pump**

1. Remove the 16T charge gear (4) after removing the external snap ring (5).
2. Remove the charge pump mounting screws and take out the charge pump cover (3), inner rotor (2) and outer rotor (1).

(When reassembling)

- Be sure to turn the inner rotor by hand.

(1) Outer Rotor

(4) 16T Charge Gear

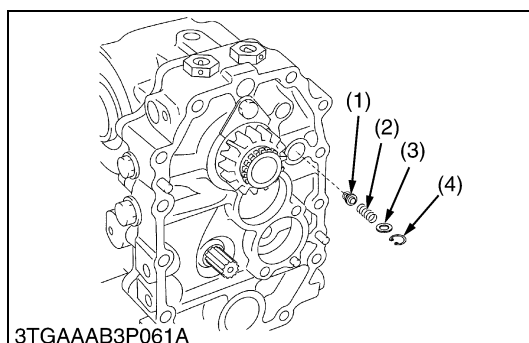
(2) Inner Rotor

(5) External Snap Ring

(3) Charge Pump Cover

W1019341

3TGAAAB3P060A

**Case Relief Valve**

1. Remove the washer (3), spring (2) and poppet (1) after removing the internal snap ring (4).

(When reassembling)

- Apply transmission oil to the poppet (1) before reassembling.

(1) Poppet

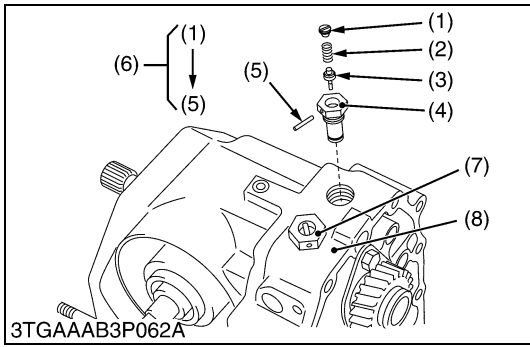
(3) Washer

(2) Spring

(4) Internal Snap Ring

W1019481

3TGAAAB3P061A



Neutral Valve

1. Remove the neutral valve assembly (6), (7) from the port block (8).
2. Take out the spring holder (1), spring (2) and poppet N (3) after tapping out the spring pin (5).

(When reassembling)

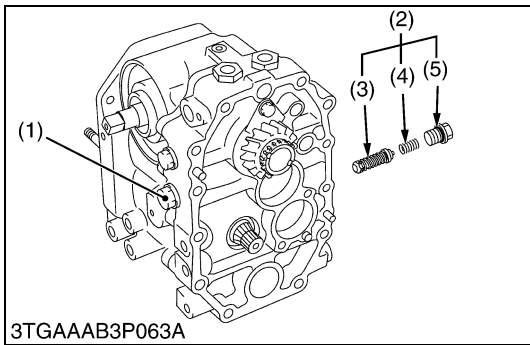
- Apply transmission oil to the O-rings.

NOTE

- **Neutral valves for forward and reverse are not interchangeable.**
- **It is indicated “F” on top of forward neutral valve and “R” for reverse neutral valve.**

- | | |
|-------------------|--------------------------------------|
| (1) Spring Holder | (5) Spring Pin |
| (2) Spring | (6) Neutral Valve Assembly (Reverse) |
| (3) Poppet N | (7) Neutral Valve Assembly (Forward) |
| (4) Valve Body | (8) Port Block |

W1019616



Check and High-Pressure Relief Valve

1. Take out the check spring (4) and the relief valve assembly (3) after removing the plug (5).

(When reassembling)

- Apply transmission oil to the O-rings and relief valve assembly (3).

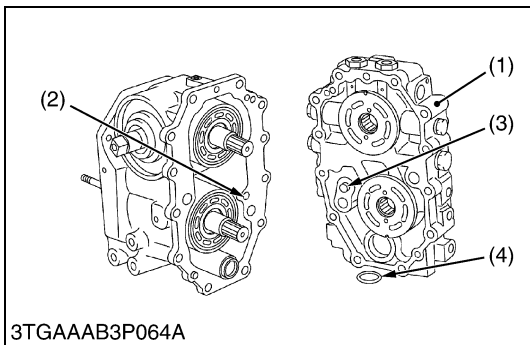
Tightening torque	Check and high-pressure relief valve plug	58.8 to 68.6 N·m 6.0 to 7.0 kgf·m 43.4 to 50.6 ft-lbs
-------------------	---	---

NOTE

- **It is impossible to disassemble relief valve assembly.**
- **The check and high-pressure relief valve for forward and for reverse are interchangeable.**

- | | |
|--|---------------------------|
| (1) Check and High-Pressure Relief Valve for Forward | (3) Relief Valve Assembly |
| (2) Check and High-Pressure Relief Valve for Reverse | (4) Check Spring |
| | (5) Plug |

W1019931



Port Block and Charge Relief Valve

1. Separate the port block (1) after removing the mounting screws.
2. Remove the spring (2) and poppet L (3).

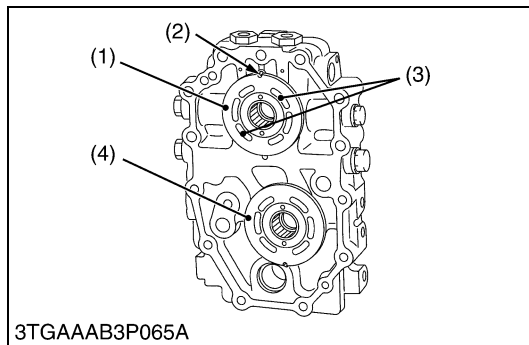
(When reassembling)

- Tighten the port block (1) mounting screws diagonally.
- Be sure to fix the O-ring (4).
- Apply transmission oil to the O-ring and poppet L.

Tightening torque	Port block mounting screw	39.3 to 44.1 N·m 4.0 to 4.5 kgf·m 29.0 to 32.5 ft-lbs
-------------------	---------------------------	---

- | | |
|----------------|--------------|
| (1) Port Block | (3) Poppet L |
| (2) Spring | (4) O-ring |

W1020103



Valve Plates for Pump and Motor

1. Remove the valve plates (1), (4).

(When reassembling)

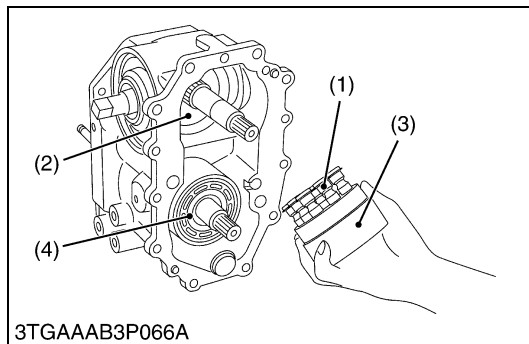
- Set the groove (2) of valve plates to spring pins firmly.

■ IMPORTANT

- **Valve plates (1), (4) are not interchangeable. Valve plate (1) of pump has two fish tails (3) and the valve plate (4) of motor has not it.**

- | | |
|--------------------------|---------------------------|
| (1) Valve Plate for Pump | (3) Fish Tail |
| (2) Groove | (4) Valve Plate for Motor |

W1020284



Cylinder Block

1. Pull out the cylinder block (3) with piston (1) as a unit.

■ IMPORTANT

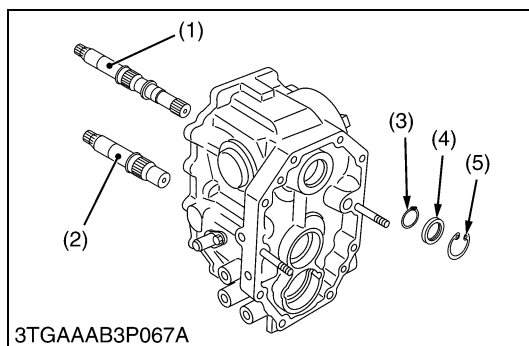
- **Make alignment mark on the piston and cylinder when removing the piston from cylinder block.**

(When reassembling)

- Apply transmission oil to the thrust plate (2) and pistons.
- Be sure to align the marks when assembling pistons to the cylinder block.

- | | |
|------------------|----------------------------|
| (1) Piston | (3) Cylinder Block (Pump) |
| (2) Thrust Plate | (4) Cylinder Block (Motor) |

W1020486



Pump Shaft and Motor Shaft

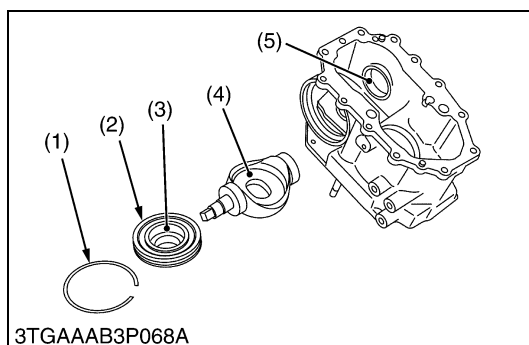
1. Remove the internal snap ring (5) then detach the oil seal (4).
2. Remove the external snap ring (3) and draw out the pump shaft (1).
3. Draw out the motor shaft (2).

(When reassembling)

- Replace oil seal with new one.
- Apply transmission oil to the oil seal.

- | | |
|------------------------|------------------------|
| (1) Pump Shaft | (4) Oil Seal |
| (2) Motor Shaft | (5) Internal Snap Ring |
| (3) External Snap Ring | |

W1020630



Trunnion

1. Remove the internal snap ring (1) then tap out the trunnion (4) lightly with cover (2).

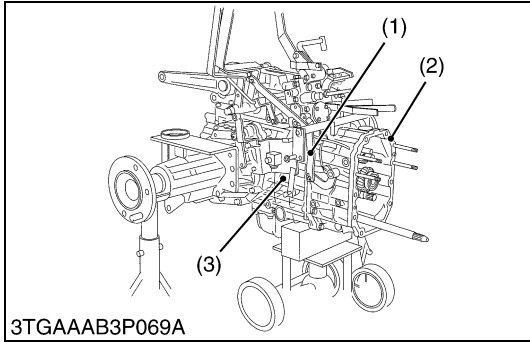
(When reassembling)

- Apply transmission oil to the O-rings and apply grease to the bushing (3) and (5).
- Assemble the cover (2) with direction of bush hole is port block side.

- | | |
|------------------------|--------------|
| (1) Internal Snap Ring | (4) Trunnion |
| (2) Cover | (5) Bushing |
| (3) Bushing | |

W1020781

(8) Transmission Case



3TGAAAB3P069A

Separating Transmission Case

1. Remove the PTO link (1).
2. Separate the transmission case (2) and differential gear case (3).

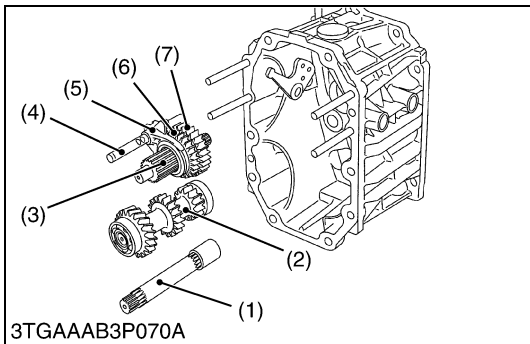
(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of transmission case and differential gear case.

Tightening torque	Transmission case mounting screw and nut	39.3 to 44.1 N·m 4.0 to 4.5 kgf·m 29.0 to 32.5 ft-lbs
-------------------	--	---

- (1) PTO Link
(2) Transmission Case
(3) Differential Gear Case

W1021038



3TGAAAB3P070A

Main Shaft and PTO Counter Shaft

1. Remove the external snap ring (9) and collar (8).
2. Tap out the PTO counter shaft (3), PTO shift fork (5) and fork rod (4) as a unit.
3. Take out the main shaft (2).

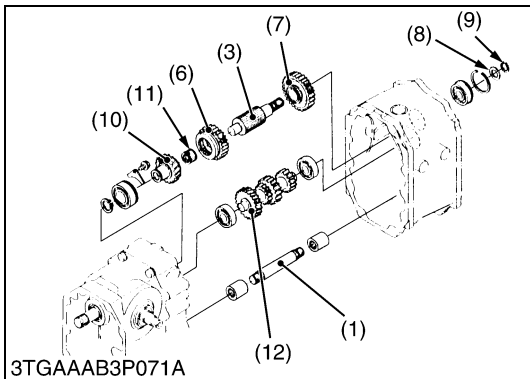
(When reassembling)

- Be sure to assemble the spring pin (12) as shown in figure.
- Apply transmission oil to the needle bearing (11).

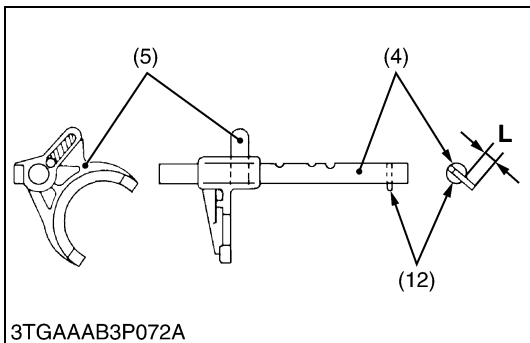
- (1) Front Counter Shaft
(2) Main Shaft
(3) PTO Counter Shaft
(4) Fork Rod
(5) PTO Shift Fork
(6) 24T Gear
(7) 27T Gear
(8) Collar
(9) External Snap Ring
(10) 18T Input Shaft
(11) Needle Bearing
(12) Spring Pin

L : 5.0 to 6.0 mm (0.197 to 0.236 in.)

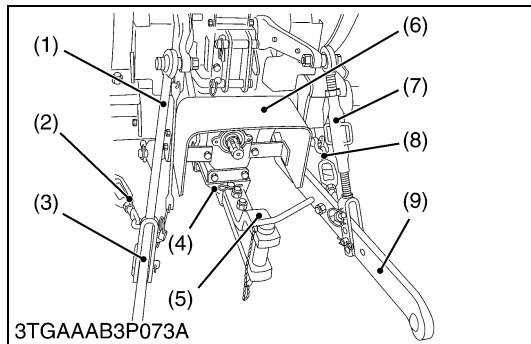
W1021369



3TGAAAB3P071A



3TGAAAB3P072A

(9) Rear PTO**3 Point Linkage and Drawbar**

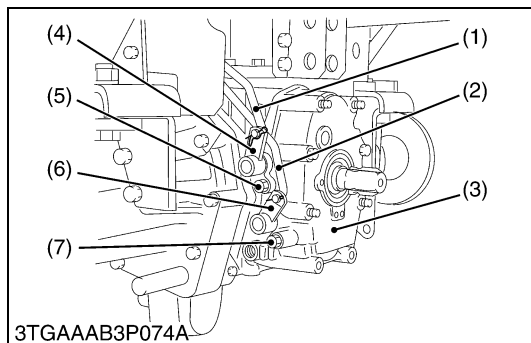
1. Remove the both lift rod (1) and (7).
2. Remove the split pin and disconnect the check chain (2) and (8).
3. Remove the lower link (3) and (9) with check chain.
4. Remove the PTO cover (6).
5. Detach the drawbar (5) and then remove the drawbar bracket (4).

(When reassembling)

Tightening torque	Drawbar bracket mounting screw (M14)	108.0 to 125.0 N·m 11.0 to 12.8 kgf·m 79.6 to 92.6 ft-lbs
-------------------	--------------------------------------	---

- | | |
|---------------------|--------------------|
| (1) Lift Rod LH | (6) PTO Cover |
| (2) Check Chain LH | (7) Lift Rod RH |
| (3) Lower Link LH | (8) Check Chain RH |
| (4) Drawbar Bracket | (9) Lower Link RH |
| (5) Drawbar | |

W1021680

**Rear PTO Case**

1. Disconnect the rear PTO rod (1) and mid-PTO rod (2) from the rear PTO lever (4) and mid-PTO lever (6).
2. Unscrew the detent plug screw (5) and (7).
3. Remove the rear PTO case (3).

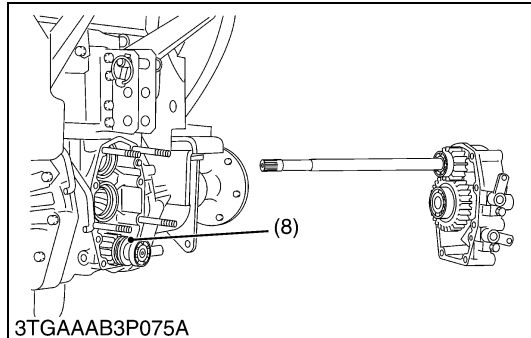
(When reassembling)

- Be sure to fix the shifter pin of mid-PTO arm to the mid-PTO shift coupler (8).
- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the differential gear case and rear PTO case.

Tightening torque	Detent plug screw	19.6 to 24.5 N·m 2.0 to 2.5 kgf·m 14.5 to 18.1 ft-lbs
	Rear PTO case mounting screw and nut	39.3 to 44.1 N·m 4.0 to 4.5 kgf·m 29.0 to 32.5 ft-lbs

- | | |
|--------------------|---------------------------|
| (1) Rear PTO Rod | (5) Detent Plug Screw |
| (2) Mid-PTO Rod | (6) Mid-PTO Lever |
| (3) Rear PTO Case | (7) Detent Plug Screw |
| (4) Rear PTO Lever | (8) Mid-PTO Shift Coupler |

W1022107

**PTO Drive Shaft and PTO Shaft**

1. Pull out the PTO drive shaft (1).
2. Tap out the PTO shaft (8).
3. Take out the shifter arm (6), (7).

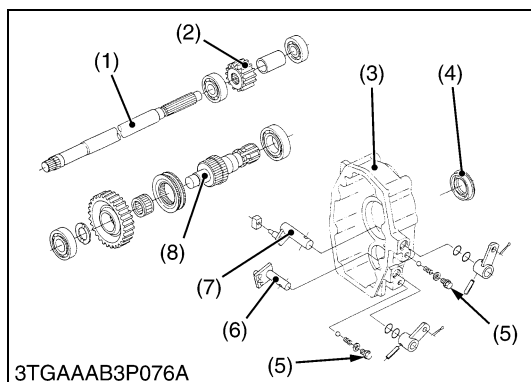
(When reassembling)

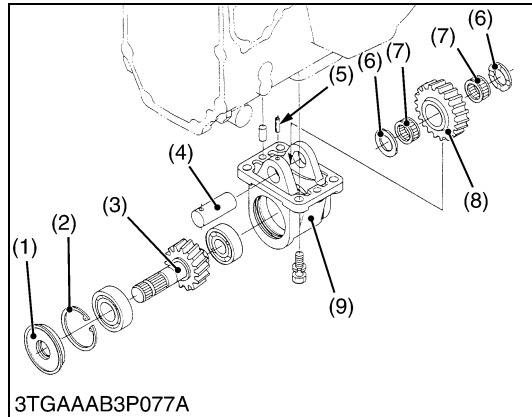
- Apply grease to the oil seal (4).

Tightening torque	Detent plug screw	19.6 to 24.5 N·m 2.0 to 2.5 kgf·m 14.5 to 18.1 ft-lbs
-------------------	-------------------	---

- | | |
|---------------------|--------------------------|
| (1) PTO Drive Shaft | (5) Detent Plug Screw |
| (2) 15T Gear | (6) Mid-PTO Shifter Arm |
| (3) Rear PTO Case | (7) Rear PTO Shifter Arm |
| (4) Oil Seal | (8) PTO Shaft |

W1022388



(10) Mid-PTO Gear Case**Mid-PTO Case and Shaft**

1. Remove the mid-PTO case (9) from differential gear case.
2. Remove the oil seal (1) and internal snap ring (2).
3. Pull out the mid-PTO shaft (3).
4. Tap in the spring pin (5) to idle shaft (4), and pull out the idle shaft (4).

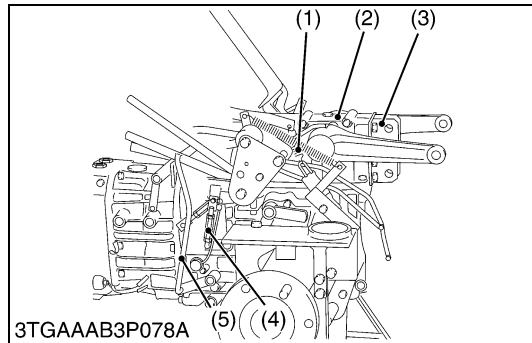
(When reassembling)

- Direct the grooved sides of the thrust collars to the needle bearing side.
- Apply grease to the oil seal (1).
- Apply liquid gasket (Three Bod 1208D or equivalent) to the joint face of mid-PTO case and differential gear case.

Tightening torque	Mid-PTO case mounting screw	29.4 to 34.3 N·m
		3.0 to 3.5 kgf·m
		21.7 to 25.3 ft-lbs

- | | |
|------------------------|--------------------|
| (1) Oil Seal | (6) Thrust Collar |
| (2) Internal Snap Ring | (7) Needle Bearing |
| (3) Mid-PTO Shaft | (8) 23T Gear |
| (4) Idle Shaft | (9) Mid-PTO Case |
| (5) Spring Pin | |

W1022598

(11) Differential Gear Case**Separating Hydraulic Cylinder**

1. Remove the position lever stay with position lever and PTO speed charge lever as a unit.
2. Remove the top link bracket (3).
3. Remove the front drive rod (5) and differential lock rod (4).
4. Remove the cruise spring (1).
5. Separate the hydraulic cylinder.

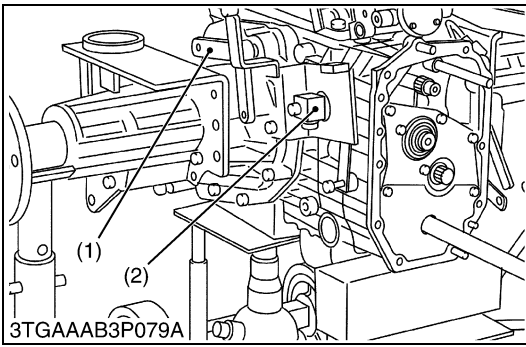
(When reassembling)

- Adjust the cruise tension (See page 3-S9).
- Be sure to fix the differential lock pedal and groove of differential fork rod.
- Apply liquid gasket (Three Bond 1208D or equivalent) to the joint face of hydraulic cylinder and differential gear case.

Tightening torque	Top link bracket mounting screw	39.3 to 44.1 N·m 4.0 to 4.5 kgf·m 29.0 to 32.5 ft-lbs
	Hydraulic cylinder mounting screw	39.3 to 44.1 N·m 4.0 to 4.5 kgf·m 29.0 to 32.5 ft-lbs

- | | |
|------------------------|---------------------------|
| (1) Cruise Spring | (4) Differential Lock Rod |
| (2) Hydraulic Cylinder | (5) Front Drive Rod |
| (3) Top Link Bracket | |

W1023086



Separating Rear Axle

1. Remove the brake lever (1) and hydraulic block (2).
2. Unscrew the lower link pin mounting screw (5) and draw out the lower link pin (4).
3. Separate the rear axle case (3).

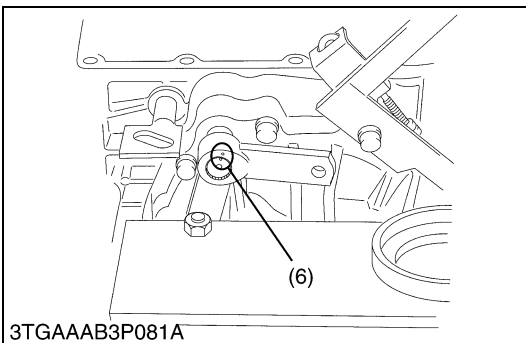
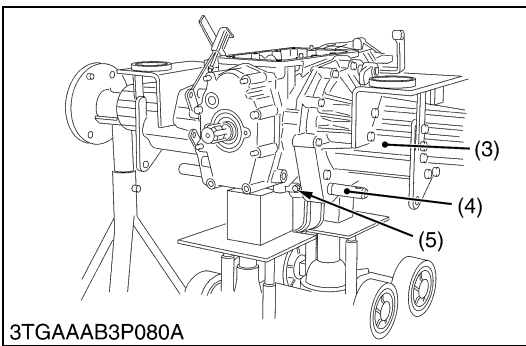
(When reassembling)

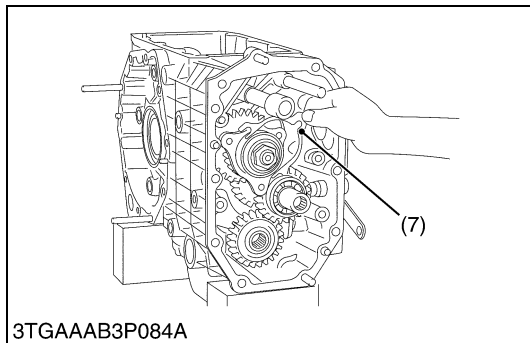
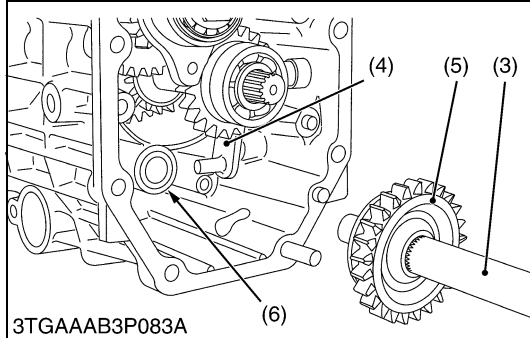
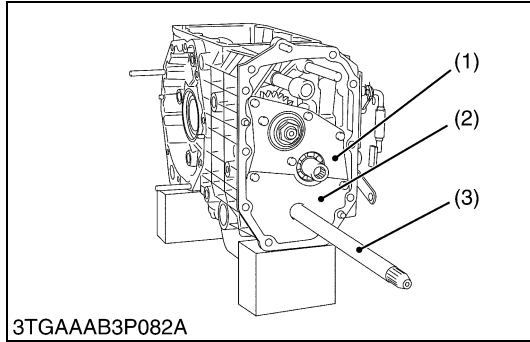
- Apply seal tape to the thread portion of the hydraulic block.
- Tighten the hydraulic block so that the block comes horizontally.
- Align the punch marks (6) as shown in figure.
- Apply liquid gasket (Three Bond 1208D or equivalent) to the joint face of rear axle and differential gear case.
- Assembling for brake discs and plate, see page 5-S4.

Tightening torque	Rear axle case mounting screw	39.3 to 44.1 N·m 4.0 to 4.5 kgf·m 29.0 to 32.5 ft·lbs
-------------------	-------------------------------	---

- | | |
|---------------------|-----------------------------------|
| (1) Brake Lever | (4) Lower Link Pin |
| (2) Hydraulic Block | (5) Lower Link Pin Mounting Screw |
| (3) Rear Axle Case | (6) Punch Mark |

W1023320



(12) Differential Gear Case**Front Drive Shaft**

1. Remove the air cover (2) and mid cover (1).
2. Draw out the front drive shaft (3) with 24T gear (5).

(When reassembling)

- Toward the manufacturer's stamp make of needle bearing (6) for forward.
- Be sure to fix the groove of 24T gear and front drive shift arm (4).
- Be sure to fix the shim (7), check the backlash and tooth contact. (See page 3-S32.)

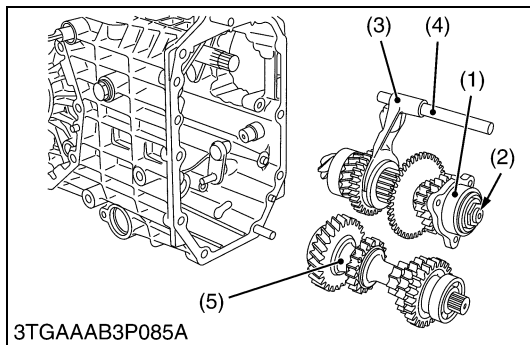
(Reference)

- Thickness of shim

0.4 mm (0.016 in.)	0.7 mm (0.028 in.)	1.0 mm (0.039 in.)
0.5 mm (0.020 in.)	0.8 mm (0.031 in.)	1.2 mm (0.047 in.)
0.6 mm (0.024 in.)	0.9 mm (0.035 in.)	1.4 mm (0.055 in.)

- | | |
|-----------------------|--------------------|
| (1) Mid Cover | (5) 24T Gear |
| (2) Air Cover | (6) Needle Bearing |
| (3) Front Drive Shaft | (7) Shim |
| (4) Shift Arm | |

W1023713



Hypoid Pinion, Rear Counter Shaft and Auxiliary Shift Fork

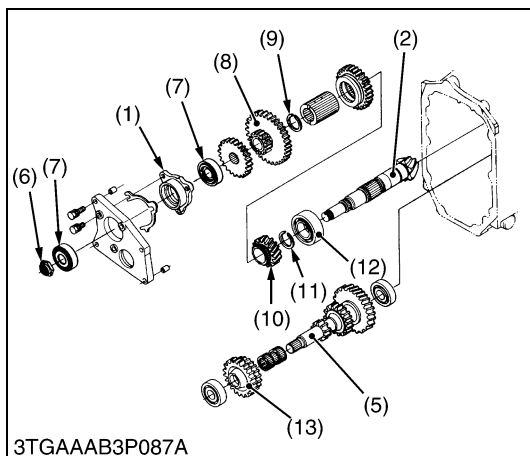
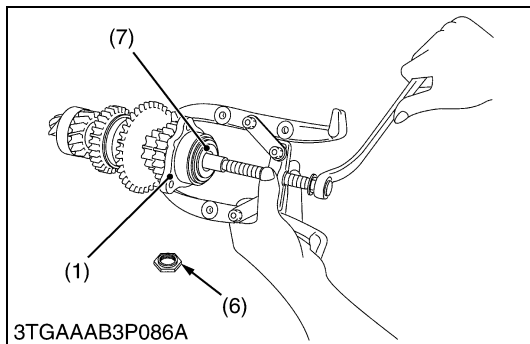
1. Take out the hypoid pinion (2), rear counter shaft (5) and auxiliary shift fork (3) as an assembly.
2. Remove the stake of the lock nut (6) and take out it.
3. Remove the bearing holder (1) and bearing (7) from hypoid pinion as a unit.
4. Take out the gears.

(When reassembling)

- Apply molybdenum disulfide (Three Bond 1901 or equivalent) to the 29T gear (8) and 13T gear (10).
- Assemble the roller bearing (12) with applying the oil for inner race.
- Install the external snap rings (9), (11) with them direction of sharp edge faces are HST side.
- Assemble the shift fork (3), noting the direction. Refer to the figure left.

■ IMPORTANT

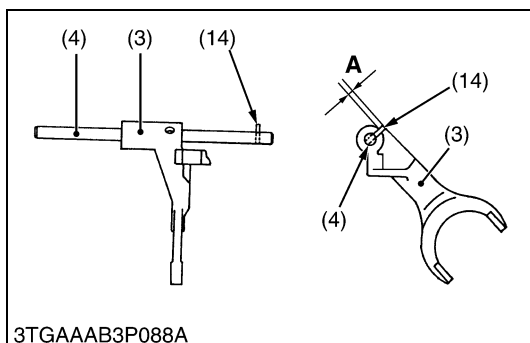
- Adjust the hypoid pinion motive torque by the tightening torque of lock nut (6). Refer to **SERVICING**.
- Adjust the backlash and tooth contact of hypoid gears. Refer to **SERVICING**.



- | | |
|----------------------------------|-------------------------|
| (1) Bearing Holder | (9) External Snap Ring |
| (2) Hypoid Pinion | (10) 13T Gear |
| (3) Shift Fork (Auxiliary Shift) | (11) External Snap Ring |
| (4) Fork Rod | (12) Roller Bearing |
| (5) Counter Shaft | (13) 19-22T Gear |
| (6) Lock Nut | (14) Spring Pin |
| (7) Taper Roller Bearing | |
| (8) 29T Gear | |

A : 5 to 6 mm (0.19 to 0.24 in.)

W1024379



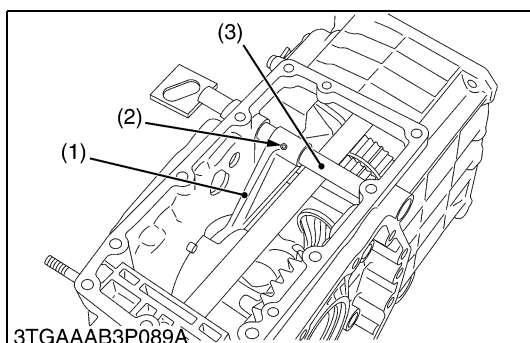
Differential Lock Shift Fork

1. Tap out the spring pin (2).
2. Set the shift fork (1) at differential lock positions.
3. Pull out the shift fork (1) and remove the fork rod (3).

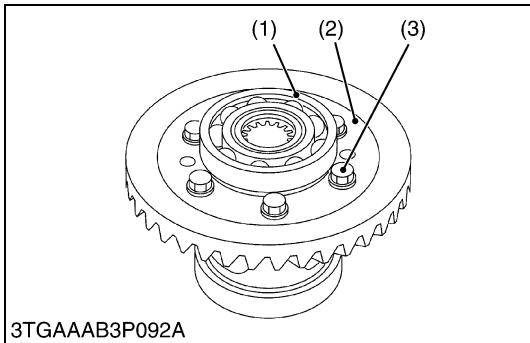
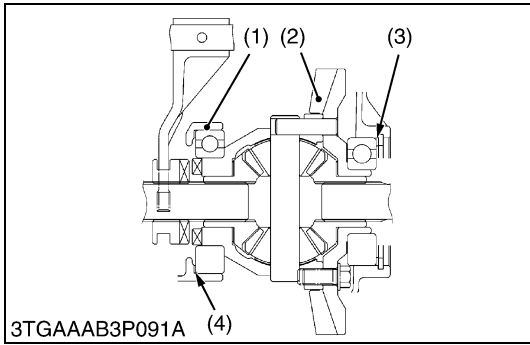
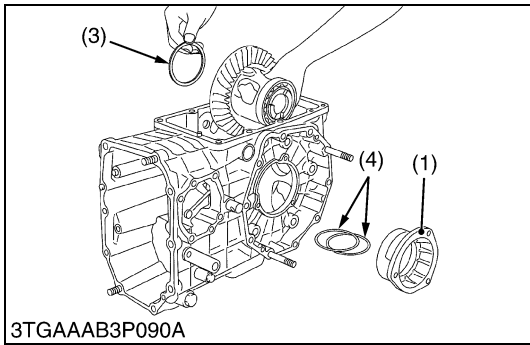
(When reassembling)

- Apply the grease to the oil seals of the shift fork rod (3).

- | | |
|----------------|--------------------|
| (1) Shift Fork | (3) Shift Fork Rod |
| (2) Spring Pin | |



W1025066



Differential Gear Assembly

1. Remove the differential bearing holder (1), noting the number of shims (4).
2. Take out the differential gear as an assembly and the collar (3).

(When reassembling)

- Install correct shims and collar.

Tightening torque	Ring gear mounting UBS screws	60.8 to 70.6 N·m 6.2 to 7.2 kgf·m 44.8 to 52.1 ft-lbs
-------------------	-------------------------------	---

■ IMPORTANT

- **Adjust the backlash and the tooth contact after assembling the differential gear assembly. Refer to SERVICING.**

(Reference)

- Increase the collar (3) thickness until to get backlash between hypoid pinion and hypoid ring gear (2). After that adjust the correct backlash with the shim (4) and the collar (3).
- Thickness of shims :

0.4 mm (0.016 in.)	0.9 mm (0.035 in.)
0.5 mm (0.020 in.)	1.0 mm (0.039 in.)
0.6 mm (0.024 in.)	1.2 mm (0.047 in.)
0.7 mm (0.028 in.)	1.4 mm (0.055 in.)
0.8 mm (0.031 in.)	
- Thickness of collars :

1.4 mm (0.055 in.)	1.7 mm (0.067 in.)
1.5 mm (0.059 in.)	1.8 mm (0.071 in.)
1.6 mm (0.063 in.)	1.9 mm (0.075 in.)

- | | |
|----------------------|------------|
| (1) Bearing Holder | (3) Collar |
| (2) Hypoid Ring Gear | (4) Shim |

W1025229

Ring Gear

1. Remove the bearing (1) with special use puller set.
2. Loosen and take out the UBS screws (3), then remove the ring gear (2).

■ NOTE

- **When loosening and tightening the UBS screws (3), use a hexagonal socket wrench to protect the screw heads from damage.**

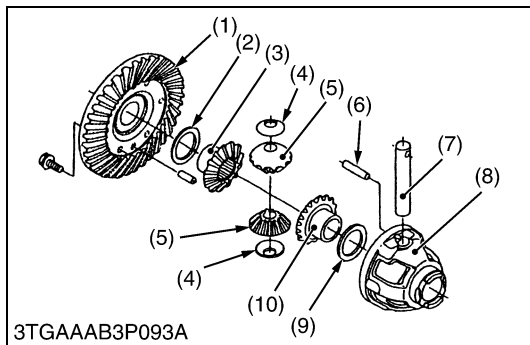
(When reassembling)

- Apply liquid lock (Three Bond 1372 or equivalent) to the UBS screws, and tighten diagonally them with correct tightening torque.

Tightening torque	Ring gear mounting UBS screws	60.8 to 70.6 N·m 6.2 to 7.2 kgf·m 44.8 to 52.1 ft-lbs
-------------------	-------------------------------	---

- | | |
|---------------|---------------|
| (1) Bearing | (3) UBS Screw |
| (2) Ring Gear | |

W1025678



Differential Pinion Shaft, Differential Pinion and Differential Side Gear

1. Take out the differential side gear (3) and shim (2).
2. Tap out the dowel pin (6).
3. Pull out the differential pinion shaft (7), then take out the differential pinions (5), pinion thrust collars (4), differential side gear (10) and shim (9).

■ NOTE

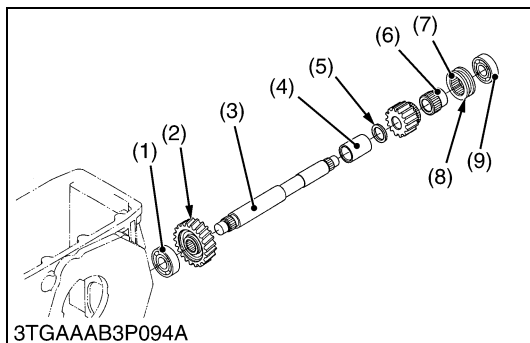
- Arrange the parts to know their original positions.

(When reassembling)

- Apply molybdenum disulfide (Three Bond 1901 or equivalent) to the inner circumferential surface of the differential side gears (3), (10) and differential pinions (5).
- Apply grease to the outer surface of the pinion thrust collars (4).

(1) Ring Gear	(6) Dowel Pin
(2) Shim	(7) Differential Pinion Shaft
(3) Differential Side Gear	(8) Differential Case
(4) Thrust Collar	(9) Shim
(5) Differential Pinion	(10) Differential Side Gear

W1025841



Mid-PTO Drive Shaft

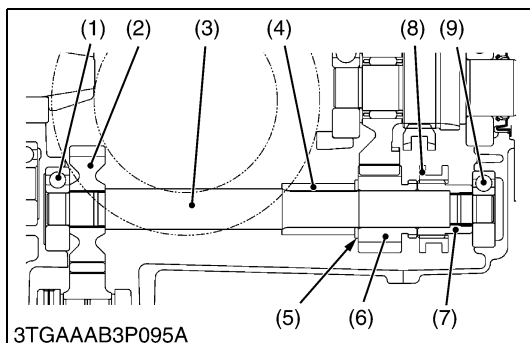
1. Pull out the mid-PTO as an assembly.
2. Take out the gears.

(When reassembling)

- Apply molybdenum difulfide (Three Bond 1901 or equivalent) to the 15T gear (6).

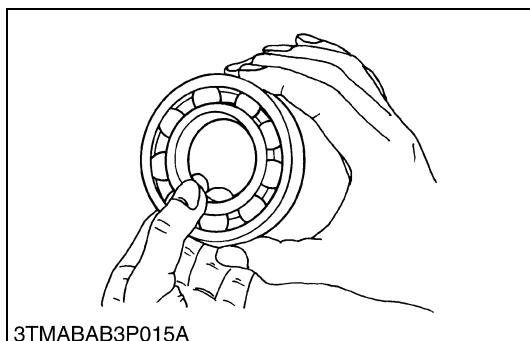
(1) Bearing	(6) 15T Gear
(2) 24T Gear	(7) Spline Boss
(3) Mid-PTO Drive Shaft	(8) Shifter
(4) Spacer	(9) Bearing
(5) Thrust Collar	

W1026252



[3] SERVICING

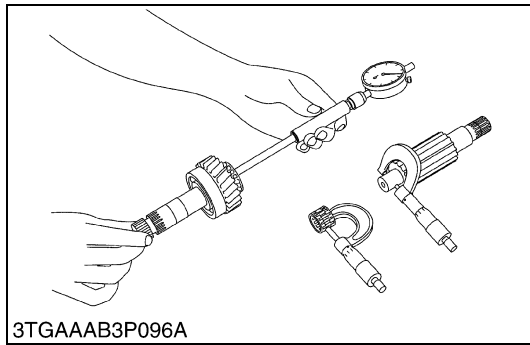
(1) Transmission Case



Checking Bearing

1. Hold the inner race, and push and pull the outer race in all directions to check for wear and roughness.
2. Apply transmission fluid to the bearing, and hold the inner race. Then, turn the outer race to check rotation.
3. If there is any defect, replace it.

W1026450



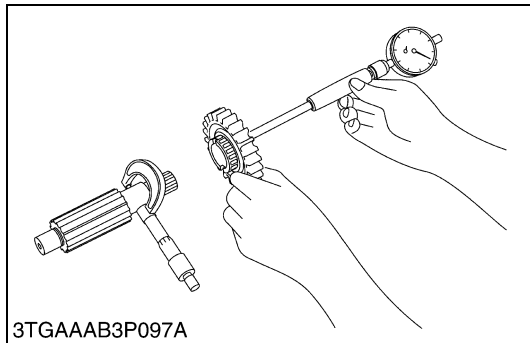
Clearance between 18T Input Shaft and PTO Counter Shaft

1. Measure the 18T input shaft I.D. and PTO counter shaft O.D..
2. Measure the O.D. of two needles installed diagonally in the needle bearing.
3. Calculate the clearance.
4. If the clearance exceeds the allowable limit, replace.

Clearance between 18T input shaft and PTO counter shaft	Factory spec.	0.016 to 0.064 mm 0.0006 to 0.0025 in.
	Allowable limit	0.1 mm 0.0039 in.

18T input shaft I.D.	Factory spec.	26.007 to 26.028 mm 1.0238 to 1.0247 in.
PTO counter shaft O.D.	Factory spec.	19.973 to 19.984 mm 0.7863 to 0.7868 in.
Needle O.D.	Factory spec.	2.994 to 3.000 mm 0.1179 to 0.1181 in.

W1026600



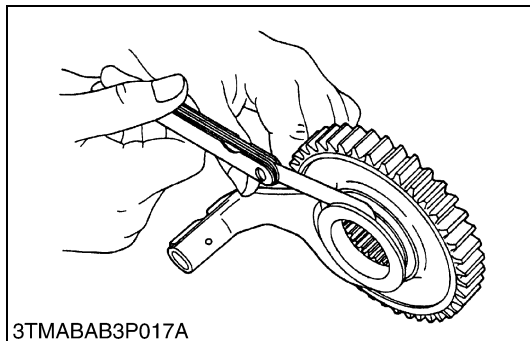
Clearance between 27T Gear and PTO Counter Shaft

1. Measure the 27T gear I.D. and PTO counter shaft O.D..
2. Calculate the clearance.
3. If the clearance exceeds the allowable limit, replace.

Clearance between 27T gear and PTO counter shaft	Factory spec.	0.020 to 0.054 mm 0.0008 to 0.0021 in.
	Allowable limit	0.1 mm 0.0039 in.

27T gear I.D.	Factory spec.	25.000 to 25.021 mm 0.9843 to 0.9851 in.
PTO counter shaft O.D.	Factory spec.	24.967 to 24.980 mm 0.9830 to 0.9835 in.

W1026848



Clearance between Shift Fork and Shifter Groove

1. Place for in the groove to check clearance with feeler gauge.
2. If the clearance exceeds allowable limit, replace.

Clearance between shift fork and shifter groove	Factory spec.	0.1 to 0.4 mm 0.004 to 0.016 in.
	Allowable limit	0.8 mm 0.031 in.

W1026997

(2) Differential Gear Case

Checking Bearings

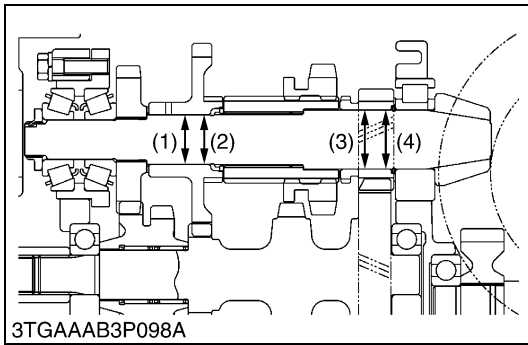
1. See page 3-S28.

W1027117

Clearance between Shift Fork and Shifter Groove

1. See above.

W1027163



Clearance between Hypoid Pinion Shaft and 29T Gear

1. Measure the 29T gear I.D. (1) and hypoid pinion O.D. (2).
2. Calculate the clearance.
3. If the clearance exceeds the allowable limit, replace.

Clearance between hypoid pinion shaft and 29T gear	Factory spec.	0.020 to 0.051 mm 0.0008 to 0.0020 in.
	Allowable limit	0.1 mm 0.0039 in.

29T gear I.D.	Factory spec.	25.000 to 25.018 mm 0.9843 to 0.9850 in.
Hypoid pinion shaft O.D.	Factory spec.	24.967 to 24.980 mm 0.9830 to 0.9835 in.

(1) 29T Gear I.D.

(2) Hypoid Pinion O.D.

W1027208

Clearance between Hypoid Pinion Shaft and 13T Gear

1. Measure the 13T gear I.D. (3) and hypoid pinion O.D. (4).
2. Calculate the clearance.
3. If the clearance exceeds the allowable limit, replace.

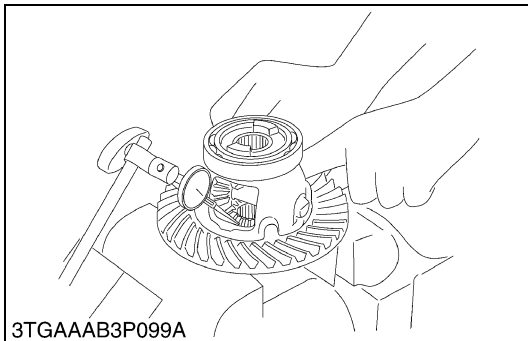
Clearance between hypoid pinion shaft and 13T gear	Factory spec.	0.020 to 0.051 mm 0.0008 to 0.0020 in.
	Allowable limit	0.1 mm 0.0039 in.

13T gear I.D.	Factory spec.	30.000 to 30.018 mm 1.1811 to 1.1818 in.
Hypoid pinion shaft O.D.	Factory spec.	29.967 to 29.980 mm 1.1798 to 1.1803 in.

(3) 13T Gear I.D.

(4) Hypoid Pinion O.D.

W1027432



Backlash between Differential Pinion and Differential Side Gear

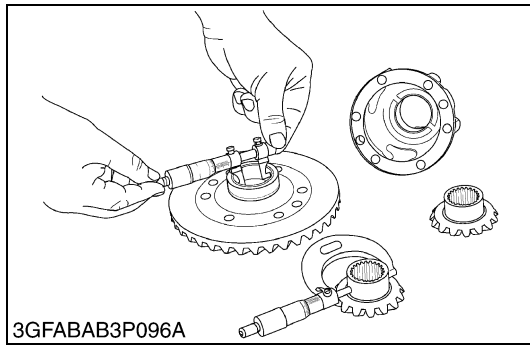
1. Set a dial indicator (lever type) on the tooth of differential pinion.
2. Hold the differential side gear and move the differential pinion to measure the backlash.
3. If the measurement exceeds the allowable limit, adjust with the differential side gear shim.

Backlash between differential pinion and differential side gear	Factory spec.	0.15 to 0.30 mm 0.0059 to 0.0118 in.
	Allowable limit	0.5 mm 0.020 in.

(Reference)

- Thickness of differential side gear shims :
0.8 mm (0.031 in.) 1.2 mm (0.047 in.)
1.0 mm (0.039 in.)

W1027630



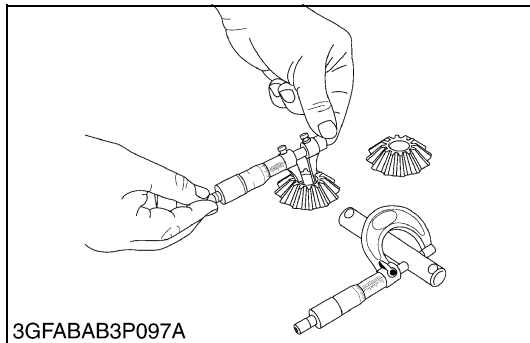
Clearance between Differential Case and Differential Side Gear

1. Measure the differential case I.D. and ring gear I.D. with an inside micrometer.
2. Measure the differential side gear boss O.D. with an outside micrometer and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace.

Clearance between differential case and differential side gear	Factory spec.	0.05 to 0.10 mm 0.0020 to 0.0039 in.
	Allowable limit	0.4 mm 0.016 in.

Differential case I.D. Ring gear I.D.	Factory spec.	32.000 to 32.025 mm 1.25984 to 1.26083 in.
Differential side gear boss O.D.	Factory spec.	31.925 to 31.950 mm 1.25689 to 1.25787 in.

W1027779



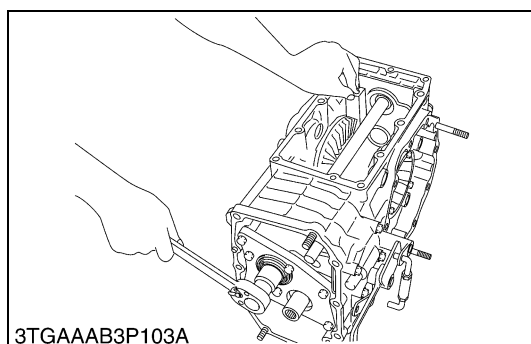
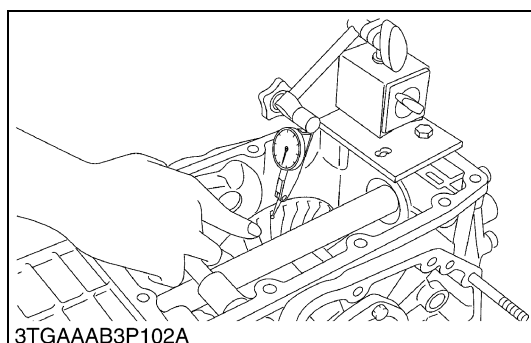
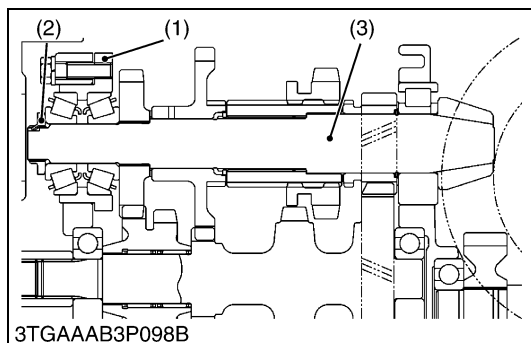
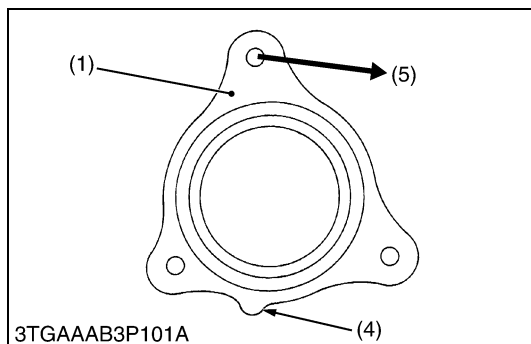
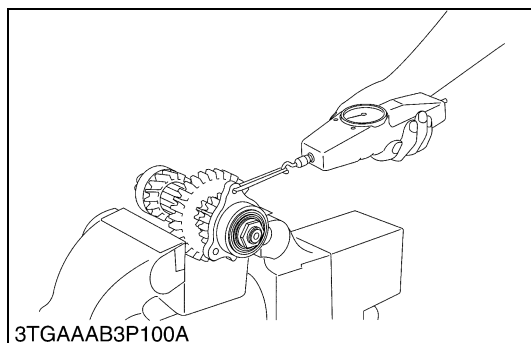
Clearance between Differential Pinion and Differential Pinion Shaft

1. Measure the differential pinion I.D. with an inside micrometer.
2. Measure the differential pinion shaft O.D. with an outside micrometer and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace.

Clearance between differential pinion and differential pinion shaft	Factory spec.	0.048 to 0.084 mm 0.00189 to 0.00331 in.
	Allowable limit	0.2 mm 0.008 in.

Differential pinion I.D.	Factory spec.	18.032 to 18.050 mm 0.70992 to 0.71063 in.
Differential pinion shaft O.D.	Factory spec.	17.966 to 17.984 mm 0.70732 to 0.70803 in.

W1027957



Adjusting of Hypoid Pinion Motive Force

1. Assemble the hypoid pinion assembly and tighten the lock nut (2) lightly with new one.
2. Rotate the hypoid pinion with applying the transmission oil to the bearings after tapping the hypoid pinion to front and rear direction by the soft hammer.
3. Tighten the lock nut (2) until the motive force (hypoid pinion start to rotate) of hypoid pinion to be factory specification.
4. Stake the lock nut (2) firmly.

Motive force	Factory spec.	10.9 to 16.7 N 1.1 to 1.7 kgf 2.5 to 3.7 lbs
Motive torque	Factory spec.	0.520 to 0.559 N·m 0.053 to 0.057 kgf·m 0.383 to 0.412 ft·lbs

- (1) Bearing Holder
(2) Lock Nut
(3) Hypoid Pinion
(4) Convex Part
(5) Pulling Direction

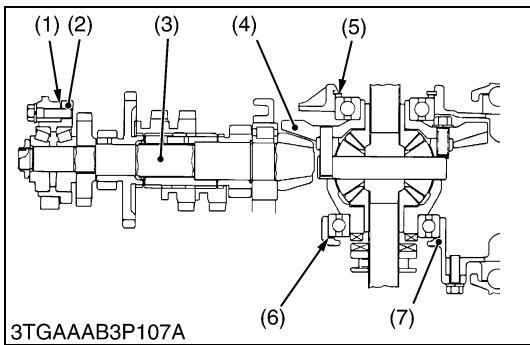
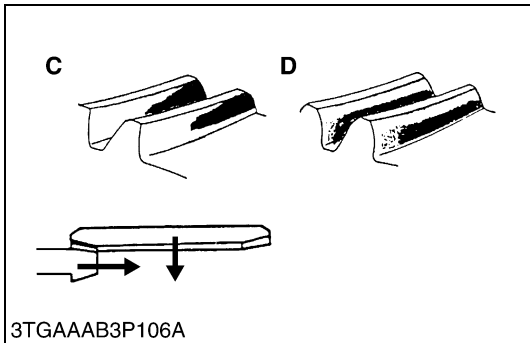
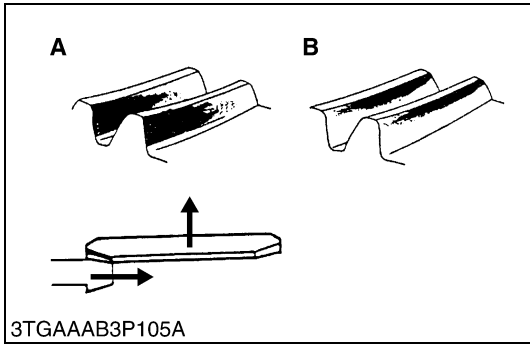
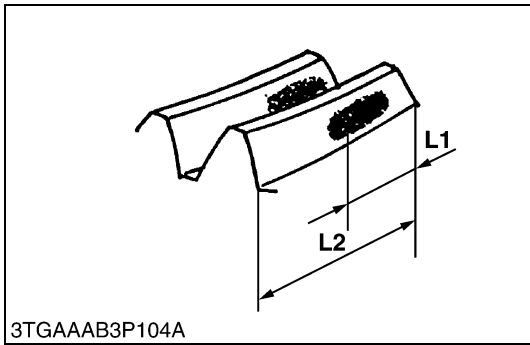
W1028110

Backlash and Tooth Contact between Hypoid Pinion and Hypoid Ring Gear

1. Set a dial gauge with its finger on the tooth surface of hypoid ring gear.
2. Measure the backlash by fixing the hypoid pinion and moving hypoid ring gear by hand.
3. If the backlash exceeds the factory specification, change the collar to chock it, and change the shims to thin it.
If the backlash is less than factory specification, change the collars and the shims as an opposite.
4. Apply red lead lightly over several teeth at three positions equally spaced on the hypoid ring gear.
5. Turn the hypoid pinion while pressing a wooden piece against the periphery of the bevel gear.
6. Check the tooth contact, if not proper, adjust according to the following instruction.

Backlash between hypoid pinion and hypoid ring gear	Factory spec.	0.20 to 0.30 mm 0.0078 to 0.0118 in.
Tooth contact	Factory spec.	More than 25 % red lead contact area on the gear tooth surface
The position of tooth contact point	Factory spec.	the center of tooth contact at 3/10 of the entire width from the small end

W1028399



Correcting of Tooth Contact

1. Proper contact.
 - No adjustment.

W1028600

2. Correcting of the heel contact and shallow contact.
 - Change the differential bearing holder collar (5) to thick it.
 - Change the bearing holder shim (1) to thick it.
 - Repeat above until the proper tooth contact and backlash are achieved.

W1028716

3. Correcting of the toe contact and deep contact.
 - Change the differential bearing holder shim (6) to thin it.
 - Change the differential bearing holder collar (5) to thick it.
 - Change the bearing holder shim (1) to thin it.
 - Repeat above until the proper tooth contact and backlash are achieved.

(Reference)

- Thickness of the shims (1), (6) :

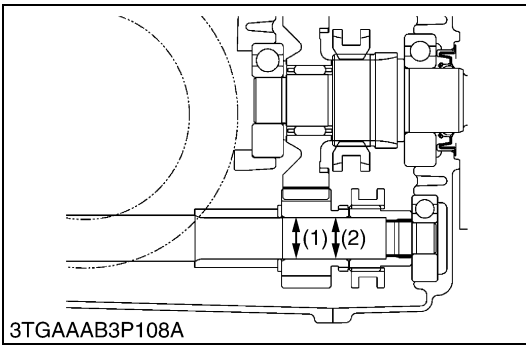
0.4 mm (0.016 in.)	0.9 mm (0.035 in.)
0.5 mm (0.020 in.)	1.0 mm (0.039 in.)
0.6 mm (0.024 in.)	1.2 mm (0.047 in.)
0.7 mm (0.028 in.)	1.4 mm (0.055 in.)
0.8 mm (0.031 in.)	
- Thickness of the collar (5) :

1.4 mm (0.055 in.)	1.7 mm (0.067 in.)
1.5 mm (0.059 in.)	1.8 mm (0.071 in.)
1.6 mm (0.063 in.)	1.9 mm (0.075 in.)

- (1) Shim
- (2) Bearing Holder
- (3) Hypoid Pinion
- (4) Hypoid Ring Gear
- (5) Collar
- (6) Shim
- (7) Differential Bearing Holder

- A : Heel Contact**
- B : Shallow Contact**
- C : Toe Contact**
- D : Deep Contact**
- L1 :3/10**
- L2 :Entire Width**

W1028812



Clearance between Mid-PTO Drive Shaft to 15T Gear

1. Measure the 15T gear I.D. (1) and mid-PTO drive shaft O.D. (2).
2. Calculate the clearance.
3. If the clearance exceeds the allowable limit, replace.

Clearance between mid-PTO drive shaft and 15T gear	Factory spec.	0.040 to 0.074 mm 0.0016 to 0.0029 in.
	Allowable limit	0.1 mm 0.0039 in.

15T gear I.D.	Factory spec.	22.520 to 22.541 mm 0.8866 to 0.8874 in.
Mid-PTO drive shaft O.D.	Factory spec.	22.467 to 22.480 mm 0.8845 to 0.8850 in.

(1) 15T Gear I.D.

(2) Mid-PTO Drive Shaft O.D.

W1029119

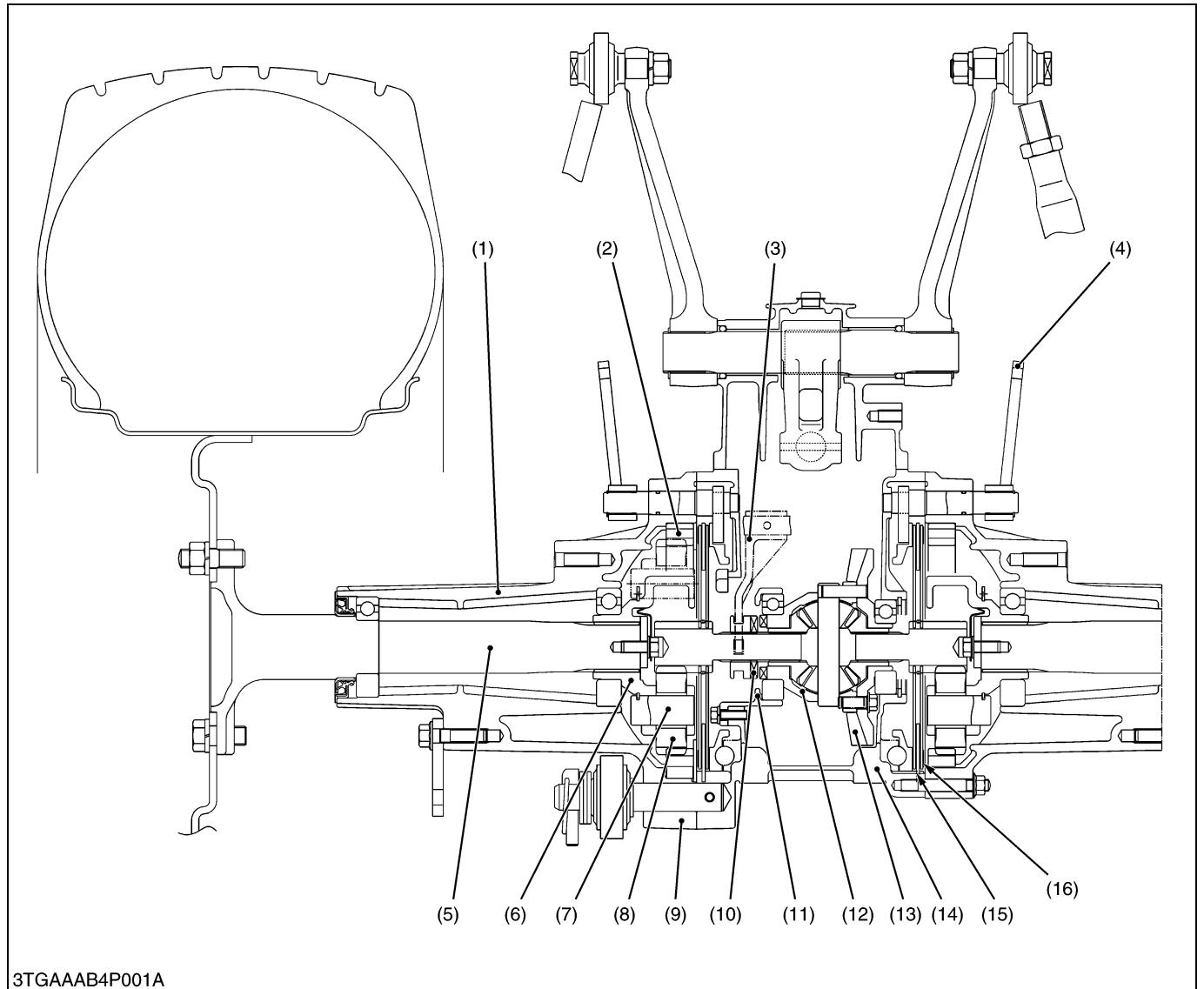
4 REAR AXLE

MECHANISM

CONTENTS

1. STRUCTURE	4-M1
2. OPERATION	4-M2

1. STRUCTURE

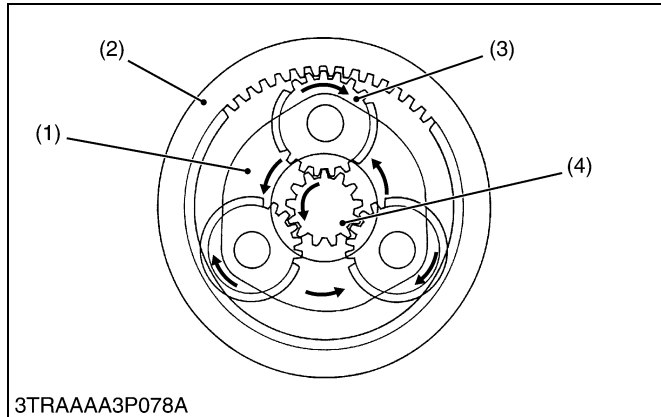


- | | | | |
|----------------------------|-----------------------|----------------------------------|------------------------|
| (1) Rear Axle Case | (5) Rear Axle Shaft | (9) Brake Case | (13) Hypoid Ring Gear |
| (2) Internal Gear | (6) Planetary Carrier | (10) Differential Lock Clutch | (14) Transmission Case |
| (3) Differential Lock Fork | (7) Planetary | (11) Differential Bearing Holder | (15) Steel Plate |
| (4) Brake Lever | (8) Planetary Gear | (12) Differential Gear Comp. | (16) Brake Disk |

The rear axle are the final mechanism which transmit power from the transmission to the rear wheels. Direction of power transmitted is changed at a right angle by the differential gear and, at the same time, speed is reduced. It is further reduced by the planetary gear to drive the rear axle shaft (5).

The rear axles (5) are semi-floating type with the ball bearing between the rear axle (5) and rear axle case (1), which support the rear wheel load as well as transmitting power to the rear wheel. They withstand all the forces caused by tire rotation and side skidding.

2. OPERATION



The final reduction system has a planetary gear system. It is compact, and is durable under heavy loads since torque loads are spread over three gears, decreasing the load on each tooth. And this system also spreads the load evenly around the circumference of the system, eliminating the sideways stress on the shafts.

Power, transmitted from the differential side gear to the brake shaft (4), drives the three planetary gears (3). Since the internal gear (2) is fixed to the rear axle case, the planetary gears (3) move around the teeth of the internal gear (2) while rotating on their axes. The movement of the planetary gears around the internal gear is transmitted to the rear axle through the planetary carrier (1). As a result, the planetary carrier (1) and rear axle rotate in the same direction as the brake shaft (4), but at a reduced speed and increased torque.

(1) Planetary Carrier
(2) Internal Gear

(3) Planetary Gear
(4) Brake Shaft

W1012834

SERVICING

CONTENTS

1. SERVICING SPECIFICATIONS	4-S1
2. TIGHTENING TORQUES	4-S2
3. DISASSEMBLING AND SERVICING.....	4-S3
[1] DISASSEMBLING AND ASSEMBLING.....	4-S3
[2] SERVICING	4-S4

1. SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Internal Gear to Planetary Gear	Backlash	0.1 to 0.2 mm 0.0039 to 0.0079 in.	0.5 mm 0.020 in.
Planetary Gear	I.D.	30.009 to 30.025 mm 1.18146 to 1.18209 in.	30.05 mm 1.1831 in.
Planetary Gear Pin	O.D.	24.967 to 24.980 mm 0.98295 to 0.98346 in.	24.95 mm 0.9823 in.
Needle Bearing	O.D.	2.494 to 2.500 mm 0.09819 to 0.09843 in.	–

W1013874

2. 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-9.)

Item	N·m	kgf·m	ft-lbs
Stopper mounting screw	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2

W1012736

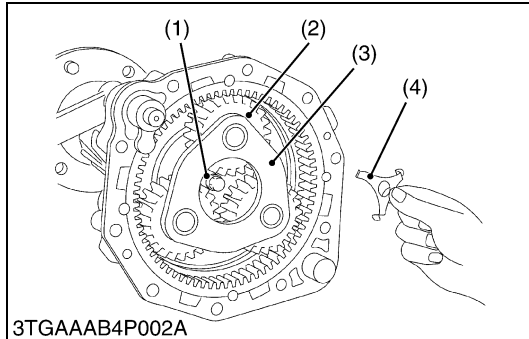
3. DISASSEMBLING AND SERVICING

[1] DISASSEMBLING AND ASSEMBLING

Separating Rear Axle

1. Refer to "DISASSEMBLING AND ASSEMBLING" section of 3. TRANSMISSION (3-S24).

W1010865



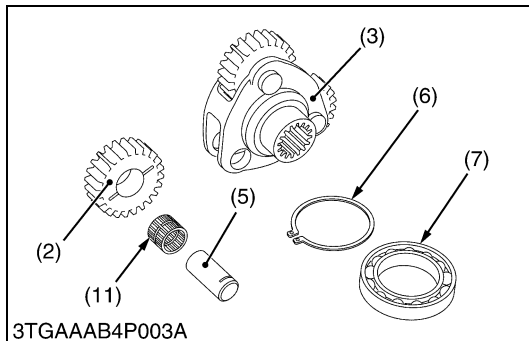
3TGAAAB4P002A

Planetary Gear

1. Take out the lock washer (4), then remove the stopper (1) mounting screw.
2. Take out the planetary carrier (3) and planetary gears (2) as a unit.
3. Remove the bearing (7) with special use puller set (Code No.: 07916-09032).
4. Open the internal snap ring (6) of the planetary carrier. Take out the planetary gear pins (5) and the internal snap ring (6) at once, and remove the planetary gears (2).

(When reassembling)

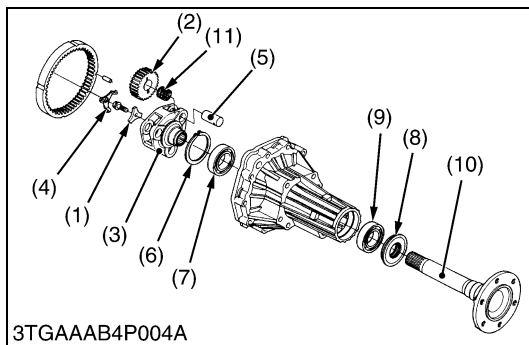
Tightening torque	Stopper mounting screw	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft·lbs
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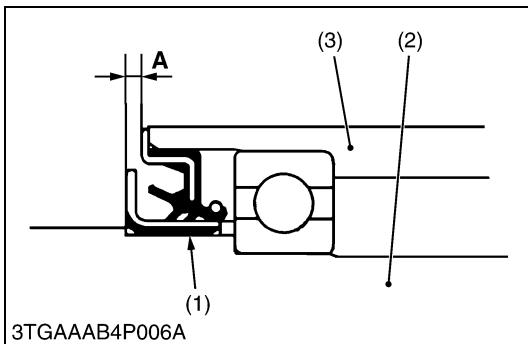
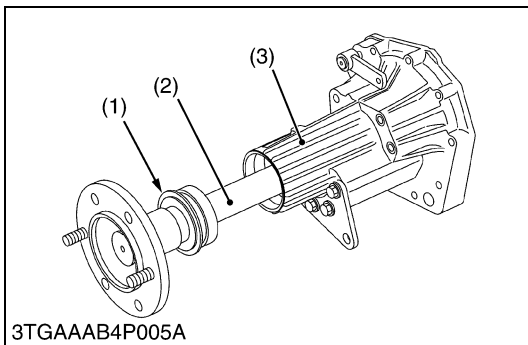
3TGAAAB4P003A

- | | |
|------------------------|---------------------|
| (1) Stopper | (7) Bearing |
| (2) Planetary Gear | (8) Oil Seal |
| (3) Planetary Carrier | (9) Bearing |
| (4) Lock Washer | (10) Rear Axle |
| (5) Planetary Gear Pin | (11) Needle Bearing |
| (6) Internal Snap Ring | |

W1010829



3TGAAAB4P004A



Rear Axle

1. Tap out the rear axle.

(When reassembling)

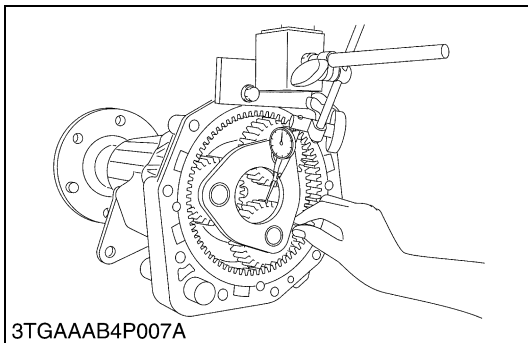
- Apply grease to the oil seal.
- Do not allow any gap (**A**) between the inner and outer surfaces of the oil seal (1). (Refer to figure left)

(1) Oil Seal
(2) Rear Axle

(3) Rear Axle Case

W1011138

[2] SERVICING

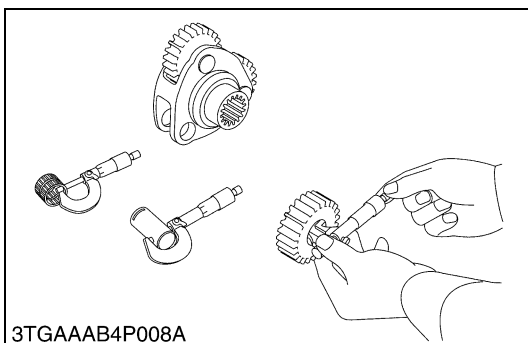


Backlash between Internal Gear and Planetary Gear

1. Set a dial indicator (lever type) on the tooth of the planetary gear.
2. Hold the planetary carrier and move the planetary gear to measure the backlash.
3. If the measurement exceeds the allowable limit, check the next items.

Backlash between internal gear and planetary gear	Factory spec.	0.1 to 0.2 mm 0.0039 to 0.0079 in.
	Allowable limit	0.5 mm 0.020 in.

W1011342



Planetary Gear I.D., Planetary Gear Pin O.D. and Needle Bearing O.D.

1. Measure the planetary gear I.D. with an inside micrometer.
2. Measure the planetary gear pin O.D. with an outside micrometer.
3. Measure the needle bearing O.D. with an outside micrometer.
4. If the measurement exceeds the allowable limit or factory specification, replace them.

Planetary gear I.D.	Factory spec.	30.009 to 30.025 mm 1.18146 to 1.18209 in.
	Allowable limit	30.05 mm 1.1831 in.

Planetary gear pin O.D.	Factory spec.	24.967 to 24.980 mm 0.98295 to 0.98346 in.
	Allowable limit	24.95 mm 0.9823 in.

Needle bearing O.D.	Factory spec.	2.494 to 2.500 mm 0.09819 to 0.09843 in.
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W1011456

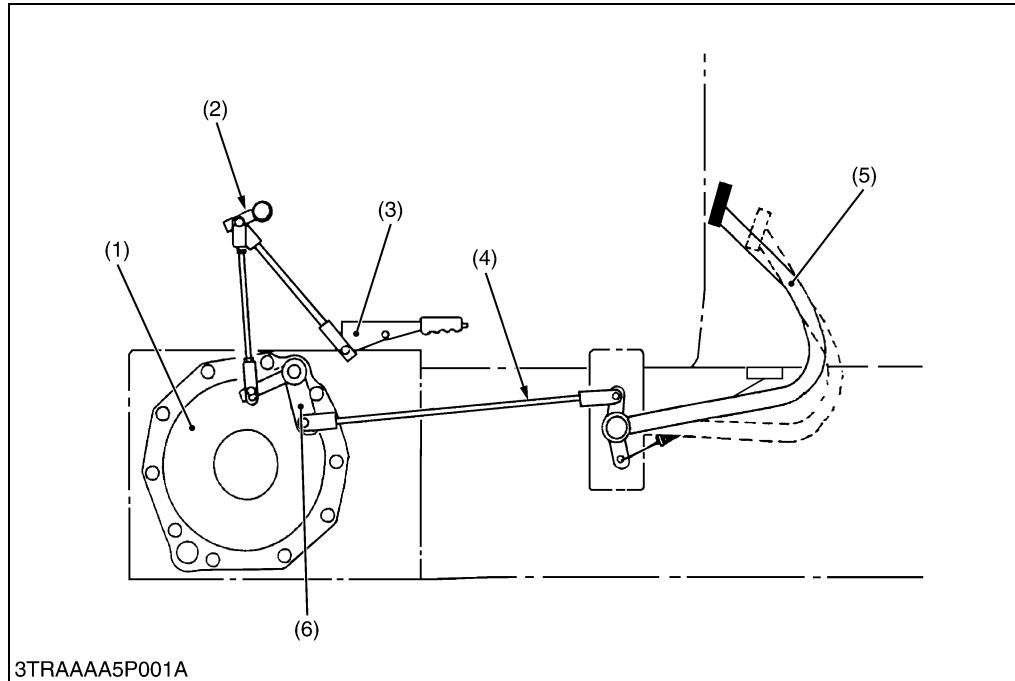
5 BRAKES

MECHANISM

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1. FEATURES	5-M1
2. OPERATION	5-M2

1. FEATURES



- (1) Rear Axle Case
- (2) Parking Brake Rod Linkage
- (3) Parking Brake Lever
- (4) Brake Rod
- (5) Brake Pedal
- (6) Brake Cam Lever

W1013188

3TRAAA5P001A

Independent mechanical wet disc brakes are used for the right and left travelling brakes. They are operated by the brake pedals through the mechanical linkages and provide stable braking and require little adjustment.

The parking brake is mechanical type which is connected to the brake lever by the rod linkages.

■ Features of Wet Disc Brakes

1. Reduced disc wear

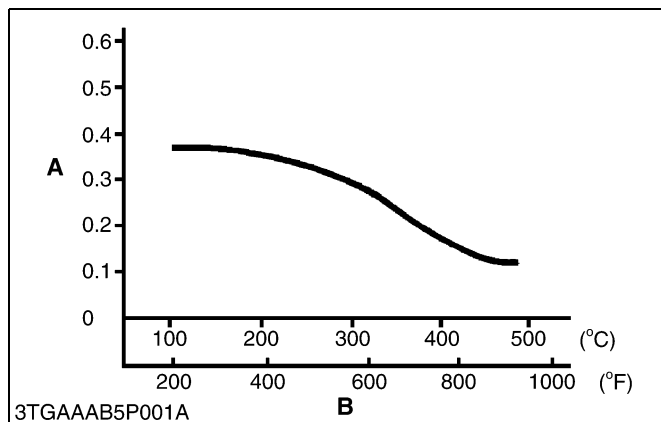
Although wet discs are worn by approx. several tens of microns depending on the accuracy of parts during the initial contact in initial period of 50 hours or so, almost no wear occurs afterward. This means that very little brake adjustments are required.

2. Stable braking

Since the brake discs are immersed in transmission oil, **Fade*** is rarely caused even after repeated braking and a stable braking force is obtained.

3. Pedal stroke does not change under influence of heat

Unlike internal expanding type brakes, the drum-to-shoe clearance of the wet disc brake does not increase due to thermal expansion and the increased pedal stroke does not result. Thus, the wet disc brake provides a constant pedal stroke.



3TGAAAB5P001A

* Fade

Fade is a phenomenon of braking force loss caused by the heat generated in repeated braking. Generally, the friction coefficient of brake disc tends to lower and the braking force reduces with the rise of the temperature of the brake disc.

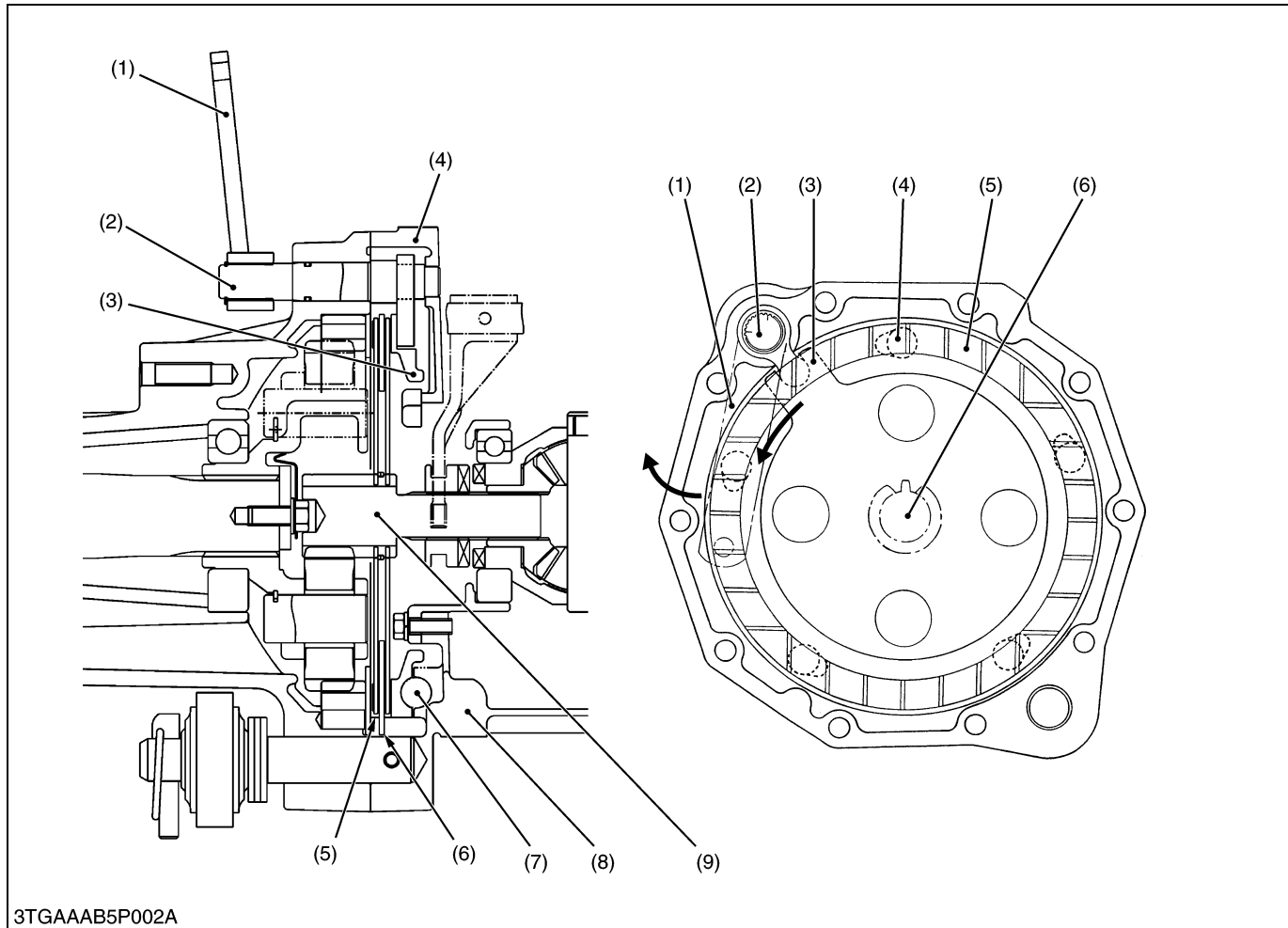
(Reference)

- Relationship between temperature and friction coefficient of brake disc.

A : Friction Coefficient (μ) B : Temperature

W1012831

2. OPERATION



3TGAAAB5P002A

- | | | | |
|-----------------|----------------|-----------|-----------------------|
| (1) Brake Lever | (4) Brake Case | (6) Plate | (8) Transmission Case |
| (2) Brake Cam | (5) Brake Disc | (7) Ball | (9) Brake Shaft |
| (3) Cam Plate | | | |

■ During Braking

When the brake pedal is pressed, the linkage causes the brake cam lever (1) and brake cam (2) to turn into the direction of arrow shown in the above diagram. Therefore, the cam plate (3) also moves the direction of arrow. At this time, since the cam plate (3) rides on the steel balls (7) set in the grooves of the differential bearing case to press the brake disc (5), the brake shaft (9) is braked by the frictional force generated by the cam plate (3) and brake disc (5).

SERVICING

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1. TROUBLESHOOTING	5-S1
2. SERVICING SPECIFICATIONS	5-S2
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[1] CHECKING AND ADJUSTING	5-S3
[2] DISASSEMBLING AND ASSEMBLING.....	5-S4
[3] SERVICING	5-S4

1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Uneven Braking Force	<ul style="list-style-type: none"> • Brake pedal play unevenly adjusted • Brake disc worn • Cam plate warped 	Adjust Replace Replace	5-S3 5-S5 5-S4
Brake Drags	<ul style="list-style-type: none"> • Brake pedal play too small • Ball holes of cam plate for uneven wear • Brake pedal return spring weaken or broken • Brake cam rusted 	Adjust Replace Replace Repair	5-S3 5-S4 – –
Poor Braking Force	<ul style="list-style-type: none"> • Brake pedal play excessive • Brake disc worn • Cam plate warped • Brake cam or lever damaged • Transmission fluid improper 	Adjust Replace Replace Replace Change	5-S3 5-S5 5-S4 – G-8

W1014322

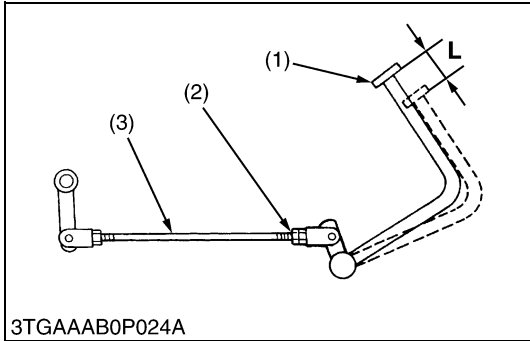
2. SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Brake Pedal Right and Left	Free Travel	25 to 30 mm 0.98 to 1.18 in.	–
	Difference	Less than 5 mm 0.19 in.	–
Parking Brake Lever	Free Travel	2 notches (Ratchet sound 2)	–
Cam Plate and Ball	Height	20.995 to 21.005 mm 0.82657 to 0.82697 in.	20.5 mm 0.81 in.
Cam Plate	Flatness	–	0.3 mm 0.012 in.
Brake Disc	Thickness	3.4 to 3.6 mm 0.134 to 0.142 in.	3.0 mm 0.118 in.
Plate	Thickness	2.592 to 2.608 mm 0.10205 to 0.10268 in.	2.1 mm 0.083 in.
Brake Pedal Shaft to Brake Pedal	Clearance	0.000 to 0.136 mm 0.0000 to 0.0054 in.	0.5 mm 0.020 in.
Brake Pedal Shaft	O.D.	24.916 to 25.000 mm 0.9809 to 0.9843 in.	–
Brake Pedal	I.D.	25.000 to 25.052 mm 0.9843 to 0.9863 in.	–

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3. CHECKING, DISASSEMBLING AND SERVICING

[1] CHECKING AND ADJUSTING



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Brake Pedal Free Travel

⚠ CAUTION

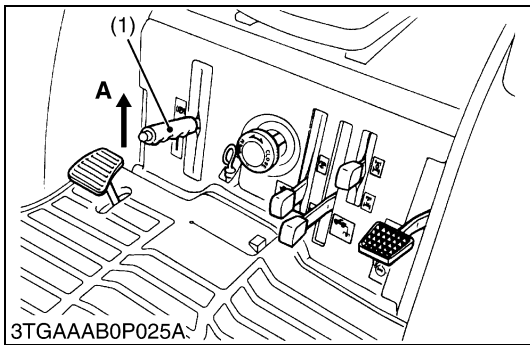
- Stop the engine and chock the wheels before checking brake pedal.
- The difference between the right and left pedal plays must be less than 5.0 mm (0.19 in.).

1. Release the parking brake.
2. Slightly depress the brake pedals (1) and measure free travel (L) at top of pedal stroke.
3. If the measurement is not within the factory specifications, loosen the lock nut (2) and turn the brake rod (3).
4. Retighten the lock nut (2) securely.
Keep the free travel in the right and left brake pedals equal.

Brake pedal free travel "L"	Factory spec.	25 to 30 mm 0.98 to 1.18 in.
-----------------------------	---------------	---------------------------------

- (1) Brake Pedal
(2) Lock Nut
(3) Brake Rod
- L : Free Travel**

W1018154



3TGAAAB0P025A

Checking Parking Brake

⚠ CAUTION

- Be sure to stop engine before checking parking brake.
1. Slowly raise the parking brake lever (1) to the ratchet sound made by the parking brake lever.
 2. If the No. of notch is not within the factory specifications, loosen the lock nut (2) and turn the brake rod LH (3) and RH (4) to adjust within acceptable limits.
 3. Retighten the lock nut (2) securely.

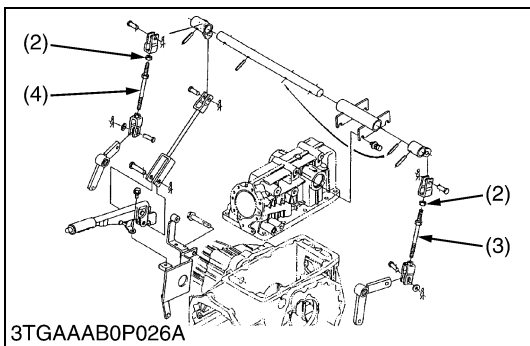
Parking brake lever free travel	2 notches (Ratchet sound 2)
---------------------------------	--------------------------------

■ IMPORTANT

- Check the brake pedal free travel after checking the parking brake.

- (1) Brake Lever
(2) Lock Nut
(3) Brake Rod LH
(4) Brake Rod RH
- A : Pull**

W1011240



3TGAAAB0P026A

[2] DISASSEMBLING AND ASSEMBLING

Removing Brake Pedal

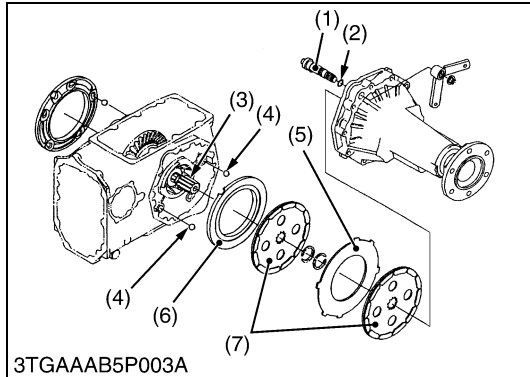
1. Refer to “DISASSEMBLING AND ASSEMBLING” section of 3. TRANSMISSION.

W1011417

Separating Brake (Rear Axle)

1. Refer to “DISASSEMBLING AND ASSEMBLING” section of 3. TRANSMISSION.

W1011463



3TGAAAB5P003A

Brake Discs and Friction Plate

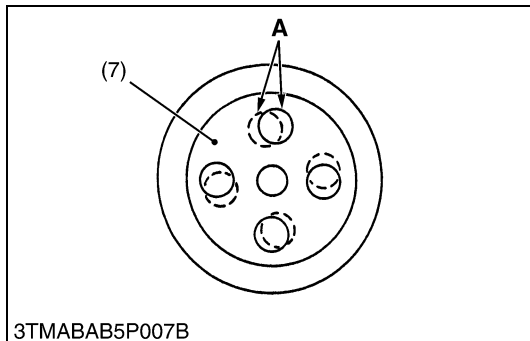
1. Draw out the brake shaft (3).
2. Detach the brake disc (7), cam plate (6) and balls (4).
3. Draw out the brake cam (1).
4. Detach the brake discs (7) and friction plate (5).

(When reassembling)

- Apply grease to the O-ring (2).
- Be sure to fix the brake cam and cam plate.
- Place the brake discs (7) so that the hole “A” of the second disc should be overlapped 50 % or more.

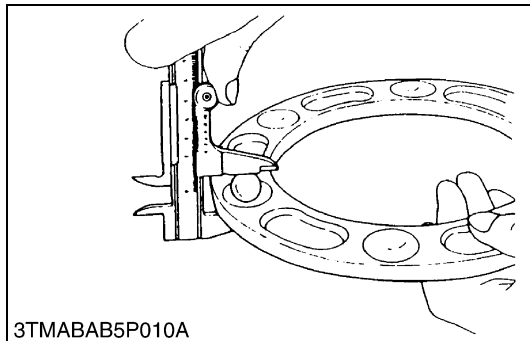
- | | |
|--------------------|-----------------|
| (1) Brake Cam | (6) Cam Plate |
| (2) O-ring | (7) Brake Disc |
| (3) Brake Shaft | |
| (4) Ball | A : Hole |
| (5) Friction Plate | |

W1011508



3TMABAB5P007B

[3] SERVICING



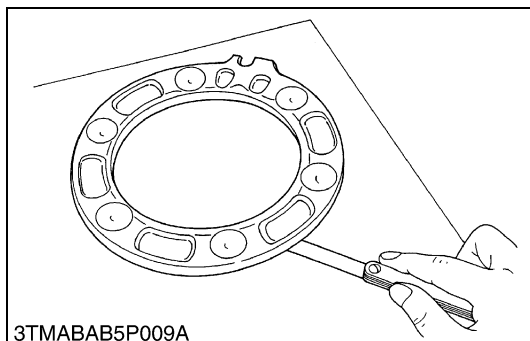
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Height of Brake Cam Plate and Ball

1. Measure the dimensions of the brake cam plate with the ball installed.
2. If the measurement is less than the allowable limit, replace the cam plate and balls.
3. Inspect the ball holes of cam plate for uneven wear. If the uneven wear is found, replace it.

Height of brake cam plate and ball	Factory spec.	20.995 to 21.005 mm 0.82657 to 0.82697 in.
	Allowable limit	20.5 mm 0.81 in.

W1011741



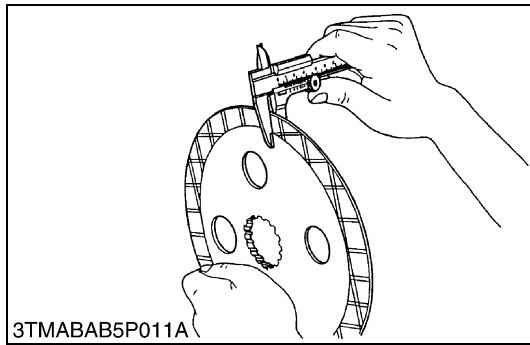
3TMABAB5P009A

Cam Plate Flatness

1. Place the cam plate on the surface plate.
2. Use a feeler gauge of 0.3 mm (0.012 in.) thick for judgment of the cam plate flatness. Measure the flatness diagonally at more than four locations.
3. If the measurement is above the allowable limit, replace it.

Cam plate flatness	Allowable limit	0.3 mm 0.012 in.
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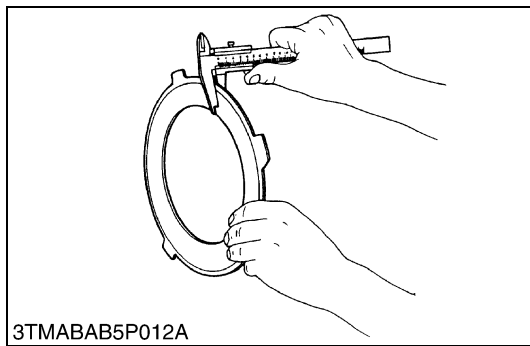
W1011852

**Brake Disc Wear**

1. Measure the brake disc thickness with vernier calipers.
2. If the thickness is less than the allowable limit, replace it.

Brake disc thickness	Factory spec.	3.4 to 3.6 mm 0.134 to 0.142 in.
	Allowable limit	3.0 mm 0.118 in.

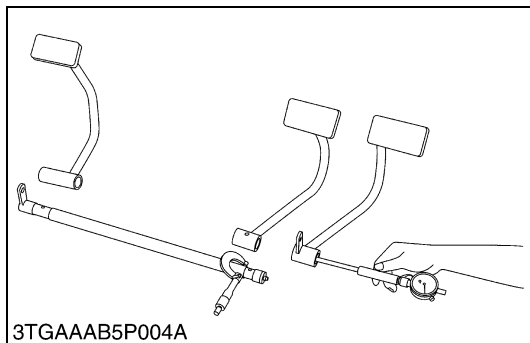
W1011953

**Plate Wear**

1. Measure the plate thickness.
2. If the thickness is less than the allowable limit, replace it.

Plate thickness	Factory spec.	2.592 to 2.608 mm 0.10205 to 0.10268 in.
	Allowable limit	2.1 mm 0.083 in.

W1012113

**Clearance between Brake Pedal Shaft and Brake Pedal**

1. Measure the brake pedal shaft O.D. (bearing surface) with an outside micrometer.
2. Measure the brake pedal I.D. with a cylinder gauge.
3. Calculate the clearance.
4. If the clearance exceeds the allowable limit, replace them.

Clearance between brake pedal shaft and brake pedal	Factory spec.	0.000 to 0.136 mm 0.0000 to 0.0054 in.
	Allowable limit	0.5 mm 0.020 in.

Brake pedal shaft O.D.	Factory spec.	24.916 to 25.000 mm 0.9809 to 0.9843 in.
Brake pedal I.D.	Factory spec.	25.000 to 25.052 mm 0.9843 to 0.9863 in.

W1012216

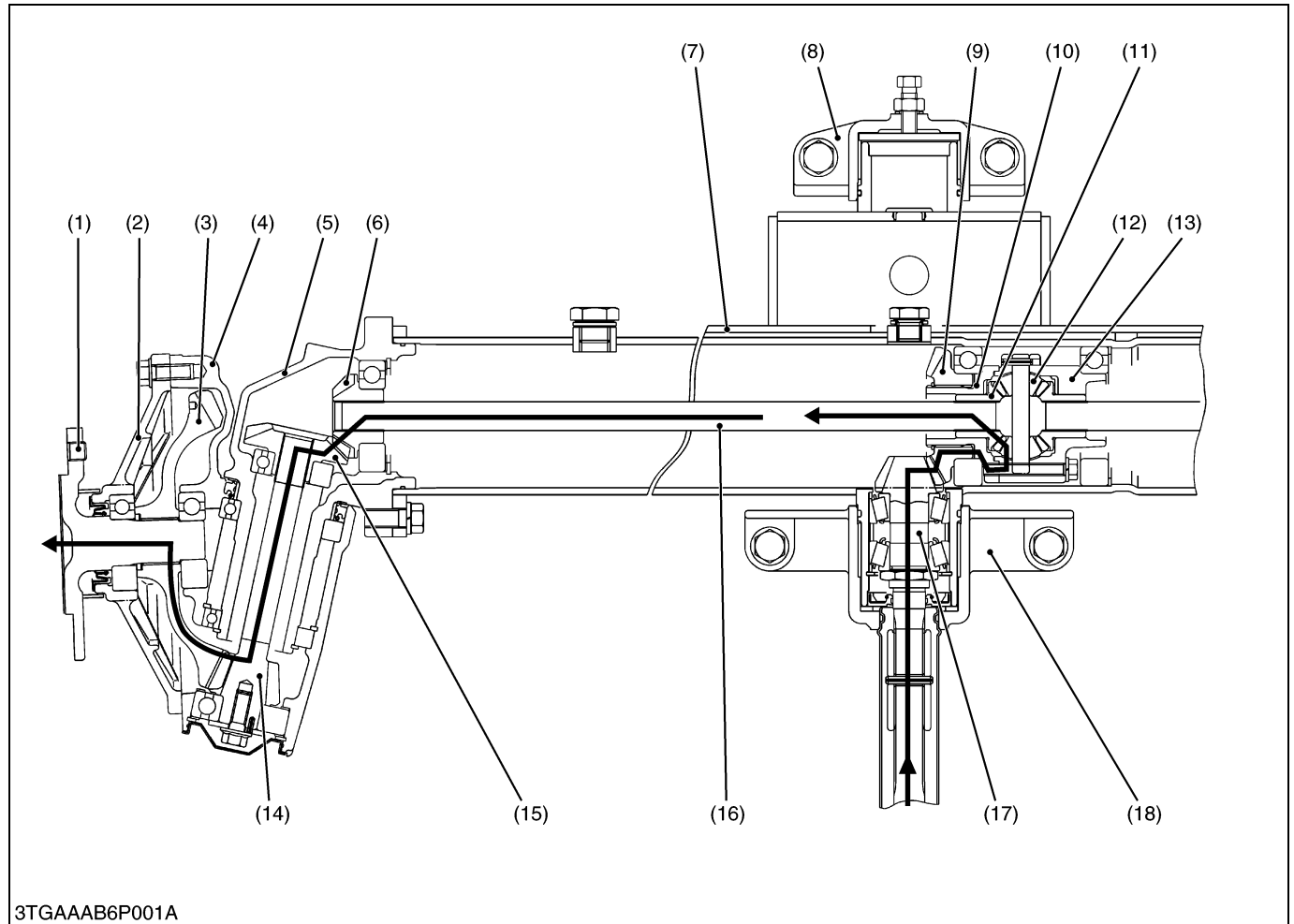
6 FRONT AXLE

MECHANISM

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1. STRUCTURE	6-M1
2. FRONT WHEEL ALIGNMENT	6-M2

1. STRUCTURE



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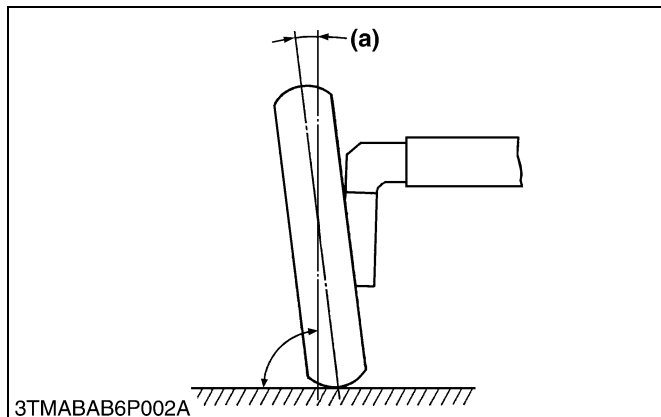
- | | | | |
|---------------------|-------------------------------|-----------------------------|-------------------------------|
| (1) Front Axle | (6) 11T Bevel Gear | (11) Differential Side Gear | (15) 16T Bevel Gear |
| (2) Gear Case Cover | (7) Front Axle Case | (12) Differential Pinion | (16) Differential Gear Shaft |
| (3) 41T Bevel Gear | (8) Front Axle Bracket, Front | (13) Differential Case | (17) 10T Bevel Pinion Shaft |
| (4) Gear Case | (9) 24T Bevel Gear | (14) 7T Pinion Shaft | (18) Front Axle Bracket, Rear |
| (5) Bevel Gear Case | (10) Differential Case Cover | | |

The structure of the front axle is constructed and power transmitted to the front axle (1) as shown above.

The differential system allows each wheel to rotate at a different speed to make turn easier. It is designed compact type to install in the front axle case (7) for getting high minimum ground clearance.

2. FRONT WHEEL ALIGNMENT

Front wheel alignment is a term given to mean four angle settings in three dimensions camber, kingpin inclination, toe-in and caster angle. These angle settings are made for the following purposes.

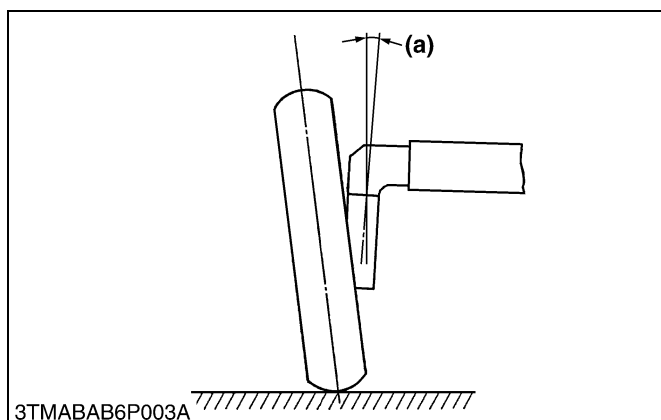


■ Camber

The front wheels are tilted from the vertical as viewed from the front, the wheels are farther apart at the top than at the bottom. This inclination is called camber (a). Camber reduces rolling resistance of the wheels, and also minimizes bending or twisting of the front axle.

Camber (a)	0.035 rad. 2 °
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W1012811

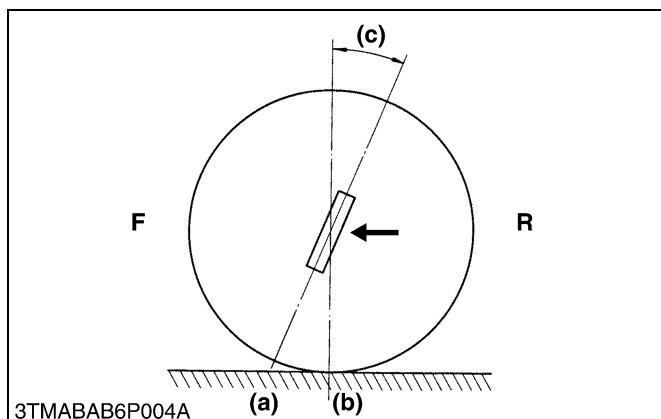


■ Kingpin Angle

The kingpin is tilted from the vertical as viewed from the front. This angle is called kingpin angle (a). As with the camber, kingpin inclination reduces rolling resistance of the wheels, and prevents any shimmy motion of the steering wheel. It also reduces steering effort.

Kingpin angle (a)	0.21 rad. 12 °
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W1013196



■ Caster

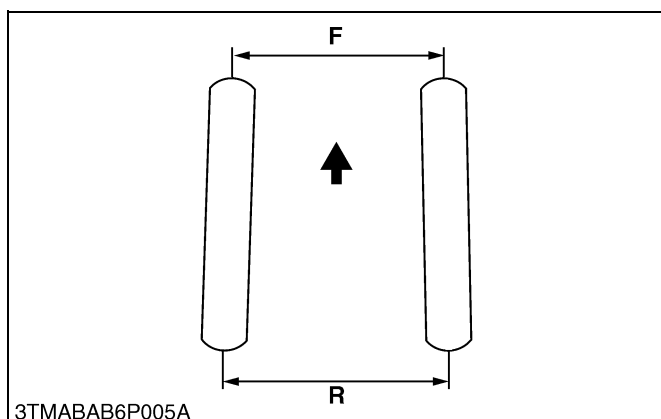
The kingpin is tilted forward as viewed from the side. That is, the intersection (a) made by the center line of the kingpin shaft and the ground is ahead of the intersection (b) made by the center line of the wheel and ground. This inclination is called caster (c). Caster helps provide steering stability. As with the kingpin inclination, caster reduces steering effort.

Caster angle (c)	0.088 rad. 5 °
------------------	-------------------

F : Front

R : Rear

W1013322



■ Toe-in

Viewing the front wheels from above reveals that the distance between the front wheels is less at the front than at the rear. This turning in of the front wheels is called toe-in. The front wheels tend to roll outward due to the camber, but toe-in offsets this and ensures parallel rolling of the front wheel. Another purpose of toe-in is to prevent excessive and uneven wear of tires.

Toe-in	2.0 to 8.0 mm 0.08 to 0.32 in.
--------	-----------------------------------

F : Front

R : Rear

W1013259

SERVICING

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[2] DISASSEMBLING AND ASSEMBLING.....	6-S6
(1) Separating Front Axle Assembly.....	6-S6
(2) Disassembling Front Axle Assembly.....	6-S8
[3] SERVICING	6-S12

1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Front Wheels Wander to Right or Left	• Tire pressure uneven	Adjust	–
	• Improper toe-in adjustment (improper alignment)	Adjust	6-S5
	• Excessive clearance between front axle center pivot and front axle bracket's bushing	Replace	6-S15
	• Front axle rocking force too small	Adjust	6-S5
	• Excessive sway of front wheel	Replace	–
	• Tie-rod end loose	Tighten	6-S8
Front Wheels Can Not be Driven	• Propeller shaft broken	Replace	–
	• Front wheel drive gears in transmission broken	Replace	3-S25
	• Front differential gear broken	Replace	6-S11
	• Coupling displaced	Reassemble	6-S6
Noise	• Excessive backlash of gear	Adjust or replace	6-S12 to S15
	• Oil insufficient	Replenish	G-8
	• Bearings damaged or broken	Replace	–
	• Gears damaged or broken	Replace	–
	• Spiral bevel pinion shaft turning force improper	Adjust	6-S13

W1014322

2. SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Front Wheel Alignment	Toe-in	2 to 8 mm 0.078 to 0.315 in.	–
	Camber Angle	0.035 rad. 2 °	–
	Caster Angle	0.088 rad. 5 °	–
	Kingpin Angle	0.209 rad. 12 °	–
Front Wheel	Steering Angle	0.907 to 0.959 rad. 52 to 55 °	–
	Axle Sway	Less than 5 mm 0.20 in.	–
Front Axle	Rocking Force	49.0 to 117.7 N 5.0 to 12.0 kgf 11.0 to 26.5 lbs	–
Front Axle Case Bosses to Bracket Bushings	Clearance	0.025 to 0.140 mm 0.00098 to 0.00551 in.	0.25 mm 0.0098 in.
Front Axle Case Bosses	O.D.	61.945 to 61.975 mm 2.43878 to 2.43996 in.	–
Bracket Bushings	I.D.	62.000 to 62.094 mm 2.44094 to 2.44465 in.	–
Differential Case, Differential Case Cover to Differential Side Gear	Clearance	0.040 to 0.094 mm 0.0016 to 0.0037 in.	0.20 mm 0.0079 in.
Differential Case, Differential Case Cover	I.D.	28.000 to 28.033 mm 1.1024 to 1.1037 in.	–
Differential Side Gear	O.D.	27.939 to 27.960 mm 1.1000 to 1.1008 in.	–
Pinion Shaft to Differential Pinion	Clearance	0.048 to 0.084 mm 0.00189 to 0.00331 in.	0.20 mm 0.0079 in.
Pinion Shaft	O.D.	10.966 to 10984 mm 0.43173 to 0.43244 in.	–
Differential Pinion	I.D.	11.032 to 11.050 mm 0.43433 to 0.43504 in.	–

W1013874

Item		Factory Specification	Allowable Limit
Differential Pinion to Differential Side Gear	Backlash	0.1 to 0.3 mm 0.004 to 0.012 in.	–
Spiral Bevel Pinion Shaft (Pinion Shaft Only)	Turning Force	58.8 to 78.4 N 6.0 to 8.0 kgf 13.2 to 17.6 lbs	–
Spiral Bevel Pinion Shaft to Spiral Bevel Gear	Backlash	0.1 to 0.3 mm 0.004 to 0.012 in.	–
11T Bevel Gear to 16T Bevel Gear	Backlash	0.15 to 0.35 mm 0.0059 to 0.0138 in.	–
7T Pinion Shaft to 41T Bevel Gear	Backlash	0.15 to 0.33 mm 0.0059 to 0.0130 in.	–

W1013874

3. TIGHTENING TORQUES

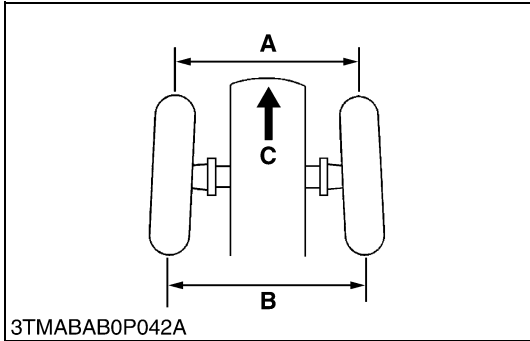
Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts : See page G-9.)

Item	N-m	kgf-m	ft-lbs
Front wheel mounting screws and nuts	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Front wheel mounting stud bolts	34.3 to 49.0	3.5 to 5.0	25.3 to 36.2
Rocking force adjusting screw lock nut	39.2 to 45.1	4.0 to 4.6	28.9 to 33.3
Steering hose retaining nut	25 to 30	2.5 to 3.0	18.1 to 21.7
Front axle bracket mounting screw	200 to 230	20.4 to 23.5	147.5 to 169.6
Tie-rod end nut (Power steering cylinder)	34.3 to 44.1	3.5 to 4.5	25.3 to 32.5
Steering cylinder mounting reamer screw	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
Tie-rod lock nut	117 to 137	12 to 14	86.8 to 101.3
Bevel gear case mounting screws	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Gear case cover mounting screws	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
7T pinion shaft UBS screw	60.8 to 70.6	6.2 to 7.2	44.8 to 52.1
Differential case cover mounting screws	29.4 to 34.3	3.0 to 3.5	21.7 to 25.3

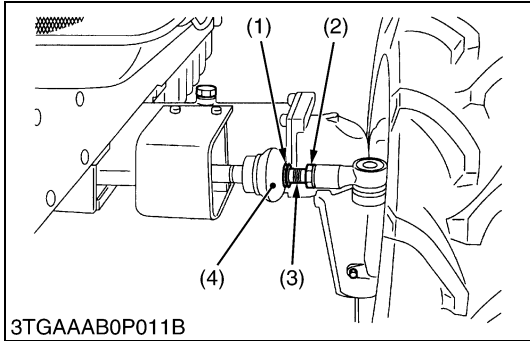
W1012736

4. CHECKING, DISASSEMBLING AND SERVICING

[1] CHECKING AND ADJUSTING



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3TGAAAB0P011B

Adjusting Toe-in

1. Park the tractor on the flat place.
2. Inflate the tires to the specified pressure.
3. Turn steering wheel so front wheels are in the straight ahead position.
4. Lower the implement, lock the parking brake and stop the engine.
5. Measure distance between tire beads at front of tire, hub height.
6. Measure distance between tire beads at rear of tire, hub height.
7. Front distance should be 2 to 8 mm (0.079 to 0.315 in.) less than rear distance.
8. If the measurement is not within the factory specifications, adjust by changing the tie-rod length.

Toe-in (B – A)	Factory spec.	2 to 8 mm 0.079 to 0.315 in.
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Adjusting

1. Detach the snap ring (1) from the dust cover (4).
2. Loosen the tie-rod lock nut (2) and turn the tie-rod joint (3) to adjust the tie-rod length until the proper toe-in measurement is obtained.
3. Retighten the tie-rod lock nut (2).
4. Attach the snap ring (1) to the dust cover (4).

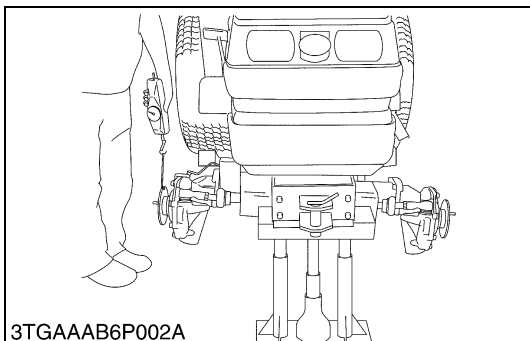
Tightening torque	Tie-rod lock nut	117 to 137 N·m 12 to 14 kgf·m 86.8 to 101.3 ft-lbs
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IMPORTANT

- A right and left tie-rod joint is adjusted to the same length.

- | | |
|----------------------|--------------------------------------|
| (1) Snap Ring | (A) Wheel to Wheel Distance at front |
| (2) Tie-rod Lock Nut | (B) Wheel to Wheel Distance at rear |
| (3) Tie-rod Joint | (C) Front |
| (4) Dust Cover | |

W1011595

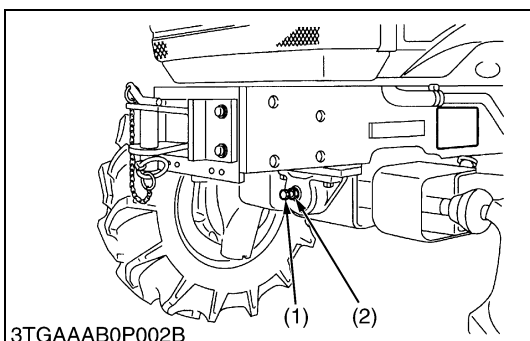


3TGAAAB6P002A

Front Axle Rocking Force

1. Jack up the front side of tractor.
2. Remove the front wheels.
3. Set a spring balance to the front wheel mounting stud bolt with nut.
4. Measure the front axle rocking force.
5. If the measurement is not within the factory specifications, adjust with the adjusting screw (1).
6. After adjustment, tight the lock nut (2) firmly.

Front axle rocking force	Factory spec.	49.0 to 117.7 N 5.0 to 12.0 kgf 11.0 to 26.5 lbs
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3TGAAAB0P002B

(When reassembling)

Tightening torque	Adjusting screw lock nut	39.2 to 45.1 N·m 4.0 to 4.6 kgf·m 28.9 to 33.3 ft-lbs
	Front wheel mounting screws and nuts	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs

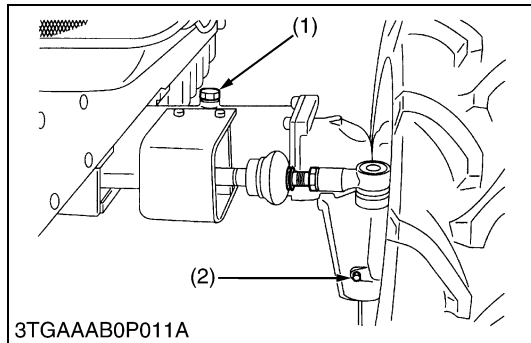
(1) Adjusting Screw

(2) Lock Nut

W1011864

[2] DISASSEMBLING AND ASSEMBLING

(1) Separating Front Axle Assembly



Draining Front Axle Case Oil

1. Place the oil pans underneath the front axle case.
2. Remove the both right and left hand side drain plugs (1) and filling plug (2) to drain the oil.
3. After draining, reinstall the drain plugs (1).
4. Fill new oil with specified amount of oil.

■ IMPORTANT

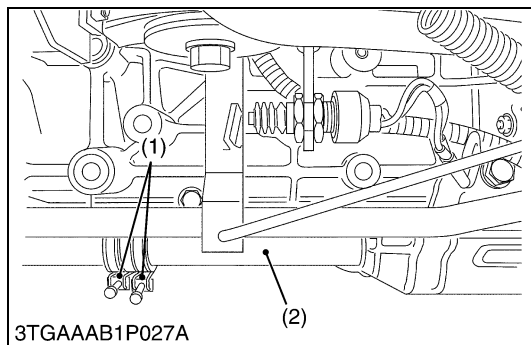
- Use **KUBOTA SUPER UDT fluid or SAE 80, 90 gear oil.** Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-8.)

Front axle case oil capacity	4.0 L 1.06 U.S.gals. 0.88 Imp.gals.
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(1) Drain Plug

(2) Filling Plug with Dipstick

W1012110



Propeller Shaft

1. Loosen the clamp (1) and slide the propeller shaft cover (2).
2. Tap out the spring pin (3) and then slide the coupling (4).
3. Remove the propeller shaft with cover.

(When reassembling)

- Apply grease to the splines of the propeller shaft and couplings.
- When inserting the spring pins (3), face their splits in the direction parallel to the universal joint as shown in the figure.

(1) Clamp

(2) Propeller Shaft Cover

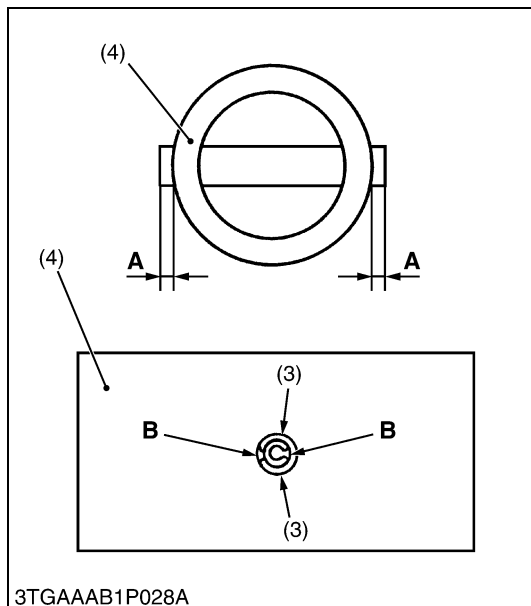
(3) Spring Pin

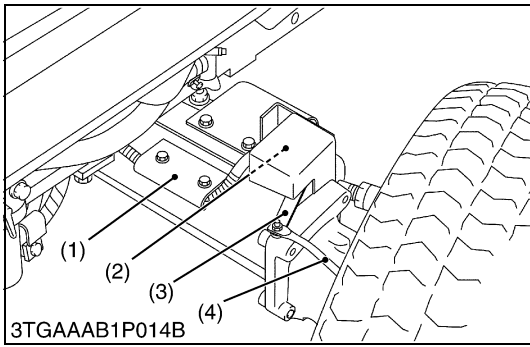
(4) Coupling

A : Approx. 1.0 mm (0.039 in.)

B : Split Portion

W1012396





Front Wheel Turning Angle Sensor

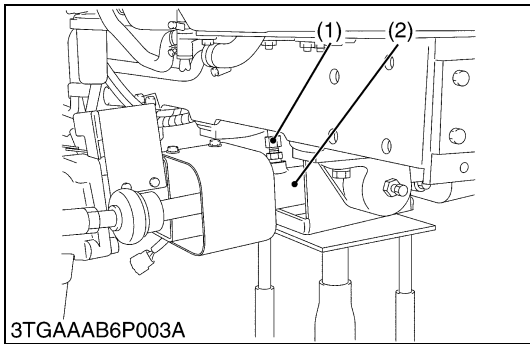
1. Remove the wire harness clamp (1).
2. Disconnect the connector (2).
3. Remove the cotter pin and disconnect the arm (4) from the sensor lever (3).

■ **IMPORTANT**

- Route the wire harness under the both power steering hoses.

- (1) Clamp
- (2) Connector
- (3) Lever
- (4) Arm

W1012536



Front Wheels and Steering Cylinder Hoses

1. Lift up the front side of tractor and place the disassembling stand under the front axle frame.
2. Remove the front wheels.
3. Disconnect the both right and left hand side steering hoses.

■ **NOTE**

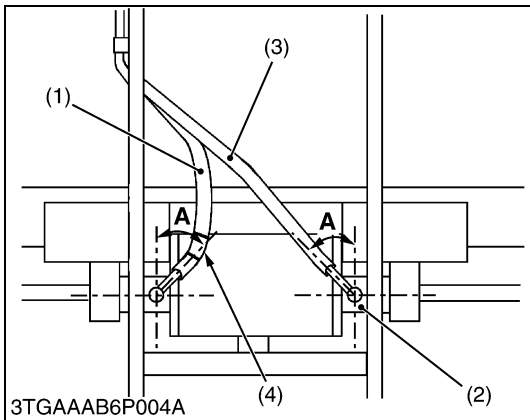
- After disconnect the steering hoses, do not steer the front axle so that the steering oil may come out from the steering cylinder connector.

■ **IMPORTANT**

- Connect the steering hoses to the original position.

(When reassembling)

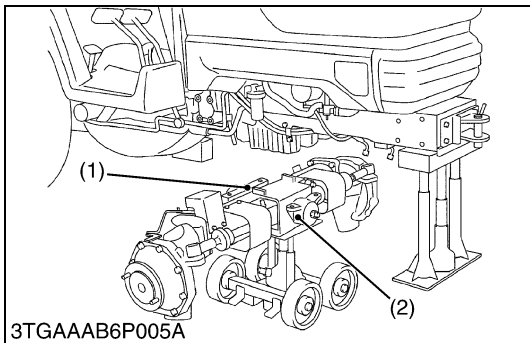
- The power steering hose RH (1) with white tape (4) to connect the right side connector of steering cylinder (2).
- Be sure to assemble the steering hose RH and LH as shown in figure.



Tightening torque	Front wheel mounting screw and nut	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft·lbs
	Steering hose retaining nut	25 to 30 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 ft·lbs

- (1) Steering Hose RH
 - (2) Steering Cylinder
 - (3) Steering Hose LH
 - (4) White Tape
- A : 0.785 rad. (45 °)**

W1012767



Front Axle Assembly

1. Place the disassembling stand under the front axle.
2. Remove the front axle brackets (Front and Rear) mounting screws.
3. Separate the front axle from the front axle frame.

(When reassembling)

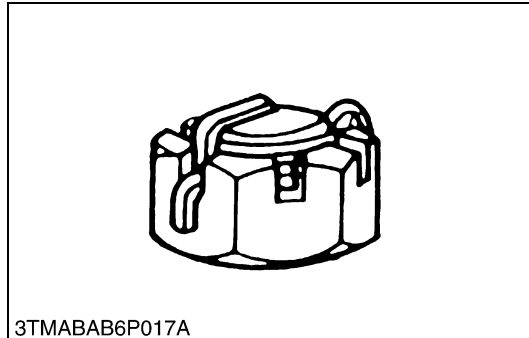
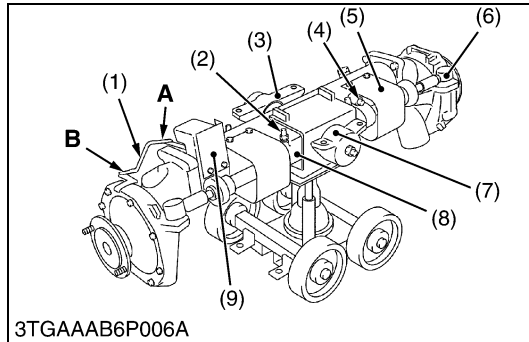
- After mounting the front axle assembly to the front axle frame, be sure to adjust the front axle rocking force. (See page 6-S5.)

Tightening torque	Front axle bracket mounting screw	200 to 230 N·m 20.4 to 23.5 kgf·m 147.5 to 169.6 ft·lbs
-------------------	-----------------------------------	---

- (1) Rear Axle Bracket
- (2) Front Axle Bracket

W1013018

(2) Disassembling Front Axle Assembly



Steering Cylinder, Axle Bracket and Front Wheel Turning Angle Sensor

1. Remove the slotted nut and remove the both RH and LH tie-rod (6).
2. Remove the front axle brackets (3), (7).
3. Remove the cylinder cover (5).
4. Remove the hydraulic connector (4) RH or LH to slide out the steering cylinder (8).
5. Remove the steering cylinder mounting reamer screw (4) and remove the cylinder (8).
6. Remove the front wheel turning angle sensor (9).

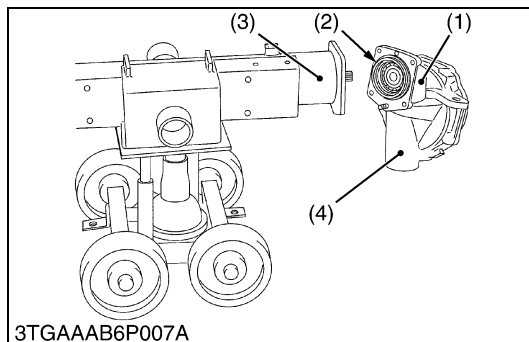
(When reassembling)

- Apply grease to the thrust collar of front axle bracket.
- Apply grease to O-rings of front axle bracket (front and rear) (3), (7) and take care not to damage them.
- After tightening the slotted nut to the specified torque, install the cotter pin as shown in the figure.
- Apply seal tape to thread portion of hydraulic connector.
- Assemble the sensor arm, longer side (A) fix to the bi-speed sensor as figure.

Tightening torque	Tie-rod end nut (Power steering cylinder)	34.3 to 44.1 N·m 3.5 to 4.5 kgf·m 25.3 to 32.5 ft·lbs
	Steering cylinder mounting reamer screw	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft·lbs

- | | |
|-------------------------------|--------------------------------------|
| (1) Sensor Arm | (7) Front Axle Bracket (Front) |
| (2) Hydraulic Connector | (8) Steering Cylinder |
| (3) Front Axle Bracket (Rear) | (9) Front Wheel Turning Angle Sensor |
| (4) Reamer Screw | |
| (5) Cylinder Cover | A : Longer Side |
| (6) Tie-rod | B : Shorter Side |

W1014907



Bevel Gear Case and Front Gear Case

1. Remove the bevel gear case mounting screws.
2. Remove the bevel gear case (1) and front gear case (4) as a unit from the front axle case (3).

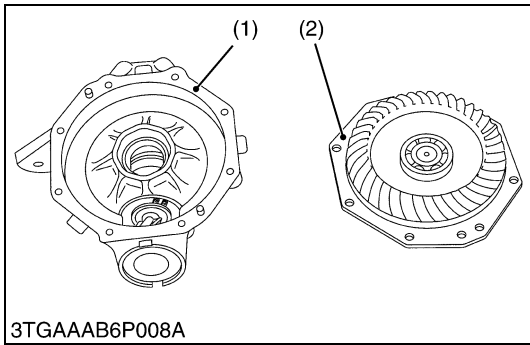
(When reassembling)

- Apply grease to the O-ring (2) and take care not to damage it.
- Do not interchange right and left bevel gear case assemblies and right and left gear case assemblies.
- Be sure to fix the turning angle sensor arm holder.

Tightening torque	Bevel gear case mounting screw	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft·lbs
-------------------	--------------------------------	---

- | | |
|---------------------|---------------------|
| (1) Bevel Gear Case | (3) Front Axle Case |
| (2) O-ring | (4) Front Gear Case |

W1015604



Gear Case Cover and Front Axle

1. Remove the gear case cover (2) from gear case (1).
2. Remove the bearing (6) with special use puller set (Code No.: 07916-09032).
3. Take out the 41T bevel gear (5).
4. Take out the divided collar (4).
5. Tap out the front axle (3).

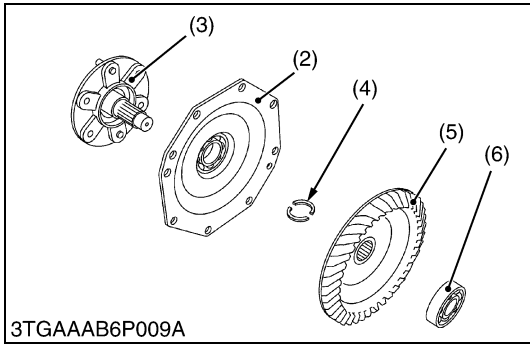
(When reassembling)

- Be sure to adjust the backlash between the 41T bevel gear (5) and 7T pinion shaft. (See page 6-S15.)
- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the gear case (1) and gear case cover (2), after eliminate the water, oil and stuck liquid gasket.

Tightening torque	Gear case cover mounting screws	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft-lbs
-------------------	---------------------------------	---

- | | |
|---------------------|--------------------|
| (1) Gear Case | (4) Divided Collar |
| (2) Gear Case Cover | (5) 41T Bevel Gear |
| (3) Front Axle | (6) Bearing |

W1015787



7T Pinion Shaft

1. Remove the cap (8).
2. Remove the UBS screw (7).
3. Remove the internal snap ring (5), and take out the shims (3). (4).
4. Tap out the 7T pinion shaft (2).

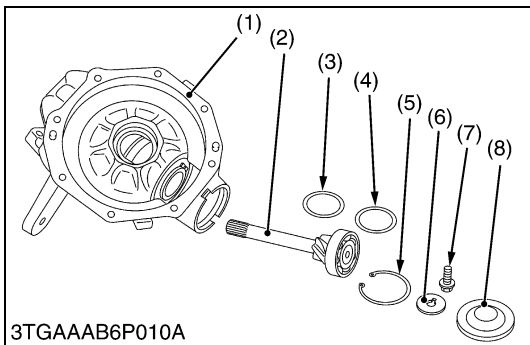
(When reassembling)

- Replace the cap (8) with new one.

Tightening torque	UBS screw	60.8 to 70.6 N·m 6.2 to 7.2 kgf·m 44.8 to 52.1 ft-lbs
-------------------	-----------	---

- | | |
|---------------------|------------------------|
| (1) Gear Case | (5) Internal Snap Ring |
| (2) 7T Pinion Shaft | (6) Washer |
| (3) Shim | (7) UBS Screw |
| (4) Shim | (8) Cap |

W1016155



Separating Gear Case

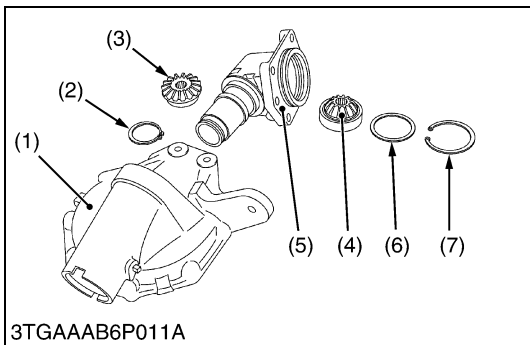
1. Remove the internal snap ring (7).
2. Take out the shim (6), 11T bevel gear (4) and 16T bevel gear (3) from bevel gear case (5).
3. Remove the external snap ring (2) from bevel gear case (5).
4. Tap out the gear case (1).

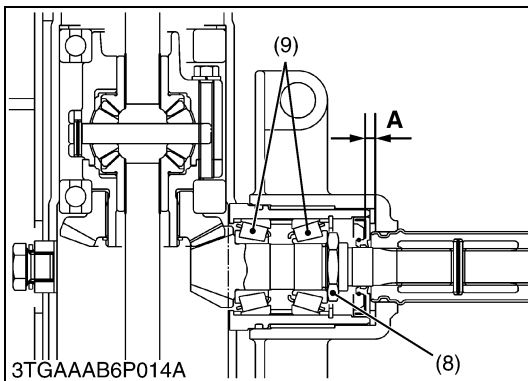
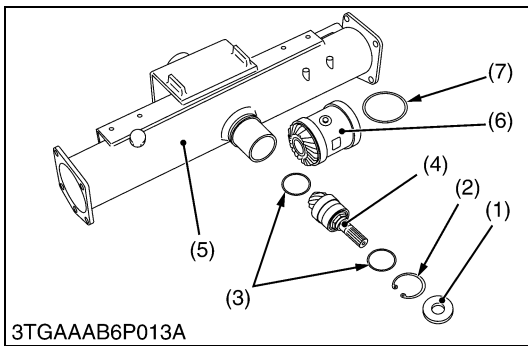
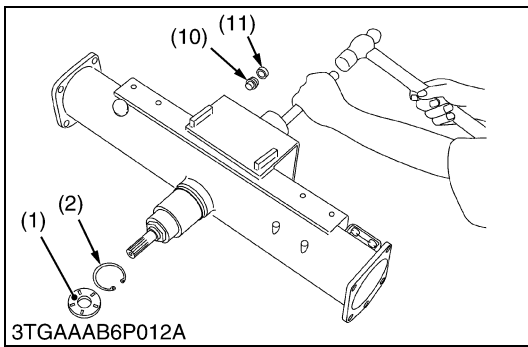
(When reassembling)

- Install the oil seal of gear case (1), noting its direction, and apply grease to it.
- Be sure to adjust the backlash between the bevel gears (3) and (4). (See page 6-S14.)

- | | |
|------------------------|------------------------|
| (1) Gear Case | (5) Bevel Gear Case |
| (2) External Snap Ring | (6) Shim |
| (3) 16T Bevel Gear | (7) Internal Snap Ring |
| (4) 11T Bevel Gear | |

W1016354





Spiral Bevel Pinion Shaft and Differential Gear Assembly

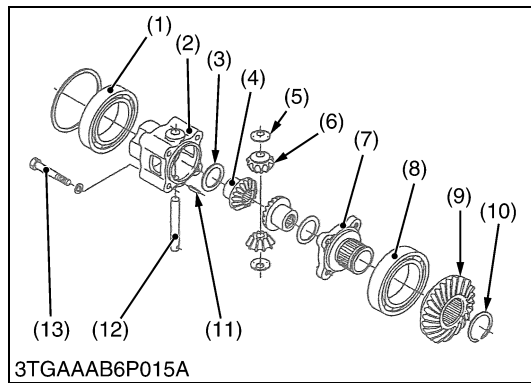
1. Remove the oil seal (1) and internal snap ring (2).
2. Take out the shim (3).
3. Remove the plug (10), (11).
4. Tap out the spiral bevel pinion shaft (4) to the rear side.
5. Take out the differential gear assembly (6) and adjusting collar (7) from left side of front axle case (5).
6. Remove the stake of lock nut (8) and then remove the lock nut (8).
7. Remove the taper roller bearings (9).

(When reassembling)

- Tighten up the lock nut (8) until the turning force of the spiral bevel pinion shaft reaches the factory specification. (See page 6-S13).
- Replace the lock nut (8) and oil seal (1) with new one.
- Apply grease to the oil seal (1).
- INstall the same shims and collars before they are removed.
- Install the taper roller bearings correctly, noting their direction, and apply gear oil to them.
- When press-fitting a oil seal, observe the dimension described in the figure (A).
- Stake the lock nut (8) firmly.

- | | |
|--------------------------------|-------------------------------|
| (1) Oil Seal | (8) Lock Nut |
| (2) Internal Snap Ring | (9) Taper Roller Bearing |
| (3) Shim | (10) Plug (Screw) |
| (4) Spiral Bevel Pinion Shaft | (11) Plug |
| (5) Front Axle Case | |
| (6) Differential Gear Assembly | A : 1.0 mm (0.039 in.) |
| (7) Adjusting Collar | |

W1016603



Differential Gear

1. Remove the ball bearing (1) with a puller.
2. Remove the differential case cover mounting screws (13), then take out the differential case cover (7), ball bearing (8) and spiral bevel gear (9) as a unit.
3. Remove the external snap ring (10), then remove the ball bearing (8) and spiral bevel gear (9).
4. Tap out the spring pin (11).
5. Pull out the differential pinion shaft (12), then take out the differential pinions (6) and differential side gears (4).

■ NOTE

- Arrange the parts to know their original position.

(When reassembling)

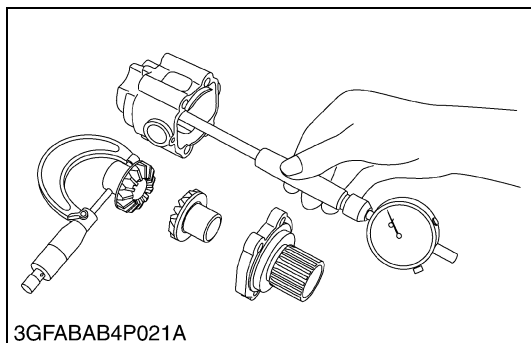
- Apply molybdenum disulfide (Three Bond 1901 or equivalent) to the inner circumferential surface of the differential side gears (4) and differential pinions (6).
- Install the differential pinion shaft (12) so that the hole on it may align with the hole on differential case (2), and install the spring pin (11).

Tightening torque	Differential case cover mounting screws	29.4 to 34.3 N·m 3.0 to 3.5 kgf·m 21.7 to 25.3 ft-lbs
-------------------	---	---

- | | |
|------------------------------|--------------------------------|
| (1) Ball Bearing | (8) Ball Bearing |
| (2) Differential Gear Case | (9) Spiral Bevel Gear |
| (3) Shim | (10) External Snap Ring |
| (4) Differential Side Gear | (11) Spring Pin |
| (5) Thrust Collar | (12) Differential Pinion Shaft |
| (6) Differential Pinion Gear | (13) Screw |
| (7) Differential Case Cover | |

W1017200

[3] SERVICING



3GFABAB4P021A

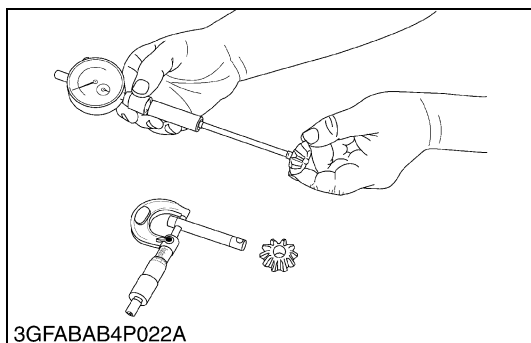
Clearance between Differential Case and Differential Side Gear and between Differential Case Cover and Differential Side Gear

1. Measure the differential side gear boss O.D..
2. Measure the differential case bore I.D. and calculate the clearance.
3. Measure the differential case cover bore I.D. and calculate the clearance.
4. If the clearance exceeds the allowable limit, replace faulty parts.

Clearance between differential case and differential side gear and between differential case cover and differential side gear	Factory spec.	0.040 to 0.094 mm 0.0016 to 0.0037 in.
	Allowable limit	0.20 mm 0.0079 in.

Differential case bore I.D. Differential case cover bore I.D.	Factory spec.	28.000 to 28.033 mm 1.1024 to 1.1037 in.
Differential side gear O.D.	Factory spec.	27.939 to 27.960 mm 1.1000 to 1.1008 in.

W1017594



3GFABAB4P022A

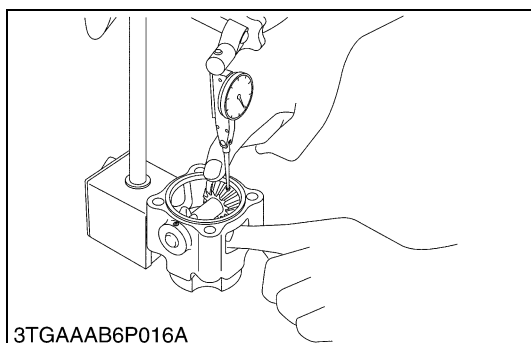
Clearance between Pinion Shaft and Differential Pinion

1. Measure the pinion shaft O.D..
2. Measure the differential pinion I.D. and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace faulty parts.

Clearance between pinion shaft and differential pinion	Factory spec.	0.048 to 0.084 mm 0.00189 to 0.00331 in.
	Allowable limit	0.20 mm 0.0079 in.

Pinion shaft O.D.	Factory spec.	10.966 to 10.984 mm 0.43173 to 0.43244 in.
Differential pinion I.D.	Factory spec.	11.032 to 11.050 mm 0.43433 to 0.43504 in.

W1017835



3TGAAAB6P016A

Backlash between Differential Pinion and Differential Side Gear

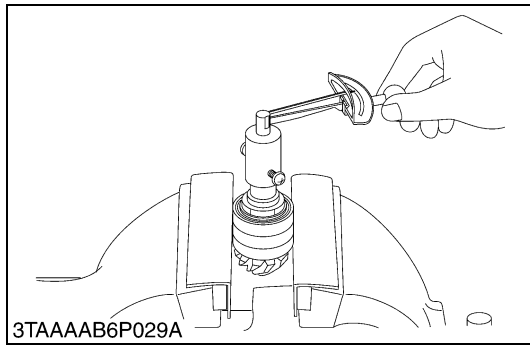
1. Set a dial gauge (lever type) on a tooth of the differential pinion.
2. Fix the differential side gear and move the differential pinion to measure the backlash.
3. If the measurement exceeds the factory specifications, adjust with the differential side gears shims.

Backlash between differential pinion and differential side gear	Factory spec.	0.1 to 0.3 mm 0.004 to 0.012 in.
---	---------------	-------------------------------------

(Reference)

- Thickness of differential side gear shims :
 - 0.8 mm (0.031 in.)
 - 1.0 mm (0.039 in.)
 - 1.2 mm (0.047 in.)

W1017973



3TAAAB6P029A

Turning Force of Spiral Bevel Pinion Shaft (Pinion Shaft Only)

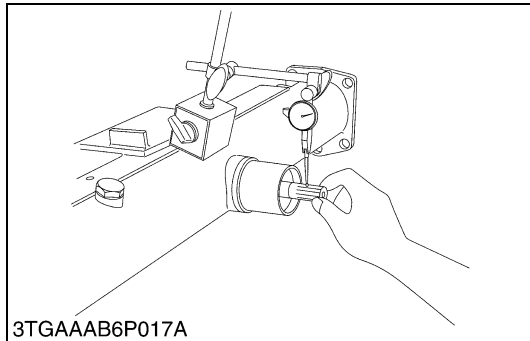
1. Clamp the spiral bevel pinion shaft assembly to the vise and tighten the staking nut.
2. Measure the turning torque of bevel pinion shaft.
3. If the turning force is not within the factory specifications, adjust with the lock nut.

■ NOTE

- After turning torque adjustment, be sure to stake the lock nut.

Turning force	Factory spec.	58.8 to 78.4 N 6.0 to 8.0 kgf 13.2 to 17.6 lbs
---------------	---------------	--

W1018125



3TGAAAB6P017A

Adjusting Backlash and Tooth Contact between Spiral Bevel Pinion Shaft and Spiral Bevel Gear

1. Set a dial gauge (lever type) with its finger on the spline of spiral bevel pinion shaft.
2. Measure the backlash by moving the spiral bevel pinion shaft by hand lightly.
3. If the backlash is not within the factory specification, change the adjusting collars (3), (4). Change the adjusting collar (4) to 0.1 mm (0.004 in.) smaller size, and change the adjusting collar (3) to 0.1 mm (0.004 in.) larger size.
4. Adjust the backlash properly by repeating the above procedures.
5. Apply red lead lightly over several teeth at three positions equally spaced on the bevel gear.
6. Turn the spiral bevel pinion shaft (2).
7. Check the tooth contact. If not proper, adjust with shim (5) and adjusting collars (3), (4) according to the instructions below :

Backlash between spiral bevel pinion shaft and spiral bevel gear	Factory spec.	0.1 to 0.3 mm 0.004 to 0.012 in.
--	---------------	-------------------------------------

(Reference)

- Thickness of adjusting collars (3), (4) :

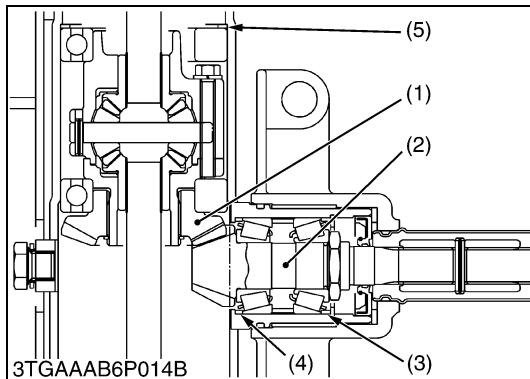
3.4 mm (0.134 in.)	4.1 mm (0.161 in.)
3.6 mm (0.142 in.)	4.2 mm (0.165 in.)
3.8 mm (0.150 in.)	4.4 mm (0.173 in.)
4.0 mm (0.157 in.)	4.6 mm (0.181 in.)
- Thickness of adjusting shims (5) :

1.9 mm (0.075 in.)	2.1 mm (0.083 in.)
2.0 mm (0.079 in.)	2.2 mm (0.087 in.)

■ NOTE

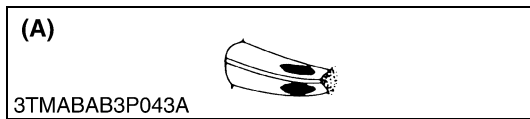
- After checking the tooth contact, checking the backlash between spiral bevel pinion shaft and spiral bevel gear again.

- | | |
|-------------------------------|----------------------|
| (1) Spiral Bevel Gear | (4) Adjusting Collar |
| (2) Spiral Bevel Pinion Shaft | (5) Shim |
| (3) Adjusting Collar | |



3TGAAAB6P014B

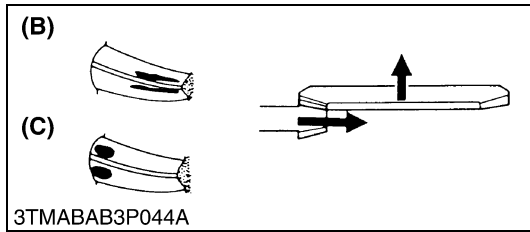
W1018396



More than 35 % red lead contact area on the gear tooth surface.
The center of tooth contact at 1/3 of the entire width from the small end.

(A) Proper Contact

W1018747



Replace the adjusting collars (3), (4) to move the bevel pinion shaft toward inside, and repeat above until the proper backlash and tooth contact are achieved.

For adjusting the tip contact, replace the shim (5) with a thinner one and repeat this procedure until the proper tip contact is achieved.

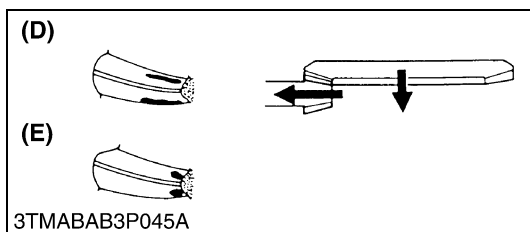
If the backlash is small, replace the shim (5) with a thicker one and repeat this procedure until the proper backlash is achieved.

Confirm the backlash and tooth contact again. Repeat above until the proper backlash and tooth contact are achieved.

(B) Shallow Contact

(C) Heel Contact

W1018900



Replace the adjusting collars (3), (4) to move the bevel pinion shaft toward inside, and repeat above until the proper backlash and tooth contact are achieved.

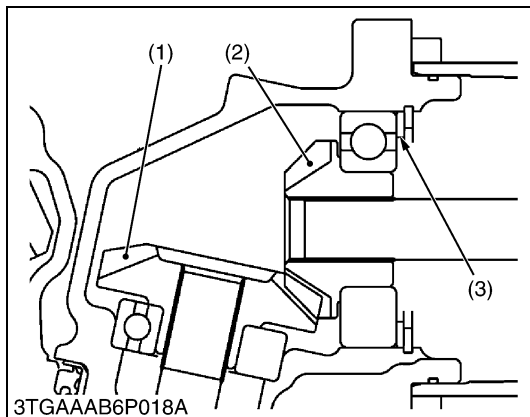
For adjusting the base contact, replace the shim (5) with a thinner one until the proper backlash is achieved.

Confirm the backlash and tooth contact again. Repeat above using the shim (5) and adjusting collars (3), (4) until the proper tooth contact is achieved.

(D) Deep Contact

(E) Toe Contact

W1018973



Backlash between 11T Bevel Gear and 16T Bevel Gear

1. Stick a strip of fuse to three spots on the 16T bevel gear (1) with grease.
2. Install the 11T bevel gear (2) and shim (3).
3. Turn the axle.
4. Remove the 11T bevel gear (2) and measure the thickness of the fuses with an outside micrometer.
5. If the backlash is not within the factory specification, adjust with shim (3).

Backlash between 11T bevel gear and 16T bevel gear	Factory spec.	0.15 to 0.35 mm 0.0059 to 0.0138 in.
--	---------------	---

(Reference)

- Thickness of adjusting shims (3) :
0.8 mm (0.031 in.) 1.2 mm (0.047 in.)
1.0 mm (0.039 in.)

(1) 16T Bevel Gear

(3) Shim

(2) 11T Bevel Gear

W1019038

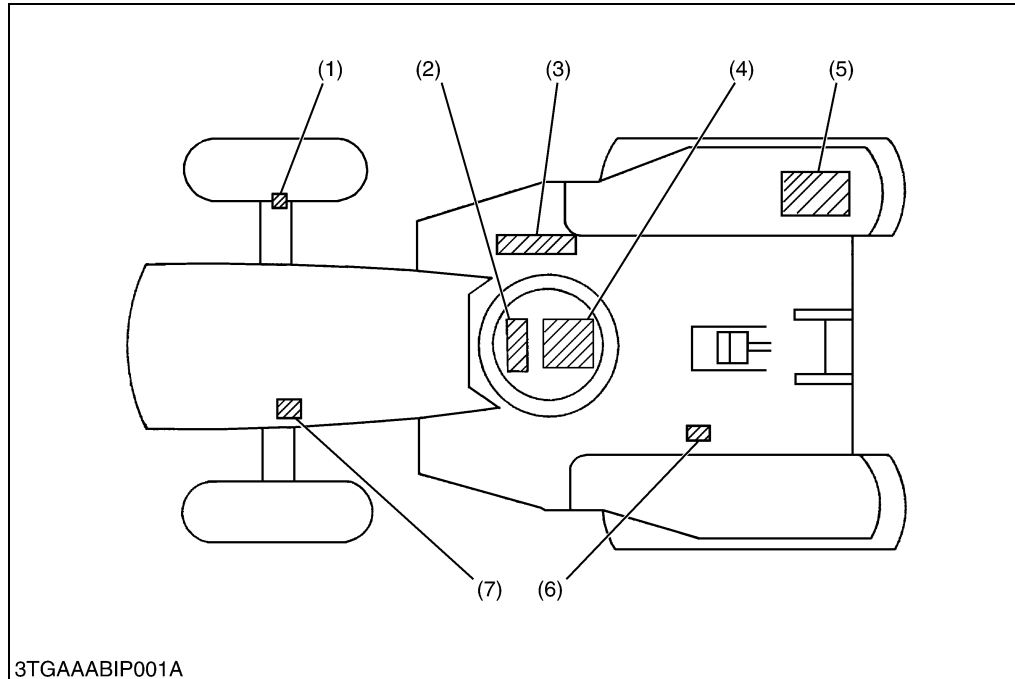
7 BI-SPEED TURN

MECHANISM

CONTENTS

1. STRUCTURE	7-M1
2. POWER TRAIN	7-M2
3. HYDRAULIC CIRCUIT	7-M3
4. ELECTRICAL CONTROL	7-M5
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[2] BI-SPEED SWITCH	7-M5
[3] ENGINE RUNNING SENSOR	7-M6
[4] FRONT WHEEL TURNING SENSOR	7-M6
[5] TRAVELLING SPEED SENSOR	7-M6

1. STRUCTURE



- (1) Front Wheel Turning Angle Sensor
- (2) Instrument Panel
- (3) Bi-speed Solenoid Valve
- (4) Hydraulic Clutch Pack
- (5) Bi-speed Controller
- (6) Travelling Speed Sensor
- (7) Engine Sensor (L Terminal)

W1014669

3TGAAABIP001A

It is used hydraulic and electrical control type bi-speed turn.

The front wheel turning angle sensor (1) is mounted on the front axle case detects the front wheel turning angle, the bi-speed controller (5) operate the bi-speed solenoid valve (3).

The solenoid valve operate the hydraulic clutch pack (4).

The terms of bi-speed turn as below.

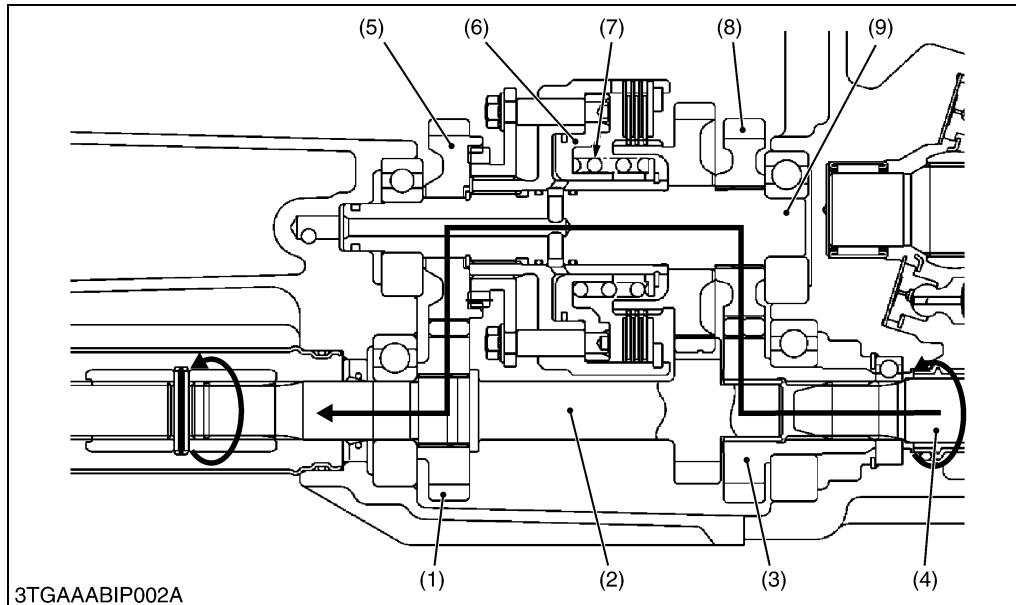
- Engine running
- 4WD mode
- Turned on the bi-speed switch
- Right or left tire turn to 0.61 rad. (35°) and more
- The travelling speed within 0.2 to 9.0 km/h (0.13 to 5.62 mph)

2. POWER TRAIN

The bi-speed hydraulic clutch pack is installed clutch housing case.

The power is transmitted as below.

■ 4WD (Not Bi-speed Turn)



- (1) 22T Gear
- (2) 18T Gear Shaft
- (3) 19T Gear
- (4) Front Drive Shaft
- (5) 27T Gear
- (6) Piston
- (7) Spring
- (8) 22T Gear
- (9) Counter Shaft

W1012894

3TGAAABIP002A

When the bi-speed turn is not operated, the front wheel turned less 0.61 rad. (35 °) or bi-speed switch has turned or travelling speed is not within 0.2 to 9.0 km/h (0.13 to 5.62 mph) the hydraulic clutch pack does not operate.

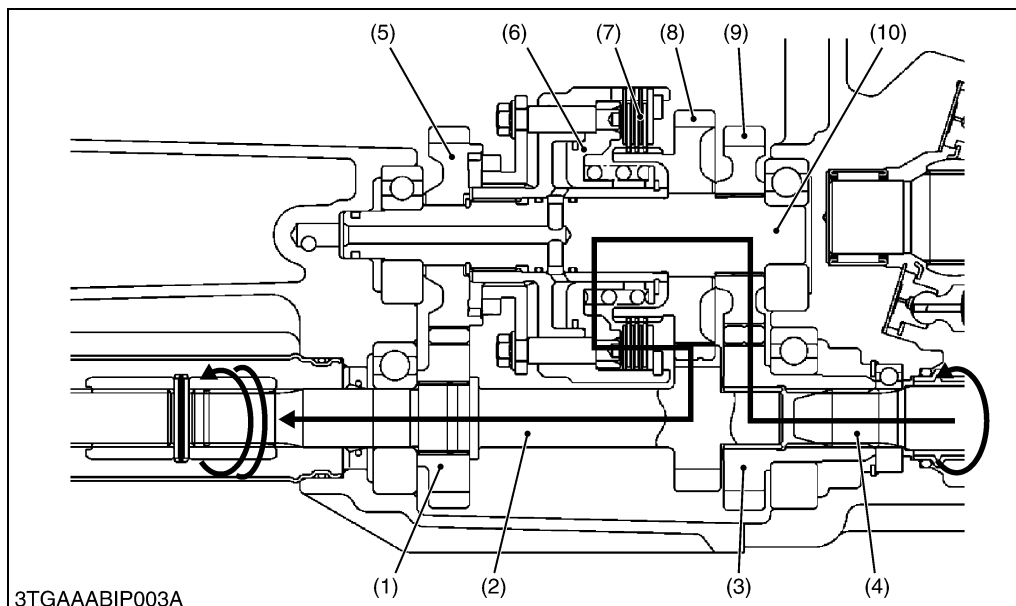
The piston (6) pushed by spring (7) and engage the 27T gear (5) with spline.

The power transmitted as follows.

Front Drive Shaft (4) → 19T Gear (3) → 22T Gear (8) → Counter Shaft (9) → 27T Gear (5) → 22T Gear (1) → 14T Gear Shaft (2)

In this case, 18T gear shaft (2) and front drive shaft (4) are same revolution.

■ Bi-speed Turn



- (1) 22T Gear
- (2) 18T Gear Shaft
- (3) 19T Gear
- (4) Front Drive Shaft
- (5) 27T Gear
- (6) Piston
- (7) Hydraulic Clutch
- (8) 32T Gear
- (9) 22T Gear
- (10) Counter Shaft

W1013080

3TGAAABIP003A

When the bi-speed solenoid valve is actuated, the piston (6) moved by hydraulic pressure.

Then piston (6) disengage from 27T gear (5) and engage the hydraulic clutch (7).

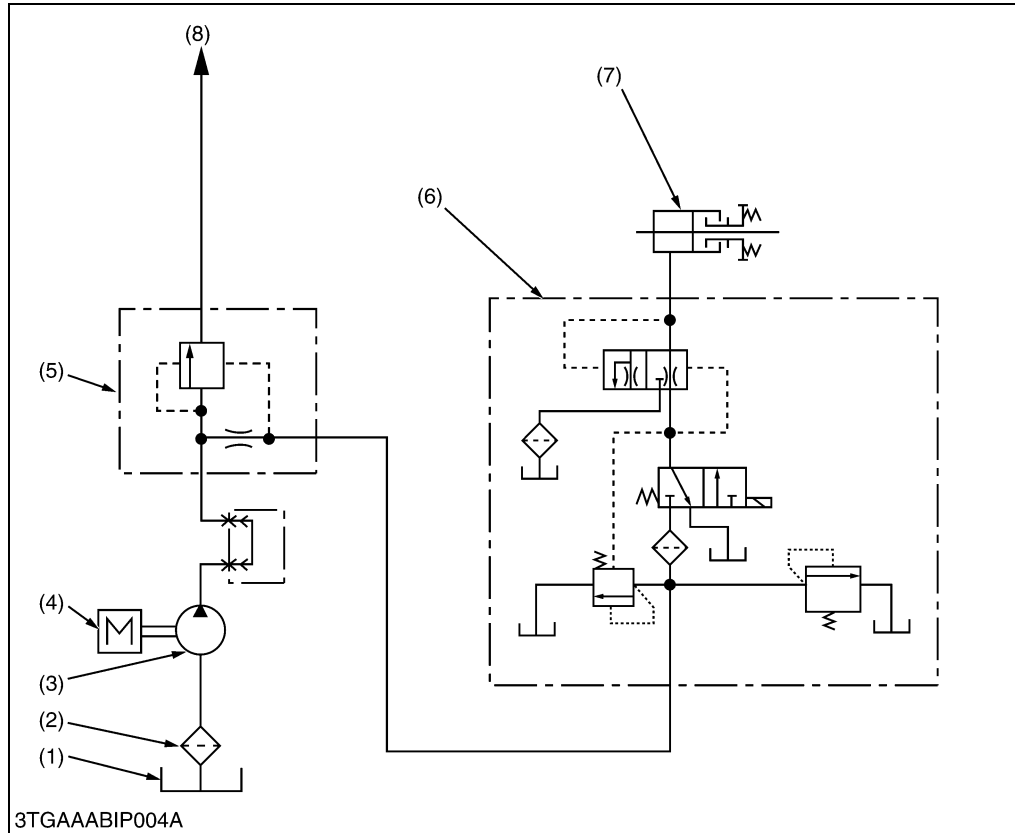
The power transmitted as follows.

Front Drive Shaft (4) → 19T Gear (3) → 22T Gear (9) → Counter Shaft (10) → Hydraulic Clutch (7) → 32T Gear (8) → 18T Gear Shaft (2).

In this case, 18T gear shaft (2) revolution speed is about approximately 2 times higher than the front drive shaft (4).

3. HYDRAULIC CIRCUIT

Bi-speed turn hydraulic circuit is constructed shown above, and oil flow is as follows.



- (1) Oil Tank (Transmission Case)
- (2) Oil Filter
- (3) Hydraulic Pump
- (4) Engine
- (5) Flow Priority Valve
- (6) Bi-speed Valve
- (7) Bi-speed Hydraulic Clutch Pack
- (8) To 3-point Linkage Circuit

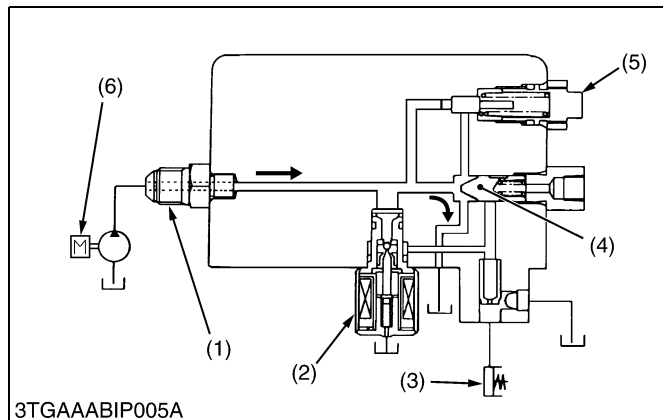
W1013299

3TGAAABIP004A

■ Oil Flow

Oil Tank (1) → Oil Filter (2) → Oil Pump (3) → Flow Priority Valve (5) → 3-Point Linkage Circuit (8)

Oil Tank (1) → Oil Filter (2) → Oil Pump (3) → Flow Priority Valve (5) → Bi-speed Valve (6) → Clutch Pack (7) → Tank (1).



3TGAAABIP005A

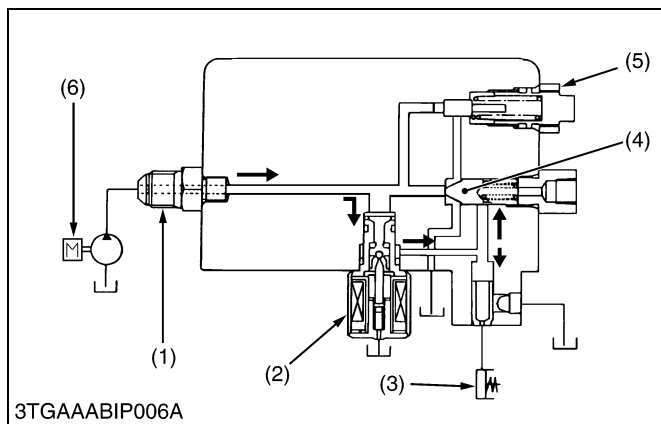
■ When Bi-speed Solenoid is not actuating

The port of hydraulic clutch (3) is closing when the bi-speed solenoid valve (2) is not actuated.

The oil from P port (1) are drain to transmission case through the unload valve (4).

- (1) P Port
- (2) Bi-speed Solenoid Valve
- (3) Hydraulic Clutch Pack for Bi-speed
- (4) Unload Valve
- (5) Relief Valve
- (6) Engine

W1013520



■ When Bi-speed Solenoid actuates (OFF → ON)

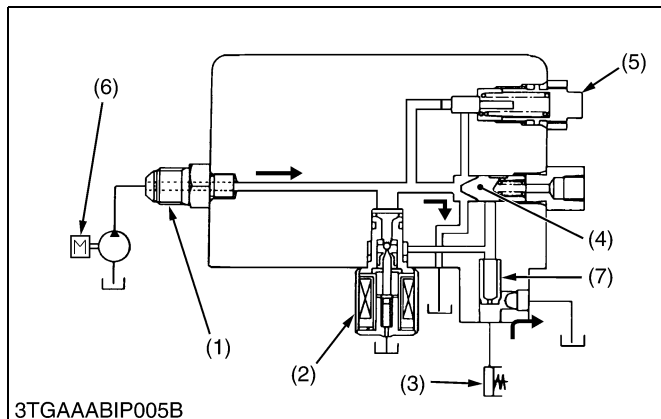
The port of hydraulic clutch (3) be opened when the bi-speed solenoid valve (2) is actuated.

The unload valve (4) will close the drain port by oil pressure that through the bi-speed solenoid valve (2).

The pressure increase until setting pressure of the relief valve (5), and operate the hydraulic clutch (3).

- | | |
|--|------------------|
| (1) P Port | (4) Unload Valve |
| (2) Bi-speed Solenoid Valve | (5) Relief Valve |
| (3) Hydraulic Clutch Pack for Bi-speed | (6) Engine |

W1013604



■ When Bi-speed Solenoid Valve goes off (ON → OFF)

When cut off the current to the bi-speed solenoid valve (2), the port of hydraulic clutch is closed by unload valve (4).

The oil in the hydraulic clutch, push back by return spring of hydraulic clutch spring, then pushed back oil open the orifice valve (7).

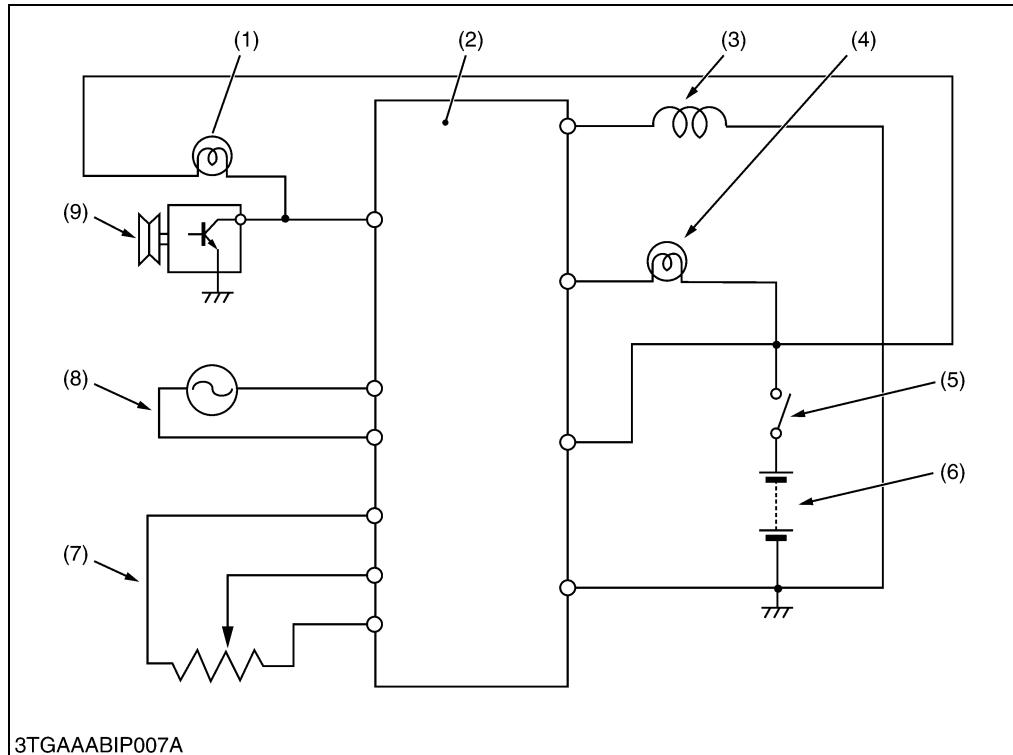
It makes quick hydraulic clutch work, with oil return to transmission case ease.

- | | |
|--|-------------------|
| (1) P Port | (4) Unload Valve |
| (2) Bi-speed Solenoid Valve | (5) Relief Valve |
| (3) Hydraulic Clutch Pack for Bi-speed | (6) Engine |
| | (7) Orifice Valve |

W1013679

4. ELECTRICAL CONTROL

[1] ELECTRICAL CIRCUIT



- (1) Charge Lamp
- (2) Controller
- (3) Bi-speed Solenoid
- (4) Bi-speed Indicate Lamp
- (5) Main Switch
- (6) Battery
- (7) Front Wheel Turning Angle Sensor
- (8) Travelling Speed Sensor
- (9) Alternator

W1015357

The bi-speed turn system is controlled by electric device as follows.

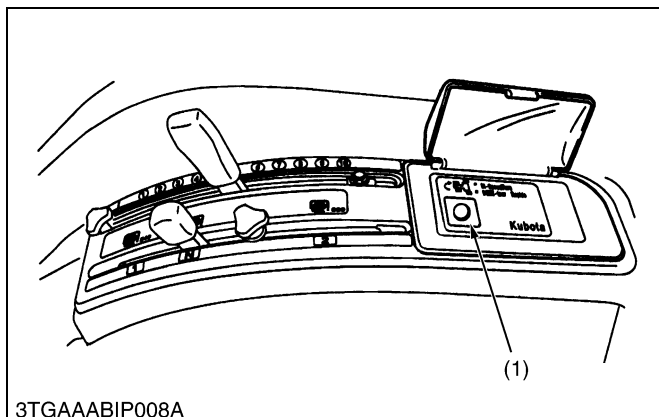
- Travelling speed sensor
- Front wheel turning angle sensor
- Bi-speed switch
- Engine running sensor (Alternator L terminal)
- Bi-speed solenoid valve

Those are controlled by controller unit.

This system equipped with fail-safe system.

If the electrical sensor (Bi-speed solenoid valve, front wheel turning angle sensor or travelling speed sensor) has failed, the bi-speed indicating lamp that located on the instrument panel will flash to mention the system failure. (Refer to 7-S6).

[2] BI-SPEED SWITCH

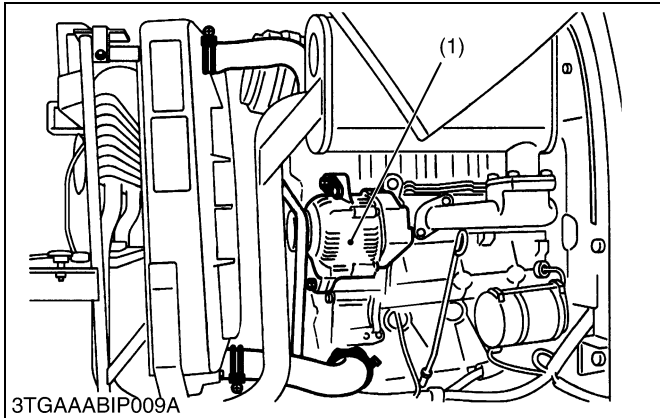


The bi-speed switch (1) mounted on the operation panel.

The switch mode indicated on the instrument panel.

- (1) Bi-speed Switch

W1015488

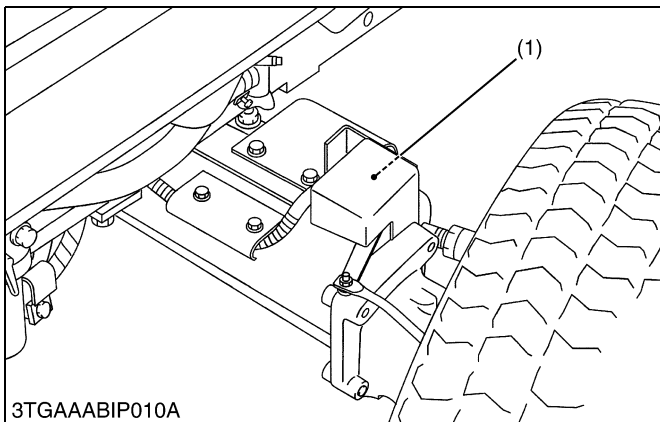
[3] ENGINE RUNNING SENSOR

The bi-speed system will not operate at engine stopping.

It is detected from L terminal voltage of alternator (1).

(1) Alternator

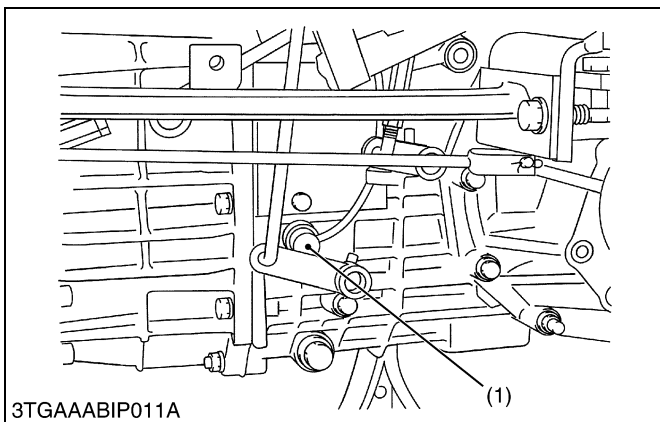
W1015587

[4] FRONT WHEEL TURNING SENSOR

The front wheel turning angle is detected by the front wheel turning angle sensor (1) mounted on the front axle case. For detection, a resistor are used.

(1) Front Wheel Turning Angle Sensor

W1014003

[5] TRAVELLING SPEED SENSOR

The travelling speed is detected by the travelling speed sensor (1) installed in the differential case.

This sensor generate the varies alternating voltage following the metal distance.

The sensor generate alternating voltage and detect to frequency from top and bottom of teeth of the gear 19-22T gap of rotating rear counter shaft.

The sensor detect the travelling speed with frequency that is in proportional to rotating speed of rear counter shaft.

(1) Travelling Speed Sensor

W1014070

SERVICING

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1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Bi-speed Turn system Does Not Operate or Slipping	<ul style="list-style-type: none"> • Front wheel turning angle sensor defect • Travelling speed sensor defect • Alternator broken • Bi-speed solenoid broken • Deficient the bi-speed hydraulic clutch • Clutch disc worn • Clutch piston scratched • Steel plate worn or deformed • Gear broken • Seal ring or O-ring damaged • Deficient the controller unit 	Replace Replace Check Replace Replace or repair Replace Replace or repair Replace Replace Replace Replace	7-S14 7-S13 10-S5 7-S13 7-S11 7-S11 7-S10 7-S11 7-S9 7-S9 7-S14
Bi-speed Turn Does Not Return to Standard 4WD Position	<ul style="list-style-type: none"> • Piston return spring broken or weak • Deficient the bi-speed turn hydraulic clutch • Clutch piston scratched • Steel plate worn or deformed • Bi-speed solenoid broken 	Replace Repair or replace Repair or replace Replace Replace	7-S11 7-S11 7-S10 7-S11 7-S13
Different Bi-speed Turn Starting Angle Between Right and Left Turning	<ul style="list-style-type: none"> • Steering cylinder improperly adjusted • Improper fine adjustment 	Adjust Adjust	– 7-S6

W1014322

2. SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Relief Valve (Bi-speed Solenoid Valve) Condition Engine Speed Maximum Oil Temperature .. 45 to 55 °C 113 to 131 °F	Setting Pressure	1.77 to 1.86 MPa 18.0 to 19.0 kgf/cm ² 256.01 to 270.24 psi	–
Unload Valve (Bi-speed Solenoid Valve) Condition Engine Speed Maximum Oil Temperature .. 45 to 55 °C 113 to 131 °F	Setting Pressure	0.2 to 0.49 MPa 2.0 to 5.0 kgf/cm ² 28.45 to 71.11 psi	–
Clutch Disc	Thickness	1.915 to 2.085 mm 0.07539 to 0.08209 in.	1.4 mm 0.055 in.
Steel Plate	Thickness	0.95 to 1.05 mm 0.0374 to 0.0413 in.	0.8 mm 0.031 in.
Pressure Plate	Thickness	1.95 to 2.05 mm 0.0768 to 0.0807 in.	1.8 mm 0.071 in.
Piston Return Spring	Free Length	44.0 mm 1.73 in.	–
	Setting Load / Setting Length	638.7 N / 26 mm 65.13 kgf / 26 mm 143.6 lbs / 1.02 in.	539.4 N / 26 mm 55.0 kgf / 26 mm 121.3 lbs / 1.02 in.
Counter Shaft B to 27T Gear	Clearance	0.040 to 0.082 mm 0.00157 to 0.00323 in.	0.1 mm 0.004 in.
Counter Shaft B	O.D.	24.959 to 24.980 mm 0.98264 to 0.98346 in.	–
27T Gear	I.D.	25.020 to 25.041 mm 0.98504 to 0.98587 in.	–
Counter Shaft B to 22T Gear	Clearance	0.040 to 0.082 mm 0.00157 to 0.00323 in.	0.1 mm 0.004 in.
Counter Shaft B	O.D.	28.459 to 28.480 mm 1.12043 to 1.12126 in.	–
22T Gear	I.D.	28.520 to 28.541 mm 1.12283 to 1.12366 in.	–
18T Gear Shaft to Bushing	Clearance	0.000 to 0.062 mm 0.00000 to 0.00244 in.	0.1 mm 0.004 in.
18T Gear Shaft	O.D.	17.989 to 18.000 mm 0.70823 to 0.70866 in.	–
Bushing	I.D.	18.000 to 18.051 mm 0.70866 to 0.71067 in.	–

W1013874

Item		Factory Specification	Allowable Limit	
Travelling Speed Sensor	Output Voltage (AC)	Approx. 1.0 V (AC)	–	
Bi-speed Solenoid Valve	Resistance	11 to 15 Ω	–	
Front Wheel Turning Angle Sensor Terminal A and Terminal C	Resistance	4.32 to 6.48 k Ω	–	
	Terminal B and Terminal C Changing of Resistance	Changing with smoothly	–	
Controller Unit Connector Voltage Terminal 4 and Terminal 8	Voltage measurement Condition	11 to 14 V (DC)	–	
	Output Voltage Terminal R/W and Chassis at Front Wheel Turning Angle Sensor Connector	Range Shift Lever ... Position 1 Cruise Control Lever ... Position 1	4.99 to 5.01 V (DC)	–
	Terminal G/W and Chassis at Bi-speed Solenoid Valve Connector	Engine Speed ... 1000 rpm	11 to 14 V (DC)	–

W1018920

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-9.)

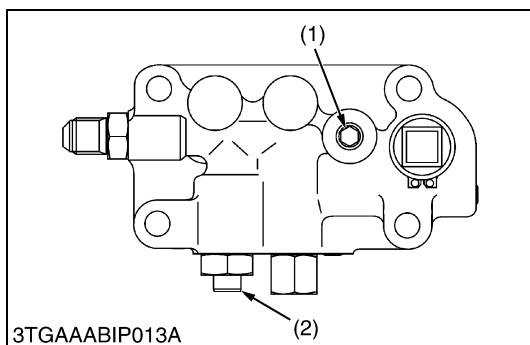
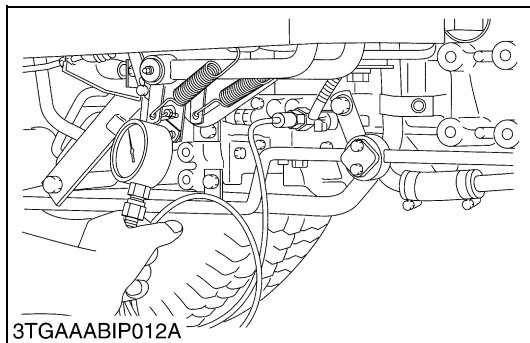
Item	N-m	kgf-m	ft-lbs
Bi-speed valve delivery pipe retaining nut	34 to 39	3.5 to 4.0	25.3 to 28.9
Bi-speed solenoid valve mounting screw	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
Clutch piston mounting nuts	9.8 to 11.8	1.0 to 1.2	7.2 to 8.7

W1012736

4. CHECKING, DISASSEMBLING AND SERVICING

[1] CHECKING AND ADJUSTING

(1) Bi-speed Solenoid Valve



Bi-speed Solenoid Valve Relief Pressure

1. Jack up the rear wheels and shift the front wheel drive lever to **OFF** position.
2. Remove the plug (1) then install the hydraulic test adaptor D (PT 1/8) and set a pressure tester.
3. Start the engine after warm up, measure the unload valve operating pressure.
4. If the measurement is not within the factory specification, check the operation of unload valve.
5. Set the bi-speed operating mode as follow.
 - Range shift lever : 1
 - Turn on the bi-speed : switch
 - Turn the front wheel right or left to 0.61 rad. (35 °) and more
 - Cruise control lever : 1 (Rotate the rear wheels)
6. Measure the bi-speed solenoid valve relief pressure. If the measurement is not within the factory specification, adjust the relief pressure with adjusting screw (2).



CAUTION

- **Be sure to disengage the front wheel drive, when checking the bi-speed solenoid valve relief valve.**

Unload valve operating pressure	Factory spec.	0.2 to 0.49 MPa 2.0 to 5.0 kgf/cm ² 28.45 to 71.11 psi
Relief valve setting pressure	Factory spec.	1.77 to 1.86 MPa 18.0 to 19.0 kgf/cm ² 256.01 to 270.24 psi

Condition

- Engine speed : Maximum
- Oil temperature : 45 to 55 °C
113 to 131 °F

(1) Plug

(2) Adjusting Screw

W1014483

(2) Fail Safe System

The bi-speed system equipped with “FAIL SAFE SYSTEM”, “FINE ADJUSTMENT MODE” and “SELF-DIAGNOSIS MODE”.

- The fail safe system mention to the operator for some trouble occurred while operating the tractor in usually.
- The fine adjustment mode is necessary to input when replace the front wheel angle sensor has been changed, to set the front tire angle information for the bi-speed controller, to proper bi-speed operation.
- The self-diagnosis mode to make easier for find out the trouble point when bi-speed system has been broken down. The handling method of there systems are as follow.

(A) When Indicating Fail Safe Lamp

When fail safe system is operate, the lamp blinking indicate as follows.

The lamp is mounted on instrument panel (Bi-speed indicating lamp).

[Lamp Blinking Chart]

Blinking mode	Related Sensor / Valve
Slow	Front wheel turning angle sensor
Slow	Disconnection for travelling speed sensor
Quick	Defective the bi-speed solenoid

Lamp Blinking Mode

Slow Lights up: 1.0 sec. Lights off: 0.2 sec.

Quick Lights up: 0.2 sec. Lights off: 0.2 sec.

(B) Fine Adjustment Mode

■ Fine adjustment function

A front wheel turning angle sensor has been introduced to detect the front wheel turning angle for better bi-speed control. This function is intended to correct fluctuations in sensor action with respect to the straight-run reference.

Procedure 1: Making the fine adjustment reference settings

1. Get the front wheels in the straight-run state.
2. Turn off the main switch.

Procedure 2: Changing to the fine adjustment mode

1. Hole down the bi-speed switch and turn on the main switch (The engine does not start). Now make sure the bi-speed lamp lights up and goes out 0.75 second later.
2. Release the bi-speed switch. This calls for the “fine adjustment and self-diagnosis mode”.

Procedure 3: Checking the lamp light-up and saving the fine adjustment data

1. First check up the bi-speed lamp.
If any setting is wrong or a component part is defective or malpositioned, the lamp starts blinking the number of times that corresponds to a trouble spot. See the “Self-diagnosis Mode”. The lamp remains off when there is nothing in trouble. If it is necessary to start the engine for making the settings again, turn off the main switch and repeat the above steps from step 1 in Procedure 1.
2. When the data is judged correct, the lamp lights up and stays on. Then hold down the bi-speed switch for longer than 3 seconds. (The lamp goes out just when this switch is pressed down.)
3. When the fine adjustment data has been properly saved, the bi-speed lamp lights up and stays on again. Now release the bi-speed switch.
4. If the data has not been saved properly, the bi-speed lamp starts flashing at shorter intervals. In such case, turn off the main switch and repeat the steps from Step 1 in Procedure 2.

Procedure 4: Exiting from the fine adjustment mode

1. Make sure the bi-speed lamp stay on. Finally turn off the main switch.

[Fine Adjustment and Self-Diagnosis Reference]

Description	Status	Related Sensor
Front wheel	Straight run	Front wheel sensor
Tractor body	Stop	Travelling speed sensor
Engine	Stop	—

(C) Self-diagnosis Mode

Procedure 1: Making the self-diagnosis reference settings

1. Get the front wheels in the straight-run state.
2. Turn off the main switch.

Procedure 2: Changing to the self-diagnosis mode

1. Hold down the bi-speed switch and turn on the main switch (The engine does not start). Now make sure the bi-speed lamp lights up and goes out 0.75 second later.
2. Release the bi-speed switch. This call for the “Fine adjustment and self-diagnosis mode”.

Procedure 3: Checking the lamp light-up and operating the self-diagnosis

1. First check up the bi-speed lamp. If any setting is wrong or a component part is defective or malpositioned, the lamp starts blinking the number of times that corresponds to a trouble spot. See the “Lamp Blinks Chart” below. If it is necessary to start the engine for making the settings again, turn off the main switch and repeat the above step from step 1 in procedure 1.
2. When the judgement is correct, the bi-speed lamp lights up and stays on.

Procedure 4: Exiting from the self-diagnosis mode

1. Turn off the main switch.

[Lamp Blinking Chart]

Number of blinking (times)	Defective Sensor
22	Front wheel turning angle sensor
18	Travelling speed sensor

■ NOTE

- The lamp flashes at the following intervals: 1.1-second on for the tens digit, 0.4-second on for the units digit and 0.4-second off between two on's.
- A 1.5-second off interval is put between two different pieces of data.

(D) Bi-speed Restraint Check

The bi-speed restraint function is designed to deactivate the bi-speed control when the machine is at a halt or running at low speed (below 0.2 km/h) or high speed (above 9.0 km/h).

The following procedures are to check the travelling speed sensor output and the controller's bi-speed restraint function.

Procedure 1: Changing to the bi-speed restraint check mode

1. Hold down the bi-speed switch and turn on the main switch (The engine does not start). Now make sure the bi-speed lamp lights up and goes out 0.75 second later.
2. Release the bi-speed switch. This calls for the “Fine adjustment and self-diagnosis mode”.
3. With the machine in the above mode, start the engine. The controller monitors the potential at the alternator terminal L and calls for the “bi-speed restraint check mode” when the engine is detected to get started. (In this mode, the bi-speed control does not work. The bi-speed restraint, depending on the input from the travelling speed sensor but regardless of the front wheel turning angle sensor output, is shown with the bi-speed lamp.)

Procedure 2: Checking the travelling speed sensor input

1. Drive the tractor straight in each of the following 3 conditions and look at the bi-speed indicating lamp to see if the bi-speed restraint works accordingly. The travelling speed sensor is mounted on the 33T gear of differential gear case.

(Reference)

	Approximate travelling speed with standard tire	Bi-speed indicating lamp
A	0 to 0.2 km/h (0 to 0.13 mph)	Lamp off
B	0.2 to 9.0 km/h (0.13 to 5.62 mph)	Lamp on
C	over 9.0 km/h (over 5.62 mph)	Lamp off

Checking condition A: Tractor at stop

Checking condition B: Drive the tractor with range gear shift 1, depress the HST foot pedal halfway for forward at engine speed around 1000 rpm

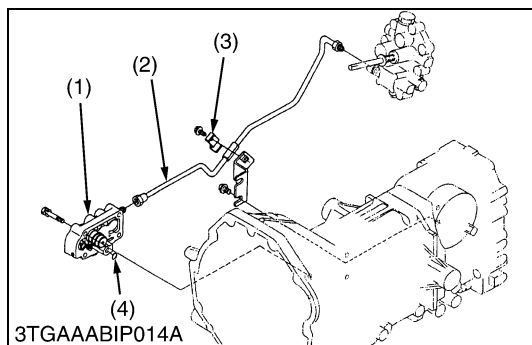
Checking condition C: Drive the tractor with range gear shift 2, depress the HST foot pedal fully for forward at engine speed around 2000 rpm

Procedure 3: Checking the bi-speed control output

1. Switch off the ignition key (main switch).
2. Switch on the ignition key (main switch) again to start the engine. Enter the ordinary control mode.
3. Turn on the bi-speed mode and turn the tractor right and left to make sure the bi-speed control functions.
4. Turn off the bi-speed mode and turn the tractor right and left to make sure the bi-speed control does not function.

Procedure 4: Exiting from the bi-speed restraint check mode

1. Turn off the main switch.
2. The bi-speed restraint mode can be accepted through the above two procedures "Checking the travelling speed sensor input" and "Checking the bi-speed control output".

[2] DISASSEMBLING AND ASSEMBLING**(1) Bi-speed Solenoid Valve****Draining Transmission Fluid**

1. See Page G-13.

W1019911

Removing Bi-speed Solenoid Valve

1. Remove the bi-speed solenoid valve delivery pipe (2) retaining nut from solenoid valve (1).
2. Remove the pipe clamp (3).
3. Remove the bi-speed solenoid valve assembly.

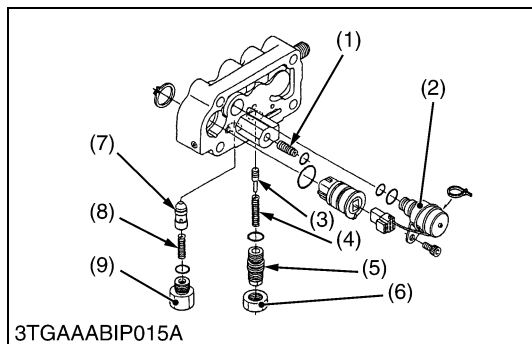
(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to the bi-speed solenoid valve case.
- Be sure to fix the O-ring (4).

Tightening torque	Bi-speed valve delivery pipe retaining nut	34 to 39 N·m 3.5 to 4.0 kgf·m 25.3 to 28.9 ft·lbs
	Bi-speed solenoid valve mounting screw	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft·lbs

- (1) Bi-speed Solenoid Valve (3) Clamp
(2) Bi-speed Solenoid Valve Delivery Pipe (4) O-ring

W1019978

**Bi-speed Solenoid Valve Assembling**

1. Remove the plug (9) and draw out the unload valve (7) and unload spring (8).
2. Loosen the lock nut (6) and unscrew the adjusting screw (5).
3. Draw out the relief valve (3) and relief valve spring (4).
4. Remove the solenoid valve mounting screw and remove the solenoid valve (2).

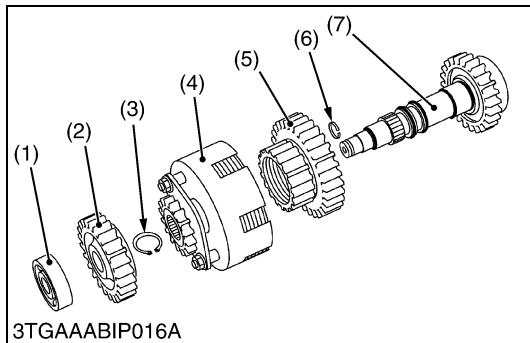
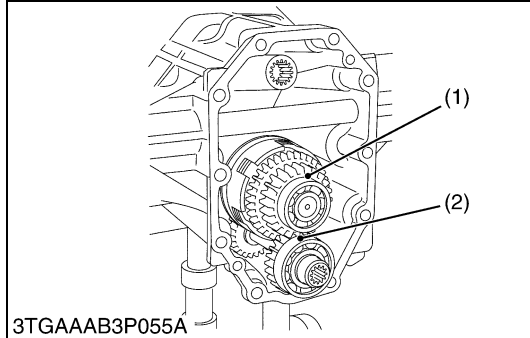
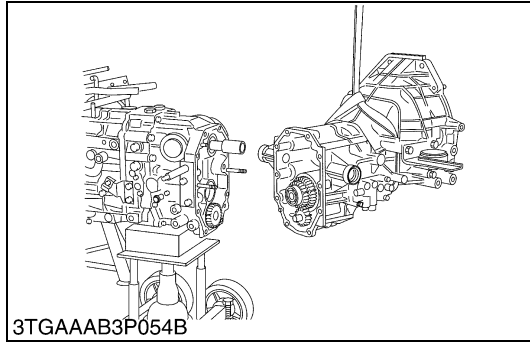
(When reassembling)

- Be sure to adjust the relief valve setting pressure, if remove the adjusting screw (5).

- (1) Orifice Valve (6) Lock Nut
(2) Solenoid Valve (7) Unload Valve
(3) Relief Valve (8) Unload Valve Spring
(4) Relief Valve Spring (9) Plug
(5) Adjusting Screw

W1020326

(2) Bi-speed Clutch Pack



Separate the Clutch Housing

1. Refer to “DISASSEMBLING AND ASSEMBLING” section of 3. TRANSMISSION.

(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to the mission case.

W1020780

Bi-speed Turn Hydraulic Clutch Assembly and 18T Gear Shaft

1. Take out the bi-speed turn hydraulic clutch assembly (1) with 18T gear shaft (2) from the clutch housing case.

(When reassembling)

- Apply grease to the oil seal of the clutch housing.

- (1) Bi-speed Turn Hydraulic Clutch Assembly (2) 18T Gear Shaft

W1021031

Bi-speed Turn Hydraulic Clutch

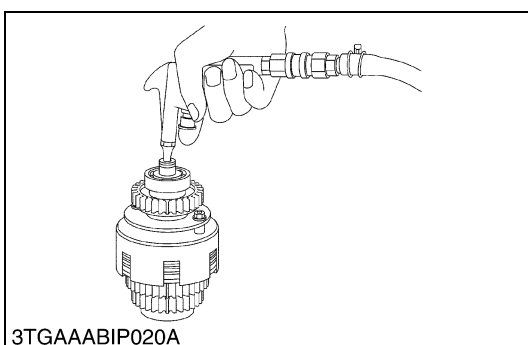
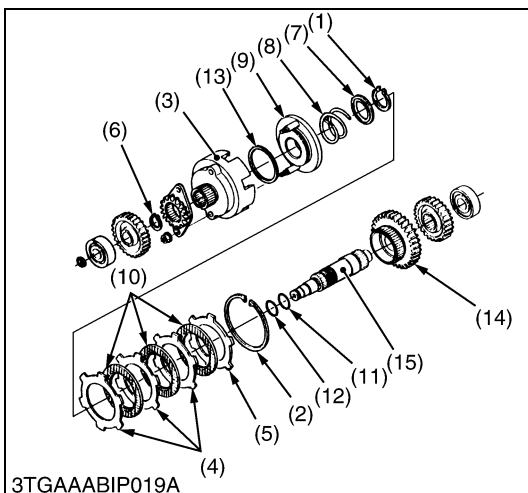
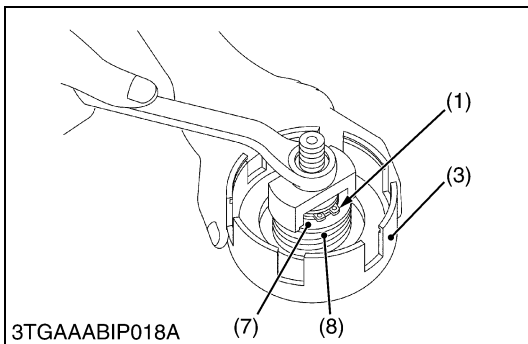
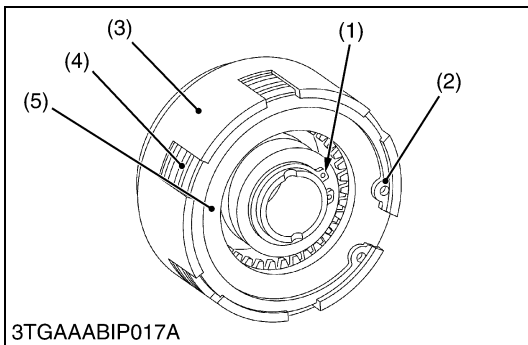
1. Take out the seal ring (6) from the counter shaft B (7).
2. Remove the bearing (1) with a puller, then take out the 27T gear (2).
3. Remove the external snap ring (3), then take out the bi-speed turn hydraulic clutch (4) and 22T gear (5).

(When reassembling)

- Apply molybdenum disulfide (Three Bond 1901 or equivalent) to the inner circumferential surface of the 27T gear (2) and 22T gear (5).
- Install the seal ring (6) to the counter shaft B (7) groove firmly.

- (1) Bearing (5) 22T Gear
 (2) 27T Gear (6) Seal Ring
 (3) External Snap Ring (7) Counter Shaft B
 (4) Bi-speed Turn Hydraulic Clutch

W1021223



Disassembling Bi-speed Turn Hydraulic Clutch

1. Remove the internal snap ring (2), then take out the three pressure plates (5), three clutch discs (10) and three steel plates (4).
2. Remove the external snap ring (1) with clutch pack disassembling tool (Code No.: 07916-53741), then take out the collar (7) and spring (8).

(When reassembling)

- Apply gear oil to the O-ring (11), (12) and D-ring (13), and take care not to damage them.
- Direct the convex side of collar (7) to the spring (8) side.
- Install the external snap ring (1) with its direction of sharp edge face is 22T gear side (14).
- Make sure the bi-speed turn hydraulic clutch is in position. Now feed compressed air (about 5 kgf/cm²) through the bi-speed turn port of the counter shaft B (15) to see if the piston (9) moves smoothly.
- Install the internal snap ring (2) with its catch fitting the groove of the clutch case (3). Be sure also that the sharp edge face is on the other side of the pressure plate (5).
- Stake the clutch piston mounting nuts firmly with punch, after tightening them.

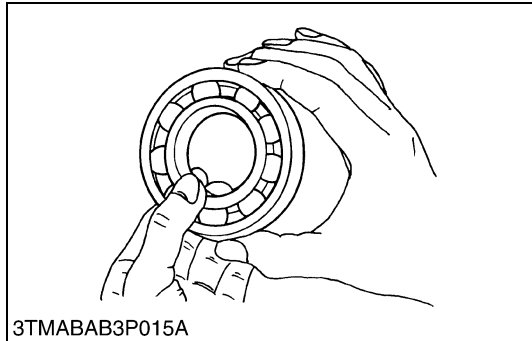
Tightening torque	Clutch piston mounting nuts	9.8 to 11.8 N-m 1.0 to 1.2 kgf-m 7.2 to 8.7 ft-lbs
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- (1) External Snap Ring
- (2) Internal Snap Ring
- (3) Clutch Case
- (4) Steel Plate
- (5) Pressure Plate
- (6) External Snap Ring
- (7) Collar
- (8) Spring
- (9) Piston
- (10) Clutch Disc
- (11) O-ring
- (12) O-ring
- (13) D-ring
- (14) 22T Gear
- (15) Counter Shaft B

W1021754

[3] SERVICING

(1) Bi-speed Hydraulic Clutch Pack and Gears

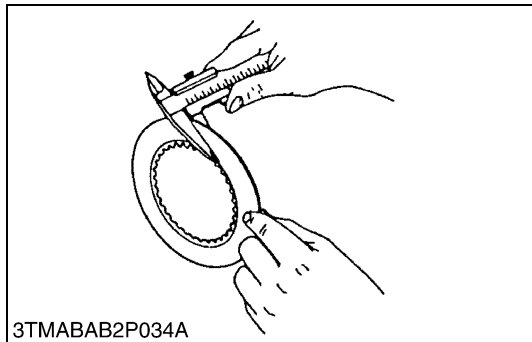


3TMABAB3P015A

Checking Bearing

1. Hold the inner race, and push and pull the outer race in all directions to check for wear and roughness.
2. Apply transmission fluid to the bearing, and hold the inner race. Then, turn the outer race to check rotation.
3. If there is any defect, replace it.

W1024036



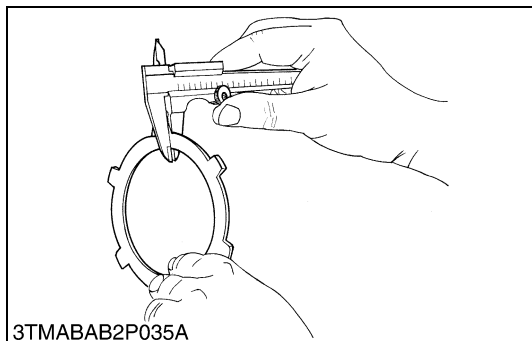
3TMABAB2P034A

Clutch Disc Wear

1. Measure the clutch disc thickness with vernier calipers.
2. If the thickness is less than the allowable limit, replace it.

Clutch disc wear	Factory spec.	1.915 to 2.085 mm 0.07539 to 0.08209 in.
	Allowable limit	1.4 mm 0.055 in.

W1024320



3TMABAB2P035A

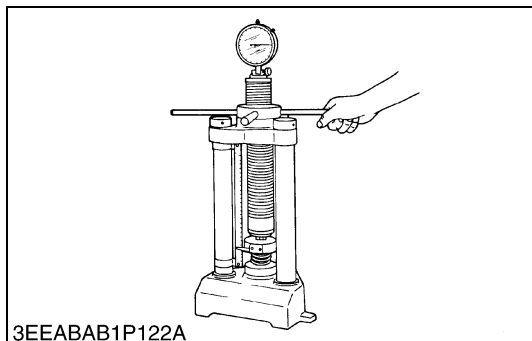
Steel Plate and Pressure Plate Wear

1. Measure the steel plate thickness with vernier calipers.
2. Measure the pressure plate thickness with vernier calipers.
3. If the thickness is less than the allowable limit, replace.

Steel plate wear	Factory spec.	0.95 to 1.05 mm 0.0374 to 0.0413 in.
	Allowable limit	0.8 mm 0.031 in.

Pressure plate wear	Factory spec.	1.95 to 2.05 mm 0.0768 to 0.0807 in.
	Allowable limit	1.8 mm 0.071 in.

W1024487



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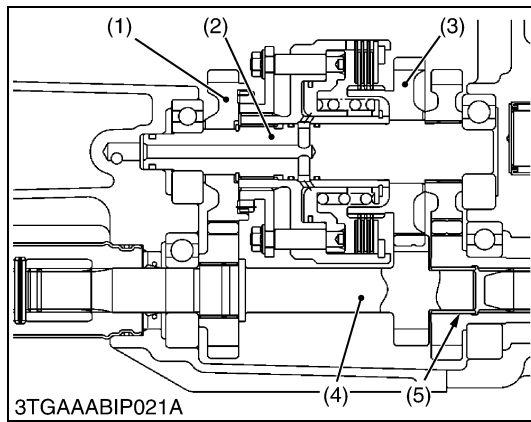
Piston Return Spring Free Length and Tension

1. Measure the free length of the piston return spring with vernier calipers.
2. Place the piston return spring on a spring compression tester and compress to the specified length, and read the gauge.
3. If the measurement is less than the allowable limit, replace.

Piston / return spring free length	Factory spec.	44 mm 1.73 in.
------------------------------------	---------------	-------------------

Piston return spring tension	Factory spec.	638.7 N / 26 mm 65.13 kgf / 26 mm 143.6 lbs / 1.02 in.
	Allowable limit	539.4 N / 26 mm 55 kgf / 26 mm 121.3 lbs / 1.02 in.

W1024789



Clearance between Counter Shaft B and 27T Gear

1. Measure the counter shaft B O.D. (2) with an outside micrometer.
2. Measure the 27T gear I.D. (1) with an inside micrometer, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace.

Clearance between counter shaft B and 27T gear	Factory spec.	0.040 to 0.082 mm 0.00157 to 0.00323 in.
	Allowable limit	0.1 mm 0.004 in.
Counter shaft B O.D.	Factory spec.	24.959 to 24.980 mm 0.98264 to 0.98346 in.
27T gear I.D.	Factory spec.	25.020 to 25.041 mm 0.98504 to 0.98587 in.

(1) 27T Gear

(2) Counter Shaft B

W1025223

Clearance between Counter Shaft B and 22T Gear

1. Measure the counter shaft B O.D. (2) with an outside micrometer.
2. Measure the 22T gear I.D. (3) with an inside micrometer, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace.

Clearance between counter shaft B and 22T gear	Factory spec.	0.040 to 0.082 mm 0.00157 to 0.00323 in.
	Allowable limit	0.1 mm 0.004 in.
Counter shaft B O.D.	Factory spec.	28.459 to 28.480 mm 1.12043 to 1.12126 in.
22T gear I.D.	Factory spec.	28.520 to 28.541 mm 1.12283 to 1.12366 in.

(2) Counter Shaft B

(3) 22T Gear

W1025492

Clearance between 18T Gear Shaft and Bushing

1. Measure the 18T gear shaft O.D. (4) with an outside micrometer.
2. Measure the bushing I.D. (5) with an inside micrometer, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace

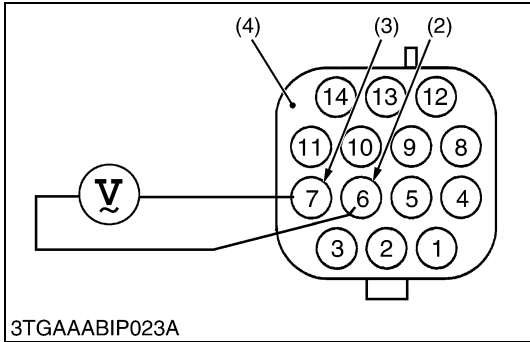
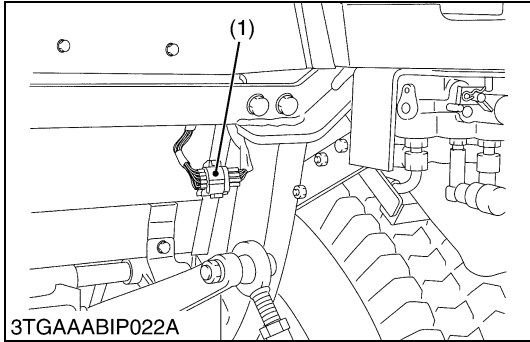
Clearance between 18T gear shaft and bushing	Factory spec.	0.000 to 0.062 mm 0.00000 to 0.00244 in.
	Allowable limit	0.1 mm 0.004 in.
18T gear shaft O.D.	Factory spec.	17.989 to 18.000 mm 0.70823 to 0.70866 in.
Bushing I.D.	Factory spec.	18.000 to 18.051 mm 0.70866 to 0.71067 in.

(4) 18T Gear Shaft

(5) Bushing

W1025700

(2) Sensors, Controller Unit and Solenoid Valve



Travelling Speed Sensor

1. Disconnect the connector (1).
2. Jack up the rear wheels and shift the front wheel drive lever to **OFF** position.
3. Start the engine and turn the rear wheel as follow condition.
 - Range shift lever : 1
 - Cruise control lever : 1
 - Engine speed : around 1000 rpm
4. Measure the travelling speed sensor voltage on the connector's terminal of wire harness side (Gray / Red (3) – Gray / Black (2))

CAUTION

- Be sure to disengage the front wheel drive, when checking the travelling sensor with rotate the rear wheel.

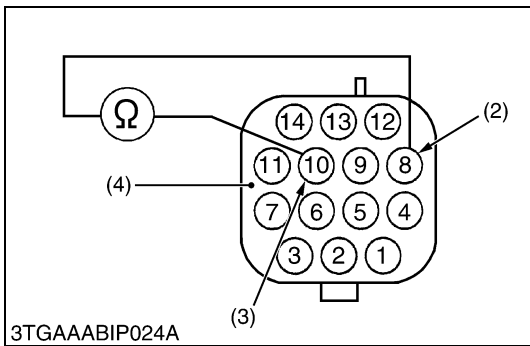
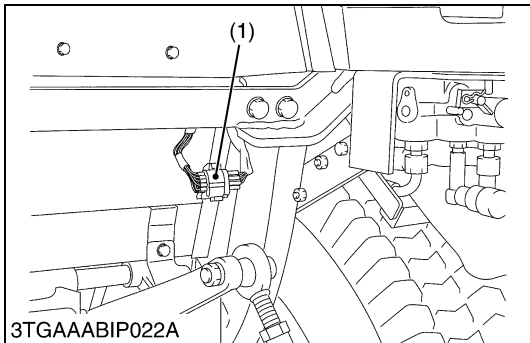
NOTE

- The analog type tester may not check for voltage.
- There is no need to “Fine adjustment” about travelling speed sensor if replaced.
- Be sure to check the alternate voltage range.

Output alternate voltage of travelling speed sensor	Factory spec.	GY/R (3) – GY/W (2)	Approx. AC 1.0 V
---	---------------	---------------------	------------------

- (1) Connector
- (2) GY/B Wire Terminal
- (3) GY/R Wire Terminal
- (4) Connector (Wire Harness)

W1013027



Bi-speed Solenoid Valve

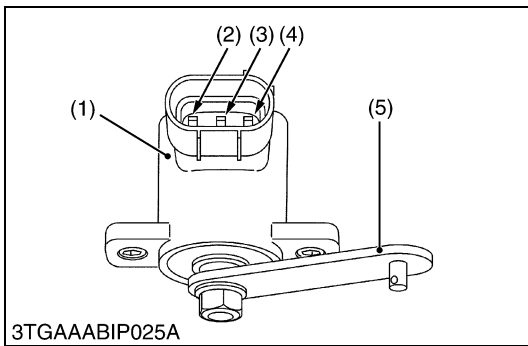
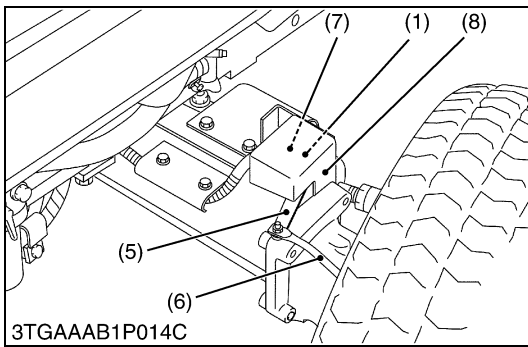
[Solenoid]

1. Disconnect the connector (1).
2. Measure the bi-speed solenoid valve resistance between ground terminal (2) and solenoid valve terminal (Green / White) (3).
If the measurement is not within the factory specifications, replace it.

Resistance between bi-speed solenoid valve and ground	Factory spec.	B (3) – G/W (2)	11 to 15 Ω
---	---------------	-----------------	-------------------

- (1) Connector
- (2) Black Terminal (Ground)
- (3) G/W Terminal
- (4) Connector (Wire Harness)

W1013314



Front Wheel Turning Angle Sensor

1. Separate the arm (6) from angle sensor lever (5).
 2. Disconnect the connector (7).
 3. Remove the sensor with sensor cover (8), then remove the sensor from sensor cover (8).
 4. Measure the angle sensor resistance between the terminal **A** (2) and ground terminal **C** (4).
 5. Set the test lead of tester between terminal **B** (3) and ground terminal **C** (4).
- Turn the sensor lever (5) slowly and check the changing of resistance value.
6. If measurement is not within the factory specifications, replace it.

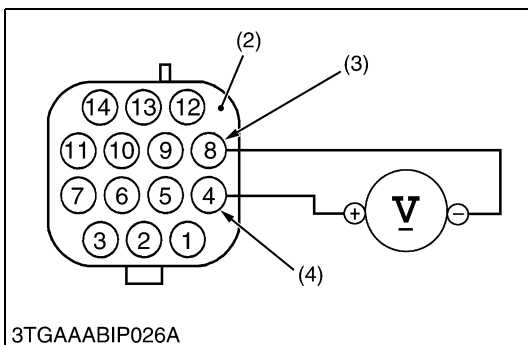
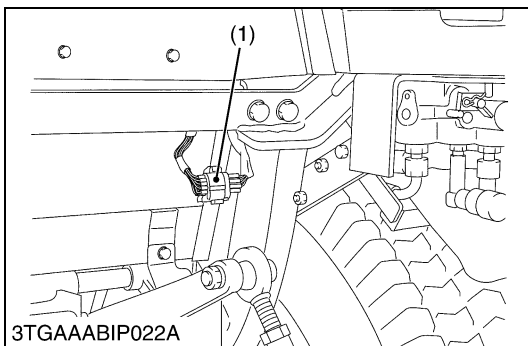
■ IMPORTANT

- If replaced a front wheel turning angle sensor, be sure to operate the “Fine adjustment system”.

Wheel turning angle sensor resistance	Factory spec.	Terminal A – Terminal C	4.32 to 6.48 k Ω
Changing of resistance value		Terminal B – Terminal C	Changing with smoothly

- (1) Front Wheel Turning Angle Sensor (5) Lever
 (2) Terminal **A** (6) Arm
 (3) Terminal **B** (7) Connector
 (4) Terminal **C** (Ground) (8) Sensor Cover

W1013508



Controller Unit

■ NOTE

- The controller used micro-computer, it is necessary a special checking instrument to inspect it.
- Check the connector voltage and output voltage. If there functions are in good condition, the controller unit may damaged.

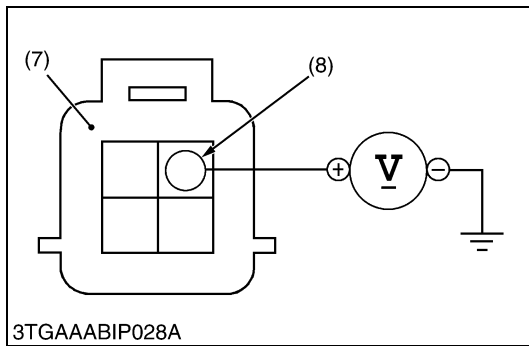
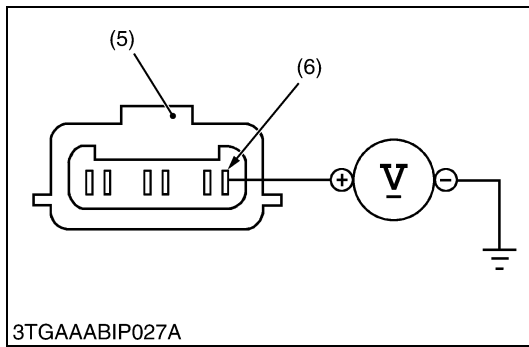
1) Connector Voltage

1. Disconnect the connector (1).
2. Turn the main switch to **ON** position. It is not necessary to run the engine.
3. Measure the voltage with voltmeter across the terminal **4** (4) and terminal **8** (3). If the voltage differs from the battery voltage, check the fuse, wiring harness or ground condition.

Voltage	Terminal 4 and Terminal 8	Battery voltage (11 to 14 V)
---------	---	------------------------------

- (1) Connector (3) Terminal **4**
 (2) Connector (Harness Side) (4) Terminal **8**

W1015274



2) Output Voltage

1. Remove the connector for front wheel turning angle sensor and bi-speed solenoid valve.
2. Jack up the rear wheels and shift the front wheel drive lever to **OFF** position.
3. Start the engine and turn the rear wheels as follow condition.
 - Range shift lever : 1
 - Cruise control lever : 1
 - Engine speed : around 1000 rpm
4. Measure the voltage across the following terminals and chassis. If the voltage differs from the factory specifications, check the wire harness.

⚠ CAUTION

- **Be sure to disengage the front wheel drive, when checking the voltages with rotate the rear wheel.**

Voltage	Terminal (6) and chassis	4.99 to 5.01 V
	Terminal (8) and chassis	Battery voltage (11 to 14 V)

- (5) Front Wheel Turning Angle Sensor Connector
 (6) Terminal (R/W)
 (7) Bi-speed Solenoid Valve Connector
 (8) Terminal (G/W)

W1015491

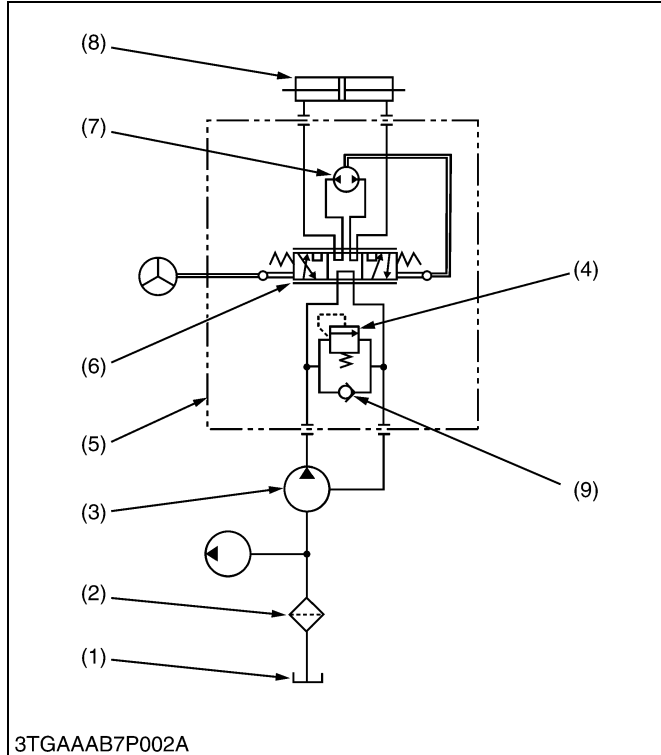
8 STEERING

MECHANISM

CONTENTS

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2. HYDRAULIC CIRCUIT FOR POWER STEERING SYSTEM



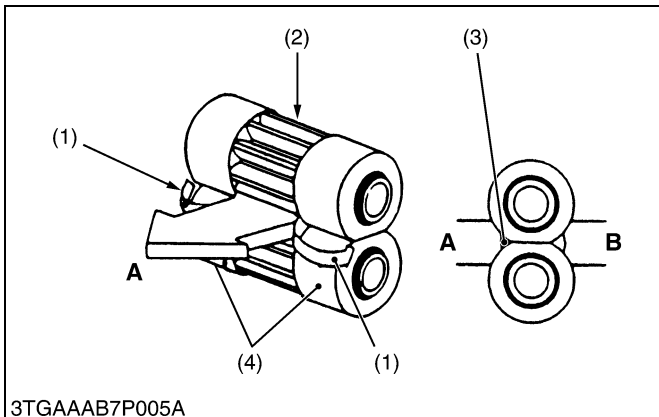
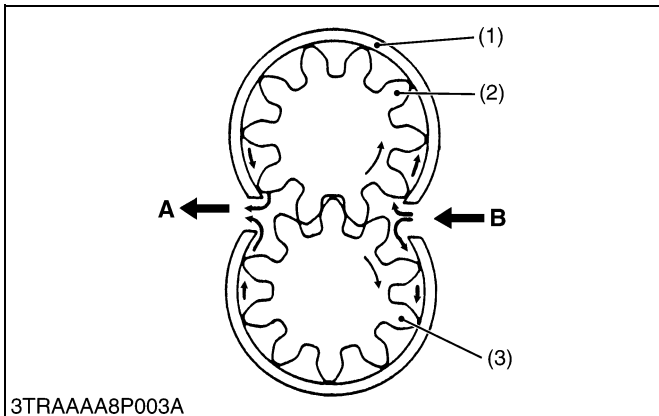
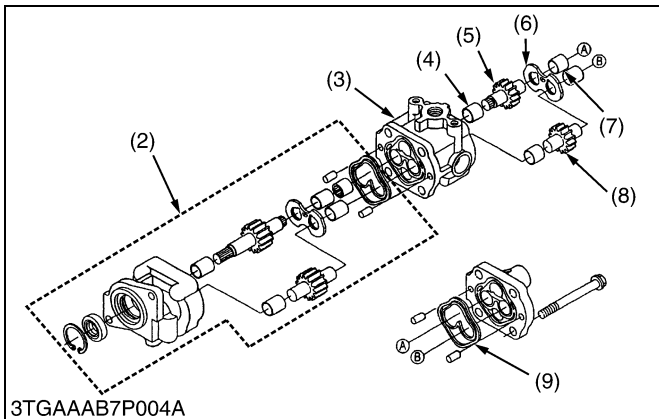
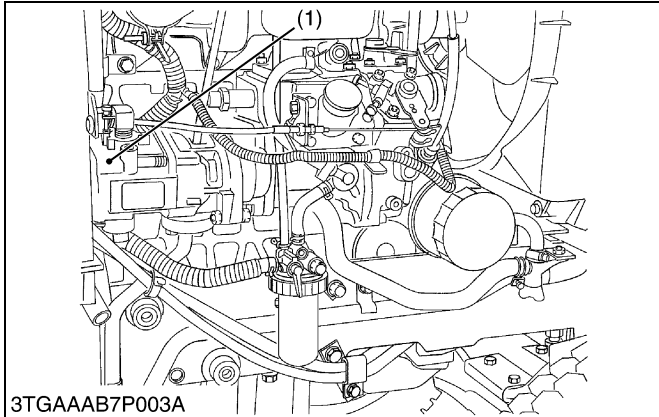
■ Hydraulic Oil Flow

1. Power steering hydraulic pump (3), driven by the engine, sucks oil from transmission case (1), and it to steering controller (5).
2. The oil which has entered steering controller (5) is directed to control valve (6). As the steering wheel is turned, control valve (6) operates, and the oil passes through gerotor (7) and into steering cylinder (8). The cylinder rod then moves to control the directional movement of the front wheels.
3. Return oil from steering cylinder (8) passes through control valve (6) and back into power steering hydraulic pump (3).
4. When the engine is not operating, and the steering wheel is turned, gerotor (7) rotates to supply oil in the pipe to steering cylinder (8). Thus the machine can be steered manually. Under this condition, check valve (9) opens, and oil returning from the steering cylinder, which would otherwise return to power steering hydraulic pump (3).

- | | |
|-----------------------------------|-------------------------|
| (1) Transmission Case | (5) Steering Controller |
| (2) Oil Filter | (6) Control Valve |
| (3) Power Steering Hydraulic Pump | (7) Gerotor |
| (4) Relief Valve | (8) Steering Cylinder |
| | (9) Check Valve |

W1012653

3. HYDRAULIC PUMP



The steering system hydraulic pump fed the oil drawn from the transmission case through the oil filter to the control valve. The steering system hydraulic pump is driven by the engine fuel camshaft.

This hydraulic pump is pressure loading type gear pump with high volumetric efficiency.

(Reference)

Pump discharge per revolution		6.128 cc/rev. 0.373 cu.in./rev.	
Pump discharge displacement	At 2800 rpm engine speed	At no-load	14.0 L/min. 3.70 U.S.gal./min. 3.08 Imp.gal./min.

- (1) Power Steering Hydraulic Pump
- (2) 3-Point System Hydraulic Pump
- (3) Pump Body
- (4) Bushing
- (5) Drive Gear
- (6) Side Plate
- (7) Bushing
- (8) Driven Gear
- (9) Double Ring

W1012894

■ Operation

The hydraulic pump has two meshing gears (2), (3) whose teeth run close to the casing (1). One gear is a drive gear which drives the driven gear.

When the drive gear is driven in the direction of the arrow by the fuel camshaft, the gear traps oil between the gear teeth and the casing. The higher the engine speed, the more the pump discharges.

- (1) Casing
- (2) Gear
- (3) Gear
- A: Outlet**
- B: Inlet**

W1013163

The pressure loading system automatically decreases the clearance between the gear and the bushings. A small amount of pressurized oil is fed behind the bushings, pressing them against the gears and forming a tighter seal against leakage. Therefore, leakage from the delivery side (high pressure) to the inlet side (low pressure) does not increase even if the pressure on the delivery side increases.

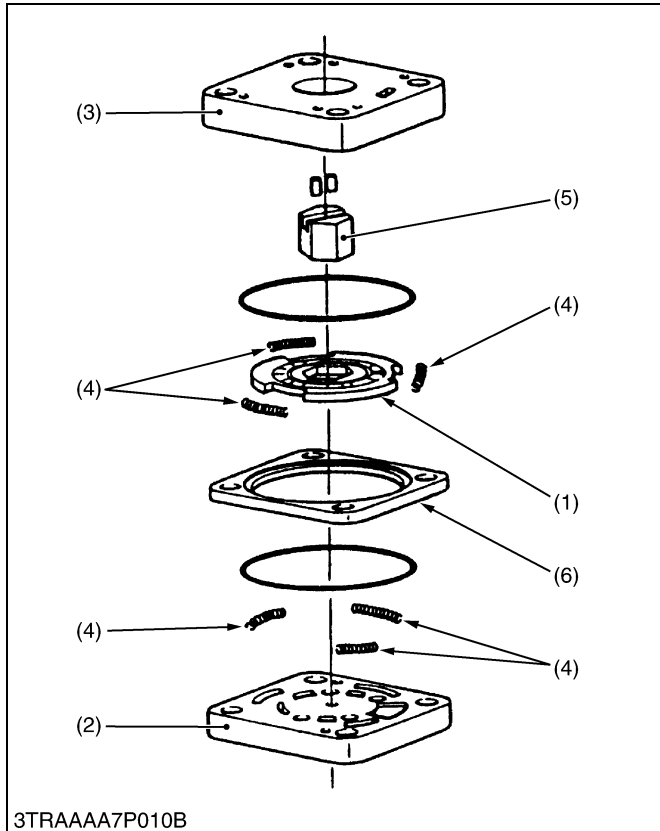
- (1) Loading Pressure
- (2) Gear
- (3) Pressure Introducing Port
- (4) Bushing
- A: Outlet**
- B: Inlet**

W1013265

4. STEERING CONTROLLER

The steering controller mainly consists of a control valve, a metering device and a relief valve with check valve. The metering device comprises a set of special gear called “Gerotor”.

[1] CONTROL VALVE



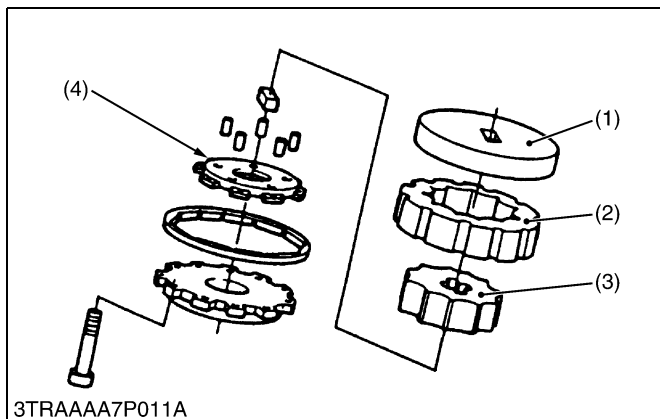
The control valve is a rotary plate type valve. When the steering wheel is not turned, the position of the valve plate (1) and the manifolds (2), (3) is kept neutral by the centering springs (4). This causes the forming of a “Neutral” oil circuit.

When the steering wheel is turned either clockwise or counterclockwise, the position of the valve plate (1) and manifolds (2), (3) changes against the centering spring. This allows the forming of a “Right Turning” or “Left Turning” oil circuit. At the same time, the gerotor rotates with the valve plate and sends the oil to the cylinder corresponding to the rotation of the steering wheel.

- | | |
|------------------------|-------------------------|
| (1) Valve Plate | (4) Centering Spring |
| (2) Port Manifold | (5) Hex. Drive Assembly |
| (3) Isolation Manifold | (6) Valve Ring |

W1013464

[2] METERING DEVICE (GEROTOR)



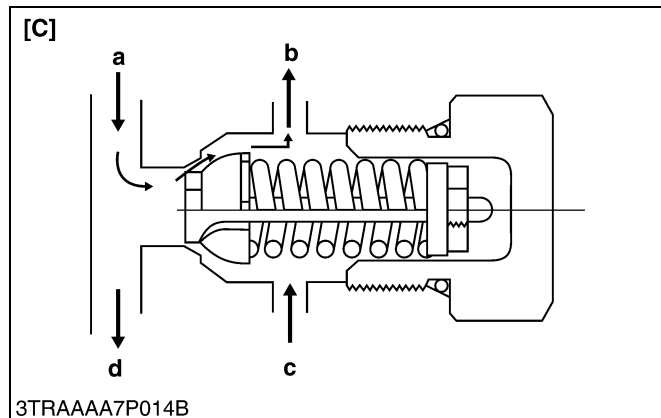
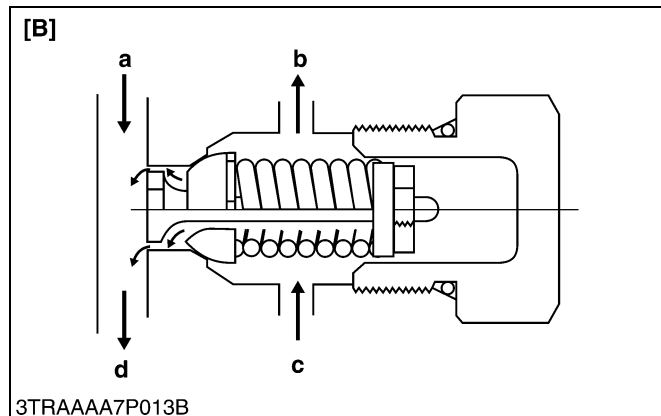
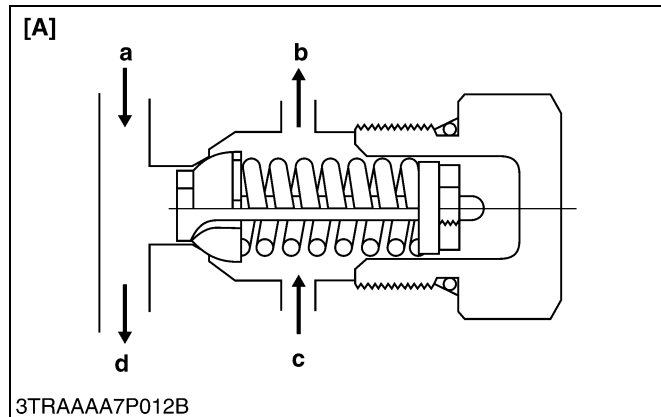
All oil directed from the hydraulic pump to the steering cylinder passes through the metering device (gerotor) on its way. This metering device is a trochoid pump. As the steering wheel is turned, the action is transmitted directly to stator (2) through drive plate (1). Thus, the gerotor sends the amount of oil corresponding to the turn of the steering wheel to the hydraulic cylinder, and the front wheels are moved through the angle corresponding to the turn of the steering wheel.

When the engine is not operating or the hydraulic pump fails. The gerotor serves as a manual pump, and thus the machine can be steered manually.

- | | |
|-----------------|----------------|
| (1) Drive Plate | (3) Rotor |
| (2) Stator | (4) Commutator |

W1013598

[3] RELIEF VALVE (WITH CHECK VALVE)



If the pressure in the hydraulic circuit rises above the set pressure of the relief valve, the relief valve will actuate to prevent the pressure from rising further and protect the hydraulic system. Also, if no oil is supplied from the hydraulic pump, the relief valve will act as a check valve and help draw oil from the return oil line to the drain hose, thus making it possible to steer the machine manually.

(Reference)

- Relief valve setting pressure: 10.7 to 11.7 MPa
109 to 119 kgf/cm²
1550 to 1693 psi
- Engine speed: Maximum
- Oil temperature: 40 to 60 °C
104 to 140 °F

[A] Relief Valve

[B] Relief Valve in Operation

[C] Check Valve in Operation

a : From Control Valve

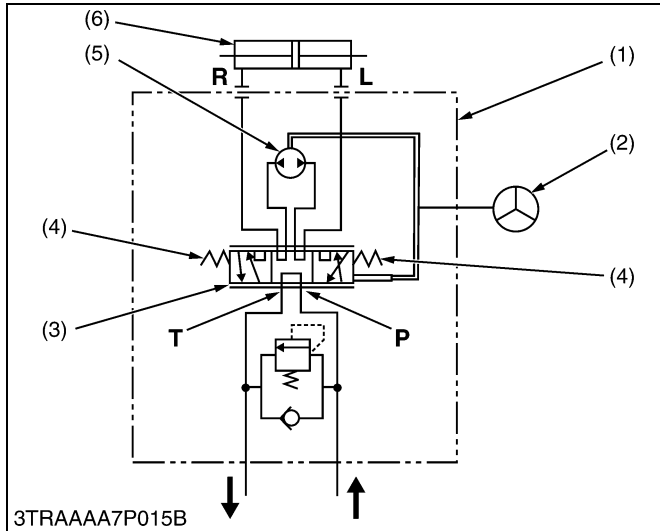
b : To Control Valve

c : From Pump

d : To Drain Hose

W1013696

5. OIL FLOW



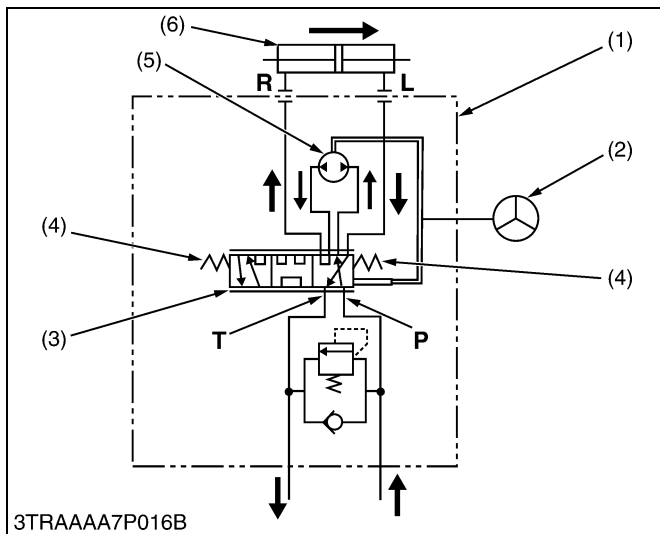
■ Neutral Position

When the steering wheel (2) is not being turned, valve plate (3) is held in the neutral position by centering springs (4). Under this condition, an oil passage is formed between **P** port (from pump) and **T** port (to transmission case) in the control valve, and all oil from the hydraulic pump flows to **T** port.

The full hydrostatic power steering systems are divided into two types: non-load reaction type and load reaction type. They are distinguished by whether the cylinder port is blocked or not with the controller in neutral. In these models, the load reaction type is used. With the load reaction type power steering, the steering wheel returns almost to the straight forward position as with an automobile when the operator releases his hands from the steering wheel.

- | | |
|-------------------------|----------------------------|
| (1) Steering Controller | P : Pump Port |
| (2) Steering Wheel | T : Tank Port |
| (3) Valve Plate | R : Cylinder Port R |
| (4) Centering Spring | L : Cylinder Port L |
| (5) Gerotor | |
| (6) Steering Cylinder | |

W1013776



■ Right Turn

When the steering wheel is turned to the right, the action is transmitted through the drive plate, gerotor, and drive link to the control valve. Valve plate (3) then rotates to the right on manifolds, located on the opposite faces of the valve plate (3). Thus, the **P** port passage in the control valve is connected with gerotor (5).

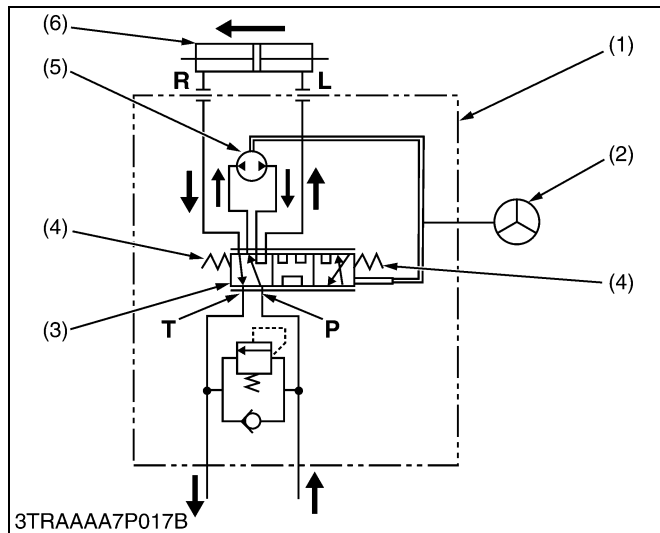
The stator of gerotor (5) turns by the amount corresponding to the turn of the steering wheel (2), and the gerotor performs the metering function and lets oil through it, the amount of which corresponds to the turn of the steering wheel (2).

The oil which has passed through gerotor (5) flows back to the control valve, in which it is directed to cylinder port **R** to operate steering cylinder (6). Consequently, the front wheels are moved to the right through the angle corresponding to the amount of the oil.

When steering cylinder (6) operates, oil returning to cylinder port **L** flows back to the transmission case through the passage connected to **T** port in the control valve.

- | | |
|-------------------------|----------------------------|
| (1) Steering Controller | P : Pump Port |
| (2) Steering Wheel | T : Tank Port |
| (3) Valve Plate | R : Cylinder Port R |
| (4) Centering Spring | L : Cylinder Port L |
| (5) Gerotor | |
| (6) Steering Cylinder | |

W1013914



■ Left Turn

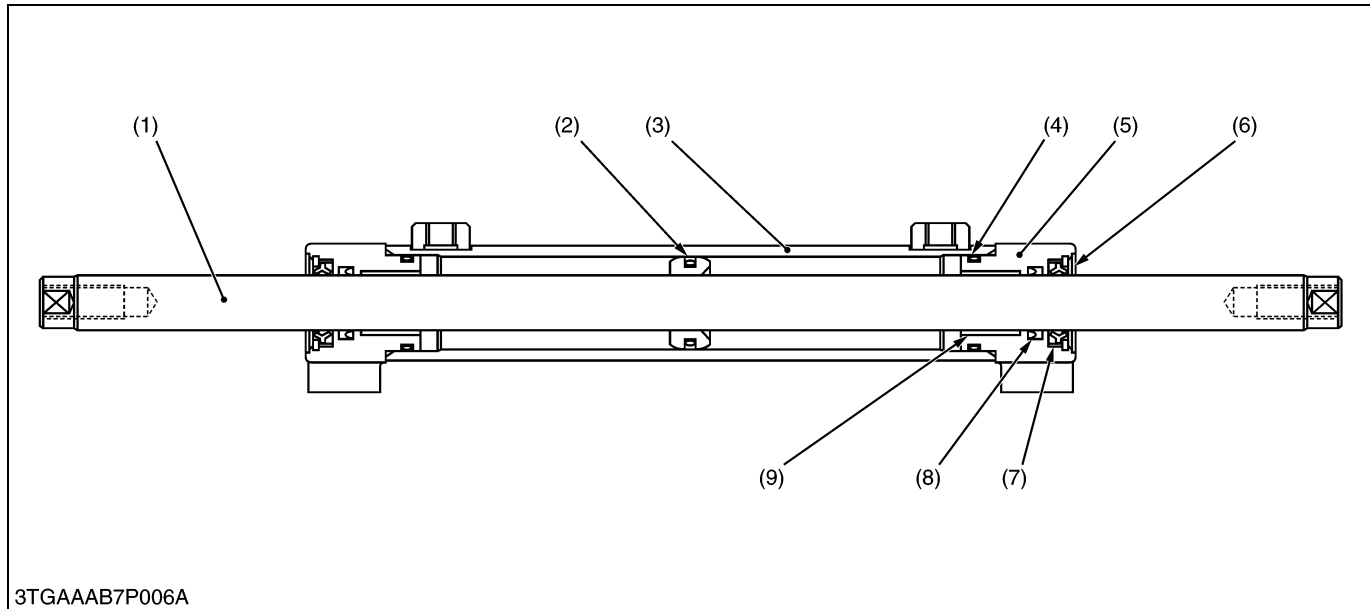
The steering system operates in the same way at a left-turn as well, except that oil flows into and out of steering cylinder in the directions opposite to those at a right-turn.

- (1) Steering Controller
- (2) Steering Wheel
- (3) Valve Plate
- (4) Centering Spring
- (5) Gerotor
- (6) Steering Cylinder

P : Pump Port
T : Tank Port
R : Cylinder Port R
L : Cylinder Port L

W1014041

6. STEERING CYLINDER



(1) Rod Assembly
 (2) Packing
 (3) Cylinder Tube

(4) O-ring
 (5) Cover

(6) Internal Snap Ring
 (7) Dust Seal

(8) Rod Gasket
 (9) Bushing

The steering cylinder is single piston both rod double-acting type.

The steering cylinder provide force in both directions.

Depending upon direction the steering wheel is turned pressure oil enters at one end of the cylinder to extend, or the other end to retract it, thereby turning front wheel of the tractor.

SERVICING

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1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Tractor Can Not Be Steered	<ul style="list-style-type: none"> Steering controller broken Hose broken 	Replace Replace	8-S7 –
Front Wheels Vibrate	<ul style="list-style-type: none"> Centering spring weaken or broken Improper toe-in adjustment Air in the hydraulic system Improperly mounted wheels Tie-rod end loose or worn Front axle bearings worn Clearance between front axle center pivots and brackets bushings excessive 	Replace steering controller Adjust Bleed Retighten Retighten or replace Replace Replace	8-S7 6-S5 – G-16 8-S8 6-S9 6-S15
Hard Steering	<ul style="list-style-type: none"> Hydraulic pump malfunctioning Overload Transmission fluid improper or insufficient Oil leak from pipe joint Insufficient tire pressure Steering controller malfunctioning Relief valve malfunctioning 	Replace – Change Retighten Inflate Replace Replace	8-S6 – G-8 – G-39 8-S7 8-S8
Steering Force Fluctuates	<ul style="list-style-type: none"> Air sucked in pump due to leaking or missing of oil Air sucked in pump from suction circuit 	Replenish Repair	G-8 –
Front Wheels Wander to Right or Left	<ul style="list-style-type: none"> Centering spring weaken or broken Air sucked in pump due to leak of oil Air sucked in pump from suction circuit Tire pressure uneven Insufficient bleeding Improper toe-in adjustment Clearance between front axle center pivots and brackets bushings excessive Tie-rod end loose or worn 	Replace steering controller Replenish Repair Inflate Bleed Adjust Replace Retighten or replace	8-S7 – – G-39 – 6-S5 6-S15 8-S8
Wheels Are Turned to a Direction Opposite to Steering Direction	<ul style="list-style-type: none"> Piping connected in reversed 	Repair	8-S7, 6-S7
Noise	<ul style="list-style-type: none"> Air sucked in pump due to lack of oil Air sucked in pump from suction circuit Pipe deformed 	Replenish Repair Replace	– – –

W1014322

2. SERVICING SPECIFICATIONS

POWER STEERING HYDRAULIC PUMP

Item		Factory Specification	Allowable Limit
Hydraulic Pump Condition <ul style="list-style-type: none"> • Engine Speed : 2800 rpm • Rated Pressure : 13.24 to 13.29 MPa 135.0 to 135.5 kgf/cm² 1920.1 to 1927.2 psi • Oil Temperature : 50 °C 122 °F 	Delivery at No Pressure	14.0 L/min. 3.70 U.S.gal/min. 3.08 Imp.gal/min.	–
	Delivery at Rated Pressure	12.1 L/min. 3.19 U.S.gal/min. 2.66 Imp.gal/min.	–
Gear to Casing	Clearance	–	0.15 mm 0.0059 in.
Bushing to Gear Shaft	Clearance	0.030 to 0.091 mm 0.0012 to 0.0036 in.	0.12 mm 0.0047 in.
Gear Shaft	O.D.	14.970 to 14.980 mm 0.5894 to 0.5898 in.	–
Bushing	I.D.	15.010 to 15.061 mm 0.5909 to 0.5930 in.	–
Side Plate	Thickness	2.48 to 2.50 mm 0.0976 to 0.0984 in.	2.40 mm 0.0945 in.

W1013874

STEERING CONTROLLER

Relief Valve Condition <ul style="list-style-type: none"> • Engine Speed : Maximum • Oil Temperature : 40 to 60 °C 104 to 140 °F 	Setting Pressure	10.7 to 11.7 MPa 109 to 119 kgf/cm ² 1550 to 1693 psi	–
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W1013874

STEERING CYLINDER

Cylinder Tube	I.D.	40.000 to 40.039 mm 1.5748 to 1.5763 in.	40.100 mm 1.5787 in.
Rod to Cylinder Cover Bushing	Clearance	0.097 to 0.173 mm 0.00381 to 0.00681 in.	0.2 mm 0.0078 in.
Rod	O.D.	24.959 to 24.980 mm 0.98263 to 0.98346 in.	–
Cylinder Cover Bushing	I.D.	25.056 to 25.153 mm 0.98645 to 0.99027 in.	–

W1015120

STEERING WHEEL

Steering Wheel Condition <ul style="list-style-type: none"> • Engine Speed : Maximum • Oil Temperature : 45 to 55 °C 113 to 131 °F • Tractor on concrete place • Tractor by itself (without any implement and weight) 	Operating Force	2.5 to 3.5 N 0.25 to 0.35 kgf 0.55 to 0.77 lbs	–
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W1015120

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-9.)

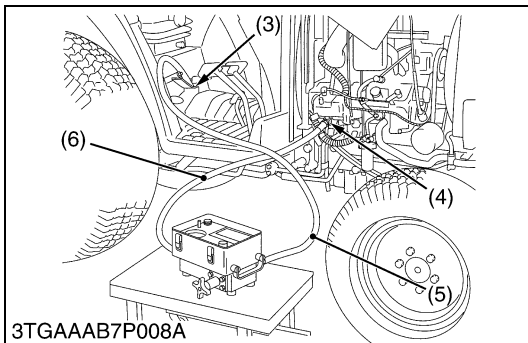
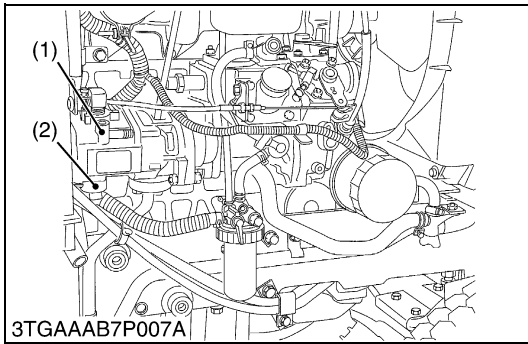
Item	N·m	kgf·m	ft-lbs
Power steering delivery hose joint screw	49.0 to 58.8	5.0 to 6.0	36.2 to 43.4
Power steering delivery hose joint	34.3 to 49.0	3.5 to 5.0	25.3 to 36.2
Power steering delivery hose retaining nut	50 to 60	5.0 to 6.0	36.16 to 43.39
Steering hose LH and RH retaining nut	25 to 30	2.5 to 3.0	18.08 to 21.69
Steering hose joint (RH and LH)	34.3 to 49.0	3.5 to 5.0	25.3 to 36.2
Draining hose joint	24.5 to 34.3	2.5 to 3.5	18.1 to 25.3
Tie-rod end nut	34.3 to 44.1	3.5 to 4.5	25.3 to 32.6
Rod joint screw	123.6 to 147.1	12.6 to 15.0	91.1 to 108.5
Cylinder mounting reamer screw	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2

W1012736

4. CHECKING, DISASSEMBLING AND SERVICING

[1] CHECKING AND ADJUSTING

(1) Hydraulic Pump (Power Steering)



Flowmeter Connecting and Test Preparation

■ IMPORTANT

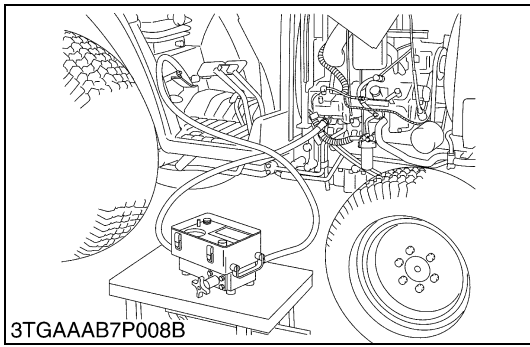
- When using a flowmeter other than KUBOTA specified flowmeter (Code No.: 07916-52792), be sure to use the instructions with that flowmeter.
- In this hook-up, there is not relief valve. Therefore while testing, do not close the flowmeter loading valve completely.

1. Remove the power steering delivery pipe (2) from hydraulic pump (1).
2. Set the adaptor **52** (4) to the hydraulic pump (1).
3. Connect the hydraulic test hose (6) (Code No.: 07916-52651) to the adaptor **52** and flowmeter (Code No.: 07916-52791) inlet port.
4. Connect the another hydraulic test hose (5) to flowmeter outlet port and insert to the transmission fluid inlet (3).
5. Open the flowmeter loading valve completely. (Turn counterclockwise.)
6. Start the engine and set the engine speed 2800 rpm.
7. Slowly close the loading valve to generate the pressure approx. 12.3 MPa (125 kgf/cm², 1778 psi).
8. Hold in this condition until oil temperature reaches approx. 50 °C (122 °F)

(Reference)

- Adaptor is included in the adaptor set (Code No.: 07916-54031).
- | | |
|----------------------------------|-------------------------|
| (1) Hydraulic Pump | (4) Adaptor 52 |
| (2) Power Steering Delivery Hose | (5) Hydraulic Test Hose |
| (3) Transmission Fluid Inlet | (6) Hydraulic Test Hose |

W1011869



Pump Test

■ **NOTE**

• **Before pump testing, perform the flowmeter connecting and test preparation.**

1. Open the loading valve completely.
2. Start the engine and set at approx. 2800 rpm.
3. Read and note the pump delivery at no pressure.
4. Slowly close the loading valve to increase pressure approx. 13.2 MPa (135 kgf/cm², 1920 psi).
5. Read and note the pump flow at rated pressure.
6. Open the loading valve and stop the engine.

(Reference)

Hydraulic pump delivery at no pressure	Factory spec.	14.0 L/min. 3.7 U.S.gal/min. 3.08 Imp.gal/min.
Hydraulic pump delivery at rated pressure	Factory spec.	12.1 L/min. 3.19 U.S.gal/min. 2.66 Imp.gal/min.

Condition

- Engine speed Approx. 2800 rpm
- Rated pressure 13.2 MPa
135 kgf/cm²
1920 psi
- Oil temperature 50 °C
122 °F

W1012184

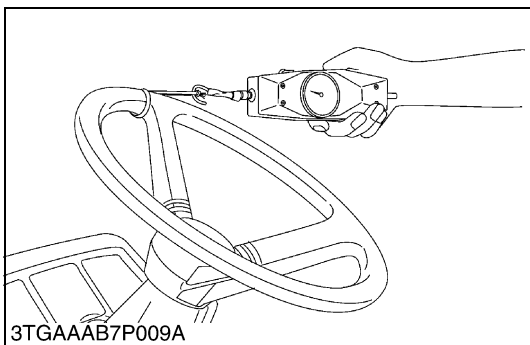
(2) Power Steering

■ **IMPORTANT**

- Use only the transmission fluid (See page G-8), in no case use mixture of oils of different brands.
- Do not disassemble the hydraulic pump and power steering needlessly.
- After installing or reassembling the power steering hydraulic components, be sure to bleed air.

(Bleeding)

- Start the engine, then turn the steering wheel slowly in both directions all the way alternately several times, and stop the engine.



Steering Wheel Operating Force

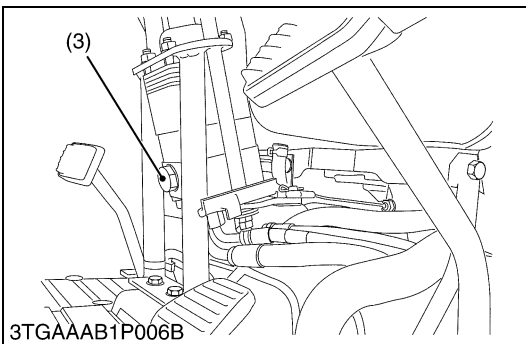
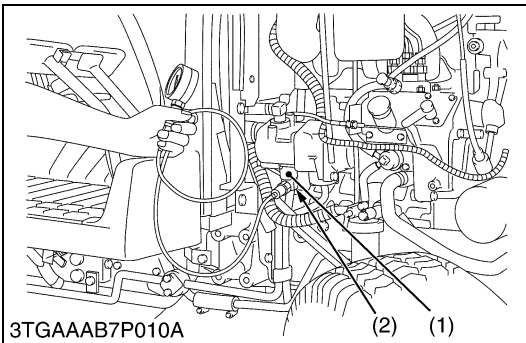
1. Park the tractor on flat concrete place.
2. Start the engine. After warming up, set the engine speed at maximum speed.
3. Set a spring balance to the steering wheel to measure the operating force.
4. If the measurement exceeds the factory specification, check the suction line, delivery line, and the performance of hydraulic pump.
And then, check the power steering assembly.

Steering wheel operating force	Factory spec.	2.5 to 3.5 N 0.25 to 0.35 kgf 0.55 to 0.77 lbs
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Condition

- Engine speed Maximum
- Oil temperature 45 to 55 °C
113 to 131 °F
- Tractor by itself (without any implement and weight)

W1012719



Relief Valve Setting Pressure

1. Remove the power steering delivery pipe from hydraulic pump.
2. Assemble the power steering delivery pipe (1) using a adaptor E (2) instead of original joint.
3. Start the engine. After warming up, set the engine speed at maximum.
4. Fully turn the steering wheel to the left end to read the relief pressure. After reading, stop the engine.
5. If the pressure is not within the factory specification, check the pump delivery line and replace the relief valve assembly.

Power steering relief valve setting pressure	Factory spec.	10.7 to 11.7 MPa 109 to 119 kgf/cm ² 1550 to 1693 psi
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Condition

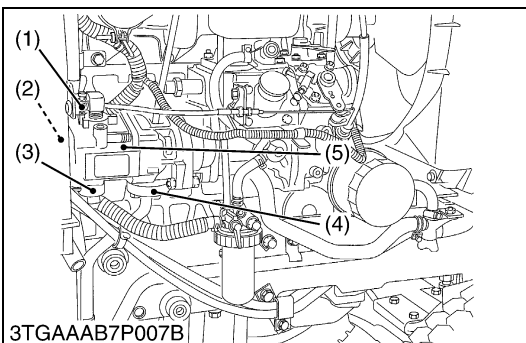
- Engine speed Maximum
- Oil temperature 40 to 60 °C
104 to 140 °F

- (1) Power Steering Delivery Pipe (3) Relief Valve Plug
(2) Adaptor E

W1012909

[2] DISASSEMBLING AND ASSEMBLING

(1) Hydraulic Pump



Hydraulic Pump

1. Open the hood and remove the side cover (RH).
2. Disconnect the power steering delivery hose (3), drain hose (1), inlet hose (2) and 3P hydraulic delivery pipe (4).
3. Remove the hydraulic pump assembly (5).

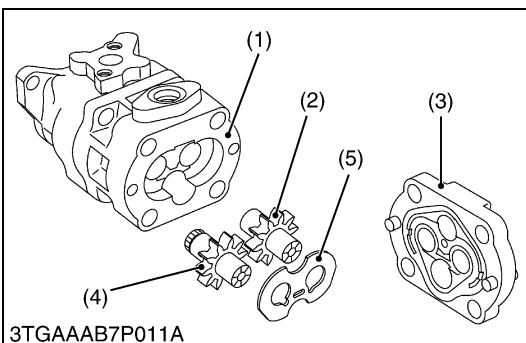
(When reassembling)

- Apply grease to the O-ring of hydraulic pump assembly.

Tightening torque	Power steering delivery hose joint screw	49.0 to 58.8 N·m 5.0 to 6.0 kgf·m 36.2 to 43.4 ft-lbs
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- (1) Drain Hose (4) 3P Hydraulic Delivery Hose
(2) Inlet Hose (5) Hydraulic Pump Assembly
(3) Power Steering Delivery Hose

W1013395



Cover, Side Plate and Gear

1. Secure the hydraulic pump with a vise, and remove the cover (3).
2. Remove the side plate (5).
3. Remove the drive gear (4) and driven gear (2) from the casing (1).

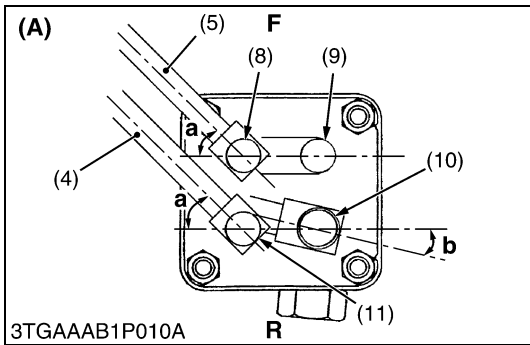
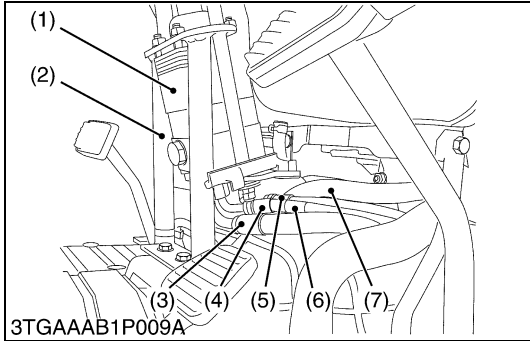
(When reassembling)

- Take care not to damage the O-ring.
- Align the holes of the cover and casing.
- Install the side plate, noting its location and direction.
- Install the gears, noting its direction.

- (1) Casing (4) Drive Gear
(2) Driven Gear (5) Side Plate
(3) Cover

W1013558

(2) Power Steering Controller



Disassembling Procedure

1. See page 1-S12 and 1-S13.

W1013745

Power Steering Hoses

1. Disconnect the draining hose (7), power steering delivery hose (3), steering hose RH (4) and steering hose LH (5).

(When reassembling)

- Connect the steering hose LH (5) to **LT** port (8).
- Connect the steering hose RH (4) with white tape (6) to **RT** port (11).
- Make arrangement the hose as figure and routing to original.
- Be sure to check the hoses are not interfere with accelerator wire.

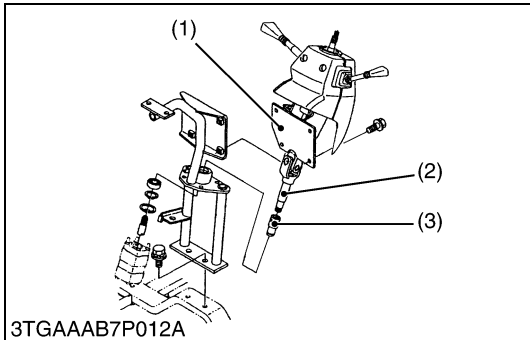
Tightening torque	Power steering delivery hose retaining nut	50 to 60 N·m 5.0 to 6.0 kgf·m 36.16 to 43.39 ft·lbs
	Steering hose LH and RH retaining nut	25 to 30 N·m 2.5 to 3.0 kgf·m 18.08 to 21.69 ft·lbs

- (1) Power Steering Controller
- (2) Steering Pillar
- (3) Power Steering Delivery Hose
- (4) Steering Hose RH
- (5) Steering Hose LH
- (6) White Tape
- (7) Drain Hose
- (8) LT Port
- (9) Drain Port

- (10) Delivery Port
- (11) RT Port

- (A) Viewed from Bottom Side**
F : Front
R : Rear
a : 0.785 rad. (45 °)
b : 0.174 to 0.262 rad. (10 to 15 °)

W1013826

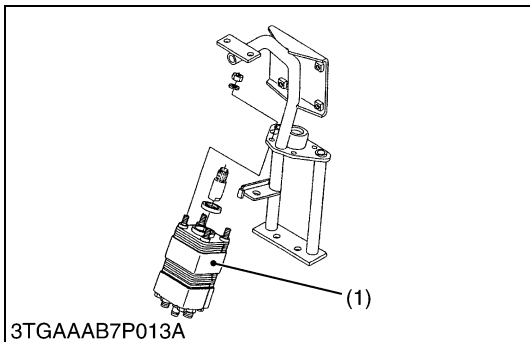


Steering Support

1. Remove the steering support mounting screws, then draw out the steering support (1) with steering shaft (2) and steering joint (3).

- (1) Steering Support
- (2) Steering Shaft
- (3) Steering Joint

W1014119

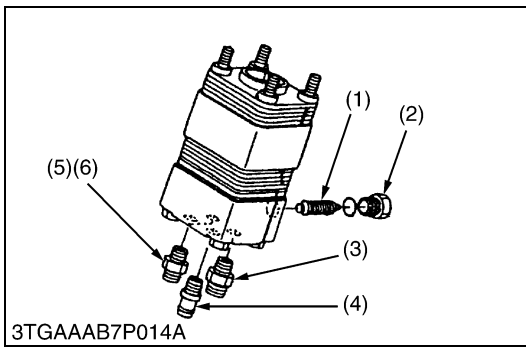


Power Steering Controller

1. Remove the power steering controller mounting nuts, and take out the power steering controller (1).

- (1) Steering Controller

W1014202



Relief Valve and Hydraulic Joint

1. Remove the relief valve plug (2).
2. Draw out the relief valve (1).
3. Remove the joint (3), (4), (5) and (6).

(When reassembling)

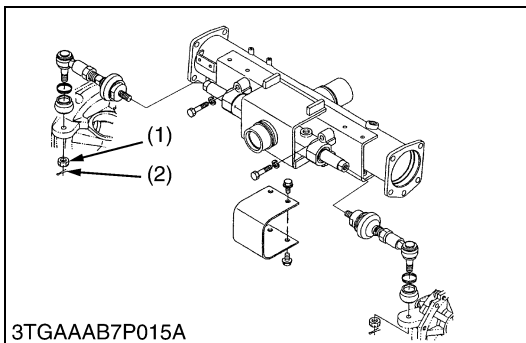
- Apply seal tape on to the thread of power steering controller side for joints.

Tightening torque	Joint (Power steering delivery hose, steering hose RH and LH)	34.3 to 49.0 N·m 3.5 to 5.0 kgf·m 25.3 to 36.2 ft·lbs
	Joint (Drain hose)	24.5 to 34.3 N·m 2.5 to 3.5 kgf·m 18.1 to 25.3 ft·lbs

- (1) Relief Valve (4) Drain Hose Joint
 (2) Relief Valve Plug (5) Steering Hose RH
 (3) Power Steering Delivery Hose Joint (6) Steering Hose LH

W1014271

(3) Power Steering Cylinder



Power Steering Hose and Sensor

1. See page 6-S7.

W1014554

Tie-rod End and Power Steering Hose Connector

1. Remove the tie-rod end nut (1) using a rod end lifter.
2. Remove the either power steering hose connector RH or LH.

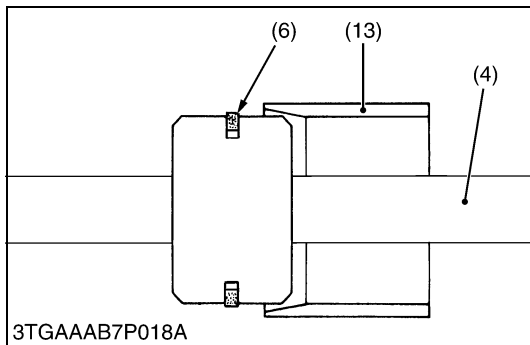
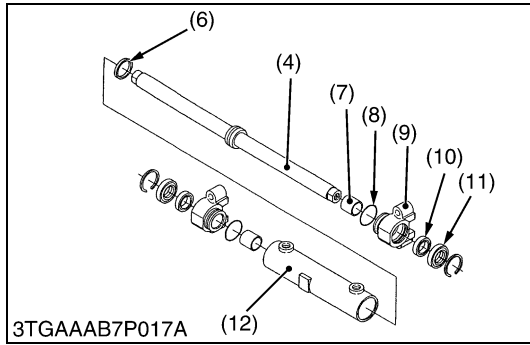
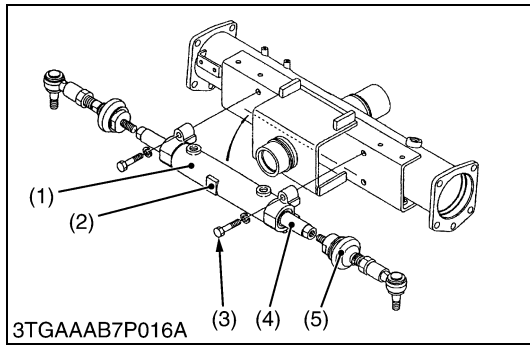
(When reassembling)

- Apply seal tape on to the thread of power steering cylinder side.
- Wrap the seal tape 1.5 to 2.0 full turns.
- Tighten the tie-rod end nut with specified torque, then tighten more so that align the hole and nut to insert the split pin (2).

Tightening torque	Tie-rod end nut	34.3 to 44.1 N·m 3.5 to 4.5 kgf·m 25.3 to 32.6 ft·lbs
-------------------	-----------------	---

- (1) Tie-rod End Nut (2) Split Pin

W1014600



Power Steering Cylinder

1. Remove the cylinder mounting reamer screw (3), then slid out the power steering cylinder assembly (1).
2. Remove the rod joint (5) from the cylinder rod (4).
3. Draw out the cylinder cover (9).
4. Draw out the cylinder rod (4).

■ IMPORTANT

- Before insert the cylinder rod (4) with piston gasket (6), through the piston gasket correcting tool (13) to prevent damage the piston gasket.
- Apply clean transmission fluid to the piston gasket (6) and bushing (7).
- Do not spin the cylinder rod (4) while inserting.

(When reassembling)

- Apply grease to the O-ring (8), rod gasket (10) and dust seal (11).
- The plate (2) of cylinder tube (12) direction to front.
- Apply lock tight (Three Bod 1324 or equivalent) to the rod joint.
- Be sure to check the toe-in after assembling. (See page 6-S5.)

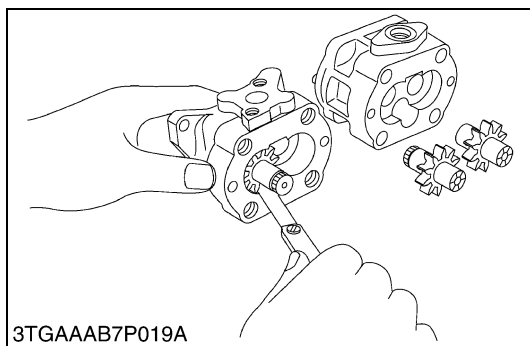
Tightening torque	Rod joint screw	123.6 to 147.1 N·m 12.6 to 15.0 kgf·m 91.1 to 108.5 ft-lbs
	Cylinder mounting reamer screw	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft-lbs

- (1) Power Steering Cylinder Assembly
- (2) Plate
- (3) Reamer Screw
- (4) Cylinder Rod
- (5) Rod Joint
- (6) Piston Gasket
- (7) Bushing
- (8) O-ring
- (9) Cylinder Cover
- (10) Rod Gasket
- (11) Dust Seal
- (12) Cylinder Tube
- (13) Piston Gasket Correcting Tool

W1014768

[3] SERVICING

(1) Hydraulic Pump (Power Steering)

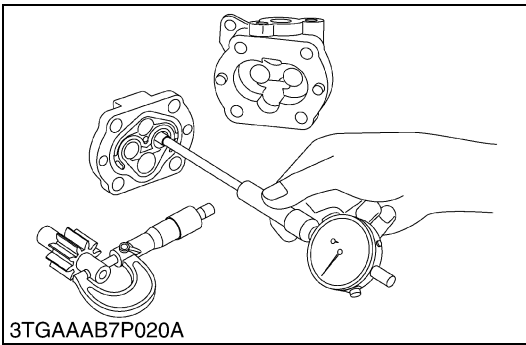


Clearance between Tip of Gear Tooth and Casing

1. Measure the clearance between gear and casing at several point with feeler gauge.
2. If the clearance exceeds the allowable limit, replace the assembly.

Clearance between tip of gear tooth and casing	Allowable limit	0.15 mm 0.0059 in.
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W1015312



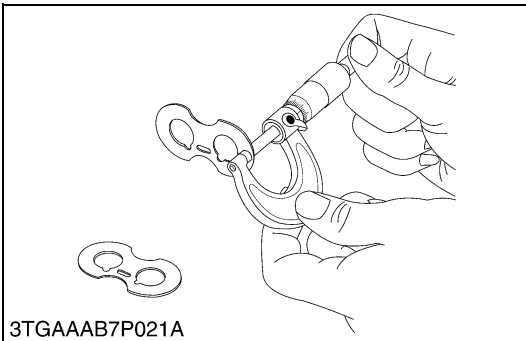
Clearance between Bushing and Gear Shaft

1. Measure the gear shaft O.D. with an outside micrometer.
2. Measure the bushing I.D. with a cylinder gauge.
3. If the clearance exceeds the allowable limit, replace it.

Clearance between bushing and gear shaft	Factory spec.	0.030 to 0.091 mm 0.0012 to 0.0036 in.
	Allowable limit	0.12 mm 0.0047 in.

Gear shaft O.D.	Factory spec.	14.970 to 14.980 mm 0.5894 to 0.5898 in.
	Factory spec.	15.010 to 15.061 mm 0.5909 to 0.5930 in.

W1015413



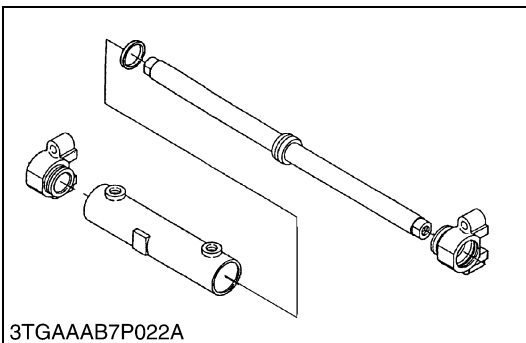
Side Plate Thickness

1. Measure the side plate thickness with an outside micrometer.
2. If the thickness is less than the allowable limit, replace it.

Side plate thickness	Factory spec.	2.48 to 2.50 mm 0.0976 to 0.0984 in.
	Allowable limit	2.40 mm 0.0945 in.

W1015581

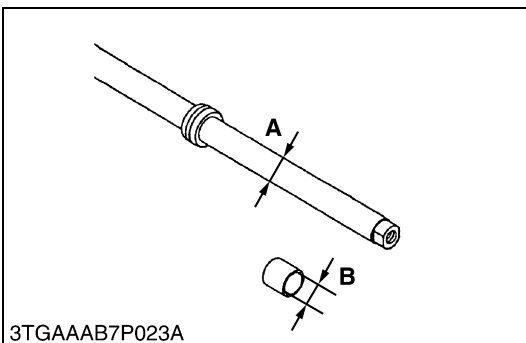
(2) Steering Cylinder



Cylinder Tube, Rod Assembly and Cylinder Covers

1. Inspect the sliding surface of the cylinder tube, rod assembly and cylinder covers.
2. If they show nicks or scoring, they must be replaced.

W1015700



Clearance between Rod and Cylinder Cover Bushing

1. Measure the rod O.D. with an outside micrometer.
2. Measure the cylinder cover bushing I.D. with a cylinder gauge, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace the cylinder cover bushing.

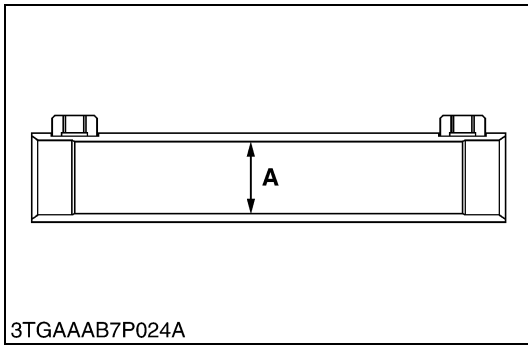
Clearance between rod and cylinder cover bushing	Factory spec.	0.097 to 0.173 mm 0.00381 to 0.00681 in.
	Allowable limit	0.2 mm 0.0078 in.

Rod O.D.	Factory spec.	24.959 to 24.980 mm 0.98263 to 0.98346 in.
Cylinder cover bushing I.D.	Factory spec.	25.056 to 25.153 mm 0.98645 to 0.99027 in.

A : Rod O.D.

B : Bush I.D.

W1015776



Cylinder Tube Wear

1. Measure the cylinder tube I.D. with a cylinder gauge.
2. If the measurement exceeds the allowable limit, replace the cylinder tube.

Cylinder tube I.D.	Factory spec.	40.000 to 40.039 mm 1.5748 to 1.5763 in.
	Allowable limit	40.100 mm 1.5787 in.

A : Cylinder Tube I.D.

W1015937

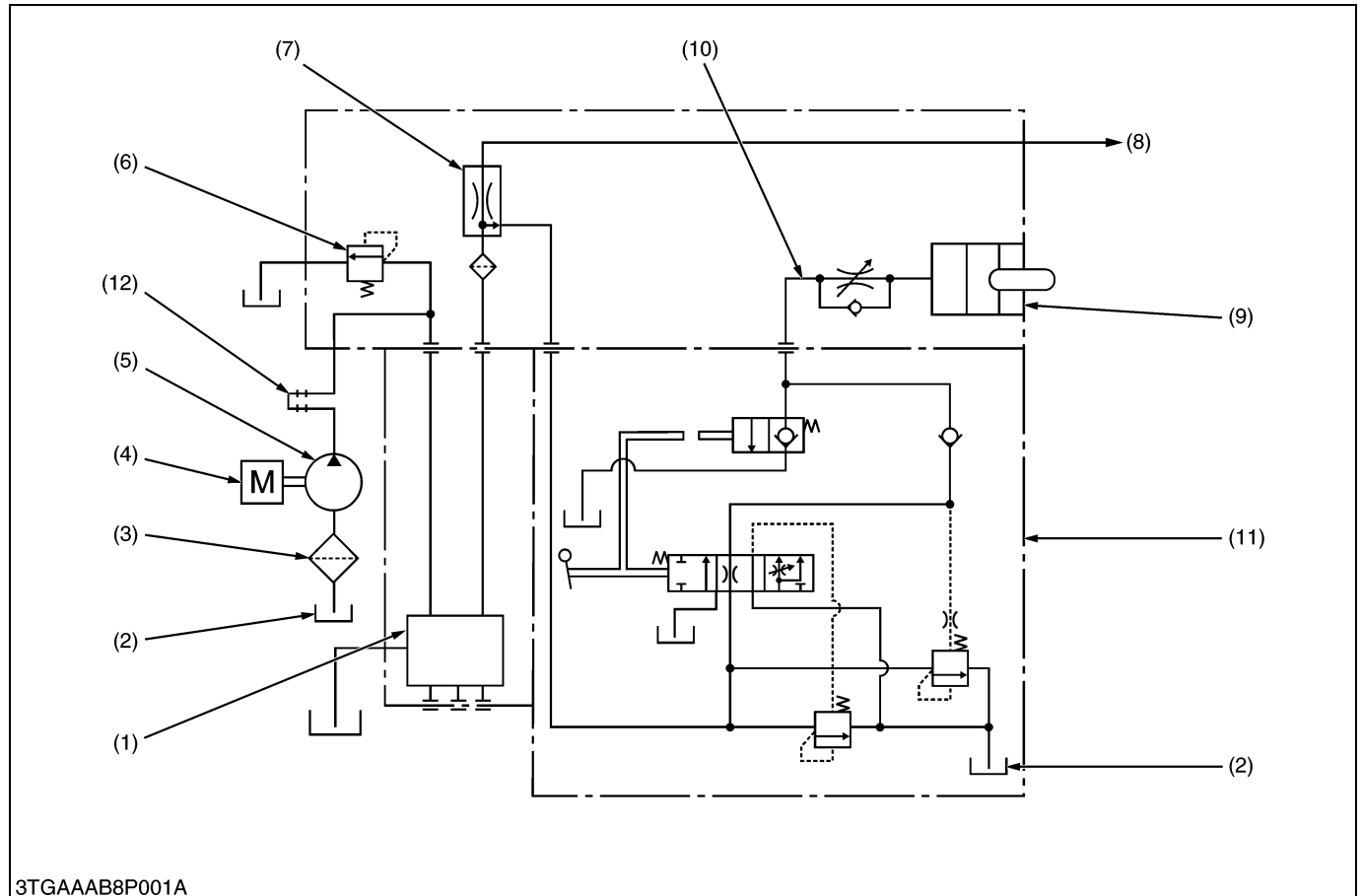
9 HYDRAULIC SYSTEM

MECHANISM

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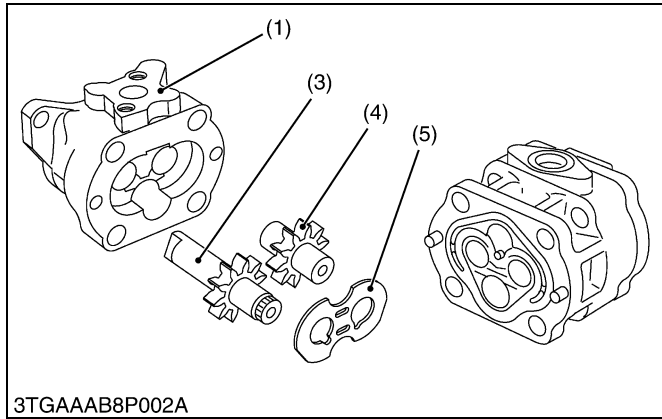
1. HYDRAULIC CIRCUIT



- | | | | |
|----------------------------------|------------------------------|-------------------------------------|----------------------------------|
| (1) Auxiliary Control Valve | (5) Hydraulic Pump | (9) Hydraulic Cylinder | (11) Position Control Valve |
| (2) Oil Tank (Transmission Case) | (6) Relief Valve | (10) Lowering Speed Adjusting Valve | (12) Hydraulic Block Type Outlet |
| (3) Oil Filter | (7) Flow Priority Valve | | |
| (4) Engine | (8) To Bi-speed Turn Circuit | | |

- When the engine (4) is started, the hydraulic pump (5) is rotated to draw oil from the transmission case (2) through the suction pipe. Supplied oil is filtered by the oil filter (3).
- Filtered oil is forced out by the hydraulic pump to auxiliary control valve (1) then flow to the priority valve (7) to divide for bi-speed circuit (8) and 3-point hydraulic circuit.
- After that the oil flows to position control valve (11).
- The position control valve (11) switches the oil flow, and oil is channeled to the hydraulic cylinder (9) for the 3-point hydraulic system or returned to the oil tank (2).
- The hydraulic system has a relief valve (6) which restricts the maximum pressure in the circuit.

2. HYDRAULIC PUMP



The hydraulic pump is composed of the casing, side plate (5), and two spur gears (drive gear (3) and driven gear (4)) that are in mesh.

Hydraulic pump is driven by the fuel camshaft.

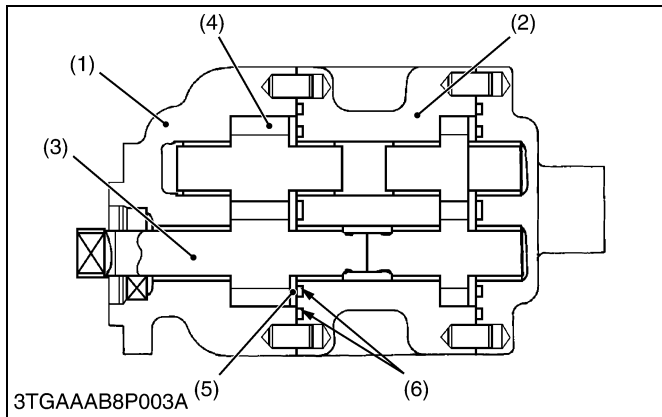
Maximum displacement is as follows.

(Reference)

Pump discharge per revolution		10.09 cc/rev. 0.615 cu.in./rev.	
Pump discharge displacement	At 2800 rpm engine speed	At no-load	23.2 L/min. 6.13 U.S.gal./min. 5.10 Imp.gal./min.

- (1) 3-Point System Hydraulic Pump
- (2) Power Steering Hydraulic Pump
- (3) Drive Gear
- (4) Driven Gear
- (5) Side Plate
- (6) Double Ring

W1012894



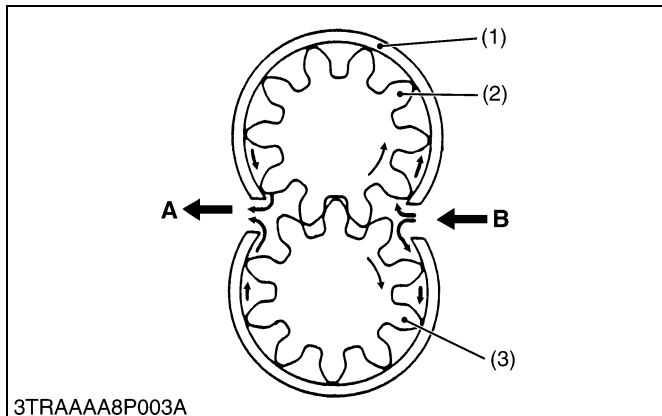
■ Operation

The hydraulic pump has two meshing gears (2), (3) whose teeth run close to the casing (1). One gear is a drive gear which drives the driven gear.

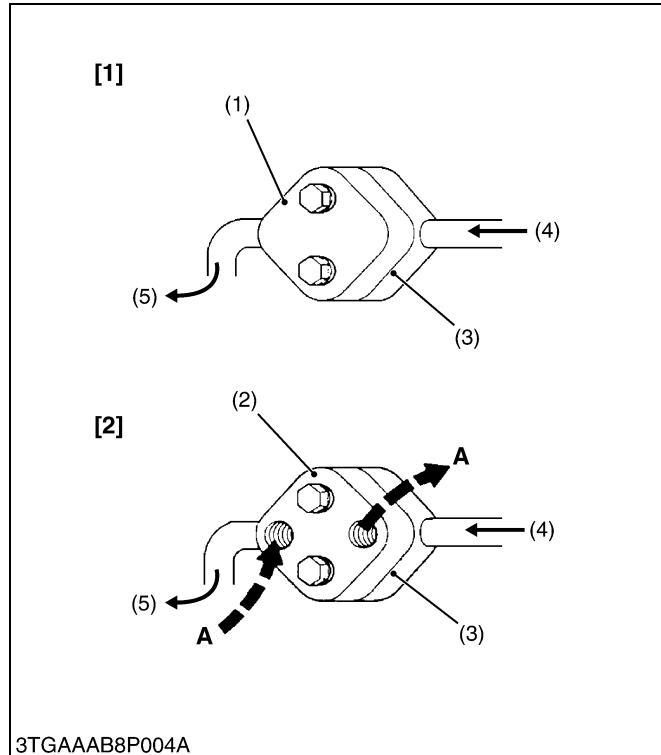
When the drive gear is driven in the direction of the arrow by the fuel camshaft, the gear traps oil between the gear teeth and the casing. The higher the engine speed, the more the pump discharges.

- (1) Casing
- (2) Gear
- (3) Gear
- A: Outlet**
- B: Inlet**

W1013163



3. HYDRAULIC BLOCK TYPE OUTLET



The hydraulic block type outlet is located at the right hand side of the clutch housing.

This hydraulic block type outlet is provided to take power out from the tractor to operate the hydraulic cylinders on the implement, such as front end loader, front blade and so on.

- (1) Block Cover
- (2) Block Outlet Cover (Option)
- (3) Hydraulic Block
- (4) From Hydraulic Pump
- (5) To Position Control Valve

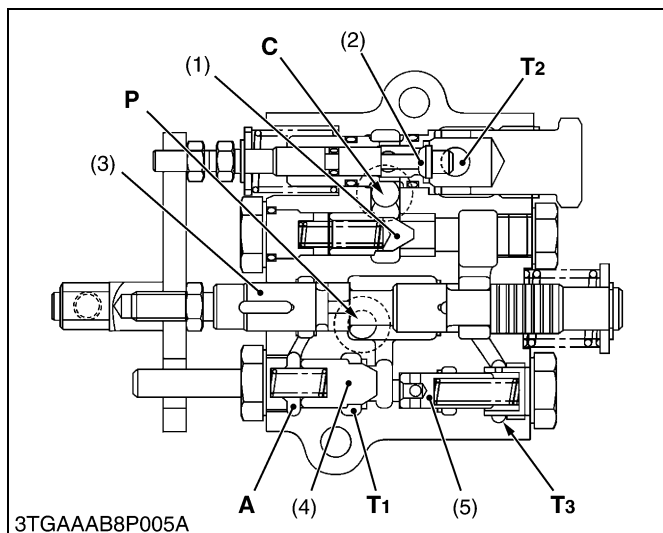
(A) To implement (Inlet) Max. flow 23.0 L/min. (6.1 U.S.gal./min., 5.1 Imp.gal./min.) No relief valve in the hydraulic block.
(B) From implement (Outlet)

- [1] When implement is not attached
- [2] When implement is attached

W1013192

4. POSITION CONTROL VALVE

[1] STRUCTURE



The control valve is composed as shown figure left.

The spool (3) is moved by the operating the position control lever. The positions of the spool movement makes four kinds of circuit such as “Neutral”, “Lifting”, “Lowering” and “Floating”.

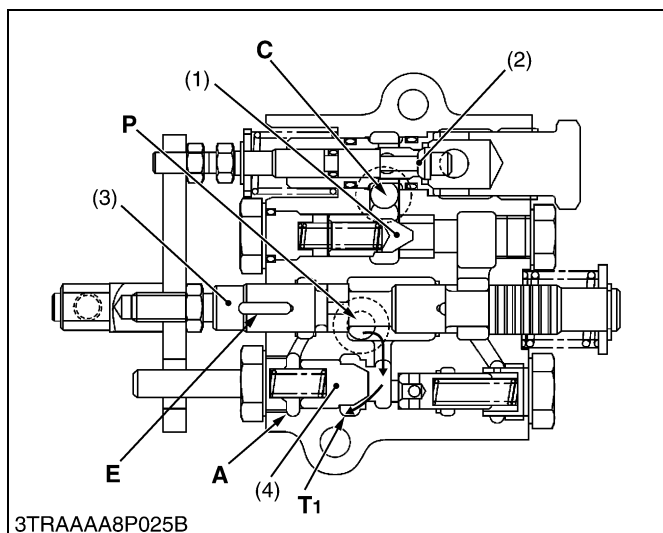
Feature of this control valve is smooth operation by built-in shockless mechanism.

- (1) Poppet 1
- (2) Poppet 2
- (3) Spool
- (4) Unload Poppet 1
- (5) Unload Poppet 2

P : Pump Port
C : Cylinder Port
T1 : Tank Port 1
T2 : Tank Port 2
T3 : Tank Port 3
A : Chamber A

W1013328

[2] OIL FLOW



■ Neutral

Pressurized oil flows at the **P** port, pushes open unload poppet 1 (4) and returns to tank from **T1** port.

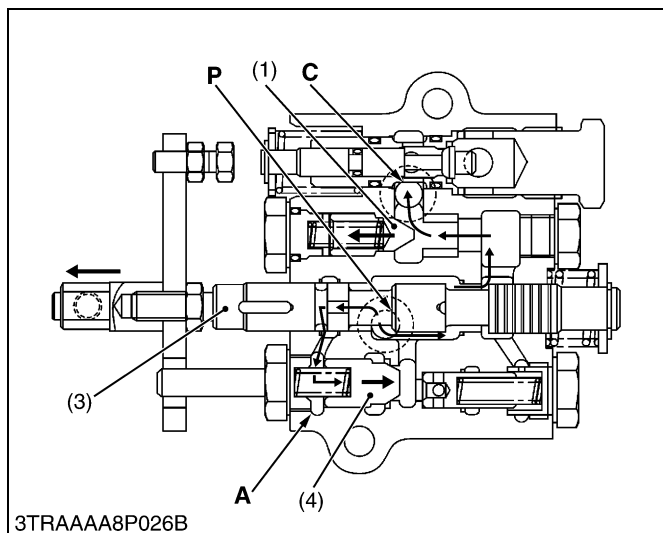
The oil in the chamber **A** behind the unload poppet 1 (4) returns to the tank through the **E** of spool (3) and control valve case. The oil in the hydraulic cylinder does not flow out because the circuit is cut off by the actions of poppet 1 (1), poppet 2 (2).

The allows the implement to be kept at a steady height.

- (1) Poppet 1
- (2) Poppet 2
- (3) Spool
- (4) Unload Poppet 1

P : Pump Port
C : Cylinder Port
T1 : Tank Port 1
E : Groove 2

W1013589



■ Lifting

When the control lever is moved to “UP”, spool (3) is pulled by the spool operating lever, forming a circuit with the **P** port and chamber **A**.

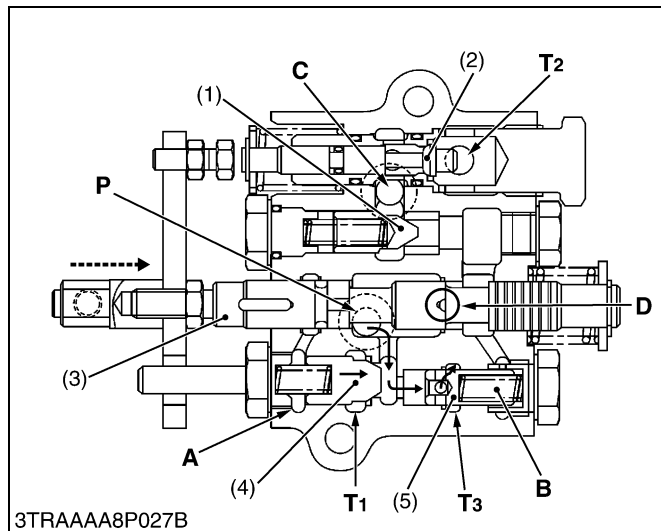
The pressurized oil thus flows into the chamber **A** and closes unload poppet 1 (4).

The pressure in the circuit slowly rises, pushing open poppet 1 (1), and the hydraulic oil flows into the hydraulic cylinder from the **C** port, lifting the implement.

- (1) Poppet 1
- (3) Spool
- (4) Unload Poppet 1

P : Pump Port
C : Cylinder Port
A : Chamber A

W1013742



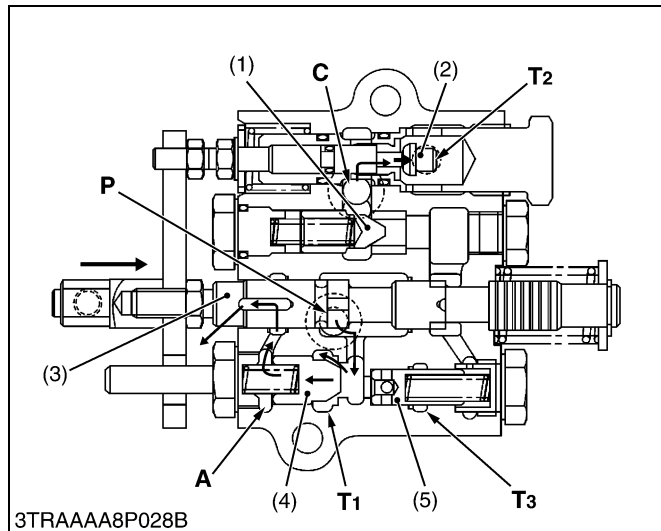
■ Lifting to Neutral (Acting the shockless mechanism)

In returning from **Lifting** to **Neutral**, the spool (3) is pushed back to the arrow-mark direction. When the Neutral position comes near, the groove part **D** of the spool (3) makes the pressure difference at the **P** port and **C** port. Therefore, the poppet 1 (1) gradually closes, and absorbs any shock at lifting stop. In that case, since oil is remained in the chamber **A** of the unload poppet (4) and closes. However, the unload poppet 2 (5) opens because of low pressure in chamber **B**, and then the oil from the pump returns to the transmission case through **T3** port until unload poppet 1 (4) opens.

- (1) Poppet 1
- (2) Poppet 2
- (3) Spool
- (4) Unload Poppet 1
- (5) Unload Poppet 2

P : Pump Port
C : Cylinder Port
A : Chamber A
B : Chamber B
D : Groove 1
T1 : Tank Port 1
T2 : Tank Port 2
T3 : Tank Port 3

W1013900



■ Lowering

When the control lever is moved to “**DOWN**”, spool (3) moves to arrow-mark direction, and pushes the poppet 2 (2). It forms a circuit with the **C** port and **T2** port.

The oil in the hydraulic cylinder is forced out by the weight of the implement, and returns to the tank through the **C** port and **T2** port, lowering the implement. The pressurized oil pushes open unload poppet (4) and returns to the tank from **T1** port.

■ Floating

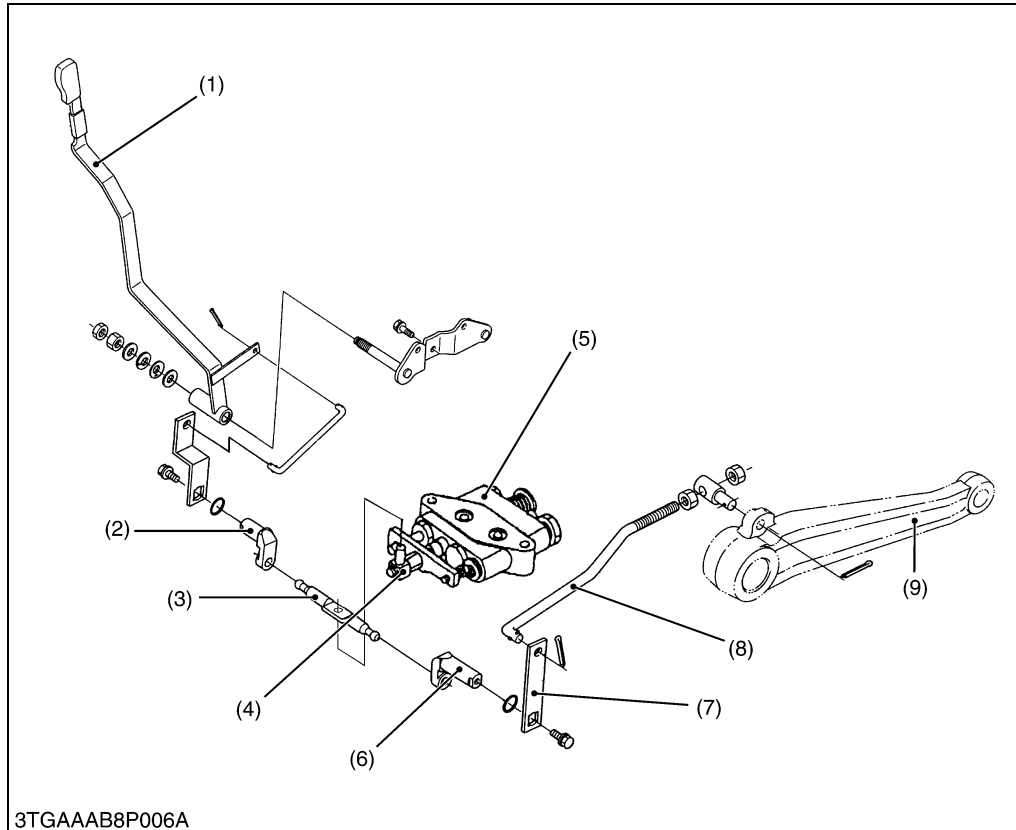
When the control lever is lowest position, spool (3) and poppet 2 (2) keeps same as lowering position. The hydraulic cylinder is unloading condition. Therefore pressurized oil pushes open unload poppet (4) and returns to tank.

- (1) Poppet 1
- (2) Poppet 2
- (3) Spool
- (4) Unload Poppet 1
- (5) Unload Poppet 2

P : Pump Port
C : Cylinder Port
T1 : Tank Port 1
T2 : Tank Port 2
T3 : Tank Port 3

W1014075

5. POSITION CONTROL LINKAGE

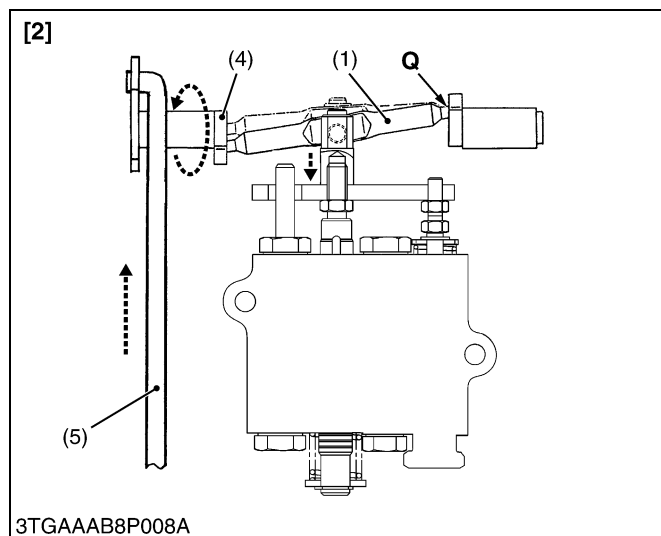
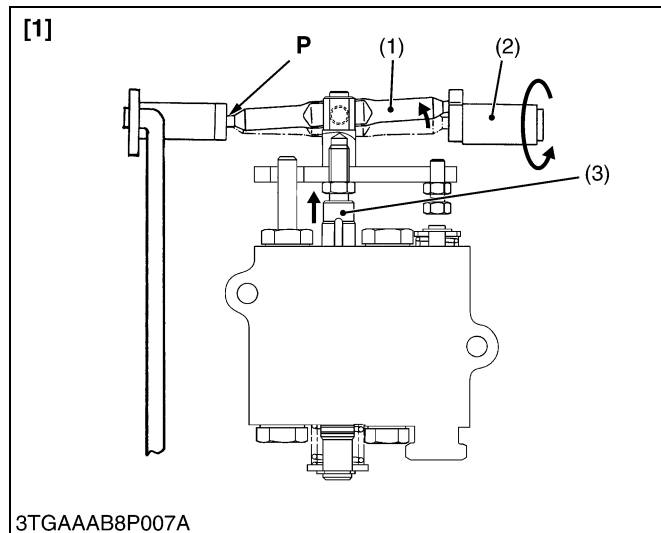


- (1) Position Control Lever
- (2) Control Arm
- (3) Spool Drive Lever
- (4) Spool
- (5) Control Valve
- (6) Feedback Lever shaft
- (7) Feedback Lever
- (8) Feedback Rod
- (9) Lift Arm

W1014379

Position control is a mechanism to raise or lower the implement attached to the tractor in proportion to the movement of the control lever.

The implement can be positioned at any height by moving the position control lever. Fine position adjustment is also easy.



■ Lifting

1. When the position control lever is moved to the **LIFT** position, the control arm (2) rotates to the arrow. Therefore, the spool drive lever (1) moves around the fulcrum **P** and pull the spool (3) opening the **LIFT** circuit.
2. When the lift arm moves upward, the feedback lever shaft (4) is rotated to the arrow, since the feedback rod (5) is actuated. Therefore, the spool drive lever (1) moves around the fulcrum **Q** and pushes the spool (3).
3. The lift arm stops when the spool returns to the neutral position.

(1) Spool Drive Lever

(2) Control Arm

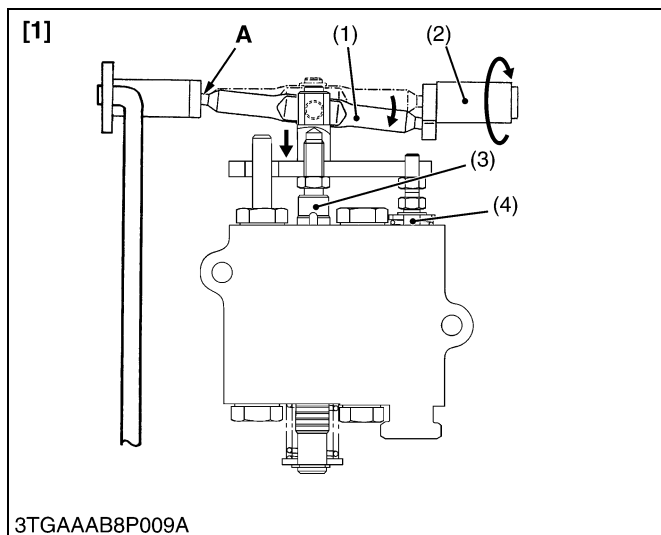
(3) Spool

(4) Feedback Lever Shaft

(5) Feedback Rod

[1] Lifting**[2] Lifting to Neutral**

W1014480



■ Lowering

1. When the position control lever is moved to the **Lowering** position, the control arm (2) rotates to the arrow. Therefore, the spool drive lever (1) moves around the fulcrum **P** and push the spool (3) and poppet 2 (4) opening the Lowering circuit.
2. When the lift arm moves downward, the feedback lever shaft (5) is rotated to the arrow, since the feedback rod (6) is actuated. Therefore, the spool drive lever (1) moves around the fulcrum **Q** and pull the spool (3).
3. The lift arm stops when the spool (3) returns to the neutral position

(1) Spool Drive Lever

(2) Control Arm

(3) Spool

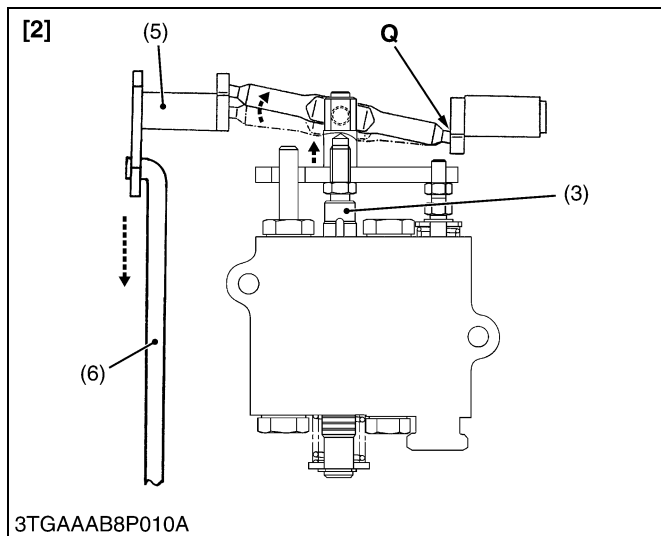
(4) Poppet 2

(5) Feedback Lever Shaft

(6) Feedback Rod

[1] Lowering

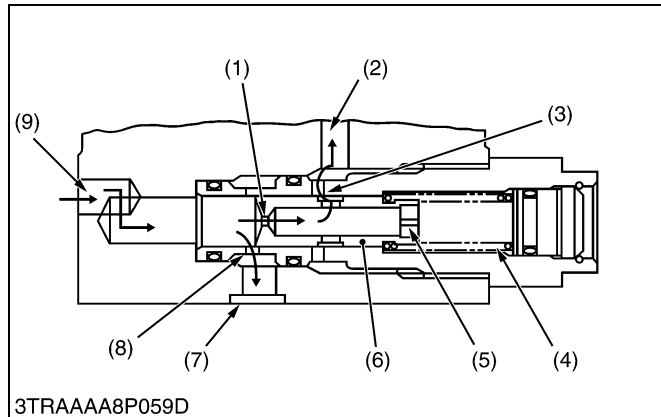
[2] Lowering to Neutral



W1014639

6. FLOW PRIORITY VALVE

[1] FUNCTION AND STRUCTURE

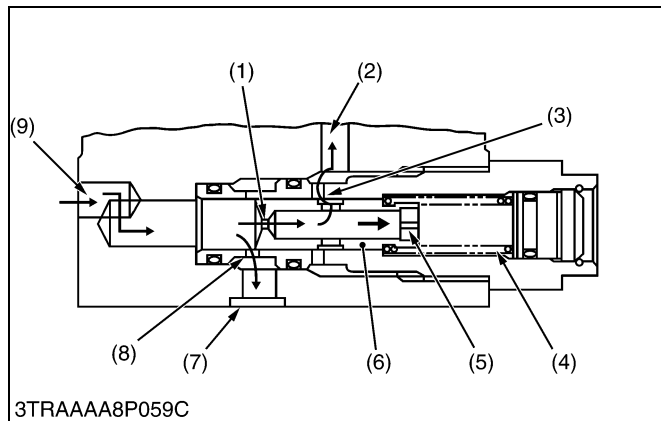


The flow priority valve is a flow divider that divides the flow from single hydraulic source (hydraulic pump) and actuates two circuits (position control circuit and Bi-speed turn circuit) simultaneously. This valve feeds fixedly controlled flow to the **PF** side (Bi-speed turn circuit) with priority and remainder to the **EF** side (position control circuit).

- | | |
|----------------------|----------------------|
| (1) Orifice | (6) Plunger |
| (2) PF Port | (7) EF Port |
| (3) Portion A | (8) Portion B |
| (4) Plunger Spring | (9) P Port |
| (5) Damper Orifice | |

W1014939

[2] OIL FLOW



■ Unloading Condition

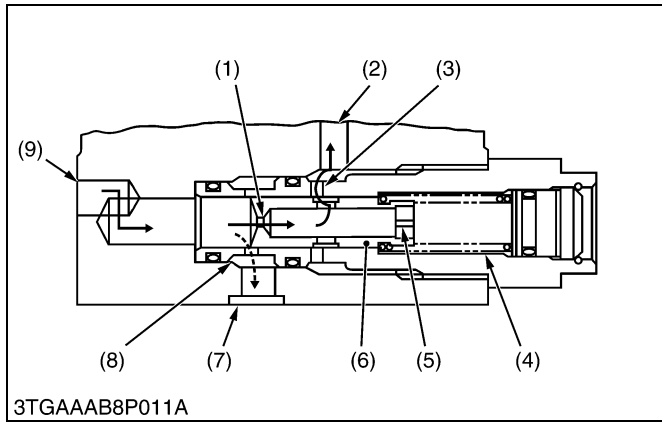
1. When the engine starts, oil flows into the valve through **P** port (9).
2. A pressure difference is created between the ends of the orifice (1) as the flow passes the orifice (1). This causes the plunger (6) to move to the right, deflecting the spring (4).
3. Then the oil passage is formed in portion **B** shown left figure, and the remainder flows to the **EF** port (position control circuit).

(Reference)

- The damper orifice prevents plunger vibration caused by a sudden change in engine rpm (change in the oil flow rate).

- | | |
|----------------------|----------------------|
| (1) Orifice | (6) Plunger |
| (2) PF Port | (7) EF Port |
| (3) Portion A | (8) Portion B |
| (4) Plunger Spring | (9) P Port |
| (5) Damper Orifice | |

W1015071

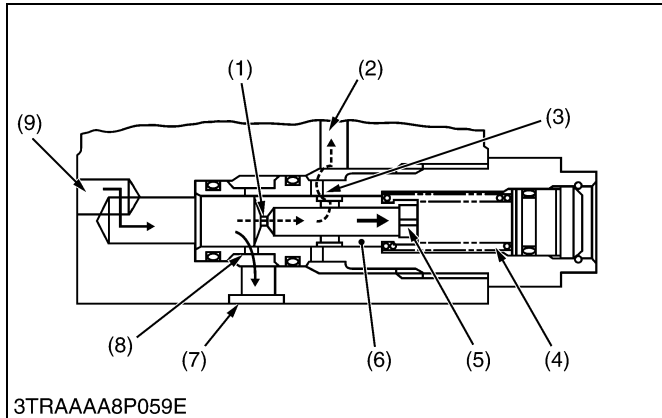


■ **When Bi-speed Turn is actuating**

1. When Bi-speed turn is actuated and pressure rises, the plunger (6) moves to the left, reducing the opening area of portion **B**, and widening the opening area of portion **A**. Therefore, there is no change in the controlled flow to the **PF** port (2). This is because the plunger moves in accordance with the balancing of the pressure difference between the ends of the orifice and spring force, controlling the opening areas of the portion **A** (3) and **B** (8).
2. The pressure in the **P** port (9) side is higher than the working pressure of the **PF** port (2) by the pressure difference between the ends of the orifice (1). When position control is not in operating, the oil of **EF** port (7) side is a free flow.

- | | |
|----------------------|----------------------|
| (1) Orifice | (6) Plunger |
| (2) PF Port | (7) EF Port |
| (3) Portion A | (8) Portion B |
| (4) Plunger Spring | (9) P Port |
| (5) Damper Orifice | |

W1015371

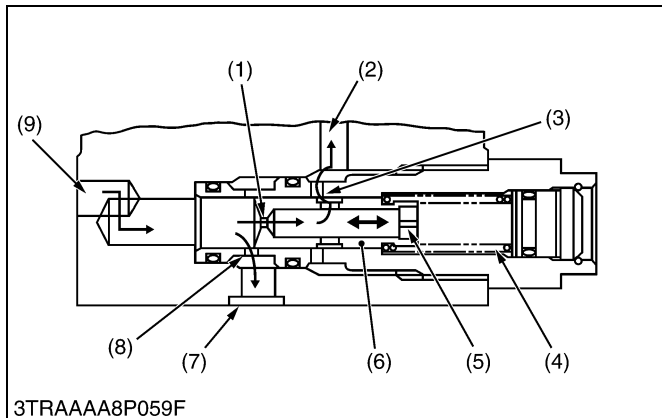


■ **When Position Control is actuating**

1. When position control is actuated and the Bi-speed turn is not, the pressure difference between the end of the orifice (1) becomes large, and causes the plunger to move the right.
2. Therefore, the opening area of portion **A** (3) becomes smaller to automatically prevent any excessive flow to the **PF** port (2) side.

- | | |
|----------------------|----------------------|
| (1) Orifice | (6) Plunger |
| (2) PF Port | (7) EF Port |
| (3) Portion A | (8) Portion B |
| (4) Plunger Spring | (9) P Port |
| (5) Damper Orifice | |

W1015516



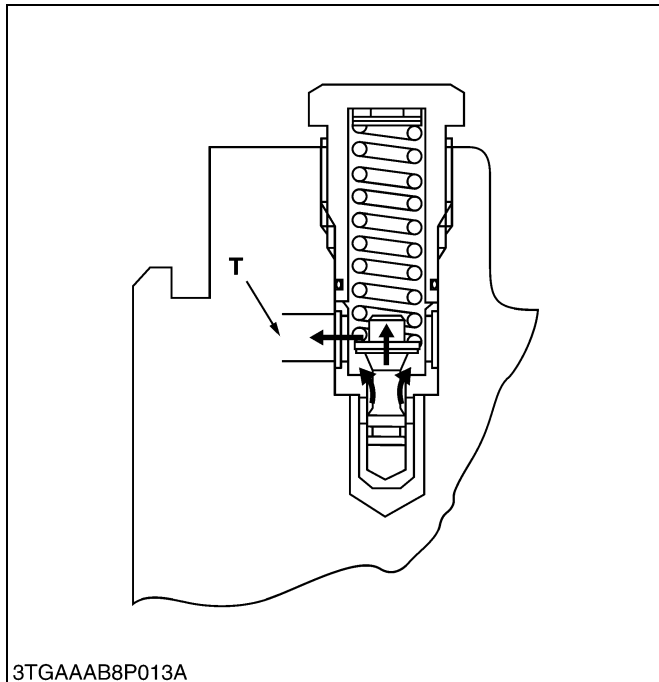
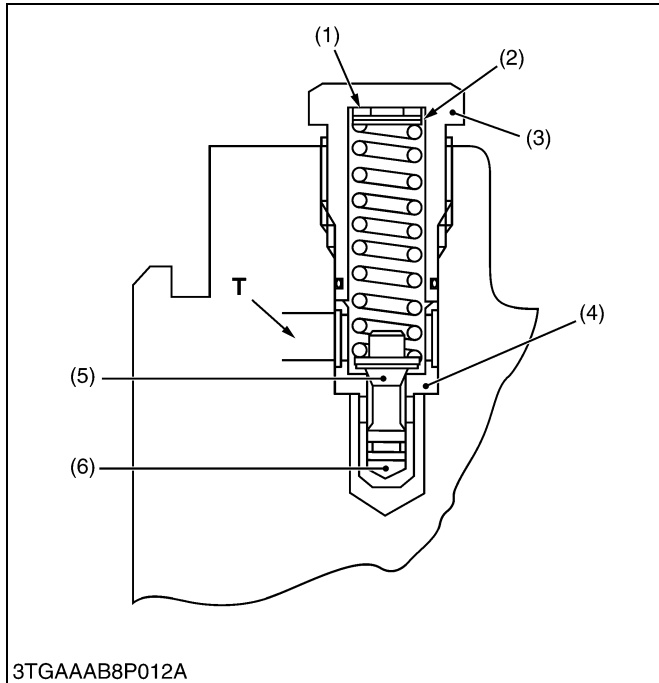
■ **When Position Control, Bi-speed Turn are actuating**

1. When the working pressures of the **PF** port (2) side and **EF** port (7) side circuits rise simultaneously, the opening areas of portion **A** (3) and **B** (8) are automatically controlled by balancing of the pressure difference between the ends of the orifice (1) and the spring (4) force to maintain the control flow at constant.

- | | |
|----------------------|----------------------|
| (1) Orifice | (6) Plunger |
| (2) PF Port | (7) EF Port |
| (3) Portion A | (8) Portion B |
| (4) Plunger Spring | (9) P Port |
| (5) Damper Orifice | |

W1015661

7. RELIEF VALVE



The 3-point hydraulic circuit has a relief valve to restrict the maximum pressure in its circuit.

This is a guide piston relief valve with damper, a direct acting relief valve suitable for relatively high pressure and capacity, and constructed so as to prevent chattering and other unstableness associated with direct acting relief valves. As shown in the diagram, poppet (5) has a guide, and there is a valve chamber called a damping chamber (6) in the base of this guide piston. The valve inlet is connected to this chamber through the clearance between the guide surface and the seat so that the chamber provides a damping effect, controlling valve vibration.

When the pressure in the circuit rises, the pressure in the damping chamber also rises, and when it exceeds the relief pressure setting the spring is compressed, making a clearance between the poppet and the seat. The hydraulic oil can escape to the transmission case through this clearance, controlling the pressure rise.

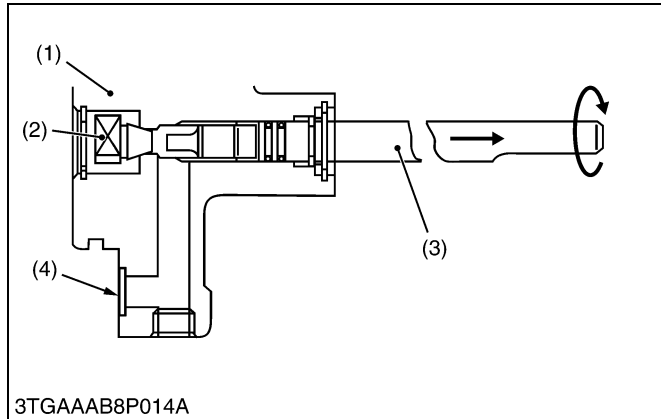
(Reference)

- Relief valve setting pressure
 - 16.7 to 17.2 MPa
 - 170 to 175 kgf/cm²
 - 2417.4 to 2488.5 psi
- Engine speed: Maximum
- Oil temperature: 45 to 55 °C (113 to 131 °F)

- | | |
|------------|----------------------|
| (1) Washer | (5) Poppet |
| (2) Shim | (6) Damping Chamber |
| (3) Plug | |
| (4) Seat | T : Tank Port |

W1016070

8. LOWERING SPEED ADJUSTING VALVE

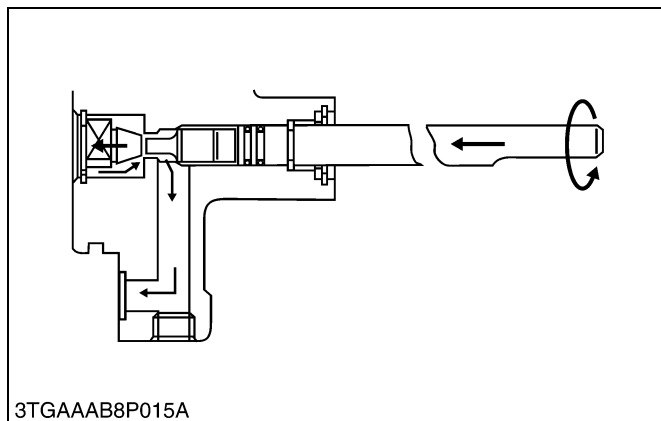


This valve acts 3-point linkage lowering speed adjusting and holding.

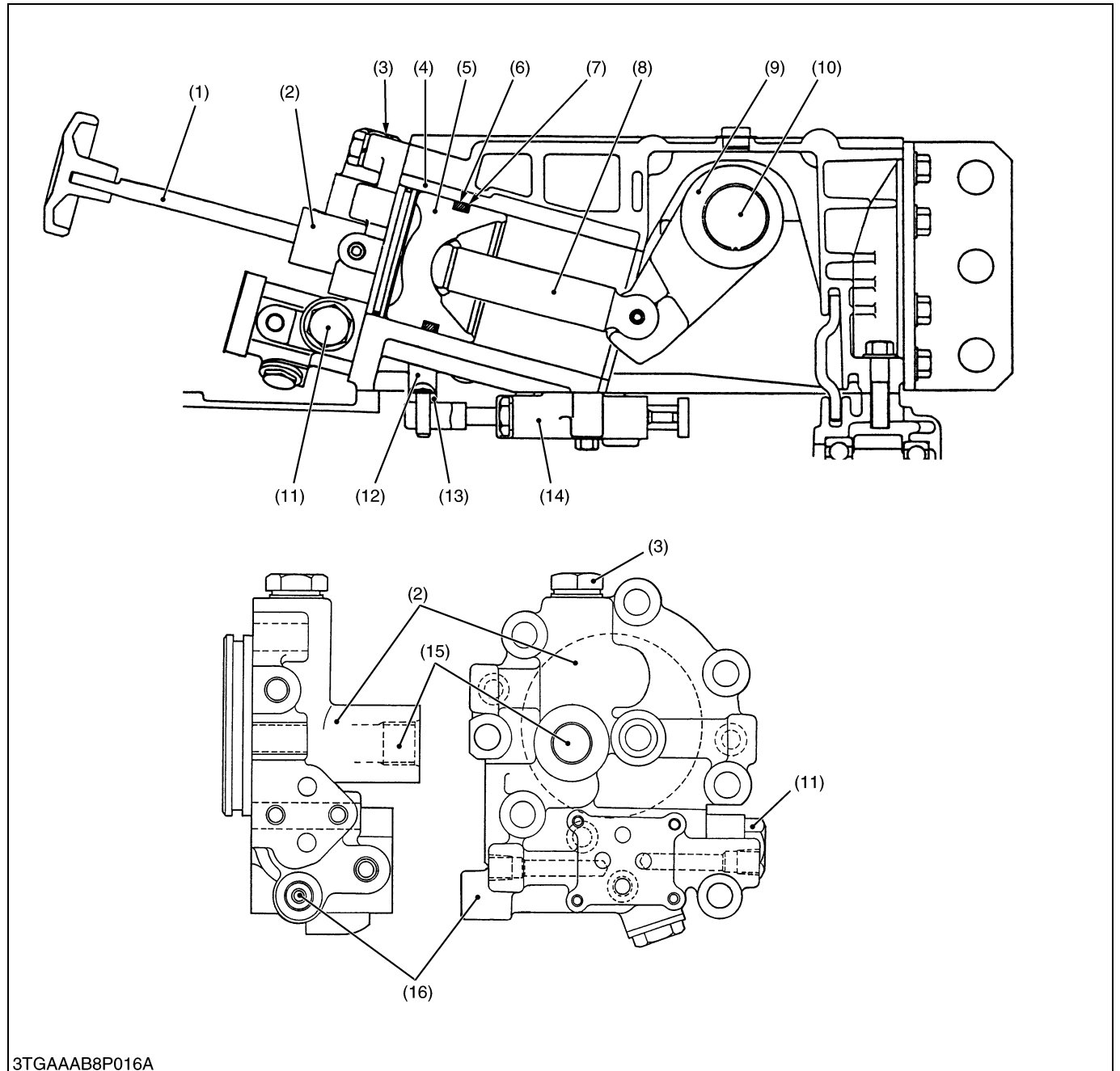
Turning the lowering speed adjusting knob (3) clockwise decreases the lowering speed, and counterclockwise increases lowering speed. When the lowering speed adjusting valve (2) is completely closed, the 3-point linkage is held at its position since oil in the hydraulic cylinder is sealed between the piston and lowering speed adjusting valve (2).

- | | |
|------------------------------------|---|
| (1) Hydraulic Cylinder Cover | (3) Lowering Speed Adjusting Shaft (Knob) |
| (2) Lowering Speed Adjusting Valve | (4) Tank Port |

W1016318



9. HYDRAULIC CYLINDER



3TGAAAB8P016A

- | | | | |
|------------------------------------|----------------------|--------------------------|-------------------------|
| (1) Lowering Speed Adjusting Shaft | (5) Hydraulic Piston | (9) Hydraulic Arm | (13) Control Arm |
| (2) Cylinder Head | (6) O-ring | (10) Hydraulic Arm Shaft | (14) Control Valve |
| (3) Relief Valve | (7) Back-up Ring | (11) Flow Priority Valve | (15) IN Port |
| (4) Hydraulic Cylinder | (8) Hydraulic Rod | (12) Spool Drive Lever | (16) Bi-speed Turn Port |

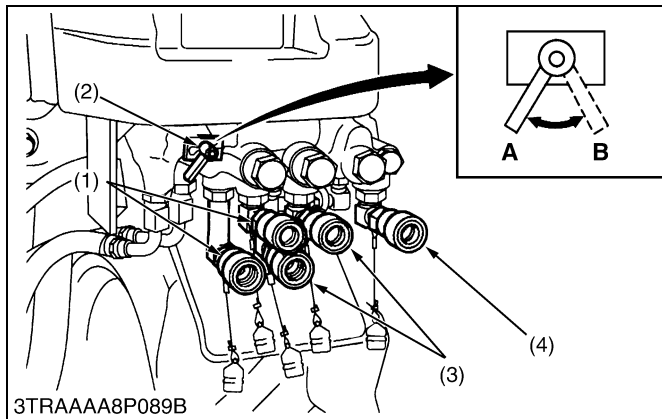
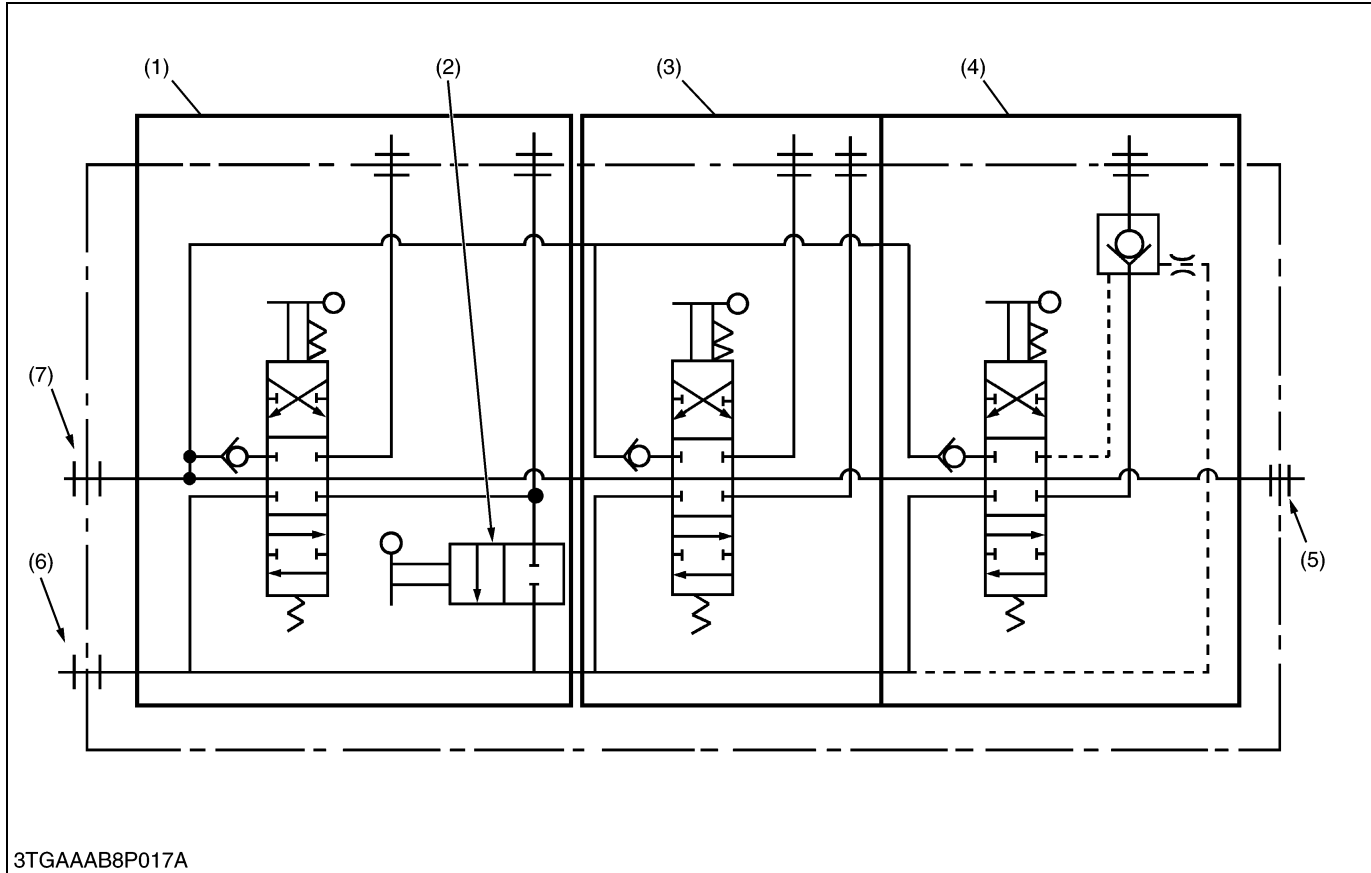
The main components of the hydraulic cylinder are shown in the figure above.

While the lift arm is rising, oil from the hydraulic pump flows into the hydraulic cylinder (4) through the control valve (14). Then oil pushes out the piston (5).

While the lift arm is lowering, oil in the hydraulic cylinder (4) is discharged to the transmission case through the control valve (14) by the weight of the implement. At this time, the lowering speed of the implement can be controlled by the lowering speed adjusting shaft (1) attached to the hydraulic cylinder (4).

10. AUXILIARY CONTROL VALVE

[1] HYDRAULIC CIRCUIT



This auxiliary control valve is a unit for three valves as single / double acting selectable valve, double acting valve and single acting valve.

The pressured oil into the three each control valve with parallel connection through the **P** port (7).

The single / double acting valve (1) is changeable for single or double acting with selector valve (2).

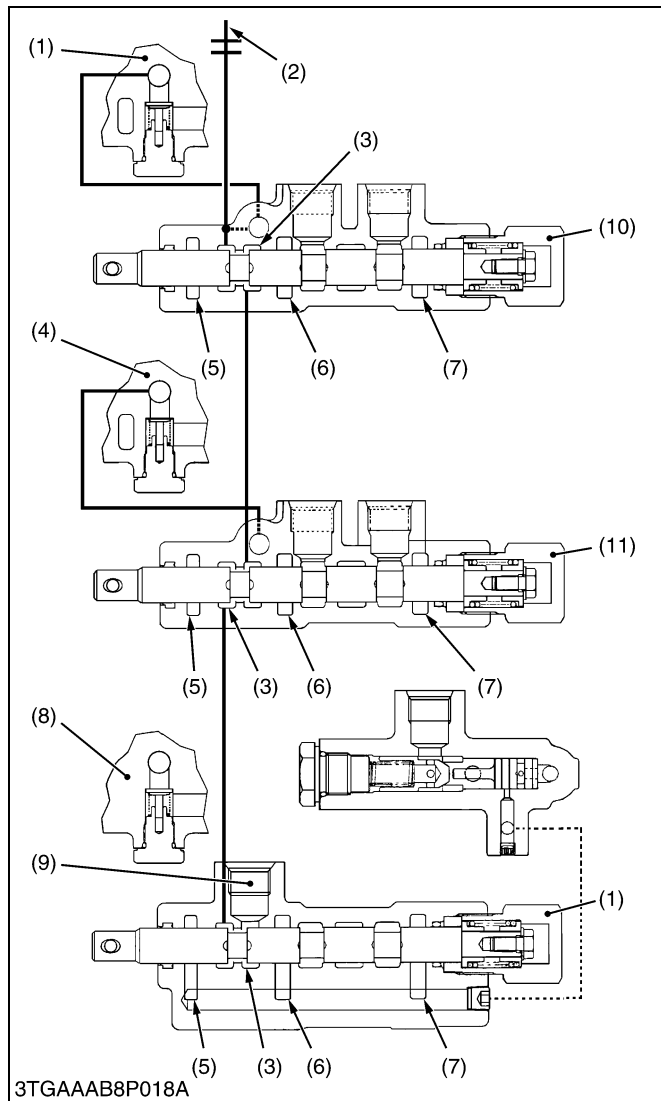
(Reference)

- Max flow 23.0 L/min.
6.1 U.S.gal./min.
5.1 Imp.gal./min.

No relief valve in the auxiliary control valve unit

- | | |
|--|--------------------------|
| (1) Single / Double Acting Valve | (6) Tank Port |
| (2) Auxiliary Control Valve Select Lever | (7) P Port |
| (3) Double Acting Valve | (A) Single Acting |
| (4) Single Acting Valve | (B) Double Acting |
| (5) PB Port | |

W1017541



■ Neutral

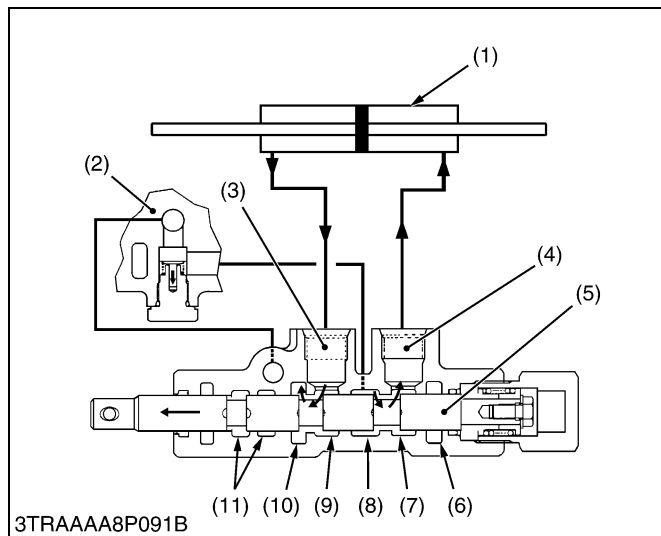
Forced oil into the auxiliary control valve through the **P** port (2) and divided two oil line. The one will reach to each check valve (1), (4) and (8).

The other one return to the 3-point linkage hydraulic valve from the **PB** outlet (9) through each **PB** port (3).

The **T3** port (5) has not refer with spool action but it has lubricating effect for spool.

- | | |
|-----------------|-----------------------------------|
| (1) Check Valve | (7) T1 Port |
| (2) P Port | (8) Check Valve |
| (3) PB Port | (9) PB Outlet |
| (4) Check Valve | (10) Single / Double Acting Valve |
| (5) T3 Port | (11) Double Acting Valve |
| (6) T2 Port | (12) Single Acting Valve |

W1017676



■ Double Acting Valve (A2 and B2 Outlet Port)
(When spool is moved to LH)

When the spool (5) is moved, the **PB** port (11) is closed. The pressured oil open the check valve (2) and into the valve through the **P2** port (8).

Pressured oil flow shows as follow.

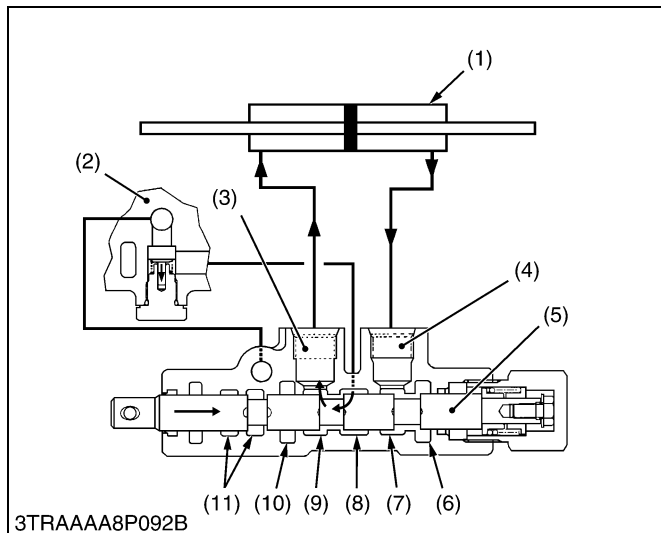
P2 Port (8) → **A2** Port (7) → **A2** Outlet (4)

The **B2** port (9) and **T2** port (10) are opened.

The oil from the **B2** outlet (3) return to the transmission case through **B2** outlet (3), **B2** port (9) and **T2** port (10).

- | | |
|----------------------------|--------------|
| (1) Double Acting Cylinder | (7) A2 Port |
| (2) Check Valve | (8) P2 Port |
| (3) B2 Outlet | (9) B2 Port |
| (4) A2 Outlet | (10) T2 Port |
| (5) Spool | (11) PB Port |
| (6) T1 Port | |

W1017623

**(When spool is moved to RH)**

When the spool (5) is moved, the **PB** port (11) is close. The pressured oil open the check valve (2) and into the valve through the **P2** port (8).

Pressured oil flow shows as follow.

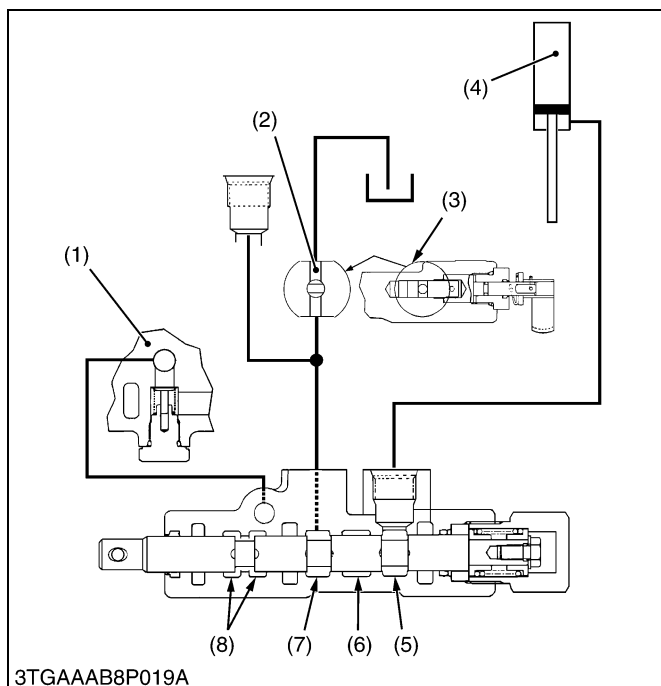
P2 port (8) → **B2** port (9) → **B2** outlet (3)

The **A2** port (7) and **T1** port (6) are opened.

The oil from the **A2** outlet (4) return to the transmission case through **A2** outlet (4), **A2** port (7) and **T1** port (6).

- | | |
|----------------------------|---------------------|
| (1) Double Acting Cylinder | (7) A2 Port |
| (2) Check Valve | (8) P2 Port |
| (3) B2 Outlet | (9) B2 Port |
| (4) A2 Outlet | (10) T2 Port |
| (5) Spool | (11) PB Port |
| (6) T1 Port | |

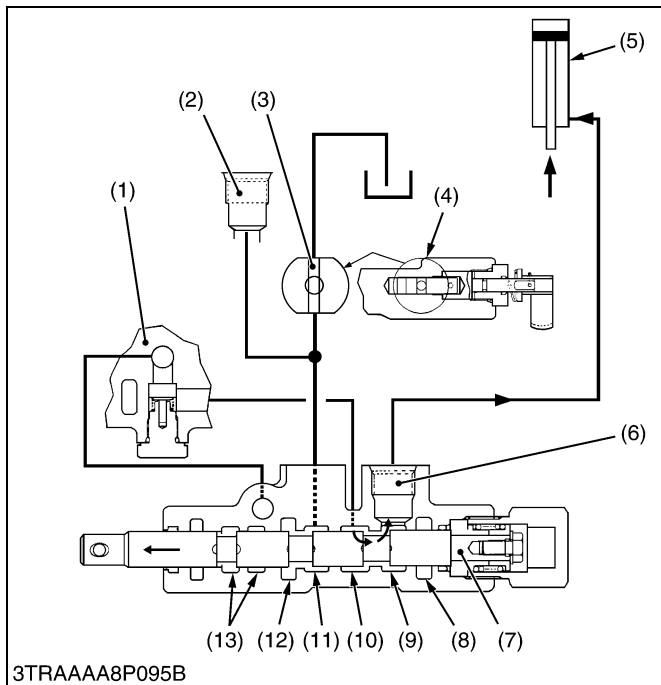
W1018283

**Single / Double Acting Valve (A1 and B1 Outlet)****(1) Double Action**

Between **B1** port (7) and **T** port (2) passage is closed by rotary valve (3) of selector lever. So, it is same function with double acting valve (**A2** and **B2** outlet).

- | | |
|----------------------------|--------------------|
| (1) Check Valve | (5) A1 Port |
| (2) T Port | (6) P1 Port |
| (3) Rotary Valve | (7) B1 Port |
| (4) Single Action Cylinder | (8) PB Port |

W1018702



(2) Single Action

Between **B1** port (11) and **T** port (3) passage is opened by rotary valve (4) of selector lever.

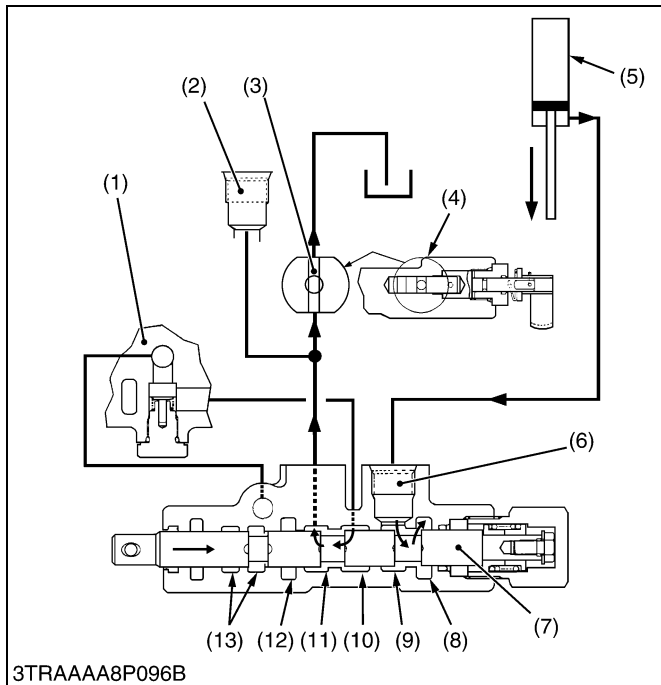
(When spool is moved to LH (When Lifting))

When the spool (7) is moved, the **PB** port (13) is closed. The pressured oil open the check valve (1) and into the valve through the **P1** port (10). The pressured oil flow shows as follow.

P1 Port (10) → **A1** Port (9) → **A3** Outlet (6)

- | | |
|----------------------------|--------------|
| (1) Check Valve | (8) T1 Port |
| (2) B1 Outlet | (9) A1 Port |
| (3) T Port | (10) P1 Port |
| (4) Rotary Valve | (11) B1 Port |
| (5) Single Action Cylinder | (12) T2 Port |
| (6) A3 Outlet | (13) PB Port |
| (7) Spool | |

W1018824



(When spool is moved RH (When Lowering))

When the spool (7) is moved, the **PB** port (13) is closed. The pressured oil open the check valve (1) and into the valve through the **P1** port (10).

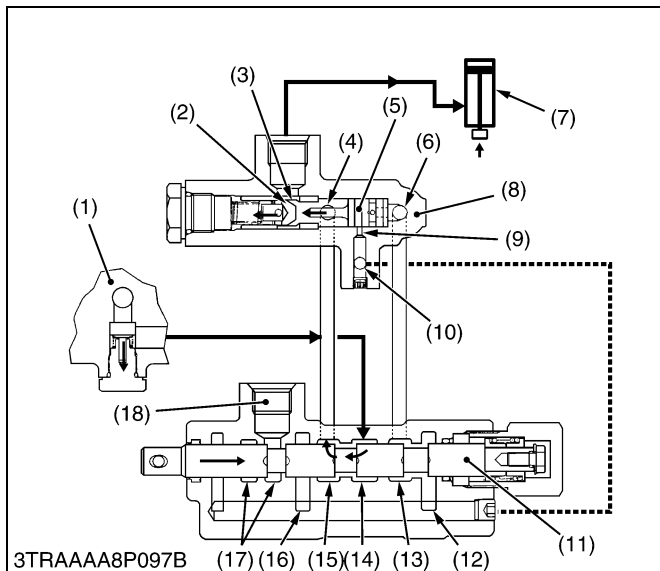
The pressured oil flow shows as follow.

P1 Port (10) → **B1** Port (11) → Rotary Valve (4) → **T** Port (3) → Transmission Case

The oil from **A3** outlet (6) flow to transmission case through the **A1** port (9) and **T1** port (8).

- | | |
|----------------------------|--------------|
| (1) Check Valve | (8) T1 Port |
| (2) B1 Outlet | (9) A1 Port |
| (3) T Port | (10) P1 Port |
| (4) Rotary Valve | (11) B1 Port |
| (5) Single Action Cylinder | (12) T2 Port |
| (6) A3 Outlet | (13) PB Port |
| (7) Spool | |

W1019018



■ Single Acting Valve (B₃ Outlet)

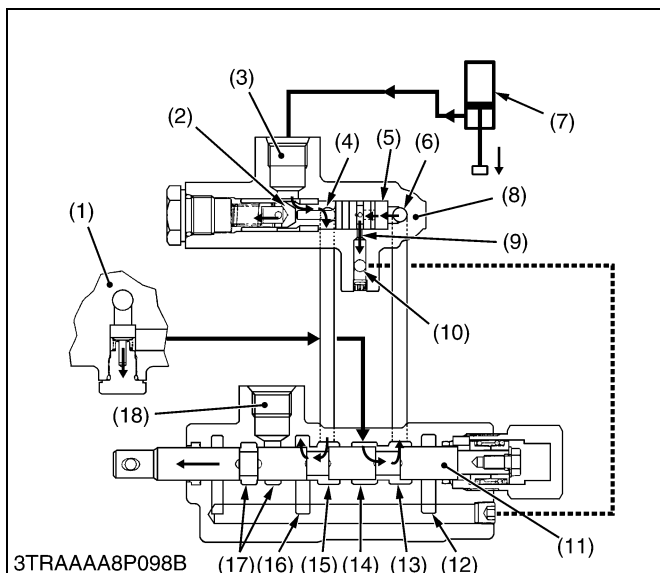
(When spool is moved RH (When Lifting))

When the spool (11) is moved, the **PB** port (17) is closed. The pressured oil open the check valve (1) and into the valve through **P₃** port (14).

The pressured oil into the unload valve (8) through **B₃** port (15) and **PX** port (4). The oil pressure push the poppet (2) to open the **B₃** outlet (3).

- | | |
|---------------------------------|--------------------------------|
| (1) Check Valve | (10) T Port |
| (2) Poppet | (11) Spool |
| (3) B₃ Outlet | (12) T ₁ Port |
| (4) PX Port | (13) A₃ Port |
| (5) Pilot Valve | (14) P₃ Port |
| (6) PY Port | (15) B₃ Port |
| (7) Single Action Cylinder | (16) T ₂ Port |
| (8) Unload Valve | (17) PB Port |
| (9) Orifice | (18) PB Outlet |

W1019283



(When spool is moved LH (When Lowering))

When the spool (11) is moved, the **PB** port (17) is closed. The pressured oil open the check valve (1) and into the valve through **P₃** port (14).

The pressured oil into the unload valve (8) through **A₃** port (13) and **PY** port (6), then push the pilot valve (5). The pilot valve (5) also push the poppet (2) to open the **B₃** outlet (3).

The oil from the **B₃** outlet (3) flow to **PX** port (4) and return to transmission case through the **B₃** port (15) and T₂ port (16).

The oil from **PY** port (6) flow to the orifice (9) after moved pilot valve and return to transmission case through the T port (10).

This orifice (9) maintain the pressure, to be opening the pilot valve (5).

- | | |
|---------------------------------|--------------------------------|
| (1) Check Valve | (10) T Port |
| (2) Poppet | (11) Spool |
| (3) B₃ Outlet | (12) T ₁ Port |
| (4) PX Port | (13) A₃ Port |
| (5) Pilot Valve | (14) P₃ Port |
| (6) PY Port | (15) B₃ Port |
| (7) Single Action Cylinder | (16) T ₂ Port |
| (8) Unload Valve | (17) PB Port |
| (9) Orifice | (18) PB Outlet |

W1019605

SERVICING

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1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Implement Does Not Rise (Not Noise)	<ul style="list-style-type: none"> Control linkage improperly adjusted Control linkage improperly assembled or damaged Position control valve malfunctioning Relief valve spring weaken or broken Hydraulic piston O-ring, cylinder damaged 	Adjust Repair or replace Repair or replace Replace Replace	9-S7 9-S7 9-S10 9-S11 9-S11
(Noise)	<ul style="list-style-type: none"> Transmission fluid improper or insufficient Oil filter clogged Suction pipe loosen or broken Suction pipe O-ring damaged Relief valve setting pressure too low Hydraulic pump malfunctioning 	Change or replenish Replace Repair or replace Replace Adjust Repair or replace	G-8 G-13 – – 9-S8 9-S6
Implement Does Not Reach Maximum Height	<ul style="list-style-type: none"> Position control rod improperly adjusted Top link length improperly adjusted Position control valve improperly adjusted Hydraulic arm shaft, hydraulic arm, lift arm improperly assembled 3 point link improperly set 	Adjust Adjust Replace Adjust Adjust	9-S7 – 9-S10 9-S12 –
Implement Drops by Weight	<ul style="list-style-type: none"> Hydraulic cylinder worn or damaged Hydraulic piston and O-ring worn or damaged Lowering speed adjusting valve damaged Position control valve malfunctioning 	Replace Replace Replace Replace	9-S14 9-S11 9-S11 9-S10
Implement Hunts (Moves Up and Down)	<ul style="list-style-type: none"> Position control valve malfunctioning 	Replace	9-S10
Oil Temperature Increases Rapidly	<ul style="list-style-type: none"> Relief valve operating Hydraulic pump leak or damaged Oil leaks from valves Gear or bearing damaged in the transmission case 	Adjust Replace or repair Replace or repair Replace	9-S8 – – –

W1014322

2. SERVICING SPECIFICATIONS

HYDRAULIC PUMP

Item		Factory Specification	Allowable Limit
Hydraulic Pump Condition <ul style="list-style-type: none"> • Engine Speed : 2800 rpm • Rated Pressure : 16.67 to 16.72 MPa 170.0 to 170.5 kgf/cm² 2417.9 to 2425.0 psi • Oil Temperature : 50 °C 122 °F 	Delivery at No Pressure	23.2 L/min. 6.13 U.S.gal/min. 5.10 Imp.gal/min.	–
	Delivery at Rated Pressure	19.9 L/min. 5.26 U.S.gal/min. 4.38 Imp.gal/min.	–
Gear to Casing	Clearance	–	0.15 mm 0.0059 in.
Bushing to Gear Shaft	Clearance	0.030 to 0.091 mm 0.0012 to 0.0036 in.	0.12 mm 0.0047 in.
Gear Shaft	O.D.	14.970 to 14.980 mm 0.5894 to 0.5898 in.	–
Bushing	I.D.	15.010 to 15.061 mm 0.5909 to 0.5930 in.	–
Side Plate	Thickness	2.48 to 2.50 mm 0.0976 to 0.0984 in.	2.40 mm 0.0945 in.

W1011105

CONTROL LINKAGE

Position Control Lever	Operating Force	24.5 to 34.3 N 2.5 to 3.5 kgf 5.5 to 7.7 lbs	–
Lift Arm	Free Play	5.0 to 15.0 mm 0.197 to 0.591 in.	–

W1013973

RELIEF VALVE

Relief Valve Condition <ul style="list-style-type: none"> • Engine Speed : Maximum • Oil Temperature : 40 to 60 °C 104 to 140 °F 	Setting Pressure	16.7 to 17.2 MPa 165 to 175 kgf/cm ² 2346.8 to 2489.0 psi	–
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W1013973

HYDRAULIC CYLINDER

Item		Factory Specification	Allowable Limit
Cylinder Bore	I.D.	75.06 to 75.10 mm 2.9551 to 2.9567 in.	75.20 mm 2.9606 in.
Hydraulic Arm Shaft to Bushing	Clearance	0.020 to 0.125 mm 0.00079 to 0.00492 in.	0.30 mm 0.0118 in.
Hydraulic Arm Shaft	O.D. (Right)	37.925 to 37.950 mm 1.49311 to 1.49409 in.	–
	O.D. (Left)	34.925 to 34.950 mm 1.37500 to 1.37598 in.	–
Bushing	I.D. (Right)	37.970 to 38.050 mm 1.49488 to 1.49803 in.	–
	I.D. (Left)	34.970 to 35.050 mm 1.37677 to 1.37992 in.	–

W1013874

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-9.)

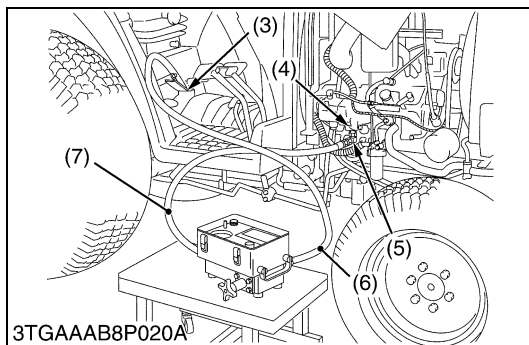
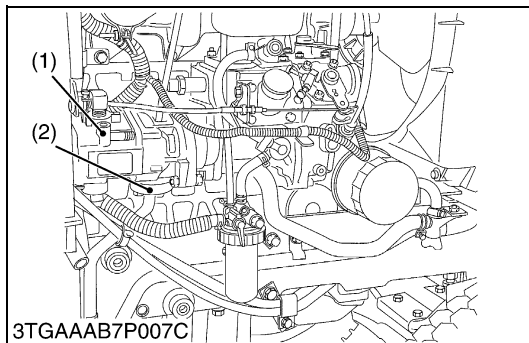
Item	N-m	kgf-m	ft-lbs
Power steering delivery hose joint screw	49.0 to 58.8	5.0 to 6.0	36.2 to 43.4
Position control valve mounting screw	19.6 to 23.5	2.0 to 2.4	14.5 to 17.4
Hydraulic cylinder cover mounting screw	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
	M10		
	M8		
Relief valve plug	17.7 to 20.6	1.8 to 2.1	13.0 to 15.2
	39.2 to 49.0	4.0 to 5.0	28.9 to 36.2

W1012736

4. CHECKING, DISASSEMBLING AND SERVICING

[1] CHECKING AND ADJUSTING

(1) Hydraulic Pump



Flowmeter Connecting and Test Preparation

■ IMPORTANT

- When using a flowmeter other than KUBOTA specified flowmeter (Code No.: 07916-52792), be sure to use the instructions with that flowmeter.
- In this hook-up, there is not relief valve. Therefore while testing, do not close the flowmeter loading valve completely.

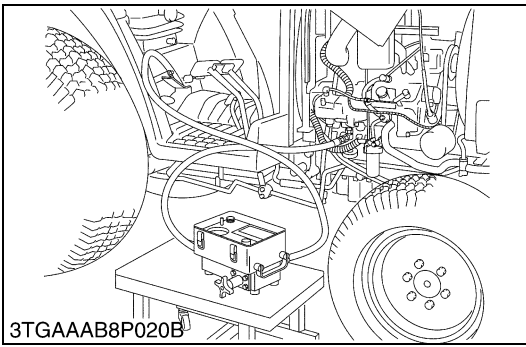
1. Remove the hydraulic delivery pipe (2) from hydraulic pump (1).
2. Set the adaptor flowmeter (See page G-38) (4) and adaptor **53** to the hydraulic pump (1).
3. Connect the hydraulic test hose (7) (Code No.: 07916-52651) to the adaptor **53** and flowmeter (Code No.: 07916-52791) inlet port.
4. Connect the another hydraulic test hose (6) to flowmeter outlet port and insert to the transmission fluid inlet (3).
5. Open the flowmeter loading valve completely. (Turn counterclockwise.)
6. Start the engine and set the engine speed 2800 rpm.
7. Slowly close the loading valve to generate the pressure approx. 15.7 MPa (160 kgf/cm², 2276 psi).
8. Hold in this condition until oil temperature reaches approx. 50 °C (122 °F)

(Reference)

- Adaptor is included in the adaptor set (Code No.: 07916-54031).

- | | |
|----------------------------------|-------------------------|
| (1) Hydraulic Pump | (5) Adaptor 53 |
| (2) Power Steering Delivery Hose | (6) Hydraulic Test Hose |
| (3) Transmission Fluid Inlet | (7) Hydraulic Test Hose |
| (4) Adaptor Flowmeter | |

W1011869



Pump Test

■ NOTE

- Before pump testing, perform the flowmeter connecting and test preparation.

1. Open the loading valve completely.
2. Start the engine and set at approx. 2800 rpm.
3. Read and note the pump delivery at no pressure.
4. Slowly close the loading valve to increase pressure approx. 16.67 MPa (170 kgf/cm², 2417.9 psi).
5. Read and note the pump flow at rated pressure.
6. Open the loading valve and stop the engine.

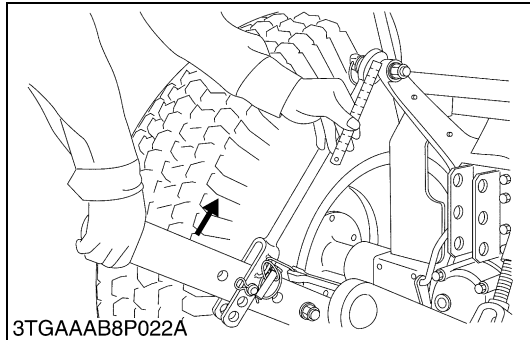
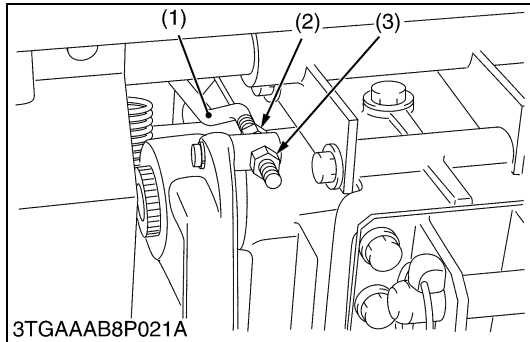
(Reference)

Hydraulic pump delivery at no pressure	Factory spec.	23.2 L/min. 6.13 U.S.gal/min. 5.10 Imp.gal/min.
Hydraulic pump delivery at rated pressure	Factory spec.	19.9 L/min. 5.26 U.S.gal/min. 4.38 Imp.gal/min.

Condition

- Engine speed Approx. 2800 rpm
- Rated pressure 16.67 MPa
170 kgf/cm²
2417.9 psi
- Oil temperature 50 °C
122 °F

W1012000

(2) Position Control Valve**Adjusting Position Control Rod**

1. Set the position control lever to the floating position.
2. Start the engine, and after warming-up, set the engine speed at 1000 to 1500 rpm.
3. Set the position control lever stopper to the maximum raising position.
4. Move the position control lever to the maximum raising position. (Contact to the position control lever stopper)
5. Turn the adjusting nut (3) and lock nut (2) until the relief valve begins to be operated. (Turn to clockwise)
6. Then turn back the adjusting nut (3) counterclockwise by 2 turn.
7. Tighten the lock nut (2) and set the engine speed to maximum.
8. Move the position control lever to the lowest position and maximum raising position (3 to 5 times to check the relief valve does not operate).
9. Set the position control lever to the maximum raising position, then move the relief arm to the upper end by hand and measure the free play.
10. Stop the engine.
11. If the measurement is not within the factory specification, adjusting position control rod again.

Lift arm free play at maximum raising position	Factory spec.	5.0 to 15.0 mm 0.197 to 0.591 in.
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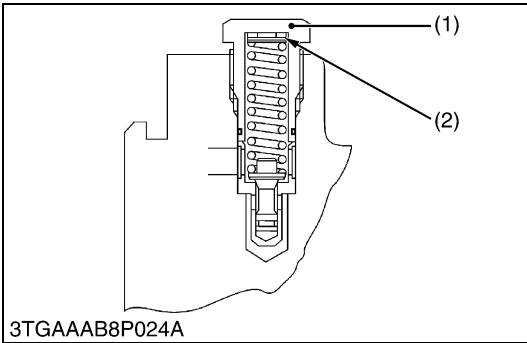
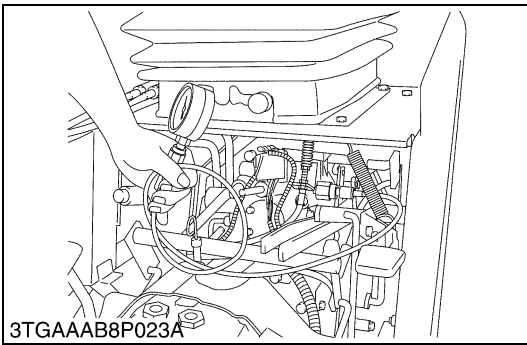
Condition

- Engine speed Maximum
- Oil temperature 45 to 55 °C
113 to 131 °F

(1) Position Control Rod
(2) Lock Nut

(3) Adjusting Nut

W1012507



Relief Valve Setting Pressure Test Using Pressure Tester

1. Start the engine and move the position control lever to the maximum raising position.
2. Turn the position control rod adjusting nut and lock nut until the relief valve begins to be operated. (Refer to 9-S7 Adjusting Control Rod)
3. Move the position control lever to the lowest position and stop the engine.
4. Remove the plug of hydraulic cylinder cover and install the adaptor 7 (Code No.: 07916-32951). Then connect the cable (Code No.: 07916-50331) and pressure gauge (Code No.: 07916-50322) to adaptor 7.
5. Start the engine and set the engine speed at maximum.
6. Move the position control lever to the maximum raising position and read the pressure when the relief valve functions.
7. Stop the engine.
8. If the pressure is not within the factory specification, remove the plug (1) and adjust with adjusting shims (2).
9. After the relief valve setting pressure test, adjust the position control rod. (See page 9-S7.)

Relief valve setting pressure	Factory spec.	16.7 to 17.2 MPa 165 to 175 kgf/cm ² 2346.8 to 2489.0 psi
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Condition

- Engine speed Maximum
- Oil temperature 45 to 55 °C
113 to 131 °F

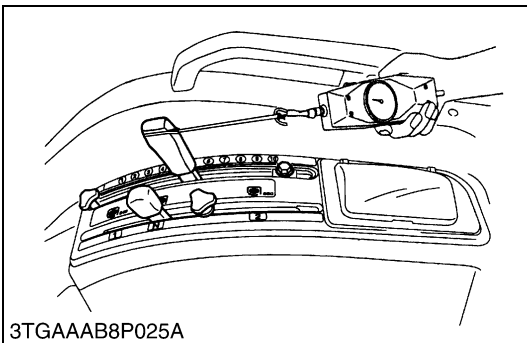
(Reference)

- Thickness of shim (2) :
0.1 mm (0.0039 in.) 0.2 mm (0.0078 in.) 0.4 mm (0.0157 in.)
- Pressure change per 0.1 mm (0.0039 in.) shim :
approx. 264.8 kPa
2.7 kgf/cm²
38.4 psi

(1) Plug

(2) Shim

W1012920



Adjusting Position Control Lever Operating Force

1. Set a spring balance to the position control lever to measure the operating force.
2. If the measurement is not within the factory specification, loosen the lock nut (1) and adjust the operating force with position control lever mounting nut (2).

(When reassembling)

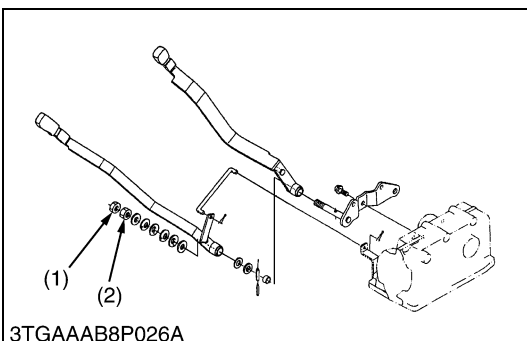
- Be sure to tight the lock nut.

Position control lever operating force	Factory spec.	25 to 34 N 2.5 to 3.5 kgf 5.5 to 7.7 lbs
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(1) Lock Nut

(2) Mounting Nut

W1013299

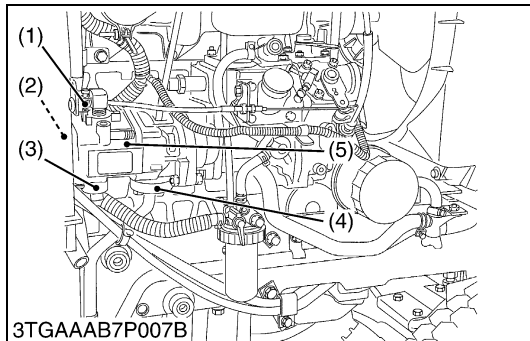


[2] DISASSEMBLING AND ASSEMBLING

(1) Hydraulic Pump

■ IMPORTANT

- The hydraulic pump is precision machined and assembled: if disassembled once, it may be unable to maintain its original performance. Therefore, when the hydraulic pump fails, replacement should be carried out with the hydraulic pump assembled except when emergency repair is unavoidable.
- When repair is required, follow the disassembly and servicing procedures shown below with utmost care.
- Be sure to test the hydraulic pump with a flowmeter before disassembling.
- After reassembly, be sure to perform break-in operation and ensure that there is nothing abnormal with the hydraulic pump.



Hydraulic Pump

1. Open the hood and remove the side cover (RH).
2. Disconnect the power steering delivery hose (3), drain hose (1), inlet hose (2) and 3P hydraulic delivery pipe (4).
3. Remove the hydraulic pump assembly (5).

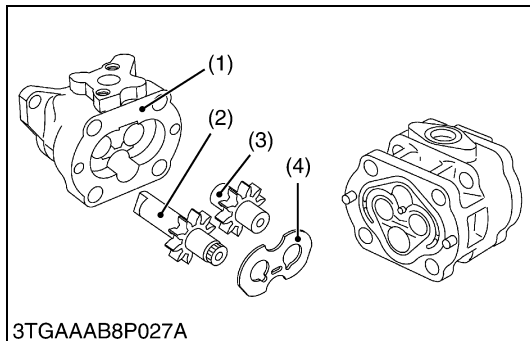
(When reassembling)

- Apply grease to the O-ring of hydraulic pump assembly.

Tightening torque	Power steering delivery hose joint screw	49.0 to 58.8 N·m 5.0 to 6.0 kgf·m 36.2 to 43.4 ft-lbs
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- | | |
|----------------------------------|--------------------------------|
| (1) Drain Hose | (4) 3P Hydraulic Delivery Hose |
| (2) Inlet Hose | (5) Hydraulic Pump Assembly |
| (3) Power Steering Delivery Hose | |

W1013560



Cover, Side Plate and Gear

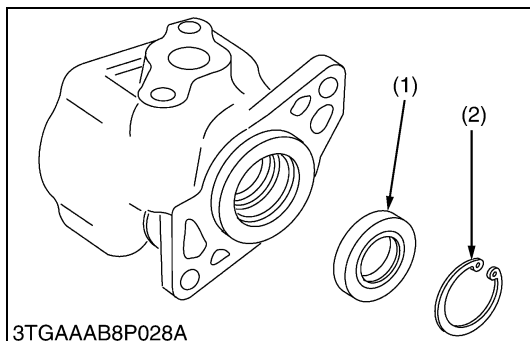
1. Secure the hydraulic pump with a vise, and remove the cover.
2. Remove the side plate (4).
3. Remove the drive gear (3) and driven gear (2) from the casing (1).

(When reassembling)

- Take care not to damage the O-ring.
- Align the holes of the cover and casing.
- Install the side plate, noting its location and direction.
- Install the gears, noting its direction.

- | | |
|-----------------|----------------|
| (1) Casing | (3) Drive Gear |
| (2) Driven Gear | (4) Side Plate |

W1013702



Oil Seal

1. Remove the internal snap ring (2), and remove the oil seal (1).

(When reassembling)

- If the oil seal is defective, worn or scratched, replace it.

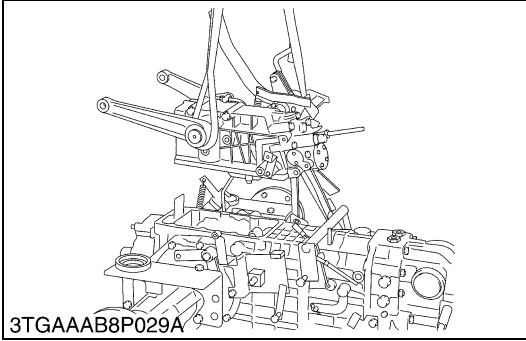
- | | |
|--------------|------------------------|
| (1) Oil Seal | (2) Internal Snap Ring |
|--------------|------------------------|

W1013888

(2) Position Control Valve

■ IMPORTANT

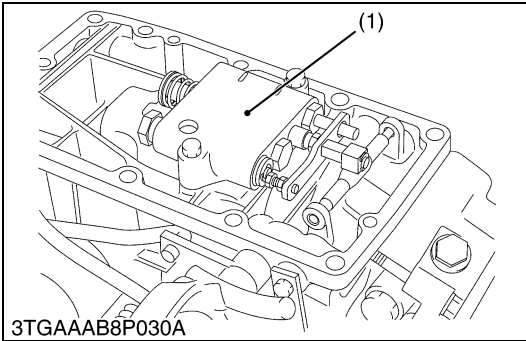
- The position control valve has been precisely machined, assembled and adjusted.
It is advisable not to disassemble it, except the unload poppet 1, unload poppet 2 and poppet 1.



Separating Hydraulic Cylinder

- See page 3-S11 to 3-S23.

W1014032



Removing Position Control Valve

- Remove the position control valve.

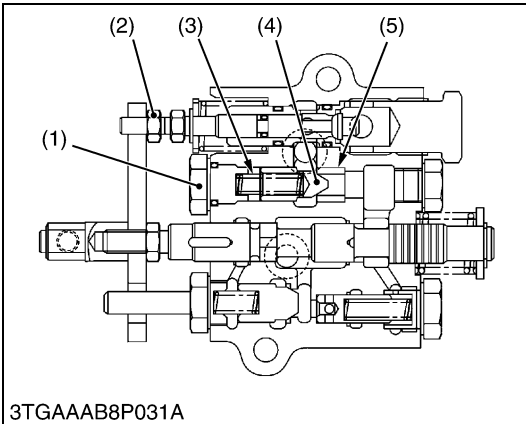
(When reassembling)

- Take care not to damage the O-rings.

Tightening torque	Position control valve mounting screws	19.6 to 23.5 N·m 2.0 to 2.4 kgf·m 14.5 to 17.4 ft·lbs
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- (1) Position Control Valve

W1014082



Poppet 1

■ IMPORTANT

- Never loosen the lock nut (2).

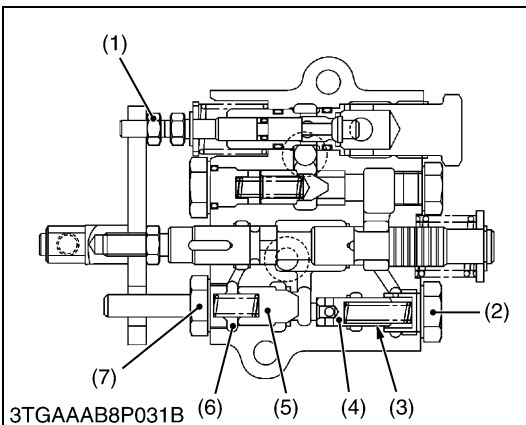
- Remove the plug (1).
- Draw out the spring (3) and poppet 1 (4).

(When reassembling)

- Apply transmission fluid to the O-ring and take care not to damage it.

- (1) Plug (4) Poppet 1
(2) Lock Nut (5) Check Valve Seat 1
(3) Spring

W1014194



Unload Poppet 1 and Unload Poppet 2

■ IMPORTANT

- Never loosen the lock nut (1).

- Remove the plug (7).
- Draw out the spring (6) and unload poppet 1 (5).
- Remove the plug (2).
- Draw out the spring (3) and unload poppet 2 (4).

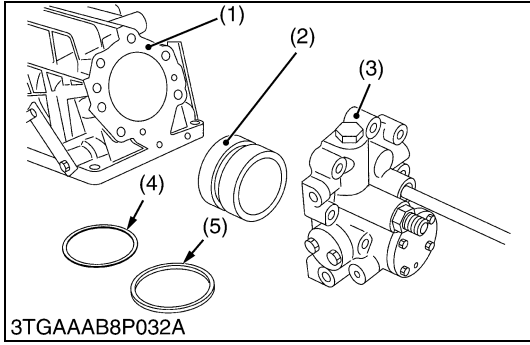
(When reassembling)

- Apply transmission fluid to the O-rings and take care not to damage them.

- (1) Lock Nut (5) Unload Poppet 1
(2) Plug (6) Spring
(3) Spring (7) Plug
(4) Unload Poppet 2

W1014336

(3) Hydraulic Cylinder Cover



Hydraulic Cylinder Cover and Piston

1. Remove the hydraulic cylinder cover (3).
2. Push out the piston from inside of hydraulic cylinder block (1).

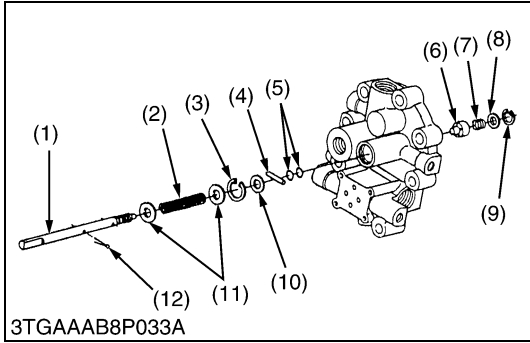
(When reassembling)

- Install the piston (2), noting O-ring (5) and back-up ring (4).
- Apply liquid lock (Three Bond 1372 or equivalent) to M8 screw to prevent oil leaking.

Tightening torque	Hydraulic cylinder cover mounting screws (M10)	39.2 to 44.1 N·m 4.0 to 4.5 kgf·m 28.9 to 32.5 ft-lbs
	Hydraulic cylinder cover mounting screw (M8)	17.7 to 20.6 N·m 1.8 to 2.1 kgf·m 13.0 to 15.2 ft-lbs

- (1) Hydraulic Cylinder Block
- (2) Piston
- (3) Hydraulic Cylinder Cover
- (4) Back-up Ring
- (5) O-ring

W1014516



Lowering Speed Adjusting Valve

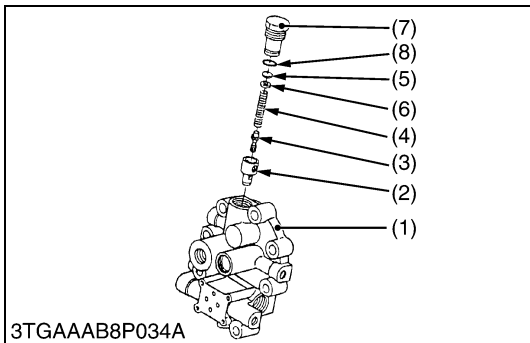
1. Remove the split pin (12) and detach the washer (11) and spring (2).
2. Remove the internal snap ring (3) and draw out the adjusting shaft (1).
3. Remove the external snap ring (9) and detach the adjusting collar (6), spring (7) and washer (8).

(When reassembling)

- Apply transmission oil to the O-rings and not give damage to them.

- (1) Adjusting Shaft
- (2) Spring
- (3) Internal Snap Ring
- (4) Straight Pin
- (5) O-ring
- (6) Adjusting Collar
- (7) Spring
- (8) Washer
- (9) External Snap Ring
- (10) Washer
- (11) Washer
- (12) Split Pin

W1014786



Relief Valve

1. Remove the plug (7).
2. Take out the washer (6), shims (5), spring (4), poppet (3) and valve seat (2).

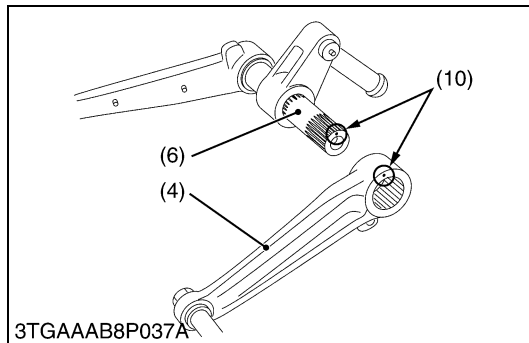
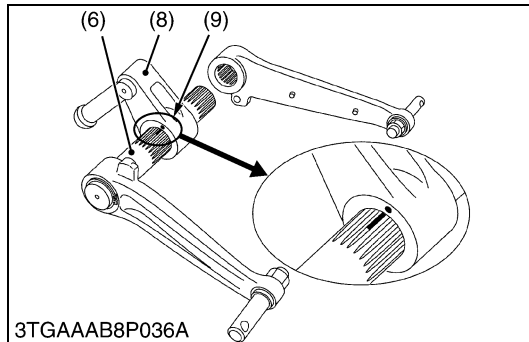
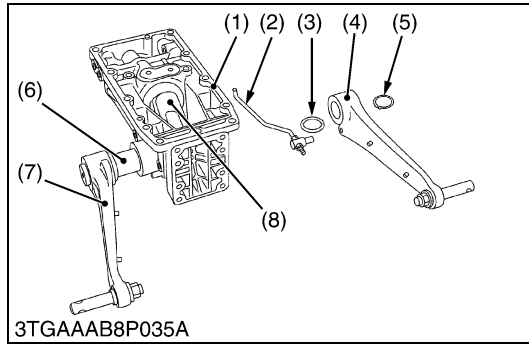
(When reassembling)

- Apply transmission fluid to the O-ring and take care not to damage it.

Tightening torque	Relief valve plug	39.2 to 49.0 N·m 4.0 to 5.0 kgf·m 28.9 to 36.2 ft-lbs
-------------------	-------------------	---

- (1) Hydraulic Cylinder Cover
- (2) Valve Seat
- (3) Poppet
- (4) Spring
- (5) Shim
- (6) Washer
- (7) Plug
- (8) O-ring

W1015330

(4) Hydraulic Cylinder**Lift Arm and Hydraulic Arm Shaft**

1. Remove the position control rod (2).
2. Remove the external snap ring and tap out the lift arm LH (4).
3. Pull out the lift arm RH (7) and hydraulic arm shaft (6) as a unit.
4. Take out the hydraulic arm (8) hydraulic rod as a unit.

(When reassembling)

- Apply molybdenum disulfide (Three Bond 1901 or equivalent) to the contact surface of the hydraulic arm and hydraulic rod.
- Align the alignment marks of the hydraulic arm (8) and hydraulic arm shaft (6).
- Align the alignment marks of the lift arm (4) and hydraulic arm shaft (6).
- Apply molybdenum disulfide (Three Bond 1901 or equivalent) to the right and left bushings of hydraulic cylinder block and O-rings (3).
- Take care not to damage the O-rings (3).

- (1) Hydraulic Cylinder Block
- (2) Position Control Rod
- (3) O-ring
- (4) Lift Arm LH
- (5) External Snap Ring
- (6) Hydraulic Arm Shaft

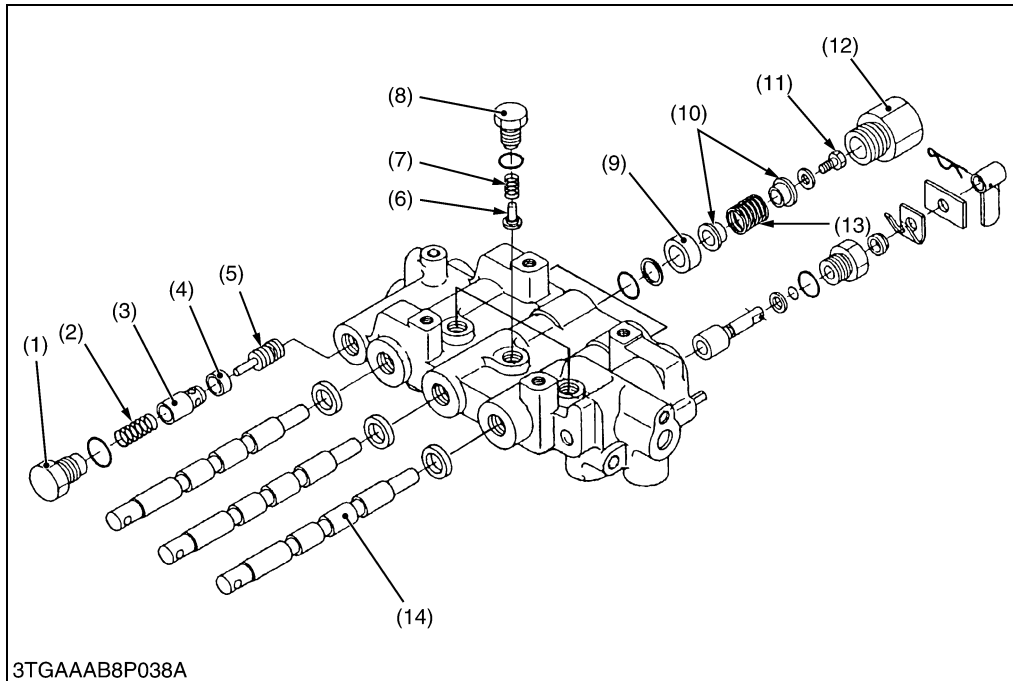
- (7) Lift Arm RH
- (8) Hydraulic Arm
- (9) Alignment Mark (Hydraulic Arm Shaft and Hydraulic Arm)
- (10) Alignment Mark (Hydraulic Arm Shaft and Lift Arm)

W1015511

(5) Auxiliary Control Valve**Removing Auxiliary Control Valve**

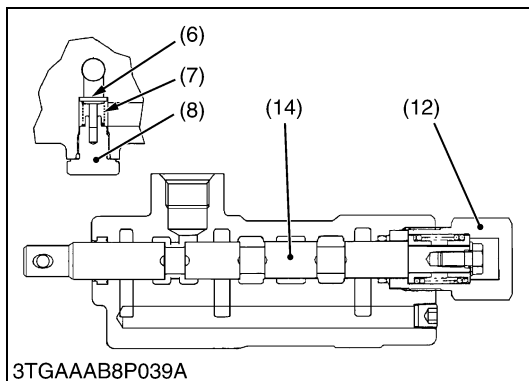
1. See page 3-S12.

W1016104

Auxiliary Control Valve

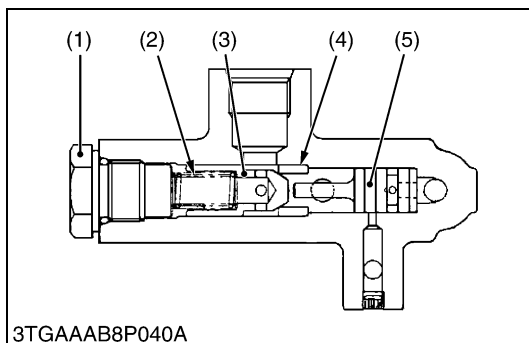
- (1) Plug
- (2) Spring
- (3) Poppet
- (4) Poppet Seat
- (5) Pilot Valve
- (6) Check Valve
- (7) Spring
- (8) Plug
- (9) Collar
- (10) Collar Retainer
- (11) Return Spring Mounting Screw
- (12) Plug
- (13) Return Spring
- (14) Spool

W1016169

**■ Spool and Check Valve**

1. Remove the plug (12) and draw out the spool (14) as a unit.
2. Remove the plug (8) and draw out the spring (7) and check valve (6).

W1016345

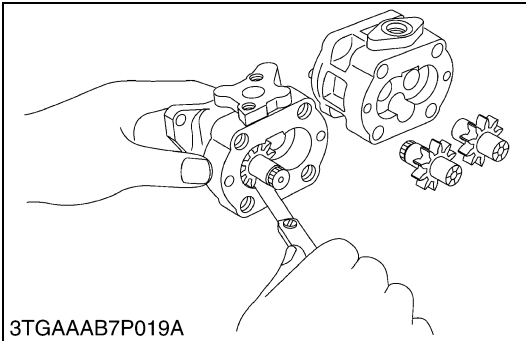
**■ Unload Valve**

1. Remove the plug (1) and draw out the spring (2), poppet (3), poppet seat (4) and pilot valve (5).

W1016490

[3] SERVICING

(1) Hydraulic Pump

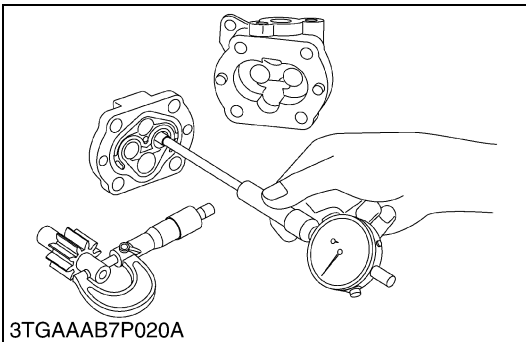


Clearance between Tip of Gear Tooth and Casing

1. Measure the clearance between gear and casing at several point with feeler gauge.
2. If the clearance exceeds the allowable limit, replace the assembly.

Clearance between tip of gear tooth and casing	Allowable limit	0.15 mm 0.0059 in.
--	-----------------	-----------------------

W1015312



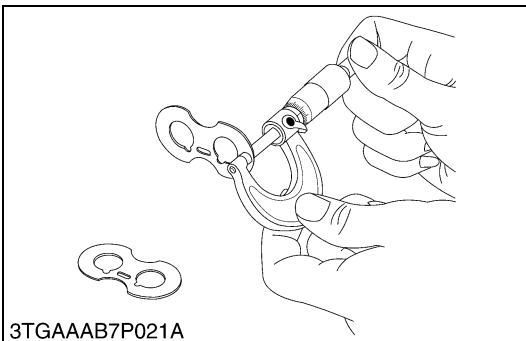
Clearance between Bushing and Gear Shaft

1. Measure the gear shaft O.D. with an outside micrometer.
2. Measure the bushing I.D. with a cylinder gauge.
3. If the clearance exceeds the allowable limit, replace it.

Clearance between bushing and gear shaft	Factory spec.	0.030 to 0.091 mm 0.0012 to 0.0036 in.
	Allowable limit	0.12 mm 0.0047 in.

Gear shaft O.D.	Factory spec.	14.970 to 14.980 mm 0.5894 to 0.5898 in.
Bushing I.D.	Factory spec.	15.010 to 15.061 mm 0.5909 to 0.5930 in.

W1015413



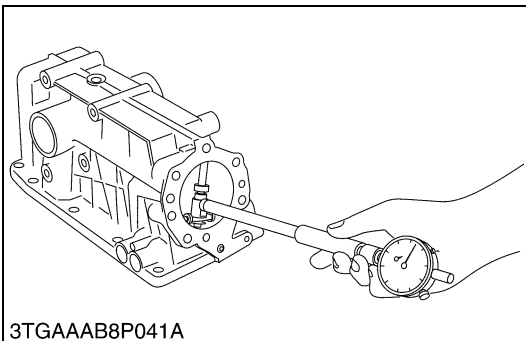
Side Plate Thickness

1. Measure the side plate thickness with an outside micrometer.
2. If the thickness is less than the allowable limit, replace it.

Side plate thickness	Factory spec.	2.48 to 2.50 mm 0.0976 to 0.0984 in.
	Allowable limit	2.40 mm 0.0945 in.

W1016755

(2) Hydraulic Cylinder

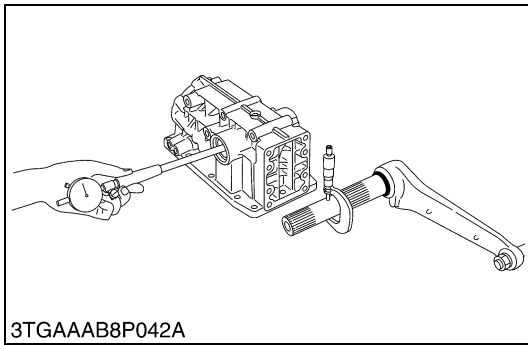


Hydraulic Cylinder Bore

1. Check the cylinder internal surface for scoring or damage.
2. Measure the cylinder I.D. with a cylinder gauge.
3. If the measurement exceeds the allowable limit, replace.

Cylinder bore I.D.	Factory spec.	75.06 to 75.10 mm 2.9551 to 2.9567 in.
	Allowable limit	75.20 mm 2.9606 in.

W1016851



Clearance between Hydraulic Arm Shaft and Bushing

1. Measure the hydraulic arm shaft O.D. with an outside micrometer.
2. Measure the bushing I.D. with a cylinder gauge.
3. If the clearance exceeds the allowable limit, replace.

■ NOTE

- If replace the bushings, be sure to use the hydraulic arm shaft bushing replacing tool. (See page G-38.)

Clearance between hydraulic arm shaft and bushing	Factory spec.	0.020 to 0.125 mm 0.00079 to 0.00492 in.
	Allowable limit	0.30 mm 0.0118 in.

Hydraulic arm shaft O.D.	Right	Factory spec.	37.925 to 37.950 mm 1.49311 to 1.49409 in.
	Left	Factory spec.	34.925 to 34.950 mm 1.37500 to 1.37598 in.
Bushing I.D.	Right	Factory spec.	37.970 to 38.050 mm 1.49488 to 1.49803 in.
	Left	Factory spec.	34.970 to 35.050 mm 1.37677 to 1.37992 in.

W1017108

10 ELECTRICAL SYSTEM

MECHANISM

CONTENTS

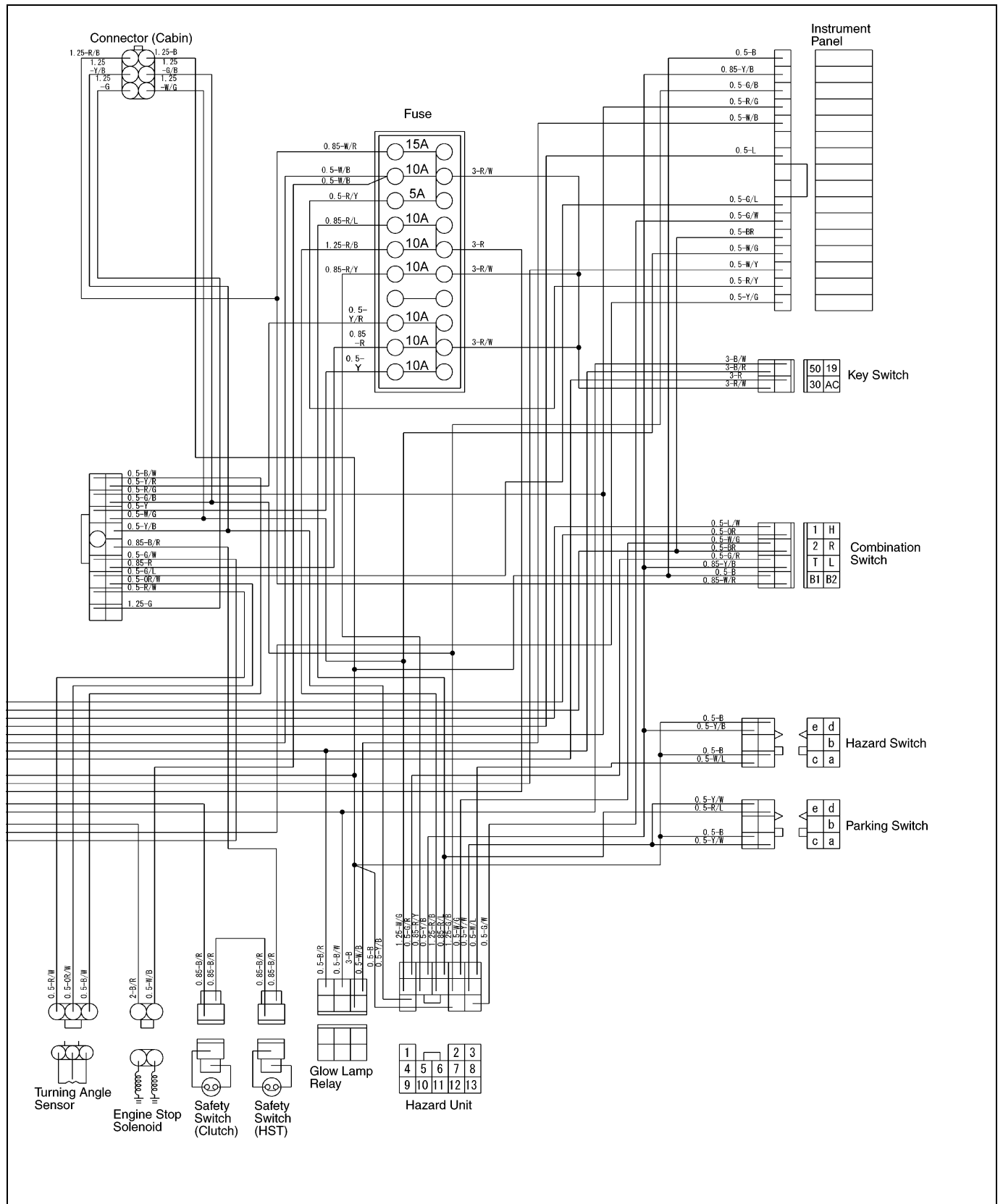
1. WIRING DIAGRAM	10-M1
2. STARTING SYSTEM	10-M4
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[2] GLOW PLUG	10-M6
[3] SAFETY SWITCH	10-M6
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4. LIGHTING SYSTEM	10-M10
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[3] HAZARD LIGHT	10-M12
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1. WIRING DIAGRAM

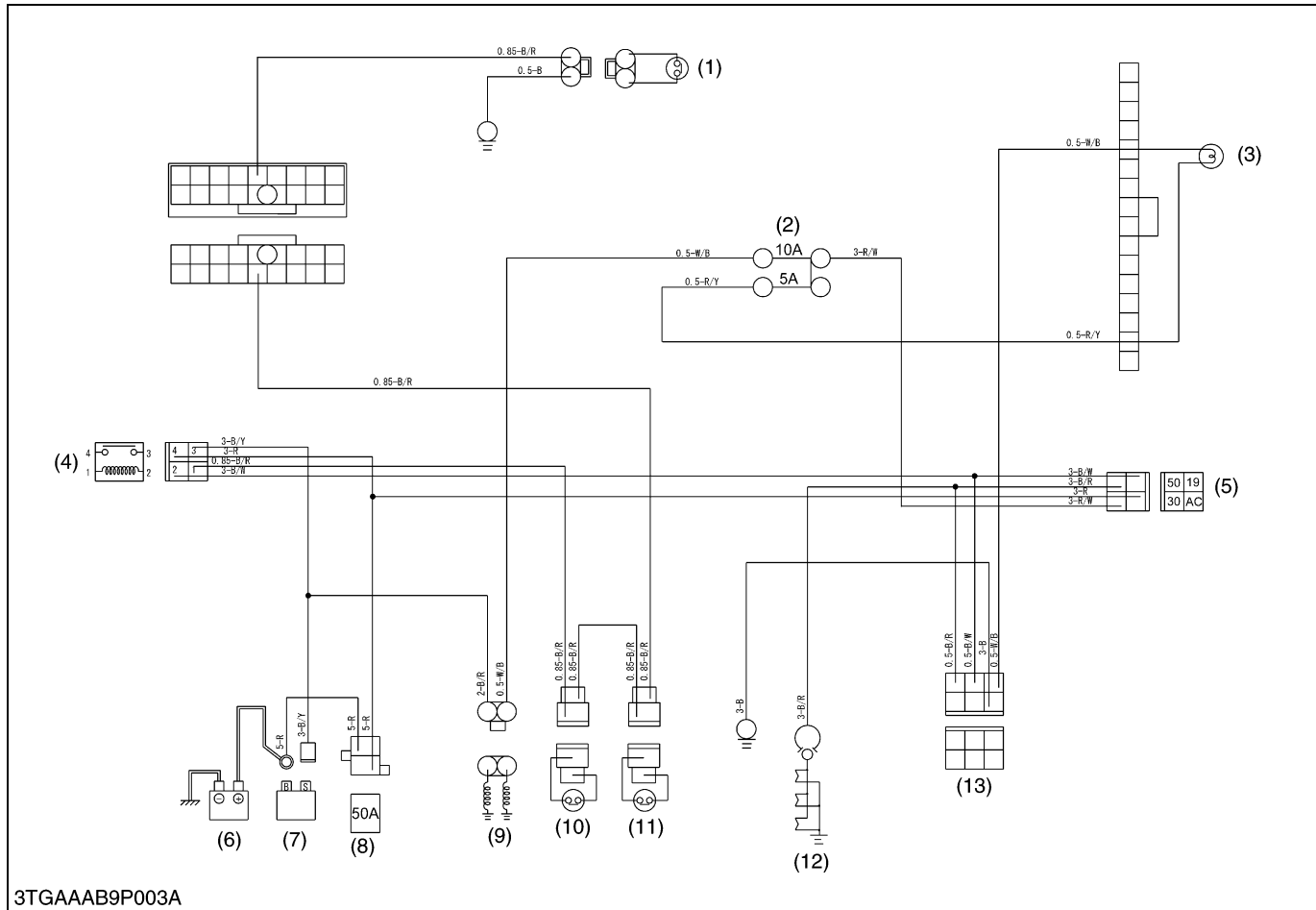
Color of Wiring

B Black	G/B Green / Black	R/W Red / White
Br Brown	G/L Green / Blue	R/Y Red / Yellow
G Green	G/R Green / Red	W/B White / Black
L Blue	G/W Green / White	W/G White / Green
Or Orange	Gr/B Gray / Black	W/L White / Blue
P Pink	Gr/R Gray / Red	W/R White / Red
Pu Purple	L/W Blue / White	W/Y White / Yellow
R Red	Or/W Orange / White	Y/B Yellow / Black
Y Yellow	R/B Red / Black	Y/G Yellow / Green
B/R Black / Red	R/G Red / Green	Y/R Yellow / Red
B/W Black / White	R/L Red / Blue	Y/W Yellow / White
B/Y Black / Yellow		

W1019456



2. STARTING SYSTEM



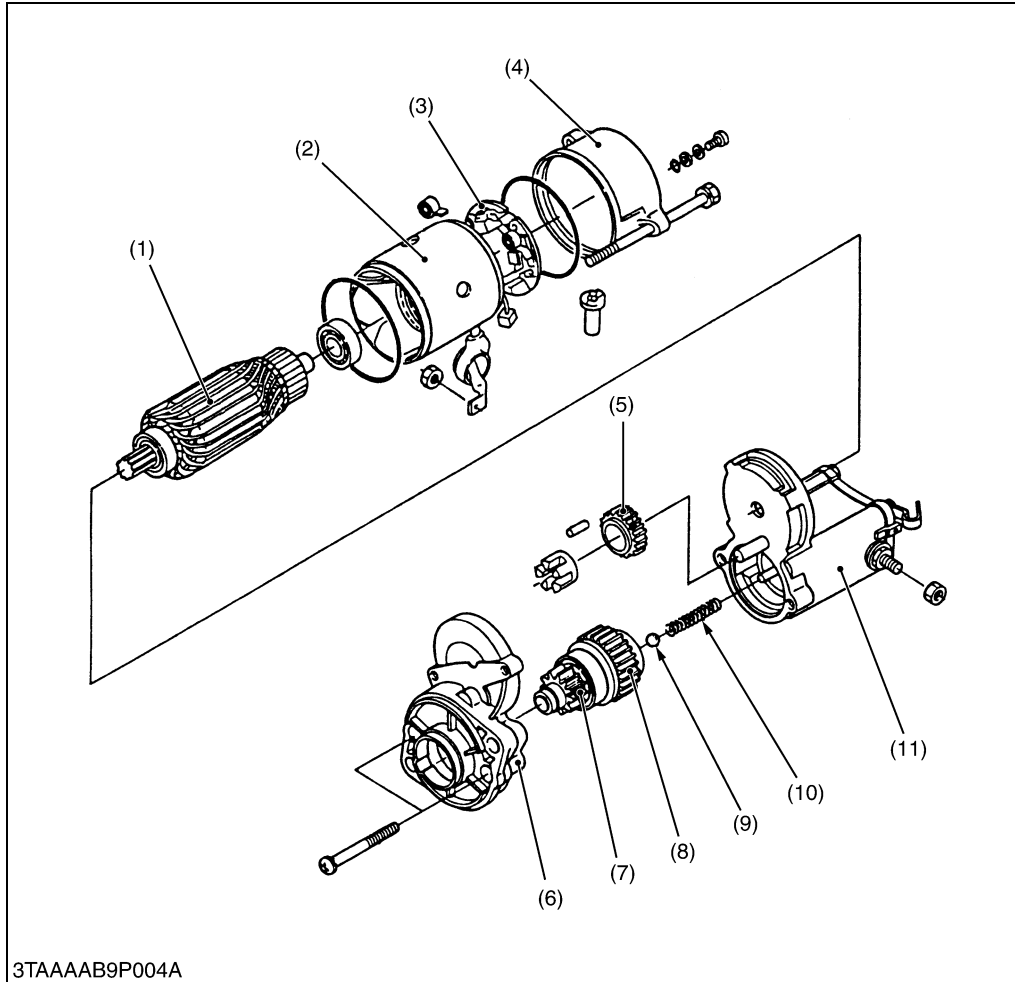
- | | | | |
|-----------------------------|----------------|-----------------------------|--------------------------|
| (1) Safety Switch (PTO) | (5) Key Switch | (8) Slow Blow Fuse | (11) Safety Switch (HST) |
| (2) Fuse | (6) Battery | (9) Engine Stop Solenoid | (12) Glow Plug |
| (3) Pre-heat Indicator Lamp | (7) Starter | (10) Safety Switch (Clutch) | (13) Glow Lamp Relay |
| (4) Starter Relay | | | |

When the main switch is turned to the **PREHEAT** position, the terminal **30** is connected to the terminals **19** and **AC**. The glow plugs become red-hot, and at the same time, pre-heat indicator lamp lights on by the glow lamp relay. After 5 seconds glow lamp relay cuts off the current of pre-heat indicator lamp for switching off the pre-heat indicator lamp. Therefore the pre-heat indicator lamp lights off but glow plugs become red hot.

When the main switch is then turned to the **START** position with the safety switches on, the terminal **30** is connected to the terminals **50** and **AC**. Consequently, battery current flows to the starter motor and start the engine.

The main switch automatically returns to the **ON** position, the terminal **30** is connected only to the terminal **AC**, thereby causing the starting circuit to be opened, stopping the starter motor.

When the main switch turned from the **ON** position to the **OFF** position, the fuel cut-off solenoid moves the fuel injection pump control rack to the “**No Fuel Injection**” position and stop the engine.

[1] STARTER

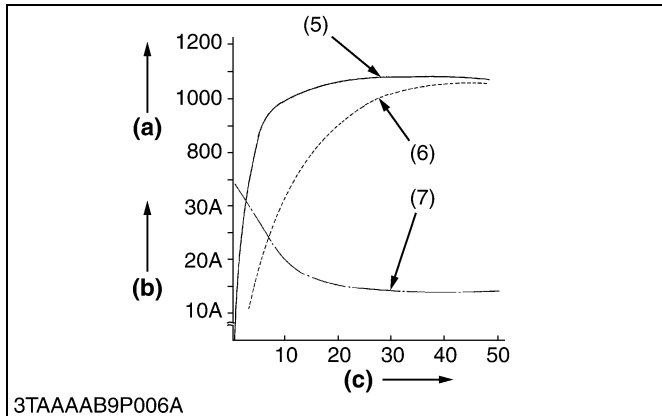
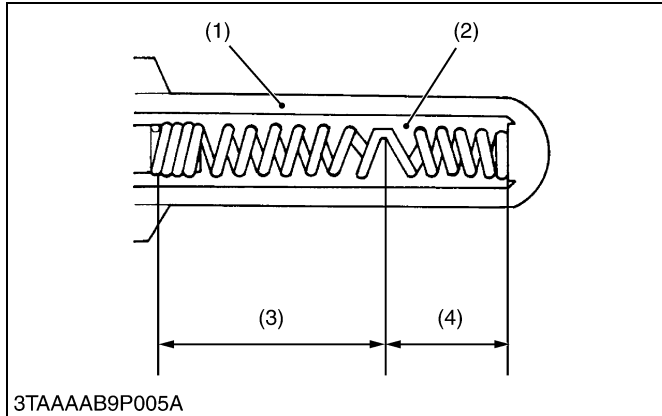
- (1) Armature
- (2) Yoke
- (3) Brush Holder
- (4) End Frame
- (5) Gear
- (6) Drive End Frame
- (7) Pinion
- (8) Roller Clutch
- (9) Ball
- (10) Spring
- (11) Magnet Switch

W1013084

3TAAAB9P004A

The starter motor is a reduction type. The speed of the pinion gear is reduced to approximately one third of motor one.

[2] GLOW PLUG



This plug is a two-material type QGS (Quick Glow System) for quick temperature rise, and has self-controlling function as well as excellent durability.

The heater (4) connected in series to the heater (3), which also functions as the resistor, is incorporated in the sheath tube (1) of the super glow plug.

The resistance of this heater (3) cum resistor is small when the temperature is low, while the resistance becomes large when the temperature rises.

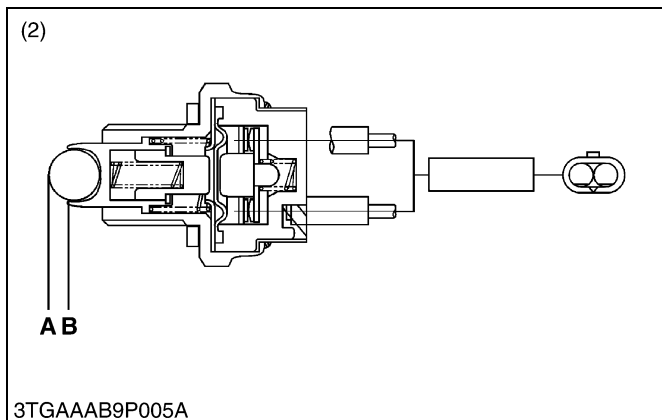
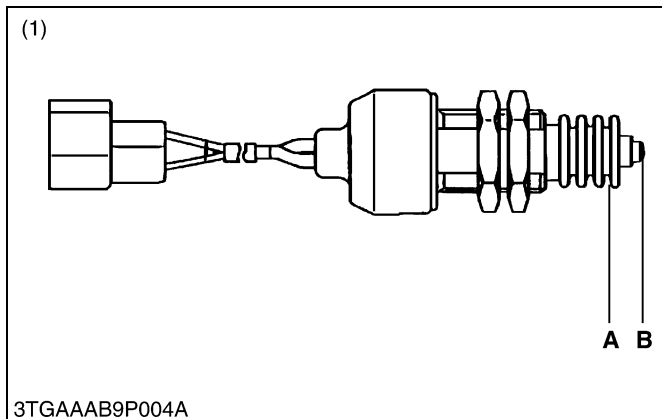
Therefore, because sufficient current is flown to the heater (4) during the initial period of energization, the temperature rises quickly and the resistance grows with the rise in the temperature of the resistor, the flowing current is reduced to prevent the heater (4) from being heated.

The ignition point is in the area of 2 to 3 mm (0.079 to 0.118 in.) from the tip of the plug in order to reduce its projection into the combustion chamber.

- | | |
|---|--------------------------------|
| (1) Sheath Tube | (a) Glow Plug Temperature (°C) |
| (2) Insulation Powder | (b) Current (A) |
| (3) Heater also functioning as a Resistor | (c) Time (Sec.) |
| (4) Heater | |
| (5) Super Glow Plug | |
| (6) Conventional Quick-heating type Glow Plug | |
| (7) Glow Plug Current | |

W1013256

[3] SAFETY SWITCH



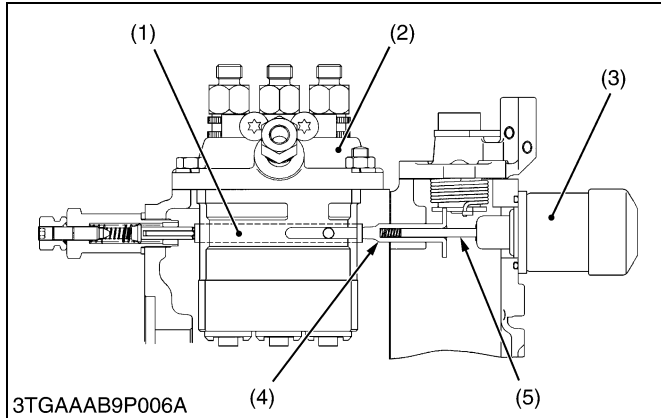
The safety switch prevents current from flowing to the starter when the safety switches are not engaged. This is to ensure safe starting.

The safety switches are located three (Clutch pedal, speed control pedal (HST) and PTO gear shift lever) different position.

- | | |
|------------------------------------|---------|
| (1) Safety Switch (Clutch and HST) | A : ON |
| | B : OFF |
| (2) Safety Switch (PTO) | |

W1013415

[4] ENGINE STOP SOLENOID

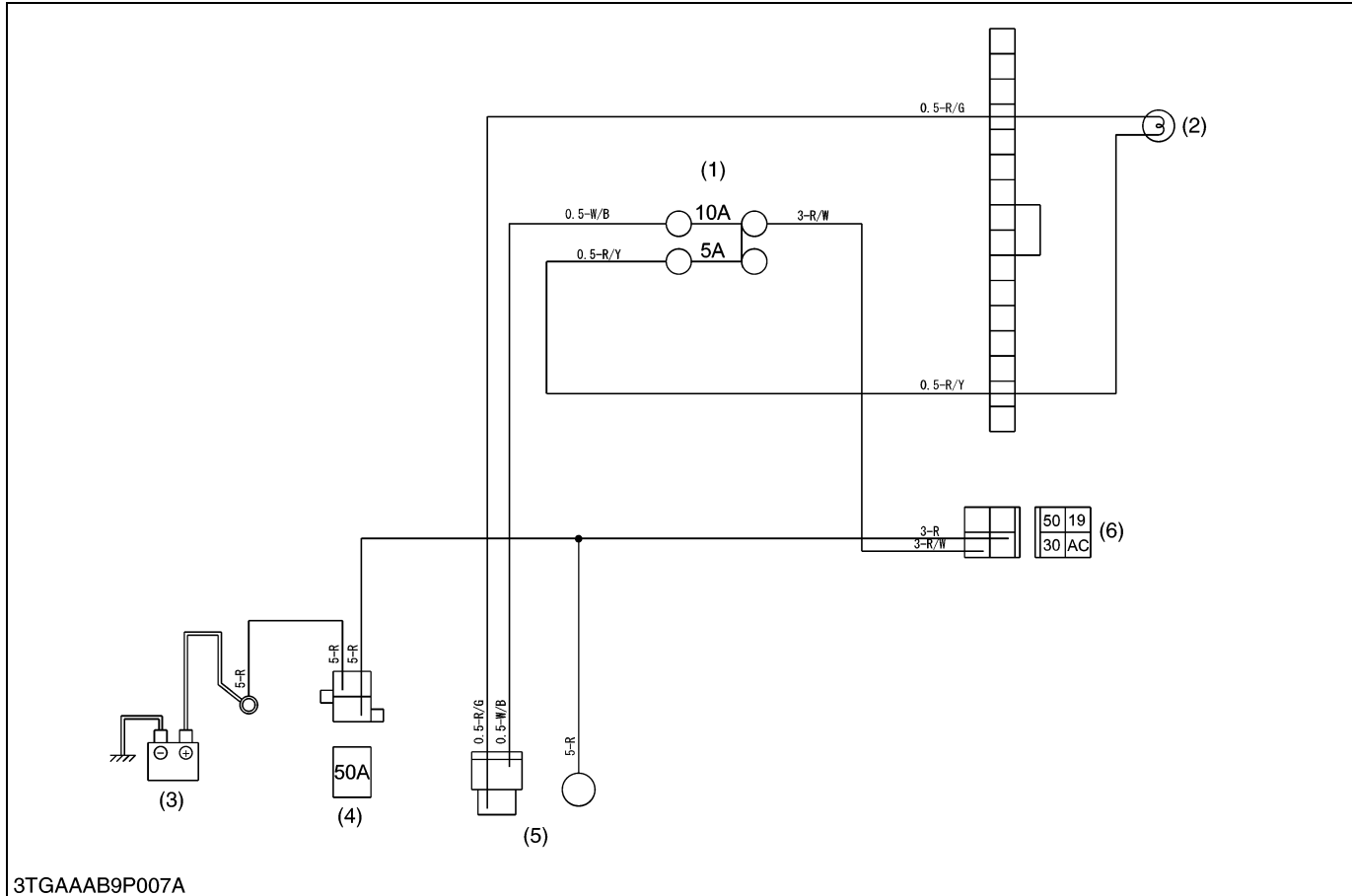


Flowing of the battery current into the fuel cut off solenoid, the plunger (5) move to right side so that the movement of control rack (1) becomes free. When the battery current stops, the plunger (5) is returned to the original position by the spring to keep the control rack (1) in **“No fuel injection”** position.

- | | |
|--------------------------|-------------|
| (1) Control Rack | (4) Guide |
| (2) Injection Pump | (5) Plunger |
| (3) Engine Stop Solenoid | |

W1013496

3. CHARGING SYSTEM

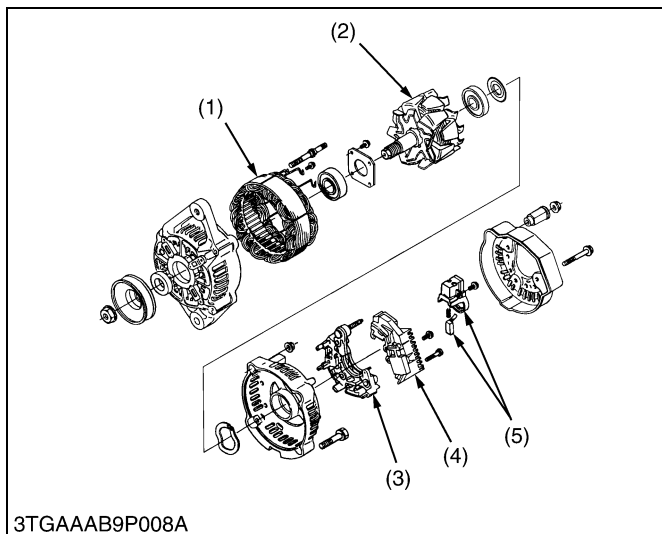


3TGAAAB9P007A

- (1) Fuse
- (2) Battery Charge Lamp
- (3) Battery
- (4) Slow Blow Fuse
- (5) Alternator
- (6) Key Switch

The charging system supplies electric power for various electrical devices and also charges the battery while the engine runs.

[1] ALTERNATOR



3TGAAAB9P008A

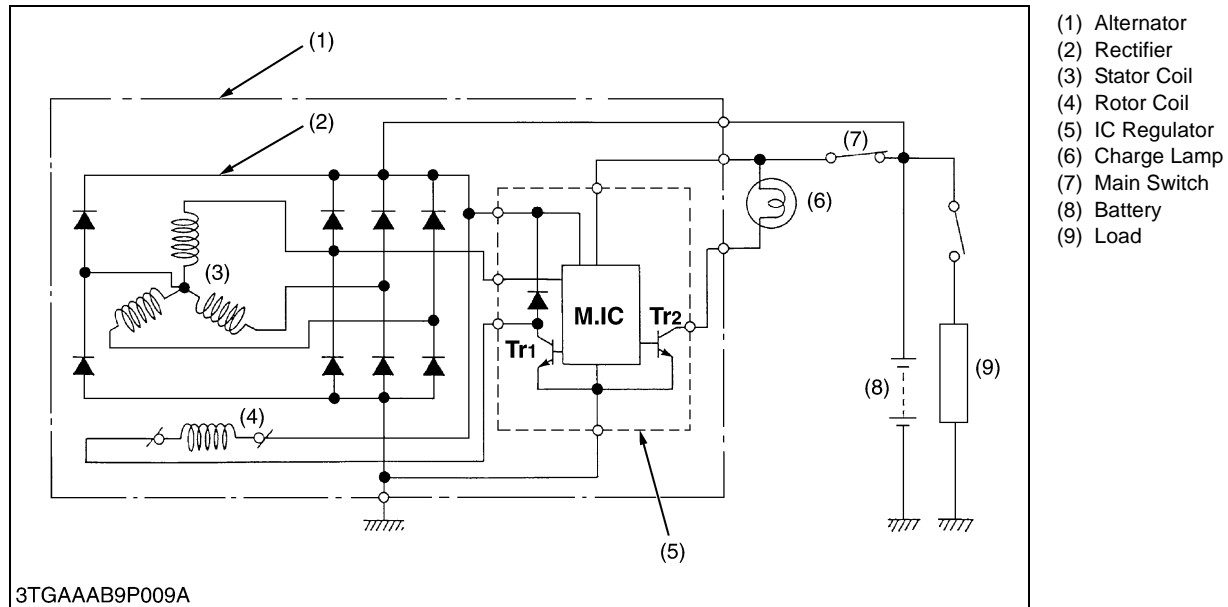
A compact alternator with an IC regulator is used, having the following characteristics :

- Approximately 26 % lighter and 17 % smaller than a standard alternator.
- Cooling performance and safety have been improved by combining the cooling fan with the rotor and incorporating the fan / rotor unit inside the alternator.
- IC regulator is fitted inside the alternator.
- The rectifier, IC regulator and similar components are easy to remove, making it easier to service the alternator.

- (1) Stator
- (2) Rotor
- (3) Rectifier
- (4) IC Regulator
- (5) Brush Holder

W1013607

[2] IC REGULATOR



- (1) Alternator
- (2) Rectifier
- (3) Stator Coil
- (4) Rotor Coil
- (5) IC Regulator
- (6) Charge Lamp
- (7) Main Switch
- (8) Battery
- (9) Load

W1013747

An IC regulator uses solid state transistors, chips or other semiconductor elements instead of the relays in a conventional regulator. Stable characteristics are achieved by cutting off the field current.

IC regulators have the following characteristics :

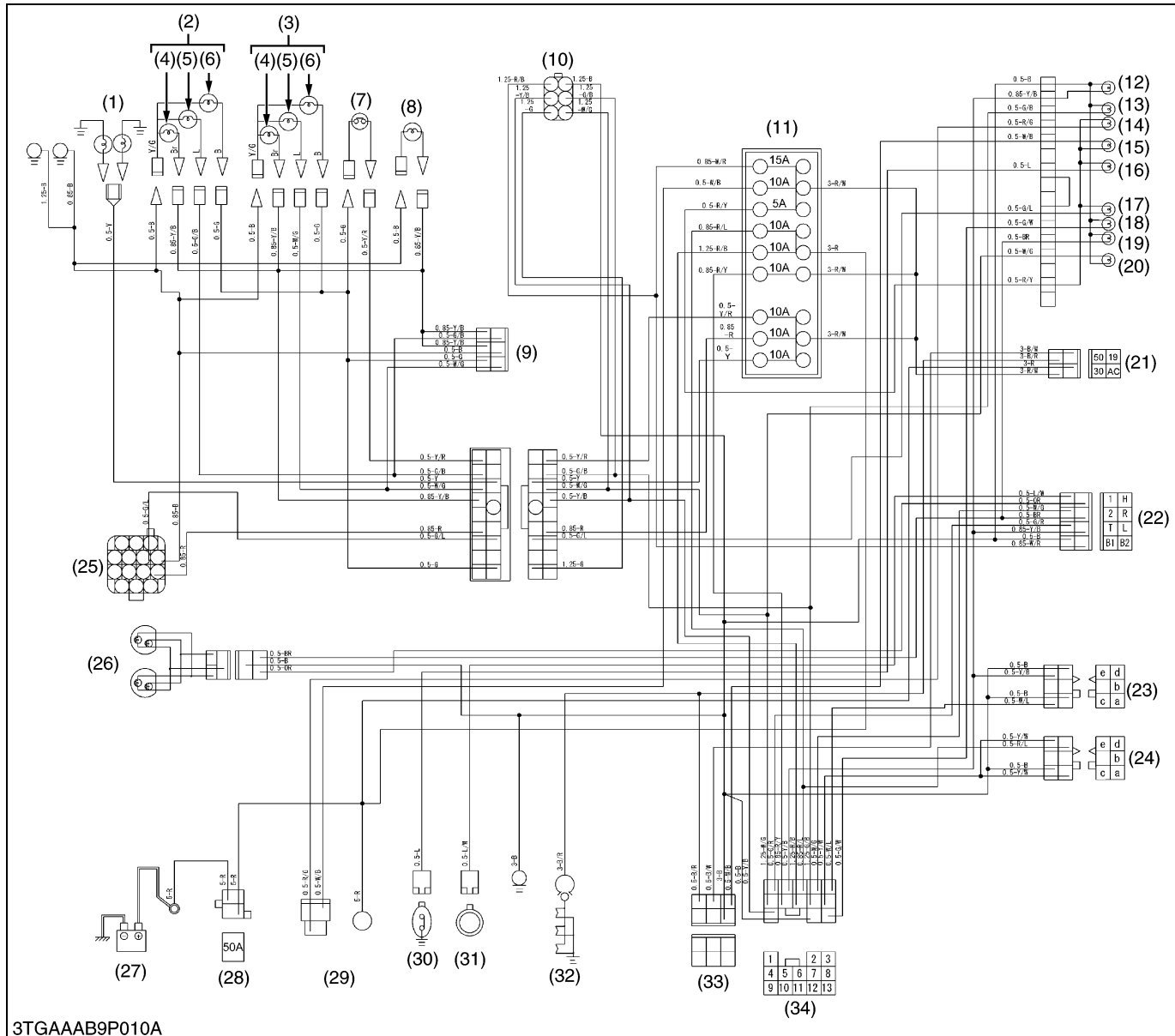
- The control voltage does not change over time, so the need for readjustment is eliminated. Since there are no moving parts, IC regulators are extremely durable and resistant to vibration.
- The overheat compensation characteristics ensure that the control voltage is reduced as the temperature rises, so the battery is charged at just the right level.

The internal circuitry of the IC regulator is shown in the diagram. It consists of a hybrid IC incorporating a monolithic IC. (The internal circuitry of the monolithic IC is extremely complex, so it is shown as simply “**M.I.C circuit**”.)

Tr1 acts as the contacts controlling the field current, and **Tr2** acts as the charge lamp relay controlling the flashing of the charge lamp.

The **M.I.C** circuit controls **Tr1** and **Tr2**, and monitors the alternator output voltage, and detects any drop in **L** terminal voltage or breaks in the rotor coil.

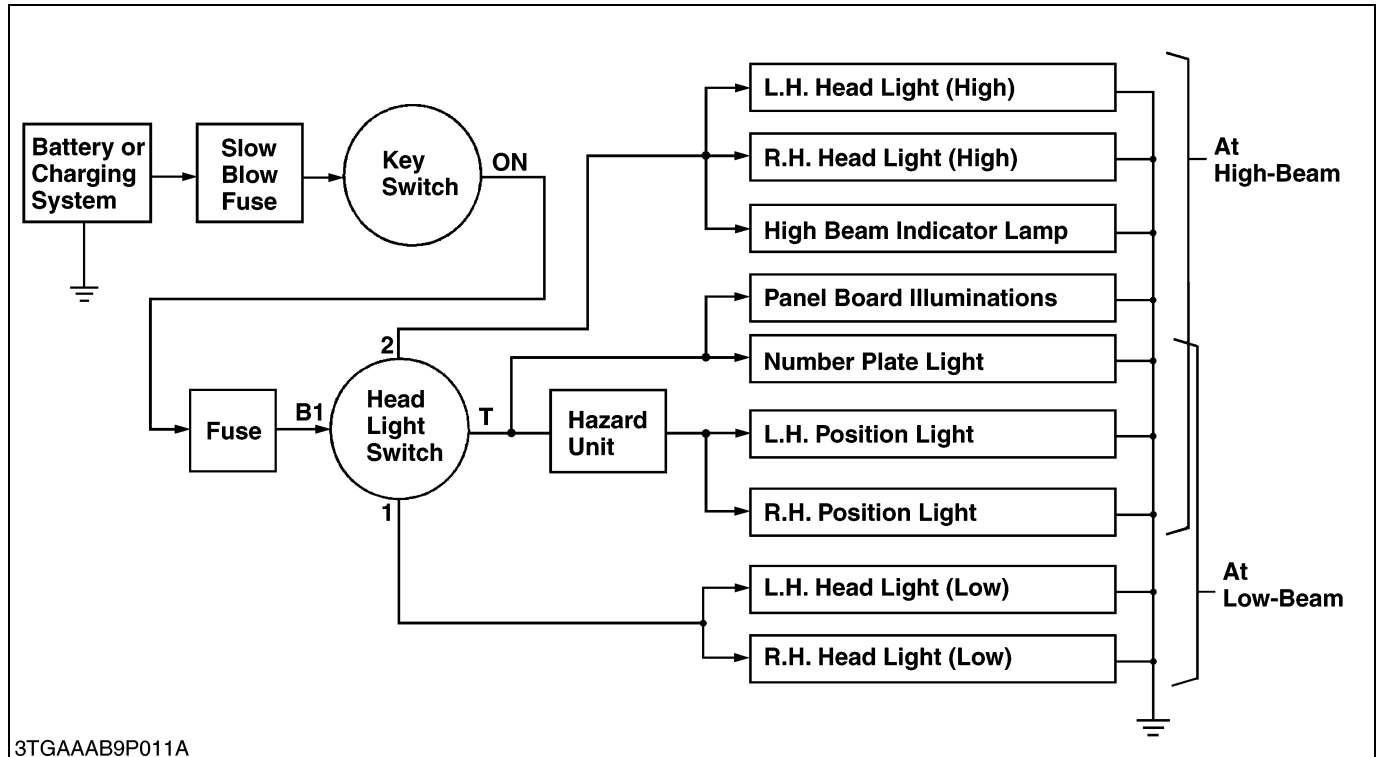
4. LIGHTING SYSTEM



- | | | | |
|-------------------------------|--|--|---------------------------------|
| (1) Working Light | (10) Connector (Cabin) | (18) Hazard Indicator Lamp | (26) Head Light |
| (2) Combination Light (Left) | (11) Fuse | (19) High Beam Indicator Lamp | (27) Battery |
| (3) Combination Light (Right) | (12) Illumination Lamp | (20) Hazard / Turn Signal Indicator Lamp L | (28) Slow Blow Fuse |
| (4) Position Light | (13) Hazard / Turn Signal Indicator Lamp R | (21) Key Switch | (29) Alternator |
| (5) Hazard Light | (14) Battery Charge Lamp | (22) Combination Switch | (30) Engine Oil Pressure Switch |
| (6) Brake Light | (15) Pre-heat Indicator Lamp | (23) Hazard Switch | (31) Horn |
| (7) Brake Light Switch | (16) Engine Oil Pressure Lamp | (24) Parking Switch | (32) Glow Plug |
| (8) Number Plate Light | (17) Bi-speed Turn Indicator Lamp | (25) Control Box | (33) Glow Lamp Relay |
| (9) Connector (Trailer) | | | (34) Hazard Unit |

The lighting system consists of main switch, combination switch, hazard switch, parking switch, brake light switch, head lights, combination lights, brake lights, etc..

[1] HEAD LIGHT

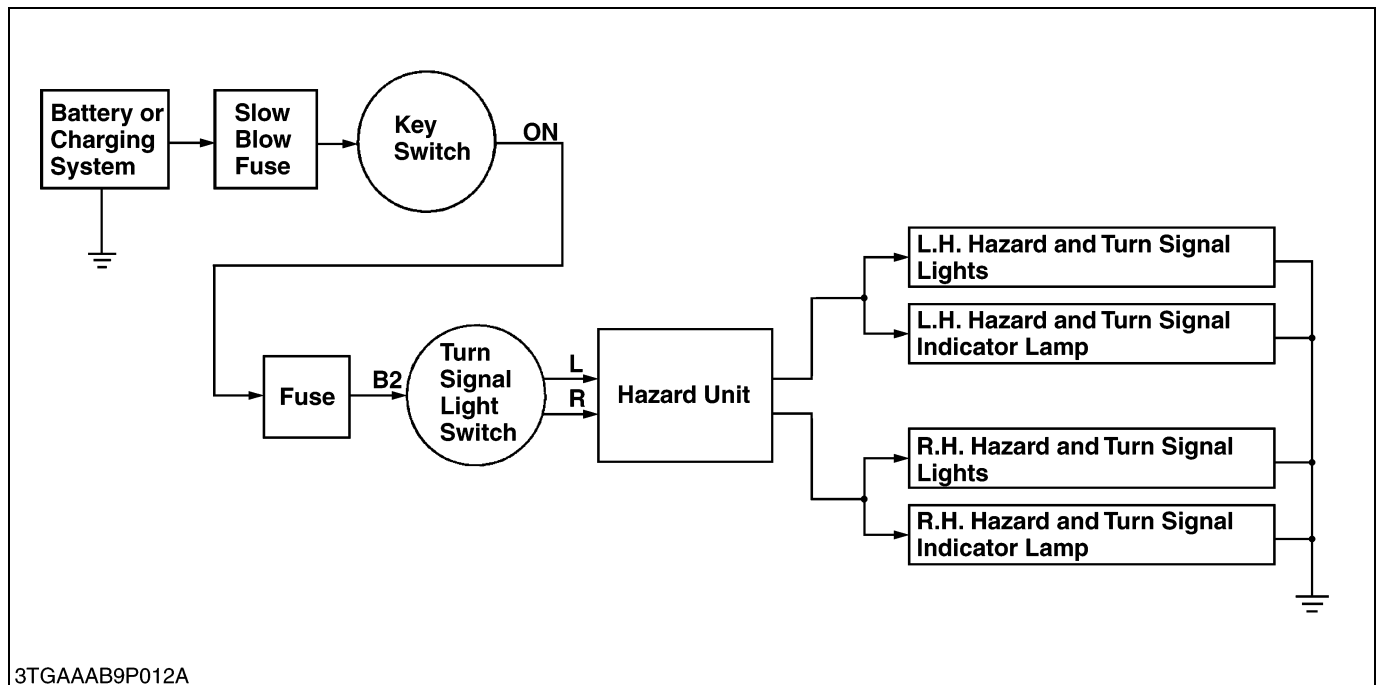


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The head light switch, which forms a combination switch with the turn signal light switch and horn switch, has three positions; **OFF**, **LOW-BEAM** and **HIGH-BEAM**.

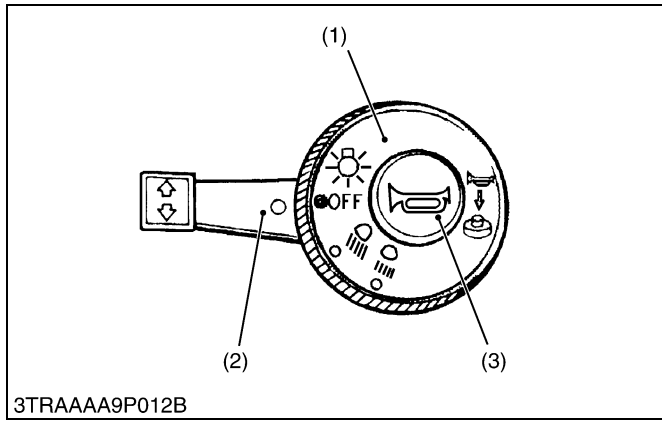
Current passes through the light circuit as shown in the figure above.

[2] TURN SIGNAL LIGHT



3TGAAAB9P012A

The turn signal light switch, which forms a combination switch with the head light switch and horn switch, has three position; **OFF**, **L** and **R**. When using turn signal light switch, blinks only one side light and other one stays off.



■ **Combination Switch**

Combination switch consist of head light switch, turn signal light switch and horn switch.

• **Head Light Switch**

	B1	T	1	2
OFF	●			
Low	●	●	●	
High	●	●		●

• **Turn Signal Light Switch**

	B2	R	L
R	●	●	
OFF	●		
L	●		●

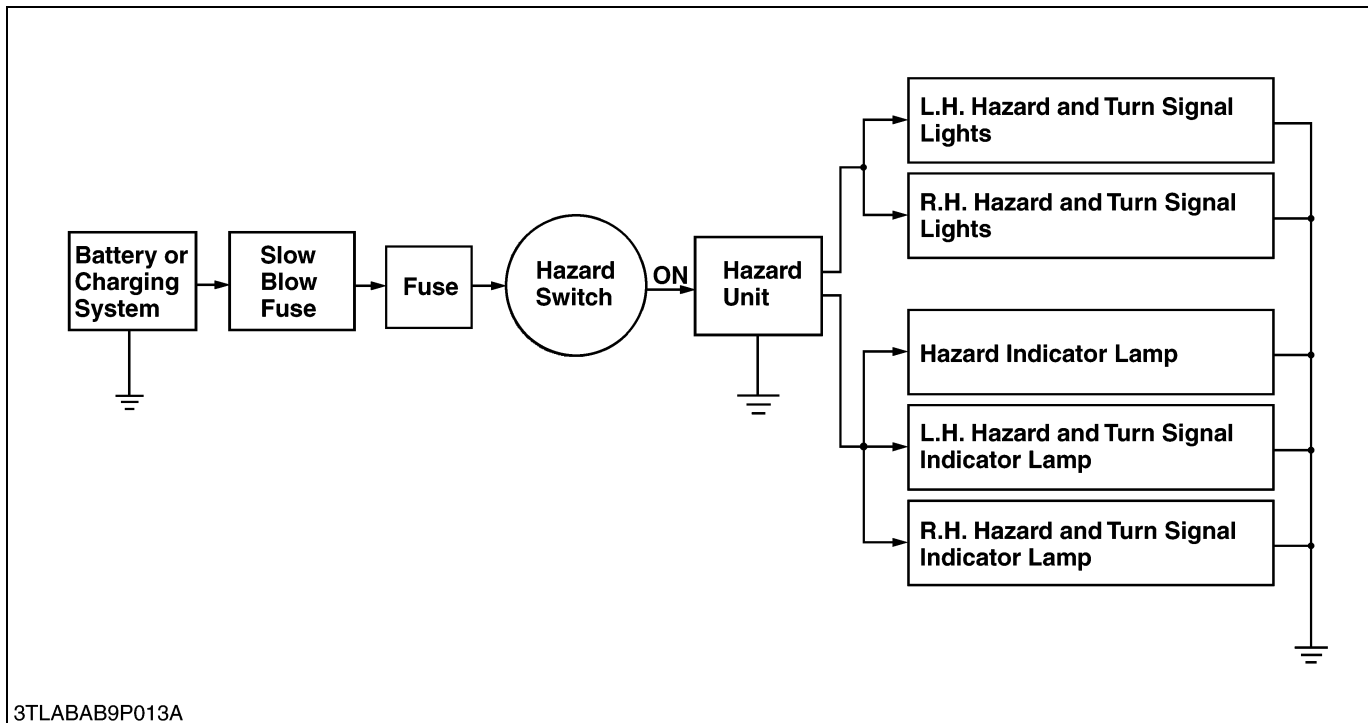
• **Horn Switch**

	B1	H
OFF	●	
ON	●	●

- (1) Head Light Switch
- (2) Turn Signal Light Switch
- (3) Horn Switch

W1014069

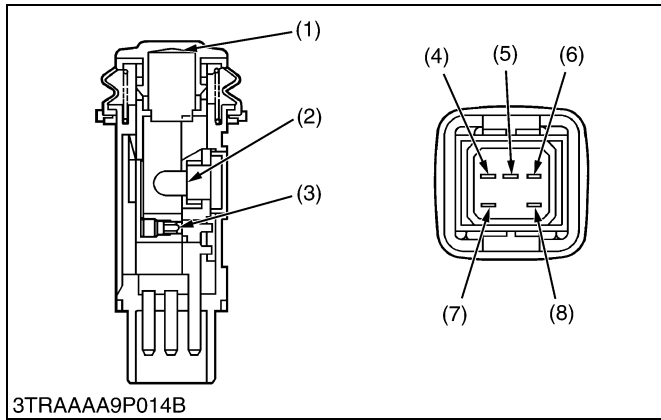
[3] **HAZARD LIGHT**



3TLABAB9P013A

The hazard switch has two position; **ON** and **OFF**.

When the hazard switch is turned to **ON**, the hazard lights and indicator lamps are blinked as shown in the figure above.



■ Hazard Switch

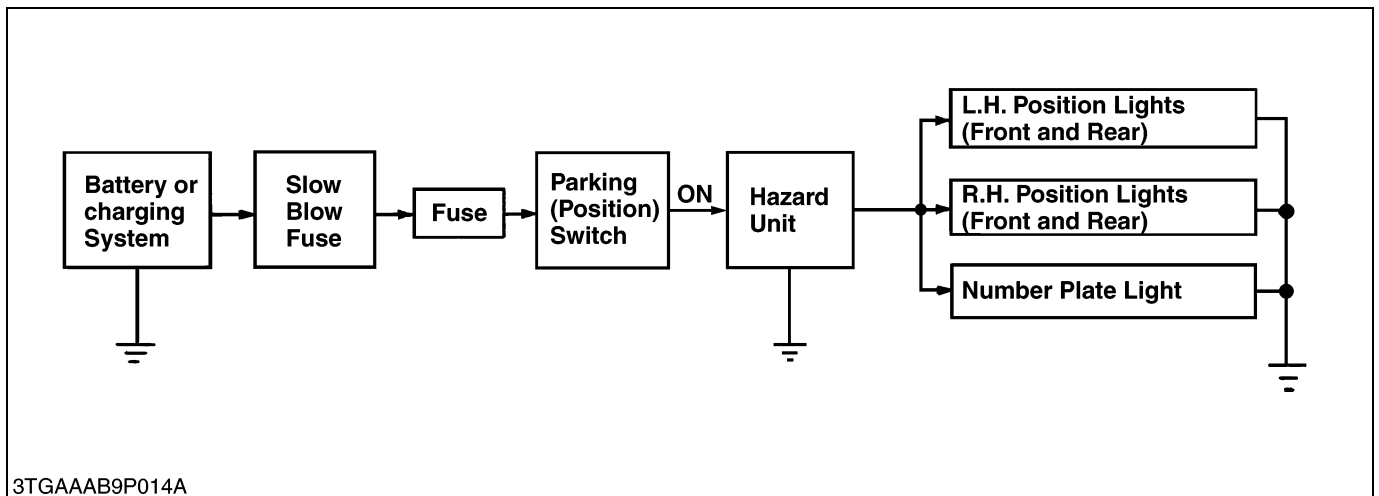
This is a pushing type switch to turn on the hazard lights. The lamp (2) in the switch is lighted up by the current from outside of the switch. The circuit in the switch is shown below.

Terminal	a	(b)	c	Lamp	
				d	e
OFF		●	●	●	●
ON	●		●	●	●

- (1) Lens
- (2) Lamp
- (3) Contact Portion
- (4) Terminal a
- (5) Terminal b
- (6) Terminal d
- (7) Terminal c
- (8) Terminal e

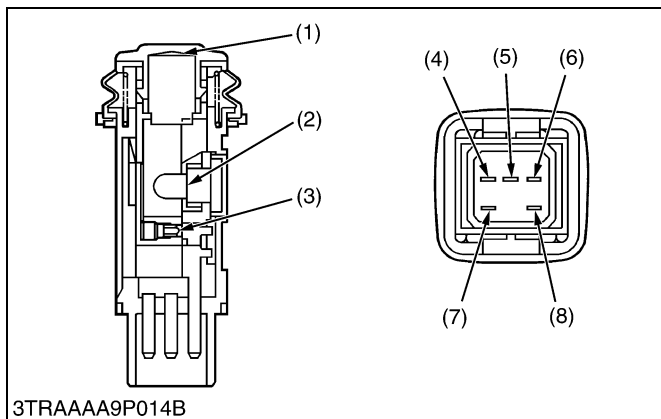
W1015017

[4] PARKING (POSITION) LIGHT



3TGAAAB9P014A

The parking (position) switch has two positions; **ON** and **OFF**.
Current passes through the light circuit as shown in the figure above.



■ Parking (Position) Switch

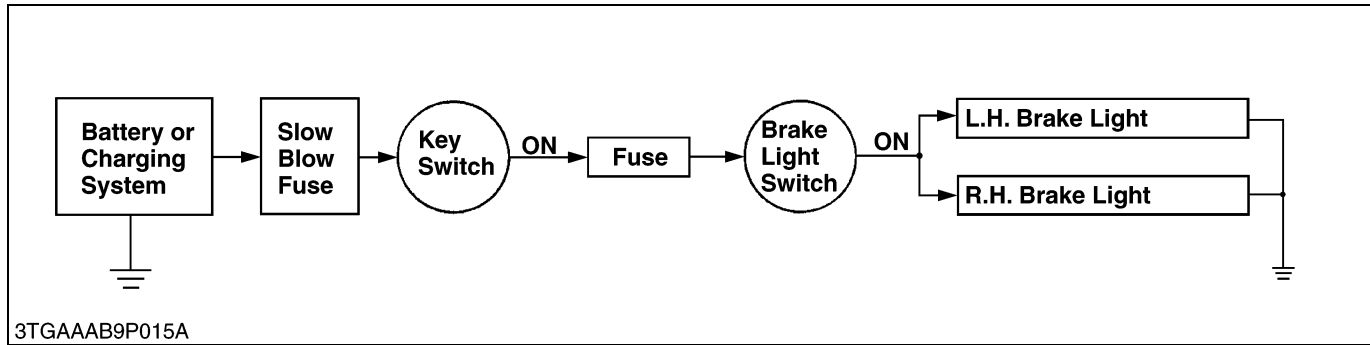
This is a pushing type switch to turn on the position lamps. The lamp (2) in the switch is lighted up when the switch is "**ON**". The circuit in the switch is shown below.

Terminal	a	(b)	c	Lamp	
				d	e
OFF		●	●	●	●
ON	●		●	●	●

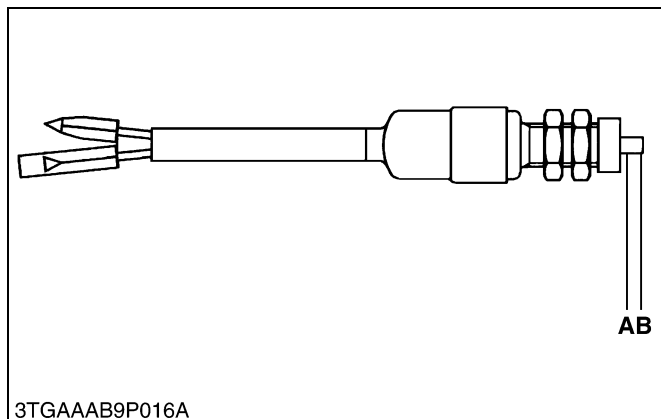
- (1) Lens
- (2) Lamp
- (3) Contact Portion
- (4) Terminal a
- (5) Terminal b
- (6) Terminal d
- (7) Terminal c
- (8) Terminal e

W1015564

[5] BRAKE LIGHT



The brake lights are lighted up by brake switch.
Current passes the circuit as shown in the figure above.



■ Brake Switch

Brake switch is turned on by pushing a brake pedal and turned off by releasing it.

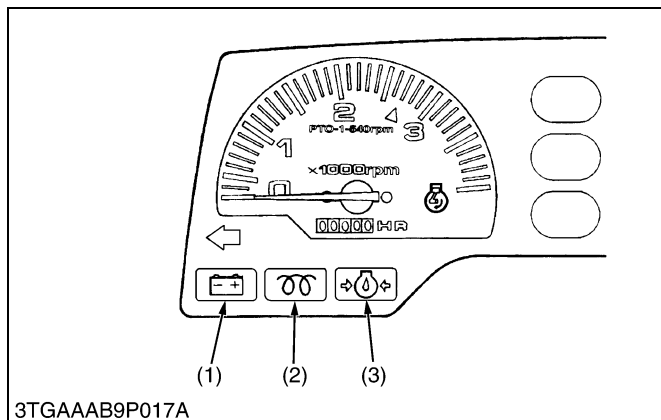
A : ON

B : OFF

W1015850

[6] EASY CHECKER

To check the conditions of tractor easily before and during operation, easy checker combination of lamps on the easy checker board is provided.



■ Indication Items

(1) Charge Lamp

When the charging system is not functioning properly, this lamp illuminates.

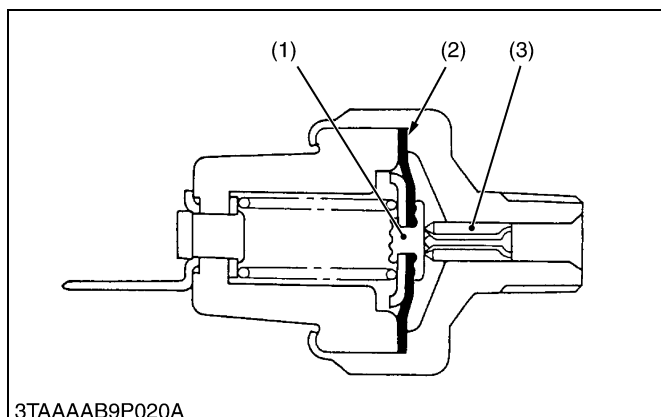
(2) Pre-heat Indicator Lamp

When the key switch is in the "Pre-heat" position, the pre-heat indicator lamp illuminates approximately 5 seconds and goes off automatically.

(3) Oil Pressure Lamp

When the engine oil pressure is low, this lamp illuminates.

W1015935



■ Oil Pressure Switch

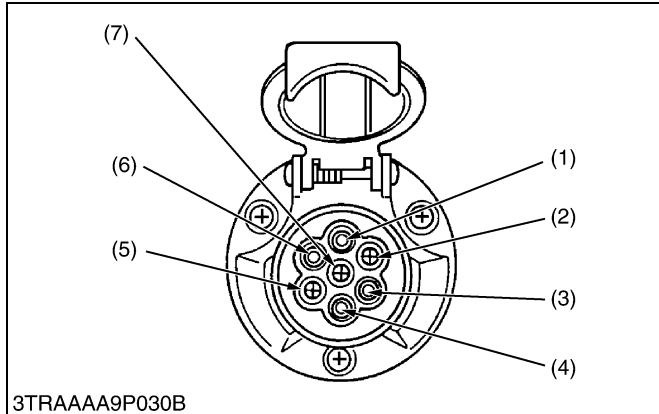
While oil pressure is high and the force applied to the diaphragm (2) is larger than the spring tension, the terminal contact (1) is open separated from the body contact (3). If the pressure drops below approx. 49 kPa (0.5 kgf/cm², 7.1 psi), the contact closes.

(1) Terminal Contact

(3) Body Contact

(2) Diaphragm

W1016053

[7] TRAILER SOCKET

The trailer socket is provided to take out the electrical power from tractor to trailer or implement.

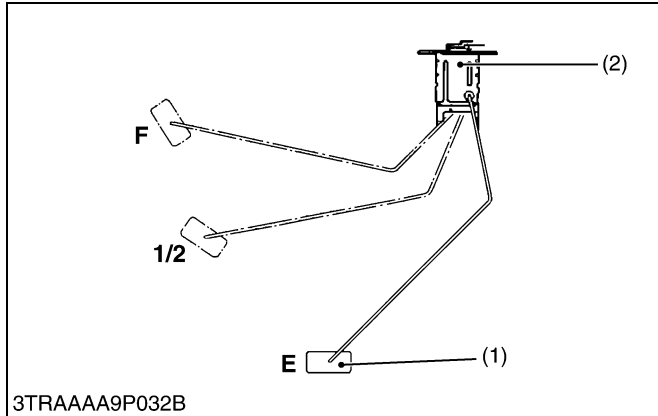
The function of each terminal is shown below.

Terminal	Function	Color of wire harness
(1)	Turn signal (LH)	Green / White
(2)	–	–
(3)	Ground	Black
(4)	Turn signal (RH)	Red / White
(5)	Tail (RH)	Yellow / Red
(6)	Brake	Yellow
(7)	Tail (LH)	Yellow / White

- (1) Terminal 1
- (2) Terminal 2
- (3) Terminal 3
- (4) Terminal 4

- (5) Terminal 5
- (6) Terminal 6
- (7) Terminal 7

W1016172

[1] FUEL QUANTITY**■ Fuel Level Sensor**

The remaining fuel quantity is detected by the fuel level sensor installed in the fuel tank and indicated on the fuel gauge. For detection, a float and a resistor are used.

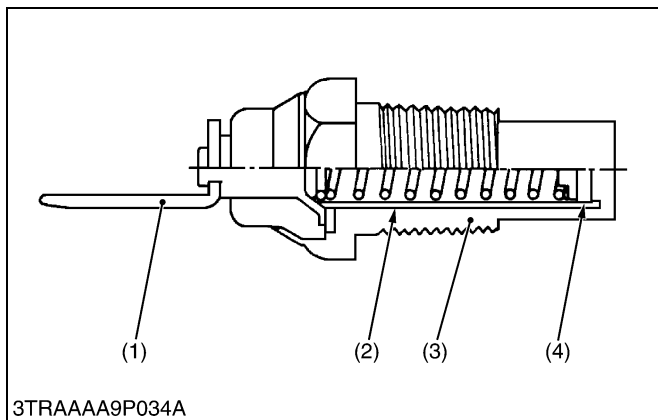
As the float (1) lowers, the resistance of the variable resistor (2) varies. The relation between the amount of fuel and the resistance is as follows.

F	1/2	E
1 to 5 Ω	27.5 to 37.5 Ω	103 to 117 Ω

(1) Float

(2) Variable Resistor

W1016525

[2] COOLANT TEMPERATURE**■ Coolant Temperature Sensor**

The coolant temperature sensor is installed to the cylinder head of engine, and its tip is in touch with the coolant. It contains a thermistor (4) whose electrical resistance decreases as the temperature increases.

Current varies with changes in the coolant temperature, and the increases or decreases in the current move the pointer of gauge.

Characteristics of Thermistor	
Temperature	Resistance
80 °C (176 °F)	Approx. 51.9 Ω
100 °C (212 °F)	Approx. 27.4 Ω

(1) Terminal

(3) Body

(2) Insulator

(4) Thermistor

W1016720

SERVICING

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(1) Checking.....	10-S25

1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
All Electrical Equipment Do Not Operate	• Battery discharged or defective	Recharge or Replace	G-22
	• Battery positive cable disconnected or improperly connected	Repair or Replace	–
	• Battery negative cable disconnected or improperly connected	Repair or Replace	–
	• Slow blow fuse blown	Replace	–
Fuse Blown Frequently	• Short-circuited	Repair or Replace	–

W1014322

BATTERY

Battery Discharges Too Quickly	• Battery defective	Replace	–
	• Alternator defective	Repair or Replace	10-S15
	• IC Regulator defective	Replace	10-S15
	• Wiring harness disconnected or improperly connected (between battery positive terminal and regulator B terminal)	Repair or Replace	–
	• Cooling fan belt slipping	Adjust tension	G-19

W1013718

STARTING SYSTEM

Starter Motor Does Not Operate	• Battery discharged or defective	Recharge or Replace	G-22
	• Slow blow fuse blown	Replace	–
	• Safety switch improperly adjusted or defective	Repair or Replace	10-S10
	• Wiring harness disconnected or improperly connected (between main switch 50 terminal and safety switches, between safety switches and starter motor, between battery positive terminal and starter motor)	Repair or Replace	–
	• Starter motor defective	Repair or Replace	10-S11
Engine Does Not Stop When Main Switch is Turned OFF	• Main switch defective	Replace	10-S7
	• Fuse blown (10 A)	Replace	G-29
	• Wiring harness disconnected or improperly connected (between main switch AC terminal and engine stop solenoid)	Repair or Replace	–
Engine Does Not Start	• Engine stop solenoid defective	Replace	10-S10
	• Engine stop solenoid defective	Replace	10-S10

W1013718

CHARGING SYSTEM

Symptom	Probable Cause	Solution	Reference Page
Charging Lamp Does Not Light when Main Switch is Turned ON	<ul style="list-style-type: none"> Fuse blown (10 A) Wiring harness disconnected or improperly connected (between main switch AC terminal and panel board, between panel board and alternator) 	Replace Repair or Replace	G-29 –
	<ul style="list-style-type: none"> Alternator defective 	Repair or Replace	10-S15
Charging Lamp Does Not Go Off When Engine is Running	<ul style="list-style-type: none"> Wiring harness disconnected or improperly connected (between main switch 30 terminal and alternator, between panel board and alternator) 	Replace Repair or Replace	–
	<ul style="list-style-type: none"> Alternator defective 	Repair or Replace	10-S15

W1013580

LIGHTING SYSTEM

Head Light Does Not Light	<ul style="list-style-type: none"> Fuse blown (15 A) Bulb blown Wiring harness disconnected or improperly connected (between main switch AC terminal and combination switch B1 terminal, between combination switch 1 terminal and head light, between combination switch 2 terminal and head light) 	Replace Replace Repair or Replace	G-29 G-29 –
License Plate Light Does Not Light	<ul style="list-style-type: none"> Fuse blown (15 A) Bulb blown Wiring harness disconnected or improperly connected (between main switch AC terminal and combination switch B1 terminal, between combination switch T terminal and tail light) 	Replace Replace Repair or Replace	G-29 G-29 –
Hazard Light Does Not Light	<ul style="list-style-type: none"> Fuse blown (10 A) Bulb blown Wiring harness disconnected or improperly connected 	Replace Replace Repair or Replace	G-29 G-29 –
	<ul style="list-style-type: none"> Flasher unit defective Hazard switch defective 	Replace Replace	10-S23 10-S22
Parking (Position) Light Does Not Light	<ul style="list-style-type: none"> Fuse blown (10 A) Bulb blown Parking (position) light switch defective Wiring harness disconnected (between parking (position) light switch and parking (position) light) 	Replace Replace Repair or Replace Repair or Replace	G-29 G-29 10-S23 –

W1013718

HORN

Horn Does Not Sound When Horn Button is Pushed	<ul style="list-style-type: none"> Combination switch defective Horn defective Wiring harness disconnected or improperly connected (between combination switch terminal and horn) 	Replace Replace Repair or Replace	10-S20 – –
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W1013718

2. SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Starter	Commutator	O.D. 30.0 mm 1.181 in.	29.0 mm 1.142 in.
	Mica	Under Cut 0.50 to 0.80 mm 0.0197 to 0.0315 in.	0.20 mm 0.0079 in.
	Brush	Length 15.0 mm 0.591 in.	11.0 mm 0.433 in.
	Brush Holder and Holder Support	Resistance Infinity	—
Glow Plug	Resistance	Approx. 0.9 Ω	—
Stop Solenoid	Pulling Coil	Resistance	Approx. 0.375 Ω
	Holding Coil	Resistance	Approx. 15.6 Ω
Fuel Level Sensor	Float at Upper-most Position	Resistance	1.0 to 5.0 Ω
	Float at Lower-most Position	Resistance	103 to 117 Ω
Coolant Temperature Sensor	at 130 °C (266 °F)	Resistance	Approx. 12.2 Ω
	at 105 °C (221 °F)	Resistance	Approx. 23.6 Ω
	at 80 °C (176 °F)	Resistance	Approx. 51.9 Ω
	at 50 °C (122 °F)	Resistance	Approx. 153.9 Ω
Alternator	No-load voltage	More than 14 V	—
	Stator	Resistance	Less than 1.0 Ω
	Rotor	Resistance	2.9 Ω
	Slip Ring	O.D. 14.4 mm 0.567 in.	12.8 mm 0.504 in.
	Brush	Length 10.5 mm 0.413 in.	8.4 mm 0.331 in.

W1013874

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-9.)

Item	N·m	kgf·m	ft-lbs
Alternator Pulley nut	58.3 to 78.9	5.95 to 8.05	43.0 to 58.2

W1012736

4. CHECKING, DISASSEMBLING AND SERVICING



CAUTION

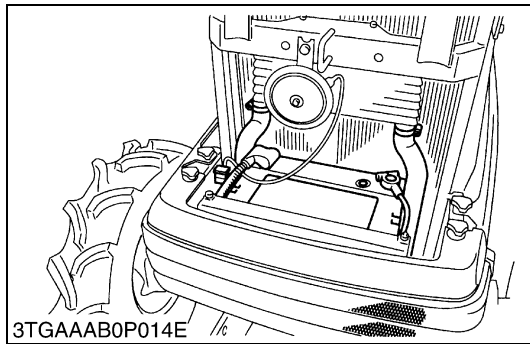
- To avoid accidental short circuit, be sure to attach the positive cable to the positive terminal before the negative cable is attached to the negative terminal.
- Never remove the battery cap while the engine is running.
- Keep electrolyte away from eyes, hands and clothes. If you are spattered with it, wash it away completely with water immediately.
- Keep open sparks and flames away from the battery at all times. Hydrogen gas mixed with oxygen becomes very explosive.

IMPORTANT

- If the machine is to be operated for a short time without battery (using a slave battery for starting), use additional current (lights) while engine is running and insulate terminal of battery. If this advice is disregarded, damage to alternator and regulator may result.

[1] BATTERY

(1) Checking

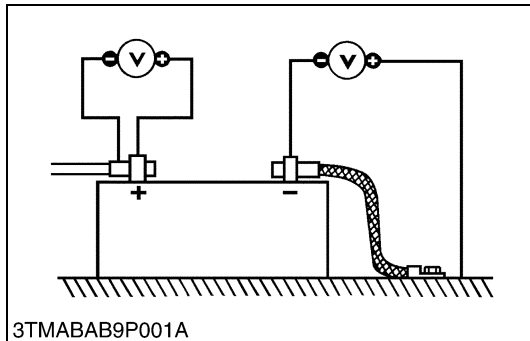


Battery Voltage

1. Stop the engine and turn the main switch off.
2. Connect the COM (-) lead of the voltmeter to the battery's negative terminal post and the (+) lead to the positive terminal post, and measure the battery voltage.
3. If the battery voltage is less than the factory specification, check the battery specific gravity and recharge the battery.

Battery voltage	Factory spec.	More than 12 V
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W1012562

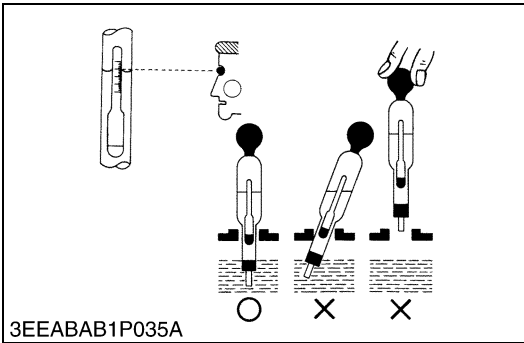
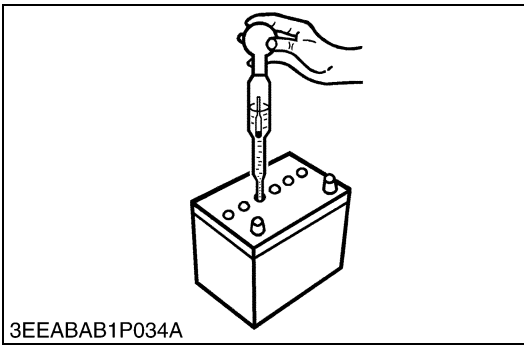


Battery Terminal Connection

1. Turn the main switch on, and turn on the head light.
2. Measure the voltage with a voltmeter across the battery's positive terminal post and the cable terminal, and the voltage across the battery's negative terminal post and the chassis.
3. If the measurement exceeds the factory specification, clean the battery terminal posts and cable clamps, and tighten them firmly.

Potential difference	Factory spec.	Less than 0.1 V
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W1012663



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

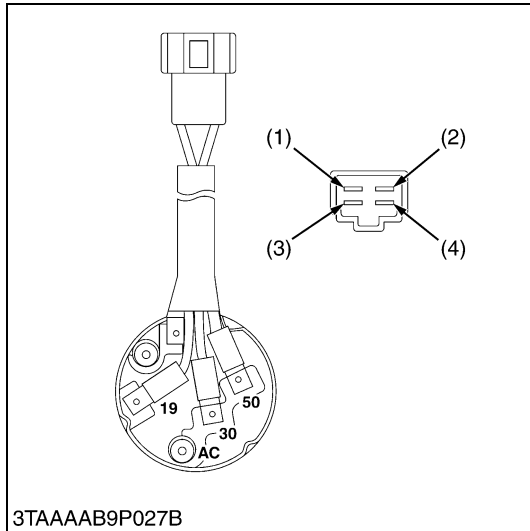
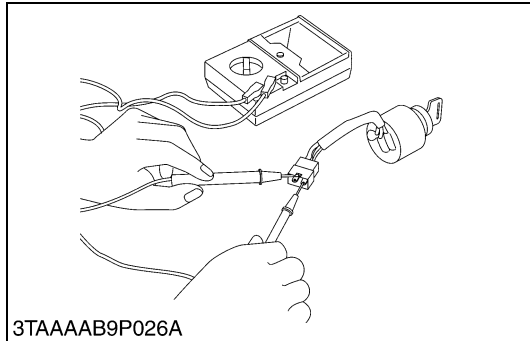
At an electrolyte temperature of 20 °C (68 °F)

W1012763

[2] STARTING SYSTEM

(1) Checking

(A) Main Switch



Main Switch Continuity

1) Main Switch Key at OFF Position

1. Set the main switch **OFF** position.
2. Measure the resistance with an ohmmeter across the **30** terminal and the **AC** terminal, **30** terminal and **50** terminal, **30** terminal and **19** terminal.
3. If infinity is not indicated, the contacts of the main switch are faulty.

Resistance	30 terminal – AC terminal	Infinity
	30 terminal – 50 terminal	
	30 terminal – 19 terminal	

2) Main Switch Key at ON Position

1. Set the main switch **ON** position.
2. Measure the resistance with an ohmmeter across the **30** terminal and the **AC** terminal.
3. If 0 ohm is not indicated, the **30 – AC** contact of the main switch are faulty.

Resistance	30 terminal – AC terminal	0 Ω
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3) Main Switch Key at PREHEAT Position

1. Set and hold the main switch key at the **PREHEAT** position.
2. Measure the resistance with an ohmmeter across the **30** terminal and the **19** terminal, and measure the resistance across the **30** terminal and the **AC** terminal.
3. If 0 ohm is not indicated, these contacts of the main switch are faulty.

Resistance	30 terminal – 19 terminal	0 Ω
	30 terminal – AC terminal	

4) Main Switch Key at START Position

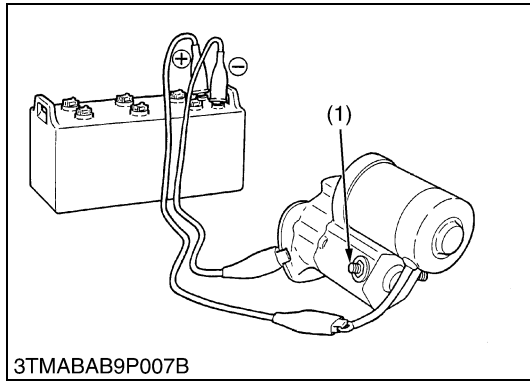
1. Set and hold the main switch key at the **START** position.
2. Measure the resistance with an ohmmeter across the **30** terminal and the **19** terminal, across the **30** terminal and the **50** terminal, and across the **30** terminal and the **AC** terminal.
3. If 0 ohm is not indicated, these contacts of the main switch are faulty.

Resistance	30 terminal – 19 terminal	0 Ω
	30 terminal – 50 terminal	
	30 terminal – AC terminal	

(1) 19 Terminal (Black / Red)
 (2) AC Terminal (Red / White)

(3) 50 Terminal (Black / White)
 (4) 30 Terminal (Red)

W1013362

(B) Starter**Motor Test****CAUTION**

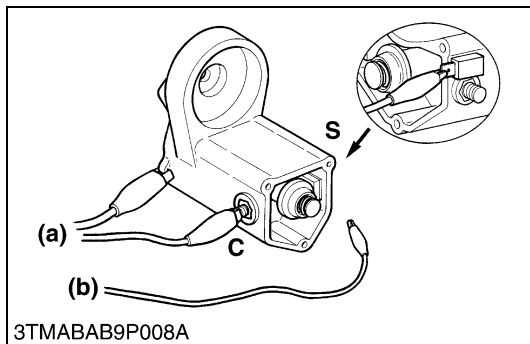
- **Secure the starter to prevent it from jumping up and down while testing the motor.**

1. Disconnect the battery negative cable from the battery.
2. Disconnect the battery positive cable and the leads from the starter.
3. Remove the starter from the engine.
4. Disconnect the connecting lead (2) from the starter **C** terminal (1).
5. Connect a jumper lead from the connecting lead (2) to the battery positive terminal post.
6. Connect a jumper lead momentarily between the starter motor housing and the battery negative terminal post.
7. If the motor does not run, check the motor.

(1) C Terminal

(2) Connecting Lead

W1014267

**Magnet Switch Test (Pull-in, Holding Coils)**

1. Remove the motor from the starter housing.
2. Prepare a 6 V battery for the test.
3. Connect jumper leads from the battery negative terminal to the housing and the starter **C** terminal.
4. The plunger should be attached and the pinion gear should pop out when a jumper lead is connected from the battery positive terminal to the **S** terminal. It's a correct.
5. Disconnect the jumper lead to the starter **C** terminal. Then the pinion gear should remain popped out. It's a correct.

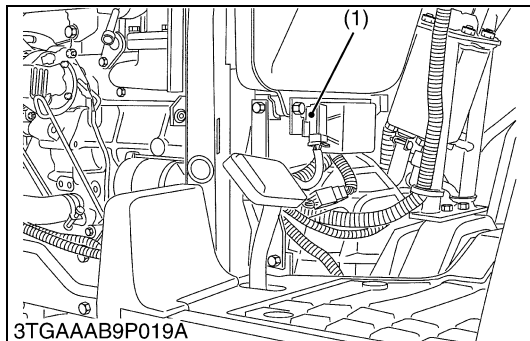
■ IMPORTANT

- **Testing time must be 3 to 5 sec..**

(a) To Negative Terminal

(b) To Positive Terminal

W1014690

**Checking Starter Relay**

1. Remove the starter relay (1).
2. Apply battery voltage across terminals **3** (4) and **4** (5), and check for continuity across terminals **1** (2) and **2** (3).
3. If continuity is not established across terminals **1** and **3**, renew the starter relay.

(1) Starter Relay

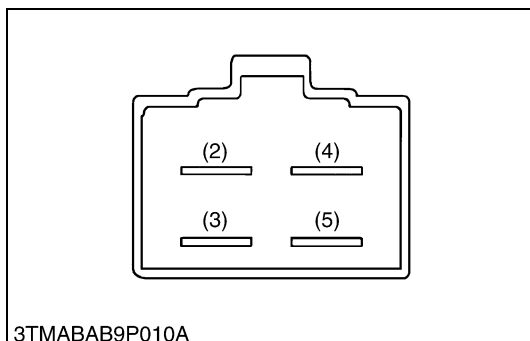
(4) Terminal 3

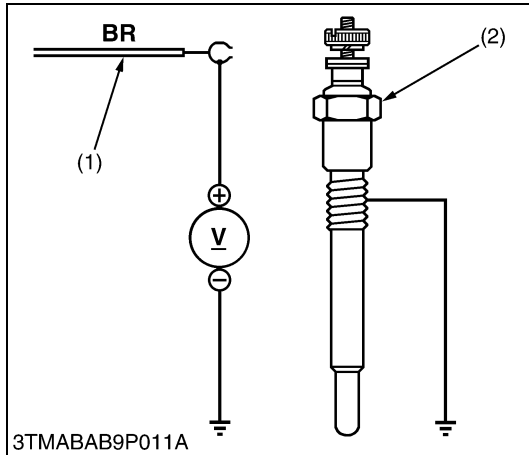
(2) Terminal 1

(5) Terminal 4

(3) Terminal 2

W1026991



(C) Glow Plug**Lead Terminal Voltage**

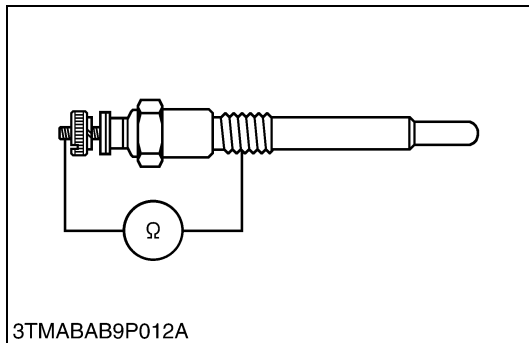
1. Disconnect the wiring lead (1) from the glow plug (2) after turning the main switch off.
2. Turn the main switch key to the “**PREHEAT**” position, and measure the voltage between the lead terminal and the chassis.
3. Turn the main switch key to the “**START**” position, and measure the voltage with a voltmeter between the lead terminal and the chassis.
4. If the voltage at either position differs from the battery voltage, the wiring harness or main switch is faulty.

Voltage (Lead terminal – Chassis)	Main switch key at “ PREHEAT ”	Approx. battery voltage
	Main switch key at “ START ”	Approx. battery voltage

(1) Wiring Lead (Positive)

(2) Glow Plug

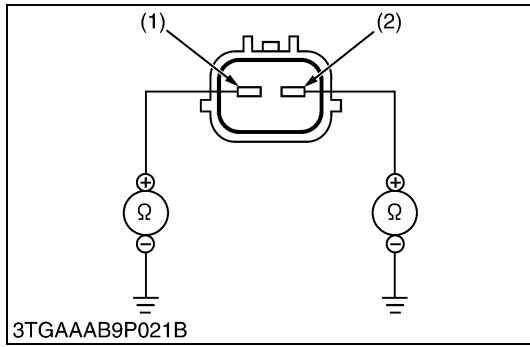
W1014913

**Glow Plug Continuity**

1. Disconnect the lead from the glow plugs.
2. Measure the resistance with an ohmmeter between the glow plug terminal and the chassis.
3. If 0 ohm is indicated, the screw at the tip of the glow plug and the housing are short-circuited.
4. If the factory specification is not indicated, the glow plug is faulty.

Glow plug resistance	Factory spec.	Approx. 0.9 Ω
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W1015115



Stop Solenoid Coil

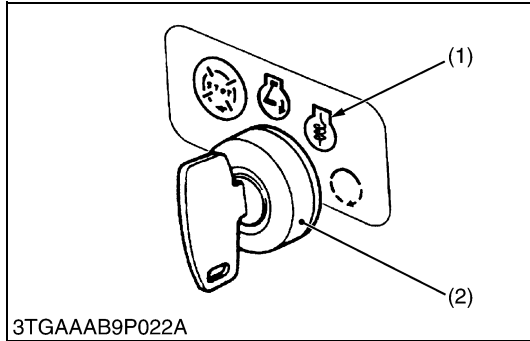
1. Disconnect the **2P** connector from engine stop solenoid.
2. Measure the resistance with an ohmmeter between the terminal **1**, terminal **2** and body.
3. If resistance differs from the factory specification, the coil is faulty.

Resistance	Terminal 1 – Body	Approx. 0.375 Ω
	Terminal 2 – Body	Approx. 15.6 Ω

(1) Terminal 1 (Pulling Coil) (2) Terminal 2 (Holding Coil)

W1015848

(F) Glow Lamp Relay

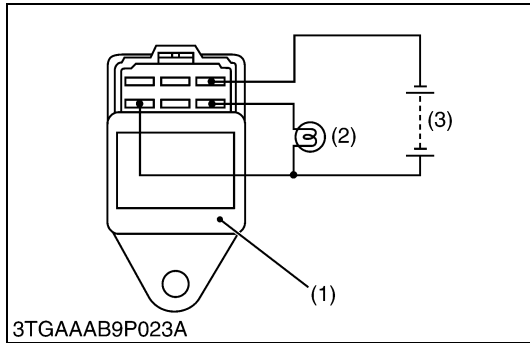


Glow Lamp and Glow Lamp Relay

1. Check the glow lamp indicator lights up then lights off after about 5 seconds when main switch is turned to glow position.
2. If the glow lamp indicator does not lights up, the fuse, glow lamp, glow lamp relay or wiring harness is faulty.

(1) Glow Position (2) Main Switch

W1016072



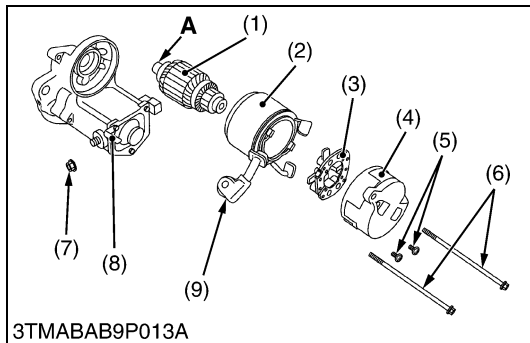
Glow Lamp Relay

1. Remove the glow lamp relay (1).
2. Connect the jumper leads as shown in the figure left.
3. If the bulb lights up when connecting a jumper lead to battery and go off about 5 seconds late, the glow lamp relay is proper.

(1) Glow Lamp Relay (2) Bulb (3) Battery (12 V)

W1016173

(2) Disassembling and Assembling



Disassembling Motor

1. Disconnect the connecting lead (9) from the magnet switch (8).
2. Remove the screws (6), and then separate the end frame (4), yoke (2) and armature (1).
3. Remove the two screws (5), and then take out the brush holder (3) from the end frame (4).

(When reassembling)

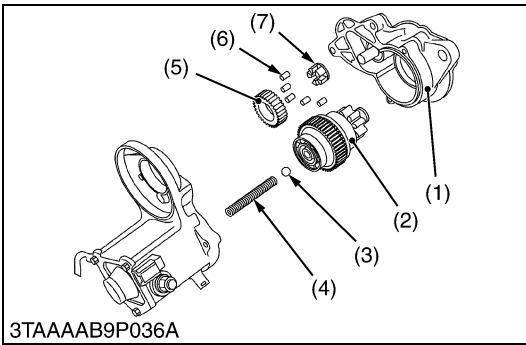
- Apply grease to the spline teeth (A) of the armature (1).

Tightening torque	Nut (7)	5.9 to 11.8 N·m 0.6 to 1.2 kgf·m 4.3 to 8.7 ft-lbs
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(1) Armature (2) Yoke (3) Brush Holder (4) End Frame (5) Screw (6) Screw (7) Nut (8) Magnet Switch (9) Connecting Lead

A : Spline Teeth

W1016288



Disassembling Magnet Switch

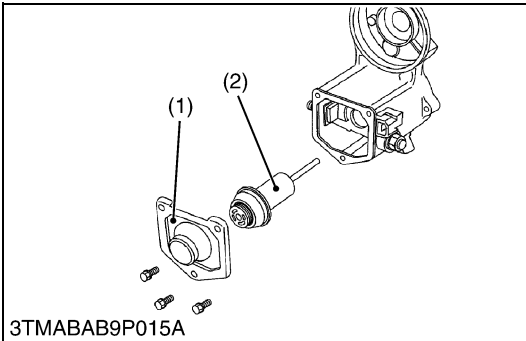
1. Remove the drive end frame (1) mounting screws.
2. Take out the overrunning clutch (2), ball (3), spring (4), gear (5), rollers (6) and retainer (7).

(When reassembling)

- Apply grease to the gear teeth of the gear (5) and overrunning clutch (2), and ball (3).

- | | |
|------------------------|--------------|
| (1) Drive End Frame | (5) Gear |
| (2) Overrunning Clutch | (6) Roller |
| (3) Ball | (7) Retainer |
| (4) Spring | |

W1016728



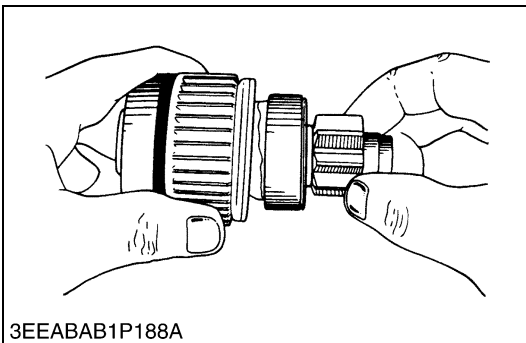
Plunger

1. Remove the end cover (1).
2. Take out the plunger (2).

- | | |
|---------------|-------------|
| (1) End Cover | (2) Plunger |
|---------------|-------------|

W1016883

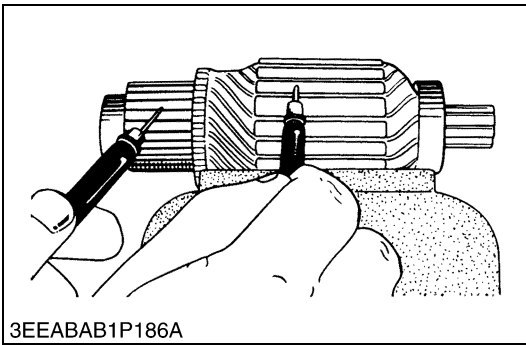
(3) Servicing



Overrunning Clutch

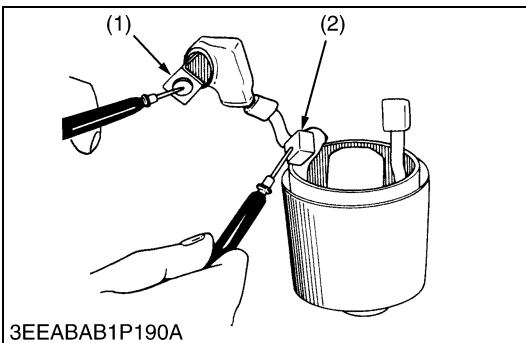
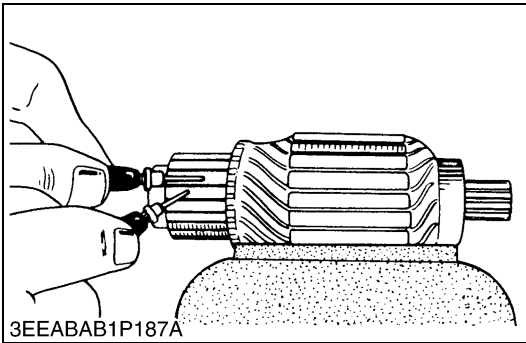
1. Inspect the pinion for wear or damage.
2. If there is any defect, replace the overrunning clutch assembly.
3. Check that the pinion turns freely and smoothly in the overrunning direction and does not slip in the cranking direction.
4. If the pinion slips or does not rotate in the both directions, replace the overrunning clutch assembly.

W1016990

**Armature Coil**

1. Check the continuity across the commutator and armature coil core with an ohmmeter.
2. If it conducts, replace the armature.
3. Check the continuity across the segments of the commutator with an ohmmeter.
4. If it does not conduct, replace the armature.

W1017767

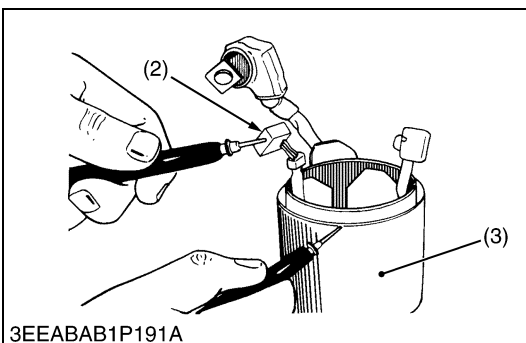
**Field Coil**

1. Check the continuity across the lead (1) and brush (2) with an ohmmeter.
2. If it does not conduct, replace the yoke assembly.
3. Check the continuity across the brush (2) and yoke (3) with an ohmmeter.
4. If it conducts, replace the yoke assembly.

(1) Lead
(2) Brush

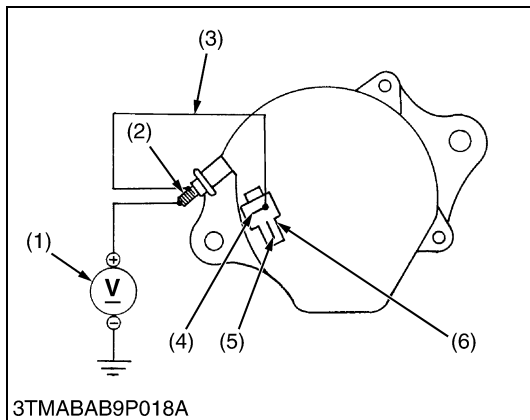
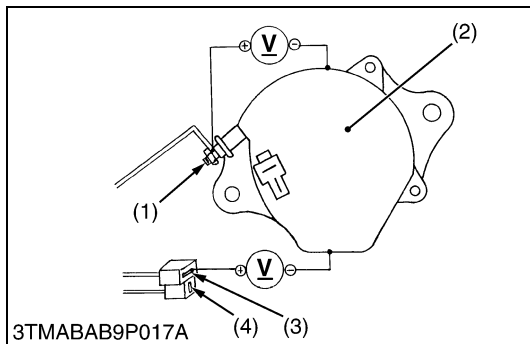
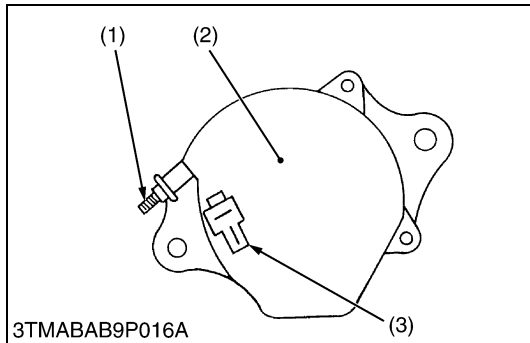
(3) Yoke

W1018015



[3] CHARGING SYSTEM

(1) Checking



Alternator

1. Disconnect the **2P** connector (3) from alternator after turning the main switch **OFF**.
2. Perform the following checkings.

- (1) **B** Terminal
(2) Alternator
(3) **2P** Connector

W1018175

Connector Voltage

1. Turn the main switch **OFF**. Measure the voltage between the **B** terminal (1) and the chassis.
2. Turn the main switch **ON**. Measure the voltage between the **IG** terminal (3) and the chassis.

Voltage (Main switch at OFF)	B terminal – Chassis	Approx. battery voltage
Voltage (Main switch at ON)	IG terminal – Chassis	Approx. battery voltage

- (1) **B** Terminal
(2) Alternator
(3) **IG** Terminal
(4) **L** Terminal

W1018279

No-Load Test

1. Connect the **2P** connector (6) to previous positions of the alternator after turning the main switch **OFF**.
2. Connect the jumper lead (3) between **IG** terminal (4) and **B** terminal (2).
3. Start the engine and then set at idling speed.
4. Disconnect the negative cable from the battery.
5. Measure the voltage between the **B** terminal (2) and the chassis.
6. If the measurement is less than the factory specification, disassemble the alternator and check the IC regulator.

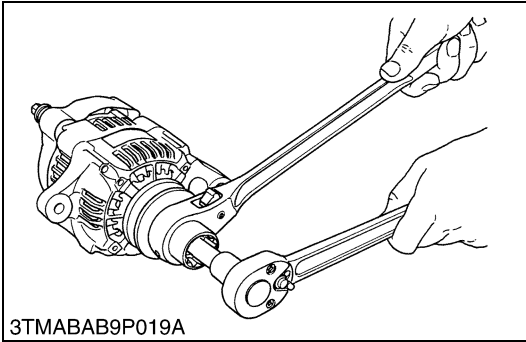
Voltage	Factory spec.	More than 14 V
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(Reference)

- Once the engine has started, the alternator temperature rises quickly up to an ambient temperature of 70 to 90 °C (158 to 194 °F). As the temperature goes higher than 50 °C (122 °F), the alternator voltage slowly drops; at higher than 100 °C (212 °F), it drops by about 1 V.

- (1) Voltmeter
(2) **B** Terminal
(3) Jumper Lead
(4) **IG** Terminal
(5) **L** Terminal
(6) **2P** Terminal

W1018478

(2) Disassembling and Assembling

3TMABAB9P019A

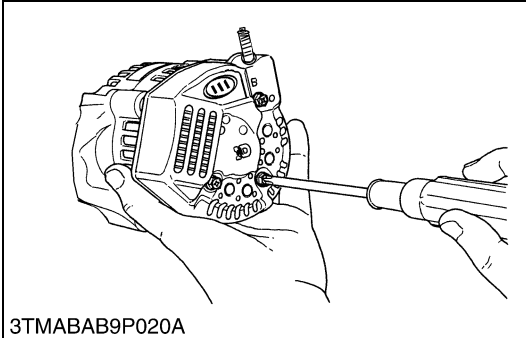
Pulley

1. Secure the hexagonal end of the pulley shaft with a double-ended ratchet wrench as shown in the figure, loosen the pulley nut with a socket wrench and remove it.

(When reassembling)

Tightening torque	Pulley nut	58.3 to 78.9 N·m 5.95 to 8.05 kgf·m 43.0 to 58.2 ft-lbs
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W1018728

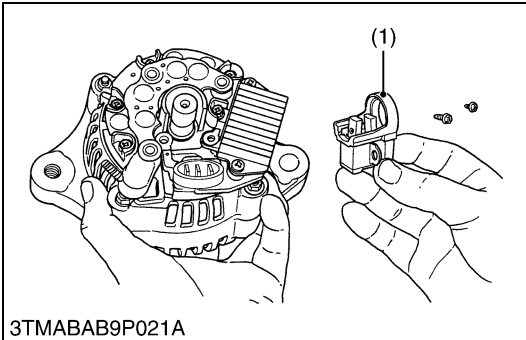


3TMABAB9P020A

Rear End Cover

1. Unscrew the three rear end cover screws and the **B** terminal nut, and remove the rear end cover.

W1018982



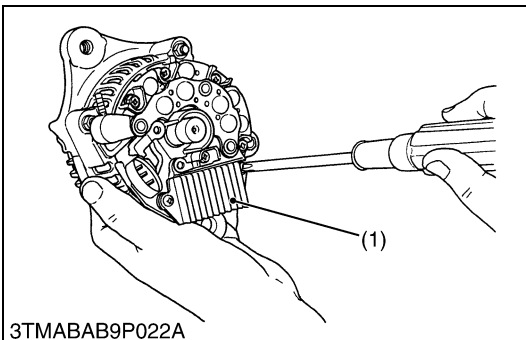
3TMABAB9P021A

Brush Holder

1. Unscrew the two screws holding the brush holder, and remove the brush holder (1).

(1) Brush Holder

W1019054



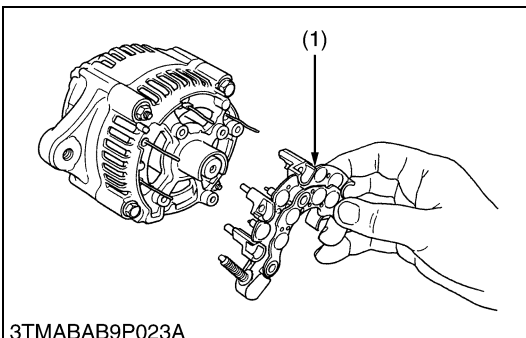
3TMABAB9P022A

IC Regulator

1. Unscrew the three screws holding the IC regulator, and remove the IC regulator (1).

(1) IC Regulator

W1019123



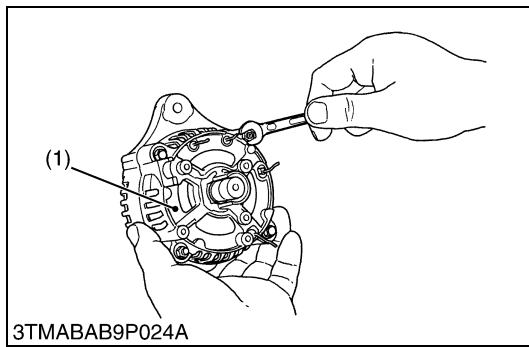
3TMABAB9P023A

Rectifier

1. Remove the four screws holding the rectifier and the stator lead wires.
2. Remove the rectifier (1).

(1) Rectifier

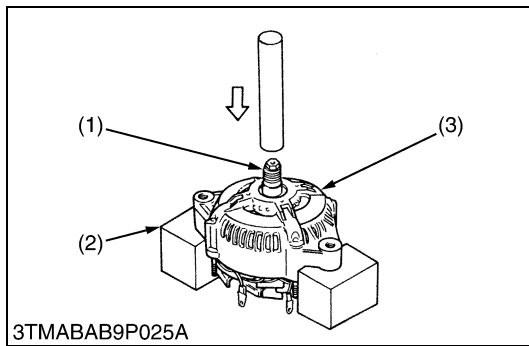
W1019192

**Rear End Frame**

1. Unscrew the two nuts and two screws holding the drive end frame and the rear end frame.
2. Remove the rear end frame (1).

(1) Rear End Frame

W1019274

**Rotor**

1. Press out the rotor (1) from drive end frame (3).

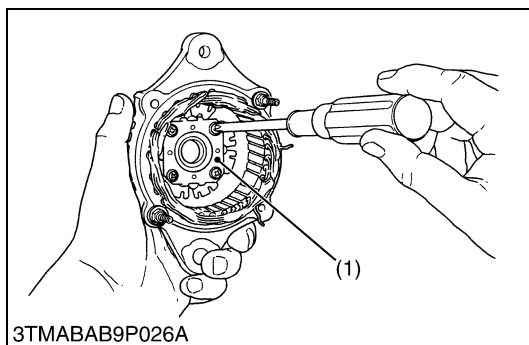
■ IMPORTANT

- Take special care not to drop the rotor and damage the slip ring or fan, etc..

(1) Rotor
(2) Block

(3) Drive End Frame

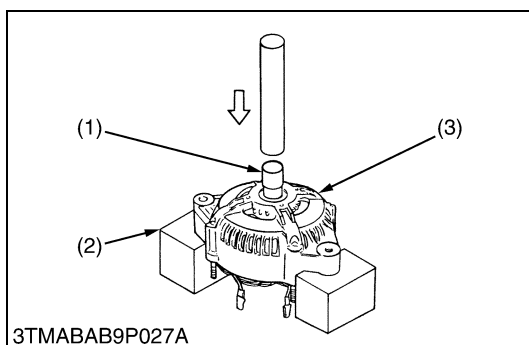
W1019438

**Retainer Plate**

1. Unscrew the four screws holding the retainer plate, and remove the retainer plate (1).

(1) Retainer Plate

W1019542

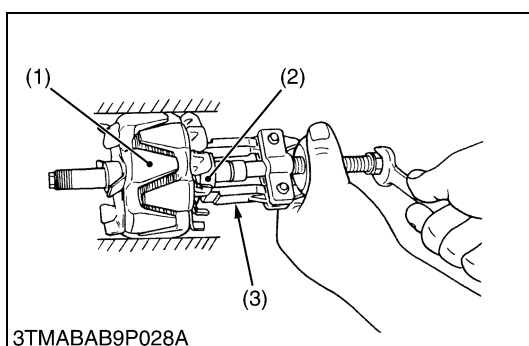
**Bearing on Drive End Side**

1. Press out the bearing from drive end frame (3) with a press and jig (1).

(1) Jig
(2) Block

(3) Drive End Frame

W1019611

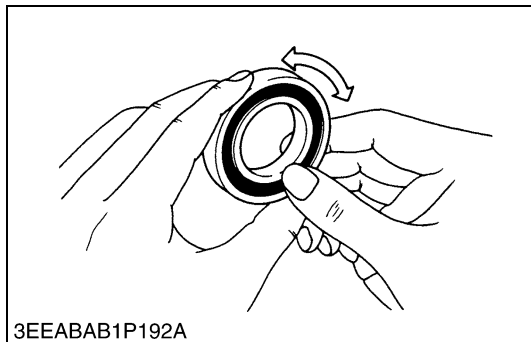
**Bearing at Slip Ring Side**

1. Lightly secure the rotor (1) with a vise to prevent damage, and remove the bearing (2) with a puller (3).

(1) Rotor
(2) Bearing

(3) Puller

W1019701

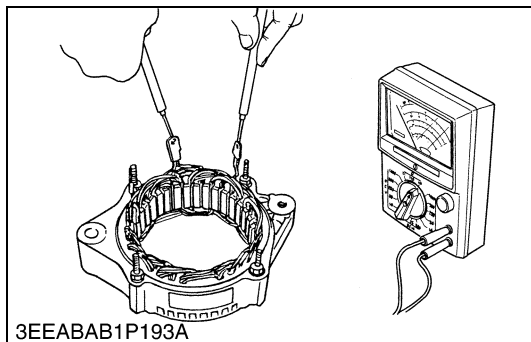
(3) Servicing

3EEABAB1P192A

Bearing

1. Check the bearing for smooth rotation.
2. If it does not rotate smoothly, replace it.

W1019790



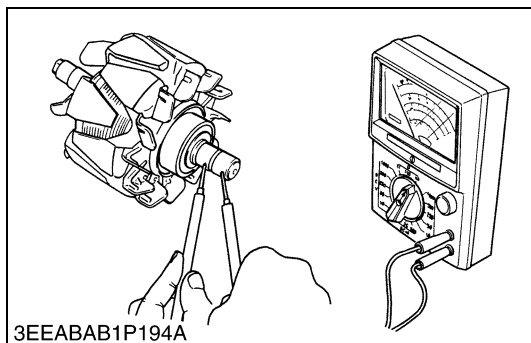
3EEABAB1P193A

Stator

1. Measure the resistance across each lead of the stator coil with an ohmmeter.
2. If the measurement is not within the factory specification, replace it.
3. Check the continuity across each stator coil lead and core with an ohmmeter.
4. If infinity is not indicated, replace it.

Resistance	Factory spec.	Less than 1.0 Ω
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W1019964



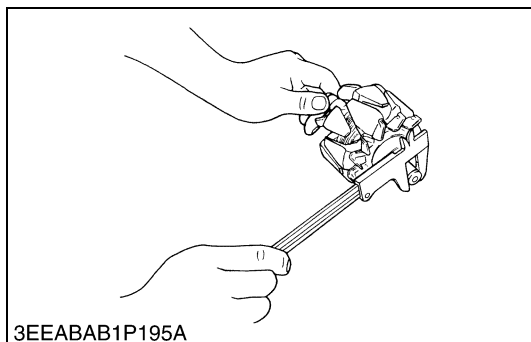
3EEABAB1P194A

Rotor

1. Measure the resistance across the slip rings with an ohmmeter.
2. If the resistance is not the factory specification, replace it.
3. Check the continuity across the slip ring and core with an ohmmeter.
4. If infinity is not indicated, replace it.

Resistance	Factory spec.	2.9 Ω
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W1020094



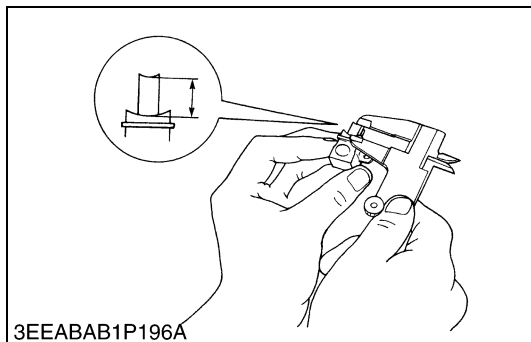
3EEABAB1P195A

Slip Ring

1. Check the slip ring for score.
2. If scored, correct with an emery paper or on a lathe.
3. Measure the O.D. of slip ring with vernier calipers.
4. If the measurement is less than the allowable limit, replace it.

Slip ring O.D.	Factory spec.	14.4 mm 0.567 in.
	Allowable limit	12.8 mm 0.504 in.

W1020208



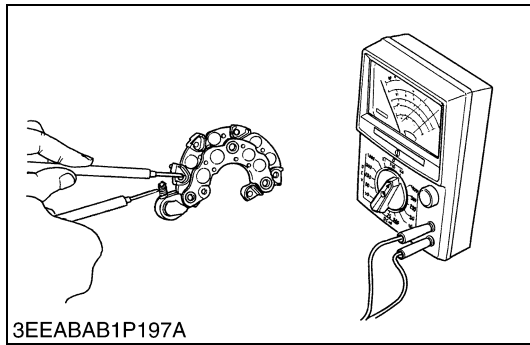
3EEABAB1P196A

Brush Wear

1. Measure the brush length with vernier calipers.
2. If the measurement is less than allowable limit, replace it.
3. Make sure that the brush moves smoothly.
4. If the brush is defective, replace it.

Brush length	Factory spec.	10.5 mm 0.413 in.
	Allowable limit	8.4 mm 0.331 in.

W1020329



Rectifier

1. Check the continuity across each diode of rectifier with an analog ohmmeter. Conduct the test in the (R \times 1) setting.
2. The rectifier is normal if the diode in the rectifier conducts in one direction and does not conduct in the reverse direction.

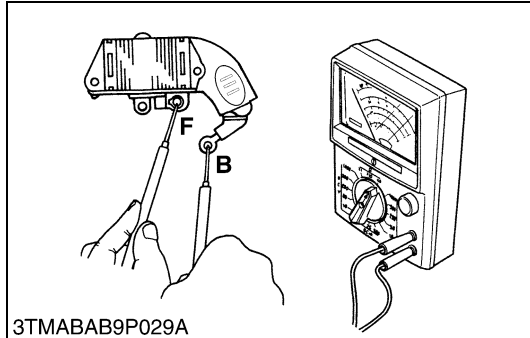
■ IMPORTANT

- Do not use a 500 V megger for measuring because it will destroy the rectifier.

■ NOTE

- Do not use an auto digital multimeter. Because it's very hard to check the continuity of rectifier by using it.

W1020452



IC Regulator

1. Check the continuity across the B terminal and the F terminal of IC regulator with an analog ohmmeter. Conduct the test in the (R \times 1) setting.
2. The IC regulator is normal if the IC regulator conducts in one direction and does not conduct in the reverse direction.

■ IMPORTANT

- Do not use a 500 V megger for measuring because it will destroy the IC regulator.

■ NOTE

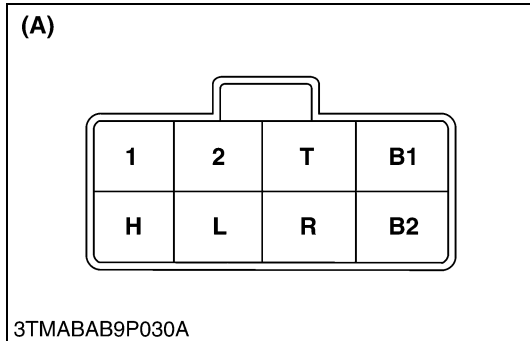
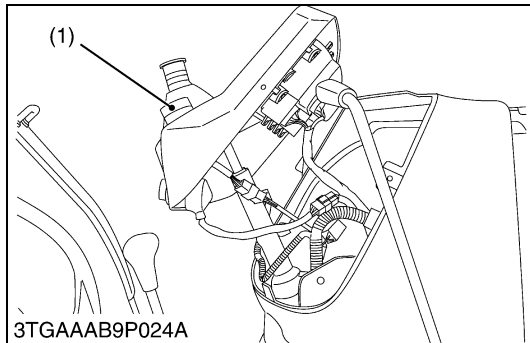
- Do not use an auto digital multimeter. Because it's very hard to check the continuity of IC regulator by using it.

W1020645

[4] LIGHTING SYSTEM

(1) Checking

(A) Combination Switch



Remove the Combination Switch

1. Remove the meter panel, and disconnect the combination switch connector **8A** after turning the main switch **OFF** position.
2. Perform the following checkings.

(1) Combination Switch

W1020799

Connector Voltage

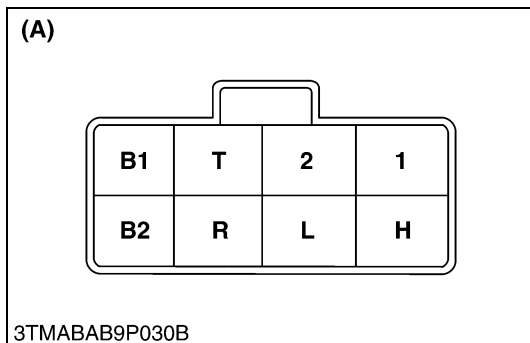
1. Disconnect the connector **8A** from the combination switch.
2. Measure the voltage with a voltmeter across the connector **B1** terminal and chassis when the main switch is **OFF** position.
3. If the voltage differs from the battery voltage, the wiring harness is faulty.
4. Measure the voltage with a voltmeter across the connector **B2** terminal and chassis when the main switch is **ON** position.
5. If the voltage differs from the battery voltage, check the wiring harness and main switch.

Voltage	Main switch at OFF position	B1 terminal – Chassis	Battery voltage
	Main switch at ON position	B2 terminal – Chassis	

(A) Wire Harness Side Connector 8A

W1020896

(B) Lighting Switch



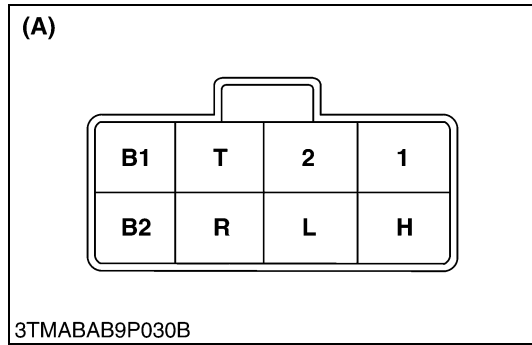
Head Light Switch Continuity when Setting Switch at OFF Position

1. Disconnect the connector **8A** from the combination switch.
2. Set the light switch to the **OFF** position.
3. Measure the resistance with an ohmmeter across the **B1** terminal to the **T** terminal, the **B1** terminal to the **1** terminal and the **B1** terminal to the **2** terminal.
4. If infinity is not indicated, renew the switch.

Resistance (Switch at OFF position)	B1 terminal – T terminal	Infinity
	B1 terminal – 1 terminal	
	B1 terminal – 2 terminal	

(A) Combination Switch Side Connector 8A

W1021136



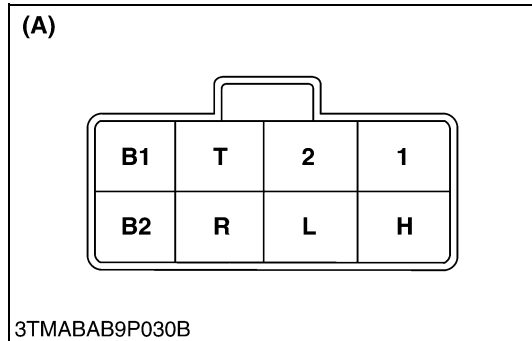
Head Light Switch Continuity when Setting Switch at HI-BEAM Position

1. Measure the resistance with an ohmmeter across the **B1** terminal to the **T** terminal and the **B1** terminal to the **1** terminal.
2. If 0 ohm is not indicated, renew the head light switch.

Resistance (Switch at HI-BEAM position)	B1 terminal – T terminal	0 Ω
	B1 terminal – 1 terminal	

(A) Combination Switch Side
Connector 8A

W1021514



Head Light Switch Continuity when Setting Switch at LO-BEAM Position

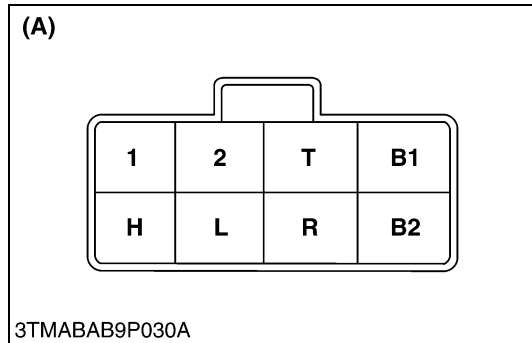
1. Measure the resistance with an ohmmeter across the **B1** terminal to the **T** terminal and the **B1** terminal to the **2** terminal.
2. If 0 ohm is not indicated, renew the head light switch.

Resistance (Switch at LO-BEAM position)	B1 terminal – T terminal	0 Ω
	B1 terminal – 2 terminal	

(A) Combination Switch Side
Connector 8A

W1021917

(C) Turn Signal Switch



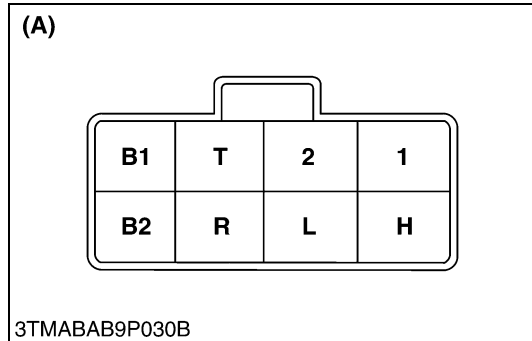
Connector Voltage

1. Disconnect the connector **8A** from the combination switch.
2. Measure the voltage with a voltmeter across the connector **B2** terminal and chassis when the main switch is **ON** position.
3. If the voltage differs from the battery voltage, check the wiring harness.

Voltage	Main switch at ON position	B2 terminal – Chassis	Battery voltage
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(A) Wire Harness Side Connector 8A

W1022090



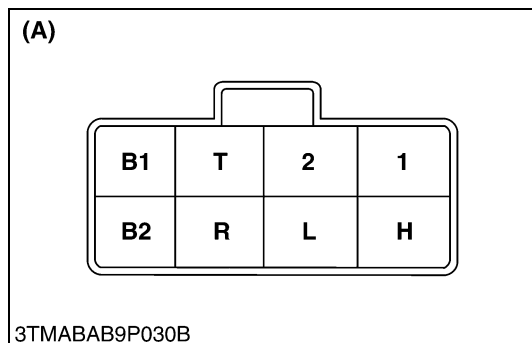
Turn Signal Switch OFF Position

1. Set the hazard switch to the **OFF** position.
2. Measure the resistance with an ohmmeter across the **B2** terminal to the **R** terminal and the **B2** terminal to the **L** terminal.
3. If infinity ohm is not indicated, renew the combination switch.

Resistance (Switch at OFF position)	B2 terminal – R terminal	Infinity
	B2 terminal – L terminal	

(A) Combination Switch Side
Connector 8A

W1022305



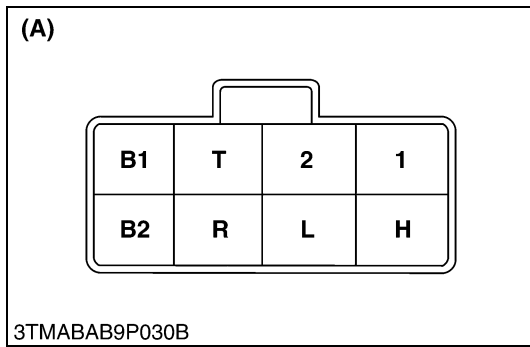
Turn Signal Switch R Position

1. Set the hazard switch to the **R** position.
2. Measure the resistance with an ohmmeter across the **B2** terminal to the **R** terminal.
3. If 0 ohm is not indicated, renew the combination switch.

Resistance (Switch at R position)	B2 terminal – R terminal	0 Ω
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(A) Combination Switch Side
Connector 8A

W1022505



Turn Signal Switch L Position

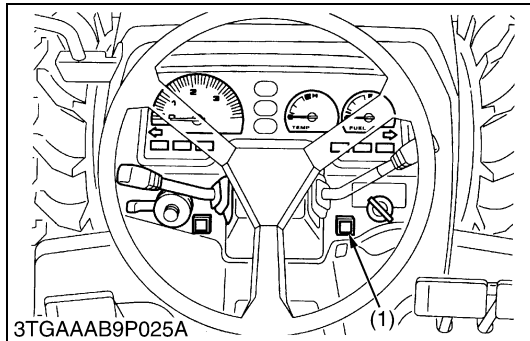
1. Set the hazard switch to the **L** position.
2. Measure the resistance with an ohmmeter across the **B2** terminal to the **L** terminal.
3. If 0 ohm is not indicated, renew the combination switch.

Resistance (Switch at L position)	B2 terminal – L terminal	0 Ω
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(A) Combination Switch Side
Connector 8A

W1022710

(D) Hazard Switch



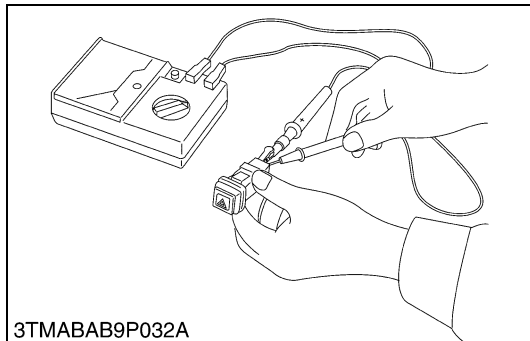
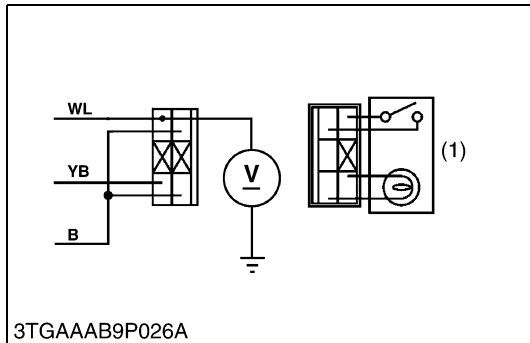
Hazard Switch Connector Voltage

1. Remove the meter panel, and disconnect the connector from hazard switch.
2. Measure the voltage with a voltmeter across the **WL** terminal and chassis.
3. If the voltage differs from the battery voltage, the wiring harness is faulty.

Voltage	WL terminal – Chassis	Approx. battery voltage
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(1) Hazard Light Switch

W1022891



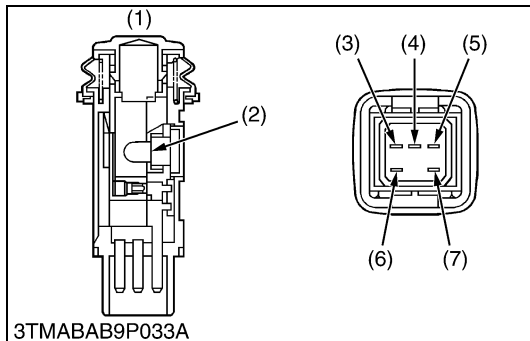
Hazard Switch Continuity

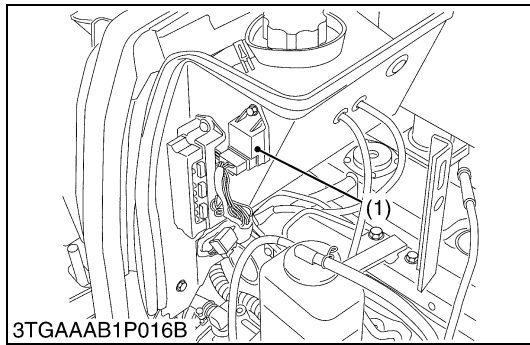
1. Remove the under panel.
2. Disconnect the connector, and remove the hazard switch.
3. Measure the resistance with ohmmeter across the **A** terminal and **C** terminal, and across the **D** terminal and **E** terminal.
4. If the measurement differs from the table below, the hazard switch or the bulb are faulty.

Resistance (Switch at OFF)	A terminal – C terminal	Infinity
Resistance (Switch at ON)	A terminal – C terminal	0 Ω
Resistance (Bulb)	D terminal – E terminal	Approx. 13 ohms

- | | |
|-----------------------|-----------------------|
| (1) Hazard Switch | (5) D Terminal |
| (2) Bulb | (6) C Terminal |
| (3) A Terminal | (7) E Terminal |
| (4) B Terminal | |

W1023023





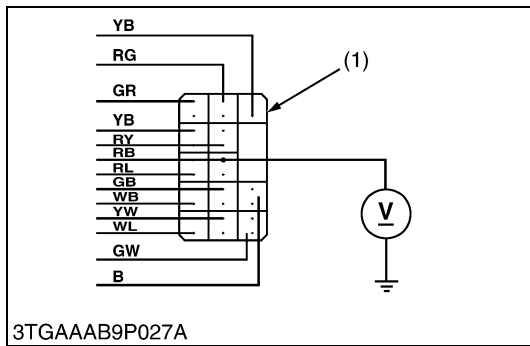
Flasher Unit Connector Voltage

1. Open the hood, and disconnect the connector from flasher unit.
2. Measure the voltage with a voltmeter across the **RB** terminal and chassis.
3. If the voltage differs from the battery voltage, the wiring harness is faulty.

Voltage	RB terminal – Chassis	Approx. battery voltage
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(1) Flasher Unit

W1023354



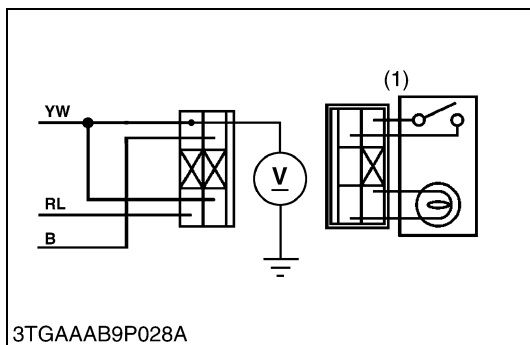
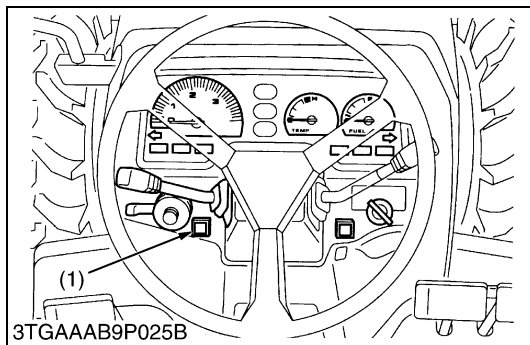
Parking (Position) Switch Connector Voltage

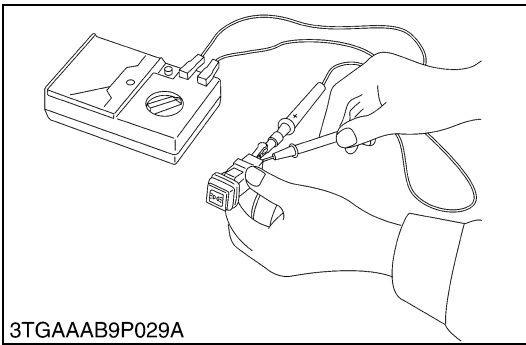
1. Remove the meter panel, and disconnect the connector from parking switch.
2. Measure the voltage with a voltmeter across the **YW** terminal and chassis.
3. If the voltage differs from the battery voltage, the wiring harness is faulty.

Voltage	YW terminal – Chassis	Approx. battery voltage
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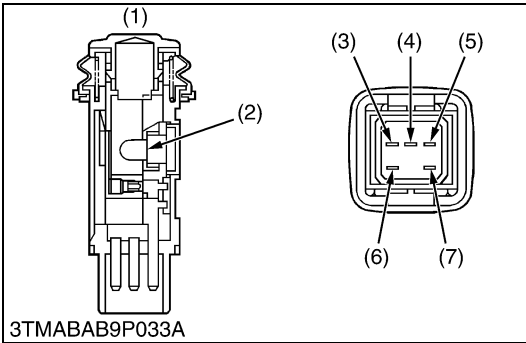
(1) Position Light Switch

W1023610





3TGAAAB9P029A



3TMABAB9P033A

Parking (Position) Switch Continuity

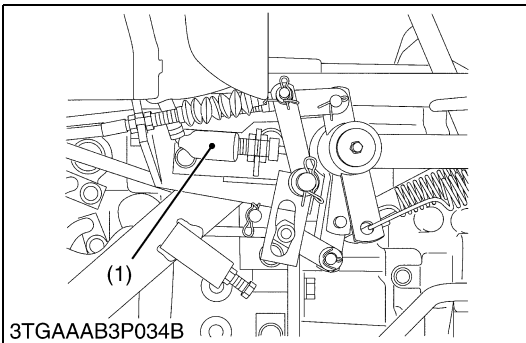
1. Remove the meter panel.
2. Disconnect the connector, and remove the parking switch.
3. Measure the resistance with ohmmeter across the **A** terminal and **C** terminal, and across the **D** terminal and **E** terminal.
4. If the measurement differs from the table below, the position switch or the bulb are faulty.

Resistance (Switch at OFF)	A terminal – C terminal	Infinity
Resistance (Switch at ON)	A terminal – C terminal	0 Ω
Resistance (Bulb)	D terminal – E terminal	Approx. 13 ohms

- (1) Parking (Position) Switch
- (2) Bulb
- (3) A Terminal
- (4) B Terminal
- (5) D Terminal
- (6) C Terminal
- (7) E Terminal

W1023769

(E) Brake Switch



3TGAAAB3P034B

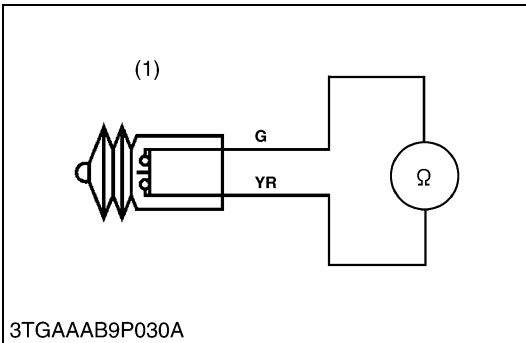
Brake Switch Continuity

1. Disconnect the leads, and measure the resistance with an ohmmeter across the brake switch leads.
2. If the measurement differs from the table below, the brake switch is faulty or need to adjust the brake switch position.

Resistance (When brake pedal is depressed)	Lead – Lead	Infinity
Resistance (When brake pedal is released)	Lead – Lead	0 Ω

- (1) Brake Switch

W1024163



3TGAAAB9P030A

Brake Switch Distance

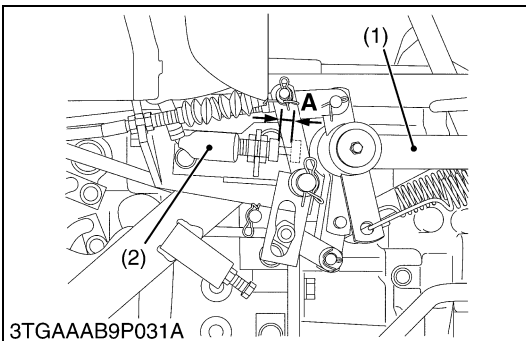
1. Set the distance **A** to 4 mm (0.16 in.) when brake pedal is released.
2. Check the brake lights by operating brake pedal (1). The brake lights should come **ON** when the brake pedal (1) is depressed. If not, adjust the distance **A**.

(Reference)

- Distance **A** : 4 mm (0.16 in.)

- (1) Brake Pedal
- (2) Brake Switch

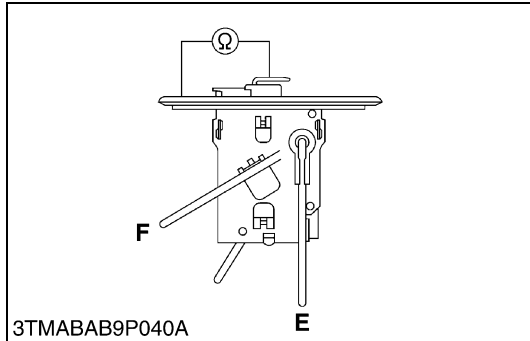
W1024380



3TGAAAB9P031A

[5] GAUGES

(1) Checking



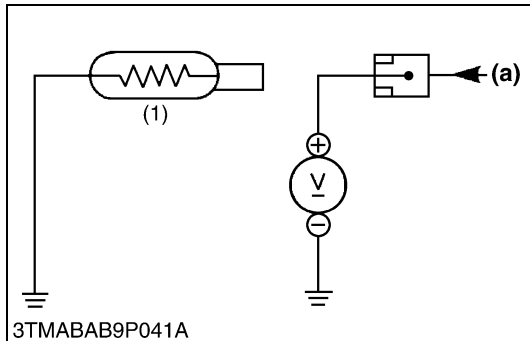
Fuel Level Sensor

1) Sensor Continuity

1. Remove the fuel level sensor from the fuel tank.
2. Measure the resistance with an ohmmeter across the sensor terminal and its body.
3. If the reference value are not indicated, the sensor is faulty.

Resistance (Sensor terminal – its body)	Reference value	Float at upper-most position	1 to 5 Ω
		Float at lower-most position	103 to 117 Ω

W1024865



Coolant Temperature Sensor

1) Lead Terminal Voltage

1. Disconnect the lead from the coolant temperature sensor after turning the main switch off.
2. Turn the main switch on and measure the voltage with a voltmeter across the lead terminal and the chassis.
If the voltage differs from the battery voltage, the wiring harness, fuse or coolant temperature gauge is faulty.

Voltage	Lead terminal – Chassis	Approx. battery voltage
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2) Sensor Continuity

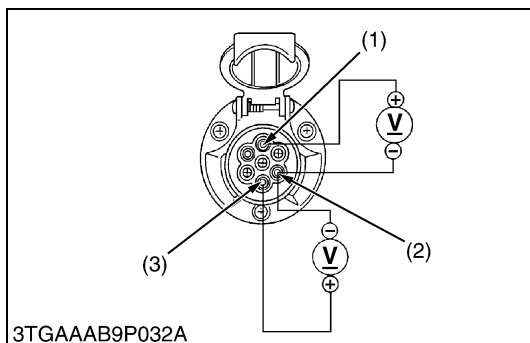
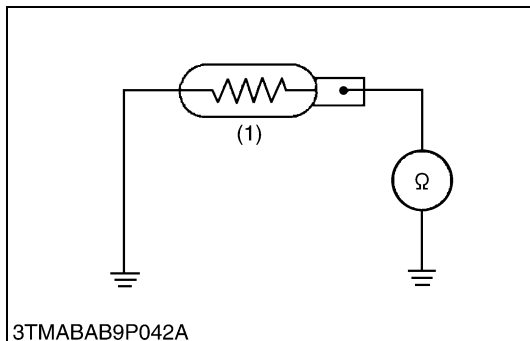
1. Measure the resistances with an ohmmeter across the sensor terminal and the chassis.
2. If the reference value is not indicated, the sensor is faulty.

Resistance (Sensor terminal – Chassis)	Reference value	Approx. 12.2 Ω at 130 °C (266 °F)
		Approx. 23.6 Ω at 105 °C (221 °F)
		Approx. 51.9 Ω at 80 °C (176 °F)
		Approx. 153.9 Ω at 50 °C (122 °F)

(1) Coolant Temperature Sensor

(a) From Temperature Gauge

W1025104



Trailer Socket

1) Turning Signal Terminals

1. Turn the main switch **ON**, and measure the voltage with voltmeter across the 1 terminal (1) and 3 terminal (2), and across the 4 terminal (3) and 3 terminal (2).
2. If the voltage differs from the battery voltage, the wiring harness or switches for turning signal are faulty.

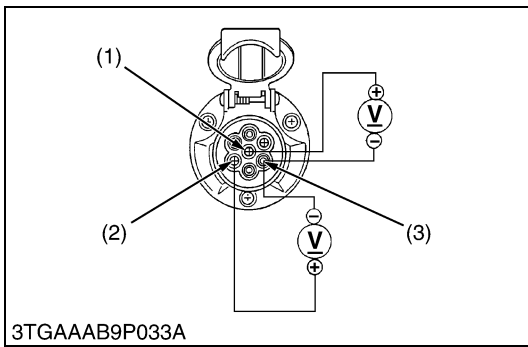
Voltage (Turning signal switch at L or hazard switch at ON)	1 terminal (Green / White) – 3 terminal (Black)	Approx. battery voltage (Intermittently)
Voltage (Turning signal switch at R or hazard switch at ON)	4 terminal (Red / White) – 3 terminal (Black)	Approx. battery voltage (Intermittently)

(1) 1 Terminal

(3) 4 Terminal

(2) 3 Terminal

W1025340



2) Tail Terminals

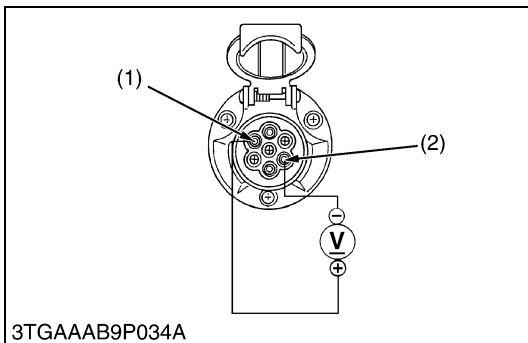
1. Turn the main switch **ON**, and measure the voltage with voltmeter across the **7** terminal (1) and **5** terminal (2), and across the **5** terminal (2) and **3** terminal (3).
2. If the voltage differs from battery voltage, the wiring harness or switches for tail lights are faulty.

Voltage (Head switch at ON or position switch at ON)	7 terminal (Yellow / White) – 5 terminal (Yellow / Red)	Approx. battery voltage
Voltage (Head light switch at ON or position switch at ON)	5 terminal (Yellow / Red) – 3 terminal (Black)	Approx. battery voltage

(1) **7** Terminal
(2) **5** Terminal

(3) **3** Terminal

W1025660



3) Brake Light Terminal

1. Turn the main switch **ON**, and measure the voltage with voltmeter across the **6** terminal (1) and **3** terminal (2).
2. If the voltage differs from battery voltage, the wiring harness or switch for brake lights are faulty.

Voltage (When stepping the brake pedal)	6 terminal (Yellow) – 3 terminal (Black)	Approx. battery voltage
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(1) **6** Terminal

(2) **3** Terminal

W1026040

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