

# WSM

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WORKSHOP MANUAL  
**TRACTOR**

**STV32,STV36,STV40**

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**Kubota**

# TO THE READER

This Workshop Manual has been prepared to provide servicing personnel with information on the mechanism, service and maintenance of STV32, STV36 and STV40. It is divided into three parts, "General", "Mechanism" and "Servicing".

## ■ General

Information on the tractor identification, the general precautions, maintenance check list, check and maintenance and special tools are described.

## ■ Mechanism

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

Refer to Diesel Engine / Tractor Mechanism Workshop Manual (Code No. 97897-01872 / 97897-18200) for the one which has not been described to this workshop manual.

## ■ Servicing

Information on the troubleshooting, servicing specification lists, tightening torque, 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 product information available at the time of publication.

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

Due to covering many models of this manual, information or picture being used have not been specified as one model.

**August 2004**

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## SAFETY FIRST

This symbol, the industry's "Safety Alert Symbol" is used throughout this manual and on labels on the machine itself to warn of the possibility of personal injury. Read these instructions carefully. It is essential that you read the instructions and safety regulations before you attempt to repair or use this unit.



### DANGER

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



### WARNING

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



### CAUTION

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

### ■ IMPORTANT

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

### ■ NOTE

- Gives helpful information.

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#### BEFORE SERVICING AND REPAIRING

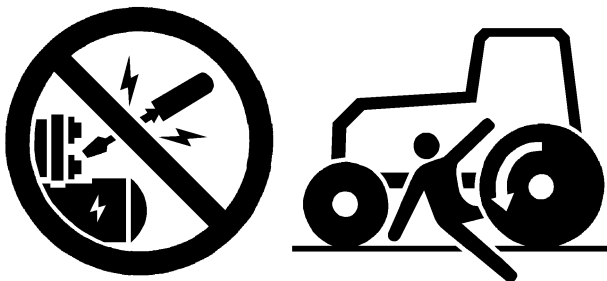
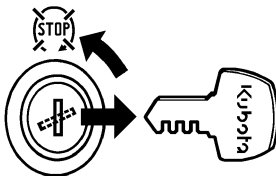
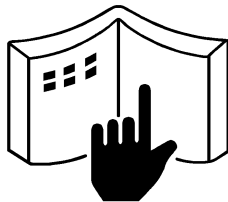
- Read all instructions and safety instructions in this manual and on your machine safety decals.
- Clean the work area and machine.
- Park the machine on a firm and level ground, and set the parking brake.
- Lower the implement to the ground.
- Stop the engine, and remove the key
- Disconnect the battery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

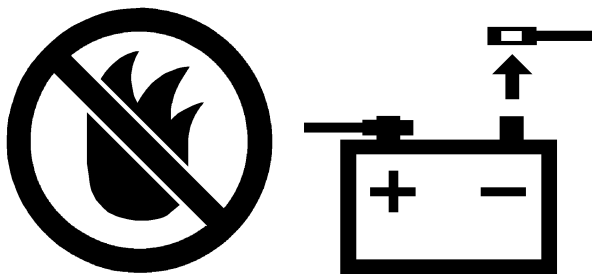
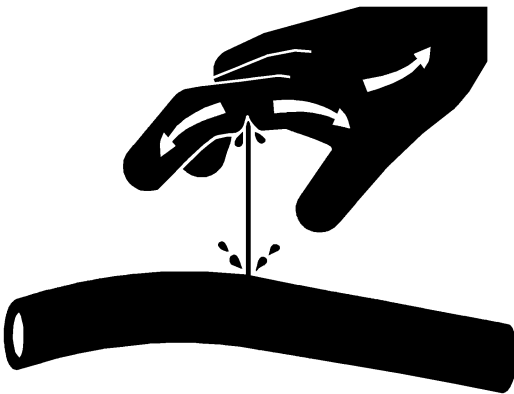
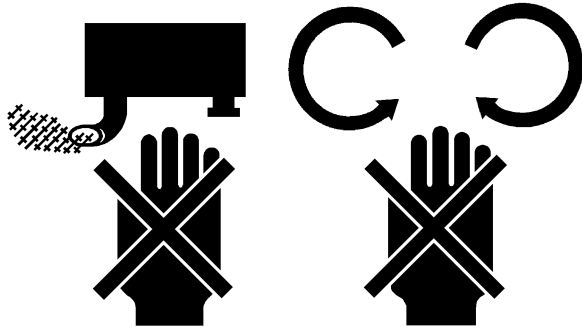
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#### SAFETY STARTING

- 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.

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### SAFETY WORKING

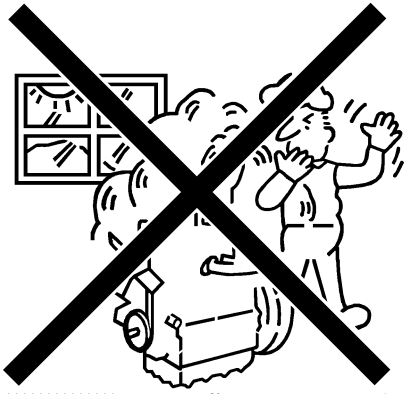
- Do not work on the machine while under the influence of alcohol, medication, or other substances or while fatigued.
- Wear close fitting clothing and safety equipment appropriate to the job.
- Use tools appropriate to the work. Makeshift tools, parts, and procedures are not recommended.
- When servicing 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.

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### 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.

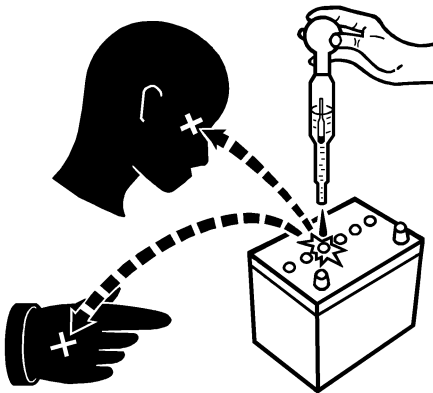
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#### VENTILATE WORK AREA

- 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.

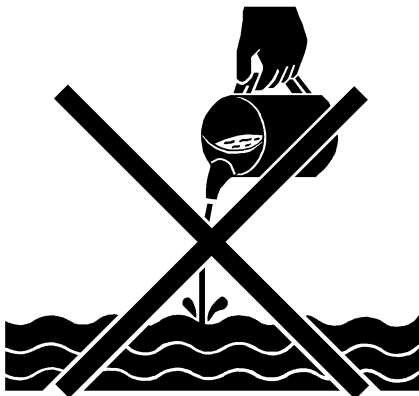
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#### PREVENT ACID BURNS

- 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.

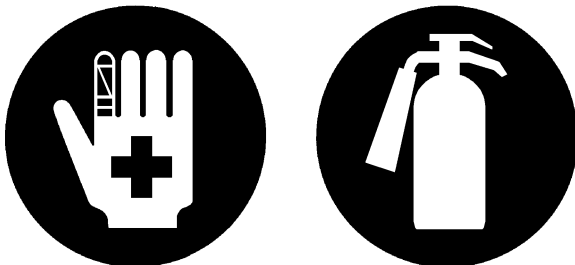
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#### DISPOSE OF FLUIDS PROPERLY

- 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.

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#### 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.

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# 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. 6C040-4742-2

## ⚠ CAUTION

**TO AVOID PERSONAL INJURY:**

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 to the ground, set the parking brake, stop the engine and remove the key.
12. Securely support tractor and implements before working underneath.

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



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

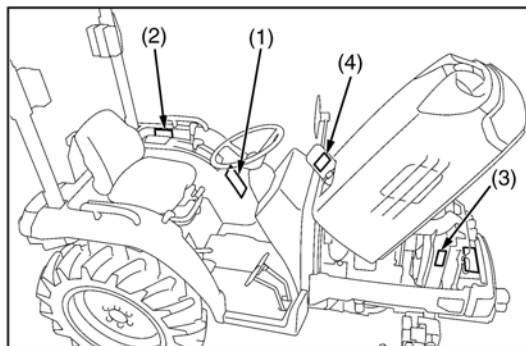
## ⚠ WARNING

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.

(4) Part No. TA040-4956-2

Diesel fuel only

No fire



(1) Part No. TA040-4965-2

	<h2>⚠ DANGER</h2>
	<p><b>TO AVOID POSSIBLE INJURY OR DEATH FROM A MACHINE RUNAWAY.</b></p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Start engine only from operator's seat with transmission and PTO OFF.</li> </ol> <p>Never start engine while standing on the ground.</p>

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



(2) Part No. TA240-4933-2

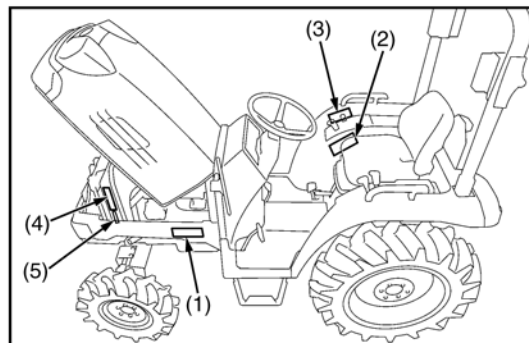
<h2>⚠ WARNING</h2> 	<p><b>BEFORE DISMOUNTING TRACTOR:</b></p> <ol style="list-style-type: none"> <li><b>1. ALWAYS SET PARKING BRAKE.</b> Leaving transmission in gear with the engine stopped will not prevent tractor from rolling.</li> <li><b>2. PARK ON LEVEL GROUND WHENEVER POSSIBLE.</b> If parking on a slope, position tractor across the slope.</li> <li><b>3. LOWER ALL IMPLEMENTS TO THE GROUND.</b> Failure to comply to this warning may allow the wheels to slip, and could cause injury or death.</li> <li><b>4. STOP THE ENGINE.</b></li> </ol>
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(5) Part No. TC030-4958-1  
Do not touch hot surface like muffler, etc.











(3) Part No. TA044-4932-1


<h2>⚠ WARNING</h2> <p><b>TO AVOID PERSONAL INJURY OR DEATH FROM ROLL-OVER:</b></p> <ol style="list-style-type: none"> <li>1. Kubota recommends the use of a Roll-Over Protective Structures (ROPS) in almost all applications.</li> <li>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.</li> <li>3. For further details, consult your Operator's Manual or your local dealer.</li> </ol>
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(1) Part No. TD020-3012-2

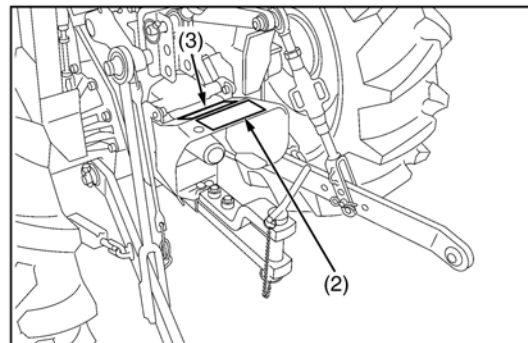
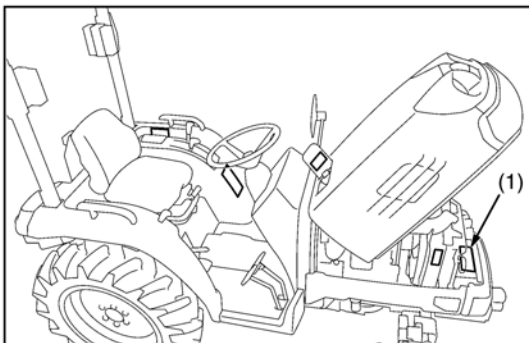
 RECYCLE	 FLAMMABLES	 SHIELD EYES	 KEEP OUT OF THE REACH OF CHILDREN	 CAUTIONS OF SULFURIC ACID	 READ INSTRUCTION MANUAL CAREFULLY	 EXPLOSIVE	<b>HYDROMETER</b>  OK CHARGE REPLACE BATTERY BATTERY DK 02109
<b>NS70MF</b> <b>12V</b> AMP. HR (5HR)    52 RESERVE CAPACITY (MIN)    123 COLD CRANKING AMPS (-18°C) 490	- DUE TO HYDROGEN GAS GENERATED FROM BATTERY, HANDLING WITHOUT CARE CAN CAUSE FIRE AND EXPLOSION. - THIS 12V BATTERY IS ONLY FOR STARTING ENGINE. DO NOT APPLY THIS PRODUCT FOR OTHER USES. - CHARGE 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>NS70MF</h1>		<h1>75D26R</h1>					
		FITTING DATE <b>0 1 2 3 4 5 6 7 8 9</b> YEAR <b>1 2 3 4 5 6 7 8 9 10 11 12</b> MONTH					
<b>DANGER EXPLOSIVE GASES</b> 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.			<b>POISON CAUSES SEVERE BURNS</b> Contains sulfuric acid. Avoid contact with skin, eyes or clothing. In event of accident flush with water and call a physician immediately.				
			<b>KEEP OUT OF REACH OF CHILDREN</b>				

(2) Part No. TA040-4959-3

	<b>WARNING</b> <b>TO AVOID PERSONAL INJURY.</b> 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

	<b>WARNING</b> <b>TO AVOID PERSONAL INJURY:</b> 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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# SPECIFICATIONS

Model		STV32		STV36		STV40		
PTO power		17.7 kW (24.1 HP)*		20.2 kW (27.5 HP)*		22.8 kW (31.0 HP)		
Engine	Maker	KUBOTA						
	Model	D1503-M		D1703-M		D1803-M		
	Type	E-TVCS, water-cooled, 4-cycle diesel						
	Number of cylinders	3						
	Bore and stroke	83 x 92.4 mm (3.27 x 3.64 in.)		87 x 92.4 mm (3.43 x 3.64 in.)		87 x 102.4 mm (3.43 x 4.03 in.)		
	Total displacement	1499 cm <sup>3</sup> (91.5 cu.in.)		1647 cm <sup>3</sup> (100.5 cu.in.)		1826 cm <sup>3</sup> (111.4 cu.in.)		
	Engine gross power	24.1 kW (32.3 HP)*		26.8 kW (35.9 HP)*		29.5 kW (39.5 HP)*		
	Rated revolution	2700 rpm						
	Maximum torque	99.2 N·m (10.0 kgf·m)		108.3 N·m (10.9 kgf·m)		120.7 N·m (12.2 kgf·m)		
	Battery	12 V, RC : 123 min, CCA : 490 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-D [below 10 °C (14 °F)]						
Capacities	Fuel tank	29.5 L (7.79 U.S.gals, 6.49 Imp.gals)						
	Engine crankcase (with filter)	6.7 L (7.1 U.S.qts, 5.9 Imp.qts)						
	Engine coolant	6.1 L (6.4 U.S.qts, 5.4 Imp.qts)						
	Transmission case	22 L (5.81 U.S.gals, 4.84 Imp.gals)						
	Front axle case	4.0 L (4.2 U.S.qts, 3.5 Imp.qts)						
	Tires	Front	Farm: 6 - 12	Turf: 24 x 8.5 - 14	Farm: 6 - 12	Turf: 24 x 8.5 - 14	Farm: 6 - 12	Turf: 24 x 8.5 - 14
Rear		9.5 - 22	13.6 - 16	9.5 - 22	13.6 - 16	9.5 - 22	13.6 - 16	
Dimensions	Overall length (with 3P)	2860 mm (112.6 in.)						
	Overall width (min. tread)	1220 mm (48.0 in.)	1310 mm (51.6 in.)	1220 mm (48.0 in.)	1310 mm (51.6 in.)	1220 mm (48.0 in.)	1310 mm (51.6 in.)	
	Overall height (with ROPS)	2350 mm (92.5 in.)	2340 mm (92.1 in.)	2350 mm (92.5 in.)	2340 mm (92.1 in.)	2350 mm (92.5 in.)	2340 mm (92.1 in.)	
	Wheel base	1610 mm (63.4 in.)						
	Minimum ground clearance	235 mm (9.3 in.)	225 mm (18.9 in.)	235 mm (9.3 in.)	225 mm (18.9 in.)	235 mm (9.3 in.)	225 mm (18.9 in.)	
	Tread	Front	1030 mm (40.6 in.)					
		Rear	950 mm (37.4 in.) 1070 mm (42.1 in.)	965 mm (38.0 in.) 1055 mm (41.5 in.)	950 mm (37.4 in.) 1070 mm (42.1 in.)	965 mm (38.0 in.) 1055 mm (41.5 in.)	950 mm (37.4 in.) 1070 mm (42.1 in.)	965 mm (38.0 in.) 1055 mm (41.5 in.)

Model		STV32		STV36		STV40	
Weight (with ROPS)		975 kg (2150 lbs)	995 kg (2194 lbs)	975 kg (2150 lbs)	995 kg (2194 lbs)	975 kg (2150 lbs)	995 kg (2194 lbs)
Travelling system	Clutch	Dry single plate					
	Steering	Hydrostatic power steering					
	Transmission	Main-hydrostatic transmission, range gear shift (3 forward and 3 reverse)					
	Brake	Wet disk type					
	Min. turning radius (with bi-speed turn)	2.2 m (7.2 feet) with brake, 2.5 m (8.2 feet) without brake					
	Differential	Bevel gear					
Hydraulic system	Hydraulic control system	Position control					
	Pump capacity	3P : 22.3 L / min (5.9 U.S.gals / min, 4.9 Imp.gals min) Power steering : 13.6 L / min (3.6 U.S.gals / min., 3.0 Imp.gals / min)					
	Three point hitch	SAE Category 1					
	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	2 speeds (540 rpm at 2670 engine rpm, 800 rpm at 2717 engine rpm)				
	Mid	PTO shaft	U.S.A. No.5 (KUBOTA 10-tooth) involute spline				
		Revolution	1 speed (2500 rpm at 2734 engine rpm)				

Note : \* Manufacture's estimate.

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

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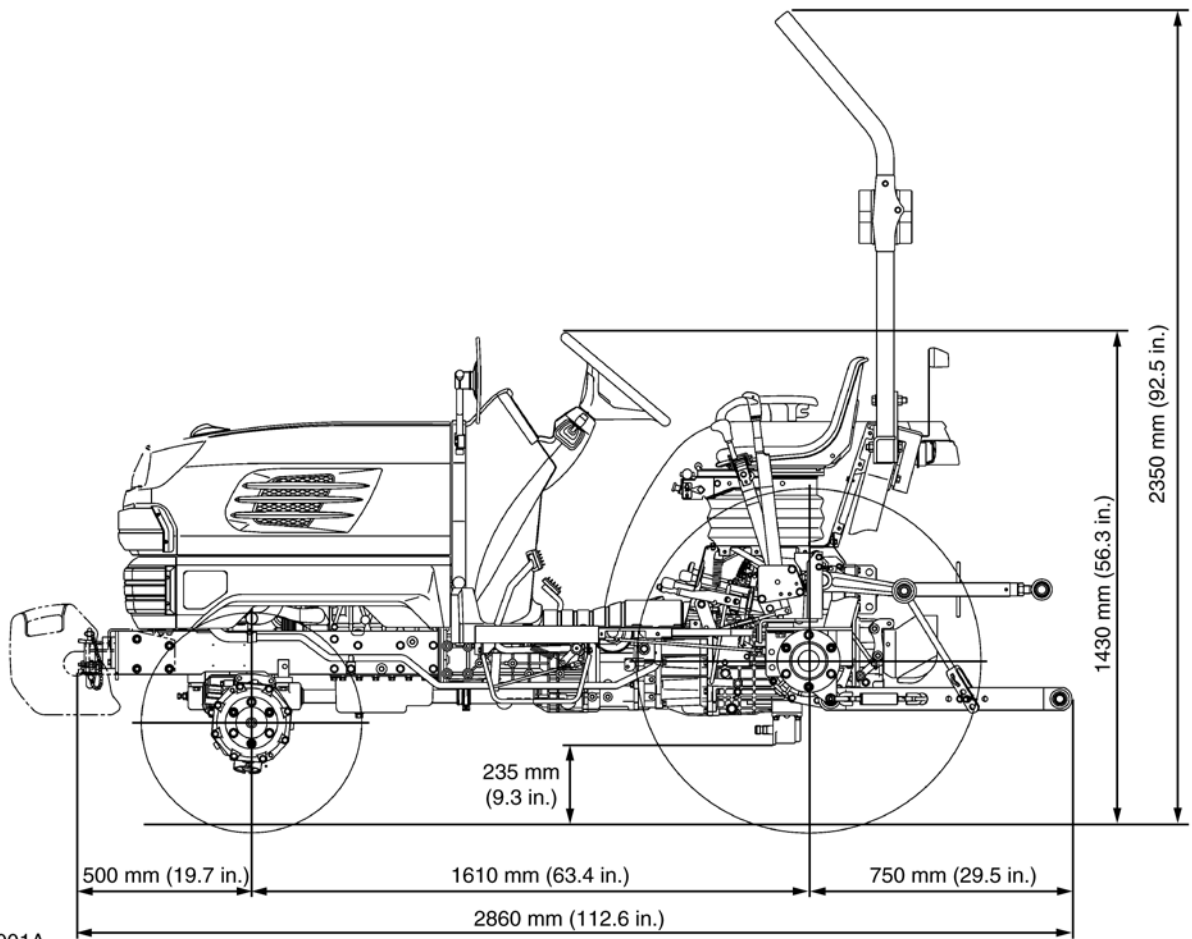
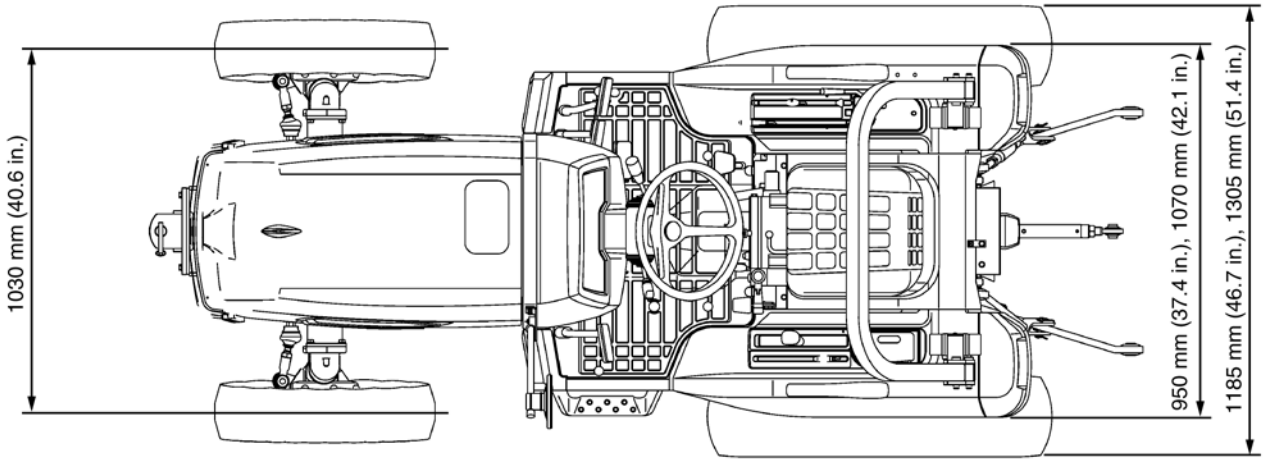
# TRAVELLING SPEEDS

Model		STV32, 36, 40	
Tire Size (Rear)		9.5 - 22	13.6 - 16
Range gear shift lever		km/h	km/h
Forward	1 (Low)	0 to 6.6	0 to 6.5
	2 (Middle)	0 to 12.7	0 to 12.6
	3 (High)	0 to 28.4	0 to 28.2
	Max. Speed (at 2850 engine rpm)	29.9	29.8
Reverse	1 (Low)	0 to 4.8	0 to 4.7
	2 (Middle)	0 to 9.2	0 to 9.2
	3 (High)	0 to 20.6	0 to 20.4
	Max. Speed (at 2850 engine rpm)	21.7	21.6

The company reserves the right to change the specifications without notice

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# DIMENSIONS



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# **G GENERAL**

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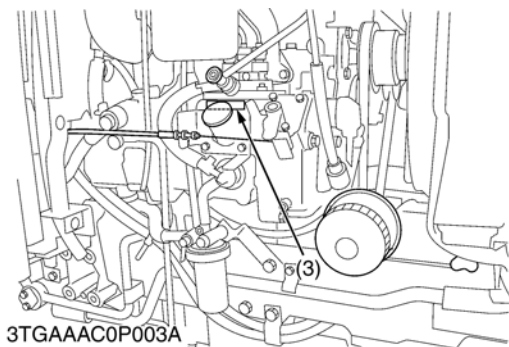
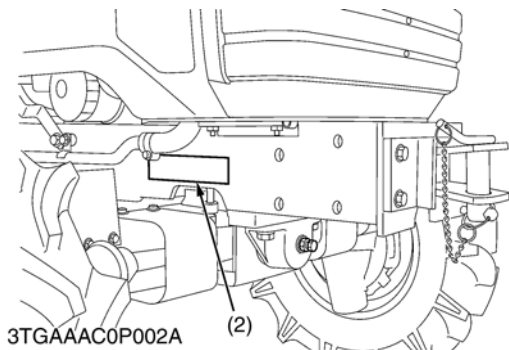
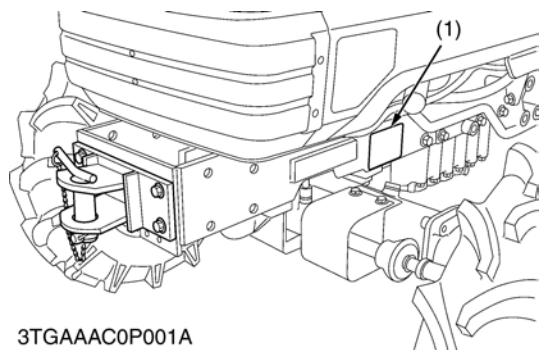
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# 1. TRACTOR IDENTIFICATION

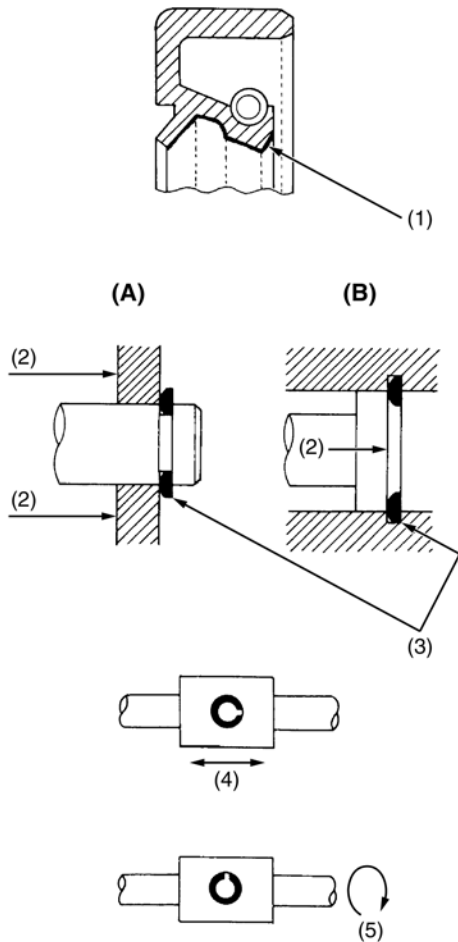
When contacting your local KUBOTA distributor, always specify engine serial number, tractor serial number and hour meter reading.

- (1) Tractor Identification Plate
- (2) Tractor Serial Number
- (3) Engine Serial Number

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## 2. GENERAL PRECAUTION



- 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

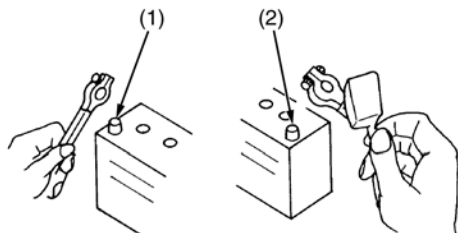
- (A) External Snap Ring
- (B) Internal Snap Ring

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### 3. HANDLING PRECAUTIONS FOR ELECTRICAL PARTS AND WIRING



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

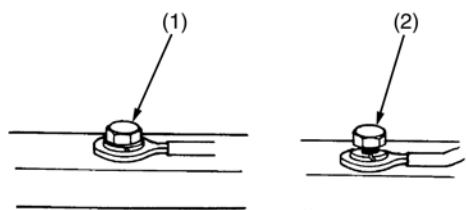
**■ IMPORTANT**

- 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

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#### [1] WIRING

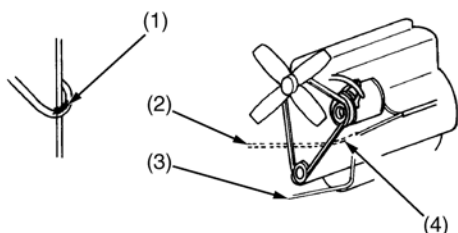


- Securely tighten wiring terminals.

- (1) Correct (Securely Tighten)                      (2) Incorrect (Loosening Leads to Faulty Contact)

000000614E

3TMABAB0P007A

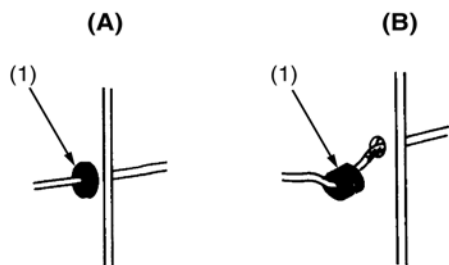


- Do not let wiring contact dangerous part.

- (1) Dangerous Part                      (3) Wiring (Correct)  
 (2) Wiring (Incorrect)                      (4) Dangerous Part

000000615E

3TMABAB0P008A

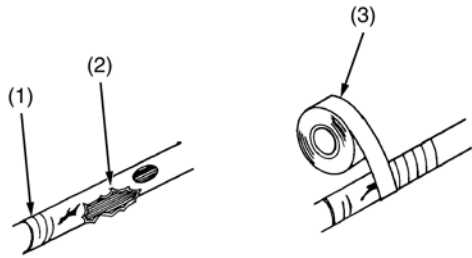


- Securely insert grommet.

- (1) Grommet                      (A) Correct  
 (B) Incorrect

000000616E

3TMABAB0P009A

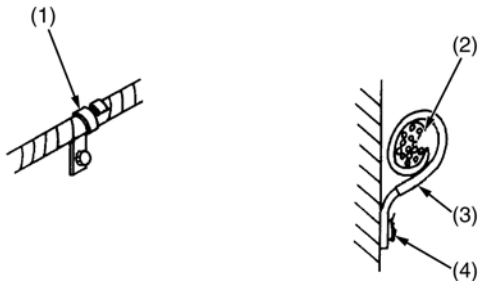


3GFABAB0P003A

● Repair or change torn or aged wiring immediately.

- (1) Aged
- (2) Torn
- (3) Insulating Vinyl Tape

000002256E

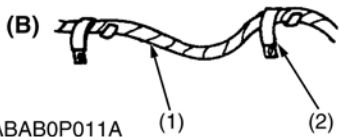
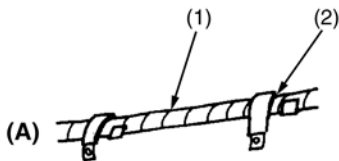


3TMABAB0P010A

● Securely clamp, being careful not to damage wiring.

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

000000617E

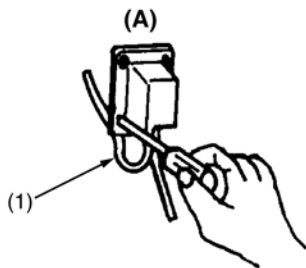


3TMABAB0P011A

● 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

000000618E

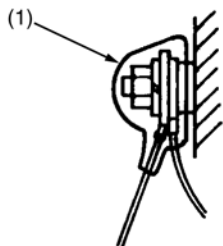


3TMABAB0P012A

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

- (1) Wiring
- (A) Incorrect

000000619E



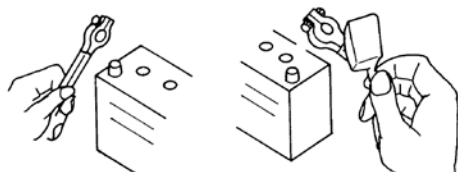
- After installing wiring, check protection of terminals and clamped condition of wiring, only connect battery.

(1) Cover  
 \*Securely Install Cover

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3TMABAB0P013A

## [2] BATTERY



3TMABAB0P006B

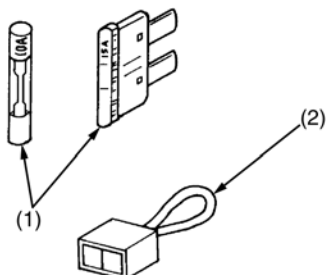
- Take care not to confuse positive and negative terminal posts.
- When removing battery cables, disconnect negative cable first. When installing battery cables, check for polarity and connect positive cable first.
- Do not install any battery with capacity other than is specified (Ah).
- After connecting 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.

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## [3] FUSE



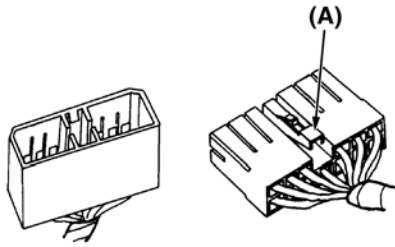
3TMABAB0P014A

- 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) Fusible Link

000000622E

# [4] CONNECTOR

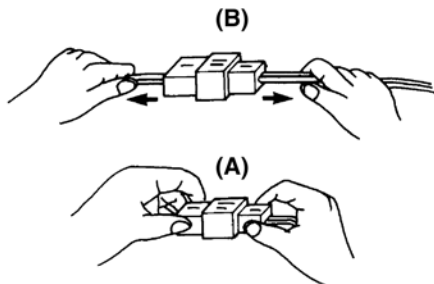


3TMABAB0P015A

- For connector with lock, push lock to separate.

(A) Push

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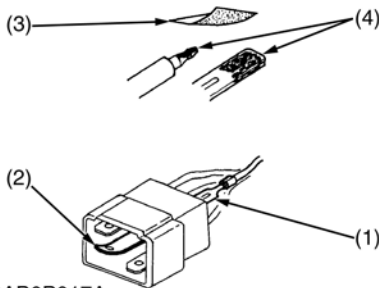
3TMABAB0P016A

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

(A) Correct

(B) Incorrect

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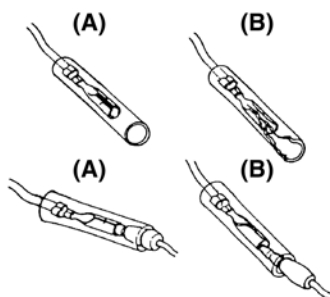
3TMABAB0P017A

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

- (1) Exposed Terminal
- (2) Deformed Terminal

- (3) Sandpaper
- (4) Rust

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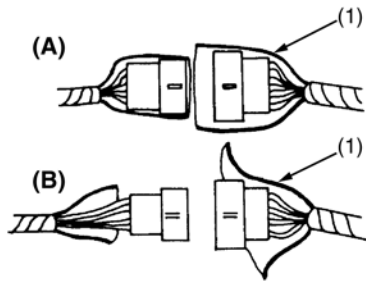
3TMABAB0P018A

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

(A) Correct

(B) Incorrect

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

(1) Cover

(A) Correct

(B) Incorrect

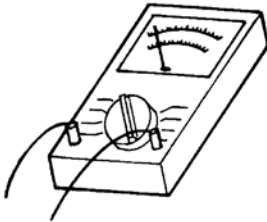
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3TMABAB0P019A

## [5] HANDLING OF CIRCUIT TESTER

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

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3TMABAB0P020A

## 4. LUBRICANTS, FUEL AND COOLANT

	Place	Capacity	Lubricants, fuel and coolant	
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 reserve tank)	6.1 L 6.4 U.S.qts. 5.4 Imp.qts.	Fresh clean water with anti-freeze	
3	Engine crankcase (with filter)	6.7 L 7.1 U.S.qts. 5.9 Imp.qts.	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	22 L 5.81 U.S.qts. 4.84 Imp.qts.	KUBOTA SUPER UDT fluid*	
5	Front differential case oil	4.0 L 4.2 U.S.qts. 3.5 Imp.qts.	KUBOTA SUPER UDT fluid or SAE80, 90 gear oil	
<b>Grease</b>				
	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	Engine oil
	Cruise control lever	2		
	Speed control wire	Oiling		

\*KUBOTA original transmission hydraulic fluid.

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## 5. TIGHTENING TORQUES

### [1] GENERAL USE SCREWS, BOLTS AND NUTS

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

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
<b>M6</b> (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
<b>M8</b> (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
<b>M10</b> (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
<b>M12</b> (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 86.7
<b>M14</b> (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
<b>M16</b> (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
<b>M18</b> (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
<b>M20</b> (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

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### [2] STUD BOLTS

Material of opponent part	Ordinariness			Aluminum		
Unit Diameter	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs
<b>M8</b> (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
<b>M10</b> (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
<b>M12</b> (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

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# 6. MAINTENANCE CHECK LIST

No.	Period		Indication on hour meter													After since	Refer-ence page	
			50	100	150	200	250	300	350	400	450	500	550	600	650			700
1	Greasing	-	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50Hr	G-18, 19
2	Engine start system	Check	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50Hr	G-19
3	Wheel bolt torque	Check	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50Hr	G-20
4	Engine oil	Change	★	☆		☆		☆		☆		☆		☆		☆	every 100Hr	G-13
5	Brake pedal	Adjust		☆		☆		☆		☆		☆		☆		☆	every 100Hr	G-23
6	Fan belt	Adjust		☆		☆		☆		☆		☆		☆		☆	every 100Hr	G-23
7	Clutch pedal	Adjust	★	☆		☆		☆		☆		☆		☆		☆	every 100Hr	G-17
8	Battery condition	Check		☆		☆		☆		☆		☆		☆		☆	every 100Hr	G-25 *4
9	Air cleaner element [Single type]	Clean		☆		☆		☆		☆		☆		☆		☆	every 100Hr	G-21 *1
		Replace																every 1 year
10	Air cleaner element [Double type] (Primary element)	Clean		☆		☆		☆		☆		☆		☆		☆	every 100Hr	G-21 *1
		Replace																every 1 year
	Air cleaner element [Double type] (Scondary element)	Replace																every 1 year
11	Fuel filter element	Clean		☆		☆		☆		☆		☆		☆		☆	every 100Hr	G-22
		Replace								☆								every 400Hr
12	Parking brake	Adjust		☆		☆		☆		☆		☆		☆		☆	every 100Hr	G-24
13	Fuel line	Check		☆		☆		☆		☆		☆		☆		☆	every 100Hr	G-22
		Replace																every 2 years
14	Engine oil filter	Replace	★			☆				☆				☆			every 200Hr	G-14
15	Hydraulic oil filter	Replace	★			☆				☆				☆			every 200Hr	G-16
16	Hydraulicoil filter [HST]	Replace	★			☆				☆				☆			every 200Hr	G-16
17	Toe-in	Adjust				☆				☆				☆			every 200Hr	G-29



No.	Item	Period	Indication on hour meter													After since	Reference page		
			50	100	150	200	250	300	350	400	450	500	550	600	650				700
18	Radiator hose and clamp	Check				☆				☆				☆			every 200Hr	G-27	
		Replace															every 2 years	G-27	*3
19	Power steering hose	Check				☆				☆				☆			every 200Hr	G-28	
		Replace															every 2 years	G-28	
20	HST oil line [HST]	Check				☆				☆				☆			every 200Hr	G-28	
		Replace															every 2 years	G-28	*3
21	Transmission fluid	Change	★							☆						every 400Hr	G-15		
22	Front axle case oil	Change	★							☆						every 400Hr	G-16		
23	Front axle pivot	Adjust												☆		every 600Hr	G-30		
24	Engine valve clearance	Adjust														every 800Hr	1-S13		
25	Cooling system	Flush														every 2 years	G-31		
26	Coolant	Change														every 2 years	G-31		
27	Fuel system	Bleed														Service as required	G-33		
28	Clutch housing water	Drain															G-33		
29	Fuse	Replace															G-34		
30	Light bulb	Replace															G-35		

**■ IMPORTANT**

- The jobs indicated by ★ must be done after the first 50 hours of operation.
- \*1 : Air cleaner should be cleaned more often in dusty conditions than in normal conditions.
- \*2 : Every year or every 6 times of cleaning.
- \*3 : Replace only if necessary.
- \*4 : When the battery is used for less than 100 hours per year, check the battery condition by reading the indication annually.

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## 7. 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.

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### [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 leak.
  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 the 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.

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## [2] CHECK POINTS OF INITIAL 50 HOURS

### Changing Engine Oil

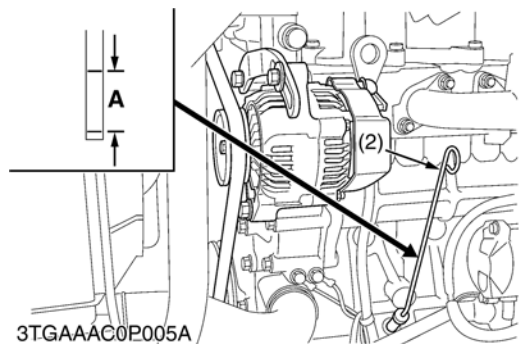
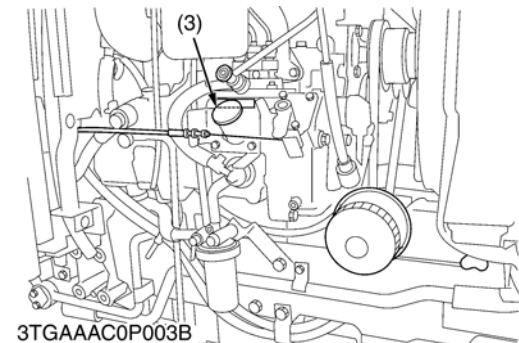
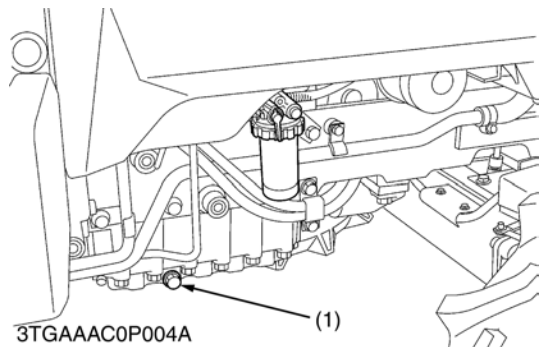
#### CAUTION

- **Before changing oil, be sure to stop the engine.**
- 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 drain plug (1) at the bottom of the engine and drain the oil completely.
- 4. Screw in the 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.)**

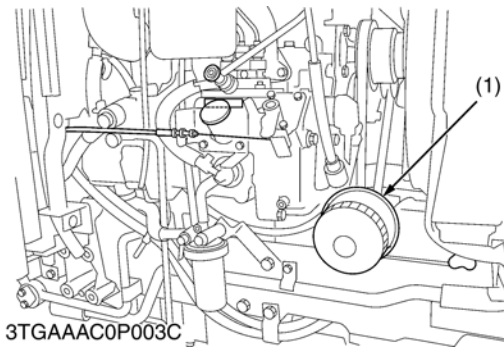
Engine oil	Capacity	6.7 L 7.1 U.S.qts 5.9 Imp.qts



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

**(A) Oil level is acceptable within this range.**

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### 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.**

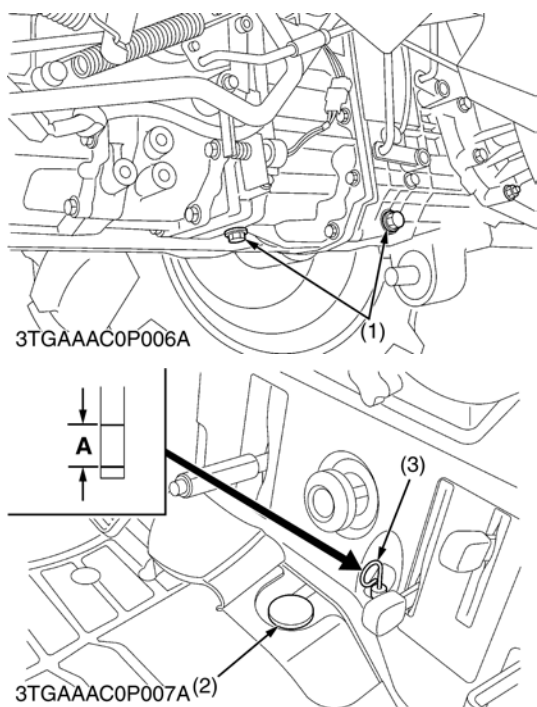
1. Remove the oil filter cartridge with the filter wrench.
2. Apply a slight coat of oil onto the rubber seal of new filter.
3. To install the new cartridge, screw it in by hand. Over tightening may cause deformation of rubber gasket.
4. After the new cartridge has been replaced, the engine oil normally 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 filter must be highly efficient. Use only a KUBOTA genuine filter or its equivalent.**

(1) Engine Oil Filter

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Changing Transmission Fluid

**⚠ CAUTION**

- **Be sure to stop the engine when 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 to the prescribed level.

**■ IMPORTANT**

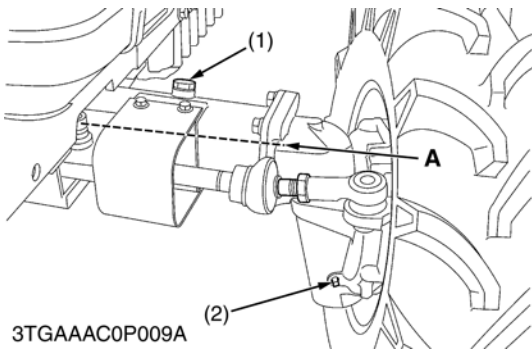
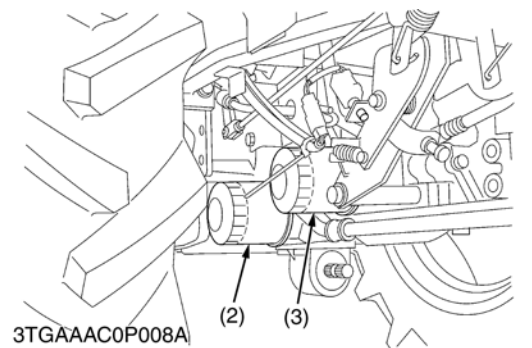
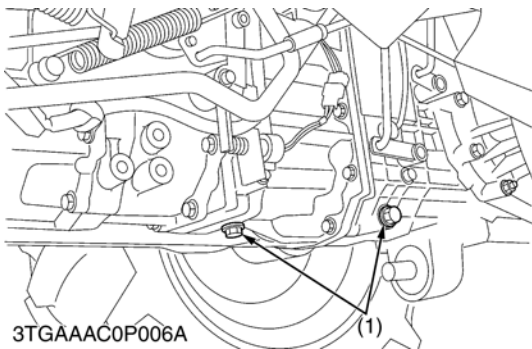
- **Use only multi-grade transmission oil. Use of other oils may damage the transmission or hydraulic system. Refer to "LUBRICANTS, FUEL AND COOLANT" (See page G-8.).**
- **Never work the tractor immediately after changing the transmission oil. Keeping the engine at medium speed for a few minutes to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

Transmission fluid	Capacity	22 L 5.81 U.S.gals 4.84 Imp.gals
--------------------	----------	--

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

**A : Oil level is acceptable within this range.**

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Replacing Hydraulic Oil Filter 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 (3) Hydraulic Oil Filter (for HST)  
 (2) Hydraulic Oil Filter

000007970E

Changing 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 (2) 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.

**■ IMPORTANT**

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

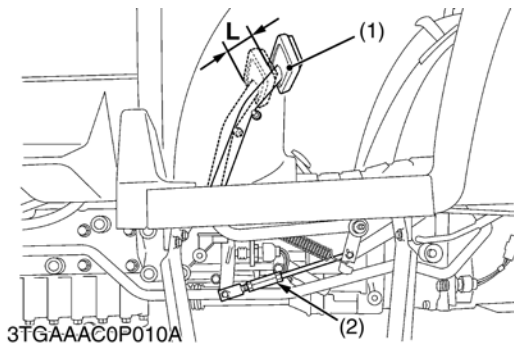
**■ NOTE**

- Oil level is at the center of the front axle.

Front axle case oil	Capacity	4.0 L 1.06 U.S.gals. 0.88 Imp.gals.
---------------------	----------	---

- (1) Filling Plug (2) Drain Plug A : Oil Level

000007971E



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 "L"	Factory spec.	20 to 30 mm 0.78 to 1.18 in.
---------------------------------	---------------	---------------------------------

- (1) Clutch Pedal
- (2) Clutch Rod

**L : Free Travel**

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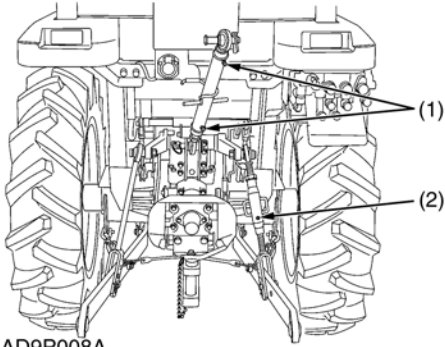
### [3] CHECK POINTS OF EVERY 50 HOURS

Greasing (To be continued)

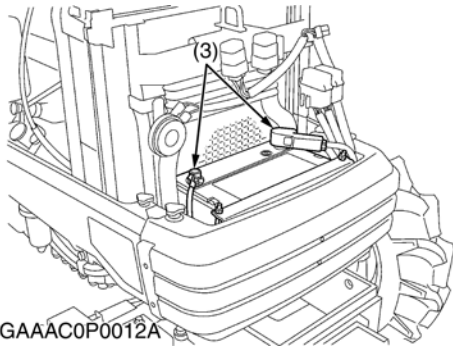
1. Apply a grease to the following position as figures.

- |                                     |   |
|-------------------------------------|---|
| (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                |   |

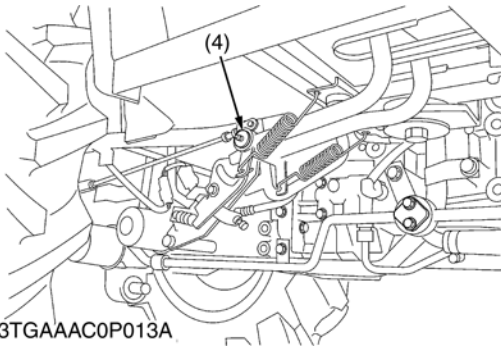
000007973E



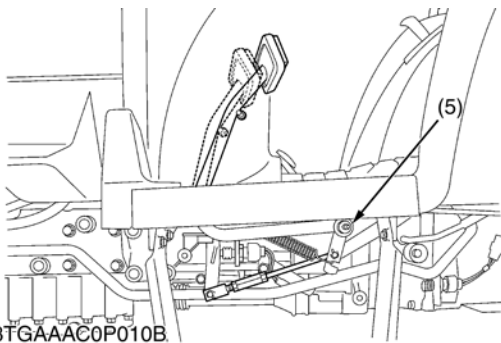
3TAAAD9P008A



3TGAAAC0P0012A

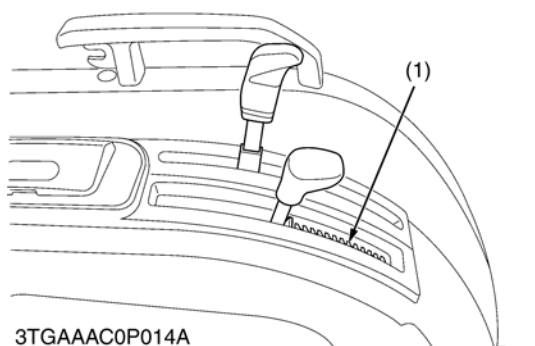


3TGAAAC0P013A



3TGAAAC0P010B



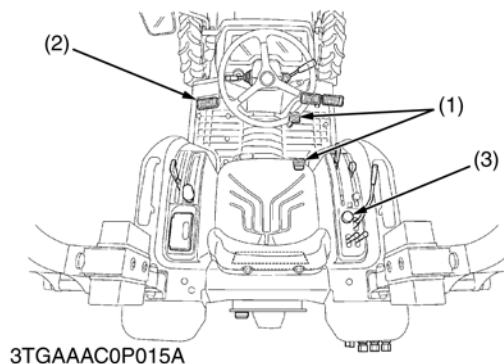


### Greasing (Continued)

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

- (1) Cruise Control Lever Guide

000007974E



### 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. Place all control levers in the "NEUTRAL" position.
2. Set the parking brake and stop the engine.

#### ■ Test : Switch for the speed control pedal

1. Sit on the operator's seat.
2. Depress the speed control pedal to the desired direction.
3. Depress the clutch pedal Fully.
4. Disengage the PTO clutch control switch.
5. Turn the key to "START" position.
6. The engine must not crank.

#### ■ Test : Switch for the PTO clutch control switch

1. Sit on the operator's seat.
2. Engage the PTO clutch control switch.
3. Depress the clutch pedal Fully.
4. Place the speed control pedal in neutral position.
5. Turn the key to "START" position.
6. The engine must not crank.

#### ■ Test : Switch for the clutch pedal

1. Sit on the operator's seat.
2. Disengage the PTO clutch control switch.
3. Place the speed control pedal in neutral position.
4. Release the clutch pedal.
5. Turn the key to "START" position.
6. The engine must not crank.

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

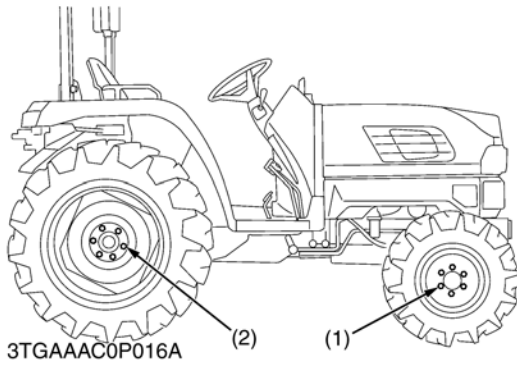
(1) Speed Control Pedal

(3) PTO Clutch Control Switch

(2) Clutch Pedal

000007975E

Checking Wheel Mounting Screws and Nuts Tightening Torque



**⚠ CAUTION**

- Never operate tractor with a loose rim, wheel or axle.
  - Any time screws and nuts are loosened, retighten to specified torque.
  - Check all screws and nuts frequently and keep them tight.
1. Check the wheel mounting screws and nuts regularly especially when new. If there are loosened, tighten as follows.

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 Mounting Screw and Nut

(2) Rear Wheel Mounting Screw and Nut

000007976E

**[4] CHECK POINTS OF EVERY 100 HOURS**

Changing Engine Oil

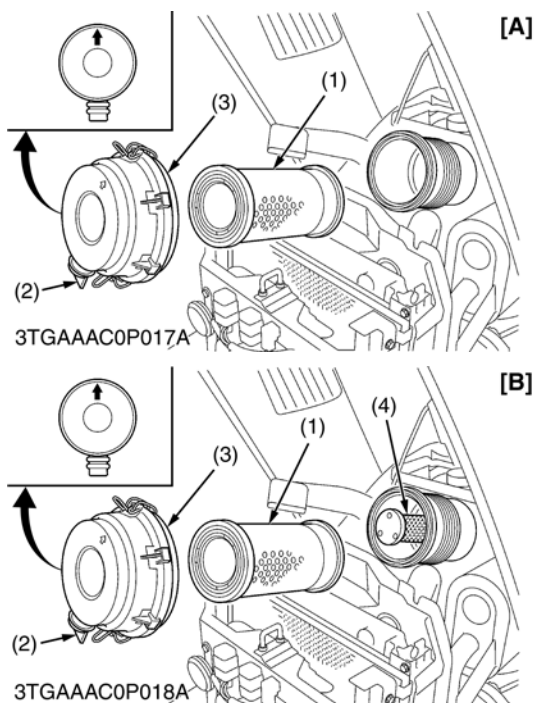
1. See page G-13.

000007977E

Checking Clutch Pedal Free Travel

1. See page G-17.

000007978E



### 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) :
  - When dry dust adheres to the element, blow compressed air from the inside, turning the element. Pressure of compressed air must be under 205 kPa (2.1 kgf/cm<sup>2</sup>, 30 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 Valves

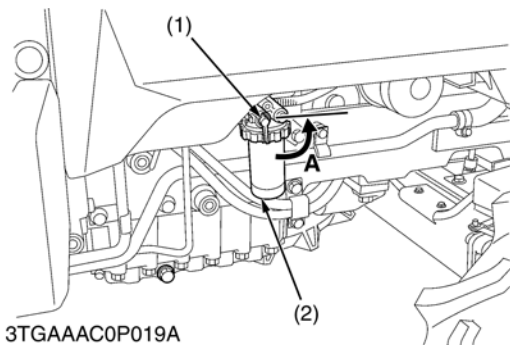
Open the evacuator valve (2) once a week under ordinary conditions or daily when used in a dusty place to get rid of large particles of dust and dirt.

- (1) Element (Primary)
- (2) Evacuator Valve
- (3) Cover
- (4) Secondary Element (Safety)

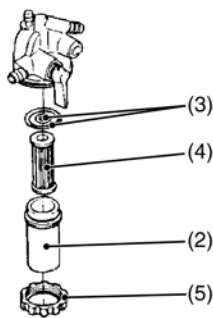
[A] Single Element Type

[B] Double Element Type

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3TGAAAB0P022A

Cleaning Fuel Filter

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

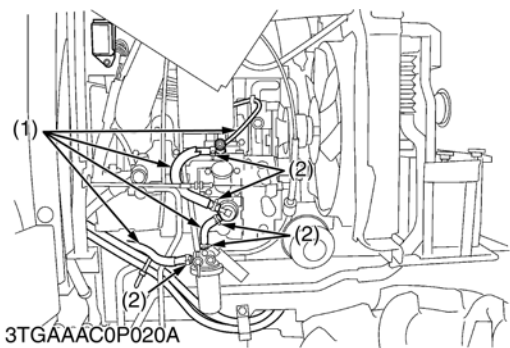
1. Close the fuel filter cock (1).
2. Unscrew the screw ring and remove the fuel filter bowl (2), and rinse the inside with kerosene.
3. Take out the filter element (4) and dip it in the kerosene to rinse.
4. After cleaning, reassemble the fuel filter, keeping out dust and dirt.
5. Bleed the fuel system. (See page G-33.)

■ **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           |                    |
| (4) O-ring           | <b>A : Close</b>   |

000007980E



3TGAAAC0P020A

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.**

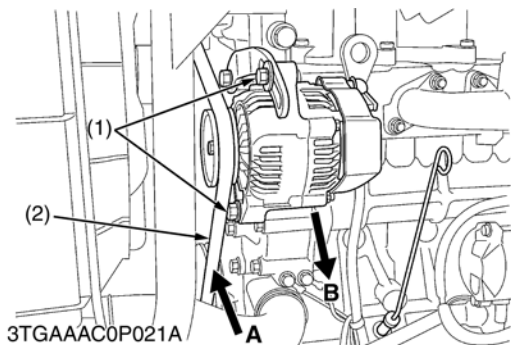
1. Check to see that all line and hose clamps are tight and not damaged.
2. If hoses and clamps are found worn or damaged, replace or repair them at once.
3. The fuel line is made of rubber and ages regardless of period of service. Replace the fuel pipe together with the clamp every two years and securely 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-33.)

■ **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 |
|---------------|-----------|

000007981E



3TGAAAC0P021A

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 0.35 in.) when the belt is pressed in the middle of the span.
------------------	---------------	--

(1) Adjusting Screw

(2) Fan Belt

**A : Check the belt tension**

**B : To tighten**

000007982E

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.	20 to 30 mm 0.79 to 1.18 in.
-----------------------------	---------------	---------------------------------

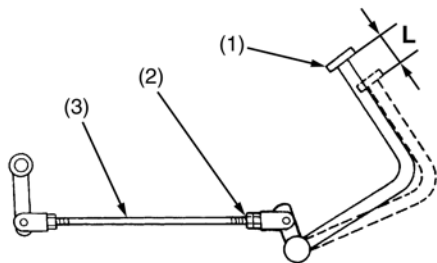
(1) Brake Pedal

(2) Lock Nut

(3) Brake Rod

**L : Free Travel**

000007983E



3TGAAAB0P024A

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)
---------------------------------	--------------------------------

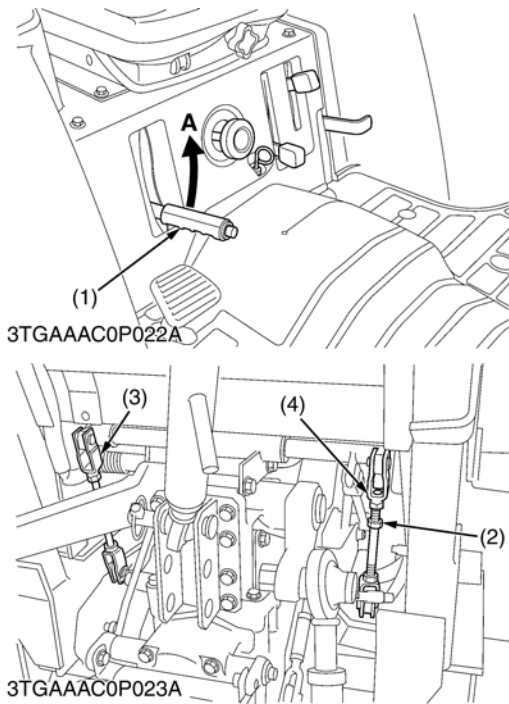
**■ IMPORTANT**

● **Check the brake pedal free travel after adjusting the parking brake.**

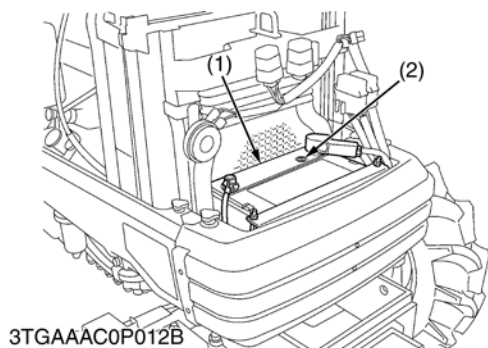
**■ NOTE**

● **Refer to "BRAKE" section for detailed method.**

- |                         |                  |
|-------------------------|------------------|
| (1) Parking Brake Lever | (4) Brake Rod RH |
| (2) Lock Nut            |                  |
| (3) Brake Rod LH        | <b>A : Pull</b>  |



000007984E



Checking Battery Condition

**⚠ DANGER**

- 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 splattered with it, wash it away completely with water immediately and get medical attention.
- Wear eye protection and rubber gloves when working around battery.

**■ NOTE**

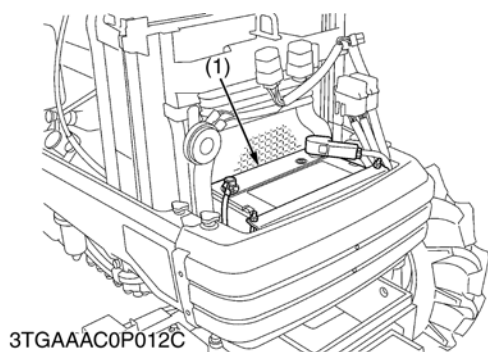
- The factory-installed battery is of non-refillable type. If the indicator turns white, do not charge the battery but replace it with new one.
1. Mishandling the battery shortens the service life and adds to maintenance costs.
  2. The original battery is maintenance free type battery, but need some servicing.  
If the battery is weak, the engine is difficult to start and the lights be dim. It is important to check the battery periodically.
  3. 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

000007986E



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, ensure the vent caps are securely in place (if equipped).
- 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. A boost charge is only for emergencies. It will partially charge the battery at a high rate and in a short time.  
When using a boost-charged battery, it is necessary to recharge the battery as early as possible.  
Failure to do this will shorten the battery's service life.
3. The battery is charged if the indicator display turns green from black.
4. When exchanging an old battery into new one, use battery of equal specification shown in table 1.

**Table 1**

Tractor model	Battery TYPE	volts	5HR. capacity (A.H.)
STV32 - 40	75D26R	12	52

Tractor model	Reserve Capacity (min)	Cold Cranking Amps	Normal Charging Rate (A)
STV32 - 40	123	490	6.5

**■ 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) Battery

000007987E



## [5] CHECK POINTS OF EVERY 200 HOURS

### Replacing Engine Oil Filter Cartridge

1. See page G-14.

000007988E

### Replacing Hydraulic Oil Filter Cartridge

1. See page G-16.

000007989E

### 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 (2) are loose or water leaks, tighten hose clamps (2) securely.
2. Replace hoses (1) and tighten hose clamps (2) securely, if radiator hoses (1) 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**

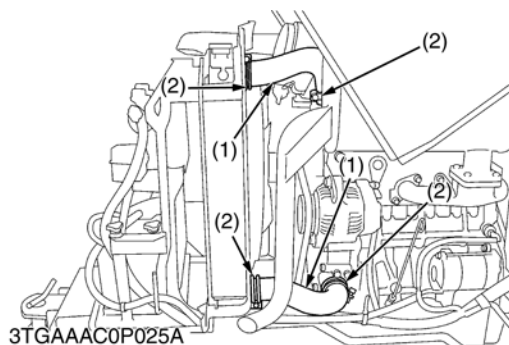
Take the following actions in the event the coolant temperature be nearly or more than the boiling point, what is called "**Overheating**".

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

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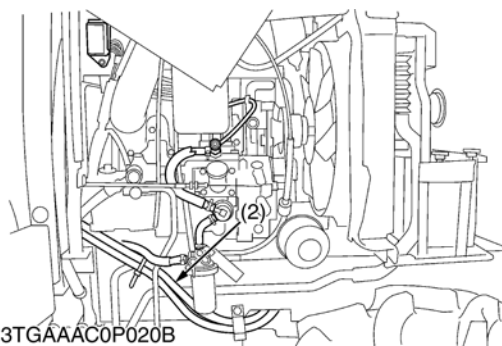
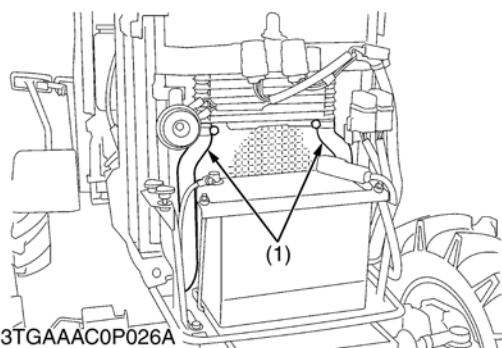
Checking HST Oil Line and Power Steering Hose

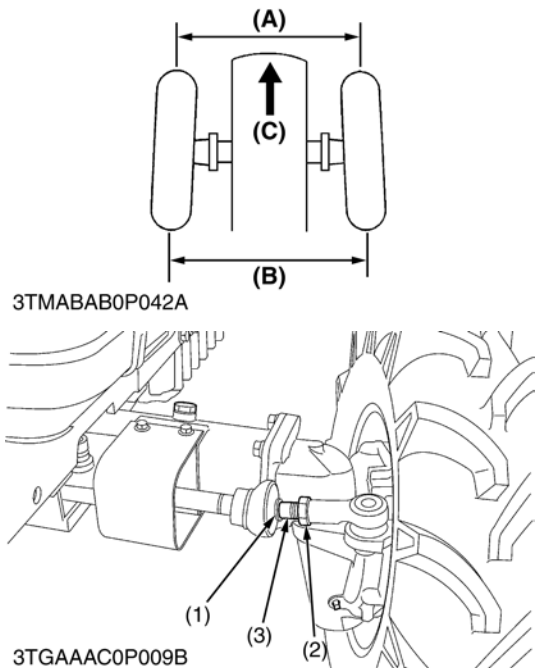
1. Check to see that all lines (1), (2) and hose clamps are tight and not damaged.
2. If hoses and clamps are found worn or damaged, replace or repair them at once.

(1) HST Oil Line

(2) Power Steering Hose

000007990E





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.
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.

Tightening torque	Tie-rod lock nut	117 to 137 N·m 12.0 to 14.0 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          | (A) Wheel to Wheel Distance at Front |
| (2) Tie-rod Lock Nut   | (B) Wheel to Wheel Distance at Rear  |
| (3) Tie-rod Lock Joint | (C) Front                            |

0000007991E

**[6] CHECK POINTS OF EVERY 400 HOURS**

Changing Transmission Fluid

1. See page G-15.

0000007992E

Replacing Fuel Filter Element

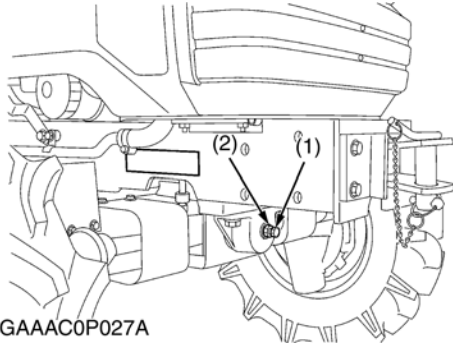
1. See page G-22.

0000007993E

Changing Front Axle Case Oil

1. See page G-16.

0000007994E

**[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.

Refer to "FRONT AXLE" section for details.

(1) Adjusting Screw

(2) Lock Nut

000007995E

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

1. See page 1-S13.

000007996E

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

1. See page G-21.

000007997E

**[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-27.)

000007998E

Replacing Fuel Hose

1. Replace the fuel hoses and clamps, if necessary.  
Refer to "Checking Fuel Line" (See page G-22.)

000007999E

Replacing Power Steering Hose

1. Replace the hoses and clamps.  
Refer to "Checking HST Oil Line and Power Steering Hose" (See page G-28.)

000008000E

Replacing HST Oil Line

1. Replace the hoses and clamps.  
Refer to "Checking HST Oil Line and Power Steering Hose" (See page G-28.)

000008001E



Flush Cooling System and Changing Coolant (Continued)**■ Anti-Freeze**

If it freezes, cooling water can damage the cylinders and radiator. If is necessary, if the ambient temperature falls below 0 °C (32 °F) to remove coolant water 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 is should be referred to SAE J1034 standard, more specifically also to SAE J19814c.
4. Mix the anti-freeze with water, and then fill in to the radiator.

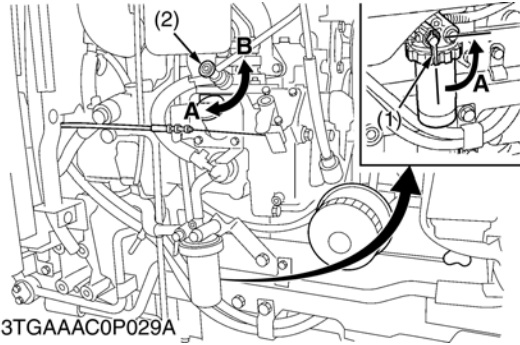
Vol % Anti-freeze	Freezing Point		Boiling Point*	
	°C	°F	°C	°F
40	-24	-12	106	222
50	-37	-34	108	226

\* 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.)**

000004769E

**[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.

**⚠ CAUTION**

- **Do not bleed the fuel system when the engine is hot.**

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 (1) except for bleeding fuel lines. Otherwise, engine runs irregularly or stalls frequently.**

- (1) Fuel Cock  
(2) Air Vent Cock

- (A) CLOSE  
(B) OPEN

000008003E

Draining Clutch Housing Water

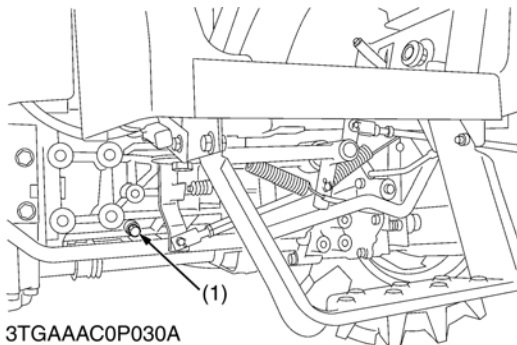
**■ NOTE**

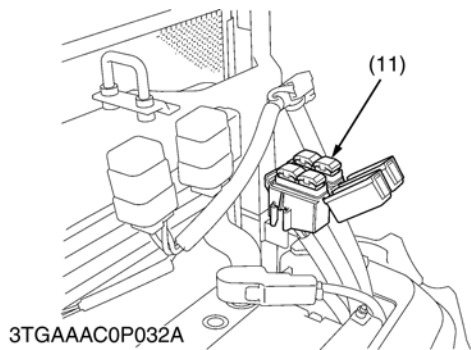
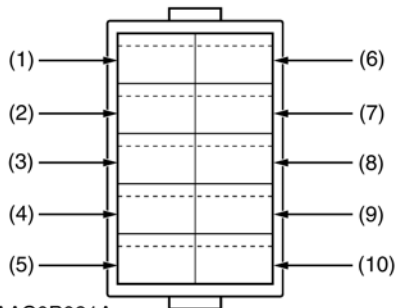
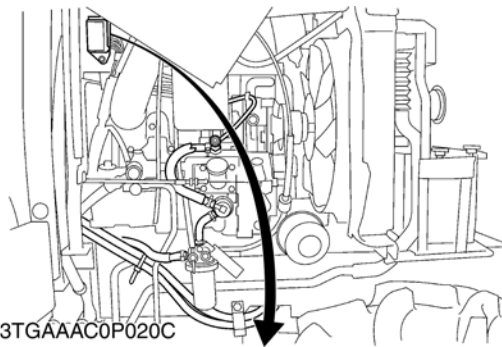
- **The tractor is equipped with drain plug (1) under the clutch housing.**
- **After operating in rain, snow or tractor has been washed, water may get into the clutch housing.**

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

- (1) Water Drain Plug

000008004E





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.**

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

■ **Protected circuit**

FUSE No.	CAPACITY (A)	Protected circuit
(1)	30	Starter
(2)	15	Hazard
(3)	10	Position
(4)	10	Alternator panel
(5)	15	Head light / Horn
(6)	10	Control box / PTO solenoid
(7)	5	Key stop
(8)	10	Work light
(9)	10	Brake
(10)	10	Flasher
(11)	Slow blow fuse	
	50	Main
	40	Key switch
	40	Key stop
	40	Glow

000008005E



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

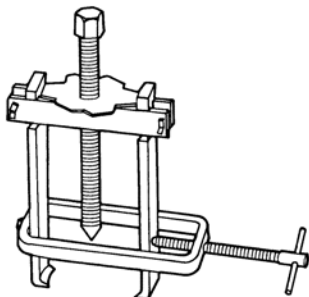
Detach the lens and replace the bulb.

Light	Capacity
Head lights	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
Work light (if equipped)	-
Number plate light	10 W

000008006E

# 8. SPECIAL TOOLS

## [1] SPECIAL TOOLS FOR ENGINE



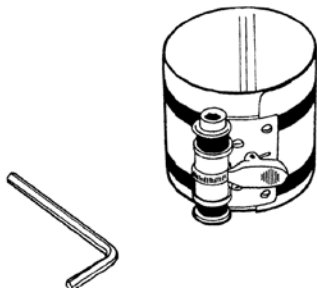
3TMABAB0P049A

### Special Use Puller Set

Code No : 07916-09032

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

000000677E



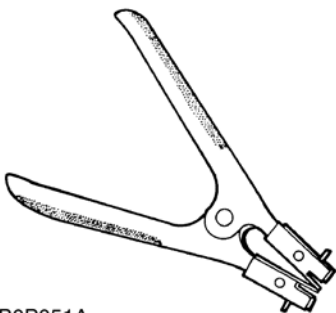
3TMABAB0P050A

### Piston Ring Compressor

Code No : 07909-32111

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

000000678E



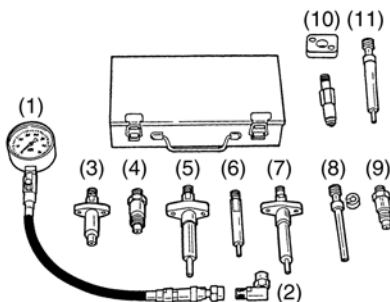
3TMABAB0P051A

### Piston Ring Tool

Code No : 07909-32121

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

000000679E



3TMABAB0P052A

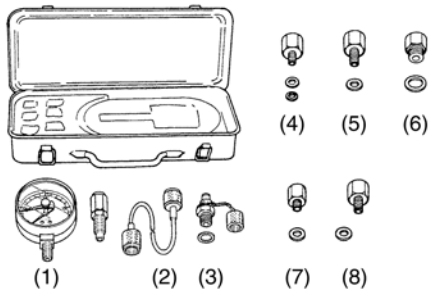
### Diesel Engine Compression Tester

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 <b>F</b>  |
| (2) L Joint          | (8) Adaptor <b>G</b>  |
| (3) Adaptor <b>A</b> | (9) Adaptor <b>H</b>  |
| (4) Adaptor <b>B</b> | (10) Adaptor <b>I</b> |
| (5) Adaptor <b>C</b> | (11) Adaptor <b>J</b> |
| (6) Adaptor <b>E</b> |                       |

000000680E



3TMABAB0P053A

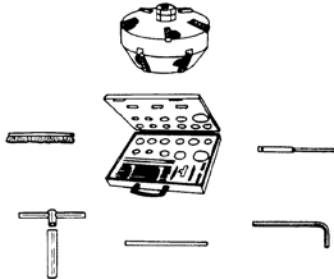
Oil Pressure Tester

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 |

000000681E



3TMABAB0P054A

Valve Seat Cutter

Code No : 07909-33102

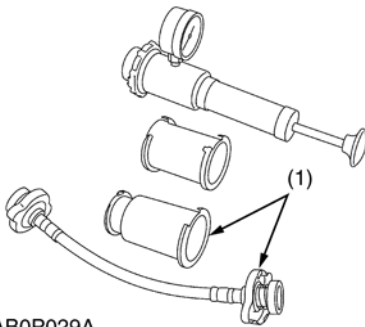
Application : Use to reseal valves.

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.)

000000682E



3TAAAB0P029A

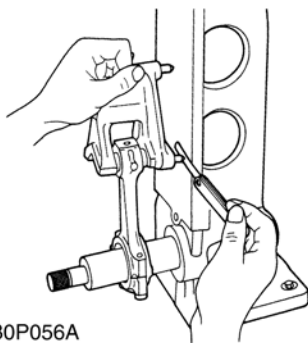
Radiator Tester

Code No : 07909-31551

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

Remarks : Adaptor (1) BANZAI Code No. RCT-2A-30S.

000000815E



3TMABAB0P056A

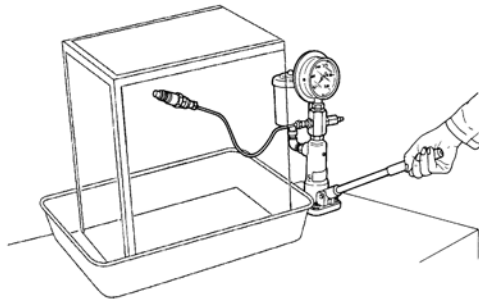
Connecting Rod Alignment Tool

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.)

000000684E



3TLABAB1P041A

Nozzle Tester

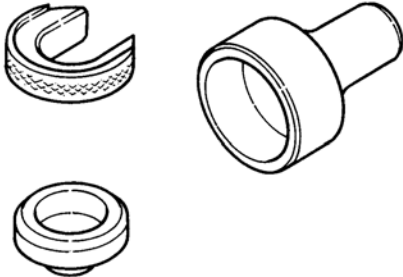
Code No : 07909-31361

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

Measuring : 0 to 50 MPa

range (0 to 500 kgf/cm<sup>2</sup>, 0 to 7000 psi)

000000685E



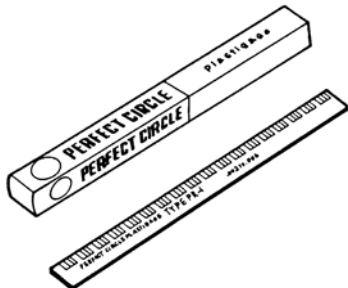
3TMABAB0P062A

Auxiliary Socket for Fixing Crankshaft Sleeve

Code No : 07916-32091

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

0000005168E



3TMABAB0P058A

Plastigage

Code No : 07909-30241

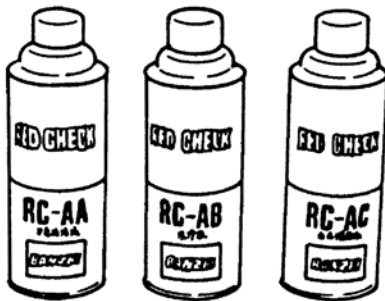
Application : Use to check the oil clearance between crankshaft and bearing, etc..

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.)

000000686E



3TMABAB0P059A

Red Check

Code No : 07909-31371

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

000000687E

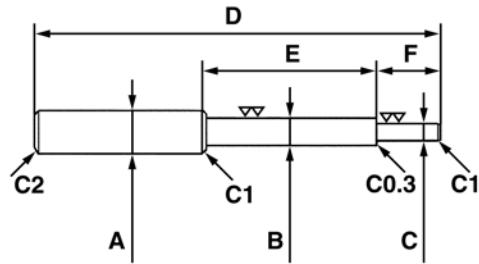
■ NOTE

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

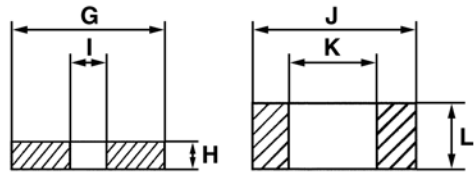
000002319E

Valve Guide Replacing Tool

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



3TMABAB0P063A



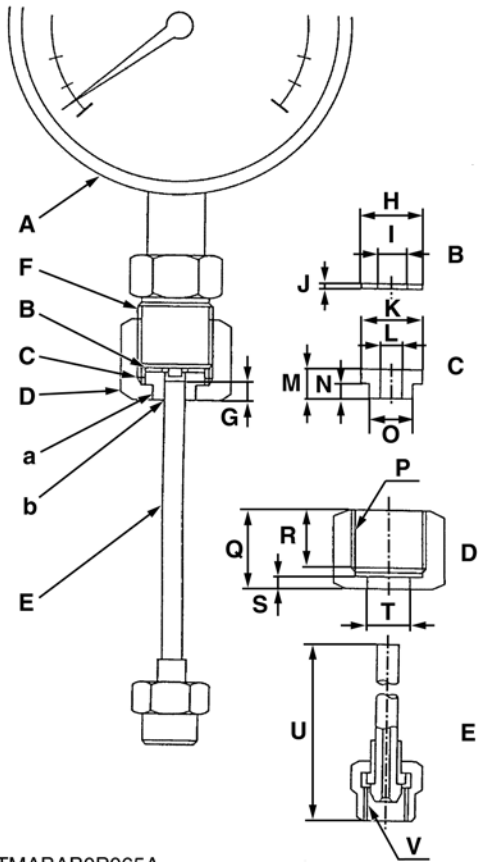
3TMABAB0P064A

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 0.358 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.)

000005170E

**Injection Pump Pressure Tester**

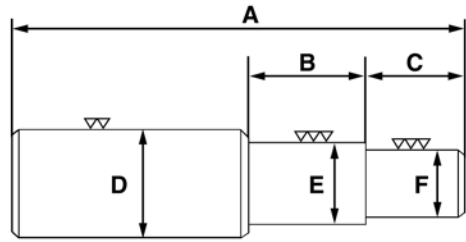
Application : Use to check fuel tightness of injection pumps.



3TMABAB0P065A

A	Pressure gauge full scale : More than 29.4 MPa (300 kgf/cm <sup>2</sup> , 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 to11.99 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

000005171E



3TMABAB0P066A

**Bushing Replacing Tools**

Application : Use to press out and 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.)

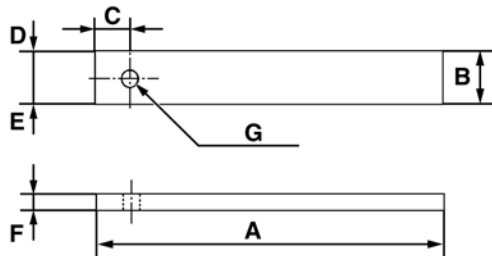
2. For idle gear bushing

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.)

000005172E

**Flywheel Stopper**

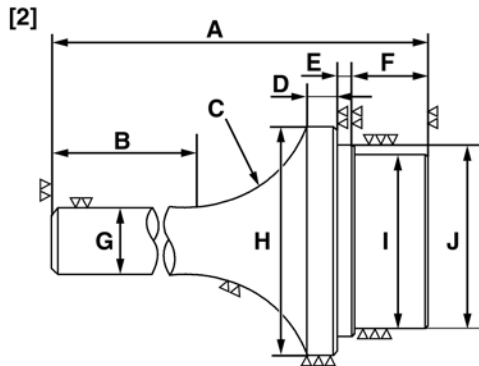
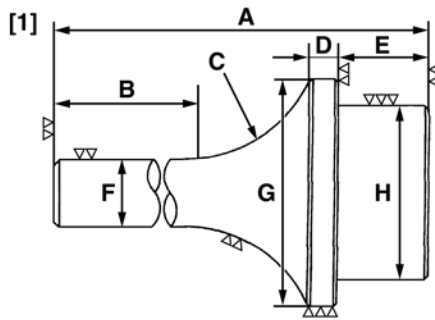
Application : Use to loosen and tighten the flywheel screw.



3TMABAB0P067A

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.)

000005174E



3TMABAB0P068A

**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.)

000005177E

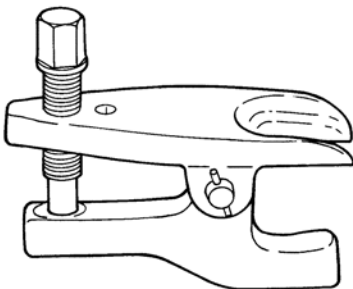
**[2] SPECIAL TOOLS FOR TRACTOR**

**Tie-rod End Lifter**

Code No : 07909-39051

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

000005181E



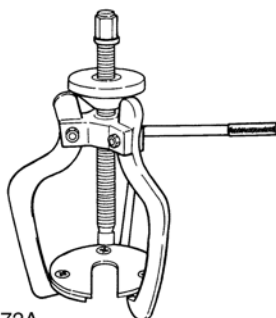
3TMABAB0P071A

**Steering Wheel Puller**

Code No : 07916-51090

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

000005182E



3TMABAB0P072A

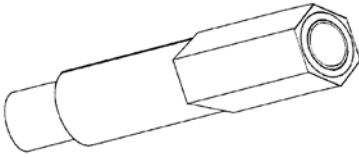


Long Connector (HST Measurement Kit for B7100HST)

Code No : 07916-60831

Application : Use for checking HST Charge relief pressure.

0000007960E

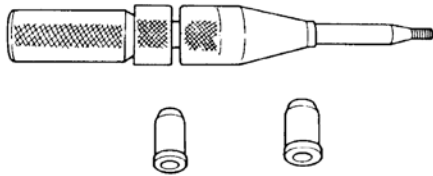


3TGAAAB0P029A

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.).

0000005184E



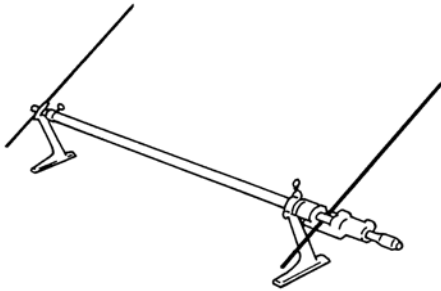
3TMABAB0P074A

Toe-in Gauge

Code No : 07909-31681

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

0000005185E



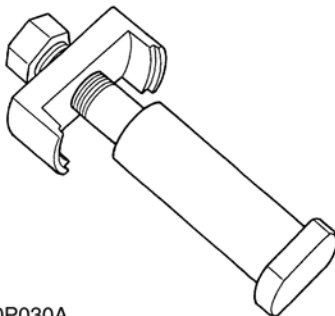
3TMABAB0P075A

Clutch Pack Disassembly Tool

Code No : 07916-53741

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

0000007961E

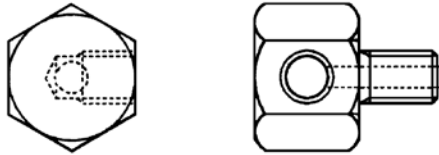


3TGAAAB0P030A

Adaptor 7

Code No : 07916-32951

Application : Use for checking regulating valve setting pressure.



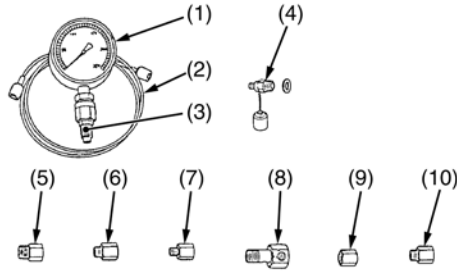
000008040E

3TGAAAB0P031A

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 x P1.5) (07916-50361) | (10) Adaptor 58 (PT1/4) (07916-52391) |

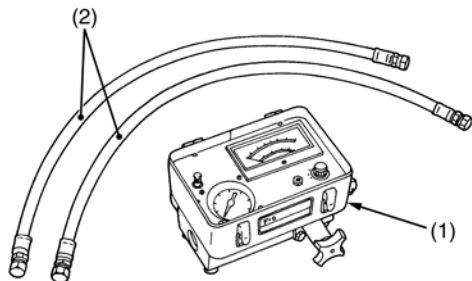
3TMABAB0P077A

000000705E

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 |
|----------------|-------------------------|

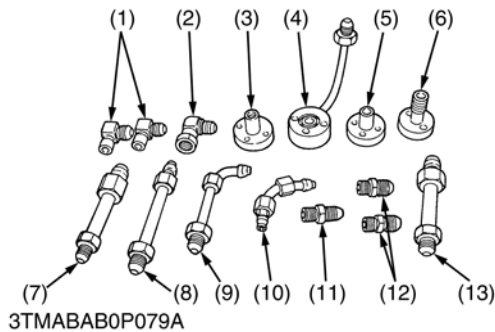
000005188E

3TMABAB0P078A

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 |                          |

3TMABAB0P079A

000005189E

■ NOTE

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

000002319E

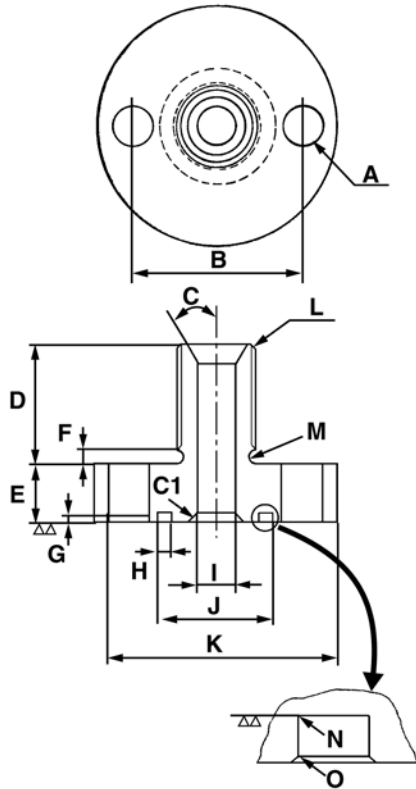
Adaptor for Flow Meter

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

■ NOTE

- When using, attach with following parts.

O-ring : 04811-00180



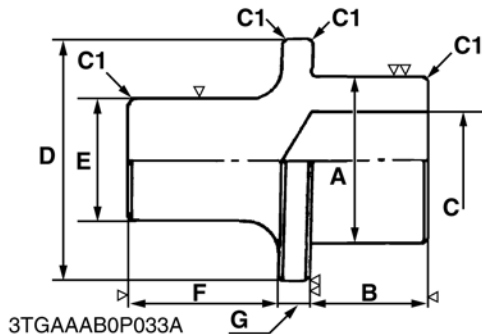
3TGAAAB0P032A

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	Chamfer 0.2 mm (0.0078 in.)

000007962E

Hydraulic Arm Shaft Bushing Replacing Tool

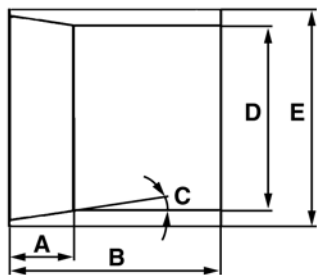
Application : Use for replacing the hydraulic arm shaft bushing in the hydraulic cylinder block.



3TGAAAB0P033A

	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. (1.75 in. dia.)	
E	30 mm dia. (1.18 in. dia.)	
F	50 mm (1.97 in.)	
G	10 mm (0.39 in.)	

000007963E



3TGAAAB0P034A

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.)

000007964E

## 9. 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.

	Tire sizes	Inflation pressure
Front	6.00 - 12, 4PR	180 kPa 1.8 kgf/cm <sup>2</sup> 25.6 psi
	24 x 8.50 - 14, 4PR	160 kPa 1.6 kgf/cm <sup>2</sup> 22.8 psi
Rear	9.5 - 22, 4PR	140 kPa 1.4 kgf/cm <sup>2</sup> 19.9 psi
	13.6 - 16, 4PR	100 kPa 1.0 kgf/cm <sup>2</sup> 14.2 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.

000008007E

## [2] TREAD



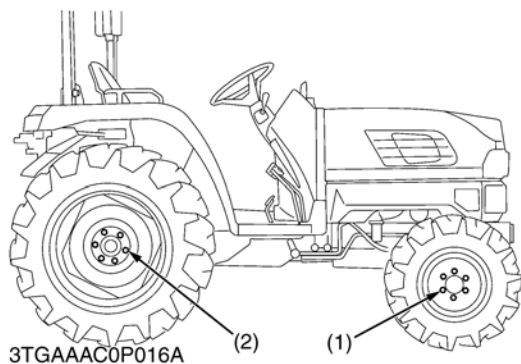
### CAUTION

- 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.
- If not attached as the figure, transmission parts may be damaged.
- Do not use tires larger than specified.

000008008E



### 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

000008009E

### (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	6.00 - 12 Farm	24 x 8.50 - 14 Turf
Tread	<p>3TGAAAB0P035A</p>	<p>3TGAAAB0P036A</p>

(1) 1030 mm (40.55 in.)

(2) 1030 mm (40.55 in.)

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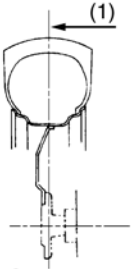
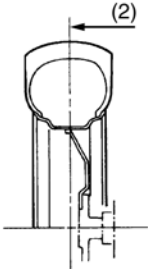
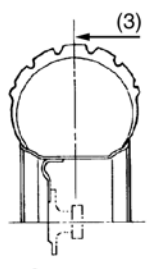
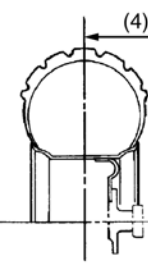
## (2) Rear Wheels

**■ IMPORTANT**

- 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		13.6 - 16 Turf	
Tread	 <p style="text-align: center;">(1)</p> <p style="text-align: center;">3TGAAAB0P037A</p>	 <p style="text-align: center;">(2)</p>	 <p style="text-align: center;">(3)</p> <p style="text-align: center;">3TGAAAB0P039B</p>	 <p style="text-align: center;">(4)</p>

(1) 950 mm (37.40 in.)

(2) 1070 mm (42.13 in.)

(3) 965 mm (37.99 in.)

(4) 1055 mm (41.5 in.)

000008011E

### [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.

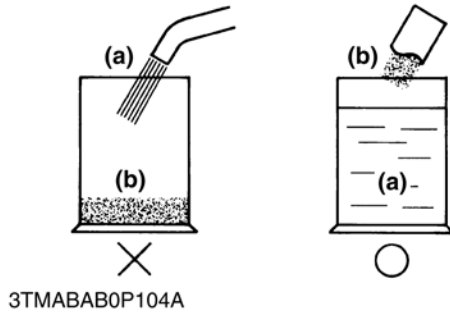
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Preparation of Calcium Chloride Solution



**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.



3TMABAB0P104A

Freezing temp.	Weight of CaCl <sub>2</sub> 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) CaCl<sub>2</sub> (Calcium Chloride)

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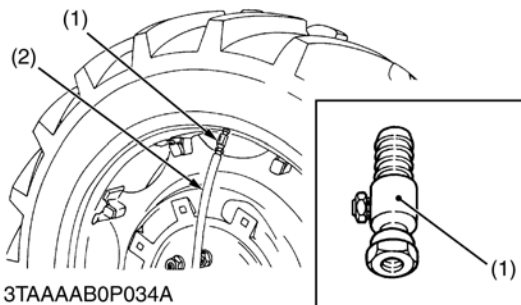
Attaching Injector

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. 07916-52501)

(1) Injector

(2) Hose

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Fig. 1

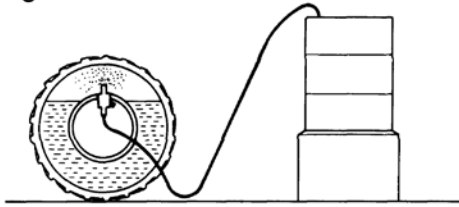


Fig. 2

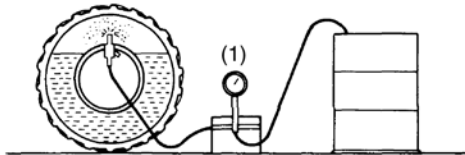
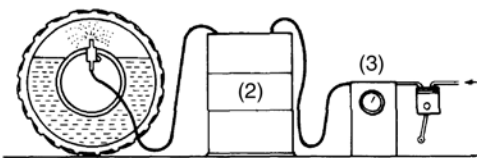
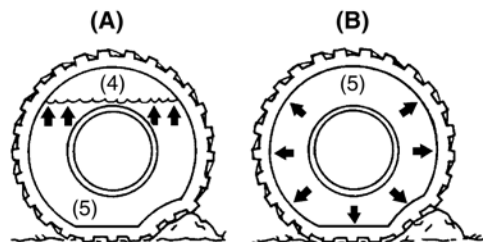


Fig. 3



3TMABAB0P111A



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 top (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
Slush free at -10 °C (14 °F) Solid at -30 °C (-22 °F) [Approx. 1 kg (2 lbs) CaCl <sub>2</sub> per 4 L (1 gal) of water]	68 kg (150 lbs)
Slush free at -24 °C (-11 °F) Solid at -47 °C (-52 °F) [Approx. 1.5 kg (3.5 lbs) CaCl <sub>2</sub> per 4 L (1 gal) of water]	72 kg (159 lbs)
Slush free at -47 °C (-52 °F) Solid at -52 °C (-62 °F) [Approx. 2.25 kg (5 lbs) CaCl <sub>2</sub> per 4 L (1 gal) of water]	76 kg (168 lbs)

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

- (A) Correct : 75 %  
Air Compresses Like a Cushion
- (B) Incorrect : 100 %  
Water can not be Compressed

000008012E

# 10. IMPLEMENT LIMITATIONS

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

	Tread (max. width)				Lower link end max. loading weight W0
	Front		Rear		
STV32, 36, 40	6.00 - 12 Farm	1050 mm (40.55 in.)	9.5 - 22 Farm	1070 mm (421.26 in.)	1150 kg (2535 lbs)
	24 x 8.50 - 14 Turf		13.6 - 16 Turf	1055 mm (415.35 in.)	

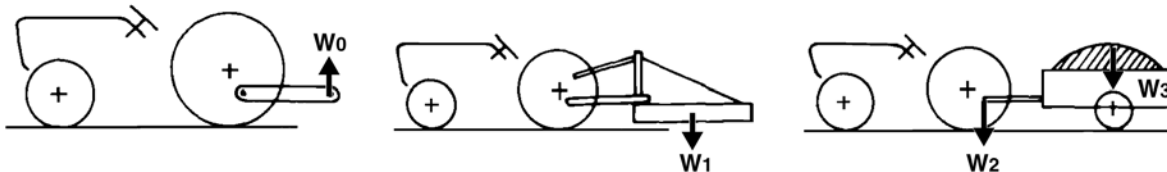
	Actual figures			Trailer loading weight W3 Max. capacity
	Lift capacity 24 inches behind lower link end W1	Max. drawbar load W2		
STV32, 36, 40	890 kg (1962 lbs)	Drawbar	500 kg (1102 lbs)	1500 kg (3300 lbs)
		High-hitch	490.5 kg (1081 lbs)	

Lower link end max. hydraulic lifting capacity.....W0

Implement weight.....The implement's weight which can be put on the lower link : W1

Max. drawbar load.....W2

Trailer loading weight.....The max. loading weight for trailer (without trailer's weight) : W3



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**NOTE**

- Implement size may vary depending on soil operating conditions.

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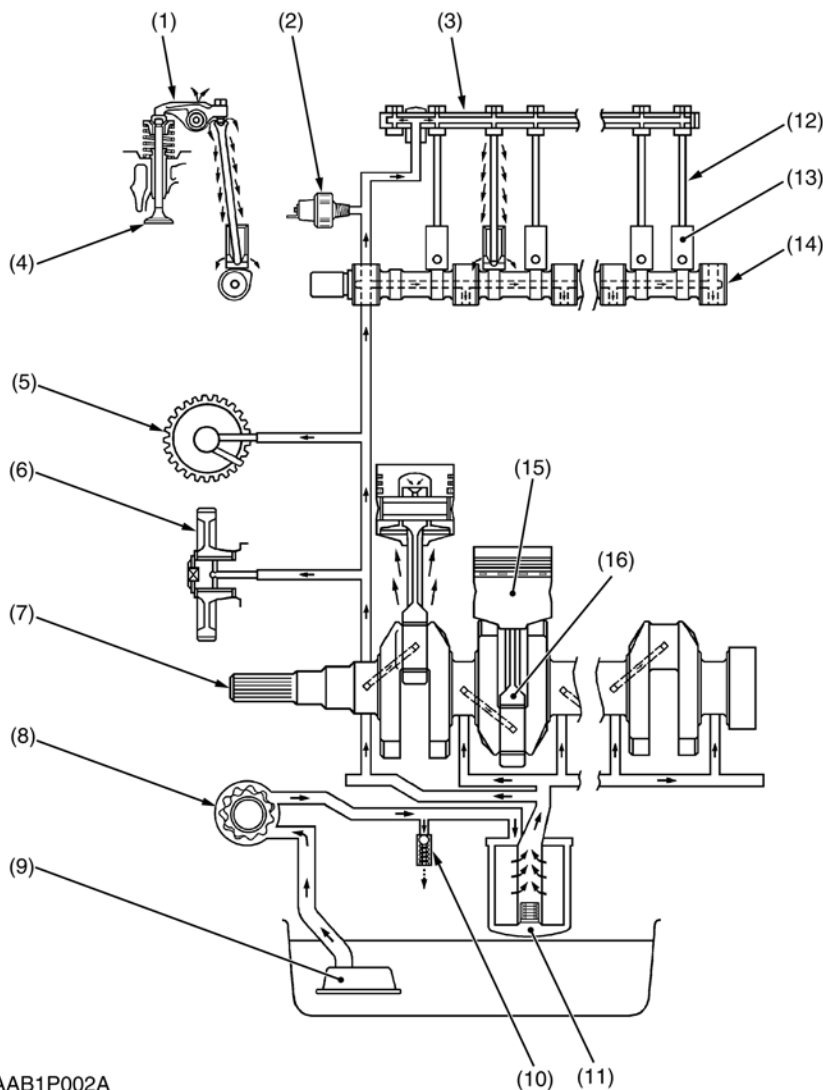
# 1 ENGINE

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1. LUBRICATING SYSTEM.....	1-M1
2. COOLING SYSTEM .....	1-M2
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# 1. LUBRICATING SYSTEM



- (1) Rocker Arm
- (2) Oil Pressure Switch
- (3) Rocker Arm Shaft
- (4) Valve
- (5) Governor Shaft
- (6) Idle Gear
- (7) Crankshaft
- (8) Oil Pump
- (9) Oil Strainer
- (10) Relief Valve
- (11) Oil Filter Cartridge
- (12) Push Rod
- (13) Tappet
- (14) Camshaft
- (15) Piston
- (16) Connecting Rod

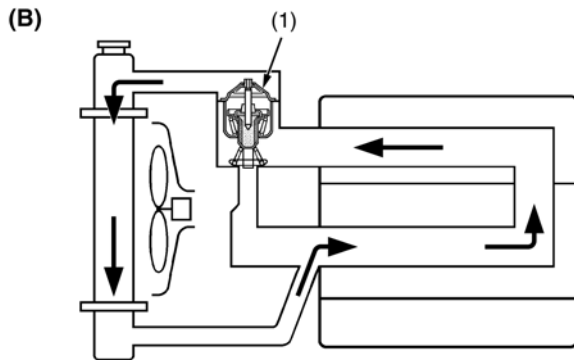
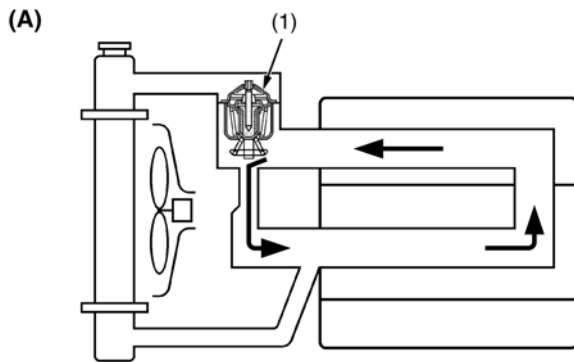
3TLAAB1P002A

A lubricating system consists of an oil strainer (9), oil pump (8), relief valve (10), oil filter cartridge (11) and oil pressure switch (2).

The oil pump sucks lubricating oil from the oil pan through the oil strainer and the oil flows down to the oil filter cartridge where it is further filtered. Then the oil is forced to crankshaft (7), connecting rods (16), idle gear (6), governor shaft (5), camshaft (14) and rocker arm shaft (3) to lubricate each part through the oil gallery.

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## 2. COOLING SYSTEM



Bottom bypass system is introduced in 03-M Series for improving the cooling performance of the radiator.

While the temperature of coolant in the engine is low, the thermostat is held closed and the coolant is allowed to flow through the bypass pipe and to circulate in the engine.

When the temperature exceeds the thermostat valve opening level, the thermostat fully opens itself to prevent the hot coolant from flowing through the bypass into the engine.

In this way, the radiator can increase its cooling performance.

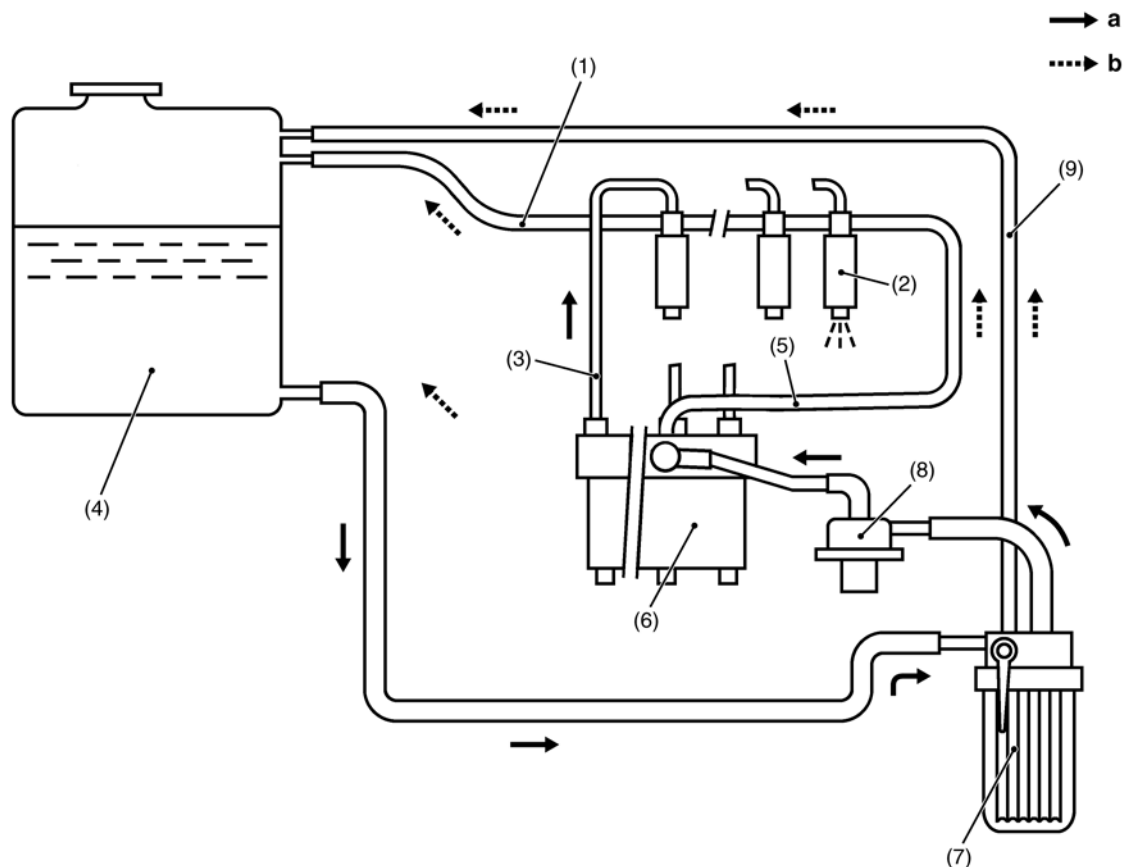
(1) Thermostat

(A) Thermostat Closed

(B) Thermostat Open

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### 3. FUEL SYSTEM



3TGAAAC1P001A

- |                        |                                  |                    |                               |
|------------------------|----------------------------------|--------------------|-------------------------------|
| (1) Fuel Overflow Pipe | (5) Injection Pump Air Vent Pipe | (7) Fuel Filter    | <b>a : Injected Fuel Flow</b> |
| (2) Injection Nozzle   | (6) Injection Pump               | (8) Fuel Feed Pump | <b>b : Returned Fuel Flow</b> |
| (3) Injection Pipe     | (9) Fuel Filter Air Vent Pipe    |                    |                               |
| (4) Fuel Tank          |                                  |                    |                               |

The fuel system of this tractor is shown in the diagram above.

Fuel from the tank flows in the passage as shown by the arrows, and is injected from the nozzle via the fuel injection pump. Overflow fuel returns to the tank.

The system includes filters and other concerns to protect it from entrance of air, water and dust.

While the engine is running, fuel is fed into the injection pump (6) by the fuel feed pump (8) after passing through the fuel filter (7). The fuel camshaft actuates the injection pump and force-feeds fuel to the injection nozzle (2) through the injection pipe (3). Fuel is then sprayed through the nozzle into the combustion chamber. The fuel discharged after lubricating and cooling the injection nozzle is returned to the fuel tank (4) automatically through the overflow pipe (1).

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(4) Crankshaft .....	1-S57
(5) Cylinder .....	1-S61
(6) Oil Pump.....	1-S62



# 1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
<b>Engine Does Not Start</b>	● No fuel	Replenish fuel	—
	● Air in the fuel system	Bleed	G-33
	● Water in the fuel system	Change fuel and repair or replace fuel system	—
	● Fuel pipe clogged	Clean	—
	● Fuel filter clogged	Clean or change	G-22
	● Excessively high viscosity of fuel or engine oil at low temperature	Use specified fuel or engine oil	G-8
	● Fuel with low cetane number	Use specified fuel	G-8
	● Fuel leak due to loose injection pipe retaining nut	Tighten retaining nut	1-S27
	● Incorrect injection timing	Adjust	1-S17
	● Fuel camshaft worn	Replace	1-S37
	● Injection nozzle clogged	Clean	1-S18
	● Injection pump malfunctioning	Replace	1-S31
	● Seizure of crankshaft, camshaft, piston, cylinder or bearing	Repair or replace	—
	● Compression leak from cylinder	Replace head gasket, tighten cylinder head screw, glow plug and nozzle holder	1-S11
	● Improper valve timing	Correct or replace timing gear	1-S36
	● Piston ring and cylinder worn	Replace	1-S55, S61
● Excessive valve clearance	Adjust	1-S13	
<b>(Starter Does Not Run)</b>	● Battery discharged	Charge	G-25, 26
	● Starter malfunctioning	Repair or replace	9-S16
	● Main switch malfunctioning	Repair or replace	9-S8
	● Safety switch (clutch pedal, HST) improperly adjusted or defective	Repair or replace	9-S16, 17
	● Starter relay defective	Replace	9-S17
	● PTO relay defective	Replace	9-S18
	● PTO clutch control switch engaged	Disengage	—
	● Fuse (30A, Starter) blown	Replace	G-34
	● Wiring disconnected	Connect	—

Symptom	Probable Cause	Solution	Reference Page
<b>Engine Revolution Is Not Smooth</b>	● Fuel filter clogged or dirty	Change	G-22
	● Air cleaner clogged	Clean or replace	G-21
	● Fuel leak due to loose injection pipe retaining nut	Tighten retaining nut	1-S27
	● Injection pump malfunctioning	Replace	1-S31
	● Incorrect nozzle injection pressure	Adjust	1-S18
	● Injection nozzle stuck or clogged	Repair or replace	1-S18
	● Governor malfunctioning	Repair	1-S32
<b>Either White or Blue Exhaust Gas Is Observed</b>	● Excessive engine oil	Reduce to specified level	G-13
	● Piston ring and cylinder worn or stuck	Repair or replace	1-S55, S61
	● Incorrect injection timing	Adjust	1-S17
	● Deficient compression	Adjust top clearance	1-S11
<b>Either Black or Dark Gray Exhaust Gas Is Observed</b>	● Overload	Loosen load	—
	● Low grade fuel used	Use specified fuel	G-8
	● Fuel filter clogged	Replace	G-22
	● Air cleaner clogged	Clean or replace	G-21
	● Deficient nozzle injection	Repair or replace nozzle	1-S18
<b>Deficient Output</b>	● Incorrect injection timing	Adjust	1-S17
	● Engine's moving parts seem to be seized	Repair or replace	—
	● Uneven fuel injection	Replace injection pump	1-S18
	● Deficient nozzle injection	Repair or replace nozzle	1-S18
	● Compression leak	Replace head gasket, tighten cylinder head screw, glow plug and nozzle holder	1-S11
<b>Excessive Lubricant Oil Consumption</b>	● Piston ring's gap facing the same direction	Shift ring gap direction	1-S40
	● Oil ring worn or stuck	Replace	1-S55, S56
	● Piston ring groove worn	Replace piston	1-S56
	● Valve stem and valve guide worn	Replace	1-S47
	● Oil leaking due to defective seals or packing	Replace	—
<b>Fuel Mixed into Lubricant Oil</b>	● Injection pump's plunger worn	Replace pump	1-S31
	● Deficient nozzle injection	Repair or replace nozzle	1-S18
	● Injection pump broken	Replace	1-S31

Symptom	Probable Cause	Solution	Reference Page
<b>Water Mixed into Lubricant Oil</b>	● Head gasket defective	Replace	1-S29
	● Cylinder block or cylinder head flawed	Replace	1-S46
<b>Low Oil Pressure</b>	● Engine oil insufficient	Replenish	G-13
	● Oil filter clogged	Replace	G-14
	● Relief valve stuck with dirt	Clean	—
	● Relief valve spring weaken or broken	Replace	—
	● Excessive oil clearance of crankshaft bearing	Replace	1-S59, S60
	● Excessive oil clearance of crankpin bearing	Replace	1-S58
	● Excessive oil clearance of rocker arm	Replace	1-S50
	● Oil passage clogged	Clean	—
	● Different type of oil	Use specified type of oil	G-8
	● Oil pump defective	Repair or replace	1-S62
<b>High Oil Pressure</b>	● Different type of oil	Use specified type of oil	G-8
	● Relief valve defective	Replace	—
<b>Engine Overheated</b>	● Engine oil insufficient	Replenish	G-13
	● Fan belt broken or elongated	Replace or adjust	1-S14, S15
	● Coolant insufficient	Replenish	G-8
	● Radiator net and radiator fin clogged with dust	Clean	—
	● Inside of radiator corroded	Clean or replace	G-31
	● Coolant flow route corroded	Clean or replace	G-31
	● Radiator cap defective	Replace	1-S15
	● Overload running	Loosen load	—
	● Head gasket defective	Replace	1-S29
	● Incorrect injection timing	Adjust	1-S17
	● Unsuitable fuel used	Use specified fuel	G-8

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## 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 min <sup>-1</sup> (rpm) 36 to 41 kgf/cm <sup>2</sup> / 290 min <sup>-1</sup> (rpm) 512 to 583 psi / 290 min <sup>-1</sup> (rpm)	2.55 MPa / 290 min <sup>-1</sup> (rpm) 26 kgf/cm <sup>2</sup> / 290 min <sup>-1</sup> (rpm) 370 psi / 290 min <sup>-1</sup> (rpm)
	Difference among Cylinders	—	10 % or less
Top Clearance		0.55 to 0.70 mm 0.0217 to 0.0276 in.	—
Valve Clearance (When 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.

Item		Factory Specification	Allowable Limit
Valve Timing (Intake Valve)	D1503-M (Open)	0.14 rad (8 °) before T.D.C.	—
	D1503-M (Close)	0.35 rad (20 °) after B.D.C.	—
	D1703-M (Open) D1803-M	0.21 rad (12 °) before T.D.C.	—
	D1703-M (Close) D1803-M	0.63 rad (36 °) after B.D.C.	—
Valve Timing (Exhaust Valve)	D1503-M (Open)	1.05 rad (60 °) before B.D.C.	—
	D1503-M (Close)	0.21 rad (12 °) after T.D.C.	—
	D1703-M (Open) D1803-M	1.05 rad (60 °) before B.D.C.	—
	D1703-M (Close) D1803-M	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 / Setting Length	117.6 N / 35.0 mm 12.0 kgf / 35.0 mm 26.4 lbs / 1.3780 in.	100.0 N / 35.0 mm 10.2 kgf / 35.0 mm 22.5 lbs / 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.	0.1 mm 0.0039 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.	—

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.
Camshaft	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 0.00358 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.	—
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	Clearance	0.093 to 0.128 mm 0.0037 to 0.0050 in.	0.2 mm 0.0079 in.
Oil Ring to Ring Groove	Clearance	0.020 to 0.060 mm 0.0008 to 0.0021 in.	0.15 mm 0.0059 in.
Top Ring	D1503-M (Ring Gap)	0.20 to 0.35 mm 0.0079 to 0.0138 in.	1.25 mm 0.0492 in.
	D1703-M D1803-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.

Item		Factory Specification	Allowable Limit
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.)	59.921 to 59.940 mm 2.35909 to 2.35984 in.	—
	Crankshaft Bearing 1 (I.D.)	59.980 to 60.039 mm 2.36142 to 2.36374 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.)	59.921 to 59.940 mm 2.35909 to 2.35984 in.	—
	Crankshaft Bearing 2 (I.D.)	59.980 to 60.025 mm 2.36142 to 2.36374 in.	—
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 0.31 mm 0.0059 to 0.0122 in.	0.5 mm 0.0197 in.
Crankshaft Sleeve	Wear	—	0.1 mm 0.0039 in.
Cylinder Bore [Standard]	D1503-M (I.D.)	83.000 to 83.022 mm 3.26772 to 3.26858 in.	+ 0.15 mm + 0.0059 in.
	D1703-M D1803-M (I.D.)	87.000 to 87.022 mm 3.42519 to 3.42606 in.	+ 0.15 mm + 0.0059 in.
Cylinder Bore [Oversize]	D1503-M (I.D.)	83.250 to 83.272 mm 3.27756 to 3.27843 in.	+ 0.15 mm + 0.0059 in.
	D1703-M D1803-M (I.D.)	87.250 to 87.272 mm 3.43503 to 3.43590 in.	+ 0.15 mm + 0.0059 in.

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**LUBRICATING SYSTEM**

Item		Factory Specification	Allowable Limit
Engine Oil Pressure	At Idle Speed	More than 98 kPa 1.0 kgf/cm <sup>2</sup> 14 psi	49 kPa 0.5 kgf/cm <sup>2</sup> 7 psi
	At Rated Speed	294 to 441 kPa 3.0 to 4.5 kgf/cm <sup>2</sup> 42.7 to 64.0 psi	245 kPa 2.5 kgf/cm <sup>2</sup> 35.6 psi
Engine Oil Pressure Switch	Working Pressure	49 kPa 0.5 kgf/cm <sup>2</sup> 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	Clearance	0.105 to 0.150 mm 0.00413 to 0.00591 in.	0.2 mm 0.0079 in.

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**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 <sup>2</sup> 20 psi	—
Radiator Cap	Pressure Falling Time	more than 10 seconds for pressure fall from 88 to 59 kPa (from 0.9 to 0.6 kgf/cm <sup>2</sup> from 13 to 9 psi)	—

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**FUEL SYSTEM**

Item		Factory Specification	Allowable Limit
Injection Pump	Injection Timing	0.297 to 0.331 rad (17 to 19 <sup>o</sup> ) before T.D.C.	—
Injection Nozzle	Injection Pressure	13.73 to 14.71 MPa 140 to 150 kgf/cm <sup>2</sup> 1991 to 2133 psi	—
Injection Nozzle Valve Seat	Valve Seat Tightness	When the pressure is 12.75 MPa (130 kgf/cm <sup>2</sup> , 1849 psi), the valve seat must be fuel tightness.	—

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### 3. TIGHTNING 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	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
Delivery hose RH retaining nut	24.5 to 29.4	2.5 to 3.0	18.1 to 21.7
Delivery hose LH retaining nut	24.5 to 29.4	2.5 to 3.0	18.1 to 21.7
Delivery hose retaining nut	34.3 to 44.1	3.5 to 4.5	25.3 to 32.5
Delivery hose joint screw	49.0 to 58.8	5.0 to 6.0	36.2 to 43.4
Bi-speed delivery pipe joint screw	34.3 to 39.2	3.5 to 4.0	25.3 to 28.9
Bi-speed delivery pipe retaining nut	29.4 to 49.0	3.0 to 5.0	21.7 to 36.2
Engine mounting screw, bolt and nut (M10)	48.1 to 55.9	4.9 to 5.7	35.5 to 41.2
Engine mounting nut (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
Cylinder head cover screw	6.9 to 11.3	0.7 to 1.15	5.1 to 8.32
*Cylinder head screw	93.1 to 98.0	9.5 to 10.0	68.7 to 72.3
*Main bearing case screw 1	46.1 to 50.9	4.7 to 5.2	34.0 to 37.6
*Main bearing case screw 2	68.6 to 73.5	7.0 to 7.5	50.6 to 54.2
*Flywheel screw	98.0 to 107.8	10.0 to 11.0	72.3 to 79.5
*Connecting rod screw	44.1 to 49.0	4.5 to 5.0	32.5 to 36.2
*Rocker arm bracket screw	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
*Idle gear shaft screw	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 mounting screw	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
Glow plugs	19.6 to 24.5	2.0 to 2.5	14.5 to 18.1
Nozzle holder assembly	49.0 to 68.6	5.0 to 7.0	36.2 to 50.6
Oil pressure switch	14.7 to 19.6	1.5 to 2.0	10.8 to 14.5
Injection pipe retaining nut	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 bolt	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	32.5 to 36.2

#### ■ NOTE

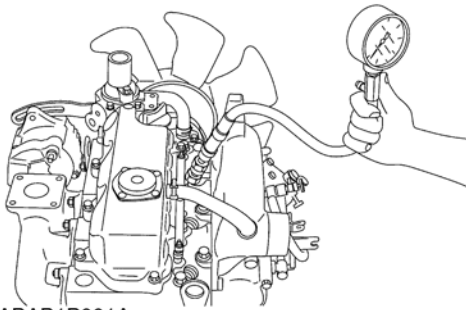
- For "\*" marked screws, bolts and nuts on the table, apply engine oil to their threads and seats before tightening.
- The letter "M" in Size x Pitch means that the screw, bolt or nut dimension stands for metric. The size is the nominal outside diameter in mm of the threads. The pitch is the nominal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

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## 4. CHECKING, DISASSEMBLING AND SERVICING

### [1] CHECKING AND ADJUSTING

#### (1) Engine Body



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#### Compression Pressure

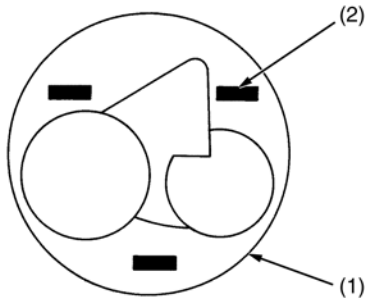
1. Run the engine until it is warmed up.
2. Stop the engine and disconnect the 2P connector from the stop solenoid in order to inject fuel.
3. Remove the air cleaner, the muffler and all injection nozzles.
4. Set a compression tester (Code No. 07909-30208) with the adaptor to the nozzle hole.
5. Keep 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

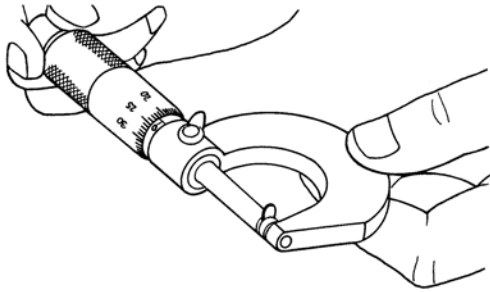
- Check the compression pressure with the specified valve clearance.
- Always use a fully charged battery for performing this test.
- Variances in cylinder compression values should be under 10 %.

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

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Top Clearance

1. Remove the cylinder head.
2. Move the piston and stick a strip of fuse on the piston head at three positions 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 clearance between the crankpin and bearing and between the piston pin and bushing.

■ **NOTE**

- **After checking the top clearance, be sure to assemble the cylinder head with a new cylinder head gasket.**

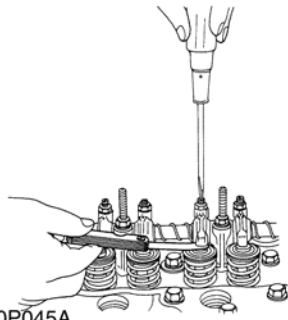
Top clearance	Factory spec.	0.55 to 0.70 mm 0.0217 to 0.0276 in.
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Tightening torque	Cylinder head screws	93.1 to 98.0 N·m 9.5 to 10.0 kgf·m 68.7 to 72.3 ft-lbs
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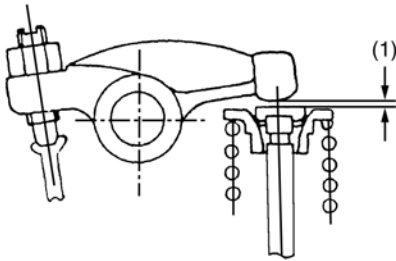
(1) Piston

(2) Fuse

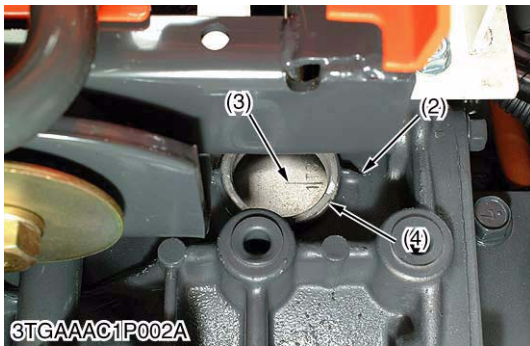
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Valve Clearance

■ **IMPORTANT**

● **The valve clearance must be checked and adjusted when engine is cold.**

1. Remove the head cover.
2. Remove the cap of the timing window (4) on the housing under the right step.
3. Align the "1TC" mark line (3) on the flywheel and projection (2) on the housing so that the No. 1 piston comes to compression or overlap top dead center.
4. Check the following valve clearance (1) marked with "☆" using a feeler gauge.
5. If the clearance is not within the factory specifications, adjust with the adjusting screw.

■ **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 top dead center position when the "TC" marking is aligned with the projection (2) in the 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 (1). (The piston is at the 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 and the projection (2) perfectly. Adjust all the other valve clearance as required.
- After turning the flywheel counterclockwise twice or three times, recheck the valve clearance (1).
- After adjusting the valve clearance (1), firmly tighten the lock nut of the adjusting screw.

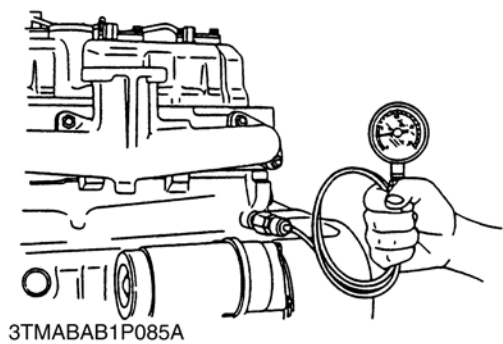
Valve arrangement		IN.	EX.
Adjustable cylinder and location of piston			
When No. 1 piston is compression top dead center	No.1	☆	☆
	No.2	-	☆
	No.3	-	-
When No. 1 piston is overlap position	No.1	-	-
	No.2	☆	-
	No.3	-	☆

- (1) Valve Clearance
- (2) Projection

- (3) TC Mark Line
- (4) Timing Window

000007475E

## (2) Lubricating System



### Engine Oil Pressure

1. Remove the engine oil pressure switch, and set an oil pressure tester (Code No. 07916-32032). (Adaptor screw size : PT 1/8)
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 <sup>2</sup> 14 psi
		Allowable limit	49 kPa 0.5 kgf/cm <sup>2</sup> 7 psi
	At rated speed	Factory spec.	294 to 441 kPa 3.0 to 4.5 kgf/cm <sup>2</sup> 42.7 to 64.0 psi
		Allowable limit	245 kPa 2.5 kgf/cm <sup>2</sup> 35.6 psi

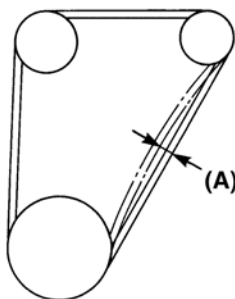
### (When reassembling)

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

Tightening torque	Oil pressure switch	14.7 to 19.6 N·m 1.5 to 2.0 kgf/cm <sup>2</sup> 10.8 to 14.5 ft-lbs
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## (3) Cooling System



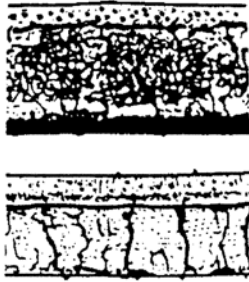
### Fan Belt Tension

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 <b>(A)</b>	Factory spec.	7 to 9 mm 0.28 to 0.35 in.
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**(A) Deflection**

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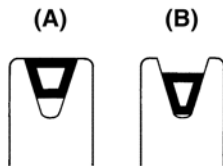
Fan Belt Damage and Wear

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.

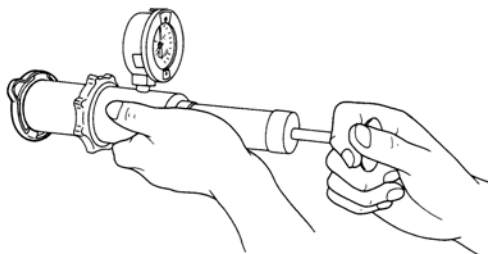
(A) Good

(B) Bad

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3EEABAB1P162A

Radiator Cap Air Leakage

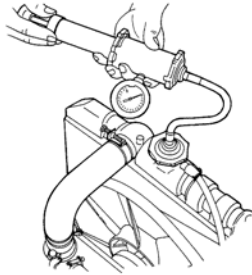
**CAUTION**

- 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) and an adapter (BANZAI Code No. RCT-2A-30S) on the radiator cap.
2. Apply the specified pressure 88 kPa (0.9 kgf/cm<sup>2</sup>, 13 psi), and measure the time for the pressure to fall to 59 kPa (0.6 kgf/cm<sup>2</sup>, 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 <sup>2</sup> from 13 to 9 psi)
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Radiator Water Leakage

1. Pour a specified amount of water into the radiator.
2. Set a radiator tester (Code No. 07909-31551) with an adaptor (BANZAI Code No. RCT-2A-30S) and raise the water pressure to the specified pressure.
3. Check the radiator for water leaks.
4. For water leak from the pinhole, replace the radiator or repair with the radiator cement. When water leak is excessive, replace the radiator.

Radiator water leakage test pressure	Factory spec.	No leaks at 137 kPa 1.4 kgf/cm <sup>2</sup> 20 psi
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Thermostat Valve Opening Temperature

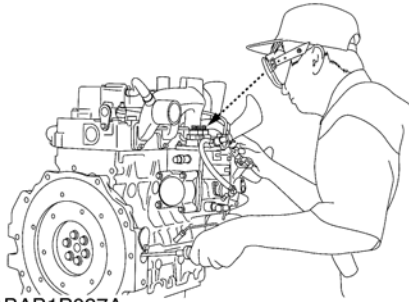
1. Suspend the thermostat in the water by a string with its end inserted between the valve and seat.
2. Heating the water gradually, read the temperature when the valve opens and leaves the string.
3. Continue heating and read the temperature when the valve opens approx. 6 mm (0.236 in.).
4. If the measurement 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

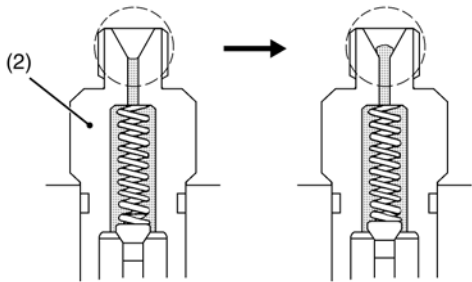
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### (4) Fuel System



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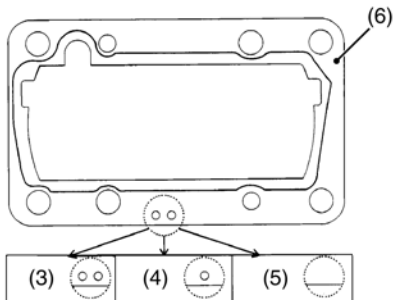
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3TGAAAC1P003A



3TGAAAC3P030A



3TMABAB1P091G

#### Injection Timing

1. Remove the stop solenoid.
2. Remove the injection pipes and nozzle.
3. Remove the cap of the timing window (1) on the housing under the right step.
4. Set the speed control lever to maximum fuel discharge position.
5. Turn the flywheel counterclockwise (facing the flywheel) until the fuel fills up to the hole of the delivery valve holder (2) for 1st cylinder.
6. Turn the flywheel further and stop turning when the fuel begins to flow over, to get the present injection timing.
7. (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.
8. If the calculation differs from specified injection timing, change, add or remove the shim (6) to adjust.

Injection timing	Factory spec.	0.297 to 0.331 rad (17 to 19°) before T.D.C.
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#### 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 (0.0079 in.), 0.25 mm (0.0098 in.) and 0.30 mm (0.0118 in.). Combine these shims for adjustments.
- Injection timing delays or advances by approx. 0.0087 rad (0.5 deg), when the thickness of the shim increased or decreased by 0.05 mm (0.002 in.).
- In disassembling and replacing, be sure to use the same number of new shims with the same thickness.

- |  |   |
|--|---|
| (1) Timing Window                      | (4) One-hole:<br>0.25 mm (0.0098 in.)     |
| (2) Delivery Valve Holder              | (5) Without hole:<br>0.30 mm (0.0118 in.) |
| (3) Two-holes:<br>0.20 mm (0.0079 in.) | (6) Soft Metal Gasket Shim                |

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**CAUTION**

- Check the 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.

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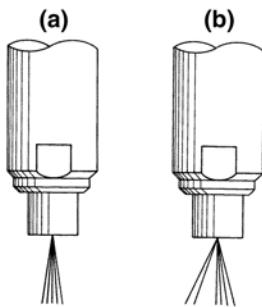
Nozzle Spraying Condition

1. Set the injection nozzle to a nozzle tester, and check the nozzle spraying condition.
2. If the spraying condition is defective, replace the nozzle piece.

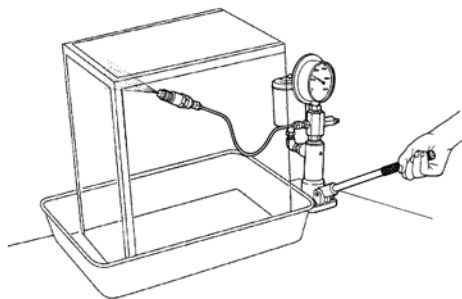
(a) Good

(b) Bad

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3TLABAB1P040A

Fuel Injection Pressure

1. Set the injection nozzle to a 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, replace the adjusting washer (1) in the nozzle holder to adjust it.

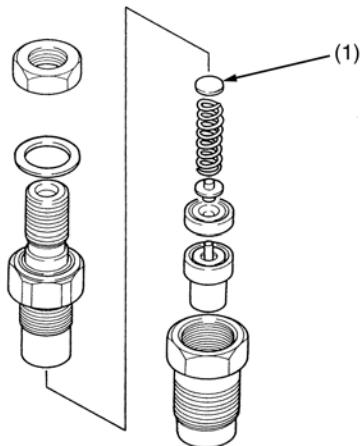
Fuel injection pressure	Factory spec.	13.73 to 14.71 MPa 140 to 150 kgf/cm <sup>2</sup> 1991 to 2134 psi
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**(Reference)**

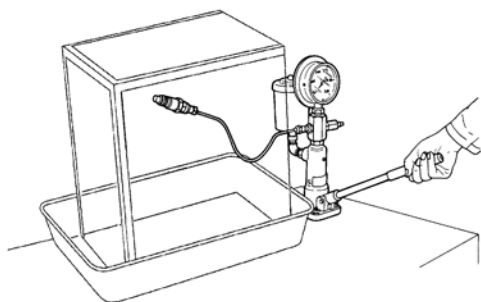
- Pressure variation with 0.01 mm (0.0004 in.) difference of adjusting washer thickness.  
Approx. 235 kPa (2.4 kgf/cm<sup>2</sup>, 34 psi)

(1) Adjusting Washer

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3TLABAB1P041A

Valve Seat Tightness

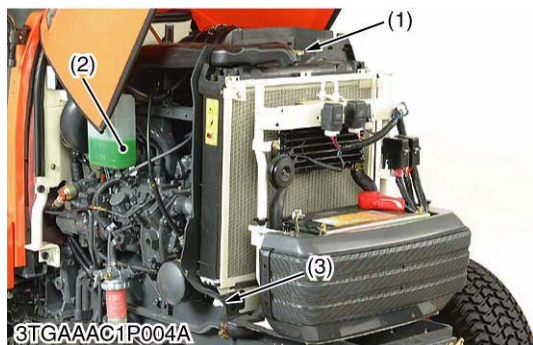
1. Set the injection nozzle to a nozzle tester.
2. Raise the fuel pressure, and keep at 12.75 MPa (130 kgf/cm<sup>2</sup>, 1849 psi) for 10 seconds.
3. If any fuel leak is found, replace the nozzle piece.

Injection pressure	Factory spec.	No fuel leak at 12.75 MPa 130 kgf/cm <sup>2</sup> 1849 psi
--------------------	---------------	---

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**[2] PREPARATION**

**(1) Separating Engine from Tractor**



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Draining Coolant

**⚠ CAUTION**

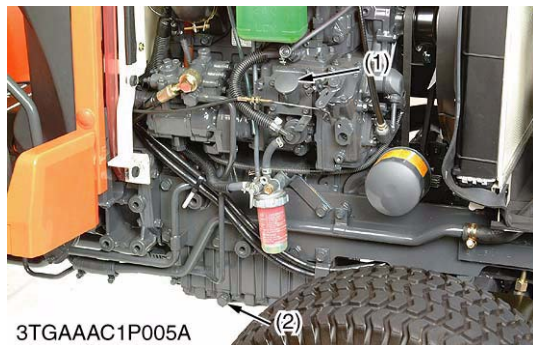
- Do not remove the radiator cap when the engine is hot. Then loosen cap slightly to the stop to relieve any excess pressure before removing cap completely.

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).

Coolant capacity (with recovery tank)	6.1 L 6.4 U.S.qts. 5.4 Imp.qts.
--	---------------------------------------

- (1) Radiator Cap
- (2) Recovery Tank
- (3) Drain Plug

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Draining Engine Oil

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

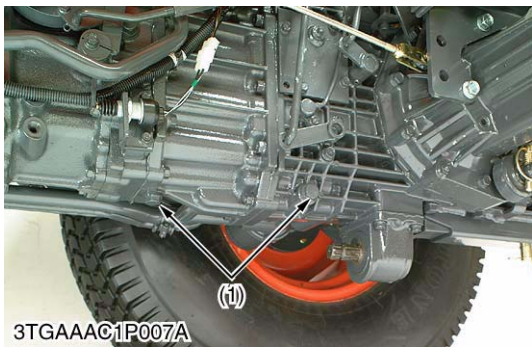
**(When reassembling)**

- 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	6.7 L 7.1 U.S.qts 5.9 Imp.qts
------------	----------	-------------------------------------

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

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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 reassembling)**

- Fill new oil from filling port after removing 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 blands oil together.**

Transmission fluid	Capacity	22 L 5.81 U.S.qts. 4.84 Imp.qts.
--------------------	----------	--

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

000007479E

Hood, Side Cover and Battery Cord

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

**(When reassembling)**

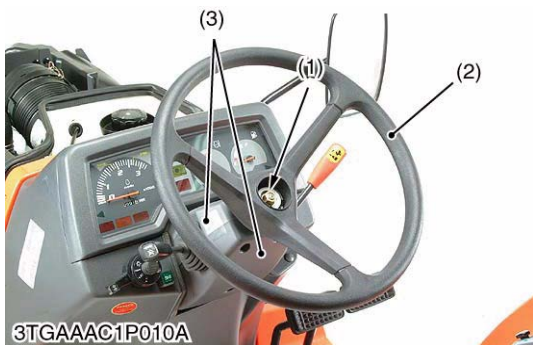
■ **NOTE**

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



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

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**Steering Wheel**

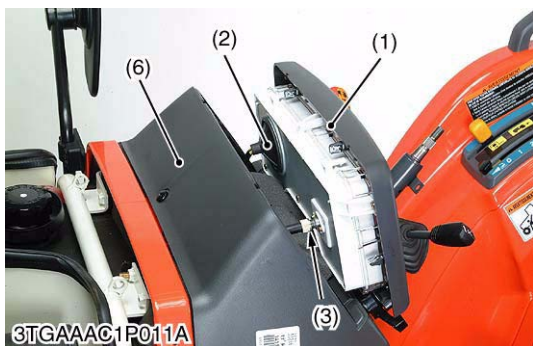
1. Remove the covers (3).
2. Remove the steering wheel cap.
3. Remove the steering wheel mounting nut (1) and remove the steering wheel (2) with a steering wheel puller (Code No. 07916-51090).

**(When reassembling)**

Tightening torque	Steering wheel mounting nut	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft·lbs
-------------------	-----------------------------	---

- (1) Nut
- (2) Steering Wheel
- (3) Cover

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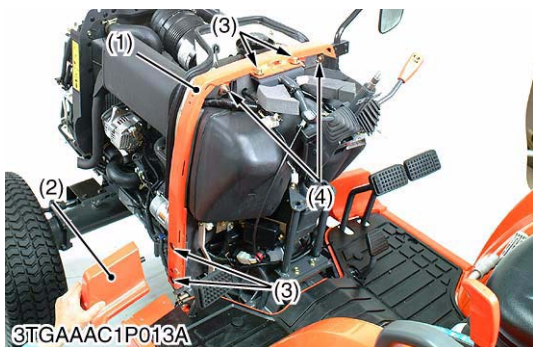
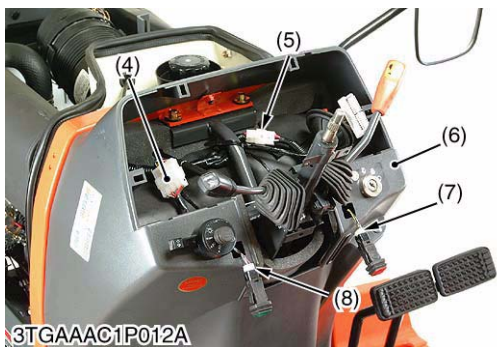


**Meter Panel and Panel Under Cover**

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 (7) and position lamp switch connector (8).
4. Remove the panel under cover (6)

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

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**Panel Under Frame**

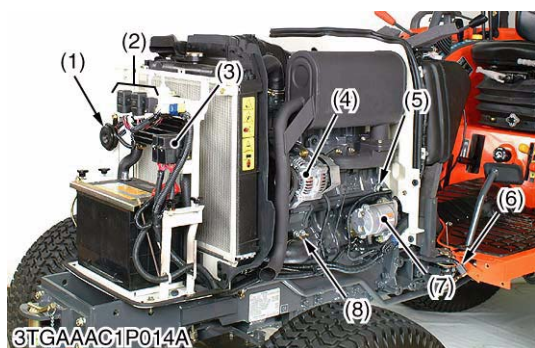
1. Remove the foot cover (2).
2. Remove the screws (3) and nuts (4), and pull up the panel under frame (1).

**(When reassembling)**

- When reassembling the panel under frame, tighten the two nuts (4) for insulation rubber first.

- (1) Panel Under Frame
- (2) Foot Cover
- (3) Screw
- (4) Nut

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#### Wiring Harness (Left Side)

1. Disconnect the connector from the horn (1).
2. Disconnect the connectors from the relays (2).
3. Separate the fuse box (3) from the stay.
4. Disconnect the battery positive cable from the battery terminal.
5. Disconnect the connector from the front wheel turning angle sensor, alternator (4), starter (7) and oil switch (5).
6. Disconnect the earth terminal (8).
7. Loosen the clamp of the terminal (6) for cabin.

- |                |                        |
|----------------|------------------------|
| (1) Horn       | (5) Oil Switch         |
| (2) Relay      | (6) Terminal for Cabin |
| (3) Fuse Box   | (7) Starter            |
| (4) Alternator | (8) Earth Terminal     |

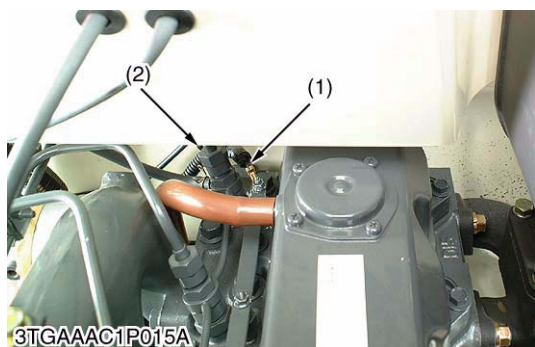
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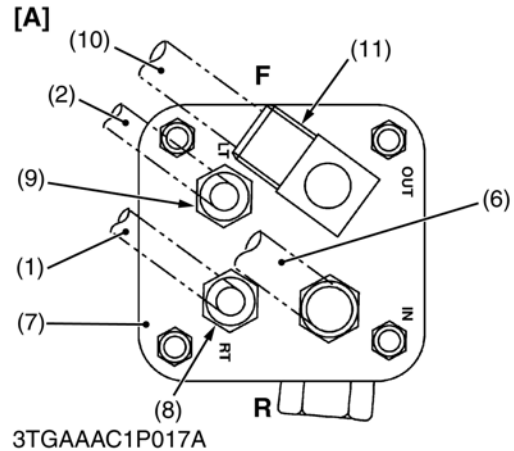
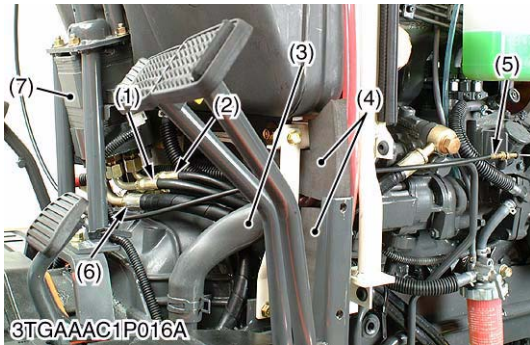
#### Wiring Harness (Right Side)

1. Remove the air cleaner and disconnect the glow plug cable (1).
2. Disconnect the 1P connector (2) from the coolant temperature sensor.
3. Disconnect the connector from the engine stop solenoid.

- |                     |                  |
|---------------------|------------------|
| (1) Glow Plug Cable | (2) 1P Connector |
|---------------------|------------------|

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**Power Steering Hoses and Accelerator Wire (Right Side)**

1. Remove the cushion rubber (4) noting not to damage it.
2. Disconnect the accelerator wire (5) from the engine.
3. Remove the power steering delivery hose (6).

**NOTE**

- **Do not lose the check valve and spring in the pump side joint.**

4. Disconnect the delivery hose LH (1) and delivery hose RH (2) from the steering controller.
5. Loosen the clamp and disconnect the suction hose (3) from the hydraulic pump.

**(When reassembling)**

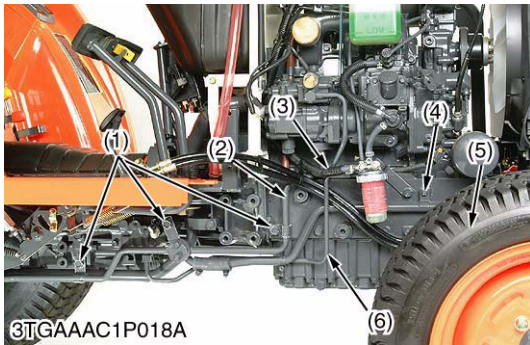
- Connect the delivery hose RH (2) to the LT port (9).
- Connect the delivery hose LH (1) to the RT port (8).
- Assemble the delivery hose (6), delivery hose LH (1) and delivery hose RH so that each hose becomes parallel to the hose joint (11).
- Be sure to check the hose joints do not interfere in other joints.

Tightening torque	Delivery hose RH (2) retaining nut	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 ft·lbs
Tightening torque	Delivery hose LH (1) retaining nut	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 ft·lbs
Tightening torque	Delivery hose (6) retaining nut (Controller side)	34.3 to 44.1 N·m 3.5 to 4.5 kgf·m 25.3 to 32.5 ft·lbs
Tightening torque	Delivery hose (6) joint screw (Pump side)	49 to 58.8 N·m 5.0 to 6.0 kgf·m 36.2 to 43.4 ft·lbs

- |                         |                            |
|-------------------------|----------------------------|
| (1) Delivery Hose LH    | (9) LT Port                |
| (2) Delivery Hose RH    | (10) Charge Hose           |
| (3) Suction Hose        | (11) Hose Joint (OUT Port) |
| (4) Cushion Rubber      |                            |
| (5) Accelerator Wire    |                            |
| (6) Delivery Hose       |                            |
| (7) Steering Controller |                            |
| (8) RT Port             |                            |

**[A] Viewed from Bottom Side**  
**F: Front Side**  
**R: Rear Side**

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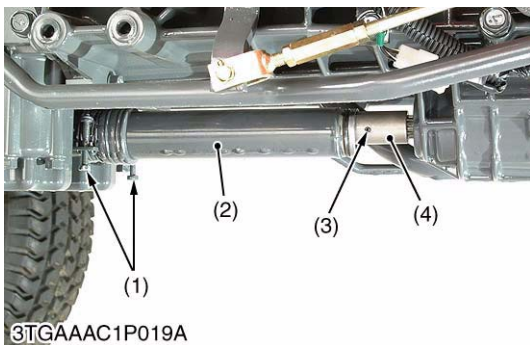
Hydraulic Pipe and Fuel Pipe (Right Side)

1. Disconnect the fuel hose (3) from the fuel filter to drain fuel.
2. Disconnect the fuel return hoses from the fuel tank.
3. Remove the retaining screws (1) and separate the 3P hydraulic delivery pipe (2) from the hydraulic pump.
4. Disconnect the bi-speed delivery pipe (6) from the hydraulic pump.
5. Remove the retaining screw (4) of the oil cooler pipe and loosen the clamp (5) of the joint hose.

Tightening torque	Bi-speed delivery pipe joint screw (Pump side)	34.3 to 39.2 N·m 3.5 to 4.0 kgf·m 25.3 to 28.9 ft·lbs
	Bi-speed delivery pipe retaining nut (Bi-speed valve side)	29 to 49 N·m 3.0 to 5.0 kgf·m 21.7 to 36.2 ft·lbs

- |                                |                            |
|--------------------------------|----------------------------|
| (1) Retaining Screw            | (4) Retaining Screw        |
| (2) 3P Hydraulic Delivery Pipe | (5) Clamp                  |
| (3) Fuel Hose                  | (6) Bi-speed Delivery Pipe |

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Propeller Shaft

1. Loosen the clamp screws (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 the cover.

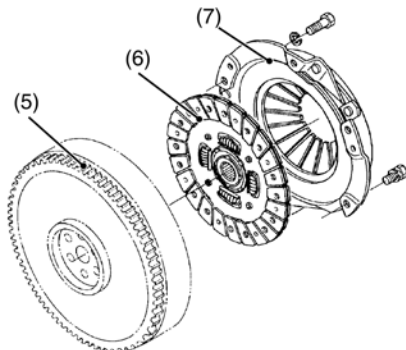
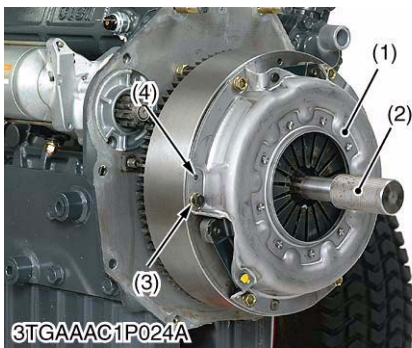
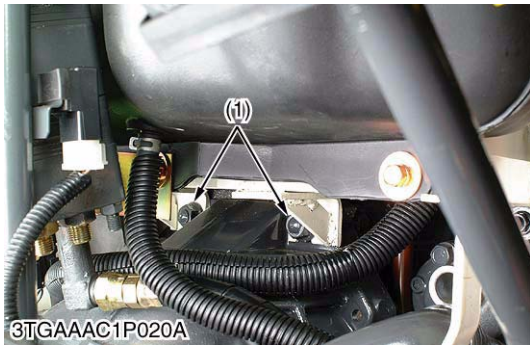
**(When reassembling)**

- Apply grease to the spline portion of the propeller shaft and couplings.
- When inserting the spring pins (3), face their splits in the direction parallel to the propeller shaft.
- Tighten the clamp screws (1) upward from the bottom side.

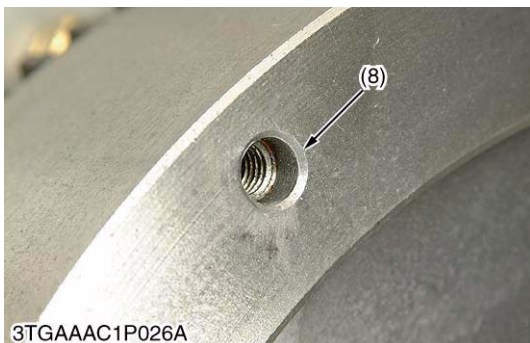
- |                           |                |
|---------------------------|----------------|
| (1) Clamp Screws          | (3) Spring Pin |
| (2) Propeller Shaft Cover | (4) Coupling   |

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**Separating the Engine from Clutch Housing**

1. Place the disassembling stand under the clutch housing 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 screw, bolt and nut (M10)	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft-lbs
	Engine mounting nut (M12)	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs

(1) Mounting Nut (M12)

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**Clutch Assembly**

1. Remove the clutch mounting screws and 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.
- Screws in two reamer screws (3) in the reamer screw holes.
- After tighten the reamer screws, tighten the other general screws.

**IMPORTANT**

- Align the center of clutch disc and flywheel by inserting the clutch center tool (2).

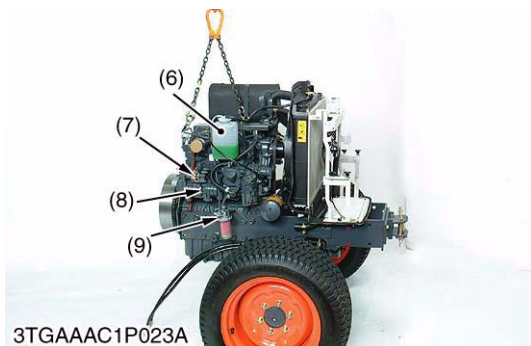
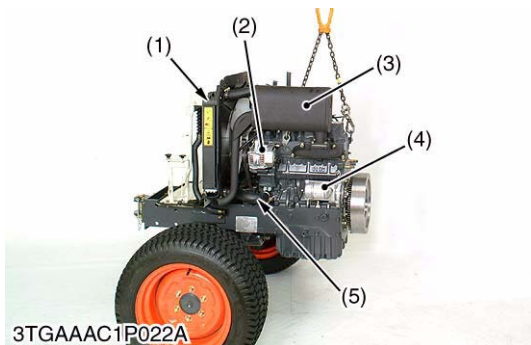
**NOTE**

- Do not allow grease and oil on the clutch disc facing.
- The reamer screw hole on the clutch cover (7) is in the next of the 5 mm (0.2 in.) dia. hole (4).
- The shape of the reamer screw hole (8) on the flywheel is different from other screw holes.

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
-------------------	-----------------------	---

- |                        |                                 |
|------------------------|---------------------------------|
| (1) Clutch Assembly    | (5) Flywheel                    |
| (2) Clutch Center Tool | (6) Clutch Disc                 |
| (3) Reamer Screw       | (7) Clutch Cover                |
| (4) 5 mm dia. Hole     | (8) Screw Hole for Reamer Screw |

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Separating Front Axle Assembly and Outer Parts

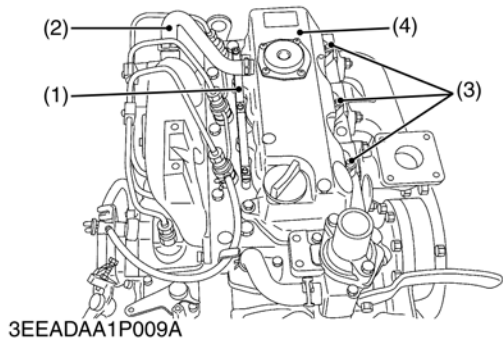
1. Disconnect the radiator hoses (1), (5).
2. Remove the muffler (3).
3. Remove the recovery tank (6).
4. Remove the starter motor (4) and alternator (2).
5. Remove the fuel filter (9).
6. Remove the regulator valve (7) and hydraulic pump (8).
7. Remove the engine mounting screws and separate the front axle assembly from engine.

- |                   |                     |
|-------------------|---------------------|
| (1) Radiator Hose | (6) Recovery Tank   |
| (2) Alternator    | (7) Regulator Valve |
| (3) Muffler       | (8) Hydraulic Pump  |
| (4) Starter Motor | (9) Fuel Filter     |
| (5) Radiator Hose |                     |

000007494E

### [3] DISASSEMBLING AND ASSEMBLING

#### (1) Cylinder Head and Valves



#### Cylinder Head Cover

1. Remove the lead (1).
2. Remove the breather hose (2).
3. Remove the head cover screws (3).
4. Remove the cylinder head cover (4).

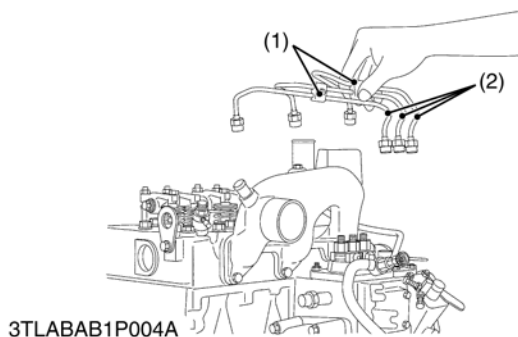
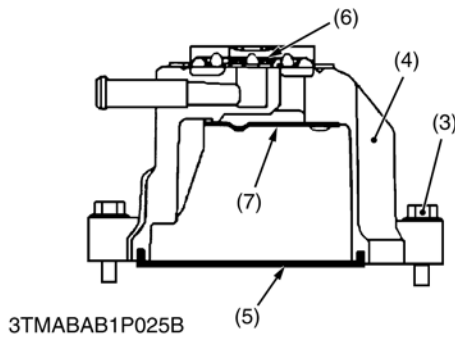
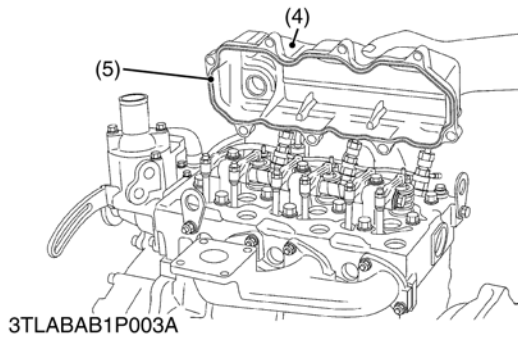
#### (When reassembling)

- 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
-------------------	---------------------------	--

- |                         |                                |
|-------------------------|--------------------------------|
| (1) Lead                | (5) Cylinder Head Cover Gasket |
| (2) Breather Hose       | (6) Breather Valve             |
| (3) Head Cover Screw    | (7) Plate                      |
| (4) Cylinder Head Cover |                                |

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#### Injection Pipes

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

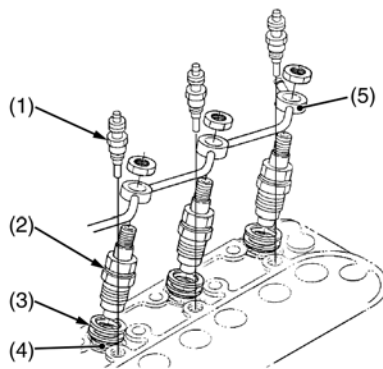
#### (When reassembling)

- Blow out dust inside the pipes.

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
-------------------	------------------------------	---

- |                |                    |
|----------------|--------------------|
| (1) Pipe Clamp | (2) Injection Pipe |
|----------------|--------------------|

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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 (3) and heat seal (4).
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) Heat Seal              |
| (2) Nozzle Holder Assembly | (5) Overflow Pipe Assembly |
| (3) Copper Gasket          |                            |

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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.

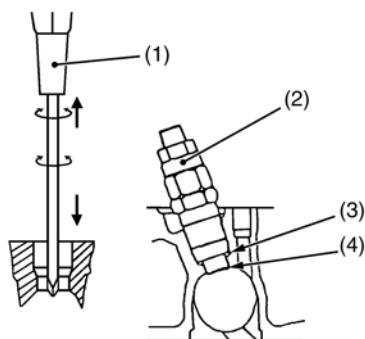
1. Drove screw driver (1) lightly into the heat seal hole.
2. Turn screw driver three or four times each way.
3. While turning the screw driver, slowly pull the heat seal (4) out together with the copper gasket (3).
4. If the heat seal drops, repeat the above procedure.

**(When reassembling)**

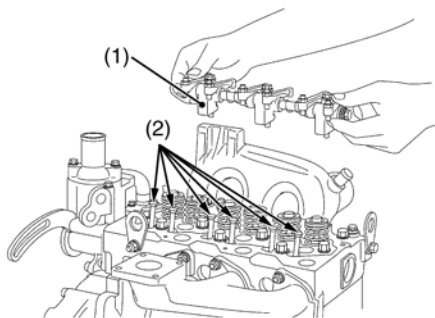
- Heat seal and copper gasket must be changed when the injection nozzle is removed for cleaning or for service.

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

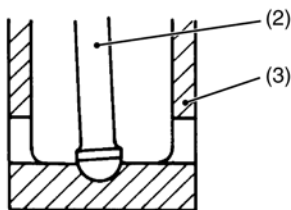
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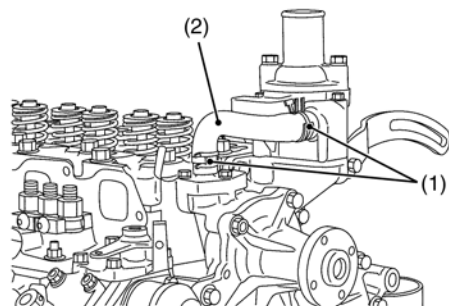
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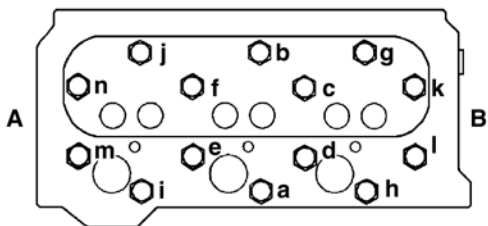
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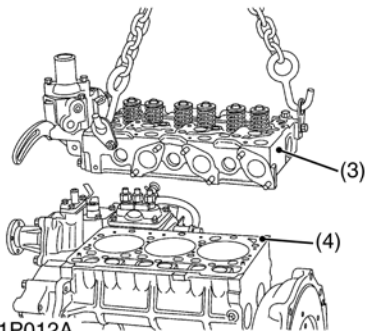
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**Rocker Arm and Push Rod**

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 screw	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft·lbs
-------------------	--------------------------	---

- (1) Rocker Arm Assembly                      (3) Tappet  
(2) Push Rod

000006434E

**Cylinder Head**

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

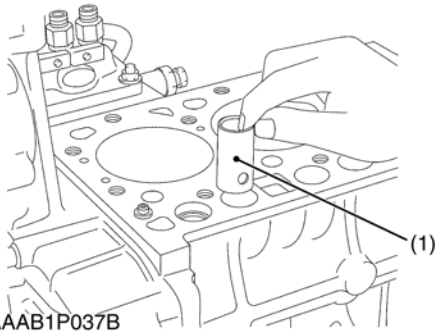
**(When reassembling)**

- Replace the cylinder head gasket (4) with a new one.
- Tighten the cylinder head screws after applying sufficient oil.
- Tighten the cylinder head screws in diagonal sequence starting from the center in the order of (a) to (n).
- 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
-------------------	---------------------	--

- (1) Pipe Clamp                                      **(n) to (a) : To Loosen**  
(2) Return Pipe                                    **(a) to (n) : To Tighten**  
(3) Cylinder Head                                **A: Gear Case Side**  
(4) Cylinder Head Gasket                      **B: Flywheel Side**

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3TGAAAB1P037B

### Tappets

1. Remove the tappets (1) from the crankcase.

#### **(When reassembling)**

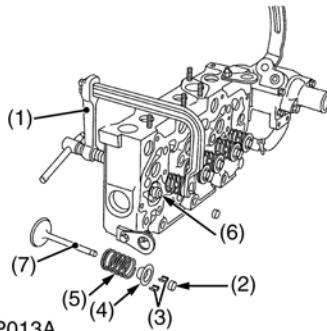
- Visually check the contact between tappets and cams for proper rotation. If defect is found, replace tappets.
- Before installing the tappets, apply engine oil thinly around them.

#### ■ **IMPORTANT**

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

(1) Tappet

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### 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 seal 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.

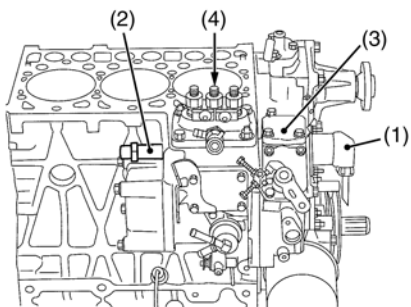
#### ■ **IMPORTANT**

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

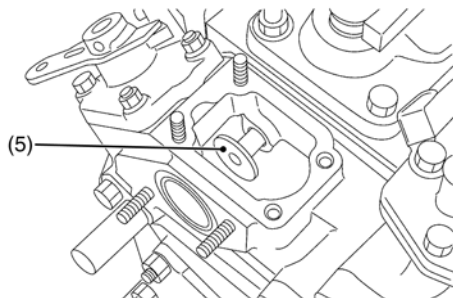
(1) Valve Spring Replacer	(5) Valve Spring
(2) Valve Cap	(6) Valve Stem Seal
(3) Valve Spring Collet	(7) Valve
(4) Valve Spring Retainer	

000000855E

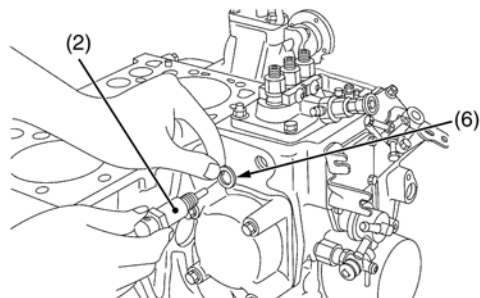
## (2) Timing Gears, Camshaft and Fuel Camshaft



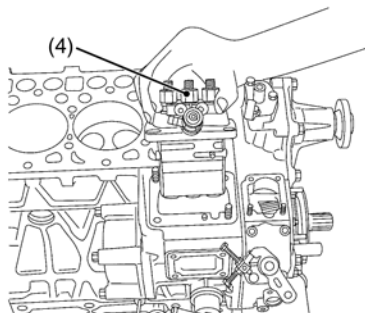
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3TGAAAC1P029A



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### Injection Pump

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

#### ■ IMPORTANT

- Before removing the injection pump assembly (4), be sure to remove the stop solenoid (1), hi-idling body (2) and stop solenoid guide (5).

#### (When reassembling)

- Before attaching the stop solenoid (1), hi-idling body (2) and solenoid guide (5), install the injection pump first into position.
- Replace the hi-idling body gasket (6) with a new one.
- When installing the stop solenoid (1), 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 (5).

Tightening torque	Hi-idling body	44.1 to 49.0 N·m 4.5 to 5.0 kgf·m 32.6 to 36.2 ft·lbs
-------------------	----------------	---

- |                    |                             |
|--------------------|-----------------------------|
| (1) Stop Solenoid  | (4) Injection Pump Assembly |
| (2) Hi-idling Body | (5) Stop Solenoid Guide     |
| (3) Cover          | (6) Hi-idling Body Gasket   |

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Governor Springs and Speed Control Plate (To be continued)

## ■ NOTE

## ● Specific tool (1) :

1.2 mm diameter hard wire with its end hooked, overall length 200 mm (7.87 in.).

The tip of wire is bent like the hook to hang governor springs.

1. Remove the injection pump cover.
2. Remove the speed control plate (5) mounting nuts and bolts.
3. Using the specific tool (1), undo the large governor spring (2) from the fork lever (3).
4. Using the specific tool (1), undo the small governor spring (4) from the fork lever (3).

(1) Specific Tool

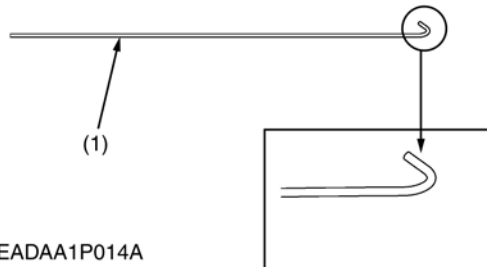
(2) Large Governor Spring

(3) Fork Lever

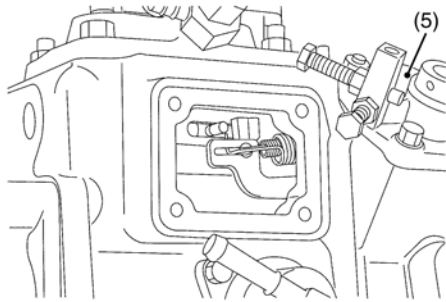
(4) Small Governor Spring

(5) Speed Control Plate

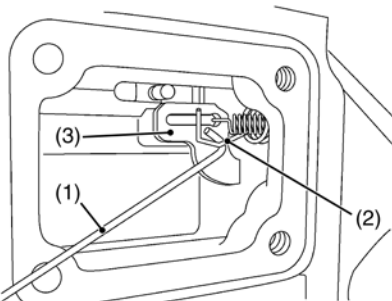
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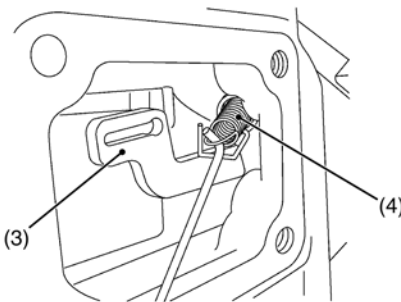
3EEADAA1P014A



3TLABAB1P011C



3EEADAA1P015A



3EEADAA1P016A



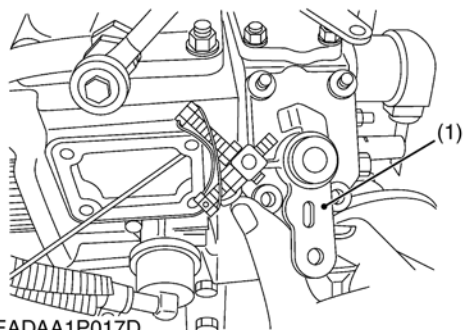
Governor Springs and Speed Control Plate (Continued)

1. Set the speed control lever (1) as the figure.
2. Take out the speed control plate (2) with care not to let the large (3) and small (4) governor springs come off this plate and fall into the gear case.

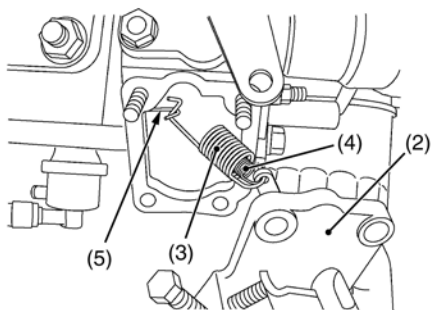
- |                           |                           |
|---------------------------|---------------------------|
| (1) Speed Control Lever   | (4) Small Governor Spring |
| (2) Speed Control Plate   | (5) Specific Tool         |
| (3) Large Governor Spring |                           |

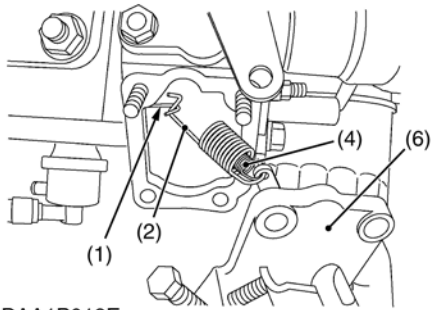
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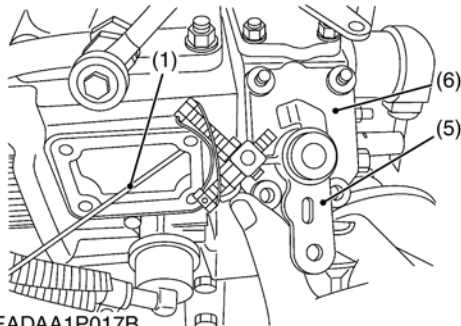


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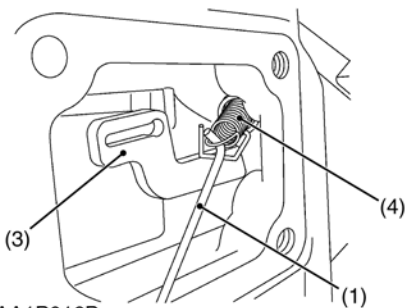




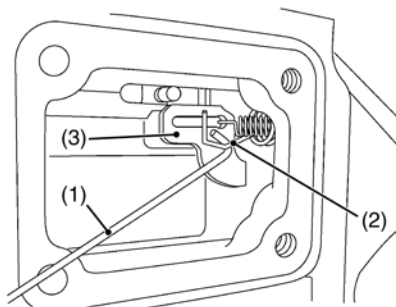
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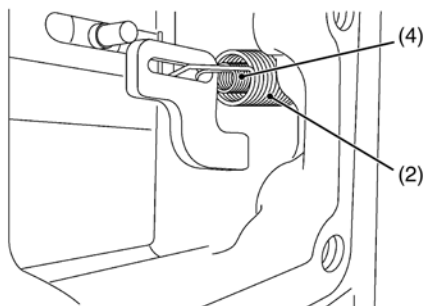
3EEADAA1P017B



3EEADAA1P016B



3EEADAA1P015A



3EEADAA1P019A

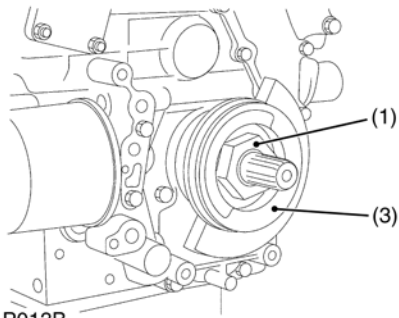
### Governor Springs and Speed Control Plate (Continued)

#### (When reassembling)

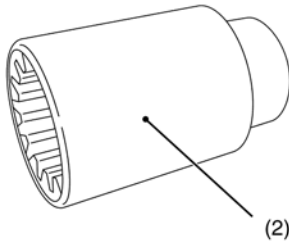
- Hook the small spring (4) first and then the large governor spring (2) on the speed control plate (6).
  - Put the specific tool (1) from the injection pump side to catch the large governor spring (2). Keep this spring slightly extended and place the speed control plate (6) in its specified position.
  - Using the specific tool (1), hook the small governor spring (4) onto the fork lever (3).
  - Using the specific tool (1), hook the large governor spring (2) onto the fork lever (3).
  - Apply and tighten up the two bolts and two nuts on the speed control plate (6).
- **NOTE**
- Be careful not to stretch the small governor spring (4) too long because otherwise it may get deformed permanently.
  - Make sure both the governor springs (2), (4) are tight on the fork lever (3).
  - Check that the speed control lever (5) positions low idle, after assembling governor springs.
  - Check that the speed control lever (5) returns to the high idle position rather than the low idle position, after moving the lever to the maximum speed position.
  - Finally attach the injection pump cover in position.

- |                           |                           |
|---------------------------|---------------------------|
| (1) Specific Tool         | (4) Small Governor Spring |
| (2) Large Governor Spring | (5) Speed Control Lever   |
| (3) Fork Lever            | (6) Speed Control Plate   |

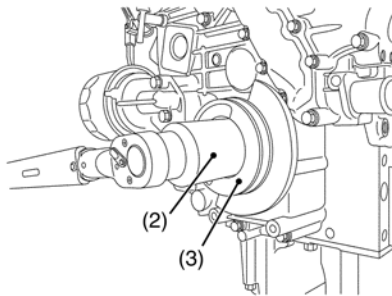
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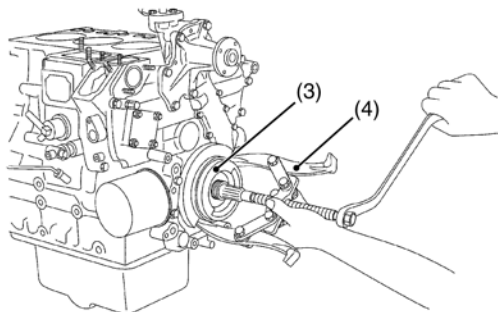
3TLABAB1P013B



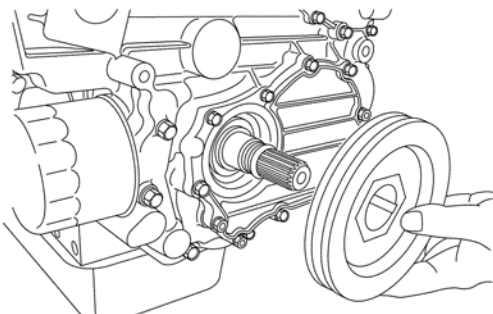
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3EEADAE1P009A



3TLABAB1P015B



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**Fan Drive Pulley**

1. Lock the flywheel not to turn using the flywheel stopper.
2. Remove the fan drive pulley mounting nut (1) using 46 mm deep socket wrench (2).
3. Remove the fan drive pulley (3) with gear puller (4).
4. Remove the feather key.

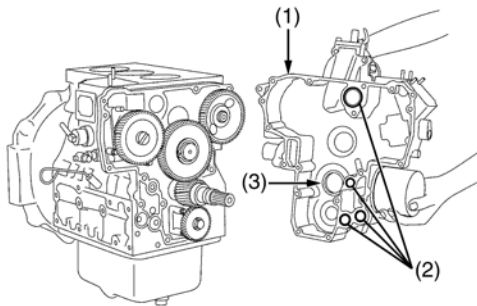
**(When reassembling)**

- Apply grease to the splines of coupling.
- Tighten the fan drive pulley mounting nut to the specified torque.

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
-------------------	-------------------------------	---

- (1) Fan Drive Pulley Mounting Nut      (3) Fan Drive Pulley  
 (2) 46 mm Deep Socket Wrench      (4) Gear Puller

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Gear Case

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

**(When reassembling)**

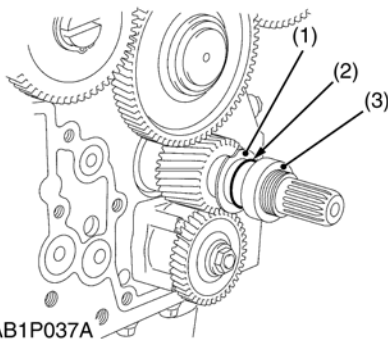
- Apply liquid gasket (Three Bond 1215 or equivalent) to both sides of hour meter gear case gasket.
- Check to see if there are four O-rings (2) inside the gear case (1).
- Apply a thin film of engine oil to the oil seal (3), and install it, noting the lip come off.
- Before installing the gear case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

(1) Gear Case

(3) Oil Seal

(2) O-ring

000006440E



3TMABAB1P037A

Crankshaft Oil Slinger

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

**(When reassembling)**

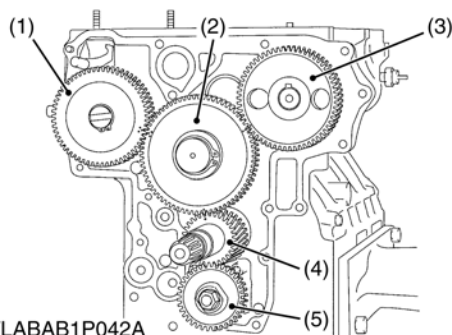
- Insert the crankshaft collar (3) after install the gear case to cylinder body.

(1) Crankshaft Oil Slinger

(3) Crankshaft Collar

(2) O-ring

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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.
  - Idle gear (2) and crank gear (4)
  - Idle gear (2) and camshaft gear (3)
  - Idle gear (2) and injection pump gear (1)

(1) Injection Pump Gear

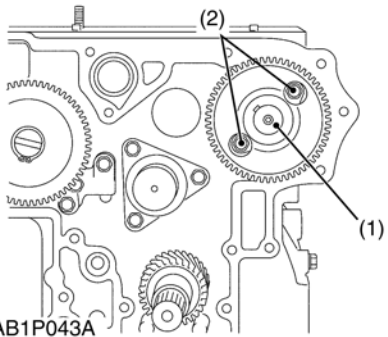
(4) Crank Gear

(2) Idle Gear

(5) Oil Pump Drive Gear

(3) Cam Gear

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**Camshaft**

1. Remove the camshaft set screws (2) 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 screw	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 Screw

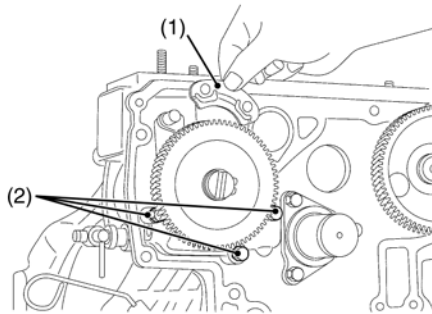
000005385E

**Fuel Camshaft and Fork Lever Assembly**

1. Remove the fuel feed pump.
2. Detach the fuel camshaft stopper (1).
3. Remove the three fork lever holder mounting screws (2).
4. Draw out the fuel camshaft assembly (5), (6) and fork lever assembly (3), (4), (7) at the same time.

**(When reassembling)**

- After installation, check to see that the fork lever 1 (3) and lever 2 (4) are fixed to the fork lever shaft, and that they can turn smoothly in the holder (7).



(1) Fuel Camshaft Stopper

(4) Fork Lever 2

(2) Fork Lever Holder Mounting Screw

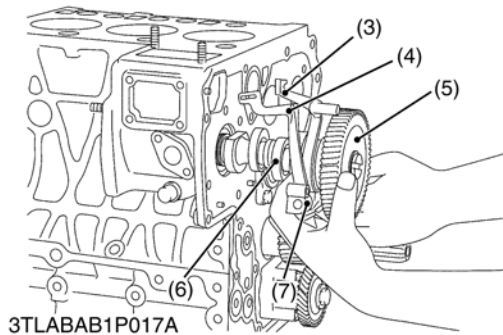
(5) Injection Pump Gear

(3) Fork Lever 1

(6) Fuel Camshaft

(7) Fork Lever Holder

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**Oil Pump**

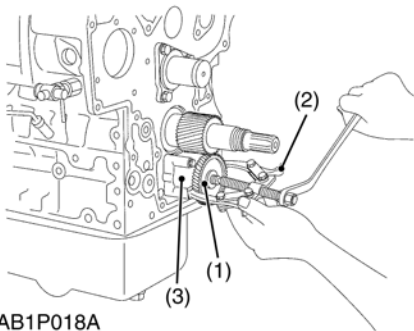
1. Remove the nut.
2. Draw out the oil pump drive gear (1) with gear puller (2).
3. Remove the four oil pump mounting screws. Detach the oil pump (3).

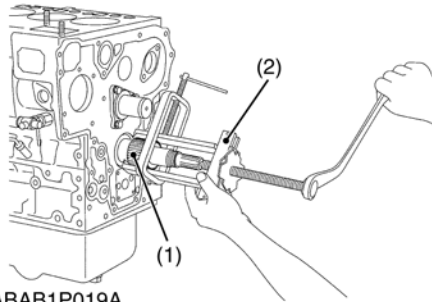
(1) Oil Pump Drive Gear

(3) Oil Pump

(2) Gear Puller

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### Crank Gear

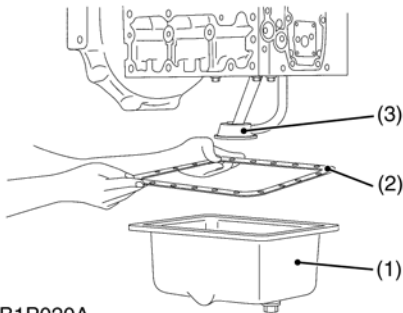
1. Draw out the crank gear (1) with a puller (2).
2. Remove the feather key.

(1) Crank Gear

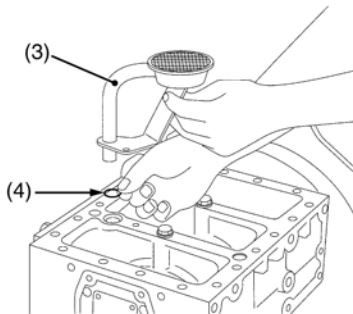
(2) Gear Puller

000005391E

### **(3) Piston and Connecting Rod**



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3TLABAB1P021A

### Oil Pan and Oil Strainer

1. Remove the oil pan mounting screws.
2. Remove the oil pan (1) by lightly tapping the rim of the pan with a wooden hammer.
3. Remove the oil pan gasket (2).
4. Remove the oil strainer (3) and O-ring (4).

#### **(When reassembling)**

- After cleaning the oil strainer (3), check to see that the filter mesh is clean, and install it.
- Visually check the O-ring (4), apply engine oil, and install it.
- Securely fit the O-ring (4) to the oil strainer (3).
- Apply a liquid gasket (Three Bond 1215 or equivalent) to the oil pan side of the oil pan gasket (2).
- To avoid uneven tightening, tighten oil pan mounting screws in diagonal order from the center.

(1) Oil Pan

(3) Oil Strainer

(2) Oil Pan Gasket

(4) O-ring

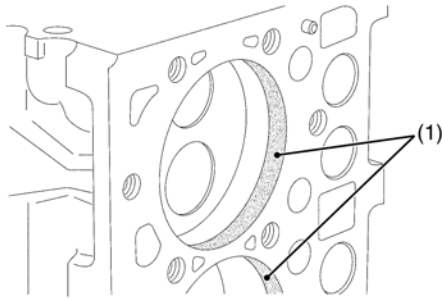
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Pistons (To be continued)

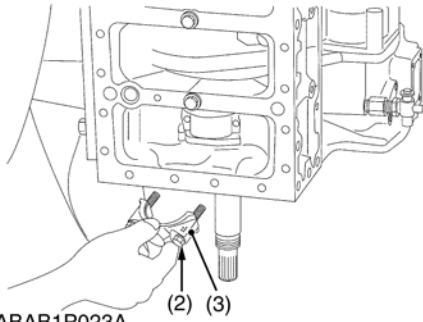
1. Completely clean carbon (1) in the cylinders.
2. Remove the connecting rod cap (3).
3. Turn the flywheel and bring the piston to top dead center.
4. Draw out the piston upward by lightly tapping it from the bottom of the crankcase with the grip of a hammer.
5. Draw out the other piston in the same method as above.

- |                          |   |
|--------------------------|---|
| (1) Carbon               | (4) Connecting Rod                                  |
| (2) Connecting Rod Screw | (5) Molybdenum Disulfide Coating<br>in Piston Skirt |
| (3) Connecting Rod Cap   |   |

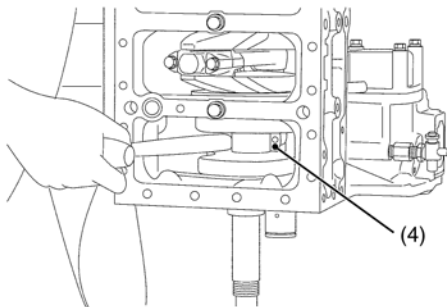
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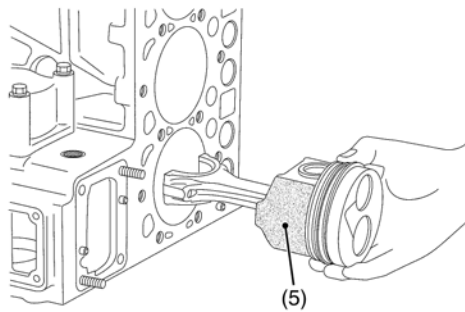
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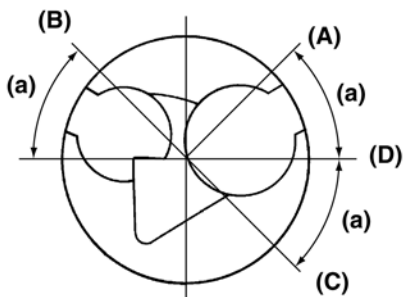
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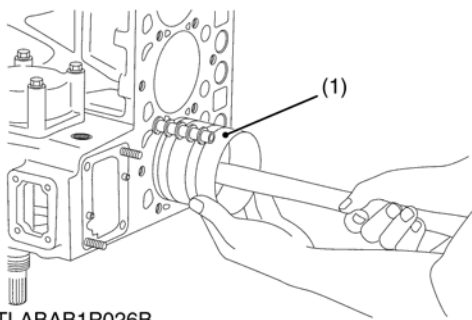
3TLABAB1P024A



3TLABAB1P025A



3TMABAB1P046A



3TLABAB1P026B

Pistons (Continued)

**(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 (1).**
- **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.**

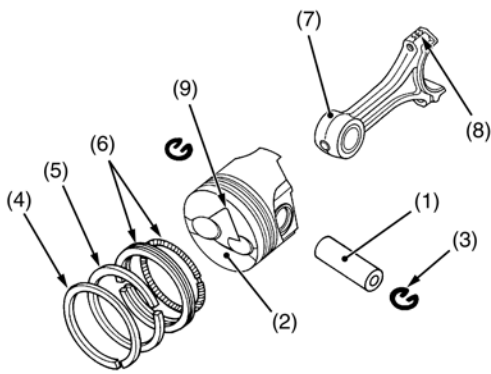
Tightening torque	Connecting rod screw	44.1 to 49.0 N·m
		4.5 to 5.0 kgf·m
		32.5 to 36.2 ft-lbs

(1) Piston Ring Compressor

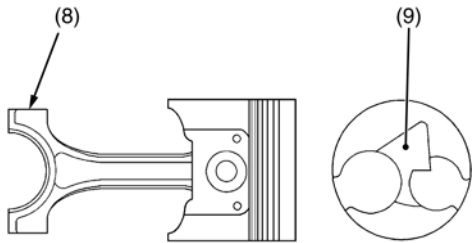
- (A) Top Ring Gap
- (B) Second Ring Gap
- (C) Oil Ring Gap
- (D) Piston Pin Hole
  
- (a) 0.79 rad (45 °)

000007505E

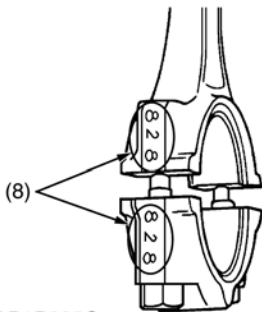




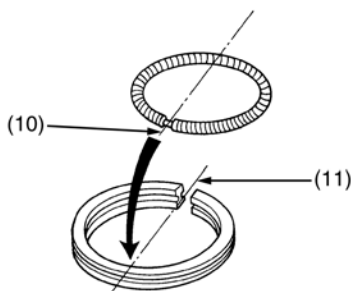
3TMABAB1P047D



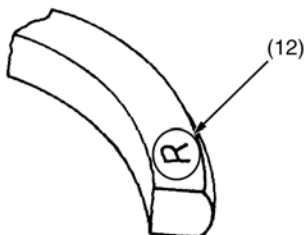
3TAAAAB1P058A



3EEABAB1P095C



3EEABAB1P100A



3EEABAB1P101A

**Piston Ring and Connecting Rod**

1. Remove the piston rings (4), (5), (6) using a piston ring tool (Code No. 07909-32121).
2. Remove the piston pin (1), and separate the connecting rod (7) from the piston (2).

**(When reassembling)**

- When installing the rings, assemble the rings so that the manufacturer's mark (12) near the gap faces the top of the piston (2).
- When installing the oil ring (6) onto the piston (2), 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 piston pin (1), immerse the piston (2) in 80 °C (176 °F) oil for 10 to 15 minutes and insert the piston pin (1) to the piston (2).
- When installing the connecting rod (7) to the piston (2), align the mark (8) on the connecting rod (7) to the fan-shaped concave (9).

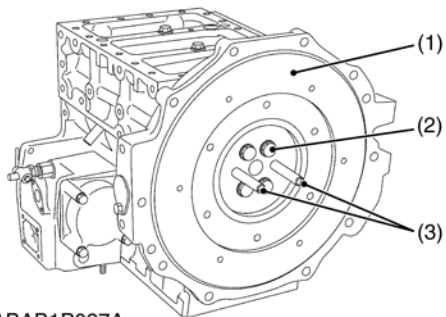
**NOTE**

- **Mark the same number on the connecting rod (7) and the piston (2) so as not to change the combination.**

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

000006447E

### (4) Crankshaft



3TLABAB1P027A

#### Flywheel

1. Fit the stopper to the flywheel (1).
2. At first, remove two pieces of the flywheel screws (2).
3. Insert two pieces of the flywheel guide screws (3) in the holes.
4. Remove the all flywheel screws (2).
5. Remove the flywheel (1) slowly along the flywheel guide screws (3).

#### (When reassembling)

- Insert two pieces of the flywheel guide screws.
- Check to see that there are no metal particles left on the flywheel mounting surfaces.
- Apply engine oil to the threads and the undercut surface of the flywheel bolt and fit the bolt.

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
-------------------	-----------------	--

- (1) Flywheel (3) Flywheel Guide Screw  
(2) Flywheel Screw

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#### Bearing Case Cover

1. Remove the bearing case cover mounting screws. First, remove inside screws (6) and then outside screws (3).
2. Screw two removed screws into the screw hole of bearing case cover (5) to remove it.

#### ■ IMPORTANT

- **The length of inside screws (6) and outside screws (3) are different. Do not take a mistake using inside screws and outside screws.**

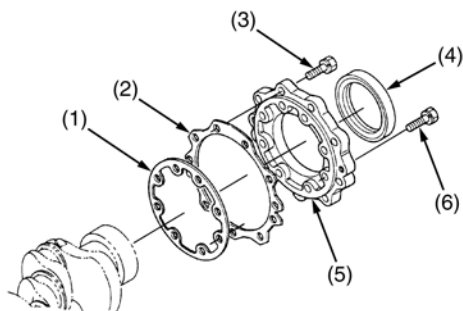
#### (When reassembling)

- Fit the bearing case gasket (1) and the bearing case cover gasket (2) with correct directions.
- Install the bearing case cover (5) to position the casting mark "UP" on it upward.
- Apply engine oil to the oil seal lip and take care that it is not rolled when installing.
- Tighten the bearing case cover mounting screws with even force on the diagonal line.

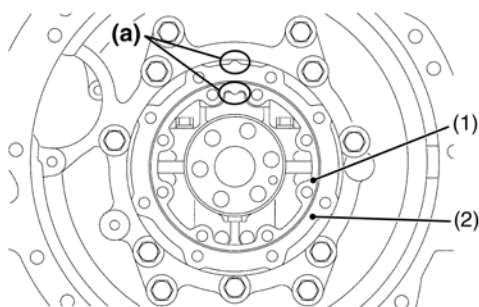
Tightening torque	Bearing case cover mounting screw	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft-lbs
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- (1) Bearing Case Gasket (5) Bearing Case Cover  
(2) Bearing Case Cover Gasket (6) Bearing Case Cover Mounting Screw  
(3) Bearing Case Cover Mounting Screw  
(4) Oil Seal (a) Upside

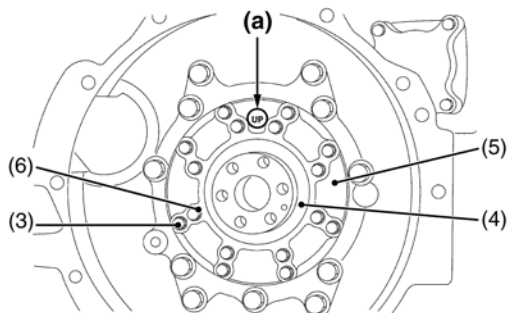
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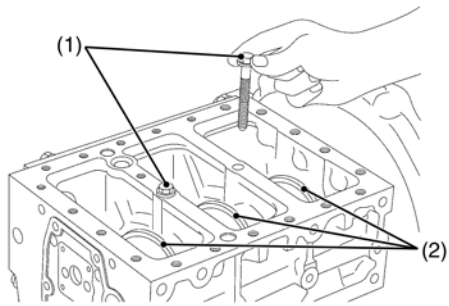
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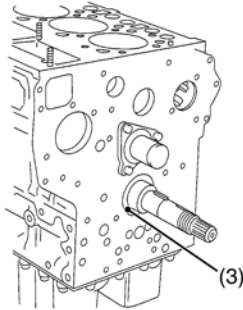
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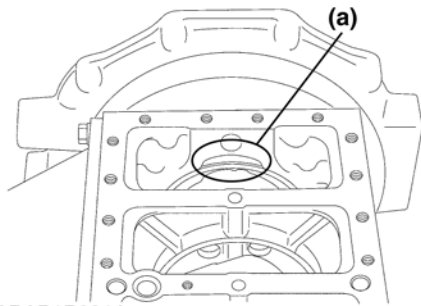


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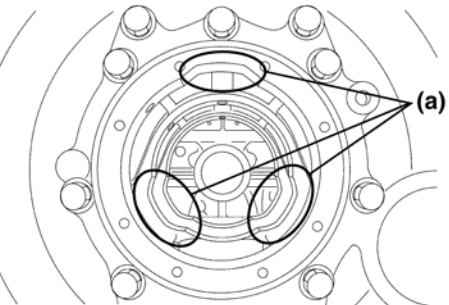
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[A]



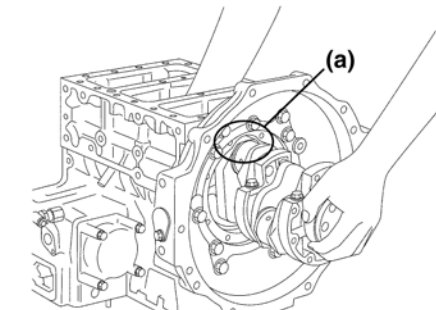
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[A]



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[A]



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Crankshaft

■ **NOTE**

- Before disassembling, check the side clearance of crankshaft. Also check it during reassembling.

**For D1503-M, D1703-M**

1. Remove the main bearing case screw 2 (1).
2. Pull out the crankshaft assembly, taking care not to damage the crankshaft bearing 1 (3).

**For D1803-M**

1. Remove the main bearing case screw 2 (1).
2. Turn the crankshaft to set the crank pin of the third cylinder to the bottom dead center. Then draw out the crankshaft until the crank pin of the second cylinder comes to the center of the third cylinder.
3. Turn the crankshaft by 2.09 rad (120°) counterclockwise to set the crank pin of the second cylinder to the bottom dead center. Draw out the crankshaft until the crank pin of the first cylinder comes to the center of the third cylinder.
4. Repeat the above steps to draw out all the crankshaft.

**(When reassembling)**

■ **IMPORTANT**

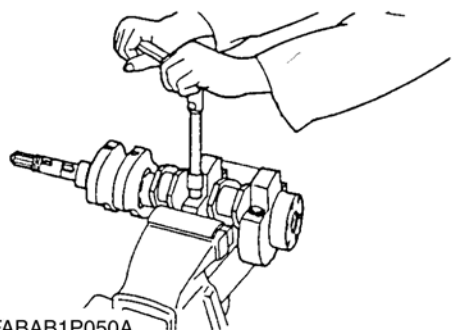
- Install the crankshaft sub assembly, aligning the screw hole of main bearing case 2 (2) with the screw hole of cylinder block.
  - When tightening the main bearing case screw 2 (1), apply oil to the screw and screw by hand before tightening the specific torque.
- If not smooth to screw by hand, align the screw holes between the cylinder block and the main bearing case.**

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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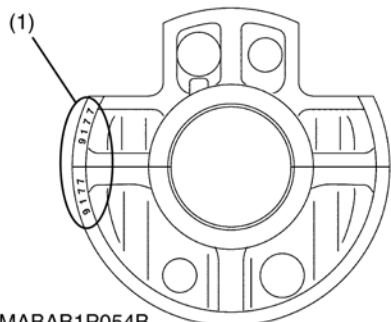
- (1) Main Bearing Case Screw 2
- (2) Main Bearing Case 2
- (3) Crankshaft bearing 1

- (a) Cut place for removing and installing the crankshaft
- [A] D1803-M

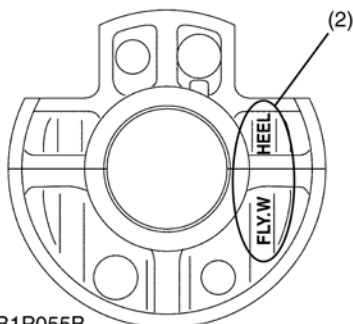
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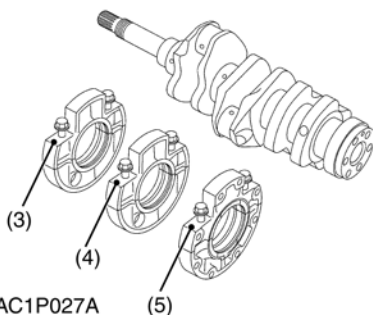
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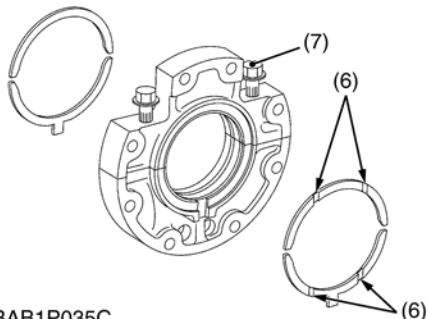
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3TMABAB1P055B



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Main Bearing Case Assembly

1. Remove the two main bearing case screws 1 (7), and remove the main bearing case assembly being careful with thrust bearing and crankshaft bearing.
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 (6) facing outward.
- Confirm that the main bearing case moves smoothly after tightening the main bearing case screw 1 (7) 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
-------------------	---------------------------	---

- (1) Alignment Number
- (2) Alignment Mark
- (3) A
- (4) B
- (5) No Mark
- (6) Oil Groove
- (7) Main Bearing Case Screw 1

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## (5) Thermostat and Water Pump

### 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.

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#### Thermostat Assembly

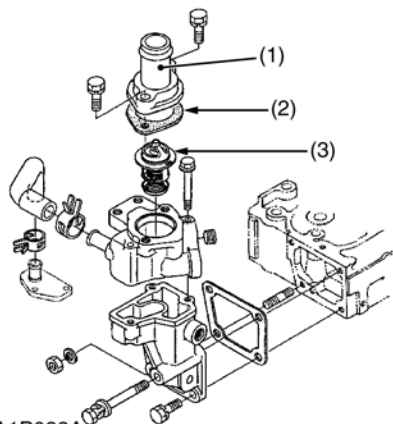
1. Remove the thermostat cover mounting screws, and remove the thermostat cover (1).
2. Remove the thermostat assembly (3).

#### **(When reassembling)**

- Apply a liquid gasket (Three Bond 1215 or equivalent) only at the thermostat cover side of the thermostat cover gasket (2).

- |                             |                         |
|-----------------------------|-------------------------|
| (1) Thermostat Cover        | (3) Thermostat Assembly |
| (2) Thermostat Cover Gasket |                         |

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#### Water Pump Assembly

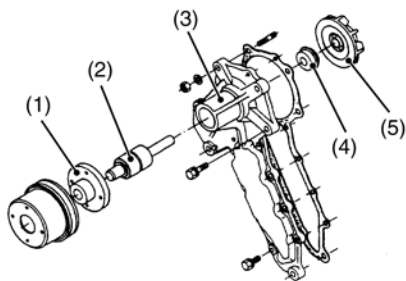
1. Loosen the alternator mounting bolts, and remove the fan belt.
2. Remove the fan and fan pulley.
3. Remove the water pump assembly from the gear case cover.
4. Remove the water pump flange (1).
5. Press out the water pump shaft (2) with the impeller (5) on it.
6. Remove the impeller from the water pump shaft (2).
7. Remove the mechanical seal (4).

#### **(When reassembling)**

- Apply a liquid gasket (Three Bond 1215 or equivalent) to the both sides of gasket.
- Replace the mechanical seal with new one.

- |                       |                     |
|-----------------------|---------------------|
| (1) Water Pump Flange | (4) Mechanical Seal |
| (2) Water Pump Shaft  | (5) Impeller        |
| (3) Water Pump Body   |                     |

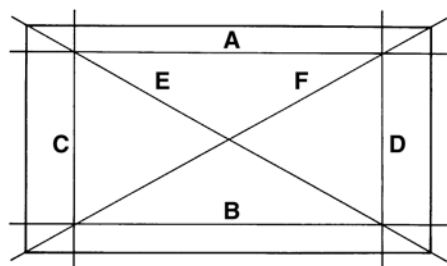
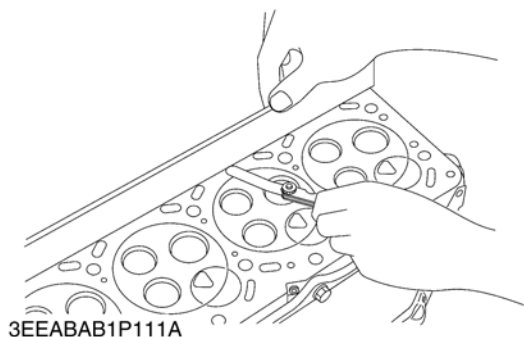
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## [4] SERVICING

### (1) 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 (A), (B), (C) and (D) and two diagonal (E) and (F) as shown in the figure.

Measure the clearance with a feeler gauge.

3. If the measurement exceeds the allowable limit, correct it with a surface grinder.

#### ■ IMPORTANT

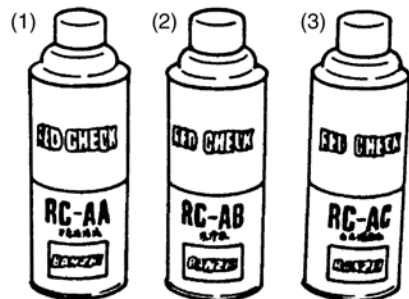
- Do not place the straightedge on the combustion chamber.
- Be sure to check the valve recessing after correcting.

Cylinder head surface flatness	Allowable limit	0.05 mm 0.0020 in.
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#### Cylinder Head Flaw

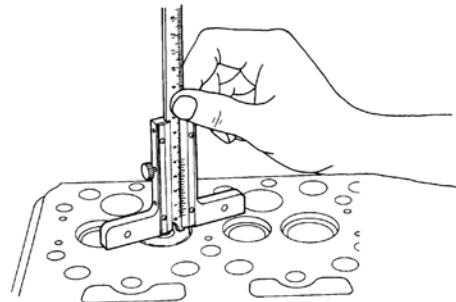
1. Prepare an air spray red check (Code No. 07909-31371).
2. Clean the surface of the cylinder head with the detergent (2).
3. Spray the cylinder head surface with the red permeative liquid (1). Leave it five to ten minutes after spraying.
4. Wash away the red permeative liquid on the cylinder head surface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



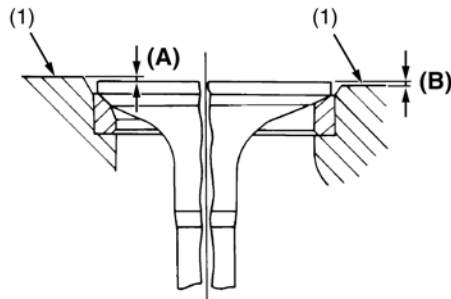
- (1) Red Permeative Liquid  
(2) Detergent

- (3) White Developer

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**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, replace the cylinder head.

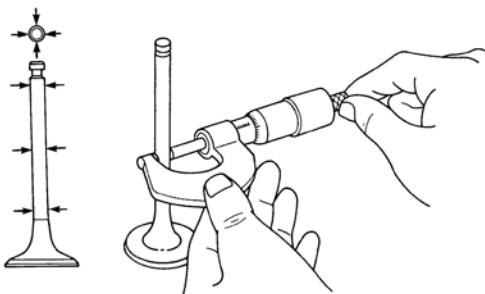
Valve recessing	Factory spec.	0.05 (protrusion) to 0.15 (recessing) mm 0.0020 (protrusion) to 0.0059 (recessing) in.
	Allowable limit	0.40 (recessing) mm 0.0157 (recessing) in.

(1) Cylinder Head Surface

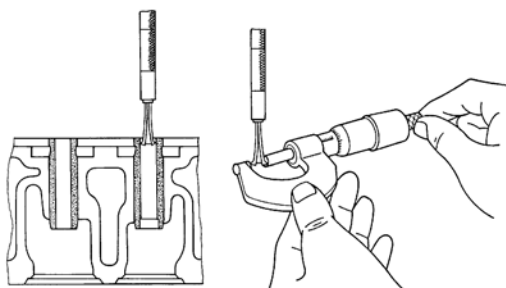
(A) Recessing

(B) Protrusion

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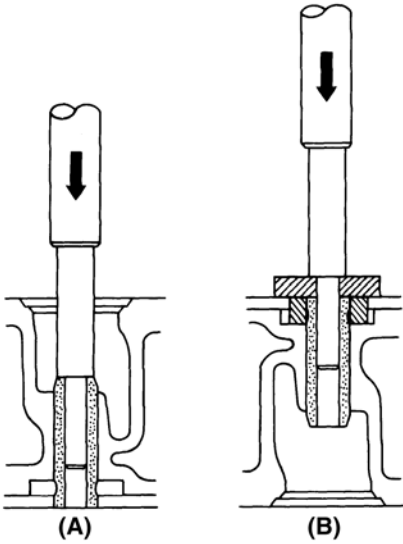
**Clearance between Valve Stem and Valve Guide**

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 valve guide	Factory spec.	0.040 to 0.070 mm 0.00157 to 0.00276 in.
	Allowable limit	0.10 mm 0.0039 in.

Valve stem O.D.	Factory spec.	7.960 to 7.975 mm 0.31339 to 0.31398 in.
Valve guide I.D.	Factory spec.	8.015 to 8.030 mm 0.31555 to 0.31614 in.

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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.
---------------------------------------	---------------	---

**■ IMPORTANT**

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

(A) When Removing

(B) When Installing

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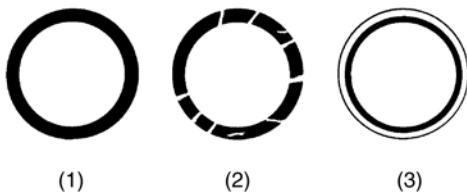
Valve Seating

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 valve, replace the valve or correct the contact of valve seating

- (1) Correct
- (2) Incorrect

- (3) Incorrect

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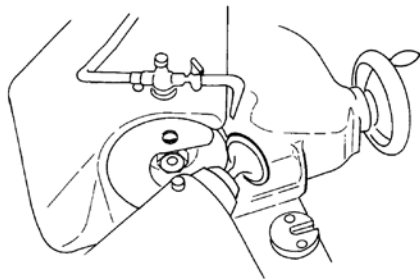
(1)

(2)

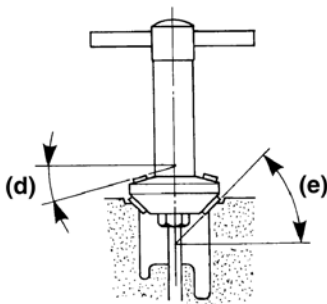
(3)

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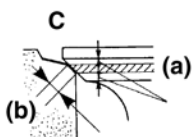
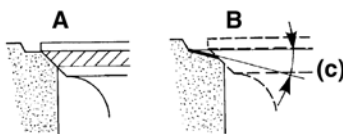




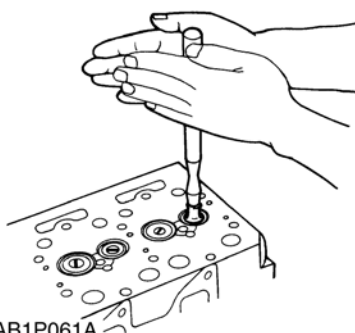
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### Correcting Valve and Valve Seat

#### ■ 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 Contact      |
| (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 °) |                        |

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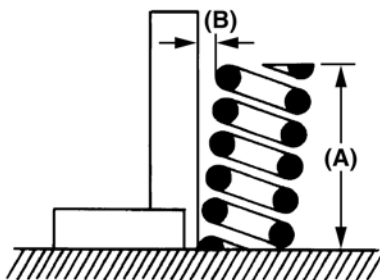
### Valve Lapping

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.

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**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)**. If the measurement exceeds the allowable limit, replace it.
4. Check the entire surface of the valve spring for scratches. If there is any defect, replace it.

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

Tilt <b>(B)</b>	Allowable limit	1.0 mm 0.039 in.
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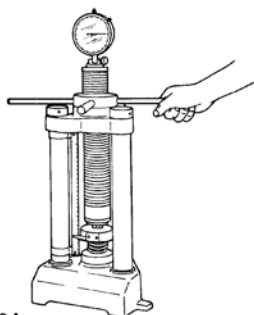
**(A) Free Length**

**(B) Tilt**

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**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.



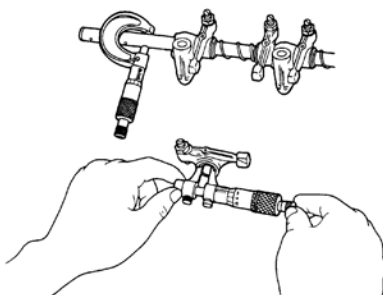
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Setting load / Setting length	Factory spec.	117.6 N / 35.0 mm 12.0 kgf / 35.0 mm 26.4 lbs / 1.3780 in.
	Allowable limit	100 N / 35.0 mm 10.2 kgf / 35.0 mm 22.5 lbs / 1.3780 in.

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**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.

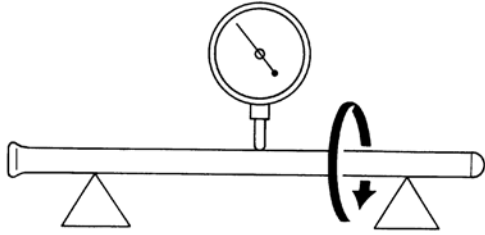


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Oil clearance between rocker arm and rocker arm shaft	Factory spec.	0.016 to 0.045 mm 0.00063 to 0.00177 in.
	Allowable limit	0.10 mm 0.0039 in.

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.

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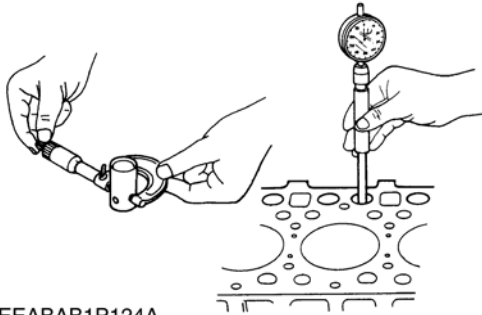
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Push Rod Alignment

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

Push rod alignment	Allowable limit	0.25 mm 0.0098 in.
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Oil Clearance between Tappet and Tappet Guide Bore

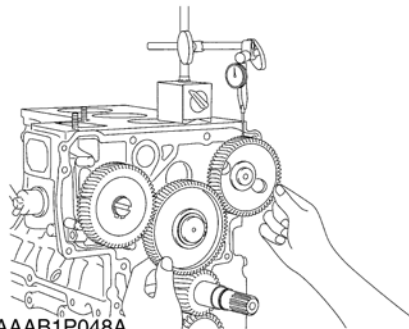
1. Measure the tappet O.D. with an outside micrometer.
2. Measure the I.D. of the tappet guide bore with a cylinder gauge, and calculate the oil clearance.
3. If the oil clearance exceeds the allowable limit or the tappet is damaged, replace the tappet.

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.
Tappet guide bore I.D.	Factory spec.	24.000 to 24.021 mm 0.94488 to 0.94571 in.

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## (2) Timing Gears, Camshaft and Fuel Camshaft



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### 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 not 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.

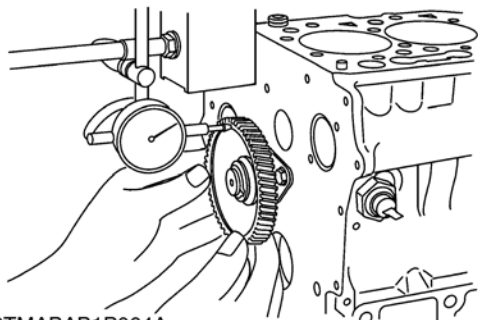
Backlash between idle gear and injection pump gear	Factory spec.	0.0415 to 0.1154 mm 0.00163 to 0.00454 in.
	Allowable limit	0.15 mm 0.0059 in.

Backlash between crank gear 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.

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### 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.



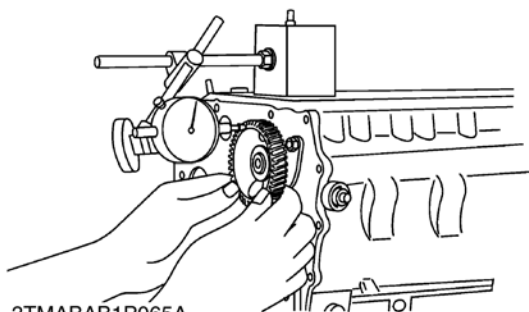
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Idle gear side clearance	Factory spec.	0.12 to 0.48 mm 0.0047 to 0.0189 in.
	Allowable limit	0.90 mm 0.0354 in.

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### Camshaft Side Clearance

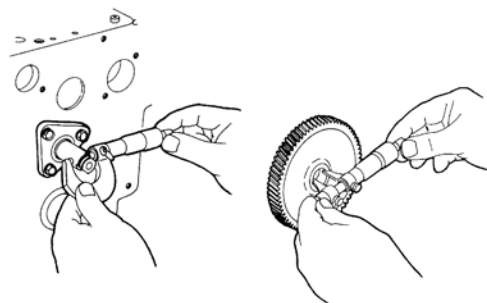
1. Set a dial indicator with its tip on the cam gear.
2. Measure the side clearance by moving the cam gear to the front and rear.
3. If the measurement exceeds the allowable limit, replace the camshaft stopper.



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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.

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**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.
4. If it still exceeds the allowable limit, replace the idle gear shaft.

Oil clearance between idle gear shaft and idle gear bushing	Factory spec.	0.025 to 0.066 mm 0.00098 to 0.00260 in.
	Allowable limit	0.10 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.

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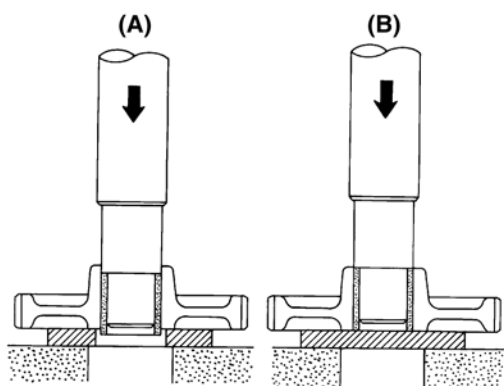
**Replacing Idle Gear Bushing**

**(When removing)**

1. Press out the used idle gear bushing using an idle gear bushing replacing tool.

**(When installing)**

1. Clean a new idle gear bushing and idle gear bore, and apply engine oil to them.
2. Press in a new bushing using an idle gear bushing replacing tool, until it is flush with the end of the idle gear.



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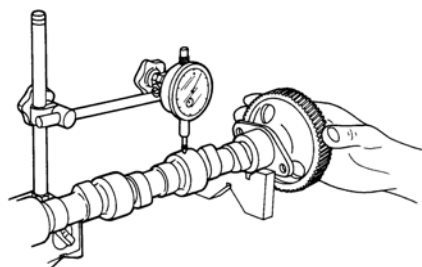
(A) When removing

(B) When installing

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**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.



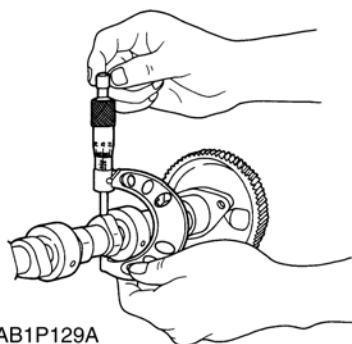
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Camshaft alignment	Allowable limit	0.01 mm 0.0004 in.
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**Cam Height**

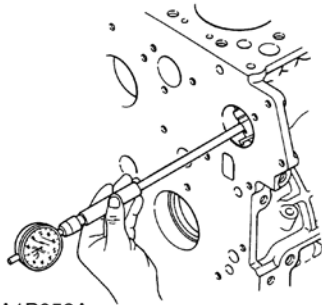
1. Measure the height of the cam at its highest point with an outside micrometer.
2. If the measurement is less than the allowable limit, replace the camshaft.



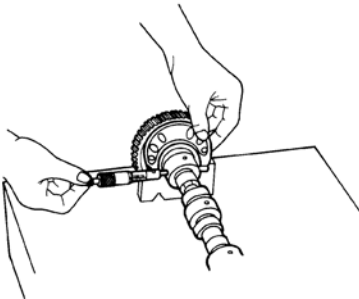
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Cam height of intake and exhaust	Factory spec.	33.90 mm 1.3346 in.
	Allowable limit	33.85 mm 1.3327 in.

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Oil Clearance of Camshaft Journal

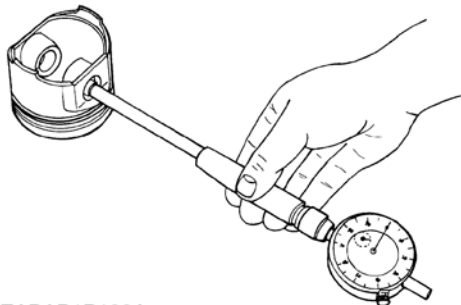
1. Measure the camshaft journal O.D. with an outside micrometer.
2. Measure the cylinder block bore I.D. for camshaft with a cylinder gauge, and calculate the oil clearance.
3. If the oil clearance exceeds the allowable limit, replace the camshaft.

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.

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**(3) Piston and Connecting Rod**



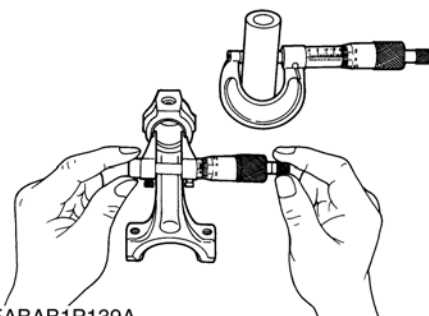
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Piston Pin Bore I.D.

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.

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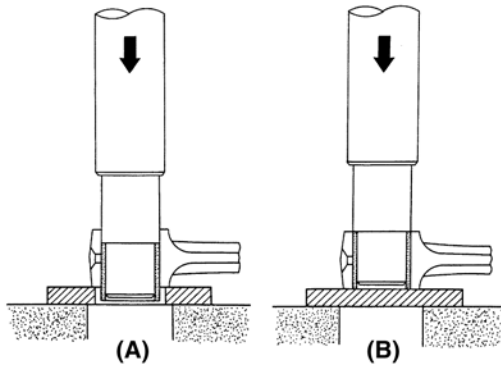
Oil Clearance between Piston Pin and Small End Bushing

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.
Small end bushing I.D.	Factory spec.	25.025 to 25.040 mm 0.98523 to 0.98582 in.

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Replacing Connecting Rod Small End Bushing

**(When removing)**

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

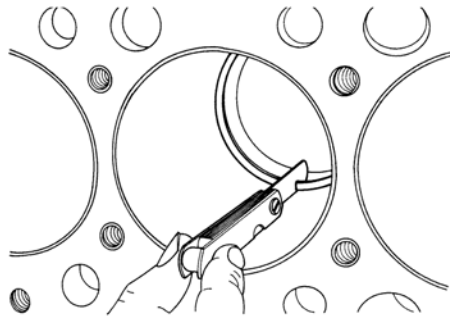
**(When installing)**

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.

(A) When removing

(B) When installing

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Piston Ring Gap

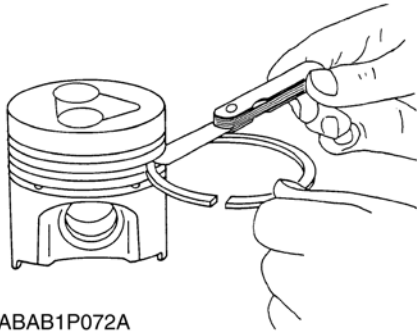
1. Insert the piston ring into the lower part of the liner (the least worn out part) with the piston.
2. Measure the ring gap with a feeler gauge.
3. If the gap exceeds the allowable limit, replace the ring.

Top ring	Factory spec.	D1503-M	0.20 to 0.35 mm 0.0079 to 0.0138 in.
		D1703-M D1803-M	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.
		0.40 to 0.55 mm 0.0157 to 0.0217 in.
	Allowable limit	

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

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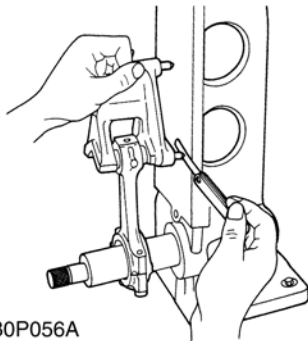
Clearance between Piston Ring and Groove

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 the 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	Factory spec.	0.093 to 0.128 mm 0.0037 to 0.0050 in.
	Allowable limit	0.2 mm 0.0079 in.

Oil ring	Factory spec.	0.020 to 0.060 mm 0.0008 to 0.0021 in.
	Allowable limit	0.15 mm 0.0059 in.

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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.**

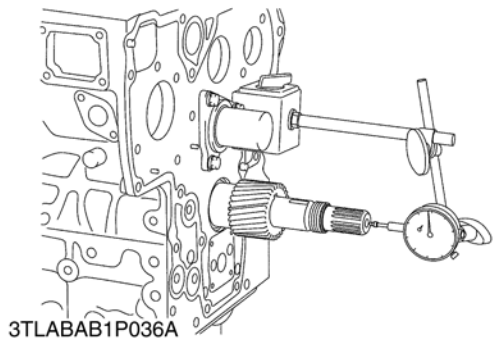
1. Install the piston pin into the connecting rod.
2. Install the connecting rod on the connecting rod alignment tool.
3. Put a gauge over the piston pin, and move it against the face plate.
4. If the gauge does not fit squarely against the face plate, measure the space between the pin of the gauge and 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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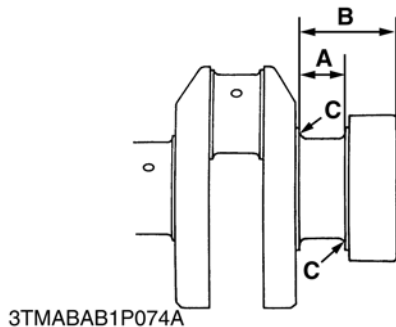
### (4) Crankshaft



#### 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 0.31 mm 0.0059 to 0.0122 in.
	Allowable limit	0.5 mm 0.0197 in.



#### (Reference)

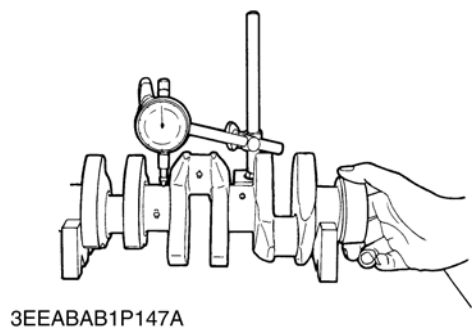
- Oversize dimensions of crankshaft journal

Oversize	0.2 mm 0.008 in.	0.4 mm 0.016 in.
Dimension A	26.20 to 26.25 mm 1.0315 to 1.0335 in.	26.40 to 26.45 mm 1.0394 to 1.0413 in.
Dimension 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.
Dimension 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 ▽▽▽▽		

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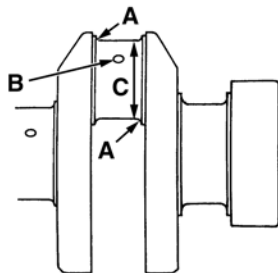
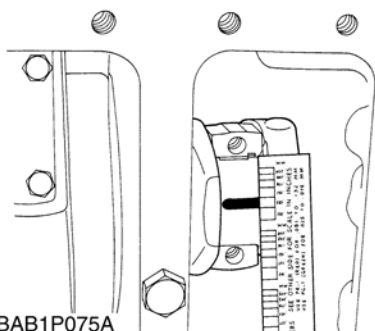
#### Crankshaft Alignment

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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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 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.**

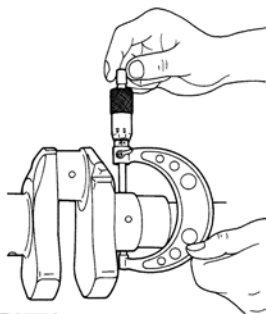
Oil clearance between crankpin and crankpin bearing	Factory spec.	0.025 to 0.087 mm 0.00098 to 0.00343 in.
	Allowable limit	0.2 mm 0.0079 in.
Crankpin O.D.	Factory spec.	46.959 to 46.975 mm 1.84878 to 1.84941 in.
Crankpin bearing I.D.	Factory spec.	47.000 to 47.046 mm 1.85039 to 1.85220 in.

**(Reference)**

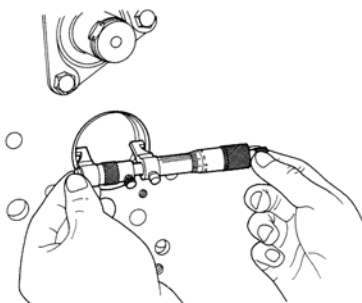
- Undersize dimensions of crankpin

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

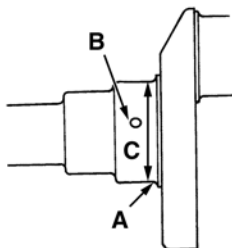
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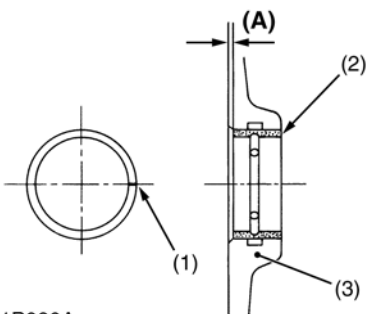
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Oil Clearance between Crankshaft Journal and Crankshaft Bearing 1

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.	59.921 to 59.940 mm 2.35909 to 2.35984 in.
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Crankshaft bearing 1 I.D.	Factory spec.	59.980 to 60.039 mm 2.36142 to 2.36374 in.
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**(Reference)**

- Undersize dimensions of crankshaft journal

Oversize	0.2 mm 0.008 in.	0.4 mm 0.016 in.
Dimension A	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
Dimension 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
Dimension C	59.721 to 59.740 mm dia. 2.35122 to 2.35197 in. dia.	59.521 to 59.540 mm dia. 2.34335 to 2.34409 in. dia.

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

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Replacing Crankshaft Bearing 1

**(When removing)**

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

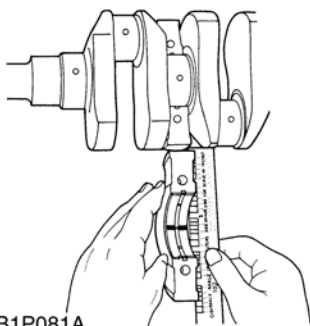
**(When installing)**

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.

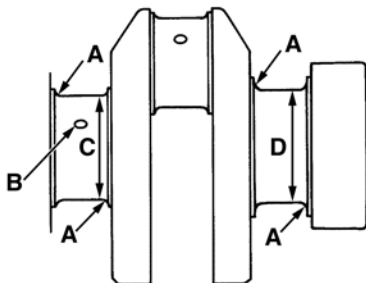
Dimension (A)	Factory spec.	4.2 to 4.5 mm 0.1654 to 0.1772 in.
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- (1) Seam
- (2) Crankshaft Bearing 1
- (3) Cylinder Block
- (A) Dimension**

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Oil Clearance between Crankshaft Journal and Crankshaft Bearing 2

1. Put a strip of plastigage on the centre 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.	59.921 to 59.940 mm 2.35909 to 2.35984 in.
Crankshaft bearing 2 I.D.	Factory spec.	59.980 to 60.025 mm 2.36142 to 2.36319 in.

**(Reference)**

- Undersize dimensions of crankshaft journal

Undersize	0.2 mm 0.008 in.	0.4 mm 0.016 in.
Dimension A	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
Dimension 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
Dimension C, D	59.721 to 59.740 mm dia. 2.35122 to 2.35197 in. dia.	59.521 to 59.540 mm dia. 2.34335 to 2.34409 in. dia.
(0.8-S) The crankshaft journal must be fine-finished to higher than ▽▽▽▽		

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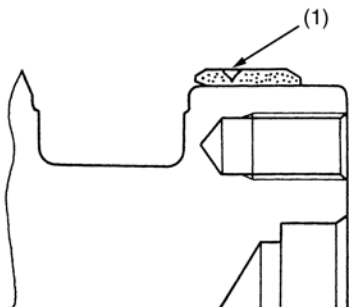
Crankshaft Sleeve Wear

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.

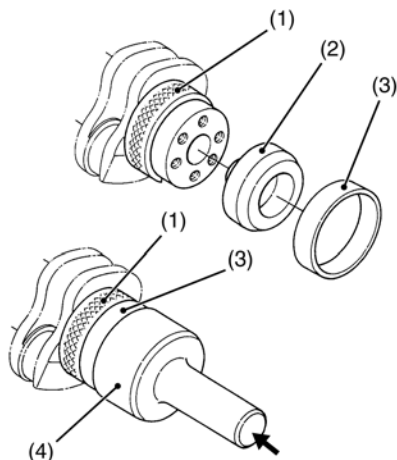
Wear of sleeve	Allowable limit	0.1 mm 0.0039 in.
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(1) Crankshaft Sleeve

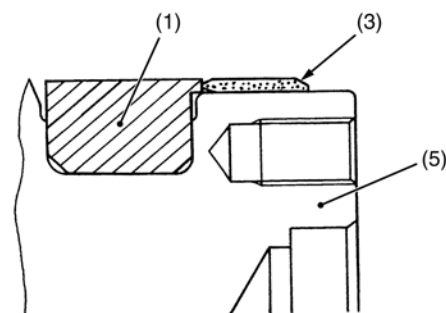
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Replacing Crankshaft Sleeve

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 to 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).

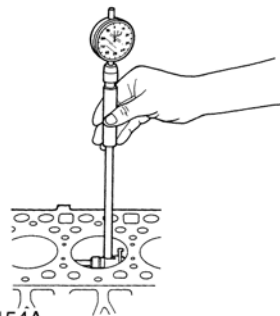
■ **NOTE**

● **Mount the sleeve with its largely chamfered surface facing outward.**

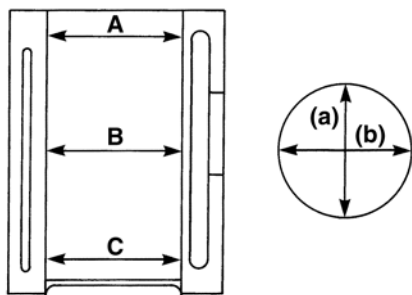
- |                       |                                  |
|-----------------------|----------------------------------|
| (1) Stopper           | (4) Auxiliary Socket for Pushing |
| (2) Sleeve Guide      | (5) Crankshaft                   |
| (3) Crankshaft Sleeve |                                  |

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**(5) Cylinder**



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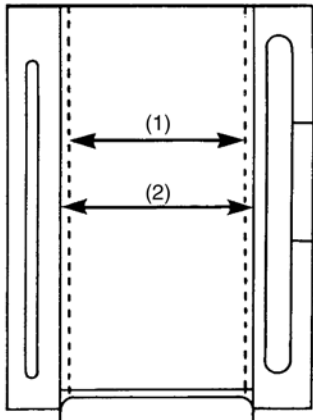
Cylinder Wear

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

Cylinder I.D.	Factory spec.	D1503-M	83.000 to 83.022 mm 3.26772 to 3.26858 in.
		D1703-M D1803-M	87.000 to 87.022 mm 3.42519 to 3.42606 in.
Maximum wear	Allowable limit	D1503-M	+0.15 mm +0.0059 in.
		D1703-M D1803-M	+0.15 mm +0.0059 in.

- |                           |                                       |
|---------------------------|---------------------------------------|
| <b>A : Top</b>            | <b>(a) Right-angled to Piston Pin</b> |
| <b>B : Middle</b>         | <b>(b) Piston Pin Direction</b>       |
| <b>C : Bottom (Skirt)</b> |                                       |

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**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.	D1503-M	83.250 to 83.272 mm 3.27756 to 3.27843 in.
		D1703-M	87.250 to 87.272 mm
		D1803-M	3.43503 to 3.43590 in.
Maximum wear	Allowable limit	D1503-M	+0.15 mm +0.0059 in.
		D1703-M	+0.15 mm
		D1803-M	+0.0059 in.
Finishing	Horn to 2.2 to 3.0 μm Rmax. ▽▽▽ (0.00087 to 0.00118 in. Rmax.)		

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

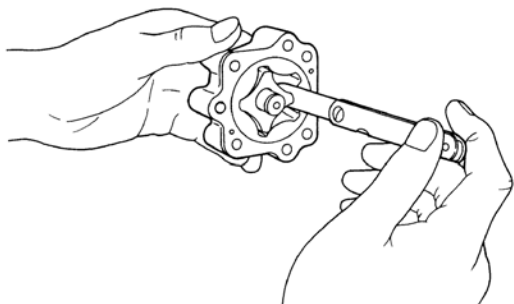
**NOTE**

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

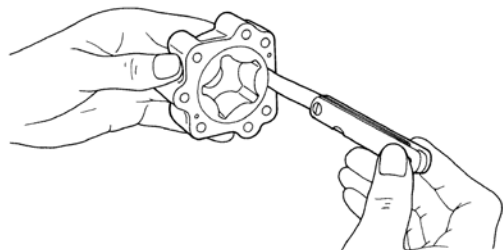
- (1) Cylinder I.D. (Before Correction)                      (2) Oversize Cylinder I.D.

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**(6) Oil Pump**



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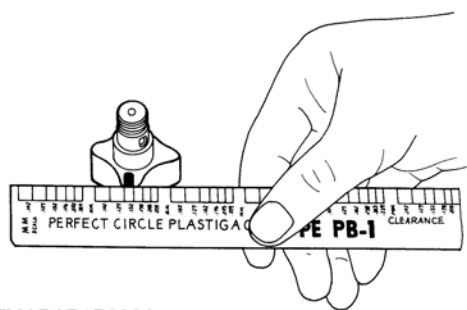
**Rotor Lobe Clearance**

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.
	Allowable limit	0.2 mm 0.0079 in.

Clearance between outer rotor and pump body	Factory spec.	0.11 to 0.19 mm 0.0043 to 0.0075 in.
	Allowable limit	0.25 mm 0.0098 in.

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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 the 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.
	Allowable limit	0.2 mm 0.0079 in.

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# **2 CLUTCH**

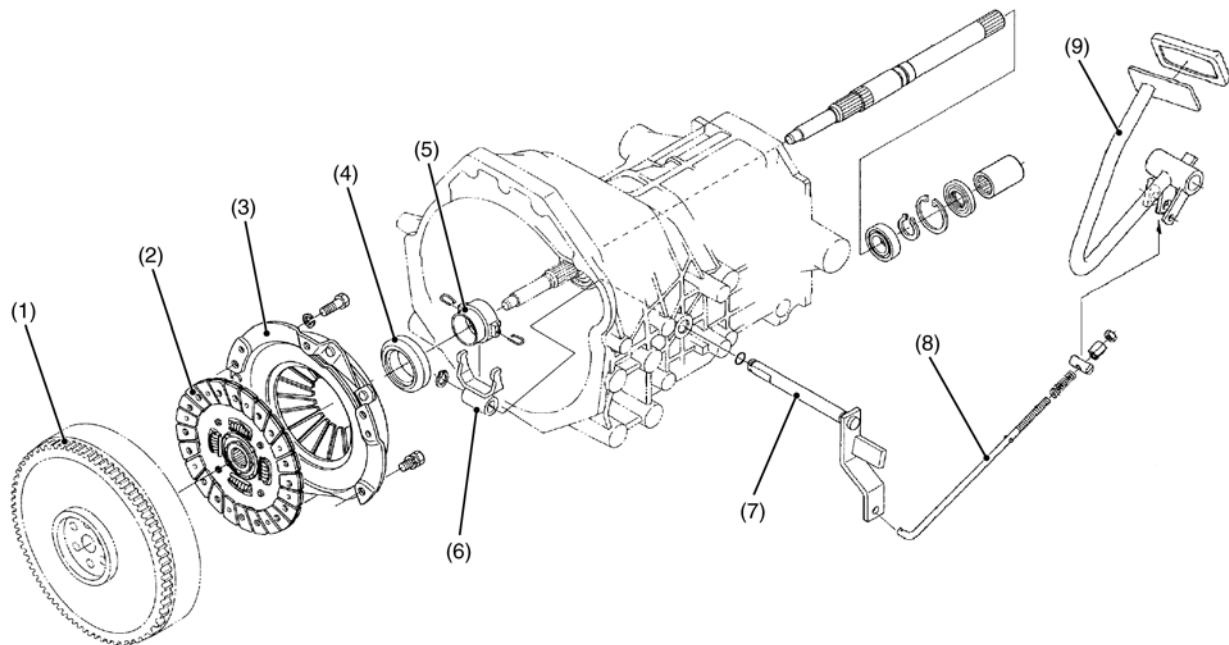


# CONTENTS

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1. LINKAGE MECHANISM .....	2-M1
----------------------------	------

# 1. LINKAGE MECHANISM



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- |                             |                     |                  |                  |
|-----------------------------|---------------------|------------------|------------------|
| (1) Flywheel                | (4) Release Bearing | (6) Release Fork | (8) Clutch Rod   |
| (2) Clutch Disc             | (5) Release Hub     | (7) Clutch Lever | (9) Clutch Pedal |
| (3) Pressure Plate Assembly |                     |                  |                  |

The dry single type clutch is adopted for this tractor.

The clutch is located between the engine and transmission, and is operated by stepping on the clutch pedal. When the clutch pedal is not depressed, the clutch is engaged and power from the engine is transmitted to the transmission.

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4. CHECKING, DISASSEMBLING AND SERVICING .....	2-S4
[1] CHECKING AND ADJUSTING .....	2-S4
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[4] SERVICING .....	2-S6

# 1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
<b>Clutch Drags</b>	● Clutch pedal free travel excessive	Adjust	2-S5
	● Clutch disc boss spline sticking or rusted	Replace or remove rust	2-S6
	● Dust on clutch disc generated from clutch disc facing	Remove rust	—
	● Release fork broken	Replace	2-S6
	● Clutch disc or pressure plate warped	Replace	2-S7
<b>Clutch Slips</b>	● Clutch pedal free travel to small	Adjust	2-S5
	● Clutch disc excessively worn	Replace	2-S6
	● Grease or oil on clutch disc facing	Replace	2-S6
	● Clutch disc or pressure plate warped	Replace	2-S7
	● Diaphragm spring weaken or broken	Replace	2-S7
<b>Chattering</b>	● Grease or oil on clutch disc facing	Replace	2-S6
	● Clutch disc or pressure plate warped	Replace	2-S7
	● Clutch disc boss spline worn or rusted	Replace or remove rust	2-S6
	● Main shaft bent	Replace	—
	● Pressure plate or flywheel face cracked or scored	Replace	2-S7
	● Clutch disc boss spline and main shaft spline worn	Replace	2-S6
	● Diaphragm spring strength uneven or diaphragm spring broken	Replace	2-S7
<b>Rattle During Running</b>	● Clutch disc boss spline worn	Replace	2-S6
	● Release bearing worn or sticking	Replace	2-S7
	● Pilot bearing worn or sticking	Replace	—
<b>Clutch Squeaks</b>	● Release bearing sticking or dry	Replace	2-S7
	● Pilot bearing worn or sticking	Replace	—
	● Clutch disc excessively worn	Replace	2-S6
<b>Vibration</b>	● Main shaft bent	Replace	—
	● Clutch disc rivet worn or broken	Replace	2-S6
	● Clutch parts broken	Replace	2-S5

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## 2. SERVICING SPECIFICATION

Item		Factory Specification	Allowable Limit
Clutch Pedal	Free Travel on Clutch Pedal	20 to 30 mm 0.78 to 1.18 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.

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### 3. TIGHTENING TORQUES

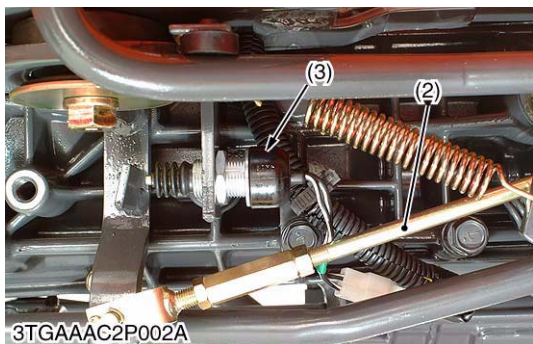
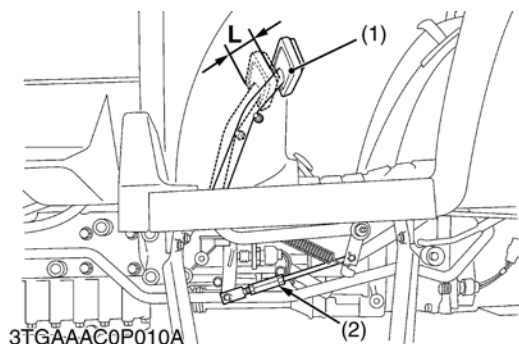
Tightening torques of screws, bolts and nuts on the table below are especially specified.  
(For general use screws, bolts and nuts : See page G-9.)

<b>Item</b>	<b>N·m</b>	<b>kgf·m</b>	<b>ft-lbs</b>
Clutch mounting screw	23.5 to 27.5	2.4 to 2.8	17.4 to 20.2

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

#### ■ IMPORTANT

- After adjustment, be sure to check the operation of the safety switch (3). The engine should not start if the clutch pedal is not fully depressed. Refer to "Safety Switches" (page 9-S16) in ELECTRICAL SYSTEM section for the safety switch.

Clutch pedal free travel "L" on top of clutch pedal	Factory spec.	20 to 30 mm 0.78 to 1.18 in.
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- (1) Clutch Pedal
- (2) Clutch Rod

(3) Safety Switch

L : Clutch Pedal Free Travel

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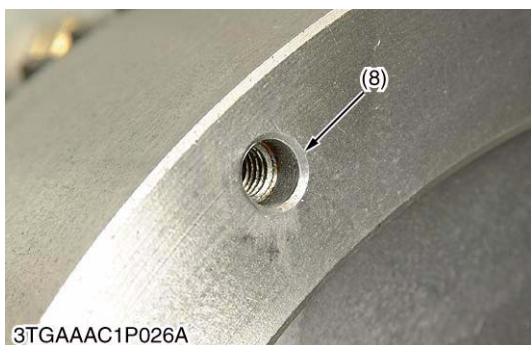
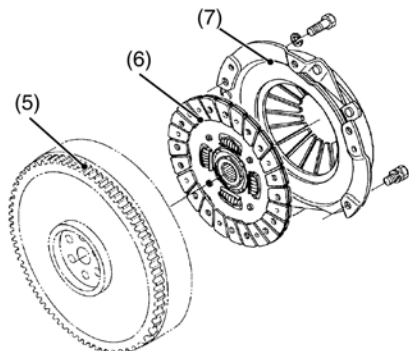
## [2] PREPARATION

### (1) Separating Engine from Clutch Housing

- Follow the procedure from "Draining Transmission Fluid" (Page 1-S20) to "Separating the Engine from Clutch Housing" (Page 1-S25) in ENGINE section.

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### [3] DISASSEMBLING AND ASSEMBLING



#### Clutch Assembly

1. Remove the clutch mounting screws and 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.
- Screws in two reamer screws (3) in the reamer screw holes.
- After tighten the reamer screws, tighten the other general screws.

#### ■ IMPORTANT

- Align the center of clutch disc and flywheel by inserting the clutch center tool (2).

#### ■ NOTE

- Do not allow grease and oil on the clutch disc facing.
- The reamer screw hole on the clutch cover (7) is in the next of the 5 mm (0.2 in.) dia. hole (4).
- The shape of the reamer screw hole (8) on the flywheel is different from other screw holes.

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
-------------------	-----------------------	---

- |                        |                                 |
|------------------------|---------------------------------|
| (1) Clutch Assembly    | (5) Flywheel                    |
| (2) Clutch Center Tool | (6) Clutch Disc                 |
| (3) Reamer Screw       | (7) Clutch Cover                |
| (4) 5 mm dia. Hole     | (8) Screw Hole for Reamer Screw |

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Clutch Release Fork

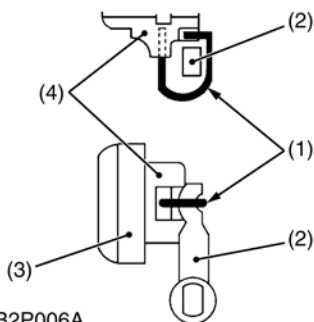
1. Remove the set spring (1) from clutch release fork (2) and release hub.
2. Remove the release bearing (3) with release hub (4).

**(When reassembling)**

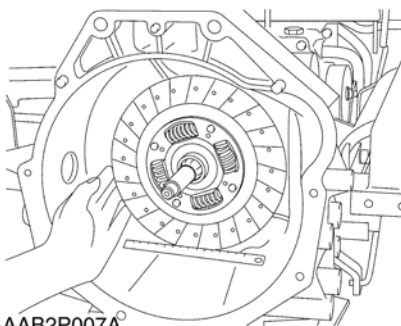
- Set the clutch release fork (2) and release hub (4) with set spring (1) in the correct direction.

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

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**[4] SERVICING**

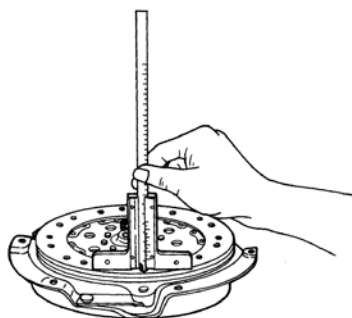


Backlash between Clutch Disc and Clutch Shaft

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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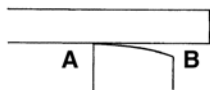
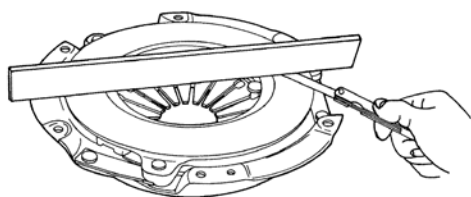


Clutch Disc Wear

1. Measure the depth from clutch disc surface to the top of 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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**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 allowable limit.

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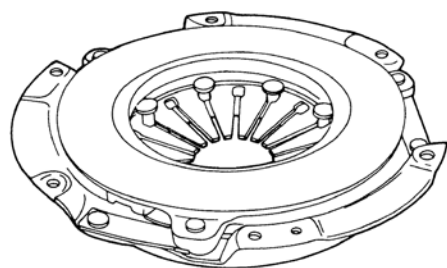
**A : Inside**

**B : Outside**

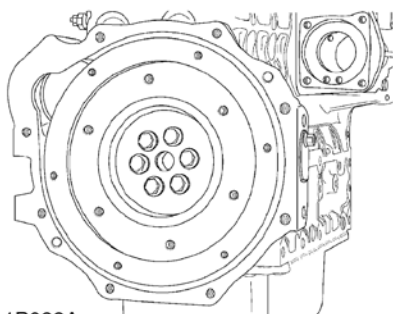
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**Checking Pressure Plate Assembly and Flywheel**

1. Wash the disassembling parts except clutch disc with a suitable cleaning solvent to remove dirt and grease before making inspection and adjustment.
2. Inspect the friction surface of pressure plate and flywheel for scoring or roughness.
  - Slight roughness may be smoothed by using fine emery cloth.
  - If these parts have deep scores or grooves on their surface, they should be replaced.
3. Inspect the surface of diaphragm spring for wear. If excessive wear is found, replace the clutch cover assembly.
4. Inspect thrust rings (wire ring) for wear or damage. As these parts are invisible from outside, shake pressure plate assembly up and down to listen for chattering noise, or lightly hammer on rivets for a slightly cracked noise. Any of these noises indicates need of replace as a complete assembly.



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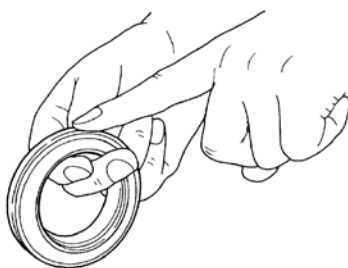
Diaphragm spring mutual difference	Allowable limit	0.5 mm 0.020 in.
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**Checking Clutch Release Bearing**

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

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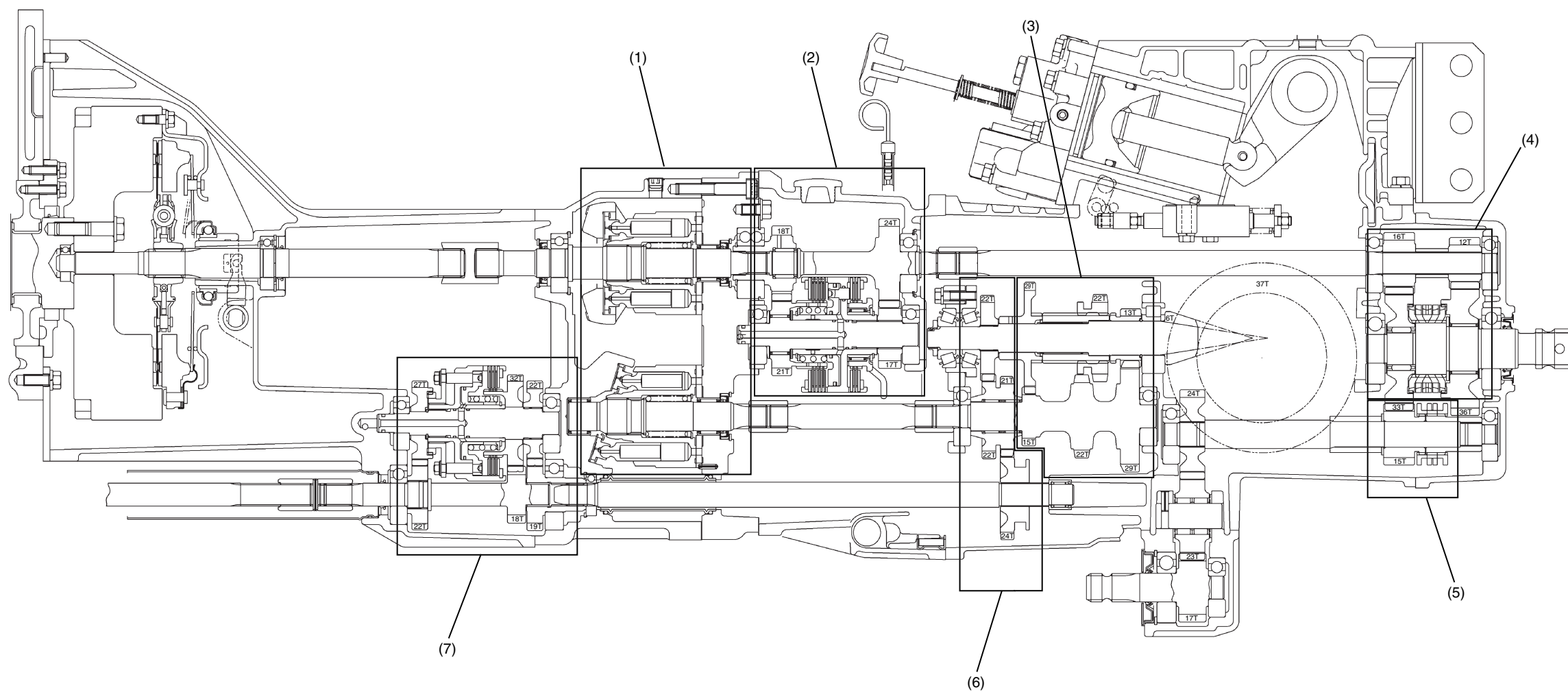
# **3 TRANSMISSION**

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# 1. STRUCTURE



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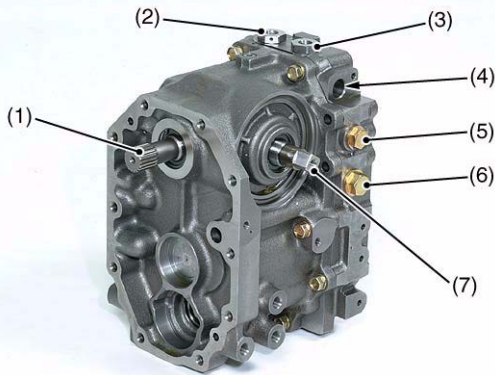
- (1) HST (Hydrostatic Transmission) Section
- (2) PTO Clutch Section
- (3) Range Gear Shift Section
- (4) Rear PTO Gear Shift Section
- (5) Mid PTO Gear Shift Section
- (6) Front Wheel Drive Section
- (7) Bi-speed Turn Clutch Section

## 2. POWER TRAIN FOR TRAVELING SYSTEM

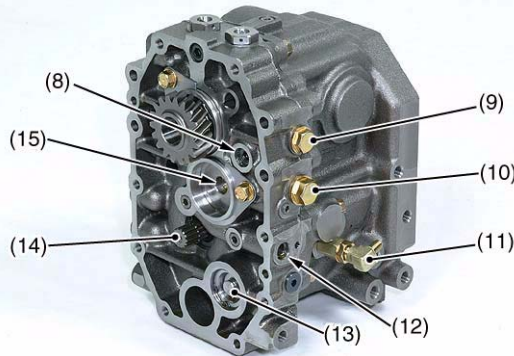
### [1] HYDROSTATIC TRANSMISSION (HST)

#### (1) Structure

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

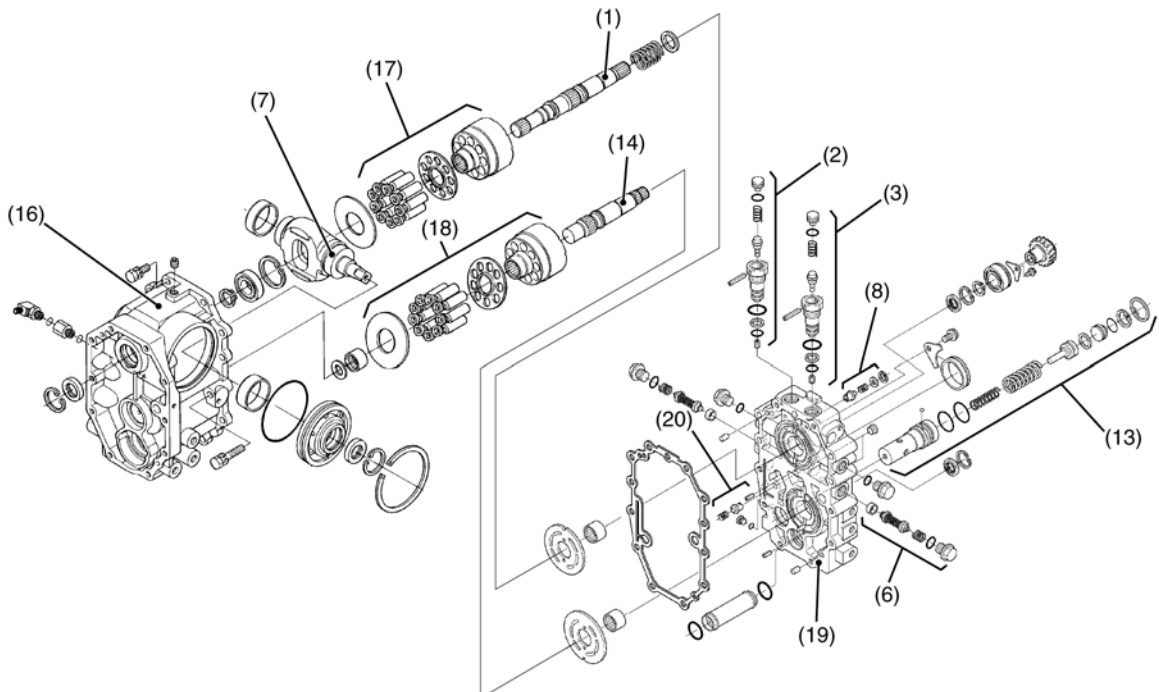


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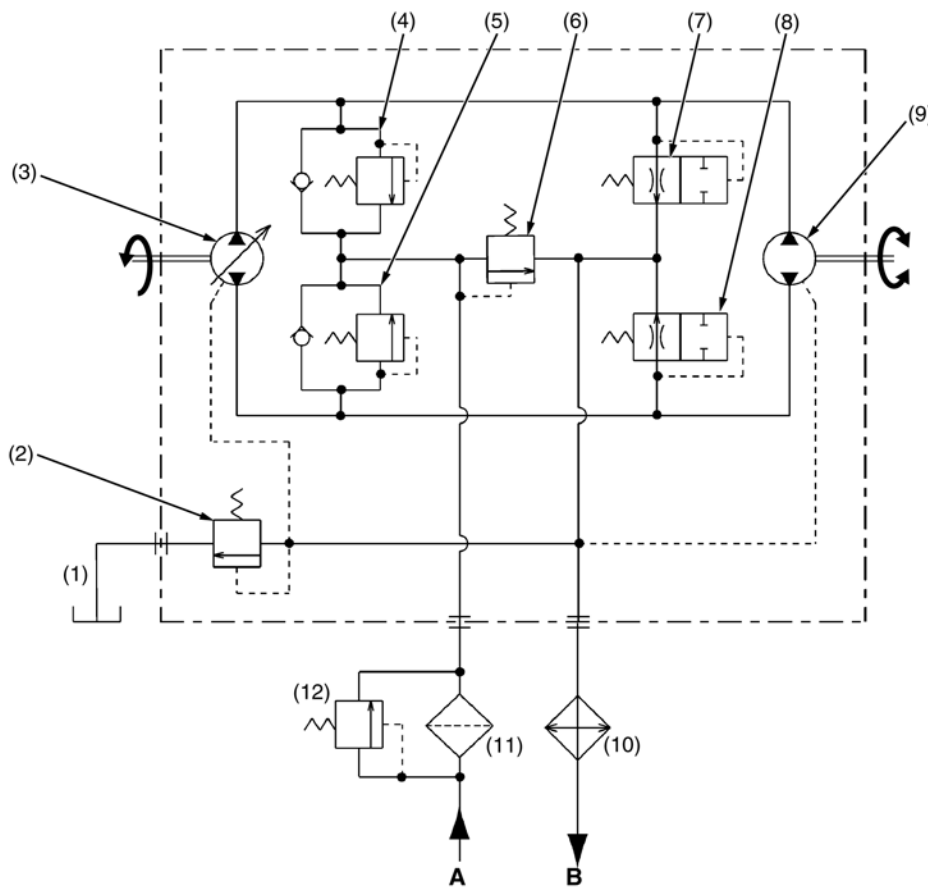
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- |  |   |
|--|---|
| (1) Input Shaft  | (11) Hose Joint<br>(for PTO Clutch)       |
| (2) Neutral Valve (Reverse)                            | (12) Charge Oil Inlet                     |
| (3) Neutral Valve (Forward)                            | (13) Accumulator<br>(for PTO Clutch)      |
| (4) Drain Port   | (14) Output Shaft                         |
| (5) Pressure Check Port<br>Plug (Forward)              | (15) Oil Exit (for PTO Clutch)            |
| (6) Check and High Pressure<br>Relief Valve (Forward)  | (16) Case                                 |
| (7) Trunnion Shaft                                     | (17) Variable Displacement<br>Piston Pump |
| (8) Case Relief Valve                                  | (18) Fixed Displacement<br>Piston Motor   |
| (9) Pressure Check Port<br>Plug (Reverse)              | (19) Port Block                           |
| (10) Check and High Pressure<br>Relief Valve (Reverse) | (20) Charge Relief Valve                  |



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**(2) Hydraulic Circuit**



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

**A : From Power Steering Controller**  
**B : To Hydraulic Pump**

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

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

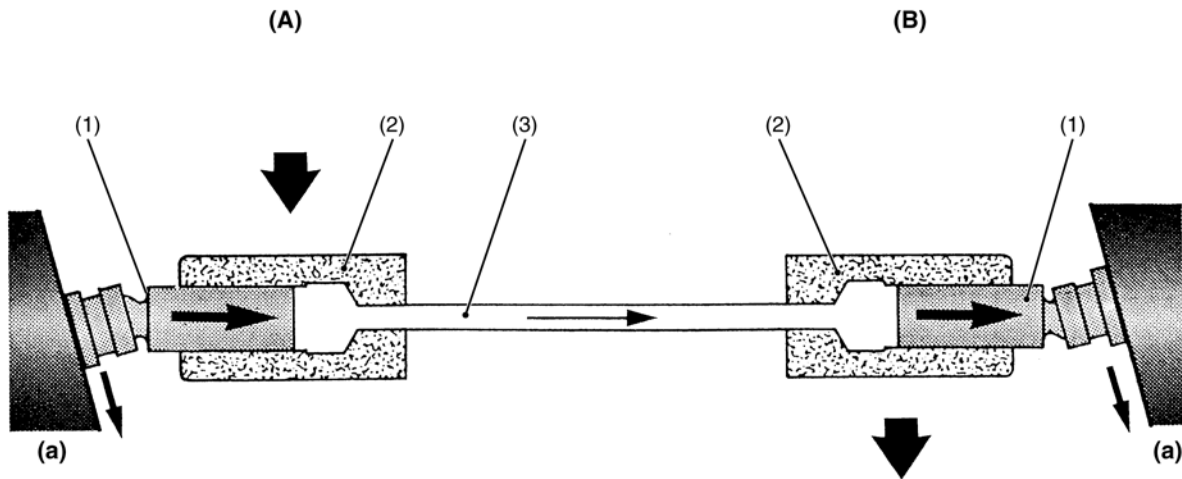
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### ■ Valve Operating Pressure

Ref. No.	Valve	Oil Temperature	Engine Revolution	Valve Operating Pressure	
(2)	Case Relief Valve	40 to 60 °C 104 to 140 °F	1500 rpm	0.3 MPa Less than 3.0 kgf/cm <sup>2</sup> at no-load 42.7 psi	
(4), (5)	Check and High Pressure Relief Valve (Forward and Reverse)			26.4 to 29.4 MPa 270 to 300 kgf/cm <sup>2</sup> 3840.2 to 4266.9 psi	
(6)	Charge Relief Valve			0.4 to 0.8 MPa 4.0 to 8.0 kgf/cm <sup>2</sup> at no-load 56.9 to 113.8 psi	
(7), (8)	Neutral Valve (Forward and Reverse)			Open	1.47 to 2.45 MPa 15.0 to 25.0 kgf/cm <sup>2</sup> 213.3 to 355.5 psi
		Close	4.9 to 9.8 MPa 50 to 100 kgf/cm <sup>2</sup> 711.2 to 1422.4 psi		

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**(3) Pump and Motor**

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(1) Piston

(2) Cylinder

(3) Oil

(A) Pump

(B) Motor

(a) Swashplate

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

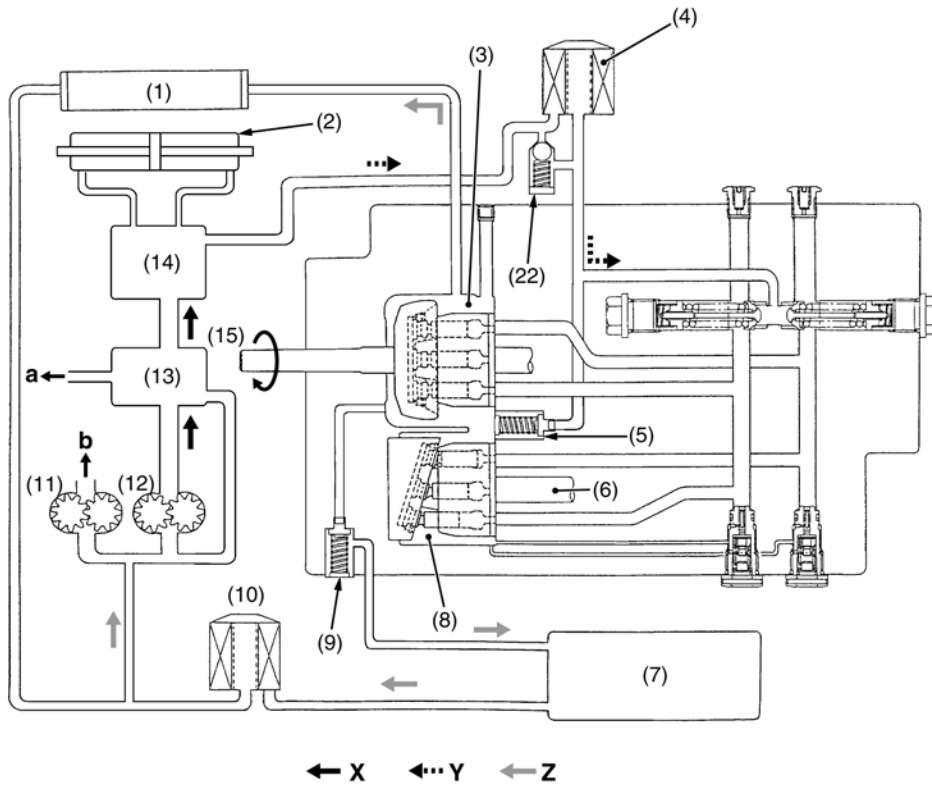
In the pump, as the cylinder rotates, pistons move across the sloping face of swashplate and slide in or out of their cylinder bores. The oil, forced out by the pump pistons, causes the motor pistons to slide out of their cylinder bores.

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

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### (4) Operation and Valves

#### ■ Neutral Position



- (1) Oil Cooler
- (2) Power Steering Cylinder
- (3) HST Pump (Variable Discharge Pump)
- (4) HST Oil Filter (10 μ)
- (5) Charge Relief Valve
- (6) Output Shaft
- (7) Oil Tank (Transmission Case)
- (8) HST Motor (Fixed Discharge Motor)
- (9) Case Relief Valve
- (10) Oil Filter
- (11) 3P Hydraulic Pump
- (12) Power Steering Pump
- (13) Regulating Valve
- (14) Steering Controller
- (15) Input Shaft
- (16) Variable Swashplate
- (17) Piston (Pump)
- (18) Cylinder Block (Pump)
- (19) Cylinder Block (Motor)
- (20) Piston (Motor)
- (21) Fixed Swashplate
- (22) Bypass Valve

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- a :** To Bi-speed Valve
- b :** To 3-Point Linkage
- X :** High Pressure Oil
- Y :** Low Pressure Oil
- Z :** Suction or Drain Oil

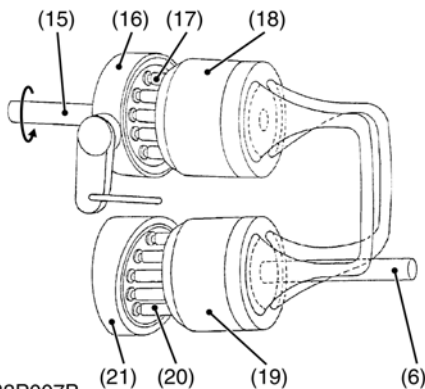
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The pump (3) and motor (8) are joined in a closed hydraulic loop and most of oil circulates within the main oil circuit. A little oil lubricates and oozes out from the clearance between the moving parts of the case.

The charge oil aids smooth operation of piston pump (3) and motor (8). The rest of the oil passes through the charge relief valve (5) into the case. Then the oil return to the pump (12) through the cooler.

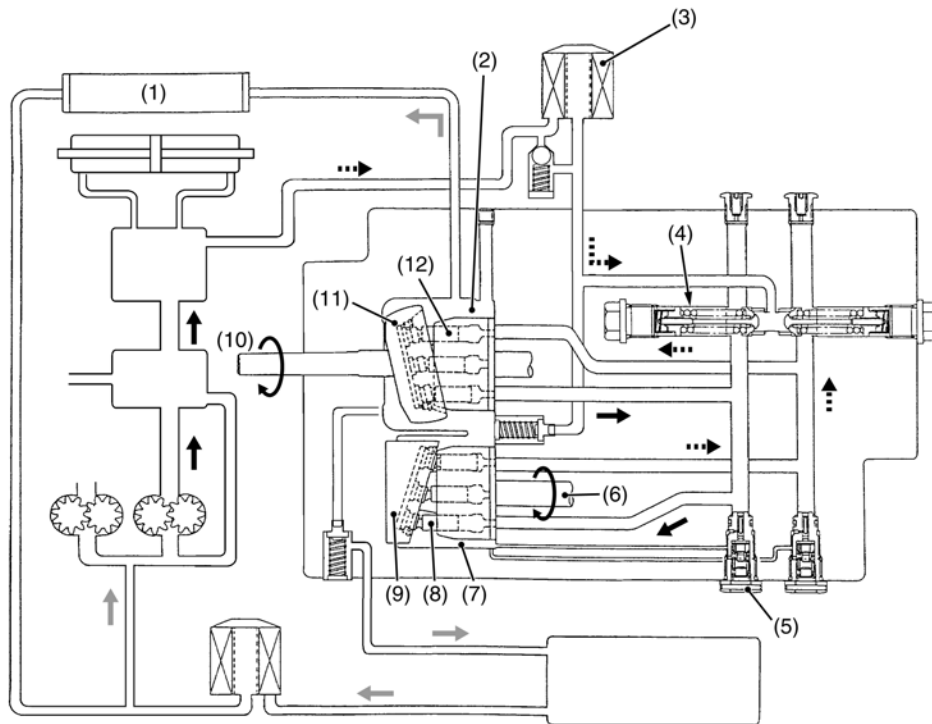
When the speed control pedal is in neutral, the variable swashplate (16) is at right angles to the pump pistons (17) and they only rotate with cylinder block (18) without reciprocating. Since the oil is not being pumped to the motor (8). The cylinder block (19) in the motor (6) is stationary and the output shaft (8) does not move.

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■ Forward Position



- (1) Oil Cooler
- (2) Cylinder Block (Pump)
- (3) HST 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) Input Shaft
- (11) Variable Swashplate
- (12) Piston (Pump)
- (13) Pump Kidney Port A
- (14) Pump Kidney Port B
- (15) Motor Kidney Port D
- (16) Motor Kidney Port C

**X : High Pressure Oil**  
**Y : Low Pressure Oil**  
**Z : Suction or Drain Oil**

← X   ← Y   ← Z

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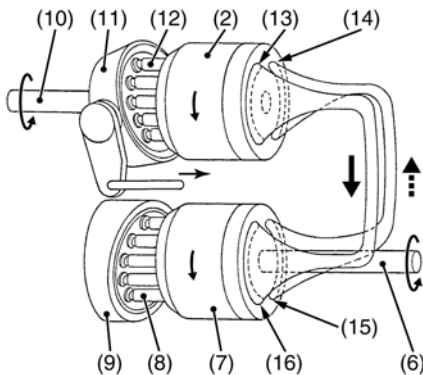
When the speed control pedal is stepped on and in forward, the variable swashplate (12) is tilted as shown in figure above.

As the pump cylinder block (2) rotates with the input shaft (10), 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 (11) determines the output shaft speed.

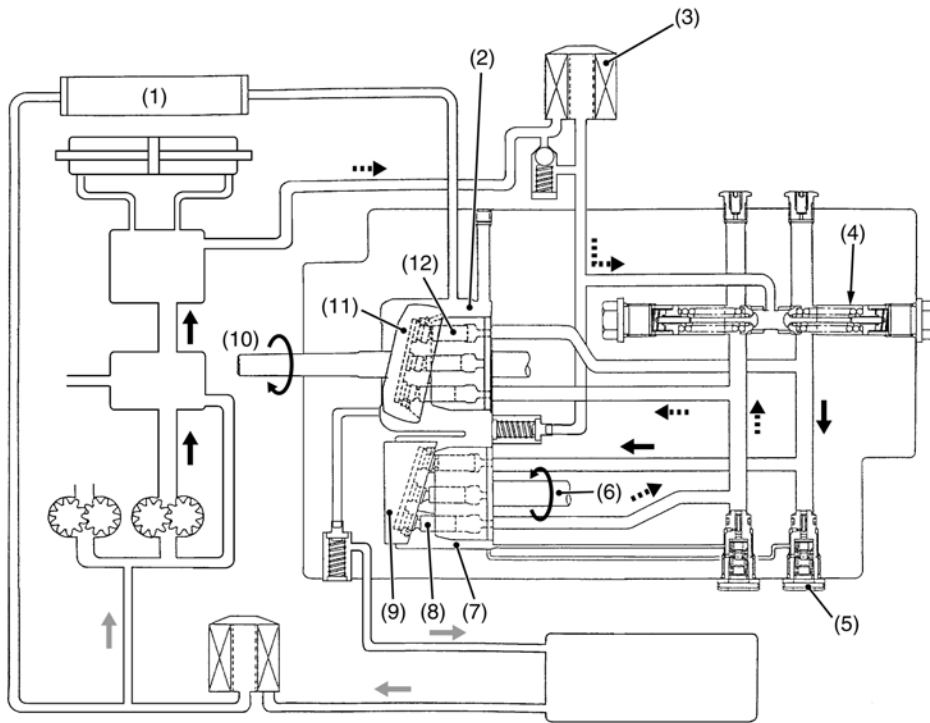
As the motor cylinder block (7) continued to rotate, oil is forced out of motor kidney port D (15) at low pressure and returns to the pump.

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■ Reverse Position



- (1) Oil Cooler
- (2) Cylinder Block (Pump)
- (3) HST 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) Input Shaft
- (11) Variable Swashplate
- (12) Piston (Pump)
- (13) Pump Kidney Port A
- (14) Pump Kidney Port B
- (15) Motor Kidney Port D
- (16) Motor Kidney Port C

**X : High Pressure Oil**  
**Y : Low Pressure Oil**  
**Z : Suction or Drain Oil**

← X   ←··· Y   ← Z

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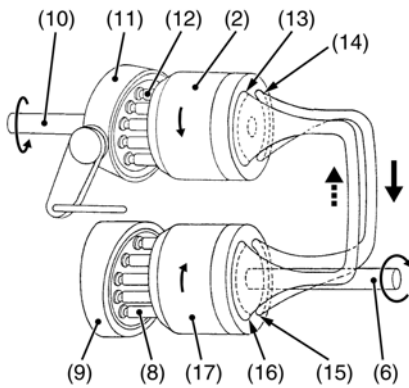
When the speed control pedal is stepped on and in reverse, the variable swashplate (11) is tilted as shown in figure above.

As the pump cylinder block (2) rotates with the input shaft (10), 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.

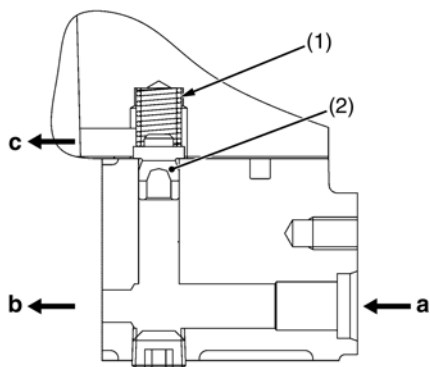
Then the output shaft (6) rotates with the motor cylinder block (7). This drives the machine rearward and the angle of pump swashplate (11) determines the output shaft speed.

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.

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3TGAAAB3P011B



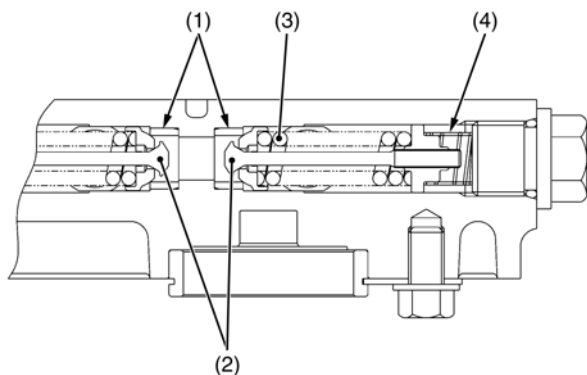
3TGAAAC3P099A

**■ Charge Relief Valve**

The charge oil flow the steering controller 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
- a : From the Steering Controller and HST Oil Filter
- b : To the Check and High Pressure Relief Valve
- c : To the Case

000007755E



3TGAAAC3P100A

**■ 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.

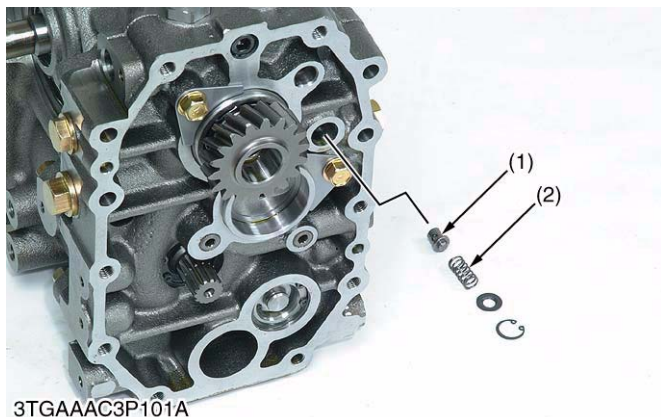
In neutral, both valves are open and charging oil enters into the main oil circuit through the valves.

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

000007756E



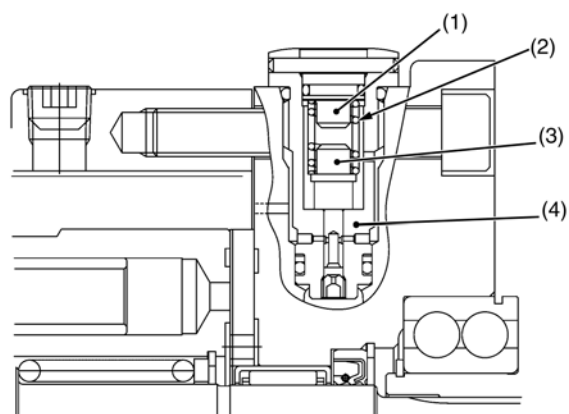
3TGAAAC3P101A

**■ 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

000007757E



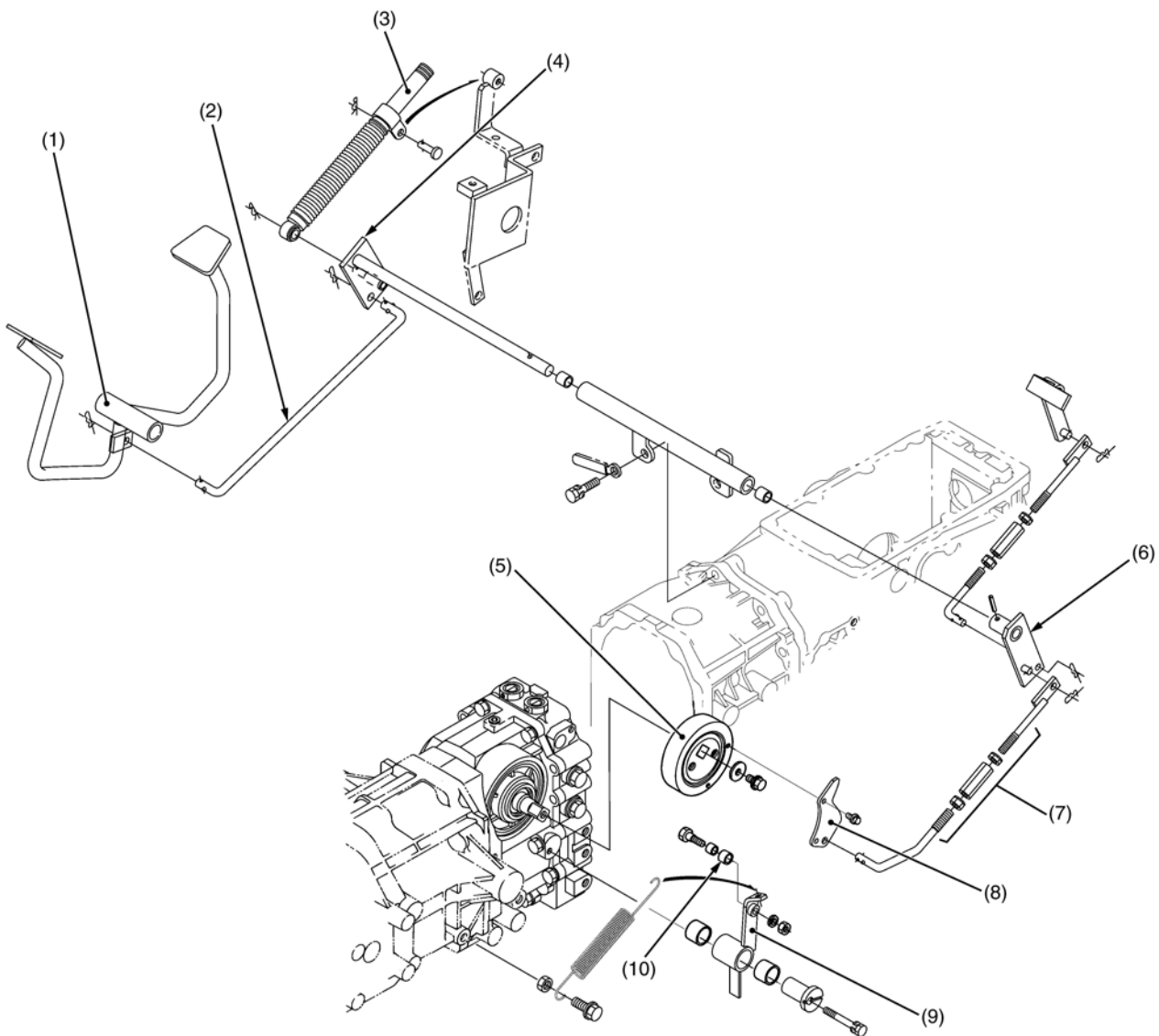
3TGAAAC3P102A

### ■ 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) Spring Holder | (3) Poppet <b>N</b> |
| (2) Spring        | (4) Valve Body      |

000007758E

**(5) Control Linkage**

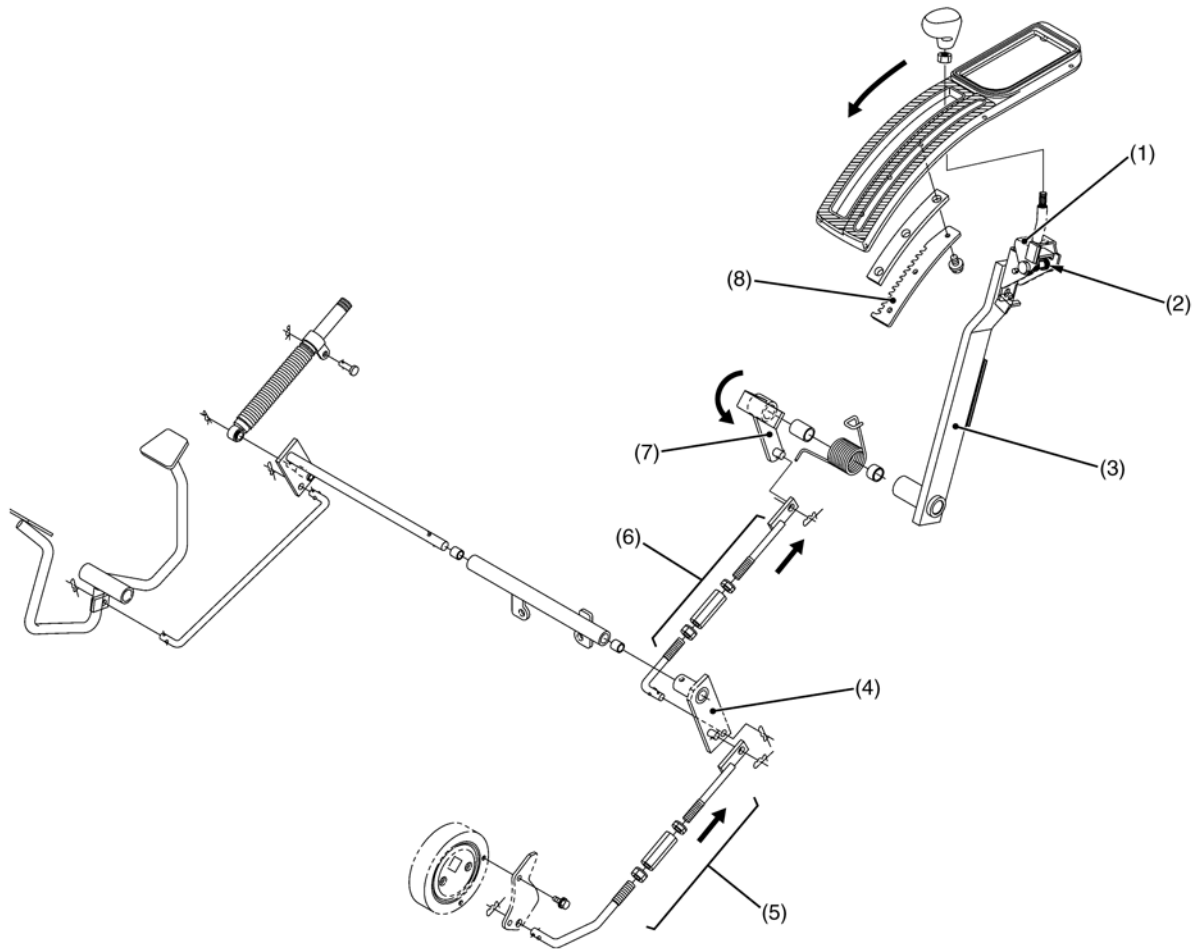
3TGAAAC3P103A

- |                         |                    |                  |                    |
|-------------------------|--------------------|------------------|--------------------|
| (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 RH (4) restricts the movement of the linkage to prevent abrupt operation or reversing.

000007760E

## (6) Cruise Control Linkage



3TGAAAC3P104A

- |                   |                                   |                  |                 |
|-------------------|-----------------------------------|------------------|-----------------|
| (1) Release Lever | (3) Cruise Control Lever Assembly | (5) HST Link Rod | (7) Cruise Link |
| (2) Spring        | (4) HST Lever LH                  | (6) Cruise Rod   | (8) Lever Guide |

When the cruise control lever (3) is shifted forward, the claw portion of the release lever (1) engages with the lever guide (8) by the spring (2) and the position of the cruise control lever (3) is maintained.

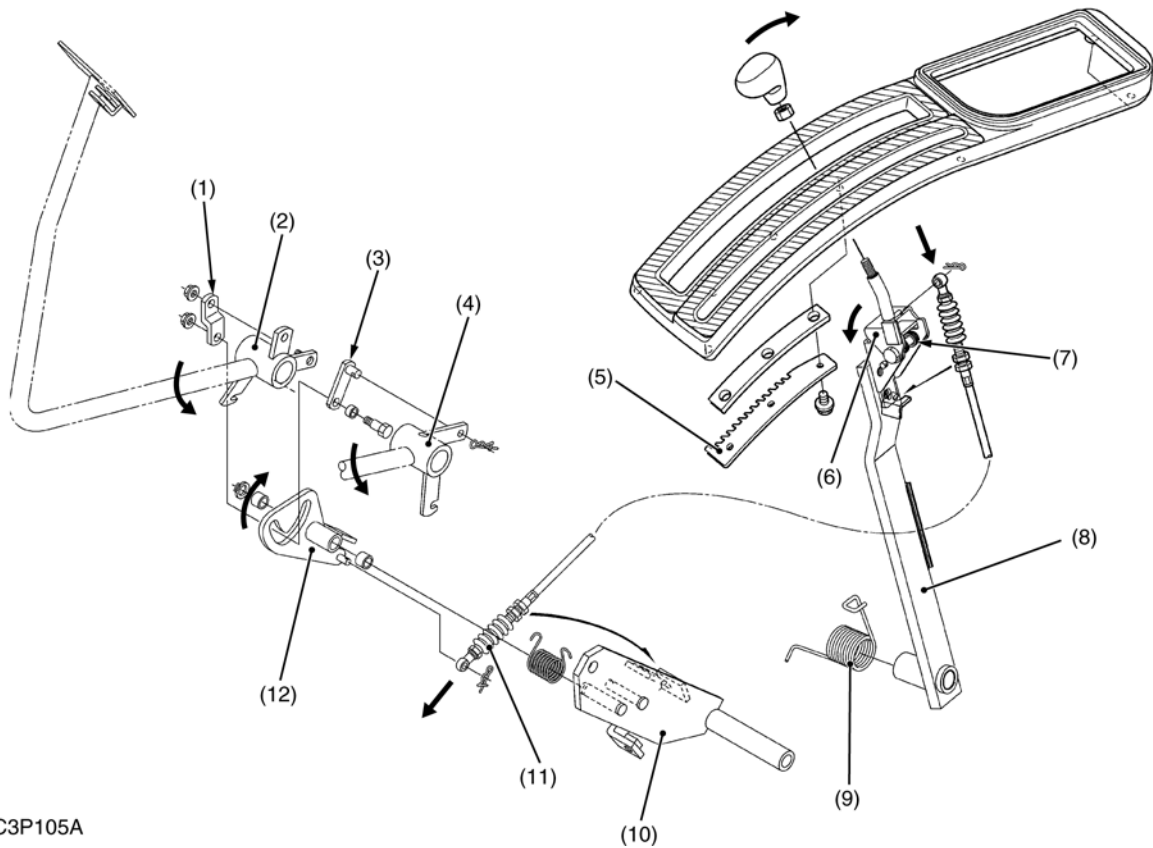
The cruise link (7), cruise rod (6) and HST link rod (5) move in the direction of the arrow of figure, and the HST starts the forward operation at the same time.

### ■ NOTE

- The forward speed increases if the speed control pedal is depressed to the forward side further while the cruise control lever is set.
- However, do not depress the speed control pedal to the backward while the cruise control lever is set. (The link mechanics might be damaged.)

000007761E



**(7) Cruise Control Release System**

3TGAAAC3P105A

- |                    |                    |                                   |                        |
|--------------------|--------------------|-----------------------------------|------------------------|
| (1) Brake Link 1   | (4) Brake Pedal LH | (7) Spring                        | (10) HST Pedal Support |
| (2) Brake Pedal RH | (5) Lever Guide    | (8) Cruise Control Lever Assembly | (11) Release Wire      |
| (3) Brake Link 2   | (6) Release Lever  | (9) Spring                        | (12) Lever 1           |

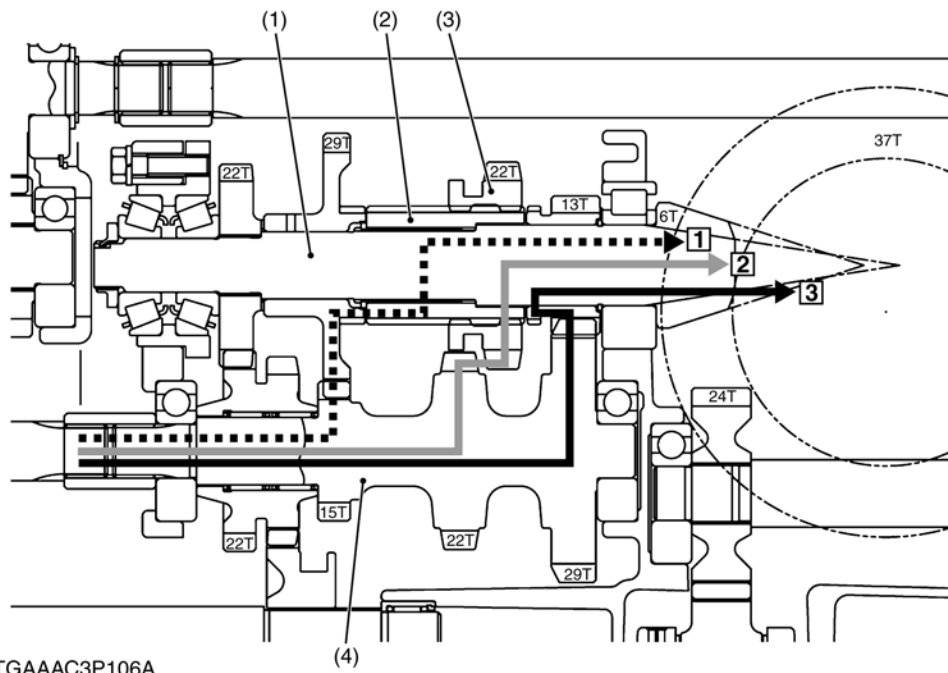
The claw portion of the release lever (6) engages with the lever guide (5) by the spring (7) when the cruise control lever is set.

When the right and left brake pedal (2) (4) is depressed at the same time, the lever 1 (12) rotates in the direction of the arrow of figure by the brake link 1 (1) and 2 (3). Then, the inner wire of release wire (11) is pulled, and release lever (6) rotates in the direction of the arrow of figure. The claw portion of the release lever (6) comes off from lever guide (5), and after all, the cruise control lever (8) returns to home position by spring (9).

When one of the brake pedal is depressed, the brake link 1 (1) and 2 (3) move along the ditch part of the lever (12), and the lever 1 (12) does not rotate.

000007762E

## [2] RANGE GEAR SHIFT SECTION



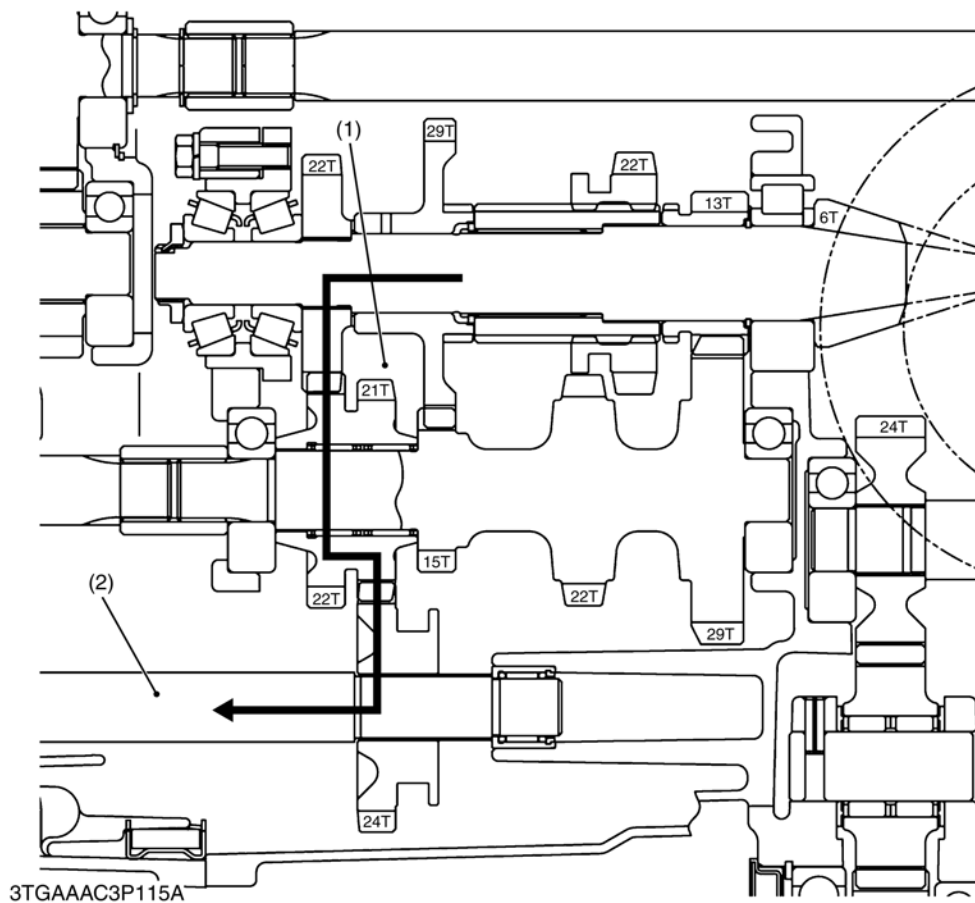
- (1) Hypoid Pinion Shaft
- (2) Spline Boss
- (3) 22T Shifter Gear
- (4) Rear Counter Shaft

- 1 : 1st Speed
- 2 : 2nd Speed
- 3 : 3rd Speed

3TGAAAC3P106A

000007763E

### [3] FRONT WHEEL DRIVE SECTION



- (1) Hypoid Pinion Shaft
- (2) Front Drive Shaft

000007764E

### [4] BI-SPEED TURN SYSTEM

#### (1) Feature

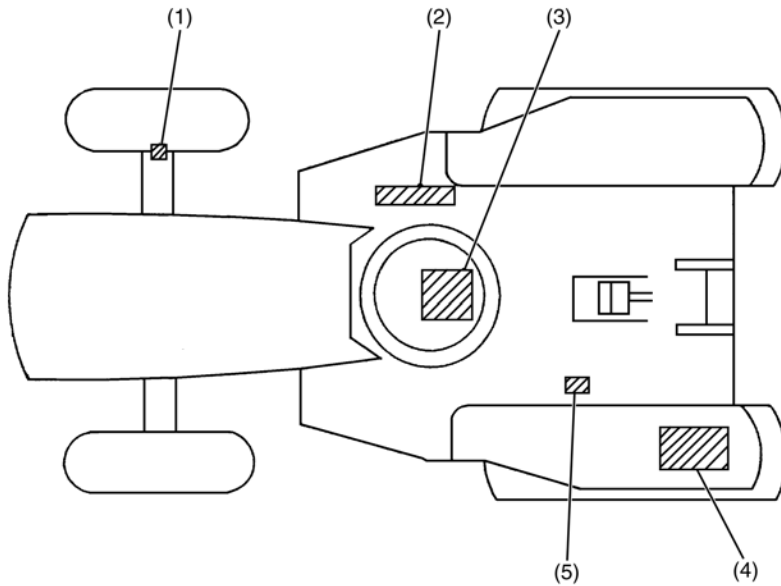
It is used hydraulic and electrical control type bi-speed turn system.

The front wheel rotates by 1.5 times the speed compared with normal 4WD when the following conditions become complete.

- Engine running
- 4WD mode
- Turned on the bi-speed switch
- Front wheel is steered to 0.61 rad (35 °) or more.
- The travelling speed within 0.2 to 9.0 km/h (0.13 to 5.62 mph)

000007766E

**(2) Related Parts and Arrangement**



- (1) Front Wheel Turning Angle Sensor
- (2) Bi-speed Valve
- (3) Hydraulic Clutch (Bi-speed)
- (4) Bi-speed Controller
- (5) Travelling Speed Sensor

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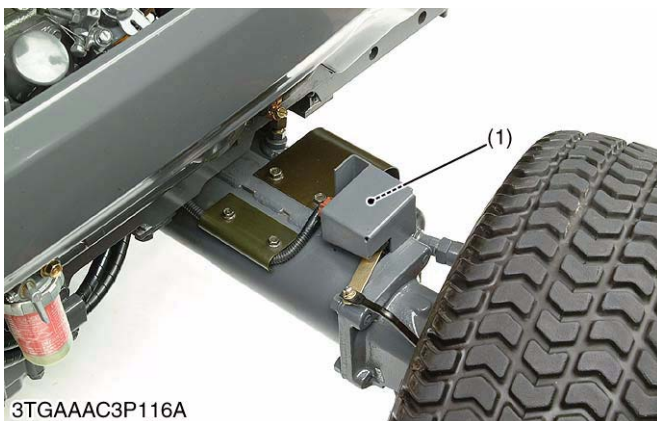
3TGAAAC3P108A

**■ Bi-speed Controller**

This controller operates the bi-speed valve under specified condition based on the information from the front wheel turning angle sensor and travelling speed sensor. The bi-speed switch (2) is on the controller. The checking and adjusting of the bi-speed turn system can be done by handling this controller (Refer to the "9. ELECTRICAL SYSTEM".

- (1) Bi-speed Switch
- (2) Bi-speed Controller

000007767E



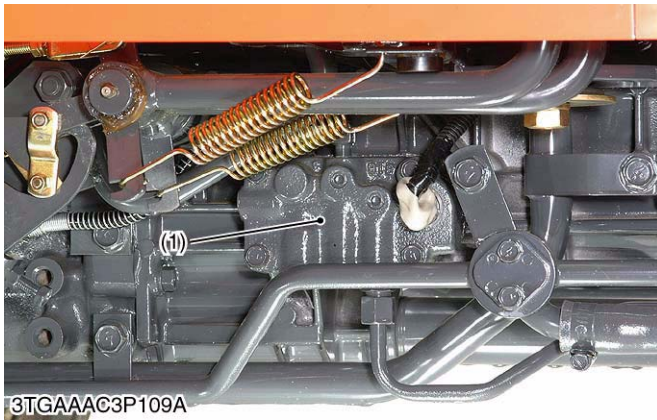
3TGAAAC3P116A

**■ Front Wheel Turning Angle Sensor**

This sensor perceives the steered angle of the front wheel.

- (1) Front Wheel Turning Angle Sensor

000007769E



**■ Bi-speed Valve**

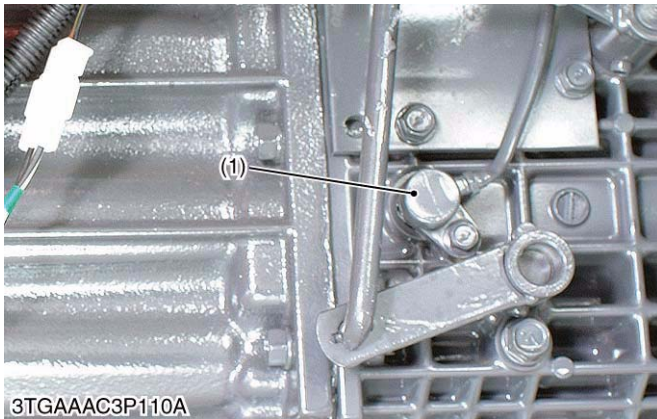
The bi-speed solenoid valve is built in the bi-speed valve (1) and opens and shuts the oil passage to the hydraulic clutch by an electric signal from bi-speed controller.

**(Reference)**

- The PTO solenoid valve is also built in the bi-speed valve.

- (1) Bi-speed Valve

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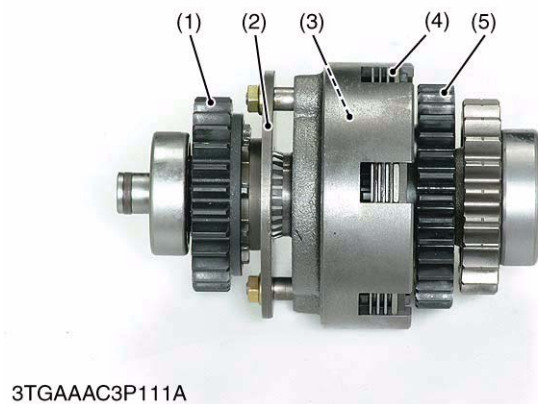


**■ Travelling Speed Sensor**

This sensor perceives the traveling speed.

- (1) Traveling Speed Sensor

000007771E



**■ Hydraulic Clutch (Bi-speed)**

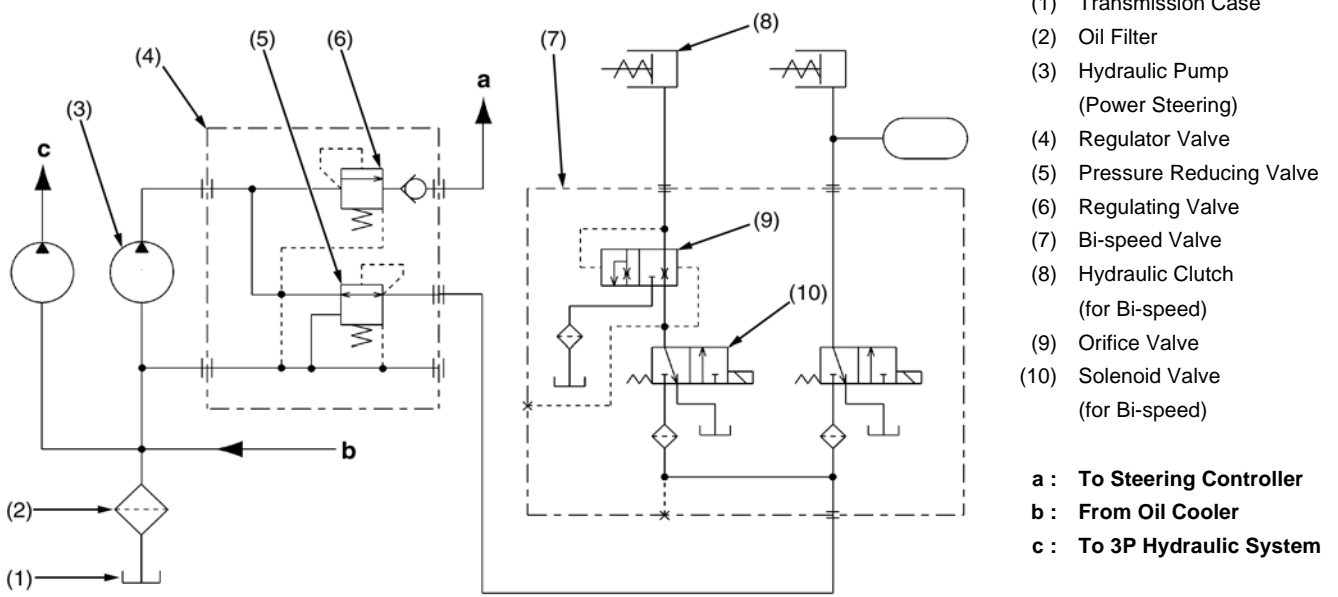
When the pressurized oil enter to the hydraulic clutch, the piston (3) moves to the right in the figure and presses clutch disc and plate (4). Then the power is transmitted to the 32T gear (5).

When oil runs away, the piston (3) and shifter (2) moves to the left in the figure by the spring force. Then the power is transmitted to the 27T gear (1).

- (1) 27T Gear
- (2) Shifter
- (3) Piston
- (4) Clutch Disc and Plate
- (5) 32T Gear

000007772E

**(3) Hydraulic Oil Flow**



3TGAAAC3P112A

The oil from the hydraulic pump (3) is adjusted with the regulator valve (4) to the pressure of 18.5 kgf/cm<sup>2</sup>, and enters the bi-speed valve (7). When the solenoid valve (10) opens by the bi-speed controller, pressurized oil enters the hydraulic clutch (8) through the orifice valve (9).

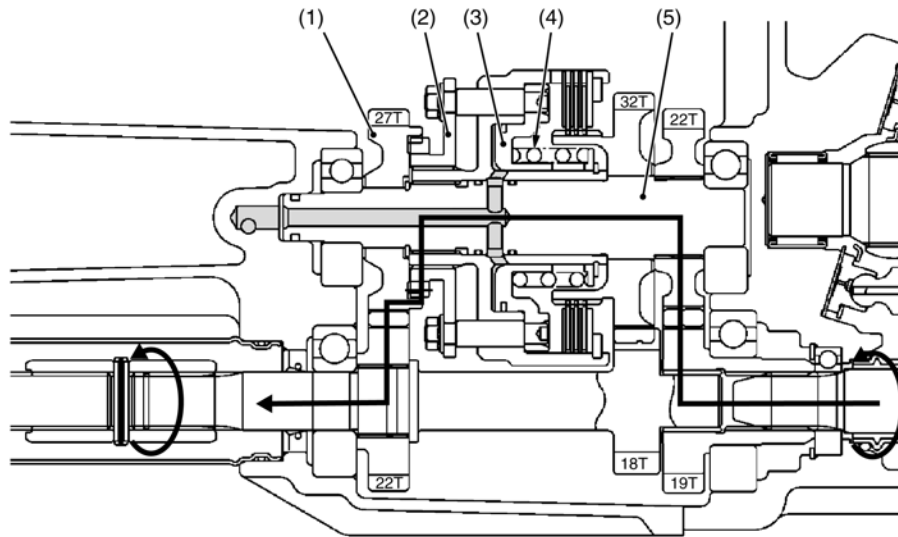
**NOTE**

- Refer to the "8. HYDRAULIC SYSTEM" section for the "Regulator Valve" and "Bi-speed Valve" in detail.

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## (4) Power Train of Hydraulic Clutch Section

### ■ 4WD Position



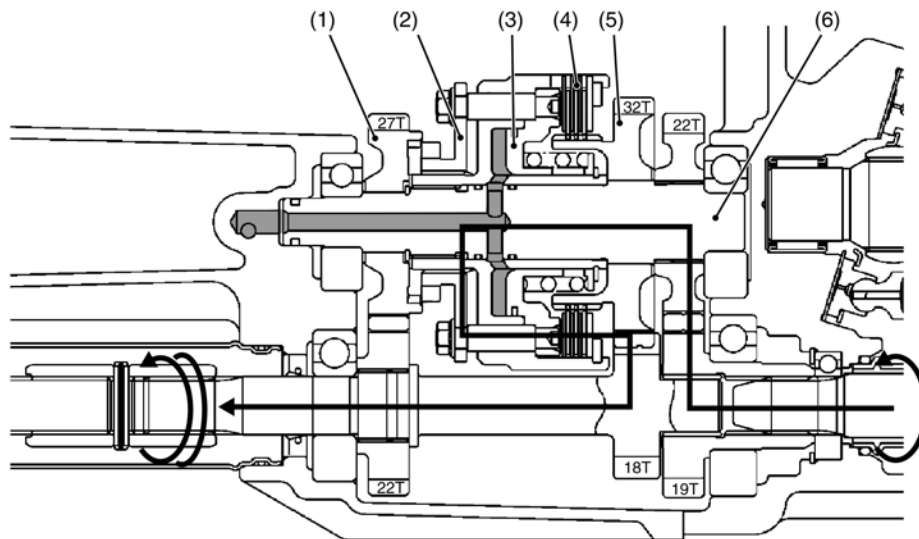
- (1) 27T Gear
- (2) Shifter
- (3) Piston
- (4) Spring
- (5) Counter Shaft

3TGAAABIP002B

When the hydraulic clutch is not operated, the piston (3) is pushed by the spring (4) and shifter (2) is engaged to the 27T gear (1) with spline. Power is transmitted as shown in the figure.

000007774E

### ■ Bi-speed Turn Position



- (1) 27T Gear
- (2) Shifter
- (3) Piston
- (4) Clutch Disc and Plate
- (5) 32T Gear
- (6) Counter Shaft

3TGAAABIP003B

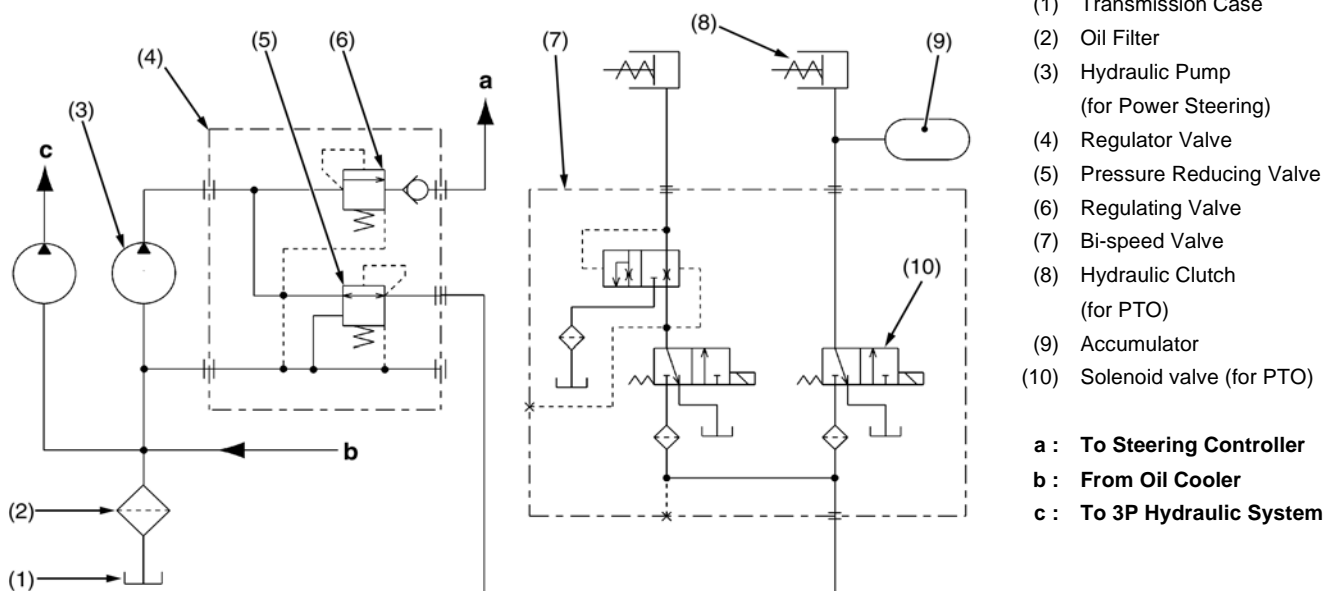
When the bi-speed solenoid valve is actuated, the piston (3) moves in the direction of arrow by hydraulic pressure. The clutch disc and plate (4) is pressed and the shifter (2) is disengaged from the 27T gear (1). Power is transmitted as shown in the figure. The front wheel rotates by 1.5 times the speed for smooth turning.

000007775E

### 3. POWER TRAIN FOR PTO SYSTEM

#### [1] INDEPENDENT PTO SYSTEM

##### (1) Hydraulic Oil Flow



3TGAAAC3P112B

This tractor is equipped with the independent PTO system. The hydraulic circuit is as shown above.

The oil from the hydraulic pump (3) is adjusted with the regulator valve (4) to the pressure of  $18.5 \text{ kgf/cm}^2$ , and enters the bi-speed valve (7). The solenoid valve (10), which is built in the bi-speed valve (7) and operated by the PTO clutch control switch, opens and shuts the oil circuit to the hydraulic clutch (8).

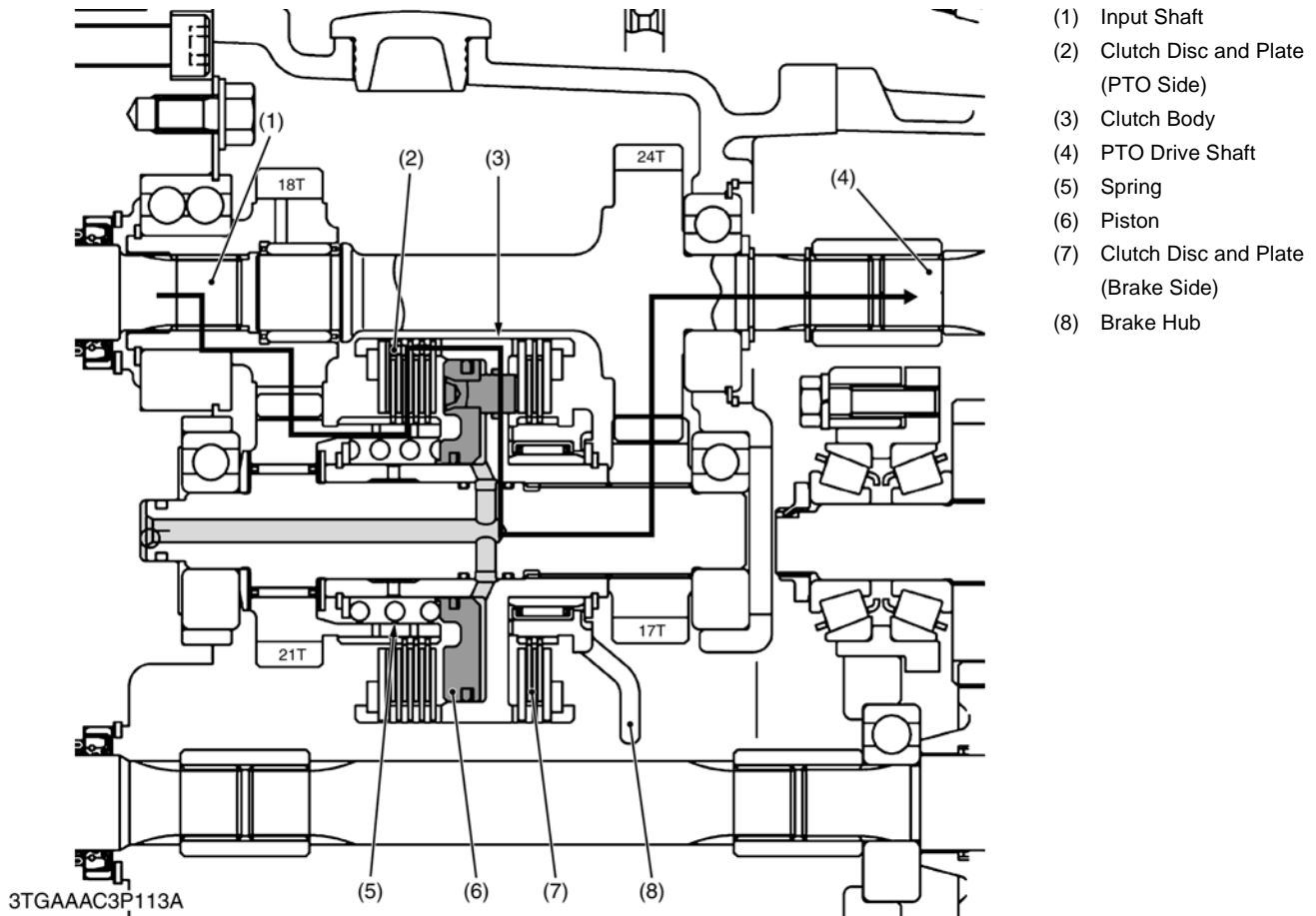
#### ■ NOTE

- Refer to the "8. HYDRAULIC SYSTEM" section for the "Regulator Valve" and "Bi-speed Valve" in detail.

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## (2) Power Train of PTO Clutch Section



### ■ PTO Engaged

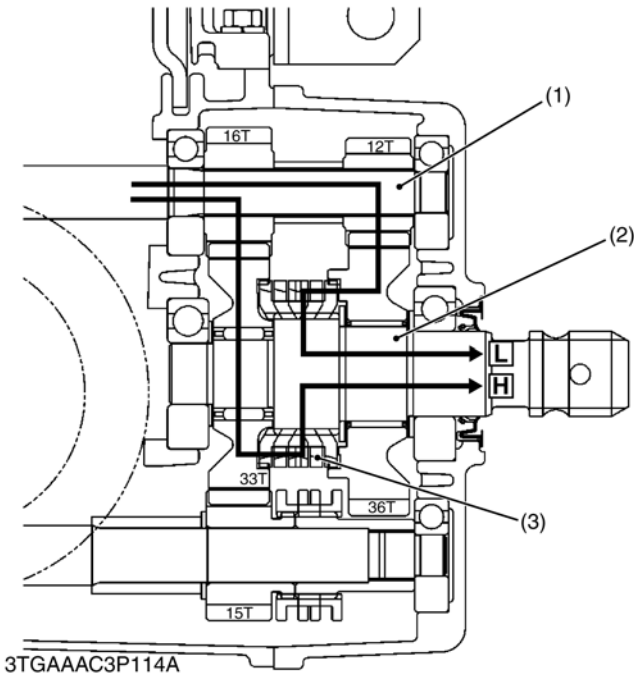
The piston (6) moves to the left in the figure by oil pressure and presses the clutch disc and plate (2). Then, the power is transmitted to the PTO drive shaft (4) as shown in figure.

### ■ PTO Disengaged

The piston (6) moves to the right in the figure by spring force and presses the clutch disc and plate (7). Then, the rotation of the PTO drive shaft (4) stops because the brake hub (8) hits the stopper inside the transmission case.

000007778E

## [2] REAR PTO GEAR SHIFT SECTION

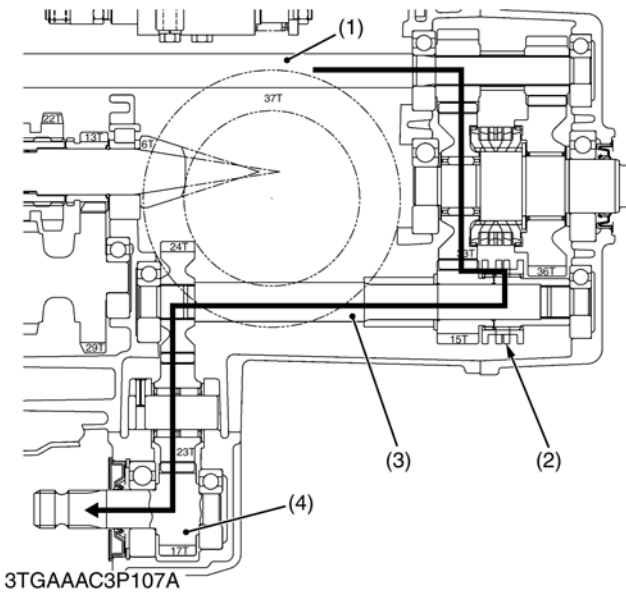


- (1) PTO Drive Shaft
- (2) PTO Shaft
- (3) Shifter

H : 800 rpm  
 (Engine 2717 rpm)  
 L : 540 rpm  
 (Engine 2670 rpm)

000007779E

## [3] MID PTO GEAR SHIFT SECTION



- (1) PTO Drive Shaft
- (2) Shifter
- (3) Mid PTO Drive Shaft
- (4) Mid PTO Shaft

■ Mid PTO Speed : 2500 rpm (Engine 2734 rpm)

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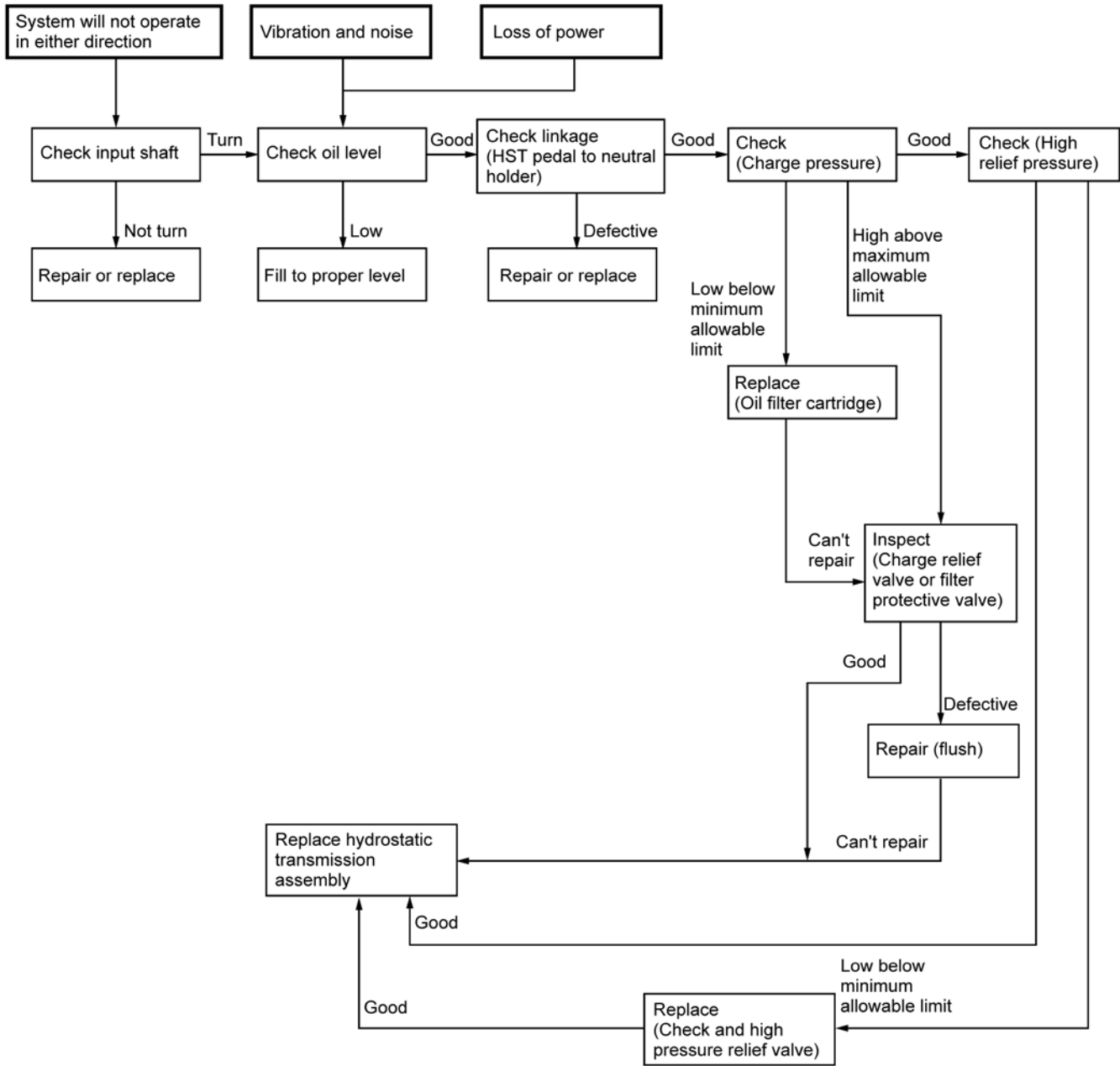
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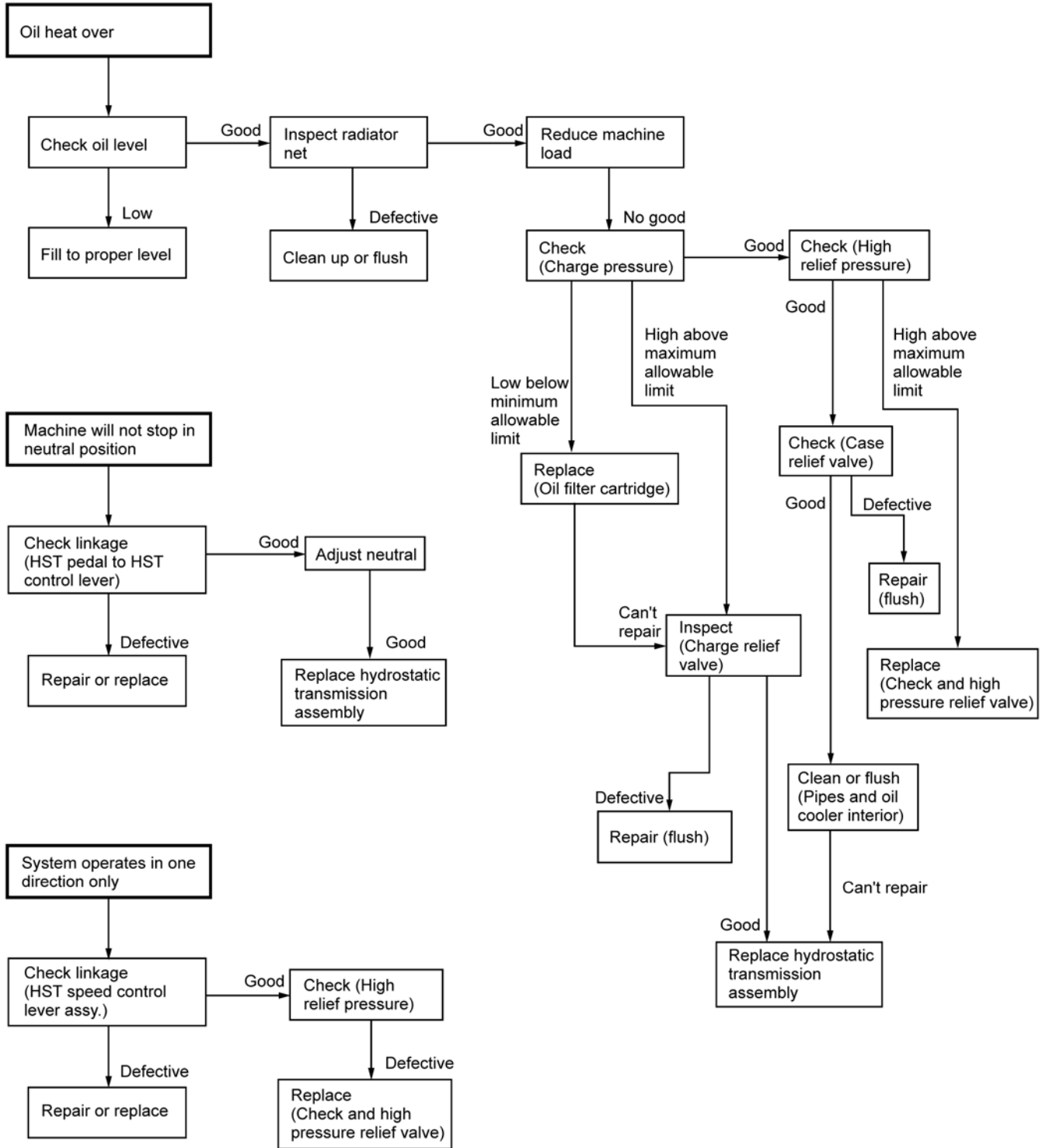
# 1. TROUBLESHOOTING

## HYDROSTATIC TRANSMISSION



3TGAAAB3P027A

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3TGAAAB3P028A

000008031E

**CLUTCH HOUSING**

Symptom	Probable Cause	Solution	Reference Page
<b>Noise from Clutch Housing</b>	● Transmission oil insufficient	Refill	G-8, 15
	● Bearing worn	Replace	3-S49
	● Gear worn or broken	Replace	—
	● Bi-speed clutch damaged	Repair or replace	3-S34

000008032E

**MID CASE SECTION**

Symptom	Probable Cause	Solution	Reference Page
<b>Mid Case</b>	● Transmission oil insufficient	Refill	G-8, 15
	● Gear worn or broken	Replace	—
	● PTO clutch damaged	Repair or replace	3-S40
	● Bearing worn	Replace	3-S49

000008033E

**TRANSMISSION CASE SECTION**

<b>Symptom</b>	<b>Probable Cause</b>	<b>Solution</b>	<b>Reference Page</b>
<b>Excessive or Unusual Noise at All Time</b>	● Improper backlash between hypoid pinion and hypoid ring gear	Adjust	3-S57
	● Improper backlash between differential pinion and differential side gear	Adjust	3-S54
	● Bearing worn	Replace	3-S49
	● Insufficient or improper type of transmission fluid used	Replenish or replace	G-8, 16
<b>Gear Slip out of Mesh</b>	● Shift fork spring tension insufficient	Replace	3-S43
	● Shift fork or shifter worn	Replace	3-S43, S53
	● Shift fork bent	Replace	3-S53
<b>Noise while Turning</b>	● Differential pinions or differential side gears worn or damaged	Replace	3-S55
	● Differential lock binding (does not disengage)	Replace	3-S49
	● Bearing worn	Replace	3-S49
<b>Differential Lock can not be Set</b>	● Differential lock shift fork damaged	Replace	3-S47
	● Differential lock shifter mounting pin damaged	Replace	3-S47
	● Differential lock clutch damaged	Replace	3-S47
<b>Differential Lock Pedal does not Return</b>	● Differential lock pedal return spring weaken or damaged	Replace	—
	● Differential lock fork rod rusted	Repair	3-S47

000008034E

## 2. SERVICING SPECIFICATIONS

### HYDROSTATIC TRANSMISSION (HST) AND LINKAGE

Item		Factory Specification	Allowable Limit
Speed Control Pedal to Frame (Forward)	Clearance	5 to 10 mm 0.20 to 0.39 in.	—
Maximum Traveling Speed (Reverse)	—	70 to 80 % of forward speed	—
Claw to Lever Guide (Cruise control)	Clearance	0 to 1 mm 0. to 0.039 in.	—
	Projection height	More than 2 mm (0.079 in.)	—
High Pressure Relief Valve	Setting pressure	26.4 to 29.4 MPa 270 to 300 kgf/cm <sup>2</sup> 3840.2 to 4266.9 psi	—
Charge Relief Valve	Setting pressure	0.4 to 0.8 Mpa 4 to 8 kgf/cm <sup>2</sup> 56.9 to 113.8 psi	—

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**BI-SPEED HYDRAULIC CLUTCH AND GEARS**

Item		Factory Specification	Allowable Limit
Clutch Disc	Thickness	1.915 to 2.085 mm 0.1754 to 0.0821 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.	—
	Load / Length	638.7 N / 26 mm 65.13 kgf / 26 mm 143.6 lbs / 1.02 in.	539.4 N / 26 mm 55 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 32T 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.	—
	32T 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 0.000 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.	—

000008036E

**HYDRAULIC PTO CLUTCH AND GEARS**

Item		Factory Specification	Allowable Limit
Clutch Disc	Thickness	1.70 to 1.90 mm 0.067 to 0.075 in.	1.55 mm 0.061 in.
Steel Plate	Thickness (Without Hole)	0.95 to 1.05 mm 0.0374 to 0.0413 in.	0.8 mm 0.031 in.
	Thickness (With Hole)	1.15 to 1.25 mm 0.045 to 0.049 in.	1.10 mm 0.043 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.	—
	Load / Length	638.7 N / 26 mm 65.13 kgf / 26 mm 143.6 lbs / 1.02 in.	539.4 N / 26 mm 55 kgf / 26 mm 121.3 lbs / 1.02 in.
Counter Shaft to 21T Gear	Clearance	0.009 to 0.040 mm 0.0004 to 0.0016 in.	0.1 mm 0.0039 in.
	Counter Shaft (O.D.)	29.991 to 30.000 mm 1.1807 to 1.1811 in.	—
	21T Gear (I.D.)	35.009 to 35.025 mm 1.3783 to 1.3789 in.	—
	Needle Bearing (O.D.)	2.497 to 2.500 mm 0.0983 to 0.0984 in.	—

000008037E

**TRANSMISSION CASE**

Item		Factory Specification	Allowable Limit
Shift Fork to Shifter Groove	Clearance	0.1 to 0.4 mm 0.0039 to 0.0157 in.	0.8 mm 0.031 in.
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.

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
Mid 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.	—
	Mid PTO Drive Shaft (O.D.)	22.467 to 22.480 mm 0.8845 to 0.8850 in.	—

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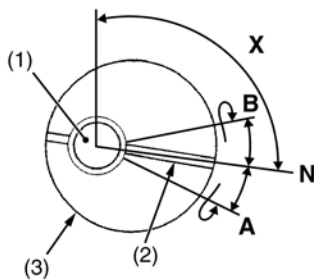
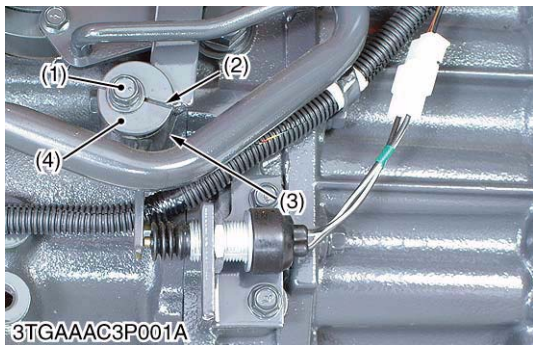
### 3. TIGHTENING TORQUES

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
Brake link retaining nut	7.8 to 9.3	0.8 to 0.95	5.8 to 6.9
Steering wheel mounting nut	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
Delivery hose RH retaining nut	25.4 to 29.4	2.5 to 3.0	18.1 to 21.7
Delivery hose LH retaining nut	25.4 to 29.4	2.5 to 3.0	18.1 to 21.7
Charge hose retaining nut	25.4 to 29.4	2.5 to 3.0	18.1 to 21.7
Delivery hose retaining nut (controller side)	34.3 to 44.1	3.5 to 4.5	25.3 to 32.5
Delivery hose joint nut (pump side)	49.0 to 58.8	5.0 to 6.0	36.2 to 43.4
Engine mounting nut (M12)	77.5 to 90.2	7.9 to 9.2	57.2 to 66.5
Bi-speed delivery pipe retaining nut (valve side)	30.0 to 49.0	3.0 to 5.0	21.7 to 36.2
Bi-speed delivery pipe joint (pump side)	34.3 to 40.0	2.5 to 4.0	25.3 to 28.9
Engine mounting screw, bolt and nut (M10)	48.1 to 55.9	4.9 to 5.7	35.5 to 41.2
Rear wheel mounting screw and nut	196.1 to 225.6	20.0 to 23.0	145.0 to 166.0
Hydraulic hoses P, PB and T retaining nut	30.0 to 40.0	3.0 to 4.0	21.7 to 28.9
ROPS mounting bolt and nut	197 to 225	20.0 to 23.0	145 to 166
Rear cross bar mounting screw	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Rubber mount screw	196.0 to 225.0	20.0 to 30.0	144.7 to 166.4
Rear frame mounting screw (M12)	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Filter bracket mounting screw	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
3P delivery pipe retaining nut	88.2 to 117.6	9.0 to 12.0	65.1 to 86.8
PTO delivery hose retaining nut	15.0 to 17.0	1.5 to 1.75	10.8 to 12.7
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
Mid case mounting screw and nut	39.3 to 44.1	4.0 to 4.5	29.0 to 32.5
Top link bracket mounting screw	39.3 to 44.1	4.0 to 4.5	29.0 to 32.5
Hydraulic cylinder mounting screw	39.3 to 44.1	4.0 to 4.5	29.0 to 32.5
Lever stay mounting screw	39.3 to 44.1	4.0 to 4.5	29.0 to 32.5
Brake stay mounting screw	39.3 to 44.1	4.0 to 4.5	29.0 to 32.5
Brake case mounting screw	39.3 to 44.1	4.0 to 4.5	29.0 to 32.5
Clutch piston mounting nut (Bi-speed)	9.8 to 11.8	1.0 to 1.2	7.2 to 8.7
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
Rear PTO case mounting screw	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
Detent plug	19.6 to 24.5	2.0 to 2.5	14.5 to 18.1
Hypoid ring gear mounting UBS screw	60.8 to 70.6	6.2 to 7.2	44.8 to 52.1

# 4. CHECKING, DISASSEMBLING AND SERVICING

## [1] CHECKING AND ADJUSTING



3TGAAAC3P002A

### Adjusting Neutral

1. Disengage the front wheel drive lever. (Drive only rear wheels.)
2. Set the range gear shift lever at 3rd speed position.
3. 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.
4. Slightly loosen the holder shaft mounting screw (1).
5. Rotate the holder shaft (4) clockwise with a screw-driver, so that the rear wheels turn reverse.
6. Then rotate it counterclockwise until wheels stop completely.
7. Put a mark aligning the groove (2) on neutral holder (Position **A**).
8. Rotate the holder shaft (4) counterclockwise so that the rear wheels turn forward.
9. Then rotate it clockwise until wheels stop completely.
10. Put mark aligning the groove (2) on neutral holder (Position **B**).
11. Set the holder shaft (4), where it is in the center between the position **A** and **B**, and tighten the holder shaft mounting screw firmly (Position **N**)

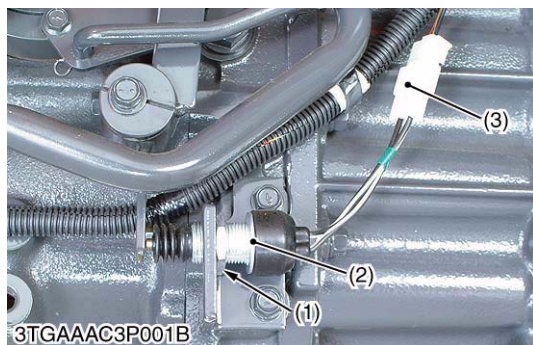
■ **NOTE**

- Run the engine at maximum speed when checking, and run the engine at low idling speed when adjusting.
- When the wheels tend to turn forward, rotate neutral holder clockwise.
- When the wheels tend turn reverse, rotate neutral holder counterclockwise.

Groove angle in neutral (X)	Reference valve	Approx. 1.80 rad 103°
-----------------------------	-----------------	--------------------------

- (1) Holder Shift Mounting Screw
- (2) Groove
- (3) Neutral Holder
- (4) Holder Shaft

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### HST Safety Switch

1. After adjusting the HST neutral position, be sure to adjust the HST safety switch (2).
2. Set the HST at neutral position.
3. Disconnect the connector (3) and remove the HST safety switch (2) once.
4. Connect the leads of an ohmmeter to the HST safety switch lead terminal.
5. Screw in the HST safety switch (2) until the ohmmeter begins to show 0 ohm.
6. Further screw in the HST safety switch 1/2 turn, and tighten the lock nut (1).

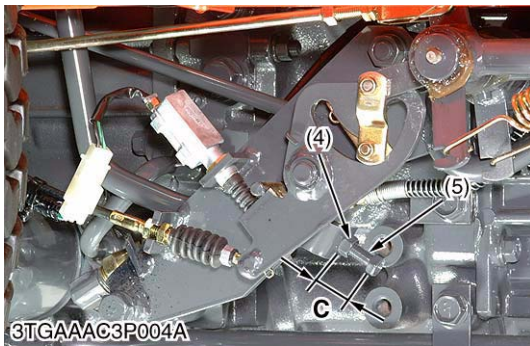
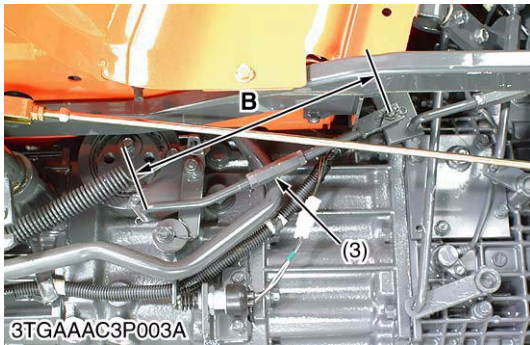
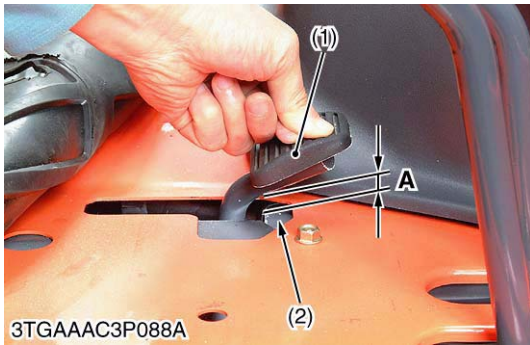
#### ■ IMPORTANT

- **Be sure to check, the ohmmeter indicates infinity when the speed control pedal is depressed for both forward and reverse.**

- (1) Lock Nut  
(2) HST Safety Switch

- (3) Connector

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Adjusting Maximum Traveling Speed

■ **NOTE**

- **Execute this adjustment after the HST neutral adjustment.**

**(Forward)**

1. Fully press down the speed control pedal (forward) (1), and measure the clearance **A** between the pedal (1) and the frame (2).
2. If the measurement is not within the factory specifications, change the length **B** of the HST link rod (3) to adjust.

Clearance <b>A</b>	Factory spec.	5 to 10 mm 0.20 to 0.39 in.
Length <b>B</b> of HST link rod	Reference value	263 mm 10.4 in.

**(Reverse)**

3. Put the tractor on a flat ground made of concrete.
4. Set the range gear shift lever at 3rd speed position and run the engine at maximum speed.
5. Measure the maximum traveling speed (reverse).
6. If the measurement is not within the factory specifications, change the length **C** of the adjusting screw (5).

Maximum traveling speed (reverse)	Factory spec.	70 to 80 % of forward speed
Length <b>C</b> of adjusting screw	Reference value	20 mm 0.79 in.

■ **NOTE**

- **Install the standard turf tires or farm tires.**

- |                                   |                     |
|-----------------------------------|---------------------|
| (1) Speed Control Pedal (Forward) | <b>A: Clearance</b> |
| (2) Frame                         | <b>B: Length</b>    |
| (3) HST Link Rod                  | <b>C: Length</b>    |
| (4) Lock Nut                      |                     |
| (5) Adjusting Screw               |                     |

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Cruise Control Linkage

■ **NOTE**

● **Execute this adjustment after the adjustment of maximum traveling speed.**

1. Engage the cruise control lever (1) to the most forward position, and measure the clearance **A** between the pedal (2) and the frame.
2. If the measurement is not within the factory specifications, change the length **L** of the cruise control rod (3) to adjust.

Clearance <b>A</b>	Factory spec.	5 to 10 mm 0.20 to 0.39 in.
Length <b>L</b>	Reference value	218.2 in. 8.59 in.

- (1) Cruise Control Lever                      **A: Clearance**
- (2) Speed Control Pedal (Forward)       **L: Length**
- (3) Cruise Control Rod

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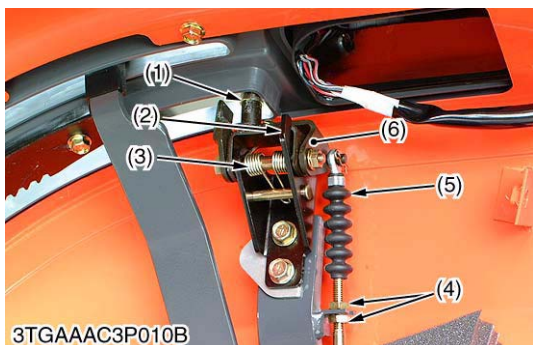
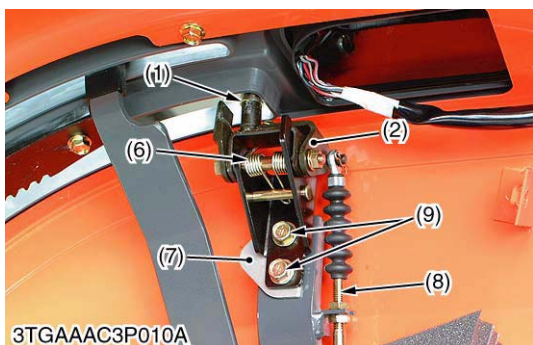
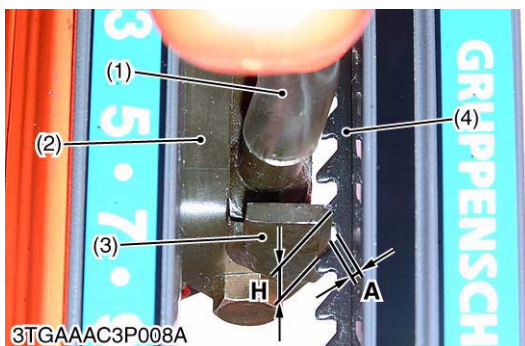
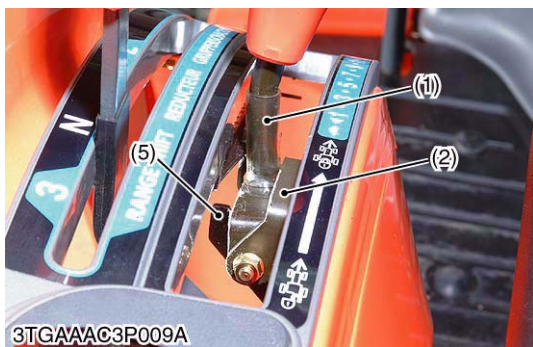
Operation Check of Cruise Control Automatic Release

1. Engage the cruise control lever (1) and confirm the following operations.
2. The cruise control lever (1) should return to the home position, when right and left brake pedals are pressed at the same time.
3. The cruise control lever (1) must not return when only one of brake pedals is pressed
4. When not operating like the above-mentioned, execute the following checks "**1) Lever Setting Position**", "**2) Release Wire**" and "**3) Brake Link**".

- (1) Cruise Control Lever                      (3) Pedal Lock
- (2) Brake Pedal

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**1) Lever Setting Position (Cruise Control)**

- Engage the cruise control lever (1).
- Confirm the release lever (2) touches the cruise control lever (1) by the spring (6), and the cruise control lever (1) touches the stopper (5).
- When not becoming like the above mentioned, check the release wire (8) and damage of the spring (6). (See "Release Wire".)
- Check the clearance **A** between the claw (3) and lever guide (4).
- Check the projection height **H** of the claw (3) from the lever guide (4).
- If the clearance **A** is not within the factory specifications, remove the left rear wheel and the fender cover, and adjust it with the shim (7).
- If the projection height **H** is not within the factory specifications, loosen the screws (9) and move the cruise lever assembly.

Clearance <b>A</b> between the claw and lever guide	Factory spec.	0 to 1 mm 0 to 0.039 in.
Projection height <b>H</b> from the lever guide		More than 2 mm (0.079 in.)

**(Reference)**

- Thickness of the shim (7): 1.0 mm (0.039 in.)

- |                          |                  |
|--------------------------|------------------|
| (1) Cruise Control Lever | (7) Shim         |
| (2) Release Lever        | (8) Release Wire |
| (3) Claw                 | (9) Screw        |
| (4) Lever Guide          |                  |
| (5) Stopper              |                  |
| (6) Spring               |                  |

**A : Clearance between the claw and lever guide**  
**H : Projection height from the lever guide**

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**2) Release Wire (Cruise Control)**

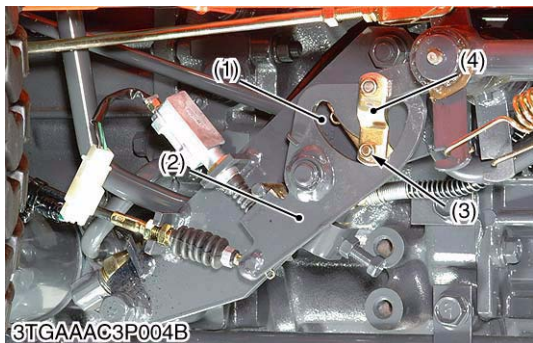
- Remove the left rear wheel and the fender cover.
- Engage the cruise control lever (1).
- Check the inner wire in the release wire (5) does not slacken.
- Check the release lever (6) touches the cruise control lever (1) by the spring (3), and the cruise control lever (1) touches the stopper (2).
- When not becoming like the above-mentioned, adjust with the adjusting nut (4).

**(Reference)**

- If the inner wire is too tight, the cruise control lever (1) does not touch the stopper (2).

- |                          |                   |
|--------------------------|-------------------|
| (1) Cruise Control Lever | (4) Adjusting Nut |
| (2) Stopper              | (5) Release Wire  |
| (3) Spring               | (6) Release Lever |

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**3) Brake Link (Cruise Control)**

1. Check the following operation of the brake link (4) by operating the brake pedals.
2. The joint bolt (3) should move along the ditch and the lever (2) must not rotate when one of brake pedals is pressed.
3. The joint bolt (3) must not move and the lever (2) should rotate when right and left brake pedals are pressed at the same time.
4. If the operation is not normal, remove the brake link (4) and check the damage and distortion of the link (4) and ditch (1).

Tightening torque	Brake link retaining nut	7.8 to 9.3 N·m 0.8 to 0.95 kgf·m 5.8 to 6.9 ft·lbs
-------------------	--------------------------	--

**NOTE**

- When reassembling the link, apply grease to the moving portion.

- |           |                |
|-----------|----------------|
| (1) Ditch | (3) Joint Bolt |
| (2) Lever | (4) Brake Link |

000007527E



**Checking High-pressure Relief Valve**

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) (3) and pressure gauge (49.0 MPa, 500 kgf/cm<sup>2</sup>, 7110 psi) after removing forward or reverse high-pressure checking port plugs.
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 is not within the factory specification, check the check and high-pressure relief valve, neutral valve and HST.

**NOTE**

- High-pressure checking port and high-pressure relief plug for forward are on the left side of the HST.

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

**Condition**

- Engine speed : 1500 rpm
- Oil temperature : 40 to 60 °C (104 to 140 °F)

- |                             |  |
|-----------------------------|--|
| (1) Neutral Valve (Forward) | (3) Adaptor C                            |
| (2) Neutral Valve (Reverse) | (4) High-pressure Relief Valve (Reverse) |

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**Checking Charge Relief Valve**

1. Start the engine to warm up the transmission oil until to reach 40 °C(104 °F)
2. Remove the plug from the oil filter bracket (2).
3. Connect the long connector (Code No.: 07916-60831) and pressure gauge.
4. Measure the pressure with speed control pedal to be neutral at engine 1500 rpm. If the measurement is not within factory specification, check charge relief valve.

Charge relief pressure	Factory spec.	0.4 to 0.8 MPa 4 to 8 kgf/cm <sup>2</sup> 56.9 to 113.8 psi
------------------------	---------------	---

**Condition**

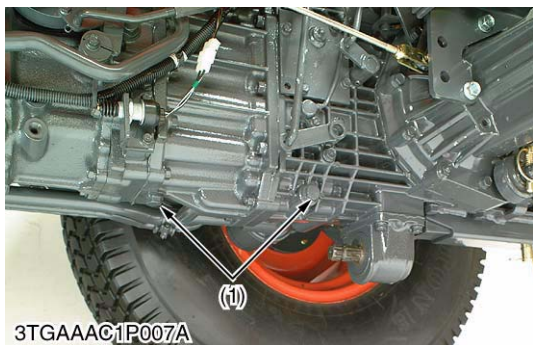
- Engine speed : 1500 rpm
- Oil temperature : 40 to 60 °C (104 to 140 °F)

- (1) HST Oil Filter Cartridge                      (3) Long Connector  
 (2) Oil Filter Bracket

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## [2] PREPARATION

### (1) Separating Engine and Clutch Housing



#### 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 reassembling)**

- Fill new oil from filling port after removing 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	22 L 5.81 U.S.qts. 4.84 Imp.qts.
--------------------	----------	--

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

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#### Hood, Side Cover and Battery Cord

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

#### **(When reassembling)**

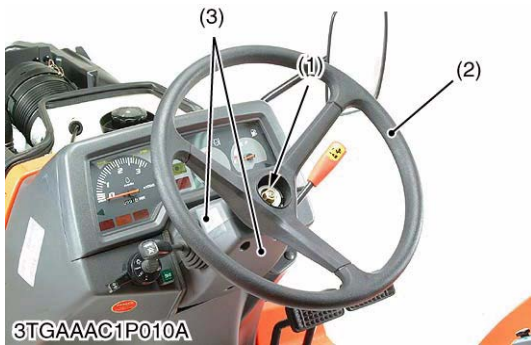
#### ■ NOTE

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

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

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**Steering Wheel**

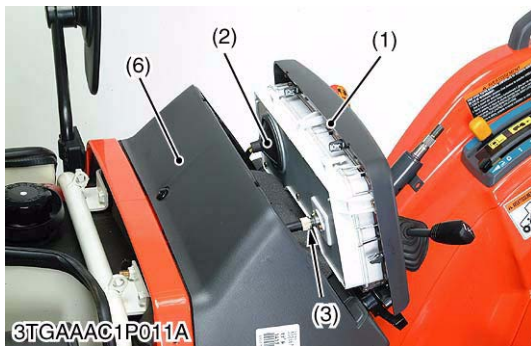
1. Remove the covers (3).
2. Remove the steering wheel cap.
3. Remove the steering wheel mounting nut (1) and remove the steering wheel (2) with a steering wheel puller (Code No. 07916-51090).

**(When reassembling)**

Tightening torque	Steering wheel mounting nut	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft·lbs
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- (1) Nut
- (2) Steering Wheel
- (3) Cover

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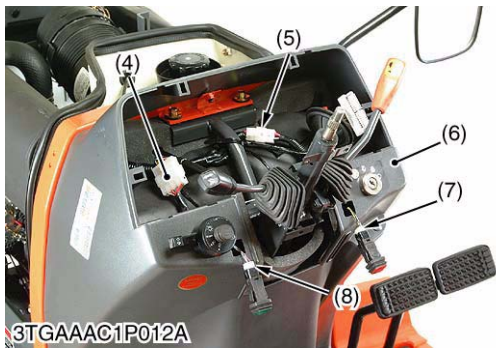


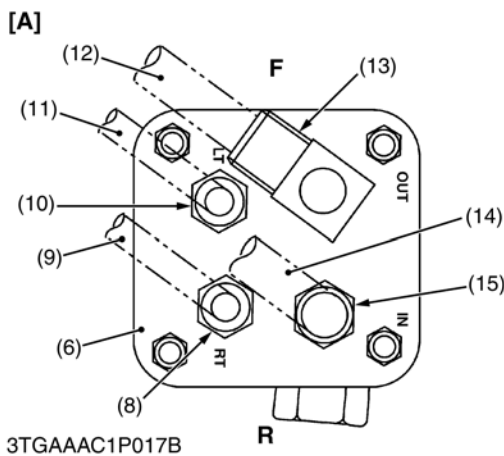
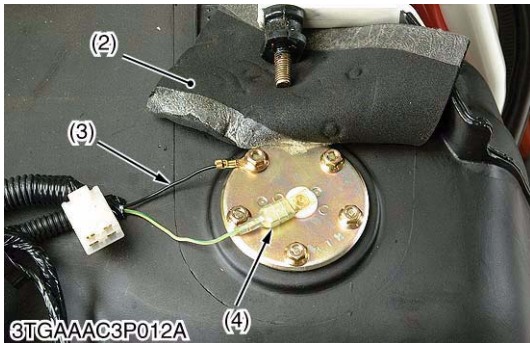
**Meter Panel and Panel Under Cover**

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 (7) and position lamp switch connector (8).
4. Remove the panel under cover (6)

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

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**Steering Pillar and Controller**

1. Remove the accelerator wire (1) from the engine.
2. Turn over the fuel sensor cover (2), and disconnect the grounding wire (3) and 1P connector (4) from the fuel tank.
3. Separate the PTO indicator relay (5) from the steering pillar (7).
4. Disconnect the power steering hoses from the steering controller (6).
5. Remove the steering pillar (7) with the steering controller (6).

**(When reassembling)**

- Connect the delivery hose RH (11) to the LT port (10).
- Connect the delivery hose LH (9) to the RT port (8).
- Assemble the delivery hose (14), delivery hose LH (9) and delivery hose RH (11) so that each hose becomes parallel to the hose joint (13).
- Be sure to check the hose joints do not interfere in other joints.

Tightening torque	Delivery hose RH (11) retaining nut	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 ft·lbs
	Delivery hose LH (9) retaining nut	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 ft·lbs
	Charge hose (12) retaining nut	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 ft·lbs
	Delivery hose (14) retaining nut (Controller side)	34.3 to 44.1 N·m 3.5 to 4.5 kgf·m 25.3 to 32.5 ft·lbs
	Delivery hose (14) joint screw (Pump side)	49.0 to 58.8 N·m 5.0 to 6.0 kgf·m 36.2 to 43.4 ft·lbs

- |                           |                            |
|---------------------------|----------------------------|
| (1) Accelerator Wire      | (11) Delivery Hose RH      |
| (2) Fuel Sensor Cover     | (12) Charge Hose           |
| (3) Grounding Wire        | (13) Hose Joint (OUT Port) |
| (4) 1P Connector          | (14) Delivery Hose         |
| (5) PTO Indicator Relay   | (15) Hose Joint (IN Port)  |
| (6) Steering Controller   |                            |
| (7) Steering Pillar       |                            |
| (8) Hose Joint (RT Port)  |                            |
| (9) Delivery Hose LH      |                            |
| (10) Hose Joint (LT Port) |                            |

**[A] Viewed from Bottom Side**  
**F: Front Side**  
**R: Rear Side**

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**Panel Under Frame**

1. Remove the foot cover (2).
2. Remove the screws (3) and nuts (4), and pull up the panel under frame (1).

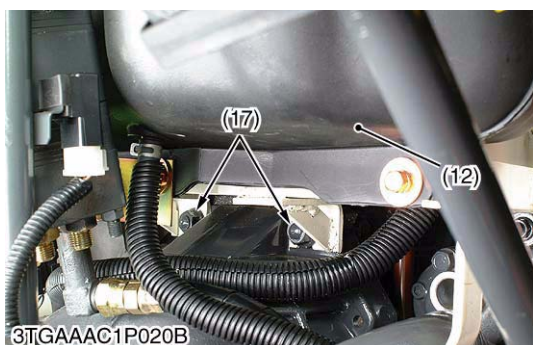
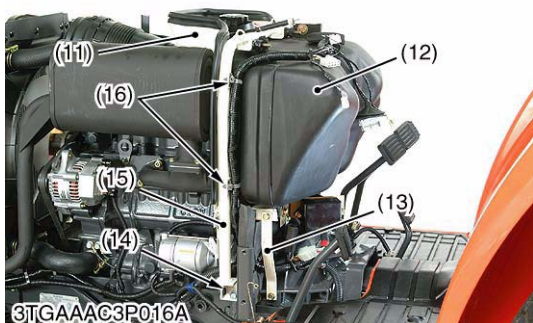
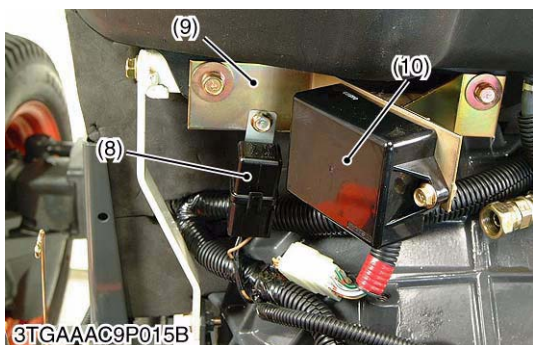
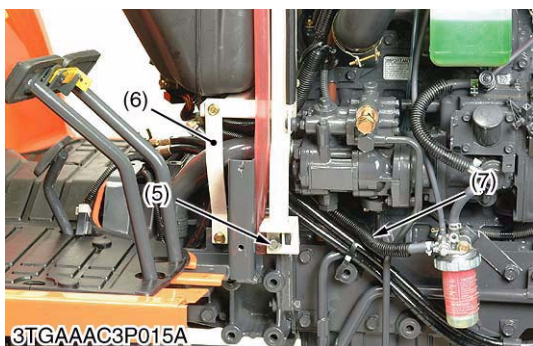
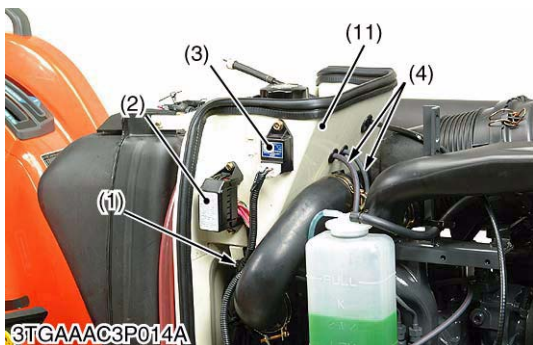
**(When reassembling)**

- When reassembling the panel under frame, tighten the two nuts (4) for insulation rubber first.

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



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**Fuel Tank**

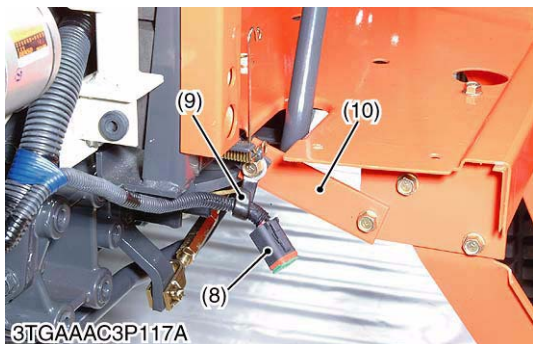
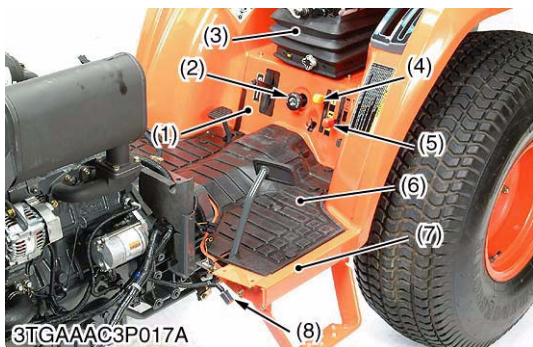
1. Disconnect the connector from the glow lamp timer (3).
2. Pull out the clamp (1) and separate the fuse box (2) from the shutter plate (11).
3. Disconnect the overflow hoses (4) from the fuel tank.
4. Separate the fuel hose (7) from the fuel filter to drain fuel.
5. Disconnect the connectors from the PTO relay (8) and flasher unit (10), and remove the plate (9) with the PTO relay (8) and flasher unit (10).
6. Remove the clamps (16) from the bonnet rear support (15).
7. Remove the bracket (6) (13), screws (5) (14) and nuts (17).
8. Remove the fuel tank (12) with the bonnet rear support (15) and shutter plate (11).

**(When reassembling)**

Tightening torque	Engine mounting M12 nut (17)	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
-------------------	------------------------------	---

- |                     |                              |
|---------------------|------------------------------|
| (1) Clamp           | (10) Flasher Unit            |
| (2) Fuse Box        | (11) Shutter Plate           |
| (3) Glow Lamp Timer | (12) Fuel Tank               |
| (4) Overflow Hoses  | (13) Bracket                 |
| (5) Screw           | (14) Screw                   |
| (6) Bracket         | (15) Bonnet Rear Support     |
| (7) Fuse Hose       | (16) Clamps                  |
| (8) PTO Relay       | (17) Engine Mounting M12 Nut |
| (9) Plate           |                              |

000007538E



Seat, Seat Under Cover and Step

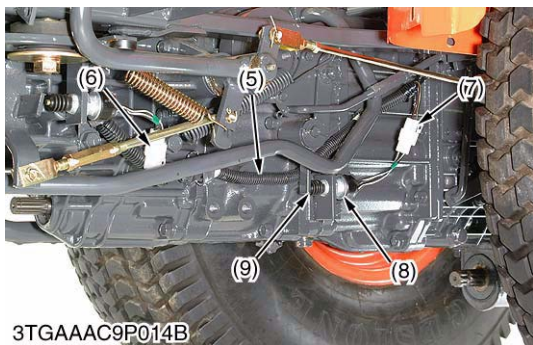
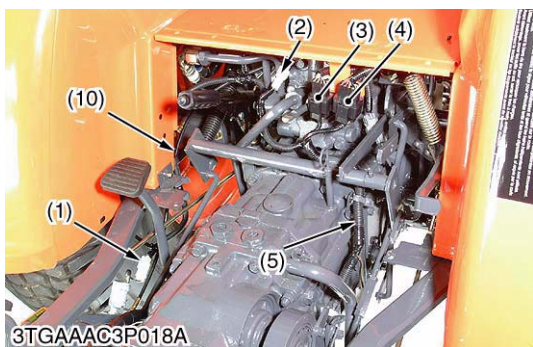
1. Remove the seat (3).
2. Remove the step mat (6).
3. Remove the grips of the mid PTO lever (4) and front wheel drive lever (5).
4. Remove the lowering speed adjusting knob (2).
5. Remove the seat under cover (1).
6. Loosen the clamp (9) for the cabin coupler (8).
7. Remove the stay (10).
8. Remove the step (7).

**(When reassembling)**

- Do not confuse the grips.
  - Grip (yellow) for the mid PTO lever.
  - Grip (red) for the front wheel drive lever.
- Be sure to fix the cabin coupler (8) with the clamp (9).

- |                                   |                   |
|-----------------------------------|-------------------|
| (1) Seat Under Cover              | (6) Step Mat      |
| (2) Lowering Speed Adjusting Knob | (7) Step          |
| (3) Seat                          | (8) Cabin Coupler |
| (4) Mid PTO Lever                 | (9) Clamp         |
| (5) Front Wheel Driver Lever      | (10) Stay         |

000007539E



Wiring Harness

1. Disconnect the brake switch connector (1) and parking brake switch connector (2).
2. Disconnect the rear harness connectors (3) (4).
3. Disconnect the safety switch connectors (6) (7).
4. Loosen the clamp and move the main harness (5) to the engine side.

**NOTE**

- Pass the main harness (5) between the neutral lever (9) and safety switch (8) while engaging the cruise control lever.

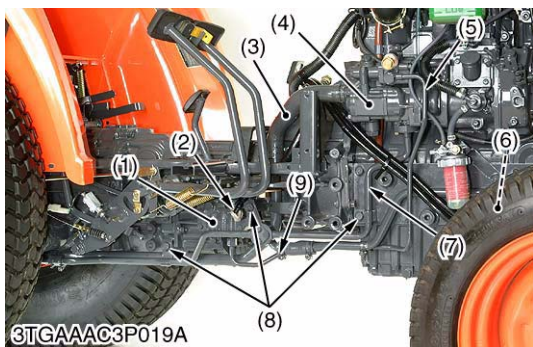
**(When reassembling)**

- Note that the main harness (5) does not interfere in the rod and the lever.
- Clamp the wiring harness for the brake switch to the cruise control release wire (10).

- |                                    |  |
|------------------------------------|--|
| (1) Brake Switch Connector         | (6) Safety Switch Connector (Clutch Pedal) |
| (2) Parking Brake Switch Connector | (7) Safety Switch Connector (HST)          |
| (3) Rear Harness Connector         | (8) Safety Switch (HST)                    |
| (4) Rear Harness Connector         | (9) Neutral Lever                          |
| (5) Main Harness                   | (10) Cruise Control Release Wire           |

000007540E





**Hydraulic Pipes and Bi-Speed Valve Connector**

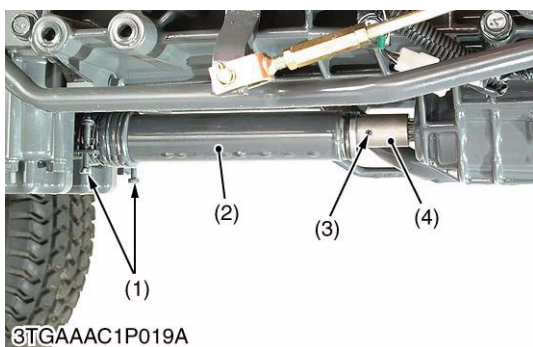
1. Disconnect the bi-speed valve connector (2).
2. Loosen the clamp and separate the hydraulic suction hose (3) from the hydraulic pump (4).
3. Remove the joints and disconnect the bi-speed delivery pipe (5) from the bi-speed valve (1) and hydraulic pump (4).
4. Remove the pipe retaining screws (8) and separate the 3P delivery pipe (7) from the hydraulic pump.
5. Loosen the pipe retaining screws (6) (10).
6. Loosen the hose clamps (9) (11).

**(When reassembling)**

Tightening torque	Bi-speed delivery pipe retaining nut (valve side)	30 to 49 N·m 3.0 to 5.0 kgf·m 21.7 to 36.2 ft·lbs
	Bi-speed delivery pipe joint (pump side)	34.3 to 40 N·m 3.5 to 4.0 kgf·m 25.3 to 28.9 ft·lbs

- |                              |                           |
|------------------------------|---------------------------|
| (1) Bi-speed Valve           | (7) 3P Delivery Pipe      |
| (2) Bi-speed Valve Connector | (8) Pipe Retaining Screw  |
| (3) Hydraulic Suction Hose   | (9) Hose Clamp            |
| (4) Hydraulic Pump           | (10) Pipe Retaining Screw |
| (5) Bi-speed Delivery Pipe   | (11) Hose Clamp           |
| (6) Pipe Retaining Screw     |                           |

000007541E



**Propeller Shaft**

1. Loosen the clamp screws (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 the cover.

**(When reassembling)**

- Apply grease to the spline portion of the propeller shaft and couplings.
- When inserting the spring pins (3), face their splits in the direction parallel to the propeller shaft.
- Tighten the clamp screws (1) upward from the bottom side.

- |                           |                |
|---------------------------|----------------|
| (1) Clamp Screws          | (3) Spring Pin |
| (2) Propeller Shaft Cover | (4) Coupling   |

000007491E



### Separating the Engine from Clutch Housing

1. Place the disassembling stand under the clutch housing 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 screw, bolt and nut (M10)	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft-lbs
	Engine mounting nut (M12)	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs

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## **(2) Separating Clutch Housing Case**

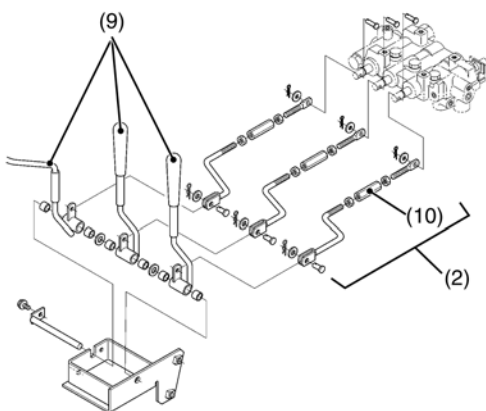
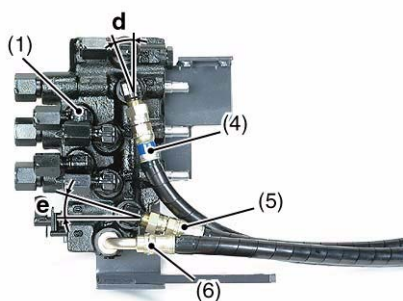
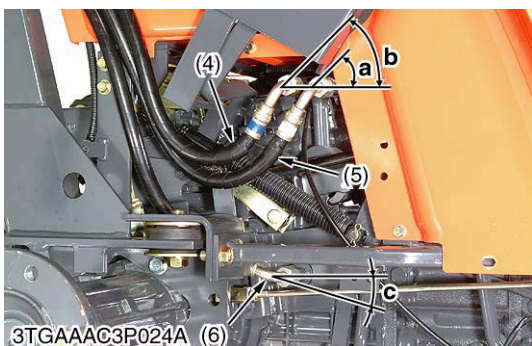
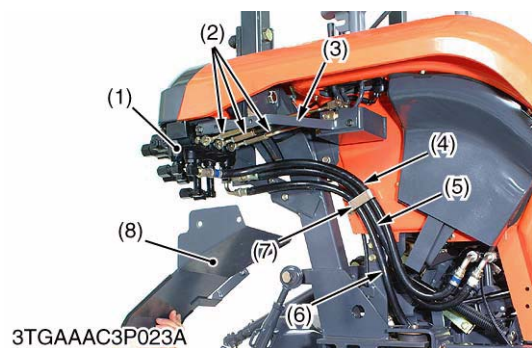


### Rear Wheel

1. Place the disassembling stand under the rear axles.
2. Remove the rear wheels.

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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**Auxiliary Control Valve**

1. Remove the valve cover (8).
2. Remove the valve stay (3).
3. Remove the connecting rods (2).

**(When reassembling)**

- Reassemble the connecting rods (2) as shown in the figure.
  - After reassembling the valve stay (3), adjust to locate the control lever (9) at a central position of the guide slot with the turnbuckle (10).
4. Remove the hose clamp (7).

**(When reassembling)**

- Clamp the hydraulic hoses in order of hydraulic hose **PB** (4), hydraulic hose **P** (5) and hydraulic hose **T** (6) from the front side.
5. Disconnect the hydraulic hoses (4) (5) (6) from the tractor body.
  6. Remove the auxiliary control valve (1) with the hydraulic hoses (4) (5) (6).

**(When reassembling)**

- Assemble the hose joints to appropriate positions referring to the table below.

(Distinction and installation angle of the hose joints)

Hydraulic Hose	Hose joint (Valve side)	Hose joint (Tractor body side)
<b>P</b> (5)	Straight joint 0.26 rad (15 °)	Bent joint with white tape 0.785 rad (45 °)
<b>PB</b> (4)	Straight joint with blue tape 0.26 rad (15 °)	Bent joint with blue tape 0.785 rad (45 °)
<b>T</b> (6)	Bent joint 1.57 rad (90 °)	Bent joint 0.349 to 0.523 rad (20 ° to 30 °)

Tightening torque	Hydraulic hoses <b>PB</b> , <b>P</b> and <b>T</b> retaining nuts	30 to 40 N·m 3.0 to 4.0 kgf·m 21.7 to 28.9 ft·lbs
-------------------	--	---

- |                              |   |
|------------------------------|---|
| (1) Auxiliary Control Valve  | <b>a: 0.785 rad (45 °)</b>                  |
| (2) Connecting Rods          | <b>b: 0.349 to 0.523 rad (20 ° to 30 °)</b> |
| (3) Valve Stay               |   |
| (4) Hydraulic Hose <b>PB</b> | <b>c: 0.26 rad (15 °)</b>                   |
| (5) Hydraulic Hose <b>P</b>  | <b>d: 0.26 rad (15 °)</b>                   |
| (6) Hydraulic Hose <b>T</b>  | <b>e: 0.26 rad (15 °)</b>                   |
| (7) Hose Clamp               |   |
| (8) Valve Cover              |   |
| (9) Control Lever            |   |
| (10) Turnbuckle              |   |

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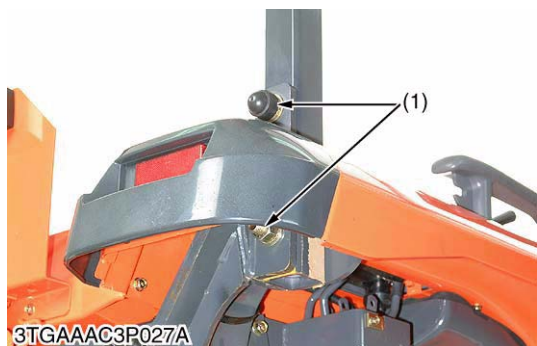
**ROPS**

1. Fold the ROPS and support it with the lift strap.
2. Disconnect the wiring connector for the lights on the ROPS.
3. Remove the ROPS mounting bolts and nuts (1).
4. Pull out the ROPS.

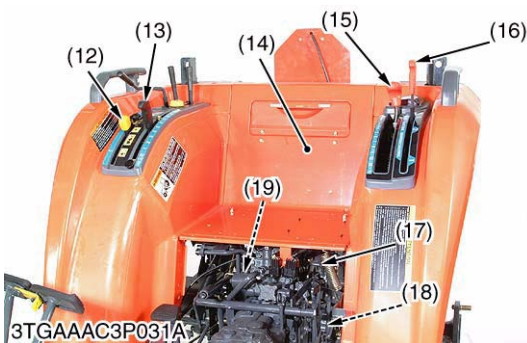
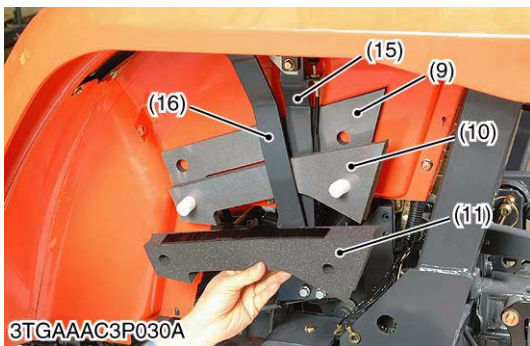
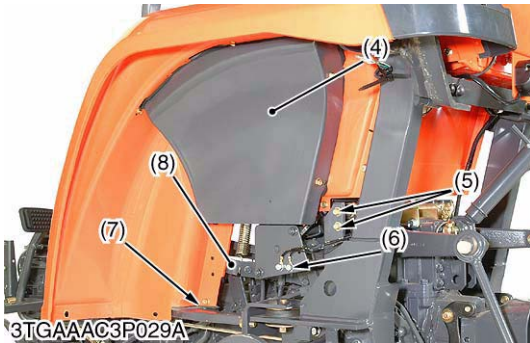
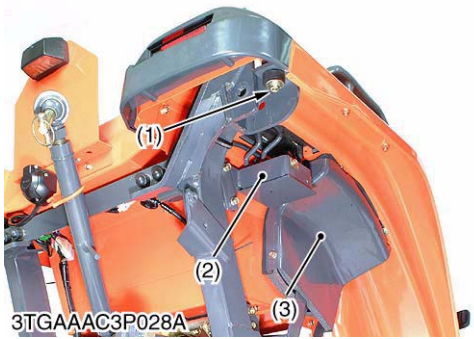
Tightening torque	ROPS mounting bolt and nut	197 to 225 N·m 20.0 to 23.0 kgf·m 145 to 166 ft-lbs
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(1) ROPS Mounting Bolt and Nut

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3TGAAAC3P027A



**Fender Assembly**

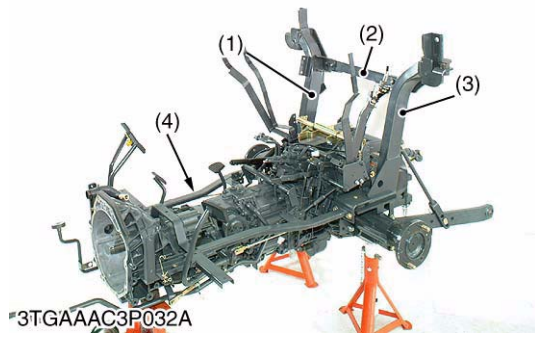
1. Remove the lever bracket (2) with the auxiliary control lever.
2. Remove the fender covers (3) (4) and the sponges (9) (10) (11).
3. Disconnect the wiring connectors for the rear PTO switch (19), mid PTO switch (17) and speed sensor (18).
4. Disconnect the grounding terminal (6).
5. Remove the differential lock pedal (8) with the spring.
6. Remove the grips of the rear PTO shift lever (12), position control lever (13), cruise control lever (15) and range gear shift lever (16).
7. Remove the screws (1) (5) (7).
8. Lift and remove the fender assembly (14) with wiring rear harness.

**(When reassembling)**

- Do not confuse the grips.
  - Grip (yellow) for the rear PTO shift lever (12).
  - Grip (red) for the range gear shift lever (16).
- Assemble the sponge (center) (10) between the cruise control lever (15) and range gear shift lever (16).

(1) Screw	(11) Sponge (Outer)
(2) Lever Bracket	(12) Rear PTO Shift Lever
(3) Fender Cover (Right)	(13) Position Control Lever
(4) Fender Cover (Left)	(14) Fender Assembly
(5) Screw	(15) Cruise Control Lever
(6) Grounding Terminal	(16) Range Gear Shift Lever
(7) Screw	(17) Mid PTO Switch
(8) Differential Lock Pedal	(18) Speed Sensor
(9) Sponge (Inner)	(19) Rear PTO Switch
(10) Sponge (Center)	

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Rear Frame and Under Frame

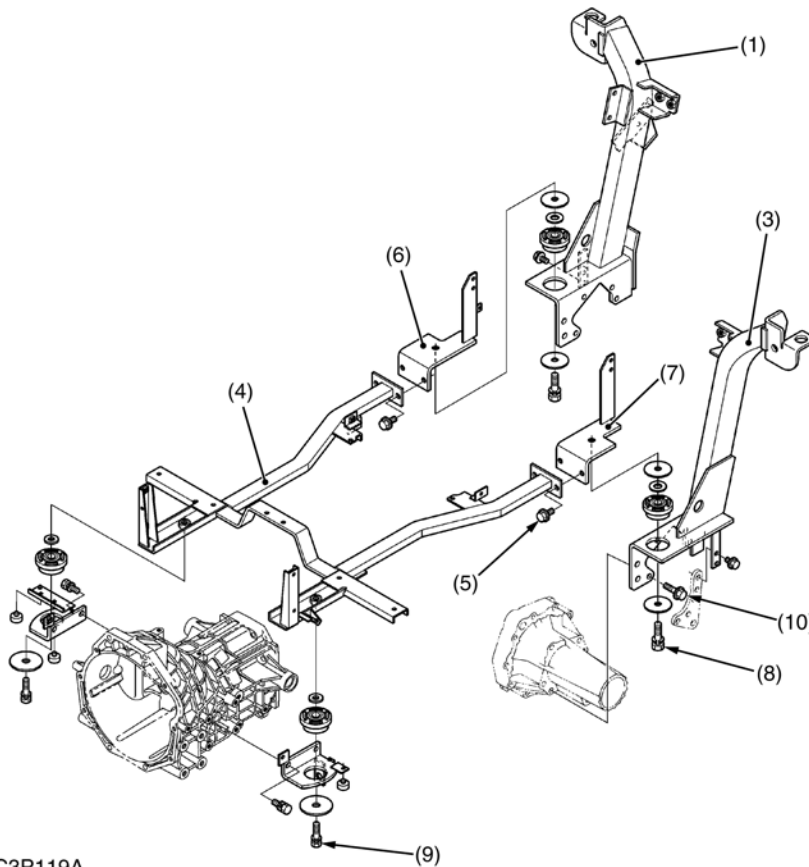
1. Remove the rear cross bar (2).
2. Remove the rubber mount screw (9) and rear frame mounting screw (5) then detach the rear frame (4).
3. Remove the rubber mount screw (8) and remove the rear bracket (6) (7).
4. Remove the under frame (1) (3).

**(When reassembling)**

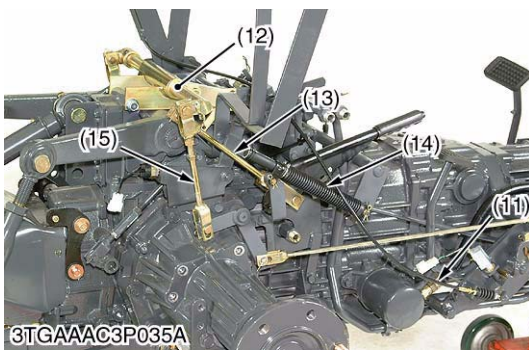
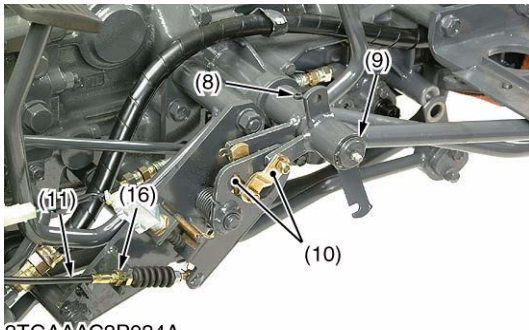
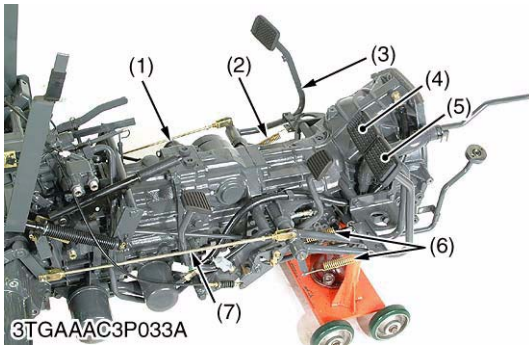
- Apply liquid lock (Three Bond 1372 or equivalent) to the rear frame mounting screw (M12) (10).

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 (8) (9)	196.0 to 225.0 N·m 20.0 to 23.0 kgf·m 144.7 to 166.4 ft-lbs
	Rear frame mounting screw (M12) (10)	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
- (2) Rear Cross Bar
- (3) Under Frame LH
- (4) Rear Frame
- (5) Rear Frame Mounting
- (6) Rear Bracket RH
- (7) Rear Bracket LH
- (8) Rubber Mount Screw
- (9) Rubber Mount Screw
- (10) Flange Bolt



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**Clutch and Brake Linkage**

1. Remove the brake rods (1) (7) and brake springs (6).
2. Remove the release wire (11).
3. Remove the brake link (10).
4. Remove the spring pin (8) and external snap ring (9), and remove the brake pedals (4) (5).
5. Remove the clutch rod and spring (2), and draw out the clutch pedal (3) with the brake shaft.
6. Remove the damper (14).
7. Remove the parking brake shaft assembly (12) with the parking brake rod 1 (13) and parking brake rod 2 (15).

**(When reassembling)**

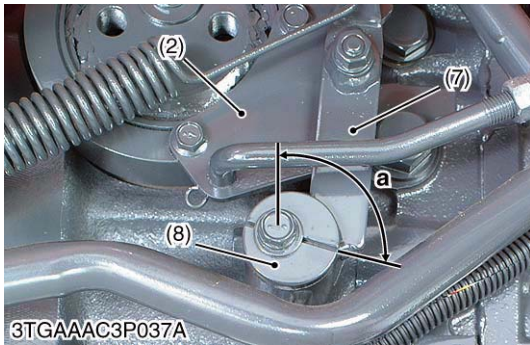
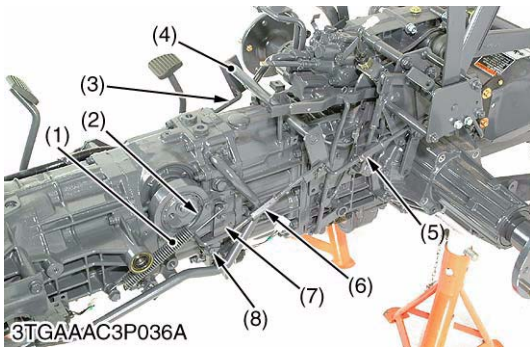
- Reassemble the release wire (11) to the guide plate (16) so that the guide plate (16) comes to the center of the threaded portion.
- Apply grease to the brake link (10).
- After reassembling the brake link (10), execute the check of **"3) Brake Link (Cruise Control)"** (See page 3-S15).
- Adjust the clutch pedal free travel (See page 2-S5).
- Adjust the brake pedal free travel (See page 5-S3).
- Adjust the parking brake lever free travel (See page 5-S4).

Clutch pedal free travel	Factory spec.	20 to 30 mm 0.78 to 1.18 in.
Brake pedal free travel		20 to 30 mm 0.78 to 1.18 in.
Parking brake lever free travel		The brake works when the lever is raised until the ratchet sound is heard twice.

Tightening torque	Brake link retaining nut	7.8 to 9.3 N·m 0.8 to 0.95 kgf·m 5.8 to 6.9 ft·lbs
-------------------	--------------------------	--

- |                         |                                    |
|-------------------------|------------------------------------|
| (1) Brake Rod (Left)    | (9) External Snap Ring             |
| (2) Clutch Spring       | (10) Brake Link                    |
| (3) Clutch Pedal        | (11) Release Wire (Cruise Control) |
| (4) Brake Pedal (Left)  | (12) Parking Brake Shaft Assembly  |
| (5) Brake Pedal (Right) | (13) Parking Brake Rod 1           |
| (6) Brake Spring        | (14) Damper                        |
| (7) Brake Rod (Right)   | (15) Parking Brake Rod 2           |
| (8) Spring Pin          | (16) Guide Plate                   |

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HST Linkage

1. Remove the return spring (1).
2. Remove the neutral holder (7) and holder shaft (8).
3. Remove the neutral cam (2) and HST link rod (6).
4. Remove the HST pedal rod (3).
5. Remove the link support (4) with the cruise control rod (5).

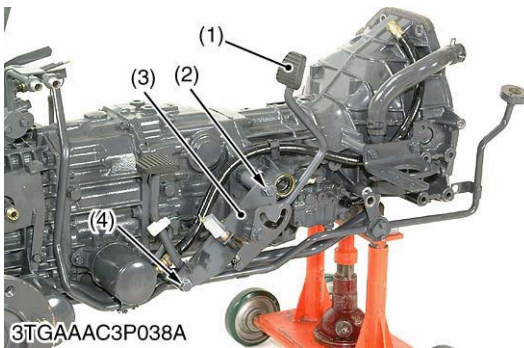
**(When reassembling)**

- Assemble the holder shaft (8) temporarily so that the angle (a) of the groove becomes a reference value.
- Execute "Adjusting Neutral" (See page 3-S10) after all assemblies ends.

Angle of the groove (a)	Reference Value	1.80 rad 103 °
-------------------------	-----------------	-------------------

- |                        |                        |
|------------------------|------------------------|
| (1) Return Spring      | (6) HST Link Rod       |
| (2) Neutral Cam        | (7) Neutral Holder     |
| (3) HST Pedal Rod      | (8) Holder Shaft       |
| (4) Link Support       |                        |
| (5) Cruise Control Rod | <b>a: Groove Angle</b> |

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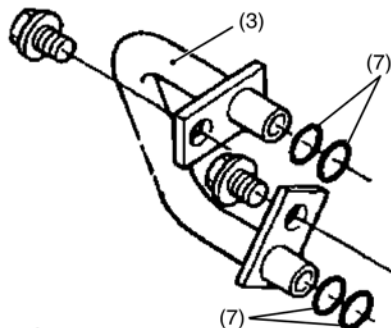
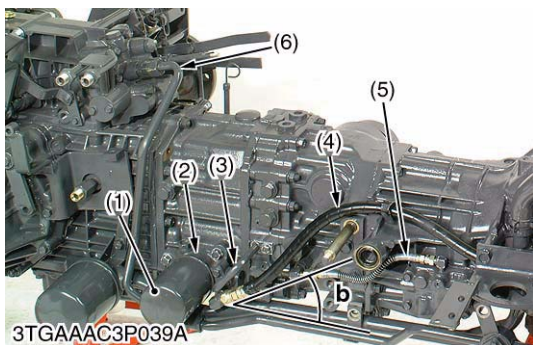
HST Pedal and Pedal Support

1. Remove the screw (4) and nut (2), and remove the pedal support assembly (3) with the brake switch.
2. Remove the speed control pedal (1).

- |                         |                            |
|-------------------------|----------------------------|
| (1) Speed Control Pedal | (3) Pedal Support Assembly |
| (2) Nut                 | (4) Screw                  |

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**Hydraulic Pipe and HST Filter Bracket**

1. Remove the charge hose (4) and PTO delivery hose (5).
2. Remove the charge pipe (3).
3. Remove the filter bracket (2) with the filter (1).
4. Disconnect the 3P delivery pipe (6) from the hydraulic cylinder.

**(When reassembling)**

- Be sure to fit four O-rings (7) to the charge pipe (3).

Tightening torque	Filter bracket mounting screw	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
	Charge hose retaining nut (Controller side)	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 ft-lbs
	3P 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
	PTO delivery hose retaining nut (Valve side)	15 to 17 N·m 1.5 to 1.75 kgf·m 10.8 to 12.7 ft-lbs

Installation angle of charge hose (4): <b>b</b>	Factory spec.	0.52 rad 30 deg.
---	---------------	---------------------

- |                       |   |
|-----------------------|---|
| (1) HST Oil Filter    | (6) 3P Delivery Pipe                            |
| (2) Filter Bracket    | (7) O-ring                                      |
| (3) Charge Pipe       |   |
| (4) Charge Hose       | <b>b: Installation Angle of Charge Hose (4)</b> |
| (5) PTO Delivery Hose |   |

000007555E

**Separating Clutch Housing Case from Hydrostatic Transmission (HST)**

1. Place a disassembly stand under the clutch housing (3) and mid case (1).
2. Support the clutch housing (3) with the lift strap.
3. Remove the clutch housing mounting screws and nuts to separate the clutch housing (3) from the HST (2).
4. Remove the 3P delivery pipe (4) and suction pipe (5) from the clutch housing (3).

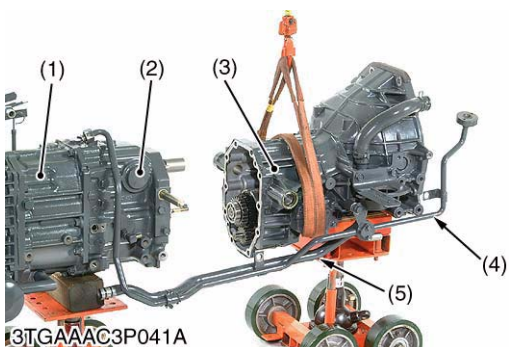
**(When reassembling)**

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

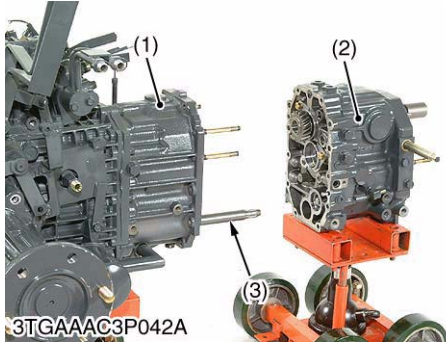
Tightening torque	Clutch housing mounting screw and nut	39.3 to 44.1 N·m 4.0 to 4.5 kgf·m 29.0 to 32.5 ft-lbs
-------------------	---------------------------------------	---

- |                                       |                      |
|---------------------------------------|----------------------|
| (1) Mid Case                          | (3) Clutch Housing   |
| (2) HST<br>(Hydrostatic Transmission) | (4) 3P Delivery Pipe |
|                                       | (5) Suction Pipe     |

000007556E



### (3) Separating HST (Hydrostatic Transmission)



#### Separating HST (Hydrostatic Transmission)

1. Place a disassembly stand under the HST (2) and mid case (1).
2. Remove the HST mounting screw and nuts to separate the HST (2) from the mid case (1).

#### ■ NOTE

- Do not pull out the front drive shaft (3) when you do not separate the mid case (1).

#### (When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to the joint face of the HST and mid 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
-------------------	----------------------------	---

- (1) Mid Case  
(2) HST (Hydrostatic Transmission)  
(3) Front Drive Shaft

000007530E

### (4) Separating Mid Case



#### Separating Mid Case

1. Remove the counter shaft and coupling (2).
2. Remove the mid case mounting screws and nuts to separate the mid case (1) from the transmission case.

#### (When reassembling)

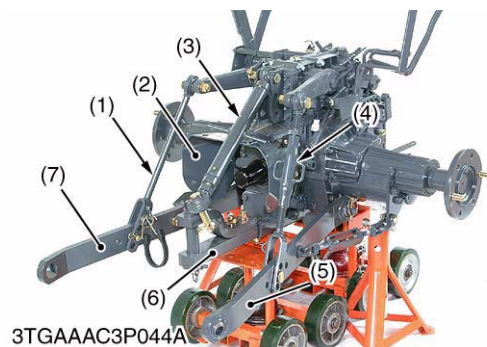
- Apply liquid gasket (Three Bond 1208D or equivalent) to the joint face of the mid case and transmission case.

Tightening torque	Mid 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
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- (1) Mid Case  
(2) Counter Shaft and Coupling

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### (5) Separating Transmission Case

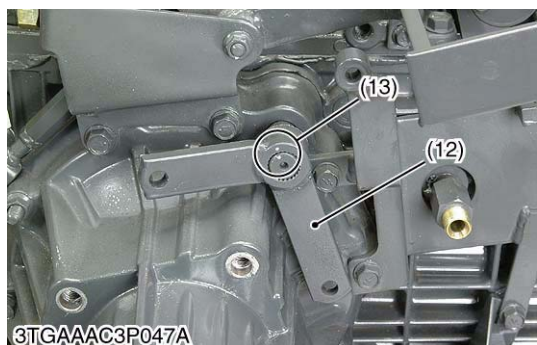
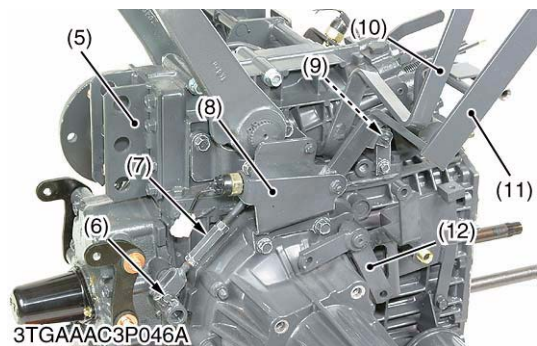
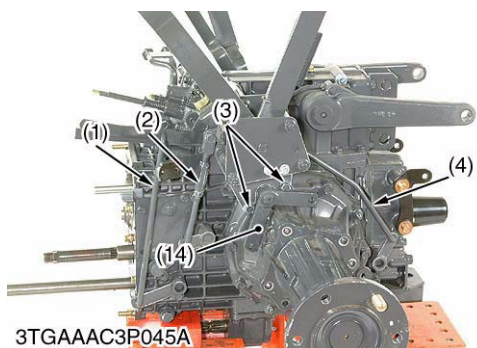


#### 3 Point Linkage and Drawbar

1. Remove the lifting rods (1) (4).
2. remove the top link (3) and PTO shaft cover (2).
3. Remove the lower links (5) (7) with the check chains.
4. Pill out the drawbar (6).

- (1) Lifting Rod (Left)  
(2) PTO Shaft Cover  
(3) Top Link  
(4) Lifting Rod (Right)  
(5) Lower Link (Right)  
(6) Drawbar  
(7) Lower Link (Left)

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Hydraulic Cylinder

1. Remove the front drive rod (1), range gear shift rod (2) and mid PTO rod (4).
2. Remove external snap ring and remove the brake lever (14) (12).
3. Remove the stay mounting screws (3).
4. Remove the spring pin (6) to separate the rear PTO rod (7).
5. Remove the spring pin (9) to separate the position control lever (10) from the hydraulic cylinder.
6. Remove the position control lever (10) and rear PTO lever (11) with the lever stay (8).
7. Remove the top link bracket (5).
8. Remove the hydraulic cylinder mounting screws and separate the hydraulic cylinder.

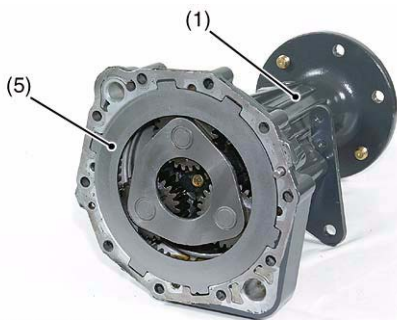
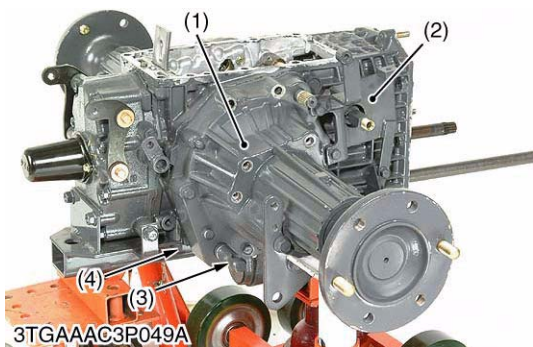
**(When reassembling)**

- Apply liquid gasket (Three Bond 1208D or equivalent) to the joint face of the hydraulic cylinder and transmission case.
- Apply liquid lock (Three Bond 1372 or equivalent) to hydraulic cylinder mounting screw at center of rear side to prevent oil leaking.
- Be sure to fix the differential lock pedal and the groove of the differential lock fork rod.
- When reassembling the brake lever (12) (14), align the punch mark (13) of the brake lever.

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
	Lever stay mounting screw	39.3 to 44.1 N·m 4.0 to 4.5 kgf·m 29.0 to 32.5 ft-lbs

- |                          |                             |
|--------------------------|-----------------------------|
| (1) Front Drive Rod      | (8) Lever Stay              |
| (2) Range Gear Shift Rod | (9) Spring Pin              |
| (3) Stay mounting Screw  | (10) Position Control Lever |
| (4) Mid PTO Rod          | (11) Rear PTO Lever         |
| (5) Top Link Bracket     | (12) Brake Lever (Right)    |
| (6) Spring Pin           | (13) Punch Mark             |
| (7) Rear PTO Rod         | (14) Brake Lever (Left)     |

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**Rear Axle**

1. Remove the brake stay (2).
2. Remove the setting screw (4) and pull out the lower link pin (3).
3. Place the disassembling stand under the rear axle case.
4. Remove the rear axle mounting screws and nuts, and separate the rear axle (1).

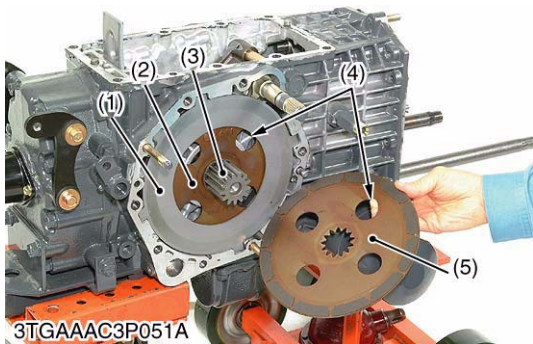
**(When reassembling)**

- Apply liquid gasket (Three Bond 1208D or equivalent) to the joint face of the rear axle case and transmission case.
- Fix the brake plate 2 (5) to the rear axle case (1) with the liquid gasket.

Tightening torque	Brake stay mounting screw	39.3 to 44.1 N·m 4.0 to 4.5 kgf·m 29.0 to 32.5 ft-lbs
	Brake 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) Rear Axle
- (2) Brake Stay
- (3) Lower Link Pin
- (4) Setting Screw
- (5) Brake Plate 2

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**Brake Disc and Brake Cam**

1. Remove the brake disc (5), brake shaft (3), brake plate 1 (1) and brake disc (2).
2. Remove the cam plate (8) and steel balls (6).
3. Remove the brake cam (7)

**(When reassembling)**

- Apply grease to the steel ball seats. (Do not grease excessively.)
- Place the brake disc (5) so that the brake disc hole (4) should be overlapped 50% or more.
- Apply grease to the O-ring on the brake cam (7).
- Be sure to fix the brake cam (7) and cam plate (8).

- (1) Brake Plate 1
- (2) Brake Disc
- (3) Brake Shaft
- (4) Brake Disc Hole
- (5) Brake Disc
- (6) Steel Ball
- (7) Brake Cam
- (8) Cam Plate

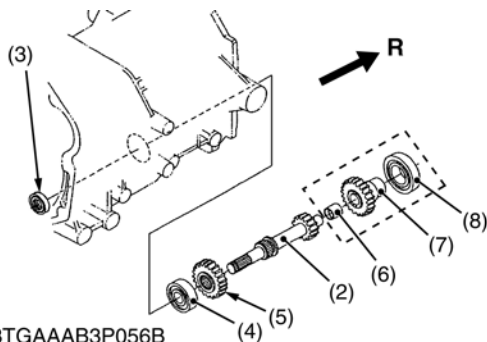
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### [3] DISASSEMBLING AND ASSEMBLING

#### (1) Clutch Housing Case



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#### 18T Gear Shaft

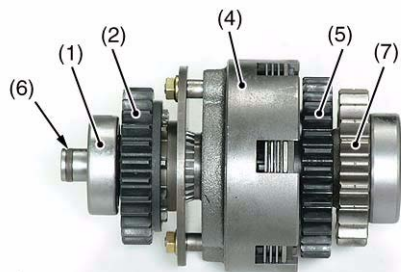
1. Take out the bi-speed turn hydraulic clutch assembly (1) with 18T gear shaft (2) from the clutch housing case.

#### **(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) Bushing      |
| (3) Oil Seal                                | (7) 19T Gear     |
| (4) Ball Bearing                            | (8) Ball Bearing |
- R : Rear Side**

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#### Bi-speed Turn Hydraulic Clutch

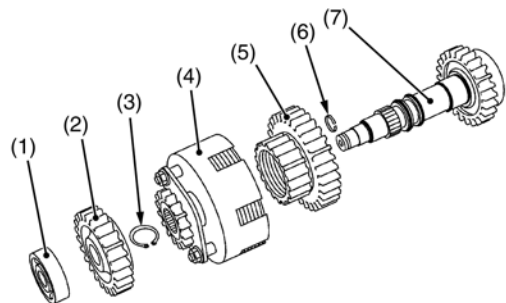
1. Take out the seal ring (6) from the counter shaft B (7).
2. Remove the bearing (1) with a puller, then take out the 27T gear (2).
3. Remove the external snap ring (3), then take out the bi-speed turn hydraulic clutch (4) and 32T gear (5).

#### **(When reassembling)**

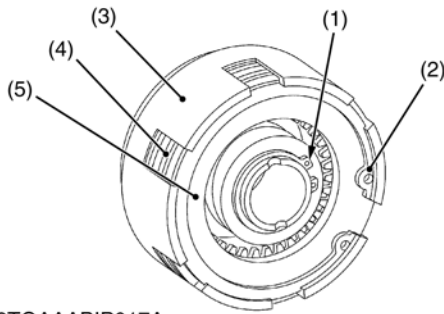
- Apply molybdenum disulfide (Three Bond 1901 or equivalent) to the inner circumference of the 27T gear (2) and 32T gear (5).
- Install the seal ring (6) to the counter shaft B (7) firmly.

- |                                    |                     |
|------------------------------------|---------------------|
| (1) Bearing                        | (5) 32T Gear        |
| (2) 27T Gear                       | (6) Seal Ring       |
| (3) External Snap Ring             | (7) Counter Shaft B |
| (4) Bi-speed Turn Hydraulic Clutch |                     |

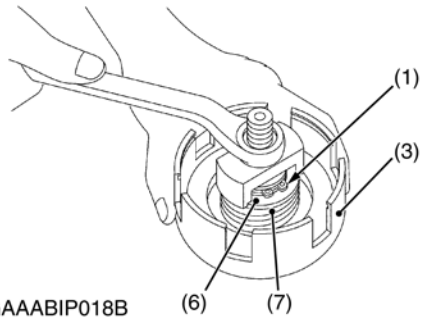
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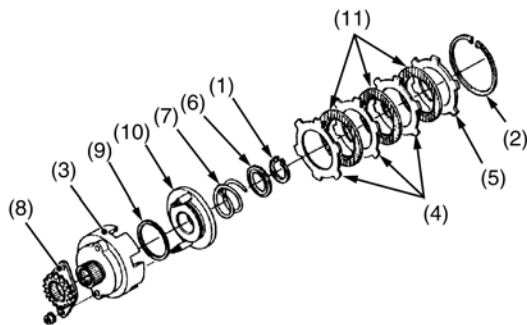
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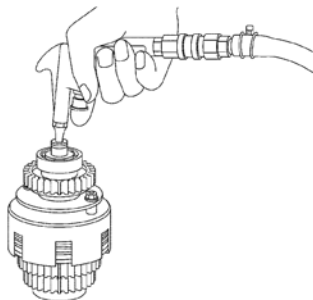
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**Disassembling Bi-speed Turn Hydraulic Clutch**

1. Remove the internal snap ring (2), then take out the pressure plate (5), three clutch discs (11) 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 (6) and spring (7).
3. Remove the piston (10).

**(When reassembling)**

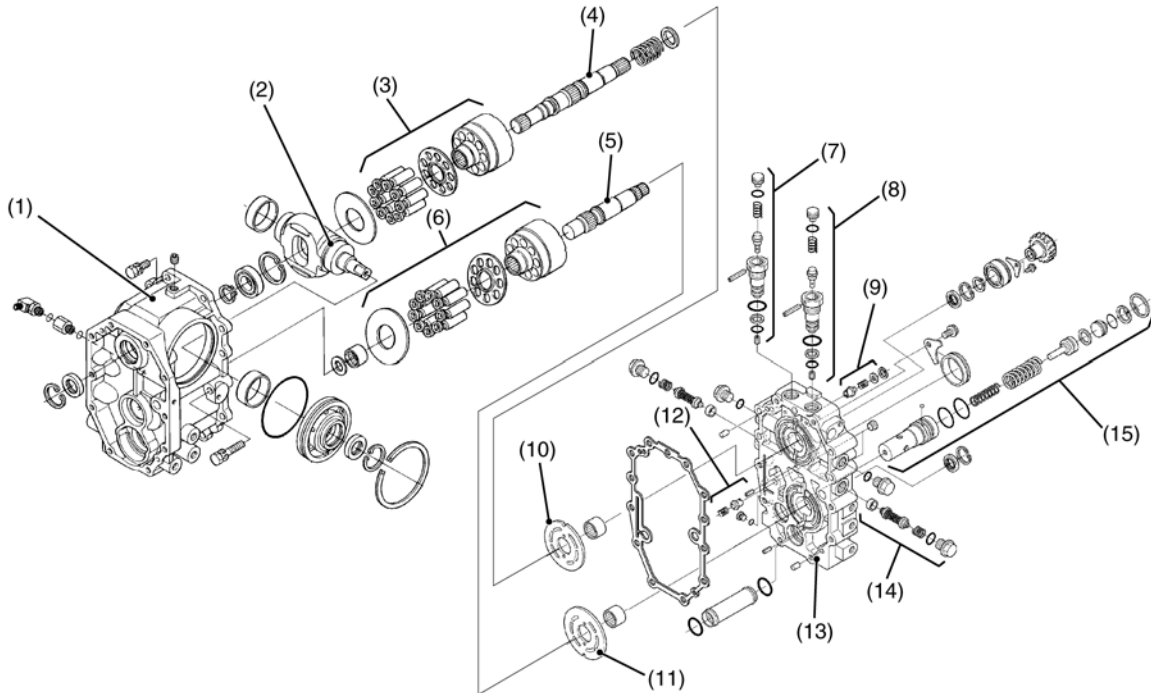
- Apply transmission oil to the D-ring (9), and take care not to damage it.
- Direct the convex side of collar (6) to the spring (7) side.
- Install the external snap ring (1) so that its sharp edge comes outside.
- Make sure the bi-speed turn hydraulic clutch is in position. Now feed compressed air (about 5 kgf/cm<sup>2</sup>) through the bi-speed turn port of the counter shaft B to see if the piston (10) moves smoothly. (See figure.)
- Install the internal snap ring (2) with its catch fitting the groove of the clutch case (3). Be sure also that the sharp edge comes outside.
- 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
-------------------	-----------------------------	--

- |                        |                  |
|------------------------|------------------|
| (1) External Snap Ring | (7) Spring       |
| (2) Internal Snap Ring | (8) Shifter      |
| (3) Clutch Case        | (9) D-ring       |
| (4) Steel Plate        | (10) Piston      |
| (5) Pressure Plate     | (11) Clutch Disc |
| (6) Collar             |                  |

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## (2) Hydrostatic Transmission (HST)



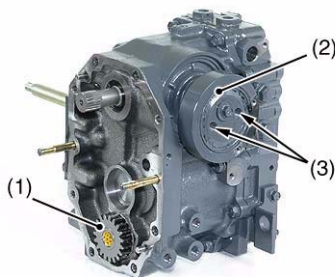
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- |  |  |                          |  |
|--|--|--------------------------|--|
| (1) Case                                 | (5) Output Shaft                       | (9) Case Relief Valve    | (13) Port Block  |
| (2) Trunnion Shaft                 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

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### Trunnion Wheel and 19T Gear

1. Remove the trunnion wheel mounting screw.
2. Remove the trunnion wheel while screw in the screw (M12 x Pitch 1.25 mm) to the screw hole (3).
3. Remove the 19T gear (1).



- |                    |                |
|--------------------|----------------|
| (1) 19T Gear       | (3) Screw Hole |
| (2) Trunnion Wheel |                |

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### Case Relief Valve

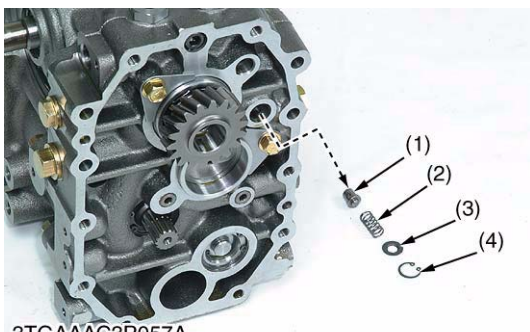
1. Remove the washer (3), spring (2) and poppet (1) after removing the internal snap ring (4).

#### **(When reassembling)**

- Apply transmission oil to the poppet (1) before reassembling.

- |            |                        |
|------------|------------------------|
| (1) Poppet | (3) Washer             |
| (2) Spring | (4) Internal Snap Ring |

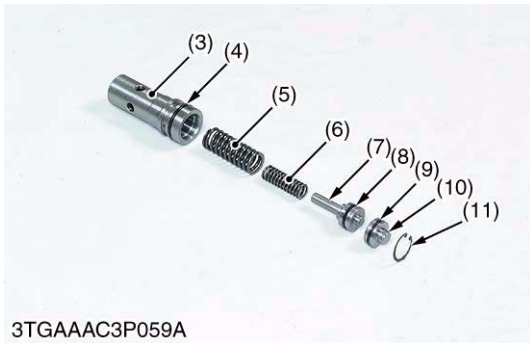
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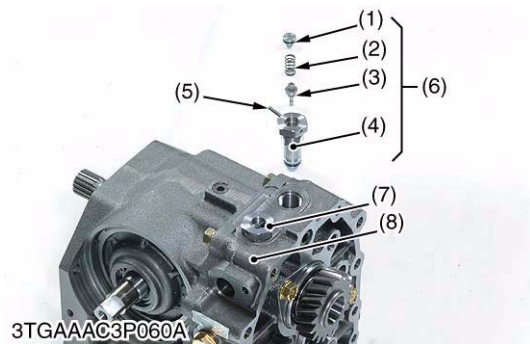
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Accumulator (for PTO Clutch)

1. Remove the internal snap ring and pull out the accumulator assembly (1).

**(When reassembling)**

- Apply transmission oil to the O-ring (4) (9) and the seal (8).

- |                          |                         |
|--------------------------|-------------------------|
| (1) Accumulator Assembly | (7) Piston              |
| (2) Internal Snap Ring   | (8) Seal                |
| (3) Case                 | (9) O-ring              |
| (4) O-ring               | (10) Cover              |
| (5) Spring               | (11) Internal Snap Ring |
| (6) Spring               |                         |

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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).

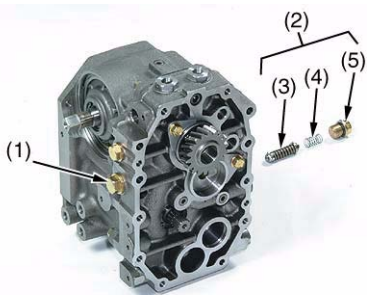
**(When reassembling)**

- Apply transmission oil to the O-rings.

- |                   |                                      |
|-------------------|--------------------------------------|
| (1) Spring Holder | (6) Neutral Valve Assembly (Reverse) |
| (2) Spring        | (7) Neutral Valve Assembly (Forward) |
| (3) Poppet N      | (8) Port Block                       |
| (4) Valve Body    |                                      |
| (5) Spring Pin    |                                      |

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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).

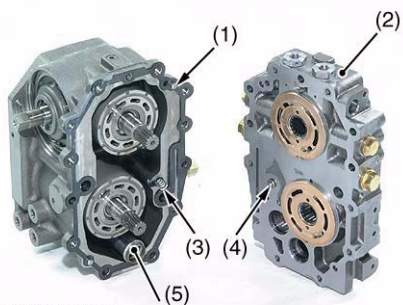
Tightening torque	Check and high-pressure relief valve plug	58.8 to 68.6 N·m 6.0 to 7.0 kgf·m 43.4 to 50.6 ft·lbs
-------------------	---	---

**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                  |

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Port Block and Charge Relief Valve

1. Separate the port block (2) after removing the mounting screws.
2. Remove the spring (3) and poppet L (4).
3. Remove the gasket (1) and the pipe (5).

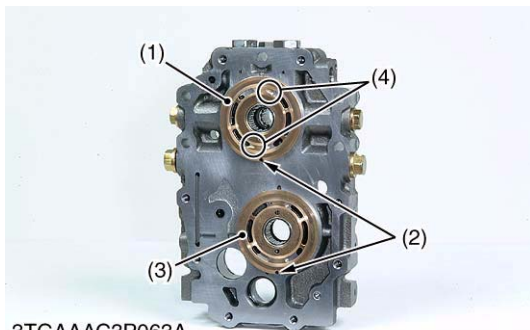
**(When reassembling)**

- Tighten the port block (2) mounting screws diagonally.
- Be sure to fix the O-ring.
- 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) Gasket     | (4) Poppet L |
| (2) Port Block | (5) Pipe     |
| (3) Spring     |              |

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Valve Plates for Pump and Motor

1. Remove the valve plates (1), (3).

**(When reassembling)**

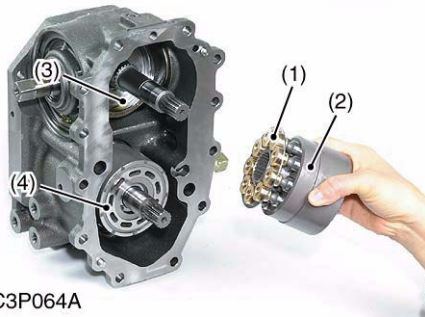
- Set the grooves (2) of valve plates to spring pins firmly.

**IMPORTANT**

- Valve plates (1), (3) are not interchangeable. Valve plate (1) of pump has two fish tails (4) and the valve plate (3) of motor has not it.

- |                          |                           |
|--------------------------|---------------------------|
| (1) Valve Plate for Pump | (3) Valve Plate for Motor |
| (2) Grooves              | (4) Fish Tail             |

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### Cylinder Block

1. Pull out the cylinder block (2) with piston (1) as a unit.

#### ■ IMPORTANT

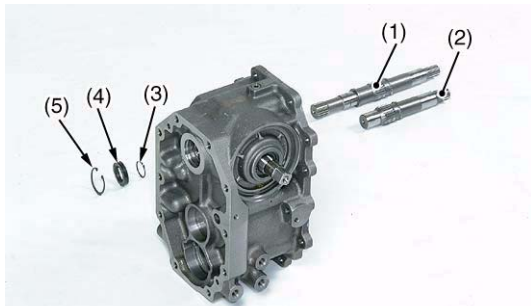
- **Make alignment mark on the piston and cylinder when removing the piston from cylinder block.**

#### **(When reassembling)**

- Apply transmission oil to the thrust plate (3) and pistons.
- Be sure to align the marks when assembling pistons to the cylinder block.

- |                           |                            |
|---------------------------|----------------------------|
| (1) Piston                | (3) Thrust Plate           |
| (2) Cylinder Block (Pump) | (4) Cylinder Block (Motor) |

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### Pump Shaft and Motor Shaft

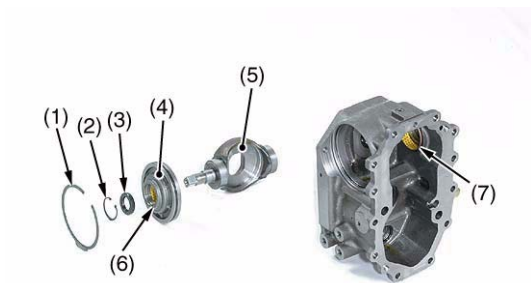
1. Remove the internal snap ring (5) then detach the oil seal (4).
2. Remove the external snap ring (3) and draw out the pump shaft (1).
3. Draw out the motor shaft (2).

#### **(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 |                        |

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### Trunnion

1. Remove the internal snap ring (1) then tap out the trunnion (5) lightly with cover (4).

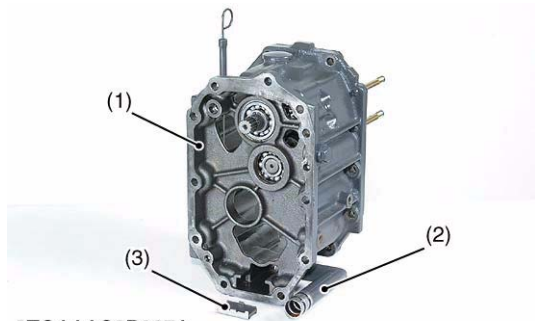
#### **(When reassembling)**

- Apply transmission oil to the O-rings and apply grease to the bushing (6) and (7).

- |                        |              |
|------------------------|--------------|
| (1) Internal Snap Ring | (5) Trunnion |
| (2) External Snap Ring | (6) Bushing  |
| (3) Oil Seal           | (7) Bushing  |
| (4) Cover              |              |

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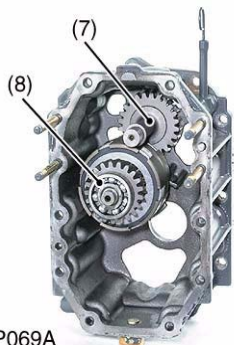
### (3) Mid Case



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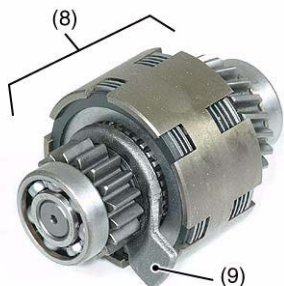
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3TGAAAC3P069A



3TGAAAC3P070A



3TGAAAC3P087A

#### Removing Hydraulic PTO Clutch

1. Remove the magnet (3) and inlet pipe (2).
2. Remove the external snap rings (4) (6) and collar (5) on the 24T gear shaft (7).
3. Tap out the 24T gear shaft (7) with the hydraulic PTO clutch assembly (8).

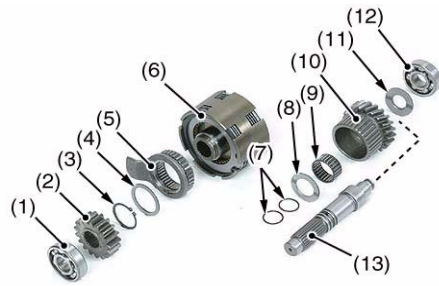
#### (When reassembling)

- Install the hydraulic clutch assembly (8) so that the stopper (9) enters a range **R**.
- Be sure to fix the magnet (3).

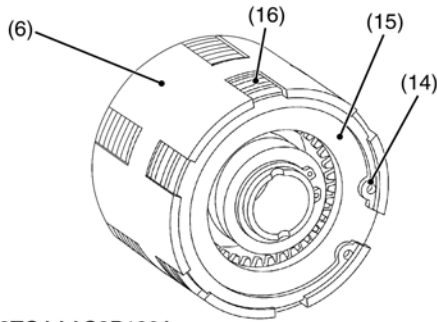
- |                        |                               |
|------------------------|-------------------------------|
| (1) Mid Case           | (7) 24T Gear Shaft            |
| (2) Inlet Pipe         | (8) Hydraulic Clutch Assembly |
| (3) Magnet             | (9) Stopper                   |
| (4) External Snap Ring |                               |
| (5) Collar             |                               |
| (6) External Snap Ring |                               |

**R: Range**

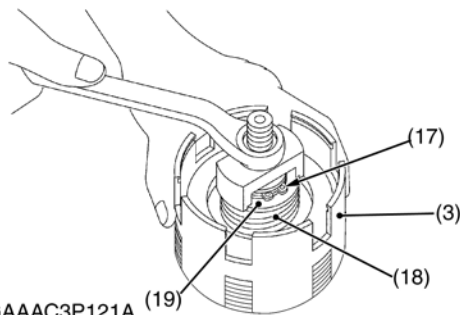
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Hydraulic PTO Clutch (To be Continued)

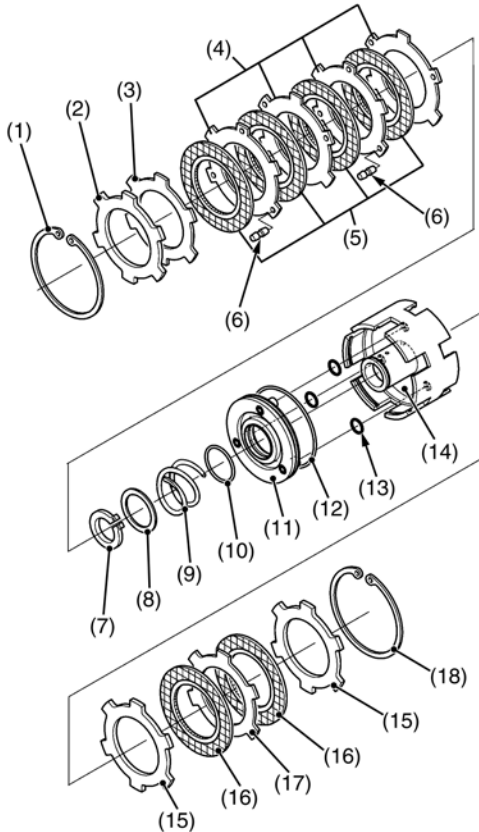
1. Remove the bearing (1) and 17T gear (2).
2. Pull out the counter shaft (13), collar (11), bearing (12), 21T gear (10), needle bearing (9) and collar (8).
3. Remove the external snap ring (3) and pull put the collar (4) and stopper (5).
4. Remove the internal snap ring (14) and take out the pressure plate (15) steel plate and clutch disc (16).
5. Remove the external snap ring (17) with clutch pack disassembling tool, and take out the collar (19) and spring (18).

**(When reassembling)**

- Apply transmission oil to the needle bearing (9).

- |                                   |                           |
|-----------------------------------|---------------------------|
| (1) Bearing                       | (11) Collar               |
| (2) 17T Gear                      | (12) Bearing              |
| (3) External Snap Ring            | (13) Counter Shaft        |
| (4) Collar                        | (14) Internal Snap Ring   |
| (5) Stopper (with Needle Bearing) | (15) Pressure Plate       |
| (6) Clutch Body                   | (16) Steel Plate and Disc |
| (7) O-rings                       | (17) External Snap Ring   |
| (8) Collar                        | (18) Spring               |
| (9) Needle Bearing                | (19) Collar               |
| (10) 21T Gear                     |                           |

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3TGAAAC3P072A

Hydraulic PTO Clutch (Continued)

1. Remove the internal snap ring (18) and take out the pressure plate (15), steel plate (17) and clutch disc (16).
2. Hydraulic clutch pack can be disassembled as shown in figure.

**(When reassembling)**

- Apply transmission oil to the clutch disc (5) (16).
- Apply transmission oil to the D-ring and O-ring on the piston (11).
- Install the internal snap rings (1) (18) with their catches fitting the groove of the clutch case (14). Be sure also that the sharp edges come outside.
- Do not confuse the 3 types of steel plates, one is steel plate, another is steel plate with holes, and the remainder is the plate with holes and rubber plugs.
- Install the steel plates in order of "steel plate with holes", "steel plate with holes and rubber plugs", "steel plate with holes", "steel plate with holes and rubber plugs" and "steel plate without hole" from the inside.
- The hole position should not correspond to the hole position of adjacent plate. (See figure.)
- After finishing reassembling, feed compressed air (about 5 kgf/cm<sup>2</sup>) through the counter shaft to see if the piston (11) moves smoothly.

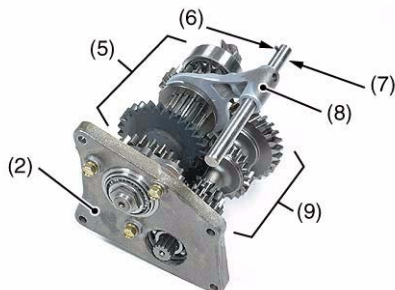
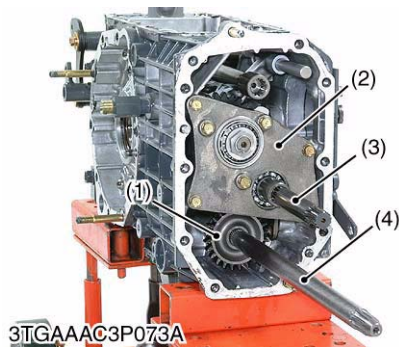
**(Reference)**

- Thickness of steel plate and pressure plate  
 Steel plate (3), (17): 1.0 mm (0.039 in.)  
 Steel plate (with hole) (4): 1.2 mm (0.047 in.)  
 Pressure plate (2), (15): 2.0 mm (0.079 in.)

(1) Internal Snap Ring	(11) Piston
(2) Pressure Plate	(12) D-ring
(3) Steel Plate	(13) O-rings
(4) Steel Plate (with Holes)	(14) Clutch Case
(5) Clutch Disc	(15) Pressure Plate
(6) Rubber Plug	(16) Clutch Disc
(7) External Snap Ring	(17) Steel Plate
(8) Collar	(18) Internal Snap Ring
(9) Spring	
(10) D-ring	

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### (4) Transmission Case



3TGAAAC3P074A



#### Front Drive Shaft and Mid Cover

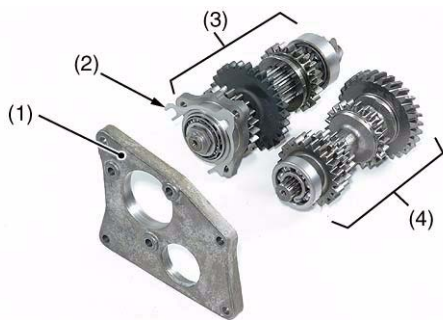
1. Remove the joint shaft (3) and coupling.
2. Remove the front drive shaft (4) and 24T gear (1).
3. Remove the mid cover mounting screws and take out the hypoid pinion assembly (5), counter shaft assembly (9), mid cover (2) and shift fork (8) at the same time.

#### (When reassembling)

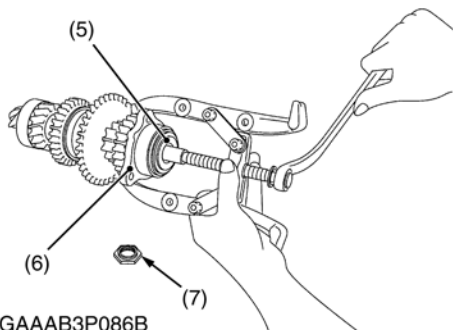
- Confirm that the spring pin (6) on the fork rod (7) is set in the groove of the transmission case.
- Confirm that the shift arm (11) is set in the groove of the 24T gear (1).
- Confirm that the shift arm (10) is set in the groove of the shift fork (8).
- Confirm that the manufactures' stamp on the needle bearing (12) faces HST side.
- Be sure to check the backlash and tooth contact between hypoid pinion and hypoid ring gear (See page 3-S57).

- |                            |                                    |
|----------------------------|------------------------------------|
| (1) 24T Gear               | (7) Fork Rod                       |
| (2) Mid Cover              | (8) Shift Fork (Range Gear Shift)  |
| (3) Joint Shaft            | (9) Counter Shaft Assembly         |
| (4) Front Drive Shaft      | (10) Shift Arm (Range Gear Shift)  |
| (5) Hypoid Pinion Assembly | (11) Shift Arm (Front Wheel Drive) |
| (6) Spring Pin             | (12) Needle Bearing                |

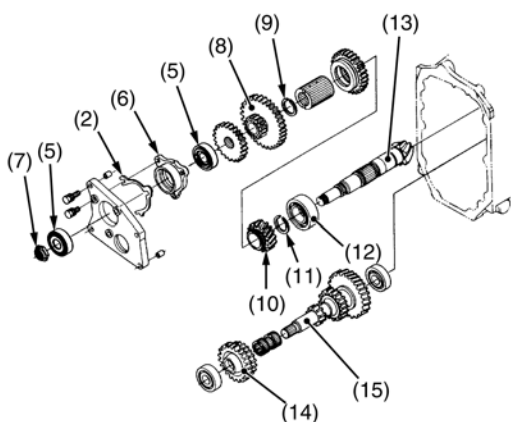
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3TGAAAB3P086B



3TGAAAB3P087B

Hypoid Pinion Assembly and Rear Counter Shaft Assembly

1. Remove the hypoid pinion assembly (3), shim (2) and counter shaft assembly (4) from the mid cover (1).
2. Remove the stake of the lock nut (7) and take out it.
3. Remove the bearing holder (6) and taper roller bearing (5) 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 their direction of sharp edge faces HST side.

**■ IMPORTANT**

- **Adjust the hypoid pinion turning torque by the tightening torque of lock nut (7). Refer to SERVICING.**
- **Adjust the backlash and tooth contact of hypoid gears. Refer to SERVICING.**

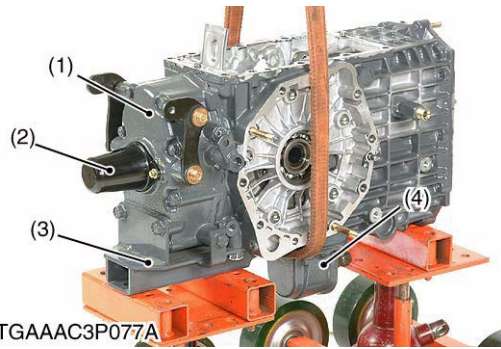
**(Reference)**

- Thickness of shim (2)

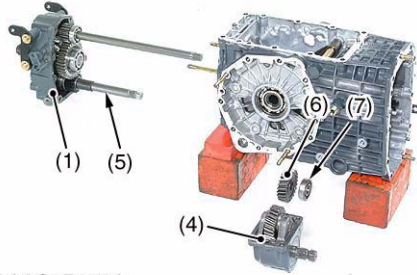
0.4 mm (0.016 in.)	0.7 mm (0.028 in.)	1.0 mm (0.039 in.)
0.5 mm (0.020 in.)	0.8 mm (0.031 in.)	1.2 mm (0.047 in.)
0.6 mm (0.024 in.)	0.9 mm (0.035 in.)	1.4 mm (0.055 in.)

- |                            |                         |
|----------------------------|-------------------------|
| (1) Mid Cover              | (9) External Snap Ring  |
| (2) Shim                   | (10) 13T Gear           |
| (3) Hypoid Pinion Assembly | (11) External Snap Ring |
| (4) Counter Shaft Assembly | (12) Roller Bearing     |
| (5) Taper Roller Bearing   | (13) Hypoid Pinion      |
| (6) Bearing Holder         | (14) 22-21T Gear        |
| (7) Lock Nut               | (15) Counter Shaft      |
| (8) 29T Gear               |                         |

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3TGAAAC3P078A

Separating Rear PTO Case and Mid PTO Case

1. Remove the drawbar bracket (3).
2. Remove the mounting screws and pull out the rear PTO case (1) with the gears and shafts on it.
3. Remove the mid PTO case (4).
4. Take out the 24T gear (6) and bearing (7) from the transmission case.

**(When reassembling)**

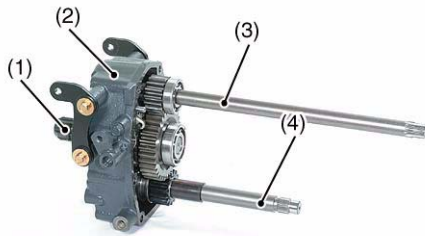
- Install the rear PTO case (1) while inserting the mid PTO drive shaft (5) into the 24T gear (6) and bearing (7).
- Apply liquid gasket (Three Bond 1208D or equivalent) to the joint face of the transmission case, rear PTO case (1) and mid PTO case (4).

Tightening torque	Rear PTO case mounting screw	39.3 to 44.1 N·m 4.0 to 4.5 kgf·m 29.0 to 32.5 ft·lbs
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

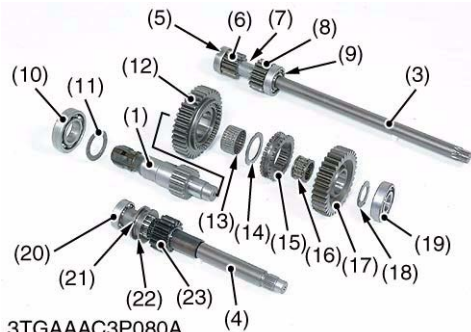
- |                     |                         |
|---------------------|-------------------------|
| (1) Rear PTO Case   | (5) Mid PTO Drive Shaft |
| (2) PTO Shaft Cover | (6) 24T Gear            |
| (3) Drawbar Bracket | (7) Bearing             |
| (4) Mid PTO Case    |                         |

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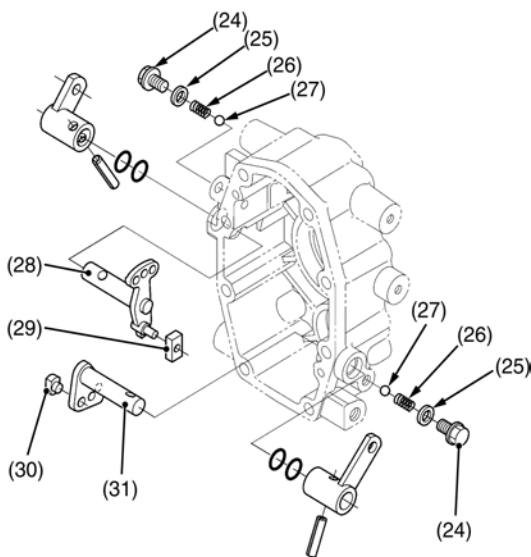




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3TGAAAC3P080A



3TGAAAC3P081A

**Rear PTO Case**

1. Pull out the PTO drive shaft (3) and mid PTO shaft (4) with gears while tapping out the PTO shaft (1).
2. Remove the gears and bearings on the PTO drive shaft (3), PTO shaft (1) and mid PTO drive shaft (4).
3. Shift levers and shift arms can be removed as shown in the figure.

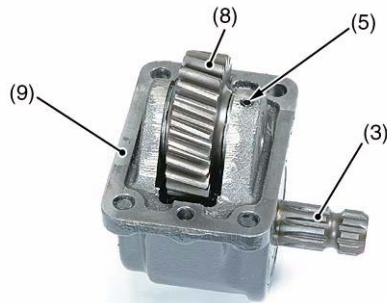
**NOTE**

- **Do not lose the detent balls.**  
**(When reassembling)**
- Confirm that the shift head (29) (30) is installed proper positions.
- After installing the PTO shaft (1) to the rear PTO case, install the oil seal on the PTO shaft.

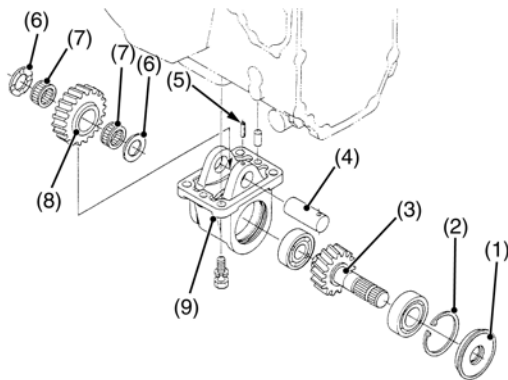
Tightening torque	Detent plug (24)	19.6 to 24.5 N·m 2.0 to 2.5 kgf·m 14.5 to 18.1 ft·lbs
-------------------	------------------	---

- |                         |                  |
|-------------------------|------------------|
| (1) PTO Shaft           | (17) 33T Gear    |
| (2) Rear PTO Case       | (18) Collar      |
| (3) PTO Drive Shaft     | (19) Bearing     |
| (4) Mid PTO Drive Shaft | (20) Shift Lever |
| (5) Bearing             | (21) Coupling    |
| (6) 12T Gear            | (22) Shifter     |
| (7) Collar              | (23) 15T Gear    |
| (8) 16T Gear            | (24) Detent Plug |
| (9) Bearing             | (25) Gasket      |
| (10) Bearing            | (26) Spring      |
| (11) Collar             | (27) Detent Ball |
| (12) 36T Gear           | (28) Shift Arm   |
| (13) Needle Bearing     | (29) Shift Head  |
| (14) Collar             | (30) Shift Head  |
| (15) Shifter            | (31) Shift Arm   |
| (16) Needle Bearing     |                  |

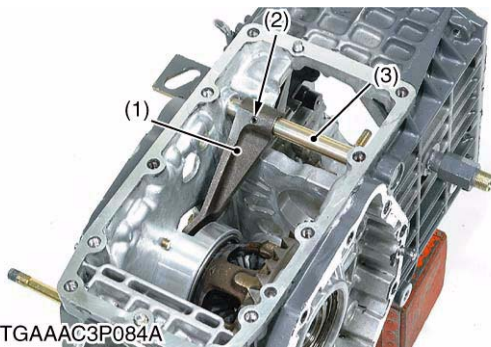
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3TGAAAC3P083A



3TGAAAC3P084A

### Mid-PTO Case and Shaft

1. Remove the oil seal (1) and internal snap ring (2).
2. Pull out the mid-PTO shaft (3).
3. 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 (6) to the needle bearing side.
- Apply grease to the oil seal (1).

- |                        |                    |
|------------------------|--------------------|
| (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         |                    |

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### Differential Lock Shift Fork

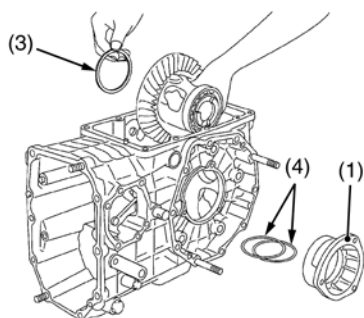
1. Tap out the spring pin (2).
2. Set the shift fork (1) at differential lock positions.
3. Pull out the shift fork (1) and remove the fork rod (3).

#### (When reassembling)

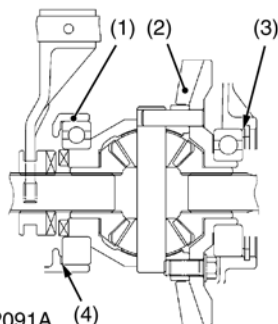
- Apply the grease to the oil seal of the fork rod (3).

- |                |              |
|----------------|--------------|
| (1) Shift Fork | (3) Fork Rod |
| (2) Spring Pin |              |

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3TGAAAB3P090A



3TGAAAB3P091A (4)

Differential Gear Assembly

1. Remove the differential bearing holder (1), noting the number of shims L (4).
2. Take out the differential gear as an assembly and the shims R (3).

**(When reassembling)**

- Install same number of shims as before disassembling.

■ **IMPORTANT**

- **Adjust the backlash and the tooth contact after assembling the differential gear assembly. Refer to SERVICING.**

**(Reference)**

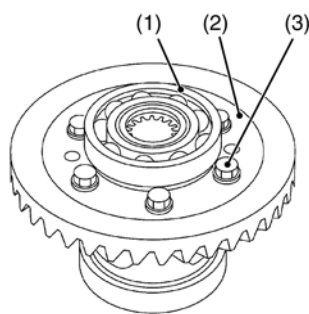
- Increase the shim R (3) thickness until to get backlash between hypoid pinion and hypoid ring gear (2). After that adjust the correct backlash with the shim L (4) and the shim R (3).
- Thickness of shims L :
 

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 shims R :
 

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) Shim R |
| (2) Hypoid Ring Gear | (4) Shim L |

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3TGAAAB3P092A

Hypoid Ring Gear

1. Remove the bearing (1) with special use puller set.
2. Loosen and take out the UBS screws (3), then remove the hypoid ring gear (2).

■ **NOTE**

- **When loosening and tightening the UBS screws (3), use a hexagonal socket wrench to protect the screw heads from damage.**

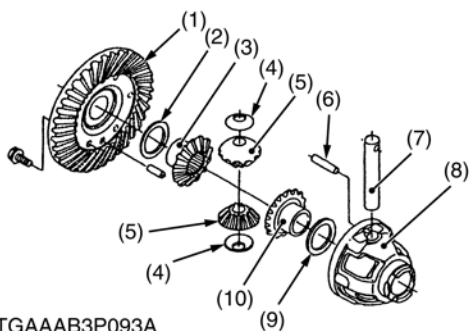
**(When reassembling)**

- Apply liquid lock (Three Bond 1372 or equivalent) to the UBS screws, and tighten diagonally them with correct tightening torque.

Tightening torque	Hypoid ring gear mounting UBS screws (3)	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) Hypoid Ring Gear |               |

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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), thrust collars (4), differential side gear (10) and shim (9).

■ **NOTE**

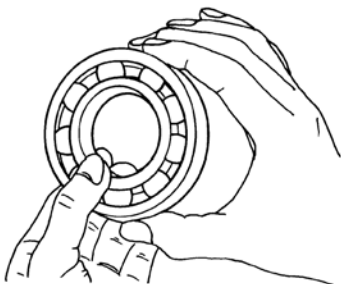
- **Arrange the parts to know their original positions. (When reassembling)**
- Apply molybdenum disulfide (Three Bond 1901 or equivalent) to the inner circumferential surface of the differential side gears (3), (10) and differential pinions (5).
- Apply grease to the outer surface of the pinion thrust 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   |

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**[4] SERVICING**

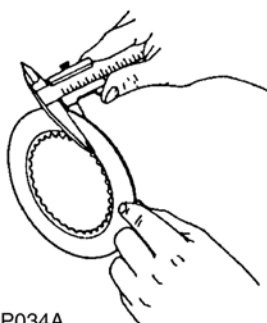
**(1) Bi-speed Hydraulic Clutch and Gears**



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.

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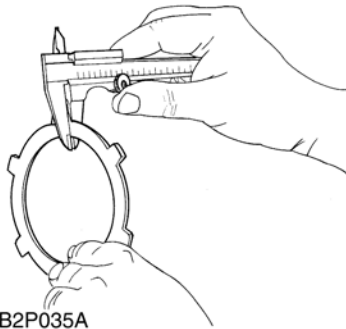


Clutch Disc Wear

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 0.0754 to 0.0821 in.
	Allowable limit	1.4 mm 0.055 in.

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**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.

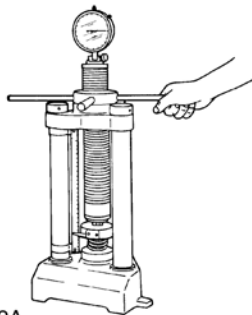
Steel plate wear	Factory spec.	0.95 to 1.05 mm 0.0374 to 0.0413 in.
	Allowable limit	0.8 mm 0.031 in.

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.

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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.



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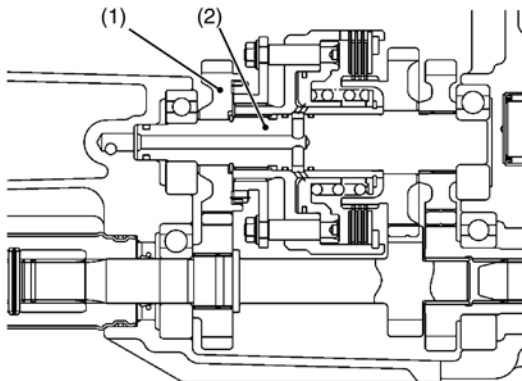
Piston / return spring free length	Factory spec.	44.0 mm 1.73 in.
------------------------------------	---------------	---------------------

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.

000007724E

**Clearance between Counter Shaft B and 27T Gear**

1. Measure the counter shaft B O.D. with an outside micrometer.
2. Measure the 27T gear I.D. with an inside micrometer, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace.



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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.
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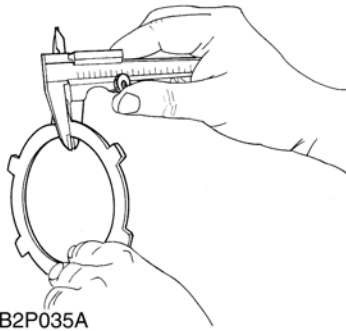
27T gear I.D.	Factory spec.	25.020 to 25.041 mm 0.98504 to 0.98587 in.
---------------	---------------	---

(1) 27T Gear

(2) Counter Shaft B

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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.

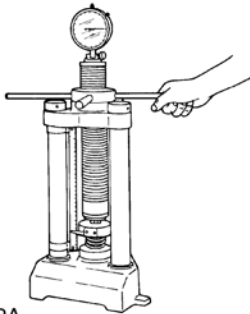
Steel plate wear (without hole)	Factory spec.	0.95 to 1.05 mm 0.0374 to 0.0413 in.
	Allowable limit	0.8 mm 0.031 in.
Steel plate wear (with holes, with holes and rubber plugs)	Factory spec.	1.15 to 1.25 mm 0.045 to 0.049 in.
	Allowable limit	1.10 mm 0.043 in.

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.

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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.



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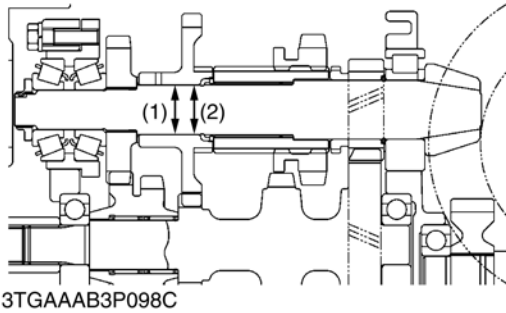
Piston / return spring free length	Factory spec.	44.0 mm 1.73 in.
------------------------------------	---------------	---------------------

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.

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**Clearance between Hypoid Pinion Shaft and 29T Gear**

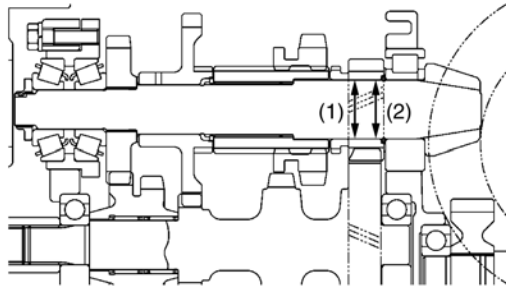
1. Measure the 29T gear I.D. and hypoid pinion O.D..
2. Calculate the clearance.
3. If the clearance exceeds the allowable limit, replace.

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.

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**Clearance between Hypoid Pinion Shaft and 13T Gear**

1. Measure the 13T gear I.D. and hypoid pinion O.D..
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.

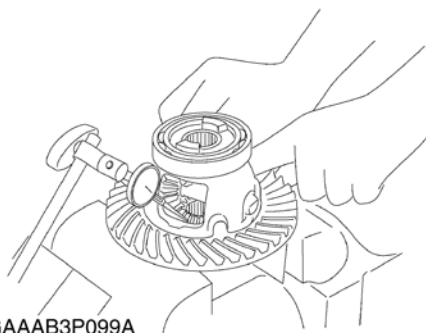
13T gear I.D.	Factory spec.	30.000 to 30.018 mm 1.1811 to 1.1818 in.
Hypoid pinion shaft O.D.	Factory spec.	29.967 to 29.980 mm 1.1798 to 1.1803 in.

(1) 13T Gear I.D. (2) Hypoid Pinion O.D.

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**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.



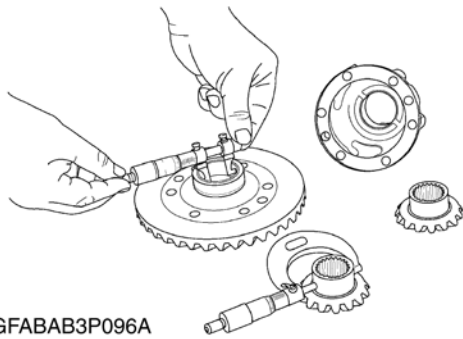
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Backlash between differential pinion and differential side gear	Factory spec.	0.10 to 0.30 mm 0.0039 to 0.0118 in.
	Allowable limit	0.5 mm 0.020 in.

**(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.)

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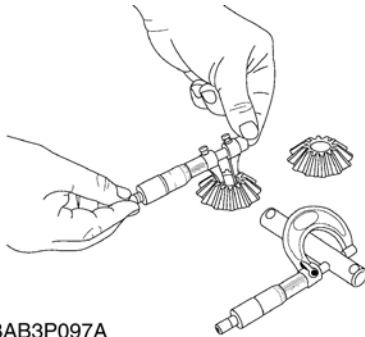
Clearance between Differential Case and Differential Side Gear

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.	Factory spec.	32.000 to 32.025 mm 1.25984 to 1.26083 in.
Differential side gear boss O.D.	Allowable limit	31.925 to 31.950 mm 1.25689 to 1.25787 in.

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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.

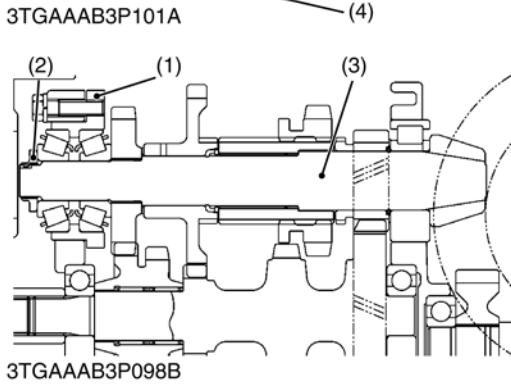
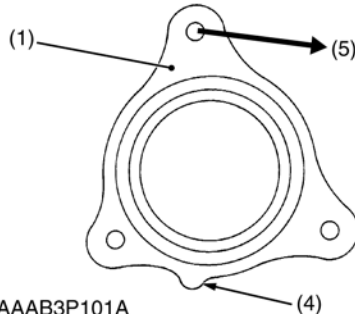
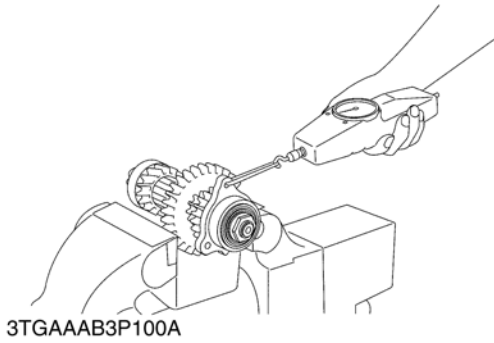
Clearance between differential pinion and differential pinion shaft	Factory spec.	0.048 to 0.084 mm 0.00189 to 0.00331 in.
	Allowable limit	0.2 mm 0.008 in.

Differential pinion I.D.	Factory spec.	18.032 to 18.050 mm 0.70992 to 0.71063 in.
Differential pinion shaft O.D.	Allowable limit	17.966 to 17.984 mm 0.70732 to 0.70803 in.

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Adjusting of Hypoid Pinion Motive Force

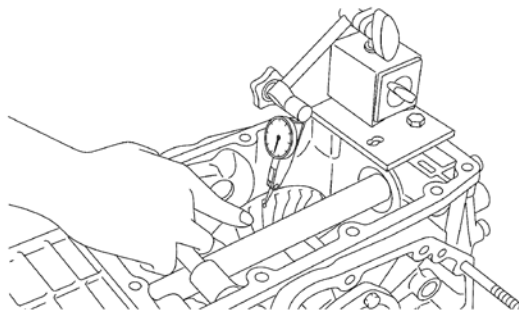
1. Assemble the hypoid pinion assembly and tighten the lock nut (2) lightly with new one.
2. Rotate the hypoid pinion with applying the transmission oil to the bearings after tapping the hypoid pinion to front and rear direction by the soft hammer.
3. Tighten the lock nut (2) until the motive force (hypoid pinion start to rotate) of hypoid pinion to be factory specification.
4. Stake the lock nut (2) firmly.



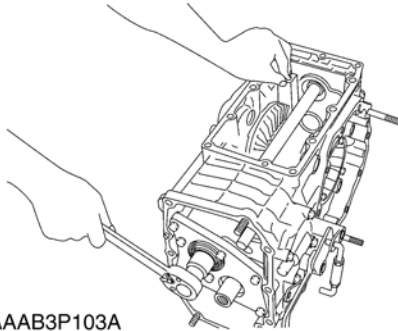
Motive force	Factory spec.	10.9 to 16.7 N 1.1 to 1.7 kgf 2.5 to 3.7 lbs
Motive torque	Factory spec.	0.520 to 0.559 N·m 0.053 to 0.057 kgf·m 0.383 to 0.412 ft·lbs

- (1) Bearing Holder
- (2) Lock Nut
- (3) Hypoid Pinion
- (4) Convex Part
- (5) Pulling Direction

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3TGAAAB3P102A



3TGAAAB3P103A

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.

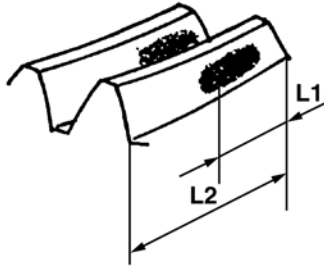
Backlash between hypoid pinion and hypoid ring gear	Factory spec.	0.20 to 0.30 mm 0.0078 to 0.0118 in.
Tooth contact	Factory spec.	More than 25 % red lead contact area on the gear tooth surface
The position of tooth contact point	Factory spec.	The center of tooth contact at 3/10 of the entire width from the small end

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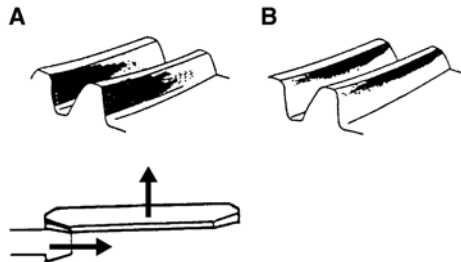
Correcting of Tooth Contact

1. Proper contact.
  - No adjustment.

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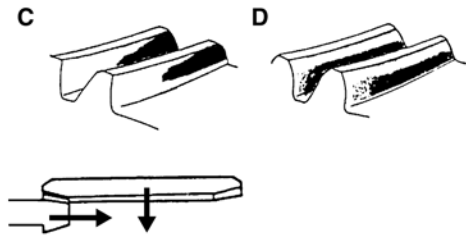
3TGAAAB3P104A



3TGAAAB3P105A

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.

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3TGAAAB3P106A

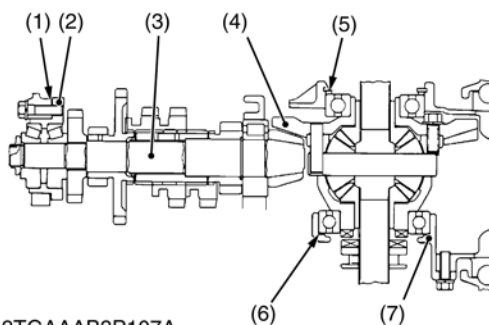
3. Correcting of the toe contact and deep contact.
  - Change the differential bearing holder shim L (6) to thin it.
  - Change the differential bearing holder shim R (5) to thick it.
  - Change the bearing holder shim (1) to thin it.
  - Repeat above until the proper tooth contact and backlash are achieved.

**(Reference)**

- Thickness of the shim (1), shim L (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 shim R (5) :
 

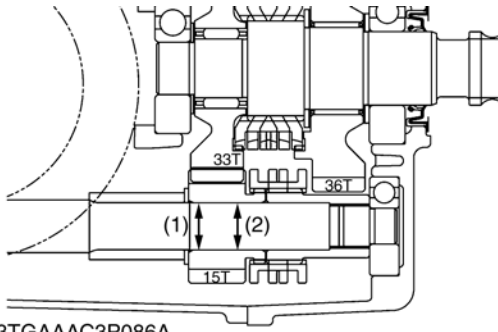
1.4 mm (0.055 in.)	1.7 mm (0.067 in.)
1.5 mm (0.059 in.)	1.8 mm (0.071 in.)
1.6 mm (0.063 in.)	1.9 mm (0.075 in.)



3TGAAAB3P107A

- |                                 |                           |
|---------------------------------|---------------------------|
| (1) Shim                        | <b>A: Heel Contact</b>    |
| (2) Bearing Holder              | <b>B: Shallow Contact</b> |
| (3) Hypoid Pinion               | <b>C: Toe Contact</b>     |
| (4) Hypoid Ring Gear            | <b>D: Deep Contact</b>    |
| (5) Shim R                      | <b>L1: 3/10</b>           |
| (6) Shim L                      | <b>L2: Entire Width</b>   |
| (7) Differential Bearing Holder |                           |

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3TGAAAC3P086A

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.

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# **4 REAR AXLE**

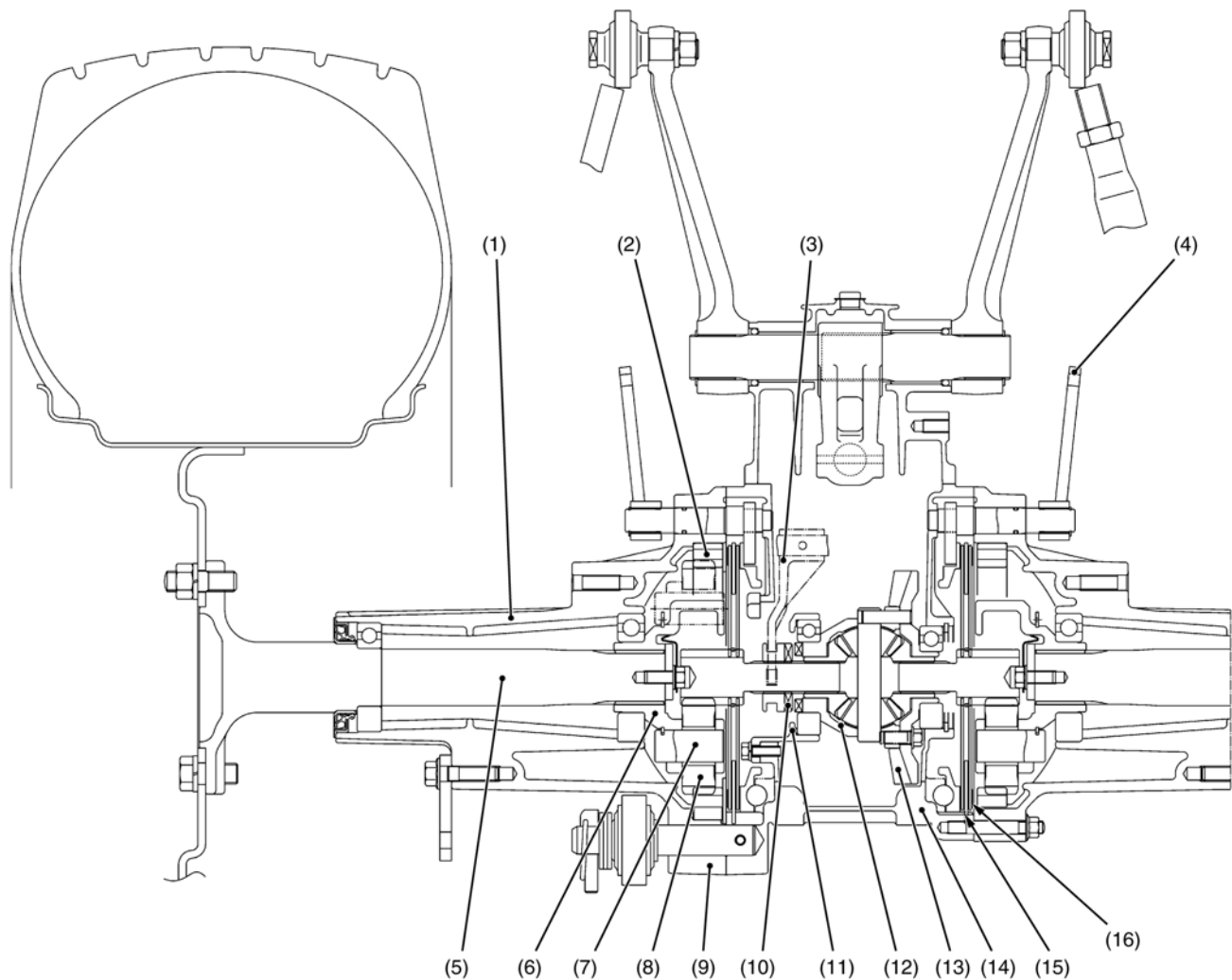
# CONTENTS

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1. STRUCTURE.....	4-M1
2. FINAL REDUCTION SYSTEM .....	4-M2



# 1. STRUCTURE



3TGAAAB4P001A

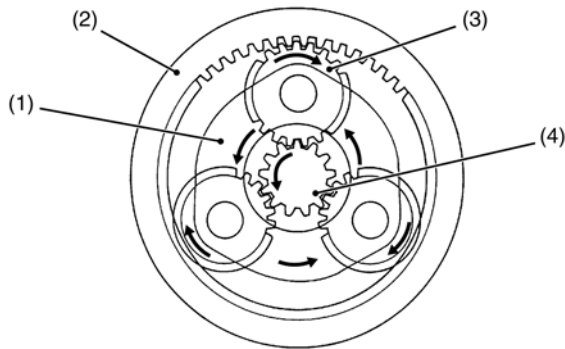
(1) Rear Axle Case	(5) Rear Axle Shaft	(9) Brake Case	(13) Hypoid Ring Gear
(2) Internal Gear	(6) Planetary Carrier	(10) Differential Lock Clutch	(14) Transmission Case
(3) Differential Lock Fork	(7) Planetary	(11) Differential Bearing Holder	(15) Steel Plate
(4) Brake Lever	(8) Planetary Gear	(12) Differential 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.

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## 2. FINAL REDUCTION SYSTEM



3TRAAAA3P078A

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 | (3) Planetary Gear |
| (2) Internal Gear     | (4) Brake SHaft    |

000007596E

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1. TROUBLESHOOTING.....	4-S1
2. SERVICING SPECIFICATIONS.....	4-S2
3. TIGHTENING TORQUES.....	4-S3
4. DISASSEMBLING AND SERVICING.....	4-S4
[1] DISASSEMBLING AND ASSEMBLING.....	4-S4
[2] SERVICING.....	4-S6

# 1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
<b>Excessive or Unusual Noise at All Time</b>	● Improper backlash between internal gear and planetary gear	Replace	4-S6
	● Bearing worn	Replace	4-S4
	● Insufficient or improper type of transmission fluid used	Replenish or change	G-8, 15
<b>Noise while Turning</b>	● Brake shaft, planetary gears and internal gear worn or damaged	Replace	4-S6

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## 2. 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 1.1815 to 1.1821 in.	30.05 mm 1.1831 in.
Planetary Gear Pin	O.D.	24.967 to 24.980 mm 0.9830 to 0.9835 in.	24.95 mm 0.9823 in.
Needle Bearing	O.D.	2.494 to 2.500 mm 0.0982 to 0.0984 in.	—

000007598E

### 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.)

<b>Item</b>	<b>N·m</b>	<b>kgf·m</b>	<b>ft-lbs</b>
Stopper mounting screw	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2

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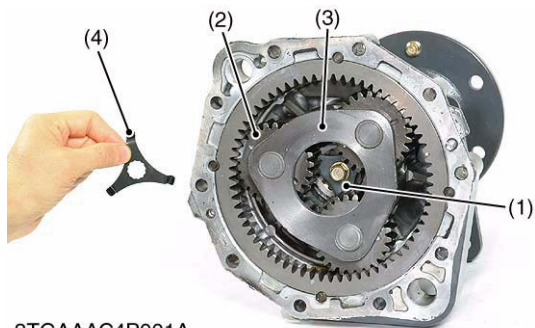
# 4. DISASSEMBLING AND SERVICING

## [1] DISASSEMBLING AND ASSEMBLING

### Separating Rear Axle

Refer to "PREPARATION" section of 3. TRANSMISSION (3-S33).

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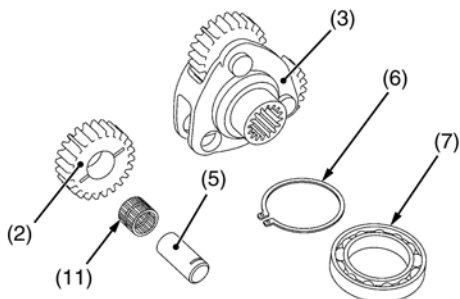
### Planetary Gear

1. Take out the stopper (4), then remove the screw and washer (1).
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).

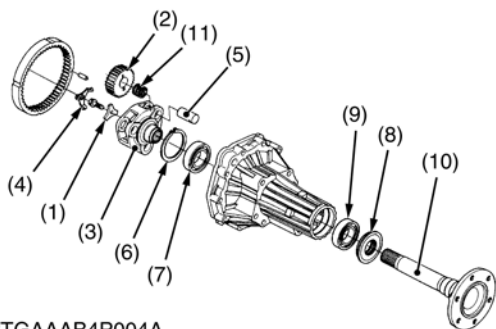
### (When reassembling)

- Assemble the fingernail of the stopper (4) to the ditch part securely.

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



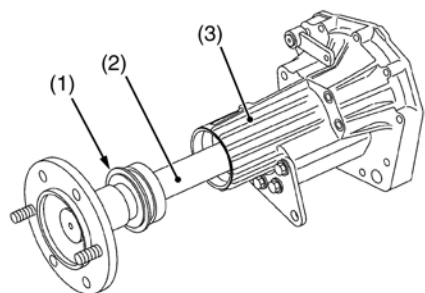
3TGAAAB4P003A



3TGAAAB4P004A

- |                        |                     |
|------------------------|---------------------|
| (1) Washer             | (7) Bearing         |
| (2) Planetary Gear     | (8) Oil Seal        |
| (3) Planetary Carrier  | (9) Bearing         |
| (4) Stopper            | (10) Rear Axle      |
| (5) Planetary Gear Pin | (11) Needle Bearing |
| (6) Internal Snap Ring |                     |

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3TGAAAB4P005A

### Rear Axle

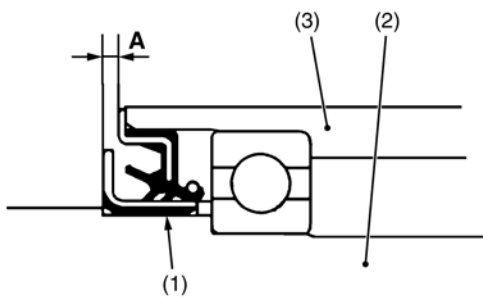
1. Tap out the rear axle.

#### (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

**A: Gap**

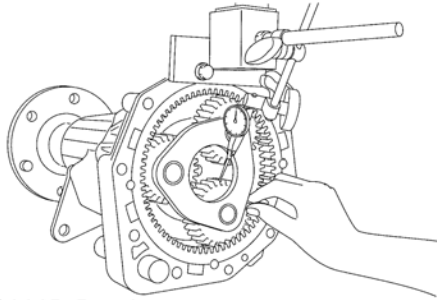


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## [2] SERVICING



3TGAAAB4P007A

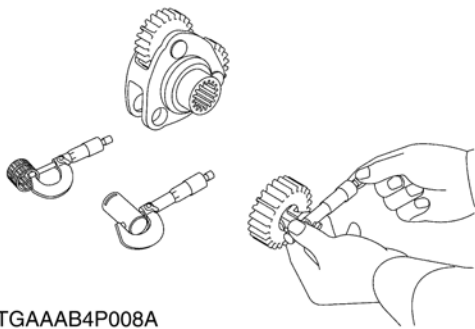
### Backlash between Internal Gear and Planetary Gear

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 ear 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.

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### Planetary Gear I.D., Planetary Gear Pin O.D. and Needle Bearing O.D.



3TGAAAB4P008A

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 1.1815 to 1.1821 in.
	Allowable limit	30.05 mm 1.1831 in.

Planetary gear pin O.D.	Factory spec.	24.967 to 24.980 mm 0.9830 to 0.9835 in.
	Allowable limit	24.95 mm 0.9823 in.

Needle Bearing O.D.	Factory spec.	2.494 to 2.500 mm 0.0982 to 0.0984 in.
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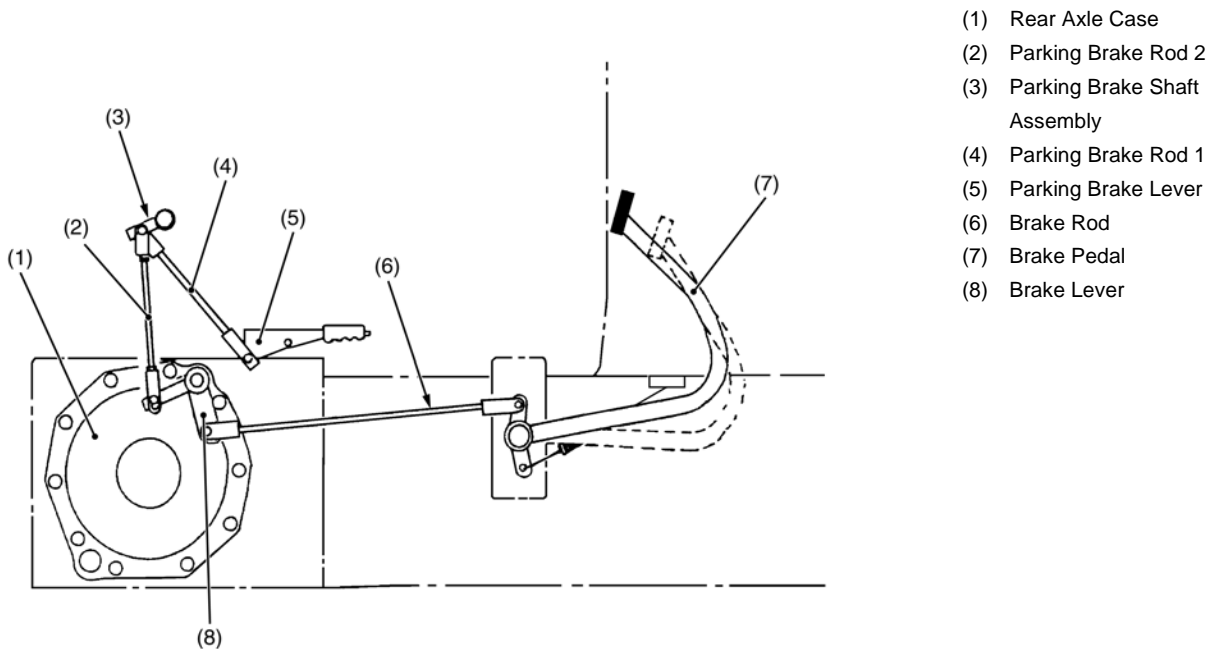
# **5 BRAKES**

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1. BRAKE LINKAGE .....	5-M1
2. OPERATION.....	5-M2

# 1. BRAKE LINKAGE



- (1) Rear Axle Case
- (2) Parking Brake Rod 2
- (3) Parking Brake Shaft Assembly
- (4) Parking Brake Rod 1
- (5) Parking Brake Lever
- (6) Brake Rod
- (7) Brake Pedal
- (8) Brake Lever

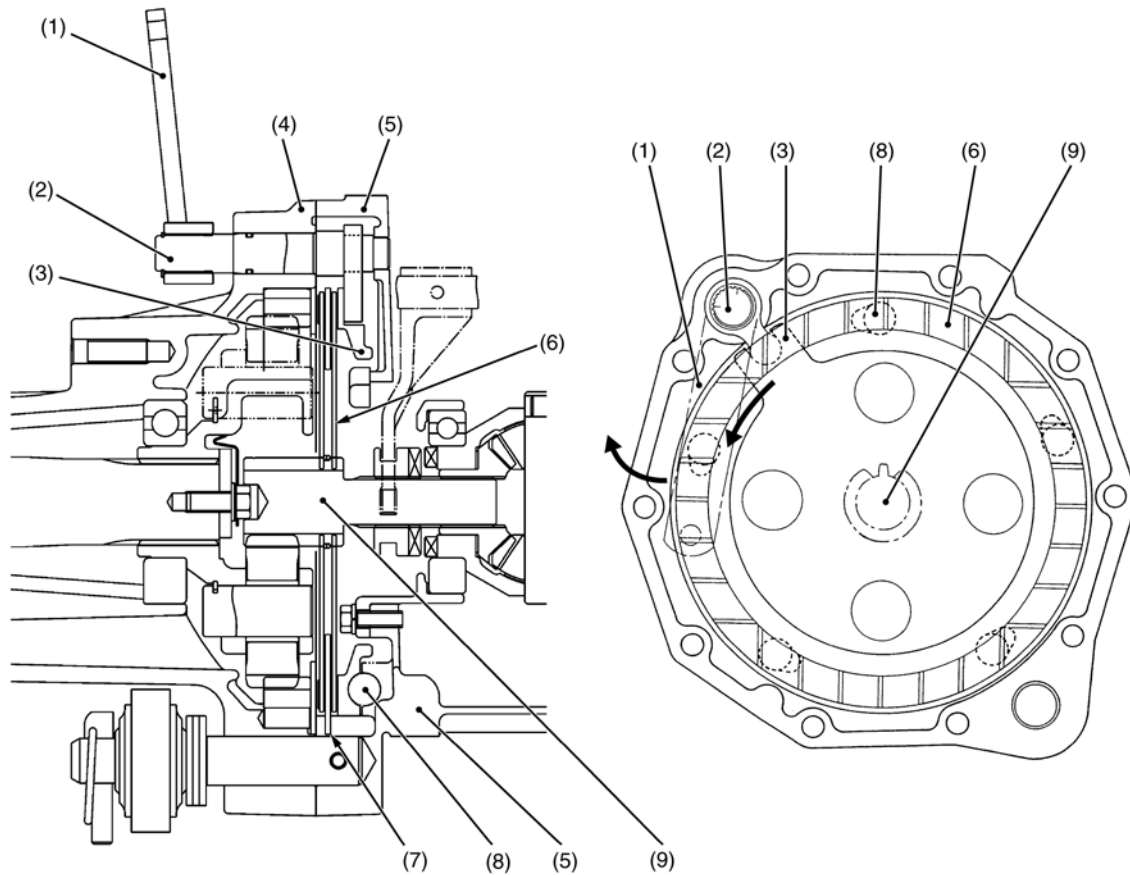
3TRAAAA5P001B

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.

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## 2. OPERATION



3TGAAAB5P002B

- |                 |                       |                 |                 |
|-----------------|-----------------------|-----------------|-----------------|
| (1) Brake Lever | (4) Rear Axle Case    | (6) Brake Disc  | (8) Steel Ball  |
| (2) Brake Cam   | (5) Transmission Case | (7) Brake Plate | (9) Brake Shaft |
| (3) Cam Plate   |                       |                 |                 |

### ■ During Braking

When the brake pedal is pressed, the linkage causes the brake 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 (8) set in the grooves of the transmission case (5) to press the brake disc (6), the brake shaft (9) is braked by the frictional force generated by the cam plate (3) and brake disc (6).

000007606E

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1. TROUBLESHOOTING.....	5-S1
2. SERVICING SPECIFICATIONS.....	5-S2
3. CHECKING, DISASSEMBLING AND SERVICING.....	5-S3
[1] CHECKING AND ADJUSTING.....	5-S3
[2] DISASSEMBLING AND ASSEMBLING.....	5-S4
[3] SERVICING.....	5-S5

# 1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
<b>Uneven Braking Force</b>	● Brake pedal free travel unevenly adjusted	Adjust	5-S3
	● Brake disc worn	Replace	5-S6
	● Cam plate warped	Replace	5-S6
<b>Brake Drags</b>	● Brake pedal free travel too small	Adjust	5-S3
	● Parking brake lever free travel too small	Adjust	5-S4
	● Brake pedal return spring weaken or broken	Replace	—
	● Brake cam rusted	Repair	5-S5
<b>Poor Braking Force</b>	● Brake pedal free travel excessive	Adjust	5-S3
	● Brake disc worn	Replace	5-S6
	● Cam plate warped	Replace	5-S6
	● Brake cam or lever damaged	Replace	5-S5
	● Transmission fluid improper	Change	G-8

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## 2. SERVICING SPECIFICATIONS

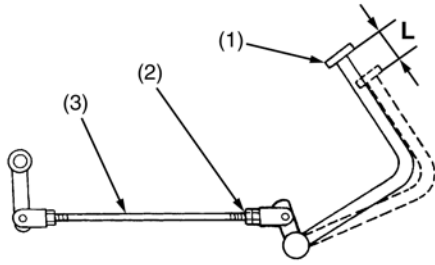
Item		Factory Specification	Allowable Limit
Brake Pedal	Free Travel	20 to 30 mm 0.79 to 1.18 in.	—
	Difference of Stroke (RH and LH)	Less than 5 mm 0.19 in.	—
Parking Brake Lever	Free Travel	The brake works when the lever is raised until the ratchet sound is heard twice	—
Cam Plate and Ball	Height	20.95 to 21.05 mm 0.8248 to 0.8287 in.	20.5 mm 0.807 in.
Cam Plate	Flatness	—	0.3 mm 0.012 in.
Brake Disc	Thickness	3.4 to 3.6 mm 0.1339 to 0.1417 in.	3.0 mm 0.118 in.
Brake Plate 1	Thickness	2.54 to 2.66 mm 0.1000 to 0.1047 in.	2.1 mm 0.083 in.
Brake Plate 2	Thickness	2.52 to 2.68 mm 0.0992 to 0.1055 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



3TGAAAB0P024A

#### 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.

Brake pedal free travel "L"	Factory spec.	20 to 30 mm 0.79 to 1.18 in.
--------------------------------	---------------	---------------------------------

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

**L : Free Travel**

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3TGAAAC5P001A



3TGAAAC5P002A



3TGAAAC5P003A

Parking Brake Lever Free Travel

1. Support the rear axle with the disassembling stand to separate the rear wheels from the ground.
2. Shift the range gear shift lever to the neutral position, and disengage the front wheel drive lever.
3. Raise the parking brake lever (1) until the ratchet sound is heard once.
4. Check right and left rear wheels. Right and left rear wheels should be free.
5. Next, raise the parking brake lever (1) until the ratchet sound is heard twice.
6. Check right and left rear wheels. Right and left rear wheels should be locked.
7. If it is not, adjust with the parking brake rod 2 (2).

Parking brake lever free travel	Factory spec.	The brake works when the lever is raised until the ratchet sound is heard twice
---------------------------------	---------------	---

■ **IMPORTANT**

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

(1) Parking Brake Lever

(2) Parking Brake Rod 2 (Left)

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**[2] DISASSEMBLING AND ASSEMBLING**

Removing Brake Pedal

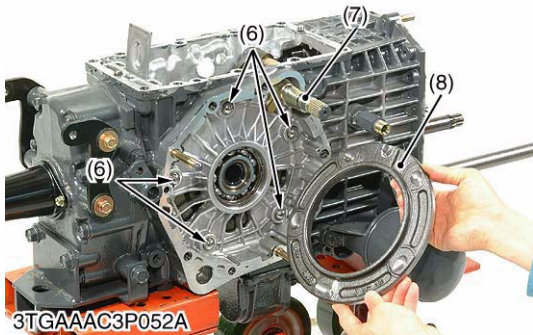
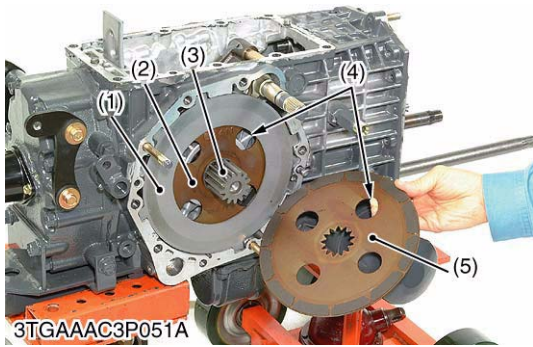
Refer to "PREPARATION" section of **3. TRANSMISSION** (3-S28).

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Separating Brake (Rear Axle)

Refer to "PREPARATION" section of **3. TRANSMISSION** (3-S33).

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Brake Disc, Brake Plate and Brake Cam

1. Remove the brake disc (5), brake shaft (3), brake plate 1 (1) and brake disc 2 (2).
2. Remove the cam plate (8) and steel balls (6).
3. Remove the brake cam (7).
4. Remove the brake plate 2 (9) from the rear axle case.

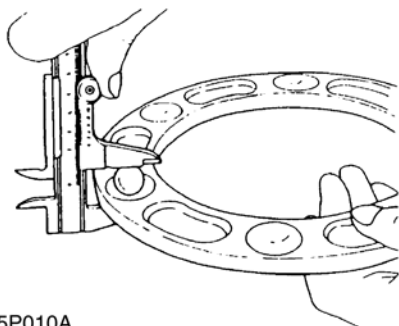
**(When reassembling)**

- Place the brake disc (5) so that the brake disc hole (4) should be overlapped 50 % or more.
- Apply grease to the O-ring on the brake cam (7).
- Be sure to fix the brake cam (7) and cam plate (8).
- Fix the brake plate 2 (9) to the rear axle case with the liquid gasket.

- |                     |                   |
|---------------------|-------------------|
| (1) Brake Plate 1   | (6) Steel Ball    |
| (2) Brake Disc      | (7) Brake Cam     |
| (3) Brake Shaft     | (8) Cam Plate     |
| (4) Brake Disc Hole | (9) Brake Plate 2 |
| (5) Brake Disc      |                   |

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**[3] SERVICING**

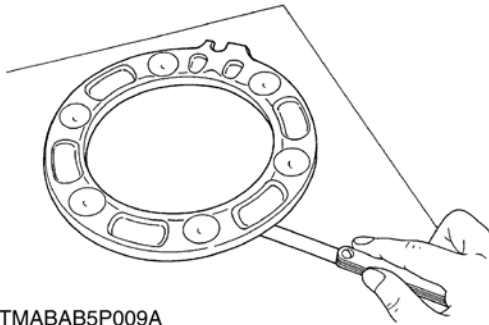


Height of Cam Plate and Ball

1. Measure the dimensions of the 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 cam plate and ball	Factory spec.	20.95 to 21.05 mm 0.8248 to 0.8287 in.
	Allowable limit	20.5 mm 0.807 in.

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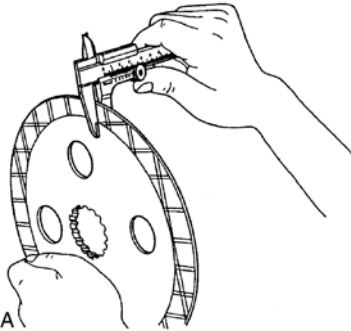
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**Cam Plate Flatness**

1. Place the cam plate on the surface plate.
2. Use a feeler gauge of 0.3 mm (0.012 in.) thick for judgement 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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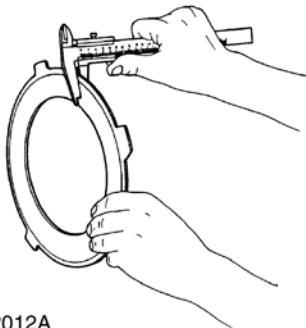
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**Brake Disc Wear**

1. Measure the brake disc thickness with vernier calipers.
2. If the measurement is less than the allowable limit, replace it.

Brake disc wear	Factory spec.	3.4 to 3.6 mm 0.1339 to 0.1417 in.
	Allowable limit	3.0 mm 0.118 in.

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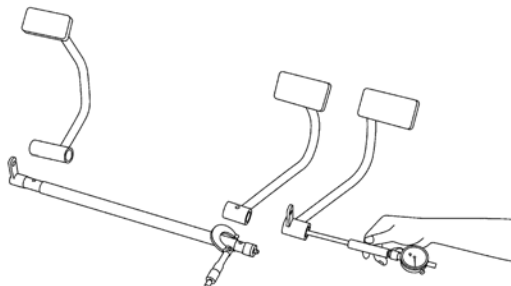
**Brake Plate Wear**

1. Measure the brake plate thickness.
2. If the thickness is less than the allowable limit, replace it.

Brake plate 1	Factory spec.	2.54 to 2.66 mm 0.1000 to 0.1047 in.
	Allowable limit	2.1 mm 0.083 in.

Brake plate 2 thickness	Factory spec.	2.52 to 2.68 mm 0.0992 to 0.1055 in.
	Allowable limit	2.1 mm 0.083 in.

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**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.

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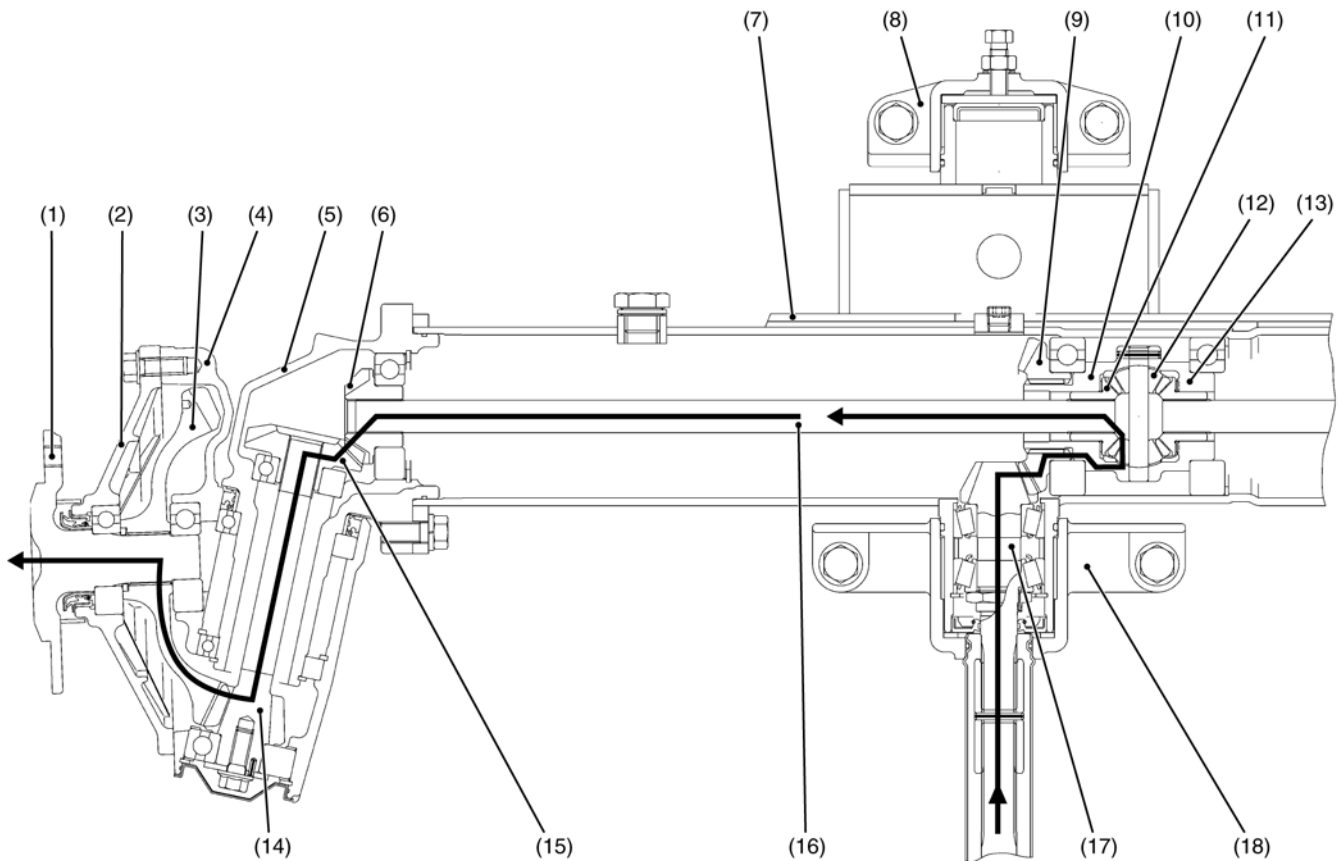
# **6 FRONT AXLE**

# CONTENTS

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1. STRUCTURE.....	6-M1
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# 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) Front 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 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.

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# CONTENTS

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# 1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
<b>Front Wheels Wander to Right or Left</b>	● Tire pressure uneven	Adjust	G-47
	● Improper toe-in adjustment	Adjust	6-S4
	● Excessive clearance between front axle case boss and bracket bushing	Replace	6-S14
	● Front axle rocking force too small	Adjust	6-S5
	● Tie-rod end loose	Tighten	6-S7
<b>Front Wheels Can Not Be Driven</b>	● Propeller shaft broken	Replace	6-S5
	● Front wheel drive gears in transmission broken	Replace	—
	● Front differential gear broken	Replace	6-S10
	● Coupling displaced	Reassemble	—
<b>Noise</b>	● Excessive backlash of gear	Adjust or replace	6-S11 to S14
	● Oil insufficient	Replenish	6-S5
	● Bearings damaged or broken	Replace	—
	● Gears damaged or broken	Replace	—
	● Spiral bevel pinion shaft turning force improper	Adjust	6-S12

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## 2. SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Front Wheel Alignment	Toe-in	2.0 to 8.0 mm 0.078 to 0.315 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	0.030 to 0.150 mm 0.0012 to 0.0059 in.	0.25 mm 0.0098 in.
	Front Axle Case Bosses (O.D.)	61.940 to 61.970 mm 2.4386 to 2.4398 in.	—
	Bracket Bushing (I.D.)	62.000 to 62.090 mm 2.44094 to 2.4445 in.	—
Differential Case to Differential Side Gear	Clearance	0.040 to 0.082 mm 0.0016 to 0.0032 in.	0.20 mm 0.0079 in.
	Differential Case Cover (I.D.)	28.000 to 28.021 mm 1.1024 to 1.1032 in.	—
	Differential Side Gear (O.D.)	27.939 to 27.960 mm 1.1000 to 1.1008 in.	—
Differential Pinion Shaft to Differential Pinion	Clearance	0.048 to 0.084 mm 0.0019 to 0.0033 in.	0.20 mm 0.0079 in.
	Differential Pinion Shaft (O.D.)	10.966 to 10.984 mm 0.4317 to 0.4324 in.	—
	Differential Pinion (I.D.)	11.032 to 11.050 mm 0.4343 to 0.4350 in.	—
Differential Pinion to Differential Side Gear	Backlash	0.10 to 0.30 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	0.10 to 0.30 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 0.35 mm 0.0059 to 0.0138 in.	—

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### 3. TIGHTENING TORQUES

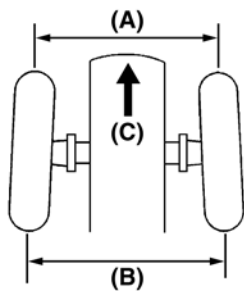
Tightening torques of screws, bolts and nuts on the table below are especially specified.  
(For general use screws, bolts and nuts : See page G-9)

Item	N·m	kgf·m	ft-lbs
Front wheel mounting screws and nuts	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Rocking force adjusting screw lock nut	39.2 to 45.1	4.0 to 4.6	28.9 to 33.3
Delivery hose retaining nut (Power steering)	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

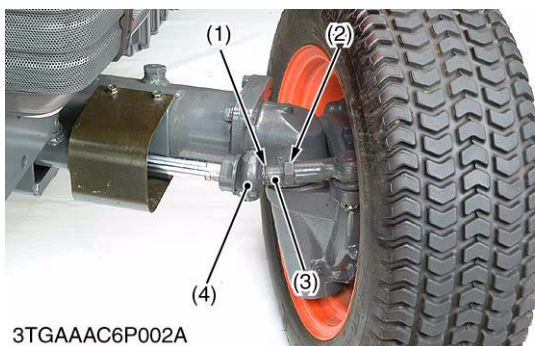
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# 4. CHECKING, DISASSEMBLING AND SERVICING

## [1] CHECKING AND ADJUSTING



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### Adjusting Toe-in

1. Park the tractor on the flat place.
2. Inflate the tires to the specified pressure.
3. Turn the steering wheel so that the 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
-------------------	------------------	--

### IMPORTANT

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

- |                      |   |
|----------------------|---|
| (1) Snap Ring        | <b>A : Wheel-to-wheel Distance at Front</b> |
| (2) Tie-rod Lock Nut | <b>B : Wheel-to-wheel Distance at Rear</b>  |
| (3) Tie-rod Joint    | <b>C : Front</b>                            |
| (4) Dust Cover       |   |

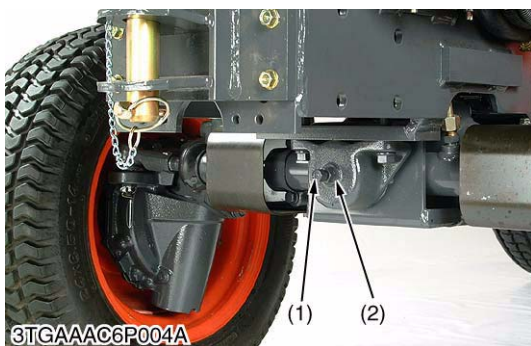
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**Front Axle Rocking Force**

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, tighten 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
--------------------------	---------------	--



**(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

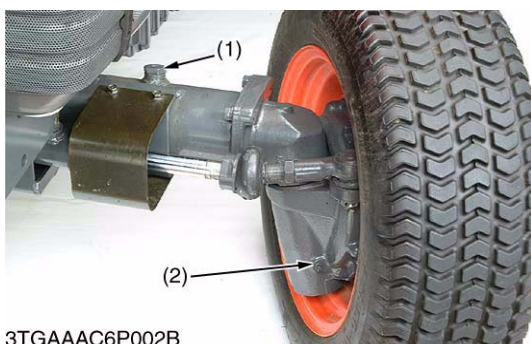
(1) Adjusting Screw

(2) Lock Nut

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**[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.

**(When refilling)**

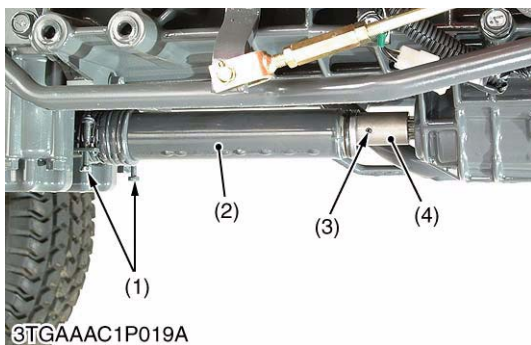
- Pour new oil with specified amount.

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

(2) Drain Plug

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**Propeller Shaft**

1. Loosen the clamp screws (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 the cover.

**(When reassembling)**

- Apply grease to the spline portion of the propeller shaft and couplings.
- When inserting the spring pins (3), face their splits in the direction parallel to the propeller shaft.
- Tighten the clamp screws (1) upward from the bottom side.

(1) Clamp Screws

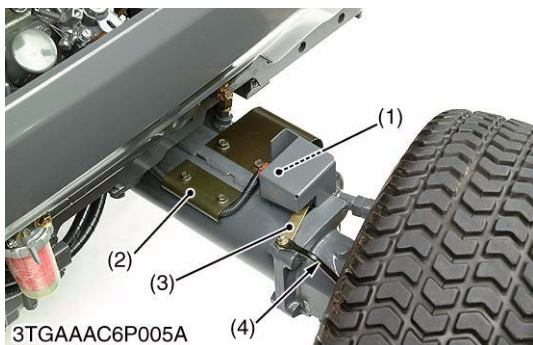
(3) Spring Pin

(2) Propeller Shaft Cover

(4) Coupling

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KiSC issued 04, 2006 A



Front Wheel Turning Angle Sensor

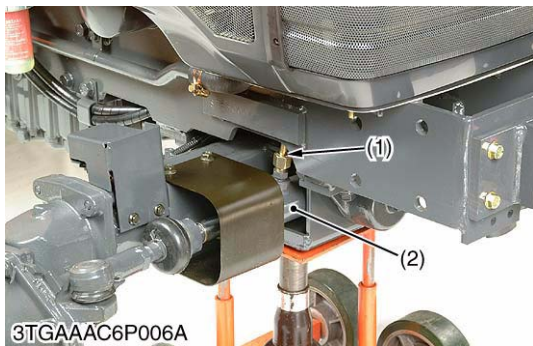
1. Remove the wire harness clamp (2).
2. Disconnect the connector (1).
3. Remove the cotter pin and disconnect the arm (4) from the sensor lever (3).

■ **IMPORTANT**

- **Route the wire harness under the both power steering hoses.**

- |               |           |
|---------------|-----------|
| (1) Connector | (3) Lever |
| (2) Clamp     | (4) Arm   |

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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 delivery hoses (1) (3).

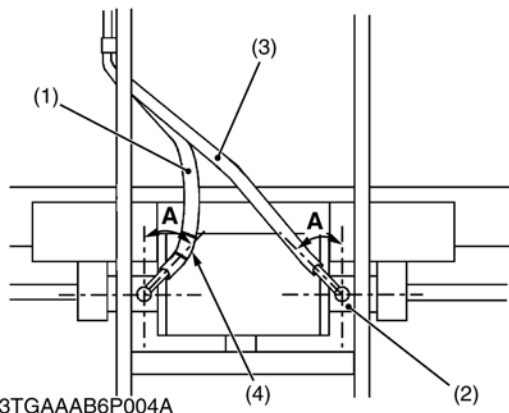
■ **NOTE**

- **After disconnect the delivery hoses, do not steer the front axle so that the steering oil may come out from the delivery hoses.**

■ **IMPORTANT**

- **Connect the delivery hoses to the original position. (When reassembling)**

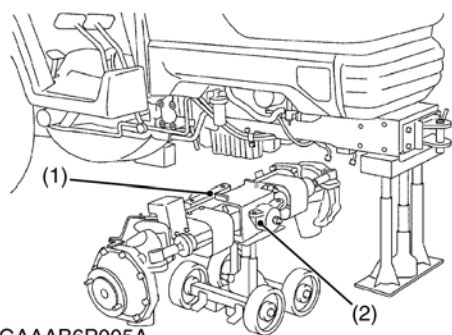
- The power delivery hose RH (1) with white tape (4) to connect the right side connector of steering cylinder (2).
- Be sure to assemble the delivery hose RH and LH as shown in figure.



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
	Delivery hose retaining nut	25 to 30 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 ft·lbs

- |                       |                            |
|-----------------------|----------------------------|
| (1) Delivery Hose RH  | (4) White Tape             |
| (2) Steering Cylinder |                            |
| (3) Delivery Hose LH  | <b>A: 0.785 rad (45 °)</b> |

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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)**

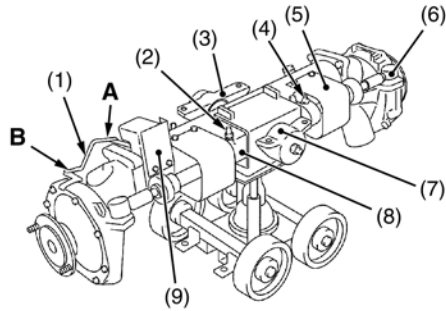
- After mounting the front axle assembly to the front axle frame, be sure to adjust the front axle rocking force. (See page 6-S5.)

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
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- |                       |                        |
|-----------------------|------------------------|
| (1) Rear Axle Bracket | (2) Front Axle Bracket |
|-----------------------|------------------------|

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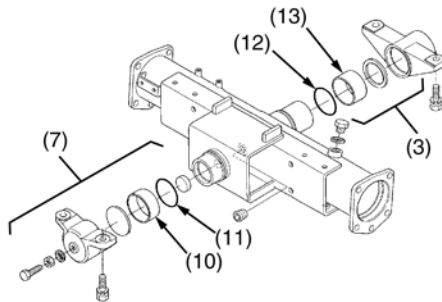
**(2) Disassembling Front Axle Assembly**



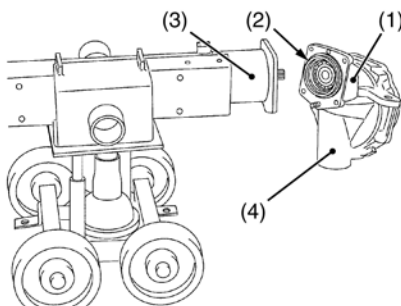
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Steering Cylinder, Axle Bracket and Front Wheel Turning Angle Sensor

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 (2) 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 O-rings (11) (12) and bushings (10) (13) of front axle bracket.
- 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                       | (10) Bushing           |
| (2) Hydraulic Connector              | (11) O-ring            |
| (3) Front Axle Bracket (Rear)        | (12) O-ring            |
| (4) Reamer Screw                     | (13) Bushing           |
| (5) Cylinder Cover                   |                        |
| (6) Tie-rod                          | <b>A: Longer Side</b>  |
| (7) Front Axle Bracket (Front)       | <b>B: Shorter Side</b> |
| (8) Steering Cylinder                |                        |
| (9) Front Wheel Turning Angle Sensor |                        |

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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)**

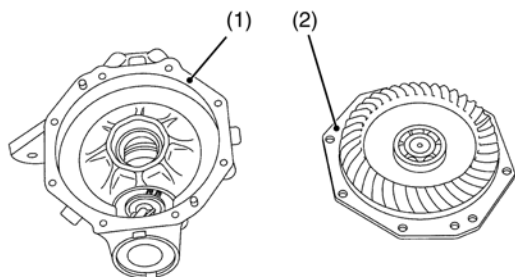
- Apply grease to the O-ring (2) and take care not to damage it.
- Do not interchange right and left bevel gear case assemblies and right and left gear case assemblies.
- Be sure to fix the turning angle sensor arm holder.

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 |

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**Gear Case Cover and Front Axle**

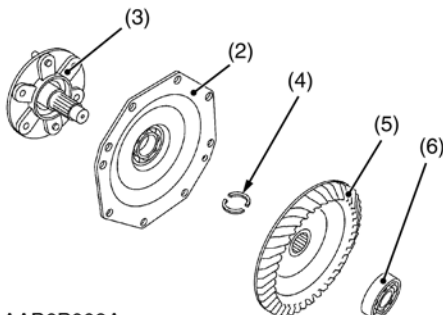


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1. Remove the gear case cover (2) from the front gear case (1).
2. Remove the bearing (6) with special use puller set (Code No.: 07916-09032).
3. Take out the 41T bevel gear (5).
4. Take out the divided collar (4).
5. Tap out the front axle (3).

**(When reassembling)**

- Be sure to adjust the backlash between the 41T bevel gear (5) and 7T pinion shaft. (See page 6-S14.)
- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the front gear case (1) and gear case cover (2), after eliminate the water, oil and stuck liquid gasket.



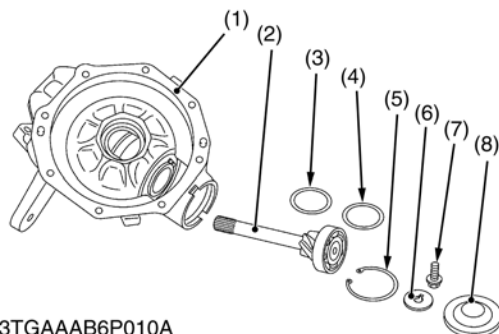
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Tightening torque	Gear case cover mounting screws	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft·lbs
-------------------	---------------------------------	---

- |                     |                    |
|---------------------|--------------------|
| (1) Front Gear Case | (4) Divided Collar |
| (2) Gear Case Cover | (5) 41T Bevel Gear |
| (3) Front Axle      | (6) Bearing        |

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**7T Pinion Shaft**



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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)**

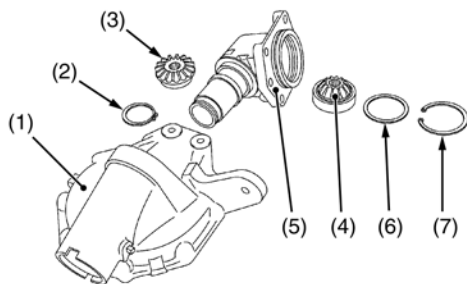
- Replace the cap (8) with new one.

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) Front Gear Case | (5) Internal Snap Ring |
| (2) 7T Pinion Shaft | (6) Washer             |
| (3) Shim            | (7) UBS Screw          |
| (4) Shim            | (8) Cap                |

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**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 front gear case (1).

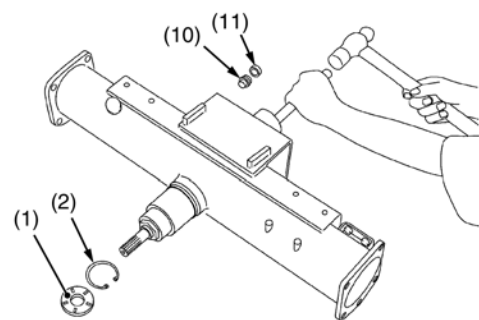
**(When reassembling)**

- Install the oil seal of front gear case (1), noting it direction, and apply grease to it.
- Be sure to adjust the backlash between the bevel gears (3) and (4). (See page 6-S13.)

- |                        |                        |
|------------------------|------------------------|
| (1) Front Gear Case    | (5) Bevel Gear Case    |
| (2) External Snap Ring | (6) Shim               |
| (3) 16T Bevel Gear     | (7) Internal Snap Ring |
| (4) 11T Bevel Gear     |                        |

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**Spiral Bevel Pinion Shaft and Differential Gear Assembly**

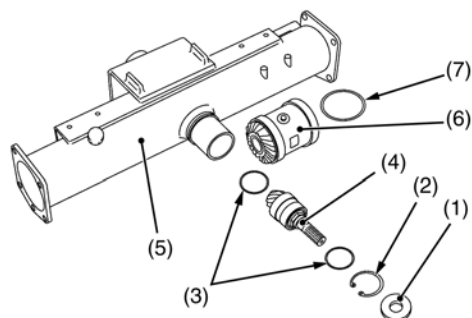


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1. Remove the oil seal (1) and internal snap ring (2).
2. Take out the collar (3).
3. Remove the plug (10), (11).
4. Tap out the spiral bevel pinion shaft (4) to the rear side.
5. Take out the differential gear assembly (6) and shim (7) from left side 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-S12).
- 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.
- Stake the lock nut (8) firmly.

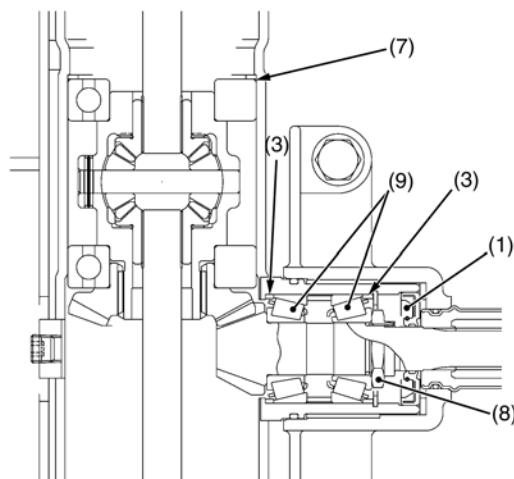


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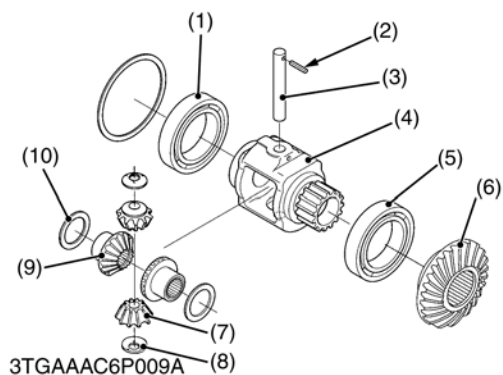
- |                                |                          |
|--------------------------------|--------------------------|
| (1) Oil Seal                   | (8) Lock Nut             |
| (2) Internal Snap Ring         | (9) Taper Roller Bearing |
| (3) Collar                     | (10) Plug (Screw)        |
| (4) Spiral Bevel Pinion Shaft  | (11) Plug                |
| (5) Front Axle Case            |                          |
| (6) Differential Gear Assembly |                          |
| (7) Shim                       |                          |

**A : 1.0 mm (0.039 in.)**

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3TGAAAC6P008A



**Differential Gear**

1. Remove the spiral bevel gear (6) with bearing (5) and bearing (1) with the puller.
2. Tap out the spring pin (2) and pull out the differential pinion shaft (3).
3. Remove the differential pinion (7) and differential side gear (9).

**NOTE**

● **Arrange the parts to know their original position. (When reassembling)**

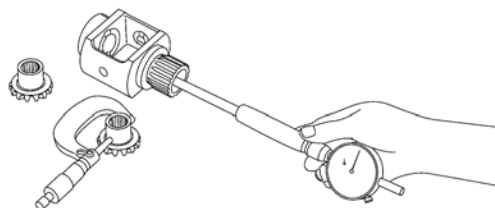
- Apply molybdenum disulfide (Three Bond 1901 or equivalent) to the inner circumferential surface of the differential side gears (9) and differential pinions (7).
- When inserting the spring pin (2), face its split in the direction right-angled to the differential pinion shaft (3).

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) Bearing                   | (6) Spiral Bevel Gear      |
| (2) Spring Pin                | (7) Differential Pinion    |
| (3) Differential Pinion Shaft | (8) Shim                   |
| (4) Differential Gear Case    | (9) Differential Side Gear |
| (5) Bearing                   | (10) Shim                  |

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**[3] SERVICING**



3TAAAB6P026A

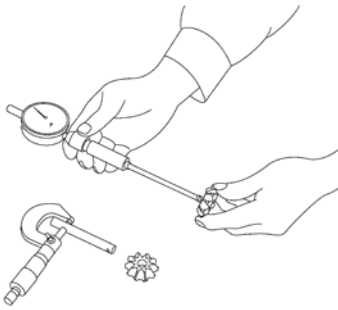
**Clearance between Differential Case and Differential Side Gear**

1. Measure the differential side gear boss O.D..
2. Measure the differential case bore I.D. and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace faulty parts.

Clearance between differential case and differential side gear	Factory spec.	0.040 to 0.082 mm 0.0016 to 0.0032 in.
	Allowable limit	0.20 mm 0.0079 in.

Differential case bore I.D.	Factory spec.	28.000 to 28.021 mm 1.1024 to 1.1032 in.
Differential side gear O.D.	Factory spec.	27.939 to 27.960 mm 1.1000 to 1.1008 in.

000007635E



3TAAAAB6P027A

Clearance between Differential 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.

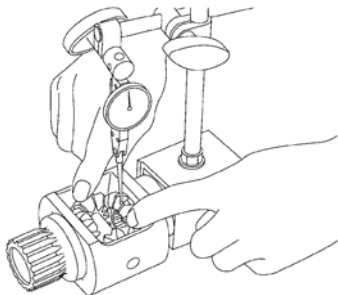
Clearance between pinion shaft and differential pinion	Factory spec.	0.048 to 0.084 mm 0.0019 to 0.0033 in.
	Allowable limit	0.20 mm 0.0079 in.

Differential Pinion shaft O.D.	Factory spec.	10.966 to 10.984 mm 0.4317 to 0.4324 in.
Differential pinion I.D.	Factory spec.	11.032 to 11.050 mm 0.4343 to 0.4350 in.

000007636E

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 and differential pinion gear shims.



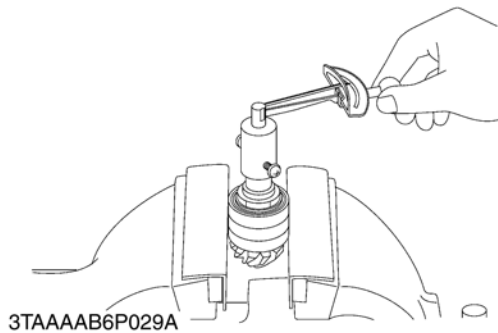
3TAAAAB6P028A

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.)
  - 1.4 mm (0.055 in.)
  - 1.6 mm (0.063 in.)
- Thickness of differential pinion gear shims:
  - 0.8 mm (0.031 in.)
  - 1.0 mm (0.039 in.)
  - 1.2 mm (0.047 in.)

000007637E



**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.

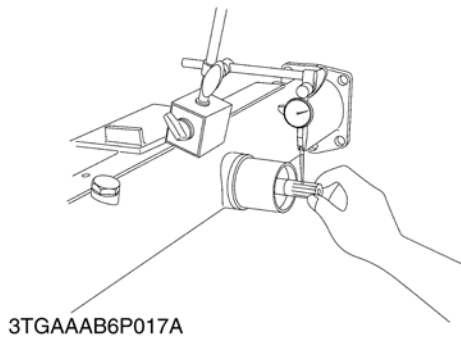
**NOTE**

- After turning torque adjustment, be sure to stake the lock nut.

Turning force	Factory spec.	58.8 to 78.4 N·m 6.0 to 8.0 kgf·m 13.2 to 17.6 ft-lbs
---------------	---------------	---

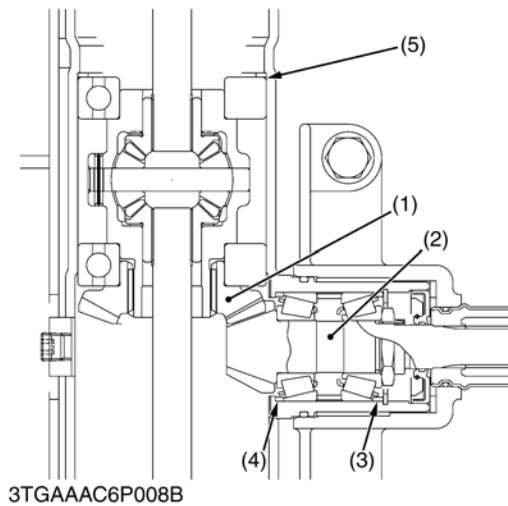
000007638E

**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 spiral bevel gear (1).
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):  
 1.6 mm (0.063 in.)    2.0 mm (0.079 in.)  
 1.7 mm (0.067 in.)    2.1 mm (0.083 in.)  
 1.8 mm (0.071 in.)    2.2 mm (0.087 in.)  
 1.9 mm (0.075 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          |                      |



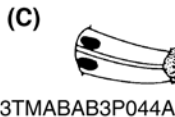
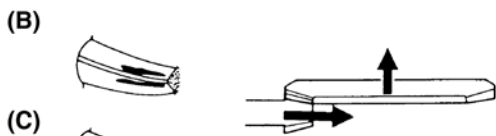
3TMABAB3P043A

● **Proper Contact**

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

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3TMABAB3P044A

● **Shallow or Heel Contact**

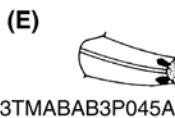
Replace the adjusting collars (3), (4) to move the bevel pinion shaft forward and replace the shim (5) with a thinner one.

Repeat this procedure until the proper tooth contact and backlash are achieved.

(B) Shallow Contact

(C) Heel Contact

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3TMABAB3P045A

● **Deep and Toe Contact**

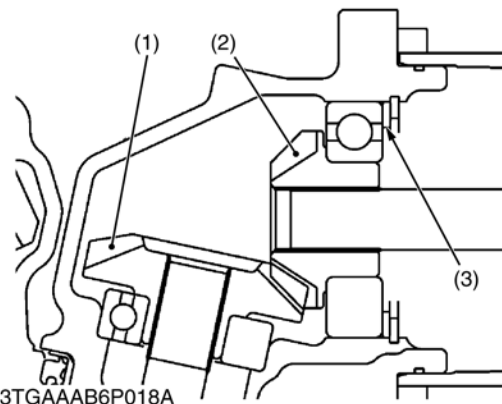
Replace the adjusting collars (3), (4) to move the bevel pinion shaft backward and replace the shim (5) with a thicker one.

Repeat this procedure until the proper tooth contact and backlash are achieved.

(D) Deep Contact

(E) Toe Contact

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3TGAAAB6P018A

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)**

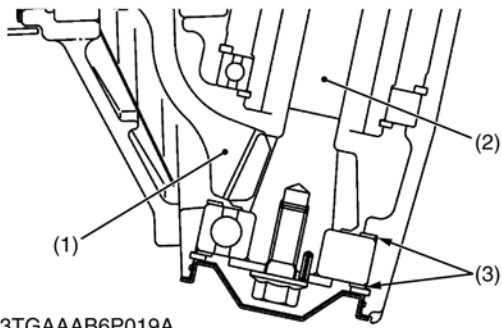
- Thickness of adjusting shims (3):  
0.8 mm (0.031 in.) 1.2 mm (0.047 in.)  
1.0 mm (0.039 in.)

(1) 16T Bevel Gear

(3) Shim

(2) 11T Bevel Gear

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3TGAAAB6P019A

**Backlash between 7T Pinion Shaft and 41T Bevel Gear**

1. Stick a strip of fuse to three spots on the 41T bevel gear (1) with grease.
2. Fix the gear case cover and gear case.
3. Turn the axle.
4. Remove the gear case cover from gear case 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 7T pinion shaft and 41T bevel gear	Factory spec.	0.15 to 0.35 mm 0.0059 to 0.0138 in.
---	---------------	---

**(Reference)**

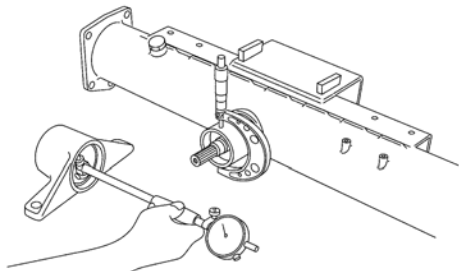
- Thickness of adjusting shims (3):  
1.2 mm (0.047 in.) 1.4 mm (0.055 in.)  
1.3 mm (0.051 in.)

- (1) 41T Bevel Gear (3) Shim
- (2) 7T Bevel Gear

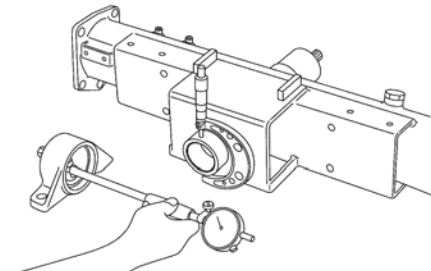
000007644E

**Clearance between Front Axle Case Bosses and Bracket Bushings**

1. Measure the front axle case bosses O.D..
2. Measure the bracket bushing I.D. and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace the bracket bushing.
4. If the clearance still exceeds the allowable limit, replace the front axle case.



3TGAAAB6P020A



3TGAAAB6P021A

Clearance between front axle case bosses and bracket bushings	Factory spec.	0.030 to 0.150 mm 0.0012 to 0.0059 in.
	Allowable limit	0.25 mm 0.0098 in.

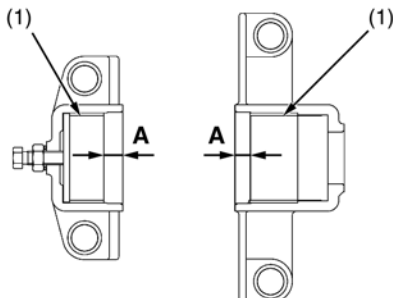
Front axle case bosses O.D.	Factory spec.	61.940 to 61.970 mm 2.4386 to 2.4398 in.
-----------------------------	---------------	---

Bracket bushings I.D.	Factory spec.	62.000 to 62.090 mm 2.44094 to 2.4445 in.
-----------------------	---------------	--

**■ Press-fitting Bushing**

- When press-fitting a new bushing, observe the dimension described in the figure.

Press-fit depth of bushing (A)	Reference value	12.0 mm 0.47 in.
--------------------------------	-----------------	---------------------



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**■ NOTE**

- After replacing the bushing, be sure to adjust the front axle rocking force.

- (1) Bushing

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# **7 STEERING**

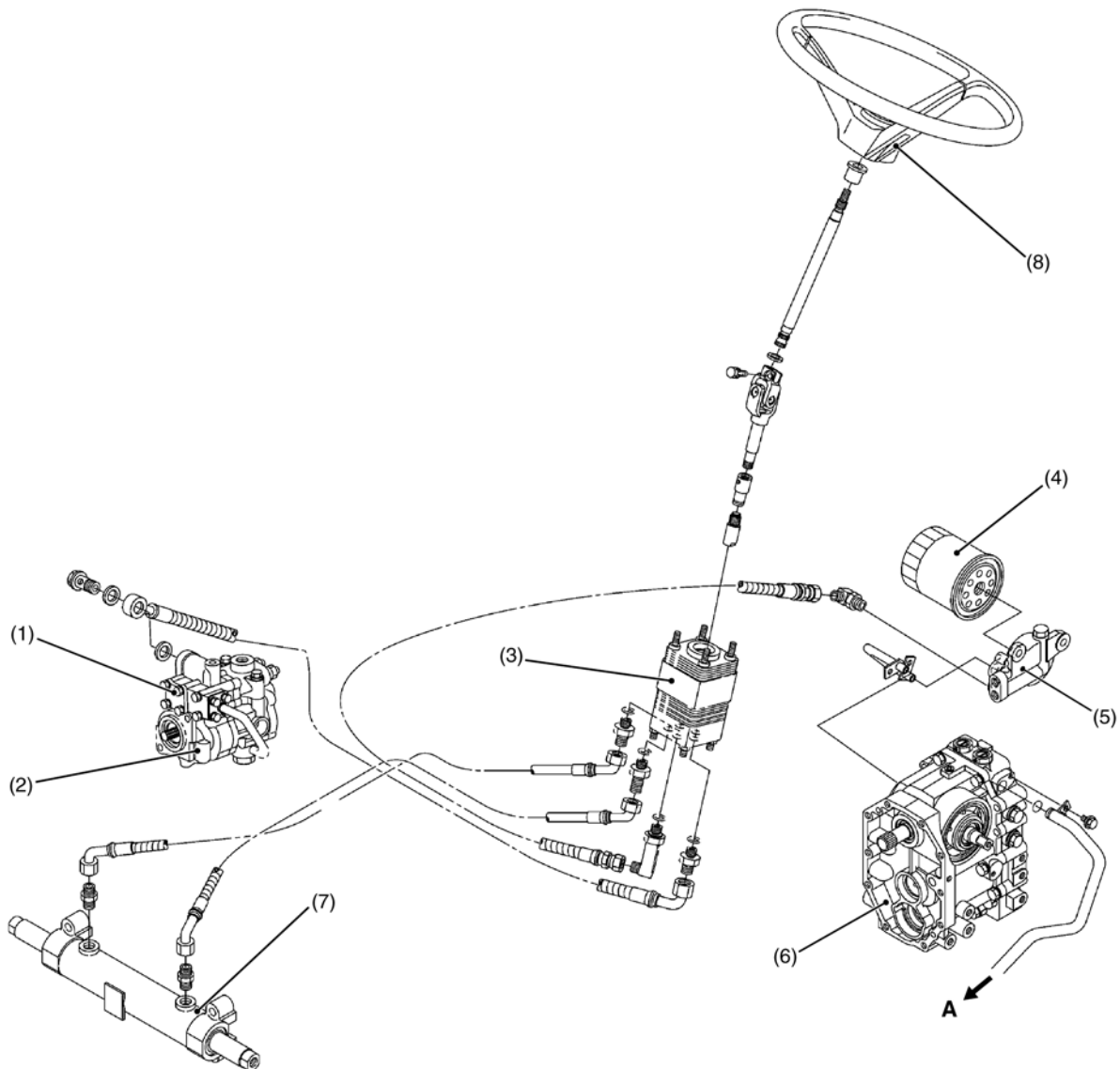
# CONTENTS

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1. STRUCTURE.....	7-M1
2. HYDRAULIC CIRCUIT FOR POWER STEERING.....	7-M2
3. STEERING CYLINDER .....	7-M3



# 1. STRUCTURE



3TGAAAC7P001A

- |                      |                         |                                    |                         |
|----------------------|-------------------------|------------------------------------|-------------------------|
| (1) Hydraulic Pump   | (3) Steering Controller | (5) Filter Bracket                 | (7) Steering Cylinder   |
| (2) Regulating Valve | (4) HST Oil Filter      | (6) HST (Hydrostatic Transmission) | (8) Steering Wheel      |
|                      |                         |                                    | <b>A: To Oil Cooler</b> |

This tractor is equipped with a full hydrostatic power steering. The steering controller (3) is connected to the steering cylinder (7) with the hydraulic pipe only, therefore it is simple in construction.

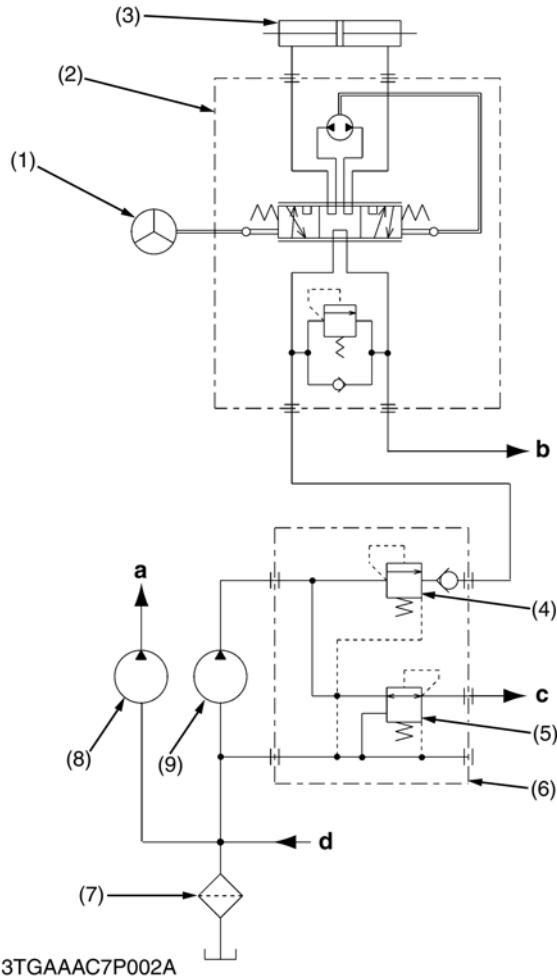
000007789E

## 2. HYDRAULIC CIRCUIT FOR POWER STEERING

The oil from the hydraulic pump (9) passes through the regulating valve (4) and enters the steering controller (2).

Return oil from the controller (2) enters into the HST (hydrostatic transmission) through the HST oil filter as charging oil.

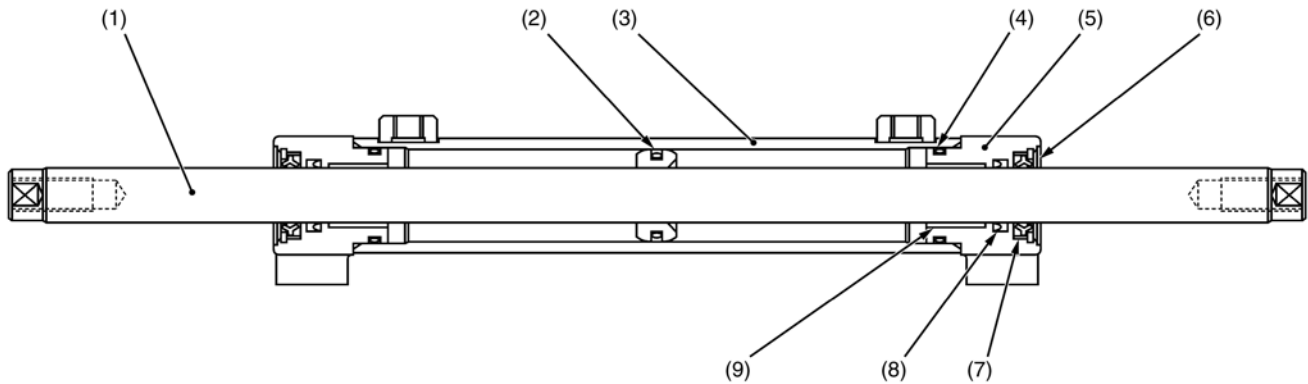
Refer to the "FULL HYDROSTATIC TYPE (TYPE 1)" in the workshop manual of Tractor Mechanism (Code No.: 97897-18200) for the steering controller (2).



- |                                     |                                   |
|-------------------------------------|-----------------------------------|
| (1) Steering Wheel                  | <b>a : To 3P Hydraulic System</b> |
| (2) Steering Controller             | <b>b : To HST</b>                 |
| (3) Steering Cylinder               | <b>c : To Bi-speed Valve</b>      |
| (4) Regulating Valve                | <b>d : From Oil Cooler</b>        |
| (5) Pressure Reducing Valve         |                                   |
| (6) Regulator Valve                 |                                   |
| (7) Oil Filter                      |                                   |
| (8) Hydraulic Pump (3P)             |                                   |
| (9) Hydraulic Pump (Power Steering) |                                   |

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### 3. STEERING CYLINDER



3TGAAAB7P006A

- |                   |            |                        |                |
|-------------------|------------|------------------------|----------------|
| (1) Rod Assembly  | (4) O-ring | (6) Internal Snap Ring | (8) Rod Gasket |
| (2) Packing       | (5) Cover  | (7) Dust Seal          | (9) Bushing    |
| (3) Cylinder Tube |            |                        |                |

The steering cylinder is single piston both rod double-acting type. This steering cylinder is installed parallel to the front axle and connected to tie-rods.

The tie-rods connected to both knuckle arm guarantees equal steering movement to both front wheels.

The steering cylinder provides 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.

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1. TROUBLESHOOTING.....	7-S1
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3. TIGHTENING TORQUES.....	7-S3
4. CHECKING, DISASSEMBLING AND SERVICING.....	7-S4
[1] CHECKING AND ADJUSTING.....	7-S4
[2] DISASSEMBLING AND ASSEMBLING.....	7-S4
(1) Steering Controller.....	7-S4

# 1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
<b>Tractor Cannot Be Steered</b>	● Steering controller broken	Replace	7-S5
	● Hose broken	Replace	—
<b>Front Wheels Vibrate</b>	● Centering spring weaken or broken	Replace steering controller	7-S5
	● Improper toe-in adjustment	Adjust	6-S4
	● Air in the hydraulic system	Bleed	7-S4
	● Improperly mounted wheels	Correct	G-48
	● Tie-rod end loose or worn	Retighten or replace	6-S7
	● Clearance between front axle case boss and brackets bushings excessive	Replace	6-S14
<b>Hard Steering</b>	● Hydraulic pump malfunctioning	Replace	8-S16
	● Overload	Loosen the load	—
	● Transmission fluid improper or insufficient	Change	G-8, 15
	● Oil leak from pipe joint	Retighten	7-S5
	● Insufficient tire pressure	Inflate	G-47
	● Steering controller malfunctioning	Replace	7-S5
	● Relief valve malfunctioning	Replace steering controller	7-S5
<b>Steering Force Fluctuates</b>	● Air sucked in pump due to leaking or missing of oil	Replenish	G-8, 15
	● Air sucked in pump from suction circuit	Repair	—
<b>Front Wheels Wander to Right and Left</b>	● Centering spring weaken or broken	Replace steering controller	—
	● Air sucked in pump due to leak of oil	Replenish	G-8, 15
	● Air sucked in pump from suction circuit	Repair	—
	● Tire pressure uneven	Inflate	G-47
	● Insufficient bleeding	Bleed	7-S4
	● Improper toe-in adjustment	Adjust	6-S4
	● Clearance between front axle case boss and brackets bushings excessive	Replace	6-S14
	● Tie-rod end loose or worn	Retighten or replace	6-S7
<b>Wheels Are Turned to a Direction Opposite to Steering Direction</b>	● Delivery hose RH and LH connected in reverse	Repair	—
<b>Noise</b>	● Air sucked in pump due to lack of oil	Replenish	G-8, 15
	● Air sucked in pump from suction circuit	Repair	—
	● Delivery hose deformed	Replace	—

## 2. SERVICING SPECIFICATIONS

### STEERING WHEEL

Item		Factory Specification	Allowable Limit
Steering Wheel	Operating Torque	1.0 to 2.0 N·m 0.10 to 0.20 kgf·m 0.72 to 1.45 ft-lbs	—

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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
Delivery hose RH retaining nut	24.5 to 29.4	2.5 to 3.0	18.1 to 21.7
Delivery hose LH retaining nut	24.5 to 29.4	2.5 to 3.0	18.1 to 21.7
Charge hose retaining nut	24.5 to 29.4	2.5 to 3.0	18.1 to 21.7
Delivery hose retaining nut (controller side)	34.3 to 44.1	3.5 to 4.5	25.3 to 32.5
Delivery hose retaining nut (pump side)	49 to 58.8	5.0 to 6.0	36.2 to 43.4
Steering controller hose joint ( <b>IN</b> port)	34.3 to 49.0	3.5 to 5.0	25.3 to 36.2
Steering controller hose joint ( <b>LT</b> port)	34.3 to 49.0	3.5 to 5.0	25.3 to 36.2
Steering controller hose joint ( <b>RT</b> port)	34.3 to 49.0	3.5 to 5.0	25.3 to 36.2
Steering controller hose joint ( <b>OUT</b> port)	24.5 to 34.3	2.5 to 3.5	18.1 to 25.3

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# 4. CHECKING, DISASSEMBLING AND SERVICING

## [1] CHECKING AND ADJUSTING

**NOTE**

- Refer to the "8. HYDRAULIC SYSTEM" for hydraulic pump and steering controller.

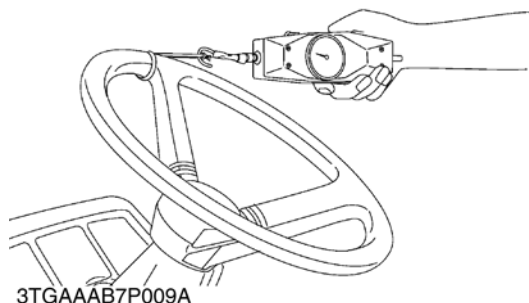
**IMPORTANT**

- Use only the transmission fluid (see page G-8), in no case mixture of oils of different brands.
- Do not disassemble the hydraulic pump and steering controller 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.

000007795E



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. Calculate the operating torque.
5. If the torque exceeds the factory specification, check the suction line, delivery line, and the performance of hydraulic pump.

And then, check the steering controller.

Steering wheel operating torque	Factory spec.	1.0 to 2.0 N·m 0.10 to 0.20 kgf·m 0.72 to 1.45 ft-lbs
---------------------------------	---------------	---

**Condition**

- Engine speed ..... Maximum
- Oil temperature ..... 40 to 60 °C (104 to 140 °F)
- Tractor by itself (without any implement and weight)

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## [2] DISASSEMBLING AND ASSEMBLING

**NOTE**

- Refer to the "8. HYDRAULIC SYSTEM" for hydraulic pump.

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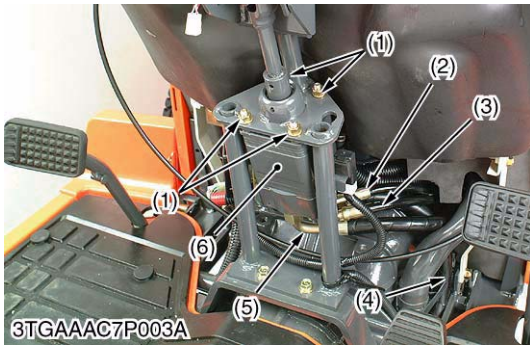
### (1) Steering Controller

Disassembling Procedure

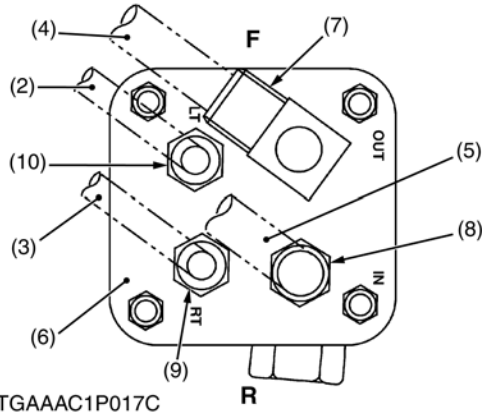
See page 3-S17, 18.

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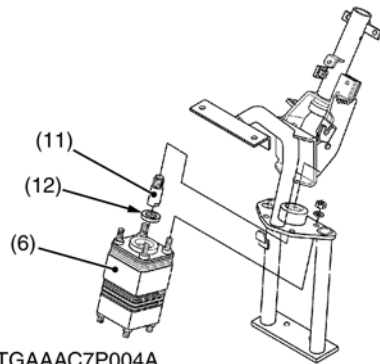




[A]



3TGAAAC1P017C



3TGAAAC7P004A

**Removing Steering Controller**

1. Disconnect the delivery hose (5), delivery hose LH (3), delivery hose RH (2) and charge hose (4).
2. Remove the mounting screws (1) and separate the steering controller (6).

**(When reassembling)**

- Apply transmission oil to the oil seal (12).
- Align the pipe joint (11) to the ditch of the steering controller (6).
- Connect the delivery hose RH (2) to the LT port (10).
- Connect the delivery hose LH (3) to the RT port (9).
- Assemble the delivery hose (5), delivery hose LH (3) and delivery hose RH (2) so that each hose becomes parallel to the hose joint (7).
- Be sure to check the hose joints do not interfere in other joints.

**NOTE**

- The edge of the hose joint (7) should be corresponding to the edge of the controller. (See figure)

Tightening torque	Delivery hose RH (2) retaining nut	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 ft·lbs
	Delivery hose LH (3) retaining nut	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 ft·lbs
	Charge hose (4) retaining nut	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 ft·lbs
	Delivery hose (5) retaining nut (Controller side)	34.3 to 44.1 N·m 3.5 to 4.5 kgf·m 25.3 to 32.5 ft·lbs
	Delivery hose (5) joint screw (Pump side)	49 to 58.8 N·m 5.0 to 6.0 kgf·m 36.2 to 43.4 ft·lbs

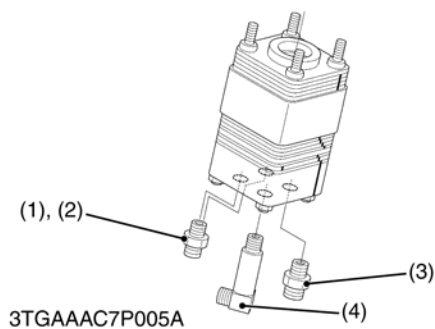
- |                           |                           |
|---------------------------|---------------------------|
| (1) Mounting Screw        | (9) Hose Joint (RT port)  |
| (2) Delivery Hose RH      | (10) Hose Joint (LT port) |
| (3) Delivery Hose LH      | (11) Pipe Joint           |
| (4) Charge Hose           | (12) Oil Seal             |
| (5) Delivery Hose         |                           |
| (6) Steering Controller   |                           |
| (7) Hose Joint (OUT port) |                           |
| (8) Hose Joint (IN port)  |                           |

**A : Viewed from Bottom Side**

**F : Front Side**

**R : Rear Side**

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Hose Joint

1. Remove the hose joints (1), (2), (3), (4).

**(When reassembling)**

- Apply seal tape on to the hose joints.

Tightening torque	Hose joint (RT, LT, IN port)	34.3 to 49.0 N·m 3.5 to 5.0 kgf·m 25.3 to 36.2 ft-lbs
	Hose joint (OUT port)	24.5 to 34.3 N·m 2.5 to 3.5 kgf·m 18.1 to 25.3 ft-lbs

(1) Hose Joint (LT port)

(3) Hose Joint (IN port)

(2) Hose Joint (RT port)

(4) Hose Joint (OUT port)

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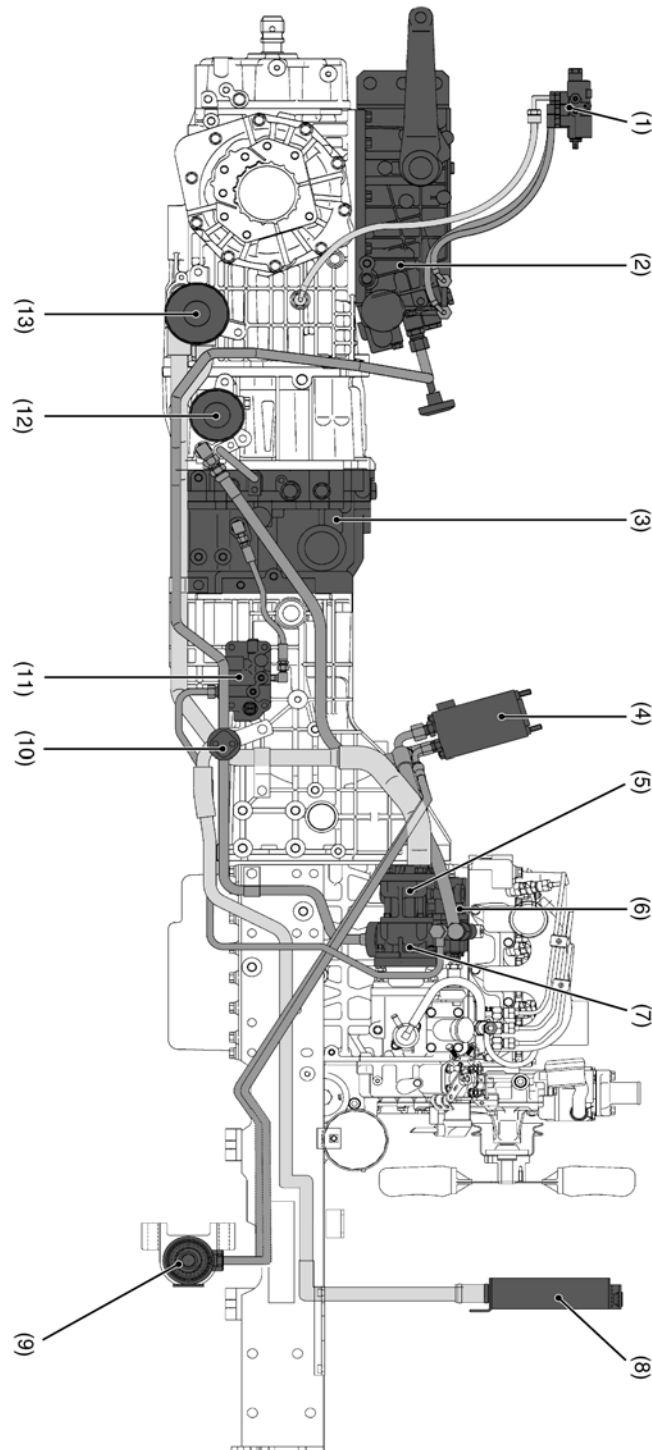
# **8 HYDRAULIC SYSTEM**

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# 1. STRUCTURE



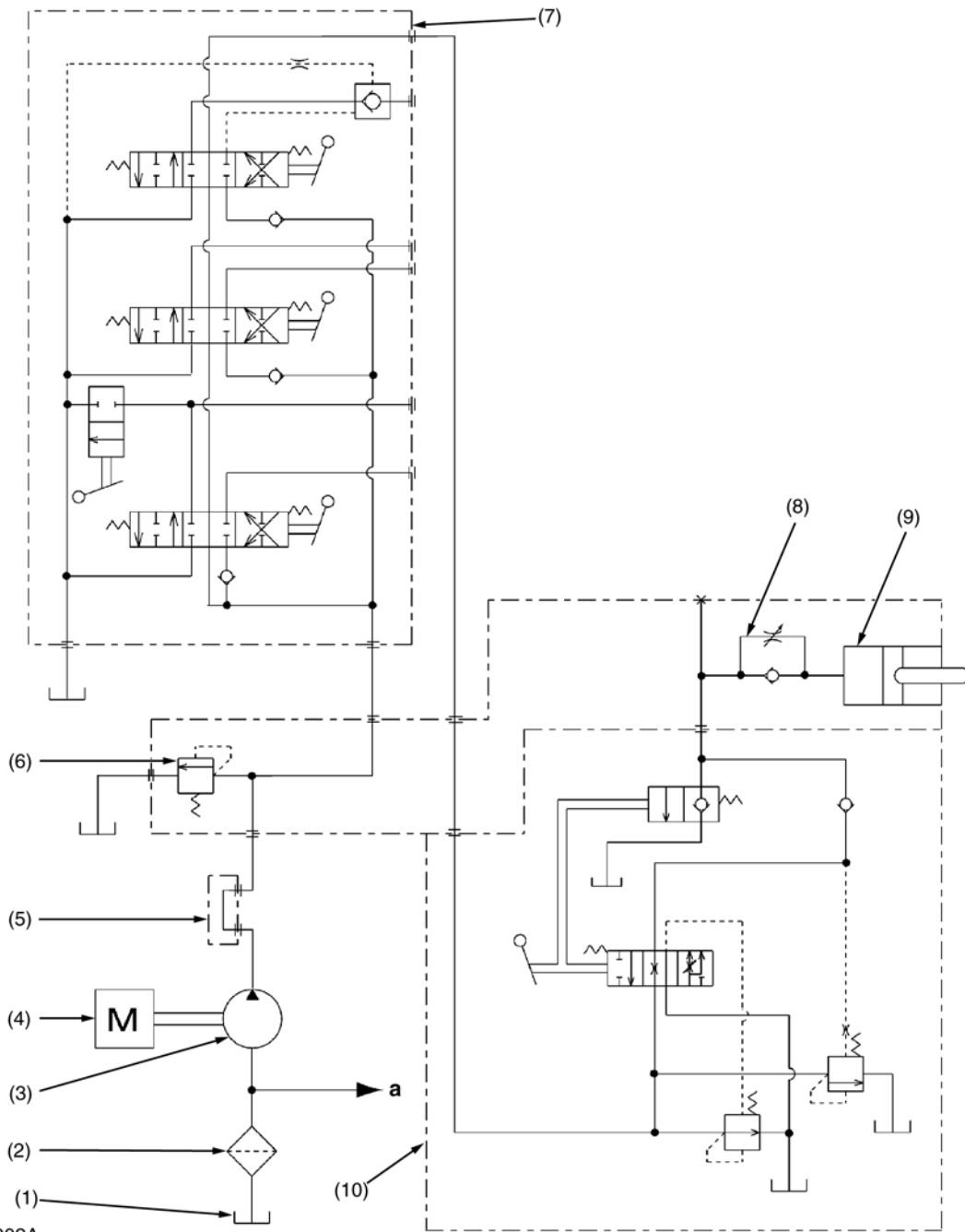
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- |                                    |                                   |                                  |                     |
|------------------------------------|-----------------------------------|----------------------------------|---------------------|
| (1) Auxiliary Control Valve        | (5) Power Steering Hydraulic Pump | (8) Oil Cooler                   | (11) Bi-speed Valve |
| (2) Hydraulic Cylinder             | (6) Regulator Valve               | (9) Steering Cylinder            | (12) HST Oil Filter |
| (3) Hydrostatic Transmission (HST) | (7) 3P Hydraulic Pump             | (10) Hydraulic Block Type Outlet | (13) Oil Filter     |
| (4) Steering Controller            |                                   |                                  |                     |

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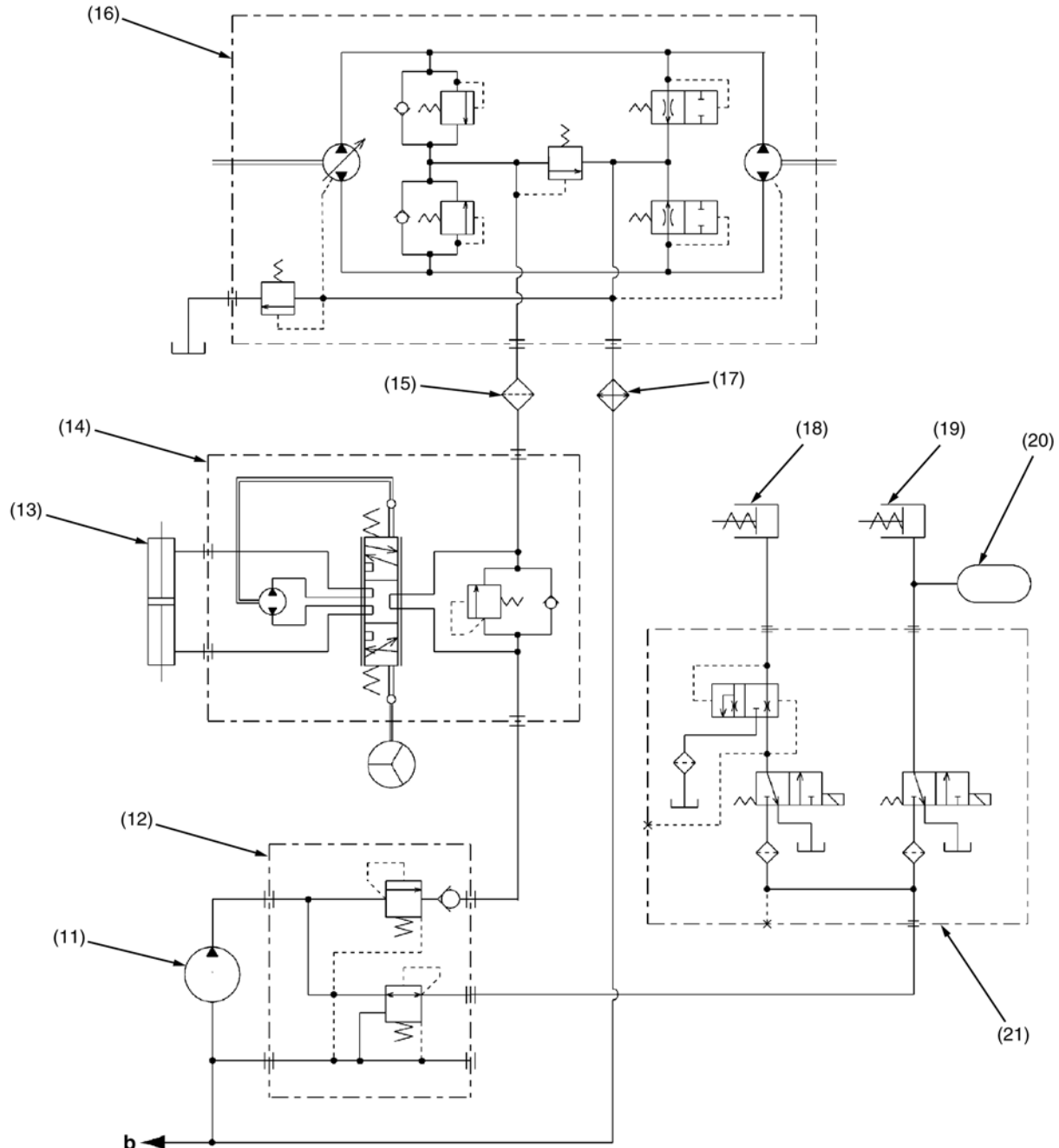
## 2. WHOLE HYDRAULIC CIRCUIT



3TGAAAC8P002A

- |                                |                                 |                                    |                             |
|--------------------------------|---------------------------------|------------------------------------|-----------------------------|
| (1) Transmission case          | (4) Engine                      | (7) Auxiliary Control Valve        | (9) Hydraulic Cylinder      |
| (2) Oil Filter                 | (5) Hydraulic Block Type Outlet | (8) Lowering Speed Adjusting Valve | (10) Position Control Valve |
| (3) Hydraulic Pump (3P System) | (6) Relief Valve                |                                    |                             |
- a : Continue to Next Page**

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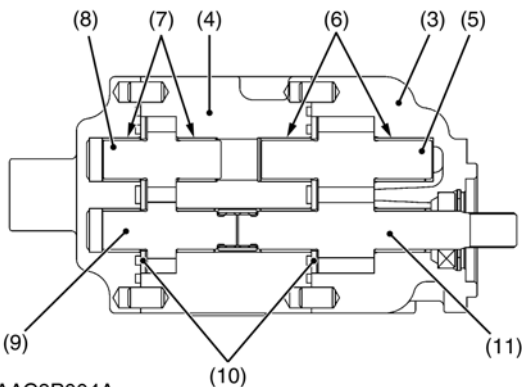
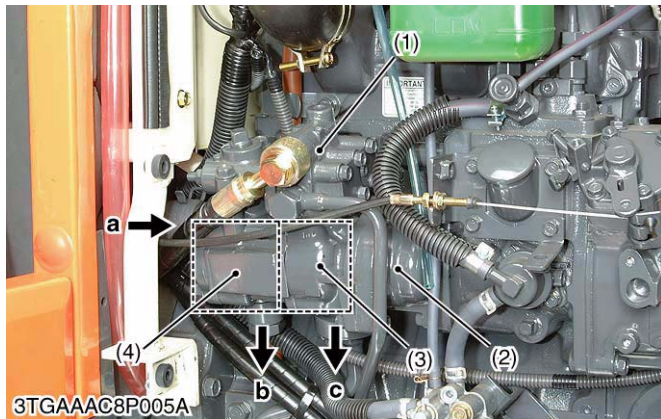
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- |   |  |                                  |                     |
|---|--|----------------------------------|---------------------|
| (11) Hydraulic Pump<br>(Power Steering) | (14) Steering Controller               | (17) Oil Cooler                  | (20) Accumulator    |
| (12) Regulator Valve                    | (15) HST Oil Filter                    | (18) Hydraulic Clutch (Bi-speed) | (21) Bi-speed Valve |
| (13) Steering Cylinder                  | (16) Hydrostatic Transmission<br>(HST) | (19) Hydraulic Clutch (PTO)      |                     |

**b : Continue to Last Page**

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### 3. HYDRAULIC PUMP



The hydraulic pump is tandem type, front side is the 3P hydraulic pump (3) and rear side is the power steering hydraulic pump (4). This pump is composed of two pairs of gears, side plates, bushing and other components as shown in the figure. The hydraulic pump is driven by the fuel camshaft, and the rotation increase with the gears in the pump holder (2) by 37/21 times.

The 3P hydraulic pump (3) pressure-feed the oil to the 3P hydraulic system. The power steering hydraulic pump (4) pressure-feed the oil to the power steering controller, bi-speed turn clutch and hydraulic PTO clutch through the regulator valve (1) and bi-speed valve.

**(Reference)**

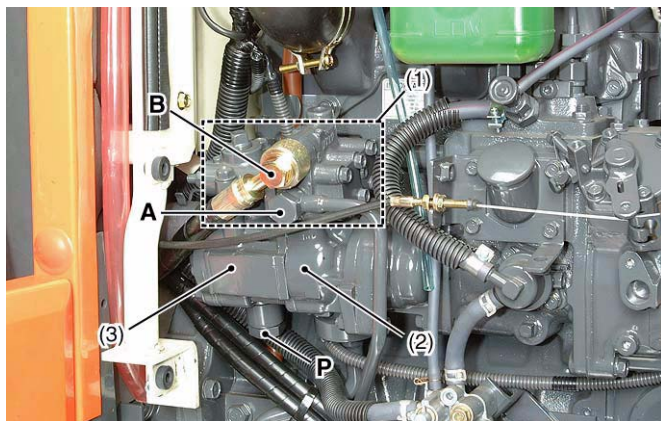
	Power steering pump	3P hydraulic pump
Pump discharge per revolution	6.128 cm <sup>3</sup> /rev. 0.374 cu.in. /rev.	10.09 cm <sup>3</sup> /rev. 0.616 cu.in. /rev.
Pump discharge per minute	14.0 L/m 3.70 U.S.gal./m 3.08 Imp.gal./m (At no load, engine 2700 rpm)	23.0 L/m 6.09 U.S.gal./m 5.07 Imp.gal./m (At no load, engine 2700 rpm)

- (1) Regulator Valve
  - (2) Pump Holder
  - (3) 3P Hydraulic Pump
  - (4) Power Steering Hydraulic Pump
  - (5) Driven Gear 1
  - (6) Bushing
  - (7) Bushing
  - (8) Driven Gear 2
  - (9) Drive Gear 2
  - (10) Side Plate
  - (11) Drive Gear 1
- a : From Transmission Case**
  - b : To Regulator Valve**
  - c : To 3P Hydraulic System**

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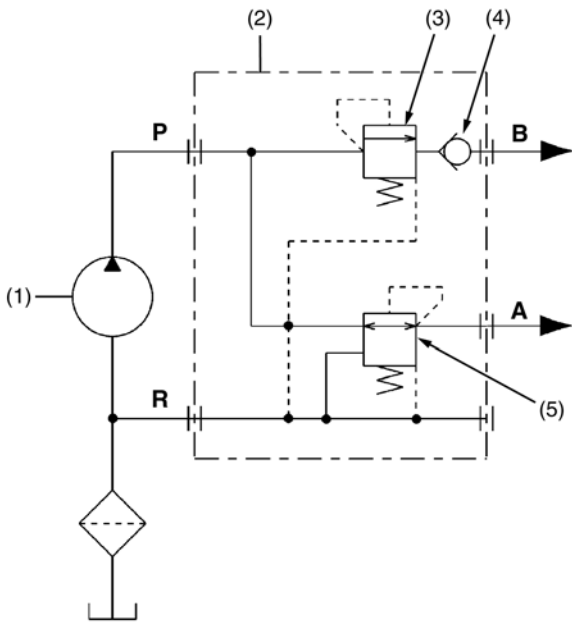
## 4. REGULATOR VALVE



The regulator valve (1) is installed on the power steering pump, regulating the oil pressure of the hydraulic PTO clutch and bi-speed clutch circuit.

- |                         |                   |
|-------------------------|-------------------|
| (1) Regulator Valve     | <b>A : A Port</b> |
| (2) 3P Hydraulic Pump   | <b>B : B Port</b> |
| (3) Power Steering Pump | <b>P : P Port</b> |

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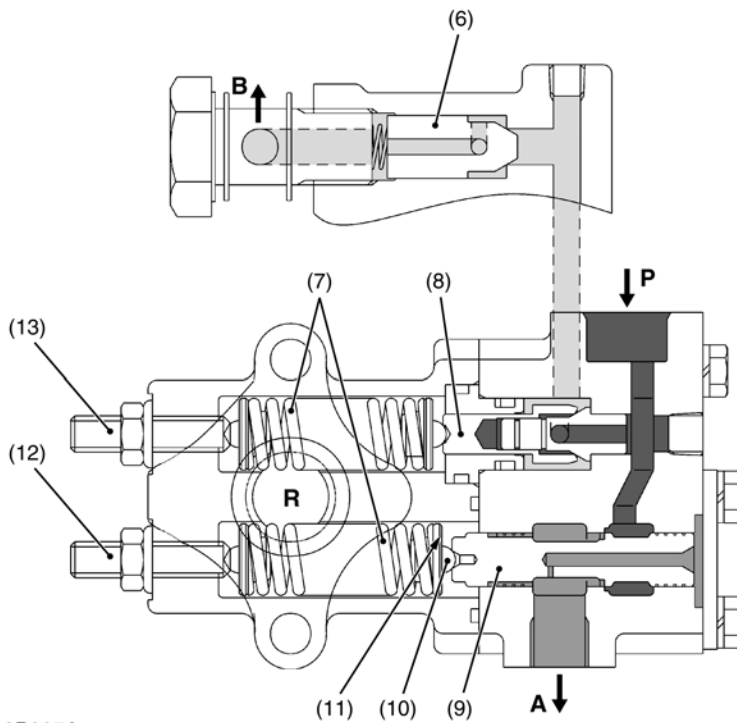
3TGAAAC8P006A

**Oil Flow**

The oil from the power steering pump passes through the regulating valve (3) and check valve (4), and then flows to the power steering circuit.

The regulating valve (3) is provided to maintain the inlet pressure of the pressure reducing valve (5) to 30 kgf/cm<sup>2</sup> except when the power steering is operated.

When the bi-speed valve operates, the oil adjusted with the reducing valve (5) to 18.5 kgf/cm<sup>2</sup> flows to the bi-speed valve through A port.



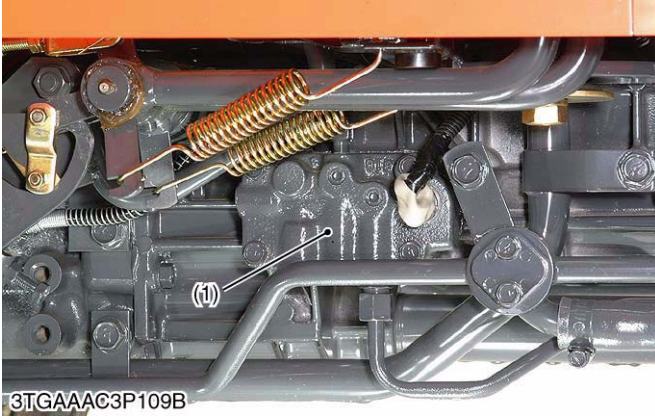
3TGAAAC8P007A

- (1) Power Steering Pump
- (2) Regulator Valve Assembly
- (3) Regulating Valve
- (4) Check Valve
- (5) Pressure Reducing Valve
- (6) Poppet (Check Valve)
- (7) Spring
- (8) Relief Poppet
- (9) Reducing Spool
- (10) Ball
- (11) Spring Receiver
- (12) Adjusting Screw
- (13) Adjusting Screw

- A : A Port (To Bi-speed Valve)**
- B : B Port (To Steering Controller)**
- P : P Port (From Pump)**
- R : R Port (To Pump)**

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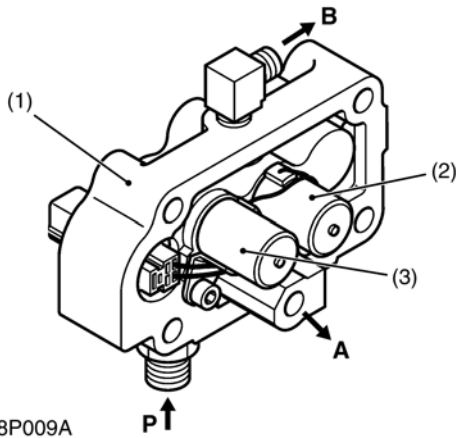
# 5. BI-SPEED VALVE



The bi-speed valve (1) is installed on a right side of the clutch housing into which the bi-speed clutch is built. The solenoid valve (2) and (3) are built into the bi-speed valve (1), and they operate respectively according to the electrical signal from the PTO switch and the bi-speed controller.

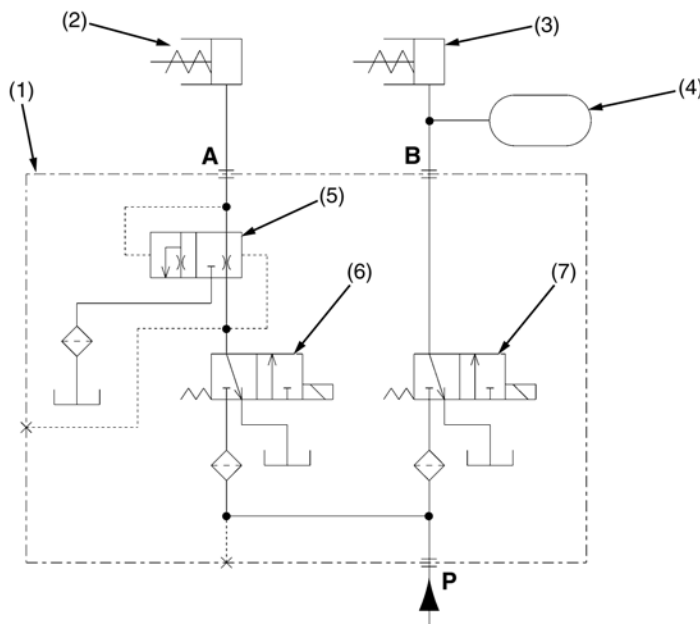
- (1) Bi-speed Valve
  - (2) Solenoid Valve (PTO)
  - (3) Solenoid Valve (Bi-speed)
- A : A Port (To Bi-speed Hydraulic Clutch)**
  - B : B Port (To PTO Hydraulic Clutch)**
  - P : P Port (From Regulator Valve)**

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3TGAAAC8P009A

## [1] HYDRAULIC CIRCUIT

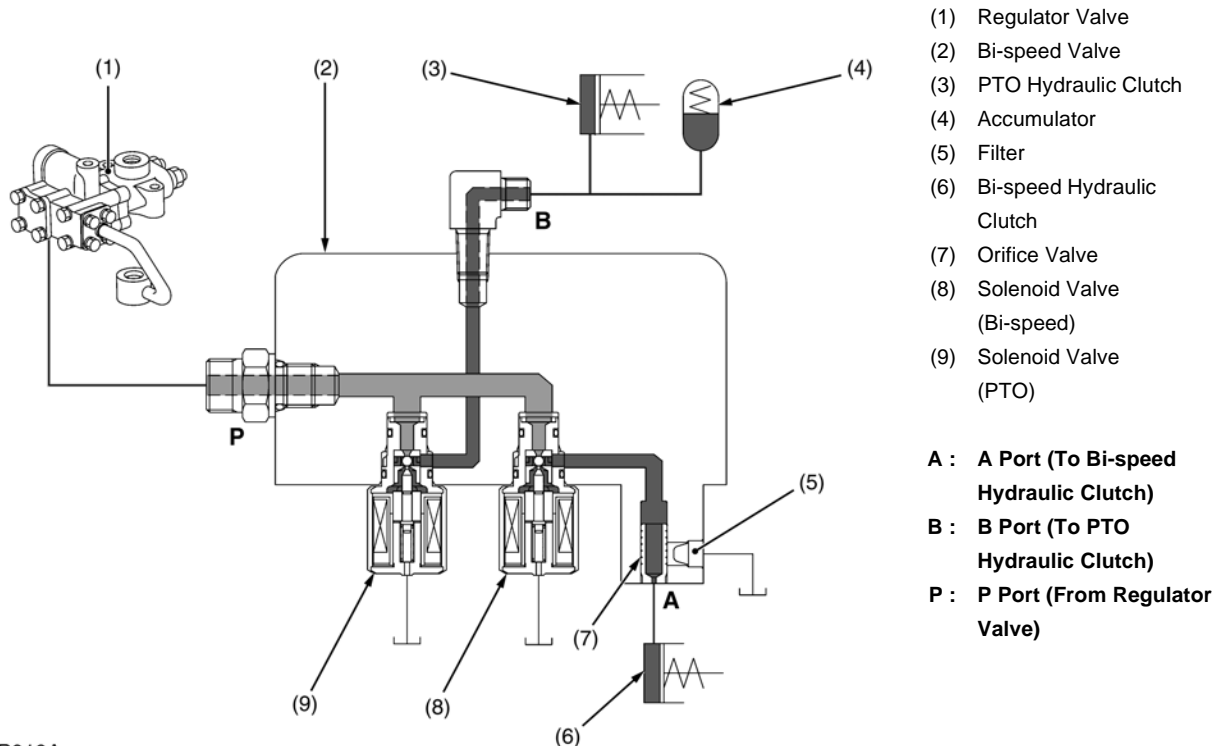


- (1) Bi-speed Valve
- (2) Bi-speed Hydraulic Clutch
- (3) PTO Hydraulic Clutch
- (4) Accumulator
- (5) Orifice Valve
- (6) Solenoid Valve (Bi-speed)
- (7) Solenoid Valve (PTO)

- A : A Port (To Bi-speed Hydraulic Clutch)**
- B : B Port (To PTO Hydraulic Clutch)**
- P : P Port (From Regulator Valve)**

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**[2] OIL FLOW**

3TGAAAC8P010A

**■ When both solenoid valves are "OFF"**

When both solenoid valves (8) (9) are "OFF", pressurized oil does not flow in bi-speed valve (2).

The piston in the hydraulic clutches (3) (6) are positioned at the left of figure by spring.

**■ When the solenoid valve (PTO) is turned "ON"**

When the solenoid valve (9) is turned on, the pressurized oil flows to the PTO hydraulic clutch (3) through the solenoid valve (9). The clutch piston moves against the spring until the stroke end and power is transmitted to the PTO shaft. Oil in the PTO hydraulic clutch (3) is kept pressured of 18.5 kg fixed.

To make the movement of the clutch piston smooth, the accumulator (4) is prepared for. The accumulator (4) is built in HST case.

**■ When the solenoid valve (PTO) is turned "OFF"**

When the solenoid valve (9) is turned off, the oil passage in the solenoid valve (9) changes, and oil in the PTO hydraulic clutch (3) is drained to the transmission case through the solenoid valve (9).

The clutch piston returns to left in figure by spring. The power to the PTO shaft is cut off.

**■ When the solenoid valve (Bi-speed) is turned "ON"**

When the solenoid valve (8) is turned on, the pressurized oil gradually flows to the bi-speed hydraulic clutch (6) through the solenoid valve (8) and orifice valve (7). The clutch piston moves against the spring at an appropriate speed until the stroke end, and power of bi-speed is transmitted to the front wheel.

Oil in the bi-speed hydraulic clutch (6) is kept pressured of 18.5 kg fixed.

**■ When the solenoid valve (Bi-speed) is turned "OFF"**

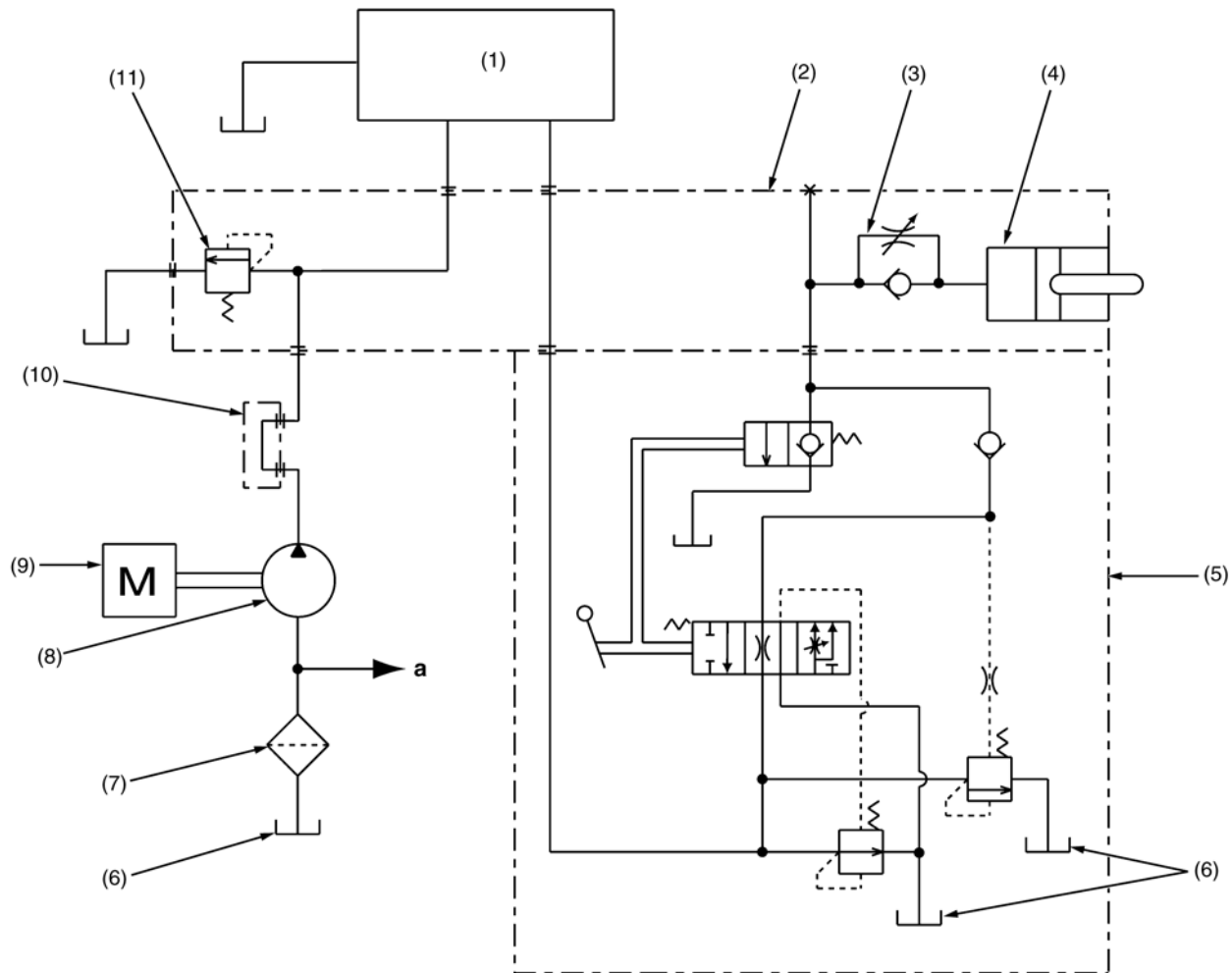
When the solenoid valve (8) is turned off, the oil passage in the solenoid (8) valve changes, and oil between the solenoid valve (8) and orifice valve (7) is drained to the transmission case through the solenoid valve (8). At this time, the orifice valve (7) moves up in figure by pressure difference. The oil in the bi-speed hydraulic clutch (6) is drained promptly to the transmission case through the filter (5).

The clutch piston returns to left in figure by spring.

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## 6. THREE POINT HYDRAULIC SYSTEM

### [1] HYDRAULIC CIRCUIT



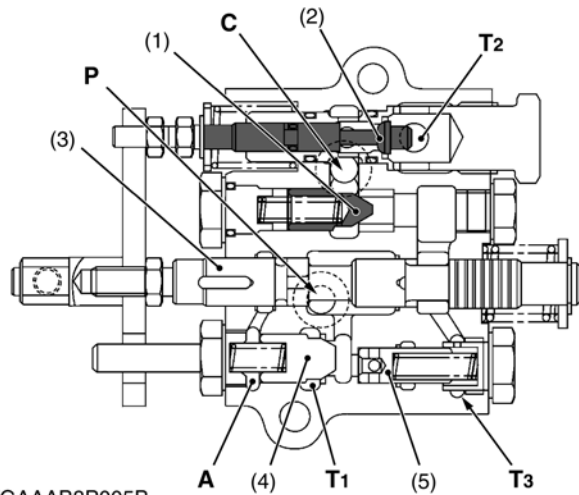
3TGAAAC8P011A

(1) Auxiliary Control Valve	(5) Position Control Valve	(9) Engine	<b>a : To Hydraulic Pump (Power Steering)</b>
(2) Hydraulic Cylinder	(6) Oil Tank (Transmission Case)	(10) Hydraulic Block Type Outlet	
(3) Lowering Speed Adjusting Valve	(7) Oil Filter	(11) Relief Valve	
(4) Hydraulic Piston	(8) Hydraulic Pump (3P)		

- When the engine (9) is started, the hydraulic pump (8) is rotated to draw oil from the transmission case (6) through the suction pipe. Supplied oil is filtered by the oil filter (7).
- Filtered oil is forced out by the hydraulic pump to auxiliary control valve (1) then flow to the position control valve (5).
- The position control valve (5) switches the oil flow, and oil is channeled to the hydraulic cylinder (4) for the 3-point hydraulic system or returned to the oil tank (6).
- The hydraulic system has a relief valve (11) which restricts the maximum pressure in the circuit.

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## [2] POSITION CONTROL VALVE



3TGAAAB8P005B

The control valve is composed as shown figure left. The spool (3) is moved by operating the position control lever. The positions of the spool movement makes four kinds of circuit such as "Neutral", "Lifting", "Lowering" and "Floating".

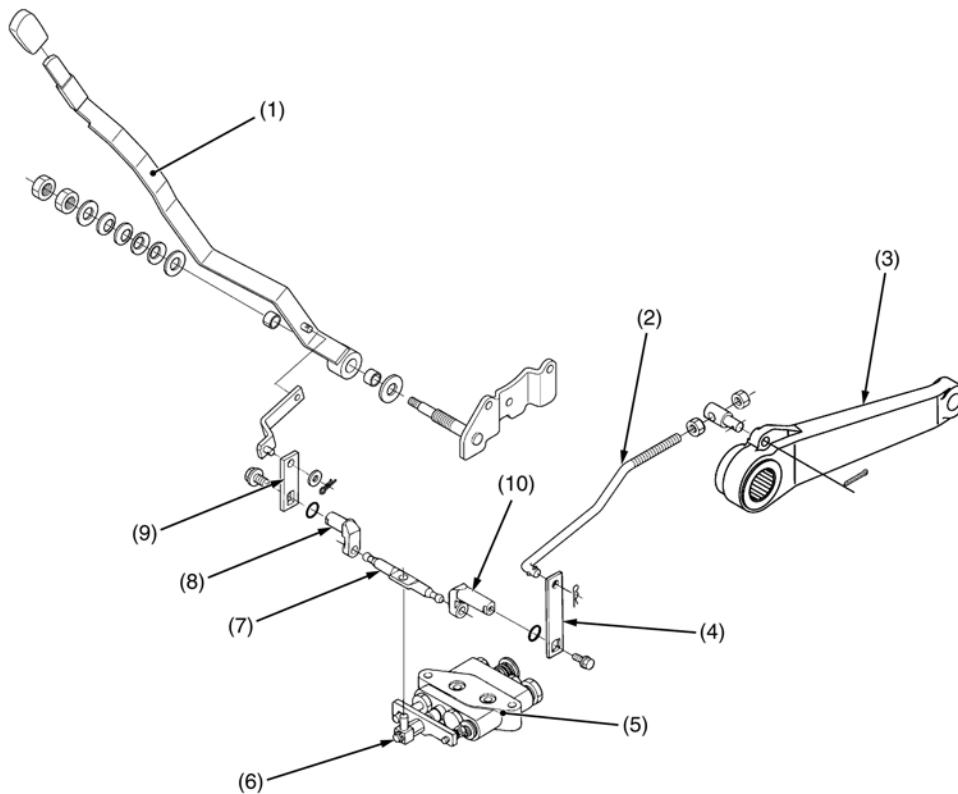
Feature of this control valve is smooth operation by built-in shockless mechanism.

Refer to "Position Control Valve -Type 4" in Workshop Manual of Tractor Mechanism (Code No. 97897-18200).

- |                     |                          |
|---------------------|--------------------------|
| (1) Poppet 1        | <b>P : Pump Port</b>     |
| (2) Poppet 2        | <b>C : Cylinder Port</b> |
| (3) Spool           | <b>T1 : Tank Port 1</b>  |
| (4) Unload Poppet 1 | <b>T2 : Tank Port 2</b>  |
| (5) Unload Poppet 2 | <b>T3 : Tank Port 3</b>  |
|                     | <b>A : Chamber A</b>     |

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## [3] FEEDBACK LINKAGE



3TGAAAC8P012A

- |                            |
|----------------------------|
| (1) Position Control Lever |
| (2) Feedback Rod           |
| (3) Lift Arm               |
| (4) Feedback Lever         |
| (5) Control Valve          |
| (6) Spool                  |
| (7) Spool Drive Lever      |
| (8) Control Arm            |
| (9) Position Arm           |
| (10) Feedback Arm          |

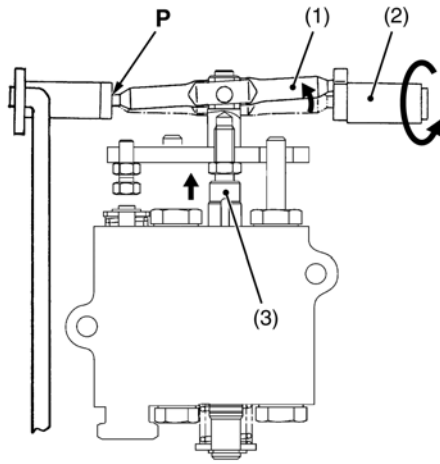
Position control is a mechanism to raise or lower the implement attached to the tractor in proportion to the movement of the control lever.

The implement can be positioned at any height by moving the position control lever. Fine position adjustment is also easy.

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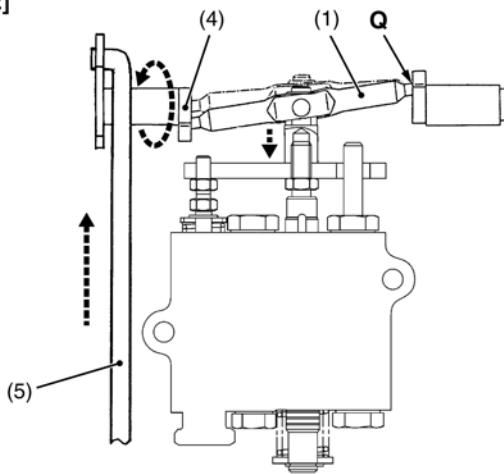
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[1]



3TGAAAC8P013A

[2]



3TGAAAC8P014A

■ **Lifting**

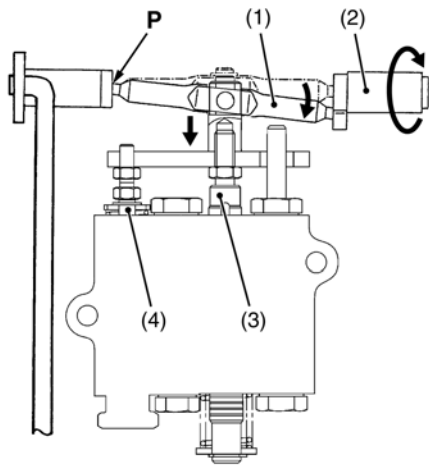
1. When the position control lever is moved to the **LIFT** position, the control arm (2) rotates to the arrow. Therefore, the spool drive lever (1) moves around the fulcrum **P** and pull the spool (3) opening the **LIFT** circuit.
2. When the lift arm moves upward, the feedback arm (4) is rotated to 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 Arm
- (5) Feedback Rod

- [1] **Lifting**
- [2] **Lifting to Neutral**
- P : Fulcrum**
- Q : Fulcrum**

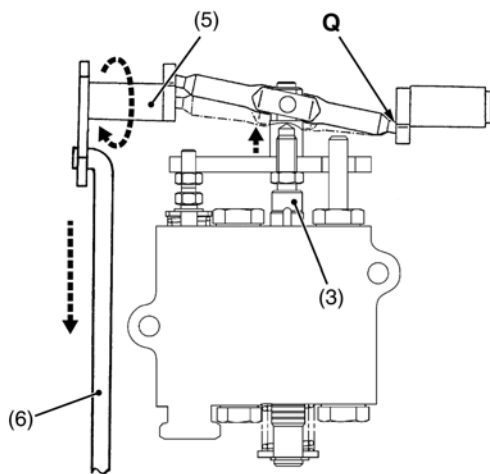
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[3]



3TGAAAC8P015A

[4]



3TGAAAC8P016A

■ Lowering

4. 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.
5. When the lift arm moves downward, the feedback arm (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).
6. 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 Arm
- (6) Feedback Rod

[3] Lowering

[4] Lowering to Neutral

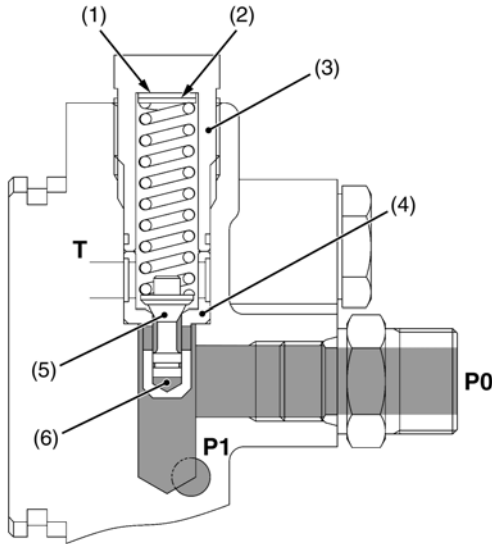
**P** : Fulcrum

**Q** : Fulcrum

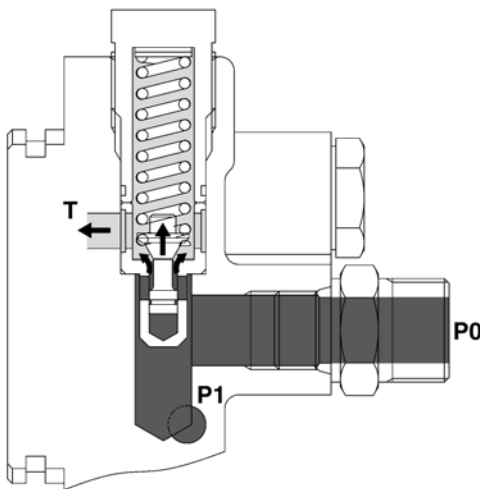
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## [4] RELIEF VALVE



3TGAAAC8P017A



3TGAAAC8P018A

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.

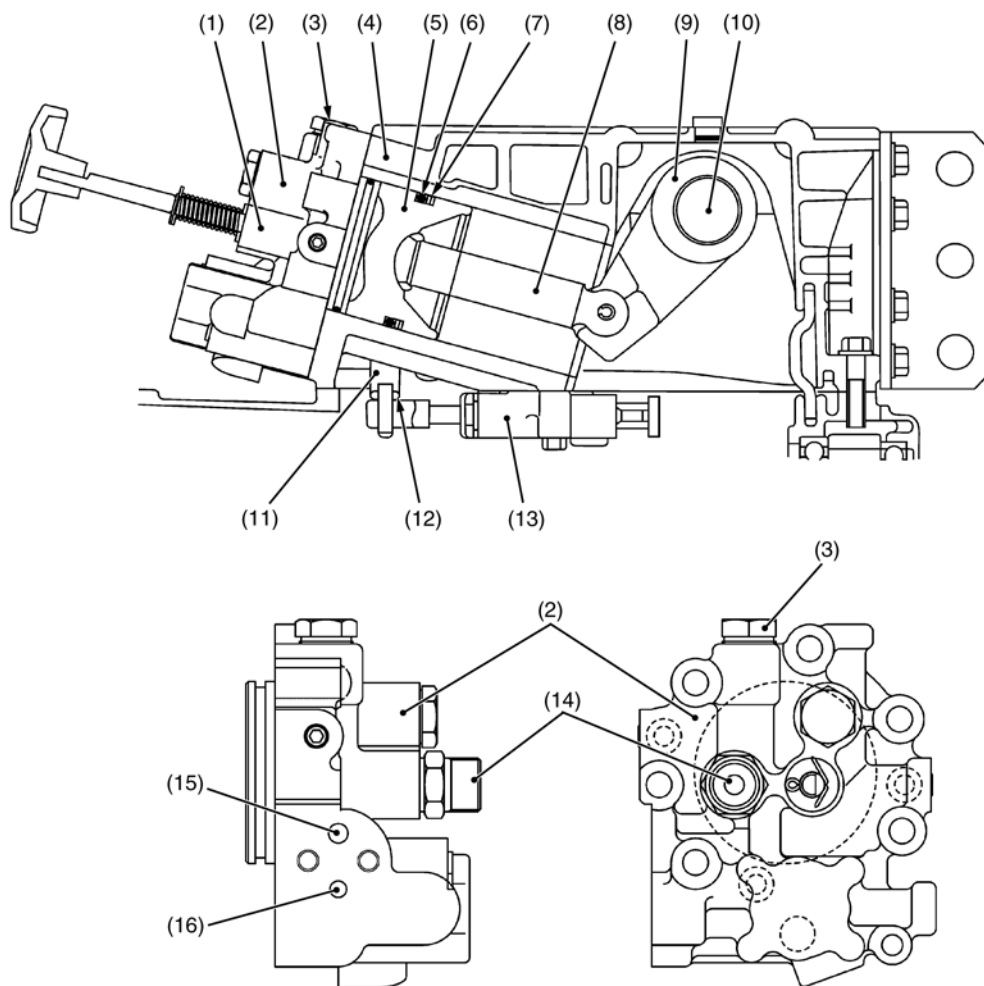
### (Reference)

- Relief valve setting pressure
  - 16.7 to 17.2 MPa
  - 170 to 175 kgf/cm<sup>2</sup>
  - 2417.4 to 2488.5 psi
  - Engine speed: Maximum
  - Oil temperature: 40 to 60 °C (104 to 140 °F)

- |                     |  |
|---------------------|--|
| (1) Washer          | <b>T : Tank Port</b>                             |
| (2) Shim            | <b>P0 : P0 Port (Pump Port)</b>                  |
| (3) Plug            | <b>P1 : P1 Port (To Auxiliary Control Valve)</b> |
| (4) Seat            |  |
| (5) Poppet          |  |
| (6) Damping Chamber |  |

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### [5] HYDRAULIC CYLINDER



3TGAAAC8P019A

- |                                    |                      |                          |  |
|------------------------------------|----------------------|--------------------------|--|
| (1) Lowering Speed Adjusting Valve | (5) Hydraulic Piston | (10) Hydraulic Arm Shaft | (14) <b>P0</b> Port (Pump Port)                    |
| (2) Cylinder Head                  | (6) O-ring           | (11) Control Arm         | (15) <b>P1</b> Port (To Auxiliary Control Valve)   |
| (3) Relief Valve                   | (7) Back-up Ring     | (12) Spool Drive Lever   | (16) <b>P2</b> Port (From Auxiliary Control Valve) |
| (4) Hydraulic Cylinder             | (8) Hydraulic Rod    | (13) Control Valve       |  |

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 (13). 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 (13) by the weight of the implement. At this time, the lowering speed of the implement can be controlled by the lowering speed adjusting valve (1) attached to the hydraulic cylinder (4).

As for the lowering speed adjusting valve (1), refer to "Type 1" in the Workshop Manual of Tractor Mechanism (Code No. 97897-18200).

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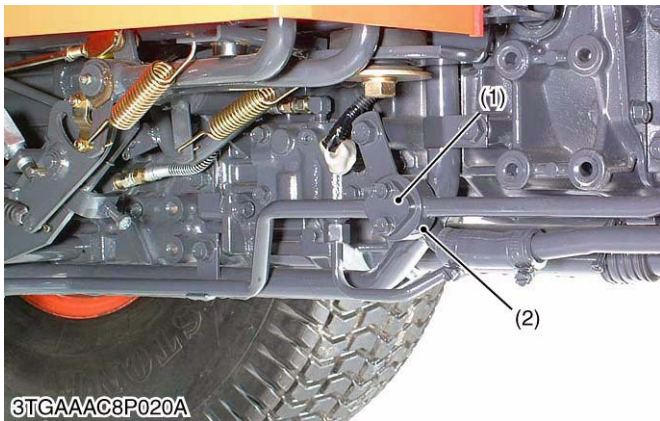
# 7. HYDRAULIC BLOCK TYPE OUTLET

The hydraulic block type outlet is located at the right hand side of the clutch housing.

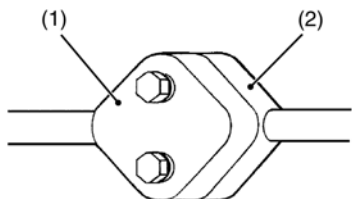
This hydraulic block type outlet is provided to take power out from the tractor to operate the hydraulic cylinders on the implement, such as front end loader, front blade and so on.

**NOTE**

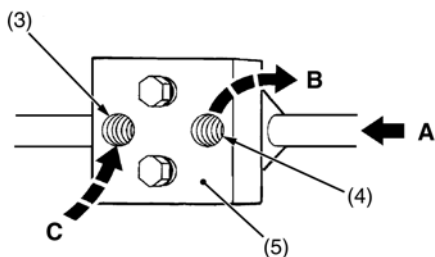
- For hydraulic block type outlet, be sure to use the control valve of the "Power beyond type" with relief valve that has a third line return to tank for the operation of hydraulic block.
- The tank port flow from implement should be connected to the tank port (6) located on the right hand side of mid case.



[1]



[2]



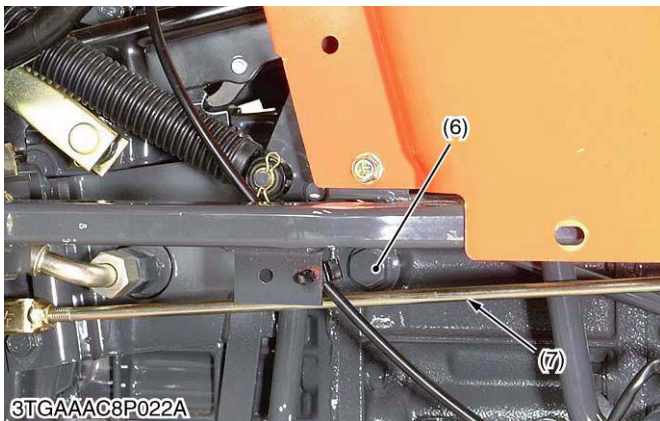
3TGAAAC8P021A

- (1) Block Cover
- (2) Hydraulic Block
- (3) Inlet
- (4) Outlet
- (5) Block Outlet Cover (Option)
- (6) Tank Port
- (7) Brake Rod (RH)

- A : From Hydraulic Pump
- B : To Implement (Outlet)  
Max. flow 23.0 L/min.  
(6.1 U.S.gal./min.,  
5.1 Imp.gal./min.)
- No relief valve in the hydraulic block.
- C : From Implement (Inlet)

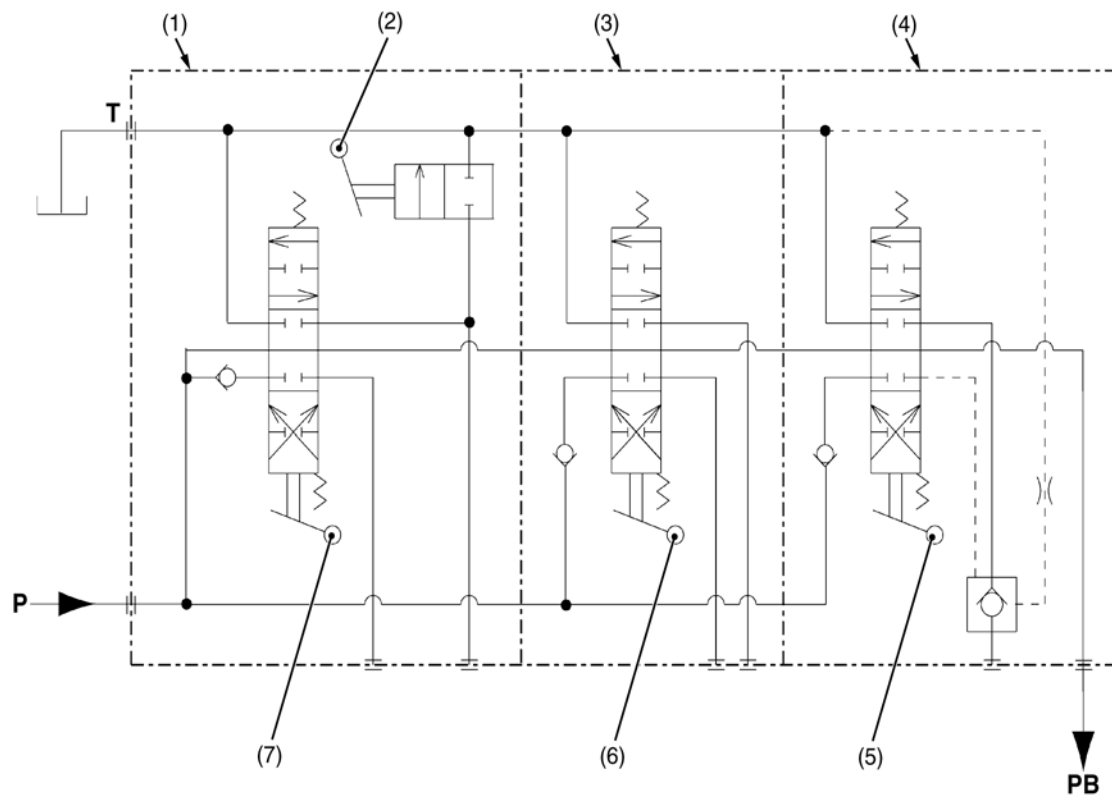
- [1] When implement is not attached
- [2] When implement is attached

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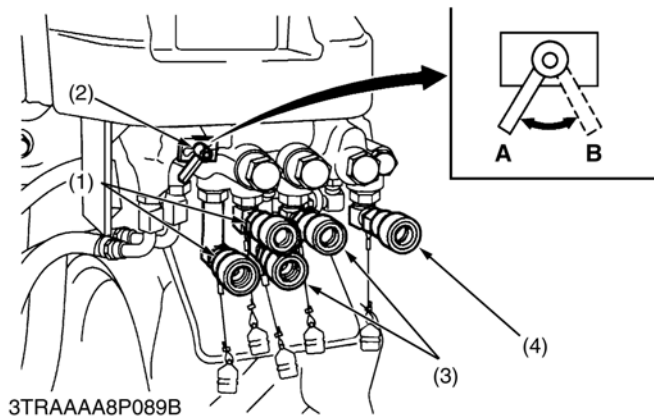
# 8. AUXILIARY CONTROL VALVE

## [1] HYDRAULIC CIRCUIT

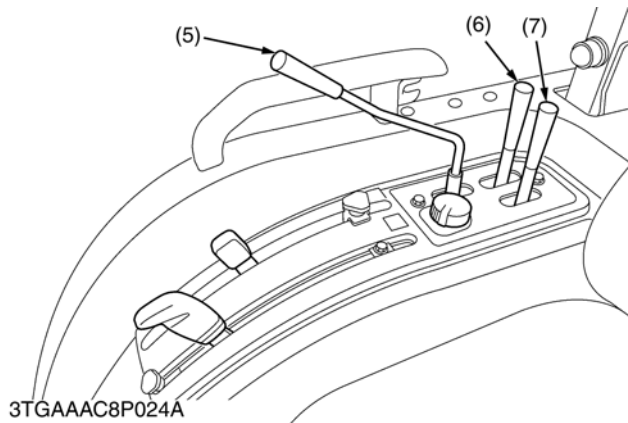


3TGAAAC8P023A

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3TRAAA8P089B



3TGAAAC8P024A

This auxiliary control valve is a unit for three valves as single / double acting valve, double acting valve and single acting valve.

The pressured oil into the three each control valve with parallel connection through the **P** port.

The single / double acting valve (1) is changeable for single or double acting with selector lever (2).

**(Reference)**

- Max flow 23.0 L/min.  
6.1 U.S.gal./min.  
5.1 Imp.gal./min.
- The maximum pressure is limited by the relief valve of 3P hydraulic system.

- |                                  |                          |
|----------------------------------|--------------------------|
| (1) Single / Double Acting Valve | <b>A : Single Acting</b> |
| (2) Selector Lever               | <b>B : Double Acting</b> |
| (3) Double Acting Valve          | <b>P : P Port</b>        |
| (4) Single Acting Valve          | <b>PB : PB Port</b>      |
| (5) Remote Control Valve Lever   | <b>T : T Port</b>        |
| (6) Remote Control Valve Lever   |                          |
| (7) Remote Control Valve Lever   |                          |

000007841E

■ **NOTE**

- Refer to "OTHERS" of auxiliary control valve in Workshop Manual of Tractor Mechanism for details.

000007842E

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# 1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
<b>Implement Does Not Rises (Not Noise)</b>	● Control linkage improperly adjusted	Adjust	8-S13
	● Control linkage improperly assembled or damaged	Repair or replace	8-M10
	● Position control valve malfunctioning	Repair or replace	8-S20, 21
	● Relief valve spring weaken or broken	Replace	8-S14
	● Hydraulic piston O-ring, cylinder damaged	Replace	8-S21
	● Auxiliary control valve malfunctioning	Repair or replace	8-S24
<b>Implement Does Not Rises (Noise)</b>	● Transmission fluid improper or insufficient	Change or replenish	G-8
	● Oil filter clogged	Replace	G-16
	● Suction pipe loosen or broken	Repair or replace	—
	● Suction pipe O-ring damaged	Replace	—
	● Relief valve setting pressure too low	Adjust	8-S14
	● Hydraulic pump malfunctioning	Repair or replace	8-S8
<b>Implement Does Not Reach Maximum Height</b>	● Position control feedback rod improperly adjusted	Adjust	8-S13
	● Top link length improperly adjusted	Adjust	—
	● Hydraulic arm shaft, hydraulic arm, lift arm improperly assembled	Adjust	8-S23
	● 3 point link improperly set	Adjust	—
<b>Implement Drops by Weight</b>	● Hydraulic cylinder worn or damaged	Replace	8-S27
	● Hydraulic piston and O-ring worn or damaged	Replace	8-S21
	● Lowering speed adjusting valve damaged	Replace	8-S22
	● Position control valve malfunctioning	Replace	8-S20
<b>Implement Hunts (Moves Up and Down)</b>	● Position control valve malfunctioning	Replace	8-S20
<b>Oil Temperature Increases Rapidly</b>	● Relief valve operating	Adjust	8-S14
	● Hydraulic pump leak or damaged	Replace or repair	8-S8
	● Oil leaks from valves	Replace or repair	—
	● Gear or bearing damaged in the transmission case	Replace	—

0000007801E

## 2. SERVICING SPECIFICATIONS

### HYDRAULIC PUMP

Item		Factory Specification	Allowable Limit
Hydraulic Pump (Power Steering)	Delivery at No Pressure	14.0 L/min. 3.70 U.S.gals./min. 3.08 Imp.gals./min.	—
	Delivery at Rated Pressure	13.72 L/min. 3.62 U.S.gals./min. 3.02 Imp.gals./min.	12.25 L/min. 3.24 U.S.gals./min. 2.69 Imp.gals./min.
Hydraulic Pump (3P Hydraulic System)	Delivery at No Pressure	23.04 L/min. 6.09 U.S.gals./min. 5.07 Imp.gals./min.	—
	Delivery at Rated Pressure	22.58 L/min. 5.97 U.S.gals./min. 4.97 Imp.gals./min.	20.16 L/min. 5.33 U.S.gals./min. 4.43 Imp.gals./min.
Housing	Depth of Scratch	—	0.09 mm 0.0035 in.
Bushing to Gear Shaft	Clearance	0.020 to 0.081 mm 0.0008 to 0.0032 in.	0.15 mm 0.0059 in.
	Gear Shaft (O.D.)	14.970 to 14.980 mm 0.5894 to 0.5898 in.	—
	Bushing (I.D.)	15.000 to 15.051 mm 0.5906 to 0.5926 in.	—
Side Plate	Length	2.48 to 2.50 mm 0.0976 to 0.0984 in.	2.40 mm 0.0945 in.

0000007802E

### CONTROL LINKAGE (3P Hydraulic System)

Item		Factory Specification	Allowable Limit
Position Control Lever	Operating Force	25 to 34 N 2.6 to 3.5 kgf 5.6 to 7.6 lbs	—
Lift Arm	Free Play	5.0 to 15.0 mm 0.197 to 0.591 in.	—

0000007803E

### RELIEF VALVE (3P Hydraulic System)

Item		Factory Specification	Allowable Limit
Relief Valve	Setting Pressure	16.7 to 17.2 MPa 170 to 175 kgf/cm <sup>2</sup> 2425 to 2489.0 psi	—

0000007804E



**HYDRAULIC CYLINDER (3P Hydraulic System)**

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 (Right)	0.120 to 0.210 mm 0.0047 to 0.0083 in.	0.30 mm 0.0118 in.
	Clearance (Left)	0.090 to 0.200 mm 0.0035 to 0.0079 in.	0.30 mm 0.0018 in.
	Hydraulic Arm Shaft O.D. (Right)	37.795 to 37.820 mm 1.4880 to 1.4890 in.	—
	Hydraulic Arm Shaft O.D. (Left)	34.925 to 34.950 mm 1.3750 to 1.3760 in.	—
	Bushing I.D. (Right)	37.940 to 38.005 mm 1.4937 to 1.4963 in.	—
	Bushing I.D. (Left)	35.040 to 35.125 mm 1.3795 to 1.3829 in.	—

0000007805E

**REGULATOR VALVE**

Item		Factory Specification	Allowable Limit
Regulating Valve	Setting Pressure	2.84 to 2.94 MPa 29.0 to 30.0 kgf/cm <sup>2</sup> 412 to 427 psi	—
Pressure Reducing Valve	Bi-speed / PTO System Pressure	1.76 to 1.86 MPa 18 to 19 kgf/cm <sup>2</sup> 256 to 270 psi	—

0000007806E

**STEERING CONTROLLER**

Item		Factory Specification	Allowable Limit
Relief Valve	Setting Pressure	10.7 to 11.7 MPa 109 to 119 kgf/cm <sup>2</sup> 1550 to 1693 psi	—

0000007807E

**STEERING CYLINDER**

Item		Factory Specification	Allowable Limit
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.	—

000007808E

### 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
Joint screw (Power steering delivery hose)	49.0 to 58.8	5.0 to 6.0	36.2 to 43.4
Joint screw (Bi-speed delivery pipe)	34.3 to 39.2	3.5 to 4.0	25.3 to 28.9
Joint screw (Regulator delivery pipe)	39.2 to 49.0	4.0 to 5.0	28.9 to 36.2
Regulator valve mounting screw	17.7 to 20.6	1.8 to 2.1	13.0 to 15.2
Pump cover mounting screw	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
PTO delivery hose retaining nut	15 to 17	1.5 to 1.75	10.8 to 12.7
Bi-speed delivery pipe retaining nut	30 to 49	3.0 to 5.0	21.7 to 36.2
Bi-speed valve retaining screw	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
Rod joint screw (steering cylinder)	123.6 to 147.1	12.6 to 15.0	91.1 to 108.5
Position control valve mounting screw	20 to 24	2.0 to 2.4	14.5 to 17.4
Hydraulic cylinder cover mounting screw (M10)	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
Hydraulic cylinder cover mounting screw (M8)	17.7 to 20.6	1.8 to 2.1	13.0 to 15.2
Relief valve plug	39.2 to 49.0	4.0 to 5.0	28.9 to 36.2

000007809E

## 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.

- The flowmeter does not provide relief valve. Therefore while testing, do not close the flowmeter loading valve completely.

1. Remove the regulator 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 2700 rpm.
7. Slowly close the loading valve to generate the pressure approx. 11.2 MPa (114 kgf/cm<sup>2</sup>, 1624 psi).
8. Hold in this condition until oil temperature reaches approx. 40 °C (104 °F).

##### (Reference)

- Adaptor is included in the adaptor set (Code No.: 07916-54031).

- |                              |                         |
|------------------------------|-------------------------|
| (1) Hydraulic Pump           | (4) Adaptor <b>52</b>   |
| (2) Regulator Delivery Pipe  | (5) Hydraulic Test Hose |
| (3) Transmission Fluid Inlet | (6) Hydraulic Test Hose |



000007843E



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. 2700 rpm.
3. Read and note the pump delivery at no pressure.
4. Slowly close the loading valve to increase pressure approx. 11.2 MPa (114 kgf/cm<sup>2</sup>, 1624 psi).
5. Read and note the pump flow at rated pressure.
6. Open the loading valve and stop the engine.

**(Reference)**

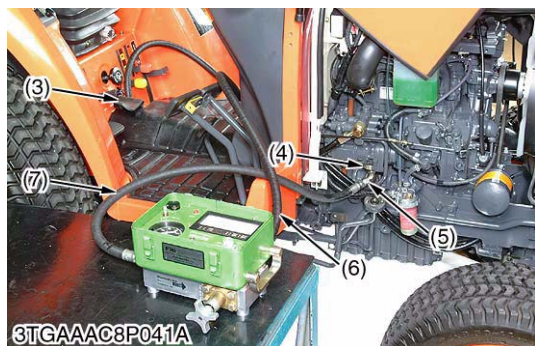
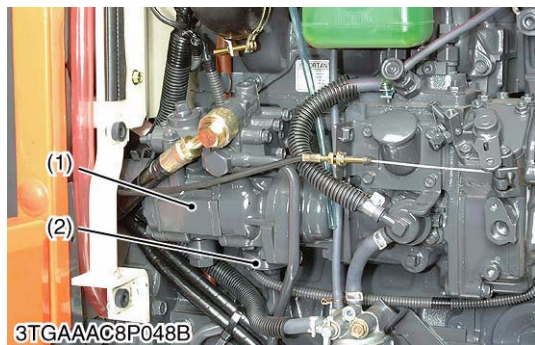
Hydraulic pump delivery at no pressure	Factory spec.	14.0 L/min. 3.70 U.S.gal./min. 3.08 Imp.gal./min.
Hydraulic pump delivery at rated pressure	Factory spec.	13.72 L/min. 3.62 U.S.gal./min. 3.02 Imp.gal./min.
	Allowable limit	12.25 L/min. 3.24 U.S.gal./min. 2.69 Imp.gal./min.

**Condition**

- Engine speed ..... Approx. 2700 rpm
- Rated pressure ..... 10.7 to 11.7 MPa  
109.1 to 119.3 kgf/cm<sup>2</sup>  
1552 to 1697 psi
- Oil temperature ..... 40 to 60 °C (104 to 140 °F)

0000007844E

## (2) Hydraulic Pump (3P Hydraulic System)



### 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.

- The flowmeter does not provide relief valve. Therefore while testing, do not close the flowmeter loading valve completely.

1. Remove the 3P delivery pipe (2) from hydraulic pump (1).
2. Set the adaptor flowmeter (4) (see page G-44) 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 2700 rpm.
7. Slowly close the loading valve to generate the pressure approx. 15.7 MPa (160 kgf/cm<sup>2</sup>, 2276 psi).
8. Hold in this condition until oil temperature reaches approx. 40 °C (104 °F).

#### (Reference)

- Adaptor is included in the adaptor set (Code No.: 07916-54031).

- |                              |                         |
|------------------------------|-------------------------|
| (1) Hydraulic Pump           | (5) Adaptor <b>53</b>   |
| (2) 3P Delivery Pipe         | (6) Hydraulic Test Hose |
| (3) Transmission Fluid Inlet | (7) Hydraulic Test Hose |
| (4) Adaptor Flowmeter        |                         |

000007845E



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. 2700 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/cm<sup>2</sup>, 2417.9 psi).
5. Read and note the pump flow at rated pressure.
6. Open the loading valve and stop the engine.

**(Reference)**

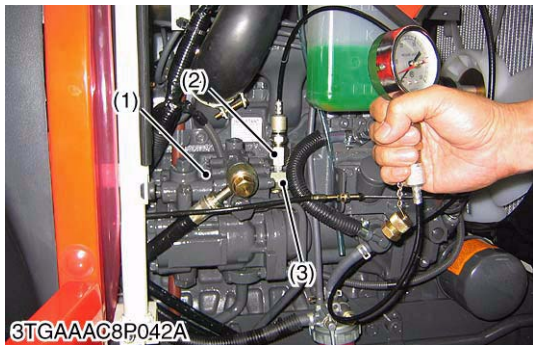
Hydraulic pump delivery at no pressure	Factory spec.	23.04 L/min. 6.09 U.S.gal./min. 5.07 Imp.gal./min.
Hydraulic pump delivery at rated pressure	Factory spec.	22.58 L/min. 5.97 U.S.gal./min. 4.97 Imp.gal./min.
	Allowabl limit	20.16 L/min. 5.33 U.S.gal./min. 4.43 Imp.gal./min.

**Condition**

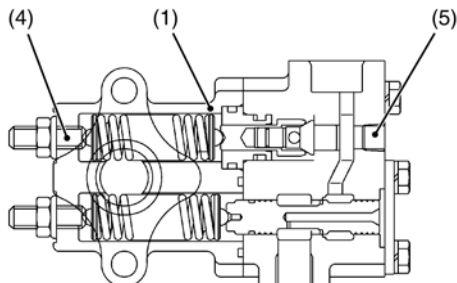
- Engine speed ..... Approx. 2700 rpm
- Rated pressure ..... 16.67 MPa  
170 kgf/cm<sup>2</sup>  
2417.9 psi
- Oil temperature ..... 40 to 60 °C (104 to 140 °F)

0000007846E

### (3) Regulator Valve



3TGAAAC8P042A



3TLABAB3P164A

#### Checking Regulating Valve Setting Pressure

1. Start the engine and warm up the transmission fluid, and then stop the engine.
2. Remove the pressure checking port (5) plug (PT 1/8).
3. Install the adaptor "7" to checking port (5), and then install the adaptor "D", the threaded joint, cable and pressure gauge.
4. Start the engine and set the maximum engine speed.
5. Measure the pressure. (Do not turn the steering wheel.)
6. If the measurement is not within factory specifications, adjust the regulating valve adjustor (4) on the regulator valve (1).

Regulating valve setting pressure	Factory spec.	2.84 to 2.94 MPa 29.0 to 30.0 kgf/cm <sup>2</sup> 412 to 427 psi
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#### Condition

- Engine speed ..... Maximum
- Oil temperature ..... 40 to 60 °C (104 to 140 °F)

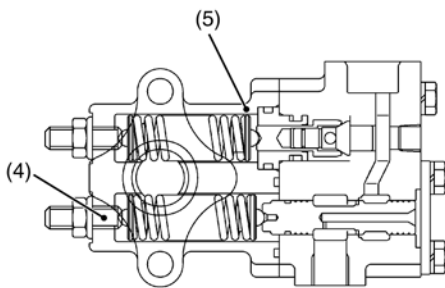
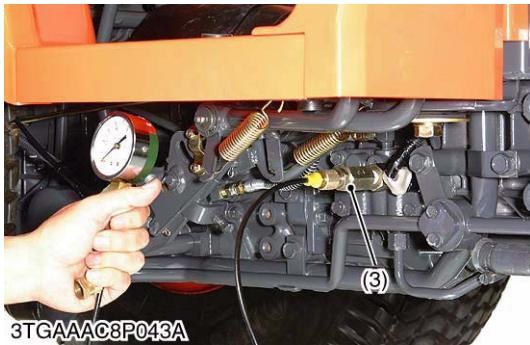
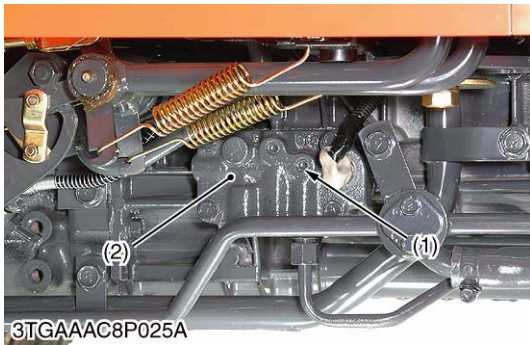
#### (Reference)

- Turn to clockwise direction → Pressure is increased
- Turn to counterclockwise direction → Pressure is decreased

- |                     |                               |
|---------------------|-------------------------------|
| (1) Regulator Valve | (4) Regulating Valve Adjustor |
| (2) Adaptor D       | (5) Checking Port (PT 1/8)    |
| (3) Adaptor 7       |                               |

000007848E





**Checking Bi-speed / PTO System Pressure**

1. Start the engine and warm up the transmission fluid, and then stop the engine.
2. Remove the bi-speed system pressure checking port (1) plug (PT 1/8) on the bi-speed valve (2).
3. Install the adaptor "D" to checking port (1), and then install the threaded joint, cable and pressure gauge.
4. Start the engine and set the idling speed.
5. Measure the pressure.
6. If the measurement is not within factory specifications, adjust the pressure reducing valve adjustor (4) on the regulator valve (5).

Bi-speed / PTO system pressure	Factory spec.	1.76 to 1.86 MPa 18 to 19 kgf/cm <sup>2</sup> 256 to 270 psi
--------------------------------	---------------	--

**Condition**

- Engine speed ..... Idling speed
- Oil temperature ..... 40 to 60 °C (104 to 140 °F)

**(Reference)**

- Turn to clockwise direction → Pressure is increased
- Turn to counterclockwise direction → Pressure is decreased

- |  |                                      |
|--|--------------------------------------|
| (1) System Pressure Checking Port (PT 1/8) | (4) Pressure Reducing Valve Adjustor |
| (2) Bi-speed Valve                         | (5) Regulator Valve                  |
| (3) Adaptor D                              |                                      |

000007847E

## (4) Steering Controller



### 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 steering controller assembly.

Power steering relief valve setting pressure	Factory spec.	10.7 to 11.7 MPa 109 to 119 kgf/cm <sup>2</sup> 1550 to 1693 psi
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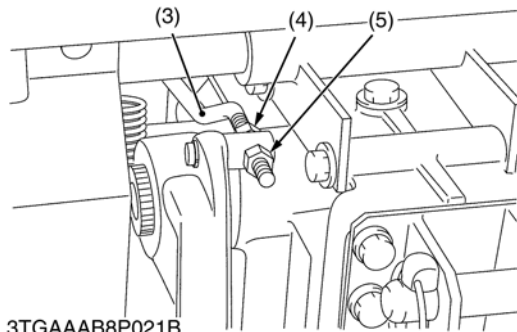
### **Condition**

- Engine speed ..... Maximum
- Oil temperature ..... 40 to 60 °C (104 to 140 °F)

(1) Power Steering Delivery Pipe      (2) Adaptor E

000007849E

### (5) Three Point Hydraulic System



#### Adjusting Feedback Rod

1. Set the position control lever (1) 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 (2) to the maximum raising position.
4. Move the position control lever (1) to the maximum raising position. (See photo).
5. Turn the adjusting nut (5) and lock nut (4) until the relief valve begins to be operated. (Turn to clockwise).
6. Then turn back the adjusting nut (5) counterclockwise by 2 turn.
7. Tighten the lock nut (4) 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 lift arm to the upper end by hand and measure the free travel.
10. Stop the engine.
11. If the measurement is not within the factory specification, adjusting position control rod again.

Lift arm free travel at maximum raising position	Factory spec.	5.0 to 15.0 mm 0.197 to 0.591 in.
--	---------------	--------------------------------------

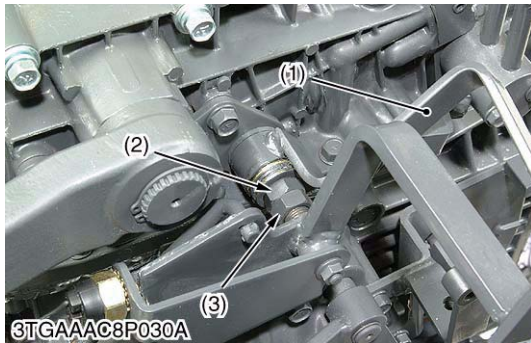
#### Condition

- Engine speed ..... Maximum
- Oil temperature ..... 40 to 60 °C (104 to 140 °F)

- |   |                                   |
|---|-----------------------------------|
| (1) Position Control Lever  | (3) Feedback Rod                  |
| (2) Position Control Lever Stopper<br>(at Maximum Raising Position) | (4) Lock Nut<br>(5) Adjusting Nut |

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Adjusting Position Control Lever Operating Force

1. Set a spring balance to the position control lever (1) to measure the operating force.
2. If the measurement is not within the factory specification, loosen the lock nut (3) 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 2.6 to 3.5 kgf 5.6 to 7.6 lbs
--	---------------	--

- (1) Position Control Lever
- (2) Mounting Nut
- (3) Lock Nut

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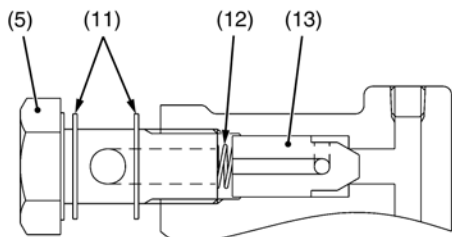
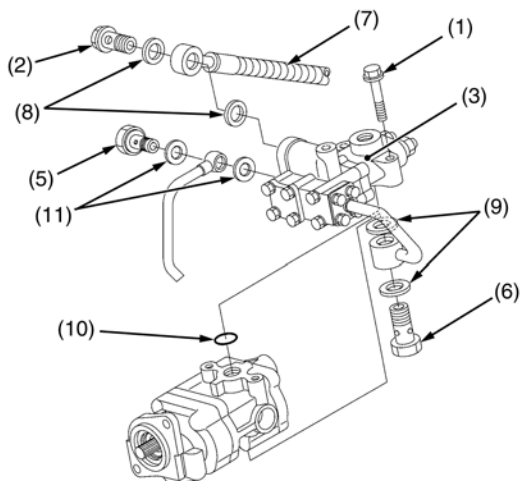
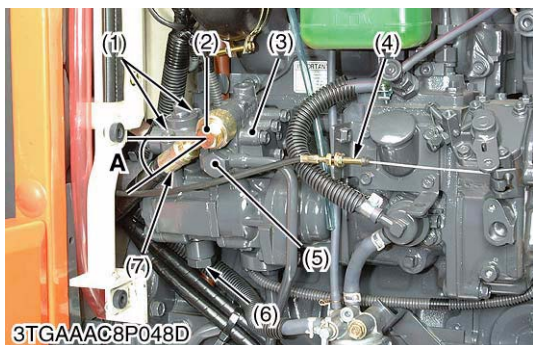
**[2] DISASSEMBLING AND ASSEMBLING**

**(1) Hydraulic Pump (Power Steering and 3P Hydraulic System)**

**■ 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.

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**Removing Hydraulic Pump Assembly**

**1) Regulator Valve**

1. Open the hood and remove the side cover (RH).
2. Disconnect the accelerator wire (4) from the engine.
3. Remove the joint screw (2) and disconnect the power steering delivery hose (7).
4. Remove the joint screw (5) and disconnect the bi-speed delivery pipe.
5. Remove the joint screw (6) and mounting screws (1), and separate the regulating valve (3) from the hydraulic pump.

**(When reassembling)**

- Apply grease to the O-ring (10) on the regulator valve (3) and take care not to damage it.
- Be sure to install the poppet (13), spring (12) and copper gasket (8) (9) (11).

Tightening torque	Joint screw (2) (Power steering delivery hose)	49 to 58.8 N·m 5.0 to 6.0 kgf·m 36.2 to 43.4 ft·lbs
	Joint screw (5) (Bi-speed delivery pipe)	34.3 to 39.2 N·m 3.5 to 4.0 kgf·m 25.3 to 28.9 ft·lbs
	Joint screw (6) (Regulator delivery pipe)	39.2 to 49.0 N·m 4.0 to 5.0 kgf·m 28.9 to 36.2 ft·lbs
	Regulator valve mounting screw	17.7 to 20.6 N·m 1.8 to 2.1 kgf·m 13.0 to 15.2 ft·lbs

Delivery hose (7) installation angle (A)	Factory spec.	0.52 rad 30°
--	---------------	-----------------

- |  |                    |
|--|--------------------|
| (1) Mounting Screw                             | (9) Copper Gasket  |
| (2) Joint Screw (Power Steering Delivery Hose) | (10) O-ring        |
| (3) Regulator Valve                            | (11) Copper Gasket |
| (4) Accelerator Wire                           | (12) Spring        |
| (5) Joint Screw (Bi-speed Delivery Pipe)       | (13) Poppet        |
- A : Installation Angle of Power Steering Delivery Hose**
- (6) Joint Screw (Regulator Delivery Pipe)
- (7) Power Steering Delivery Hose
- (8) Copper Gasket

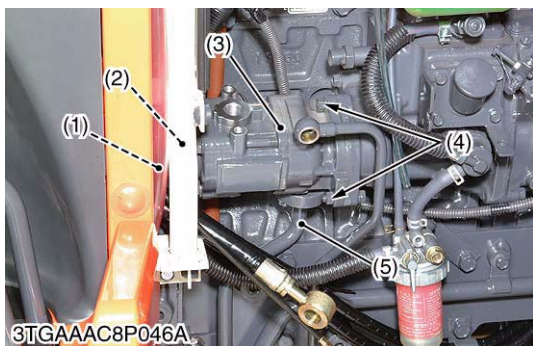
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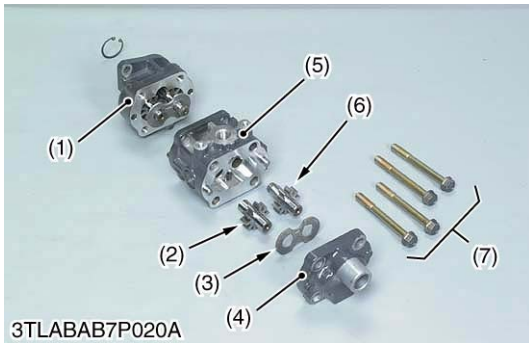
**2) Removing Hydraulic Pump**

1. Loosen the clump (2) and separate the suction hose (1) from the hydraulic pump (3).
2. Disconnect the 3P delivery pipe (5) from the hydraulic pump (3).
3. Remove the mounting screws (4) and remove the hydraulic pump (3).

- |                  |                    |
|------------------|--------------------|
| (1) Suction Hose | (3) Hydraulic Pump |
| (2) Clump        | (4) Mounting Screw |

0000007855E





Disassembling Hydraulic Pump

**1) Disassembling Hydraulic Pump (Power Steering)**

1. Remove the pump cover mounting screws (7).
2. Remove the drive gear (6), driven gear (2) and side plate (3) from the casing.

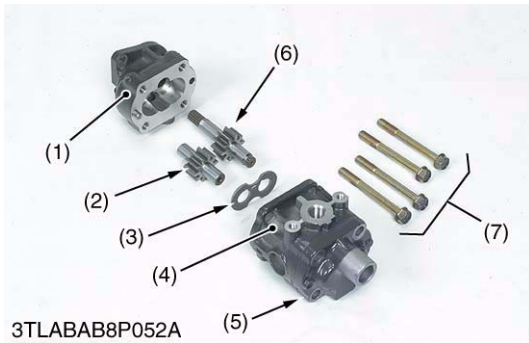
**(When reassembling)**

- Take care not to damage the gasket.
- Align the hole of the pump cover (4) and casing 2 (5).
- Install the side plate, noting its location and direction.
- Install the gears, noting its direction.

Tightening torque	Pump cover mounting screw	39.2 to 44.1 N·m 4.0 to 4.5 kgf·m 28.9 to 32.5 ft-lbs
-------------------	---------------------------	---

- |                 |                 |
|-----------------|-----------------|
| (1) Casing 1    | (5) Casing 2    |
| (2) Driven Gear | (6) Driven Gear |
| (3) Side Plate  | (7) Screw       |
| (4) Pump Cover  |                 |

000007856E



**2) Disassembling Hydraulic Pump (3P Hydraulic System)**

1. Remove the pump cover mounting screws (7).
2. Remove the drive gear (6), driven gear (2) and side plate (3) from the casing.

**(When reassembling)**

- Take care not to damage the gasket.
- Align the hole of the pump cover (5) and casing 2 (4).
- Install the side plate, noting its location and direction.
- Install the gears, noting its direction.

Tightening torque	Pump cover mounting screw	39.2 to 44.1 N·m 4.0 to 4.5 kgf·m 28.9 to 32.5 ft-lbs
-------------------	---------------------------	---

- |                 |                 |
|-----------------|-----------------|
| (1) Casing 1    | (5) Pump Cover  |
| (2) Driven Gear | (6) Driven Gear |
| (3) Side Plate  | (7) Screw       |
| (4) Casing 2    |                 |

000007857E

### 3) Hydraulic Pump Running-in

After reassembly, perform running-in operation in the following manner, and check the pump for abnormality before use. If the pump temperature should rise noticeably during running-in, recheck should be performed.

1. Install the hydraulic pump to the tractor, and mount the suction pipe and delivery pipe securely.
2. Set the engine speed at 1300 to 1500 min<sup>-1</sup> (rpm), and operate the hydraulic pump at no load for about 10 minutes.
3. Set the engine speed at 2000 to 2200 min<sup>-1</sup> (rpm), and with the hydraulic pump applied with 2.94 MPa (30 kgf/cm<sup>2</sup>, 427 psi) to 4.90 MPa (50 kgf/cm<sup>2</sup>, 711 psi) pressure, operate it for approx. 15 minutes.
4. With the engine set to maximum speed, fully turn the steering wheel to the left or right, then actuate the relief valve five times for 25 seconds (one time 5 seconds) (for power steering pump.)
5. Stop the engine, then loosen the feedback rod lock nut by 5 turns and screw in the adjusting nut.
6. With the engine set to maximum speed, raise the position control lever and actuate the relief valve five times for 25 seconds (one time 5 seconds) (for 3P hydraulic pump).

000007858E

## (2) Bi-speed Valve

### Draining Transmission Fluid

See page 1-S20.

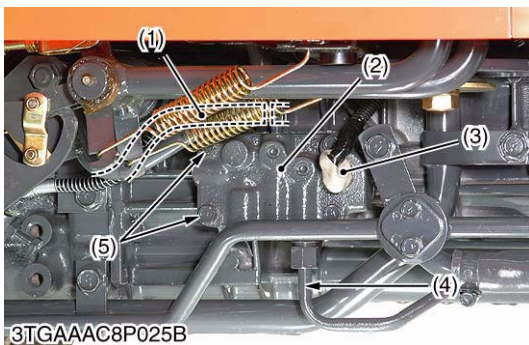
000007859E

### Removing Bi-speed Valve

1. Disconnect the 4P connector (3) from the bi-speed valve (2).
2. Disconnect the PTO delivery hose (1) and bi-speed delivery pipe (4) from the bi-speed valve (2).
3. Remove the mounting screws (5) and remove the bi-speed valve (2).

#### **(When reassembling)**

- Apply liquid gasket (Three Bond 1208D or equivalent) to the bi-speed valve case.)

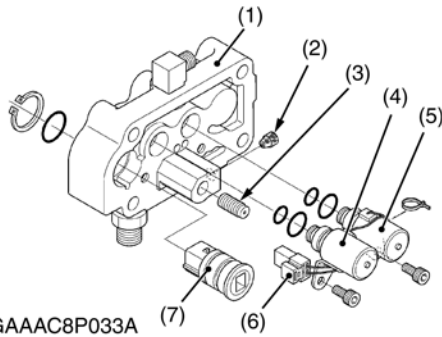


Tightening torque	PTO delivery hose (1) retaining nut	15 to 17 N·m 1.5 to 1.75 kgf·m 10.8 to 12.7 ft·lbs
	Bi-speed delivery pipe (4) retaining nut	30 to 49 N·m 3.0 to 5.0 kgf·m 21.7 to 36.2 ft·lbs
	Bi-speed valve mounting screw	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft·lbs

- |                       |                            |
|-----------------------|----------------------------|
| (1) PTO Delivery Hose | (4) Bi-speed Delivery Pipe |
| (2) Bi-speed Valve    | (5) Mounting Screw         |
| (3) 4P Connector      |                            |

000007860E





3TGAAAC8P033A

Bi-speed Valve Assembly

1. The solenoid valve (4) (5) can be removed together with the connector.

- |   |  |
|---|--|
| (1) Bi-speed Valve                          | (5) Solenoid Valve<br>(for PTO Clutch) |
| (2) Filter                                  | (6) Connector                          |
| (3) Orifice Valve                           | (7) Joint                              |
| (4) Solenoid Valve<br>(for Bi-speed Clutch) |  |

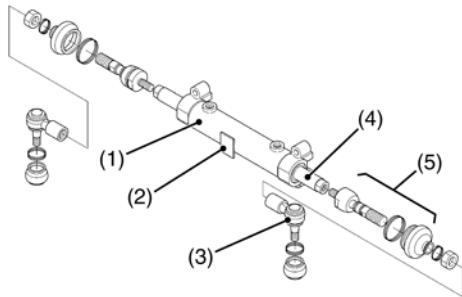
000007861E

**(3) Steering Cylinder**

Removing Steering Cylinder

See page 6-S5 to 6-S7.

000007862E



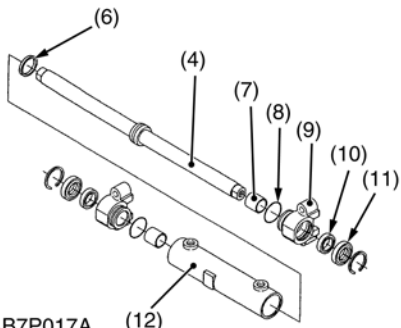
3TGAAAC8P047A

Disassembling Steering Cylinder

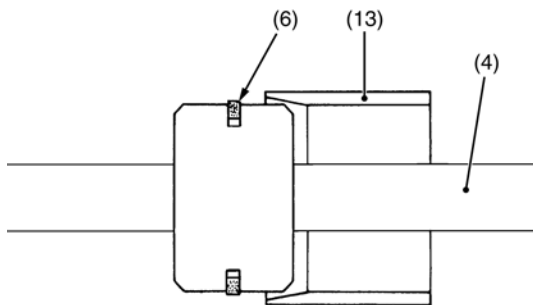
1. Remove the rod joint (5) from the cylinder rod (4).
2. Draw out the cylinder cover (9).
3. Draw out the cylinder rod (4).

■ **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 (5).
- Be sure to check the toe-in after assembling. (See page 6-S4.)



3TGAAAB7P017A



3TGAAAB7P018A

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
-------------------	-----------------	--

- |                                      |                                    |
|--------------------------------------|------------------------------------|
| (1) Power Steering Cylinder Assembly | (7) Bushing                        |
| (2) Plate                            | (8) O-ring                         |
| (3) Tie Rod                          | (9) Cylinder Cover                 |
| (4) Cylinder Rod                     | (10) Rod Gasket                    |
| (5) Rod Joint                        | (11) Dust Seal                     |
| (6) Piston Gasket                    | (12) Cylinder Tube                 |
|                                      | (13) Piston Gasket Correcting Tool |

000007863E

### (4) Position Control Valve (3P Hydraulic System)

**■ 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.

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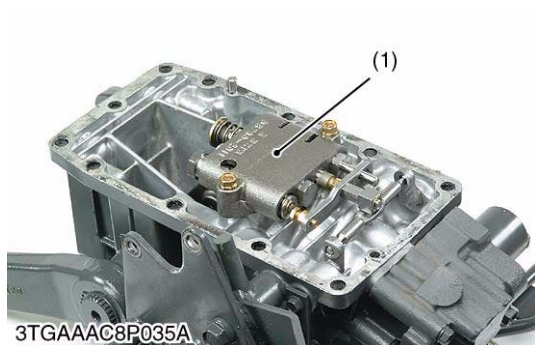
Separating Hydraulic Cylinder

See page 3-S32.

0000007864E



3TGAAAC3P048A



3TGAAAC8P035A

Removing Position Control Valve

1. 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
-------------------	--	---

(1) Position Control Valve

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Poppet 1

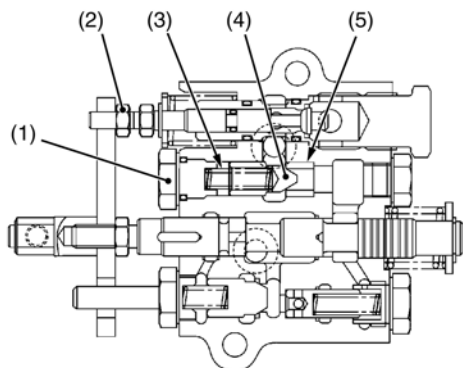
**■ IMPORTANT**

- Never loosen the lock nut (2).

1. Remove the plug (1).
2. 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
- (2) Lock Nut
- (3) Spring

- (4) Poppet 1
- (5) Check Valve Seat 1

3TGAAAB8P031A

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Unload Poppet 1 and Unload Poppet 2

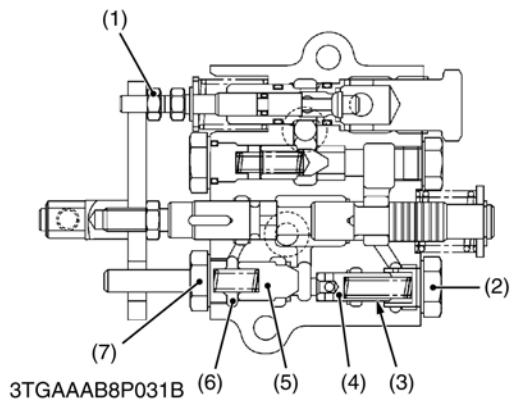
**■ IMPORTANT**

- **Never loosen the lock nut (1).**

1. Remove the plug (7).
2. Draw out the spring (6) and unload poppet 1 (5).
3. Remove the plug (2).
4. 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.



3TGAAAB8P031B

- |                     |                     |
|---------------------|---------------------|
| (1) Lock Nut        | (5) Unload Poppet 1 |
| (2) Plug            | (6) Spring          |
| (3) Spring          | (7) Plug            |
| (4) Unload Poppet 2 |                     |

000007868E

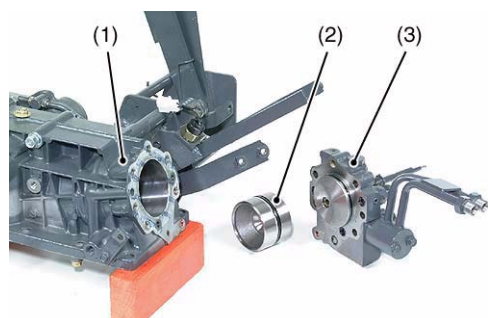
**(5) Hydraulic Cylinder Cover (3P Hydraulic System)**

Hydraulic Cylinder Cover and Piston

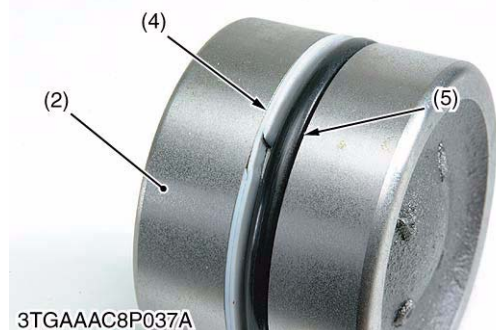
1. Remove the hydraulic cylinder cover (3).
2. Push out the piston from inside of hydraulic cylinder block (1).

**(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.



3TGAAAC8P036A

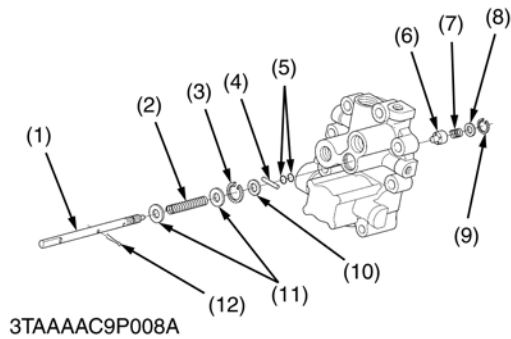


3TGAAAC8P037A

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 | (4) Back-up Ring |
| (2) Piston                   | (5) O-ring       |
| (3) Hydraulic Cylinder Cover |                  |

000007869E



**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    | (7) Spring             |
| (2) Spring             | (8) Washer             |
| (3) Internal Snap Ring | (9) External Snap Ring |
| (4) Straight Pin       | (10) Washer            |
| (5) O-ring             | (11) Washer            |
| (6) Adjusting Collar   | (12) Split Pin         |

000007870E

**Relief Valve**

1. Remove the plug (8).
2. Take out the washer (5), shims (6), spring (4), poppet (3) and valve seat (2).

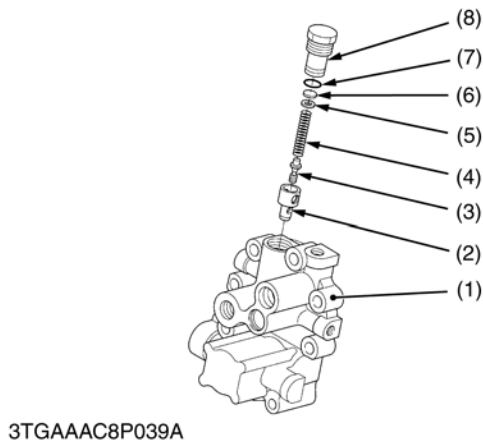
**(When reassembling)**

- 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 | (5) Washer |
| (2) Valve Seat               | (6) Shim   |
| (3) Poppet                   | (7) O-ring |
| (4) Spring                   | (8) Plug   |

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3TGAAAC8P039A

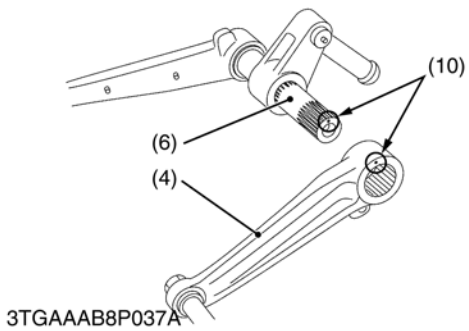
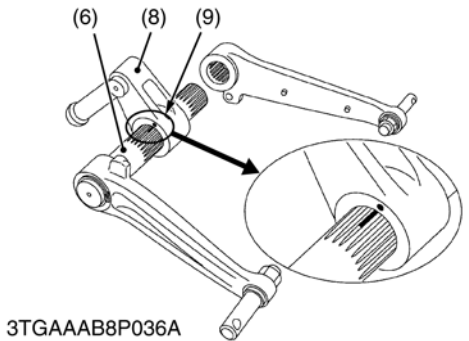
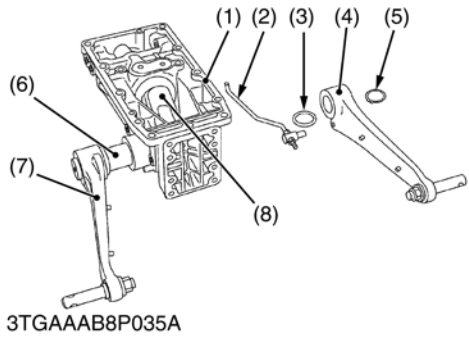
### (6) Hydraulic Cylinder (3P Hydraulic System)

#### 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) and 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 (9) of the hydraulic arm (8) and hydraulic arm shaft (6).
- Align the alignment marks (10) 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 | (7) Lift Arm RH  |
| (2) Position Control Rod     | (8) Hydraulic Arm  |
| (3) O-ring                   | (9) Alignment Mark (Hydraulic Arm Shaft and Hydraulic Arm) |
| (4) Lift Arm LH              | (10) Alignment Mark (Hydraulic Arm Shaft and Lift Arm)     |
| (5) External Snap Ring       |  |
| (6) Hydraulic Arm Shaft      |  |

000007872E

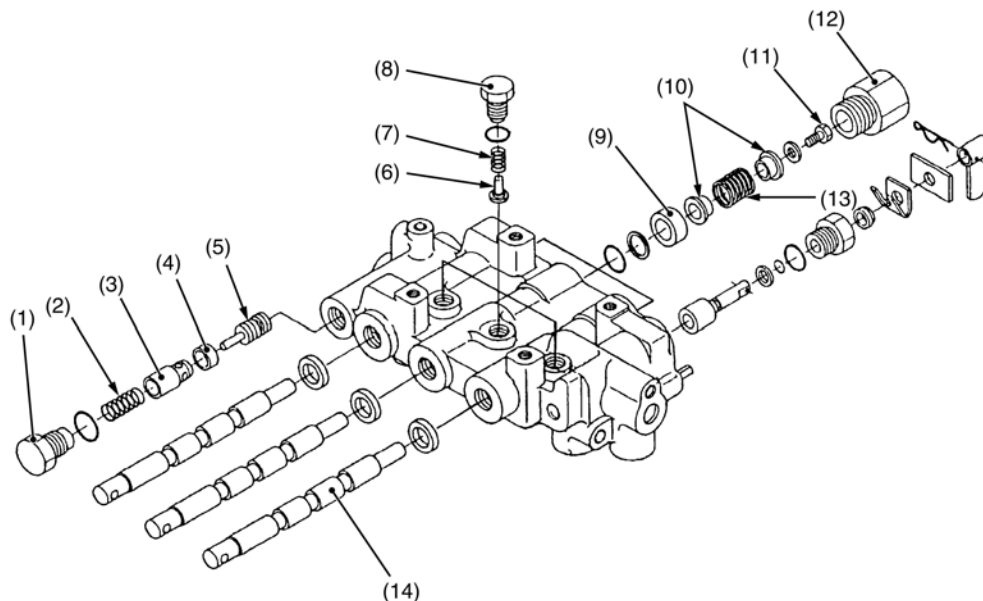
### (7) Auxiliary Control Valve

#### Removing Auxiliary Control Valve

See page 3-S24.

000007873E

#### 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

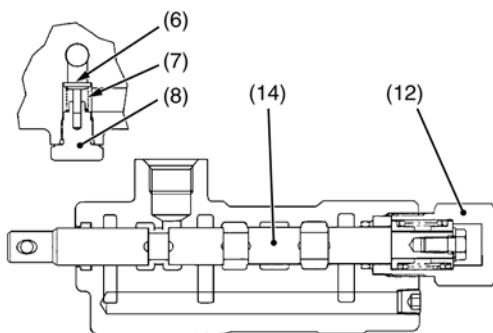
000001200E

3TGAAAB8P038A

#### ■ 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).

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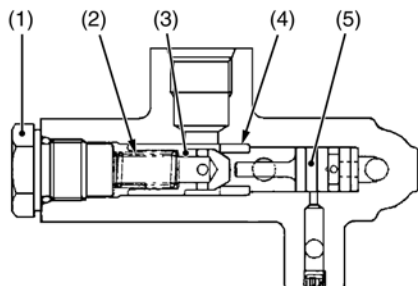


3TGAAAB8P039A

#### ■ Unload Valve

1. Remove the plug (1) and draw out the spring (2), poppet (3), poppet seat (4) and pilot valve (5).

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3TGAAAB8P040A

### [3] SERVICING

#### (1) Hydraulic Pump (Power Steering and 3P Hydraulic System)



3TLABAB7P021A

##### Housing Bore (Depth of Scratch)

1. Check for the scratch on the interior surface of the housing caused by the gear.
2. If the scratch reaches more than half the area of the interior surface of the housing, replace at pump assembly.
3. Measure the housing I.D. where the interior surface is not scratched, and measure the housing I.D. where the interior surface is scratched.
4. If the values obtained in the two determinations differ by more than the allowable limit, replace the hydraulic pump as a unit.

##### **(Reference)**

- Use a cylinder gauge to measure the housing I.D..

Depth of scratch	Allowable limit	0.09 mm 0.0035 in.
------------------	-----------------	-----------------------

0000007877E

##### Clearance between Bushing and Gear Shaft

1. Measure the gear shaft O.D. with an outside micrometer.
2. Measure the bushing I.D. with an inside micrometer or cylinder gauge, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace the gear shaft and the bushing as a unit.

Clearance between bushing and gear shaft	Factory spec.	0.020 to 0.081 mm 0.0008 to 0.0032 in.
	Allowable limit	0.15 mm 0.0059 in.

Gear shaft O.D.	Factory spec.	14.970 to 14.980 mm 0.5894 to 0.5898 in.
Bushing I.D	Factory spec.	15.000 to 15.051 mm 0.5906 to 0.5926 in.

0000007878E

##### 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.

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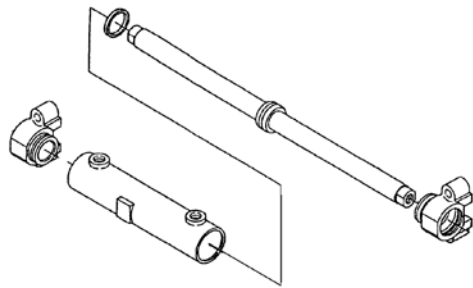


3TLABAB7P022A

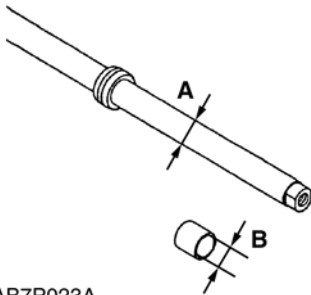


3TLABAB7P023A

## (2) Steering Cylinder



3TGAAAB7P022A



3TGAAAB7P023A

### Cylinder Tube, Rod Assembly and Cylinder Covers

1. Inspect the sliding surface of the cylinder tube, rod assembly and cylinder covers.
2. If they shows nicks or scoring, they must be replaced.

000007880E

### 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.

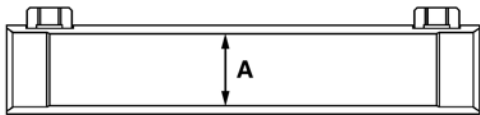
**A : Rod O.D.**

**B : Bush I.D.**

000007881E

### 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.



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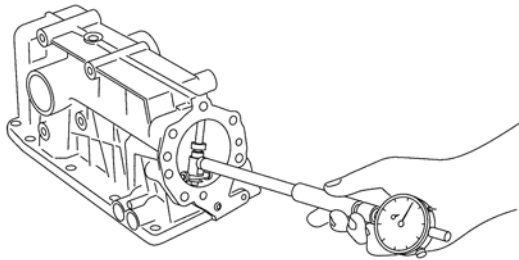
Cylinder tube I.D.	Factory spec.	40.000 to 40.039 mm 1.5748 to 1.5763 in.
	Allowable limit	40.100 mm 1.5787 in.

**A : Cylinder Tube I.D.**

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### (3) Hydraulic Cylinder



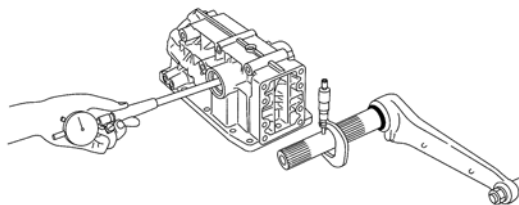
3TGAAAB8P041A

#### 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.

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3TGAAAB8P042A

#### 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-45.)

Clearance between hydraulic arm shaft and bushing	Right	Factory spec.	0.120 to 0.210 mm 0.0047 to 0.0083 in.
	Left		0.090 to 0.200 mm 0.0035 to 0.0079 in.
	Allowable limit		0.30 mm 0.0118 in.

Hydraulic arm shaft O.D.	Right	Factory spec.	37.795 to 37.820 mm 1.4880 to 1.4890 in.
	Left		34.925 to 34.950 mm 1.3750 to 1.3760 in.
Bushing I.D.	Right		37.940 to 38.005 mm 1.4937 to 1.4963 in.
	Left		35.040 to 35.125 mm 1.3795 to 1.3829 in.

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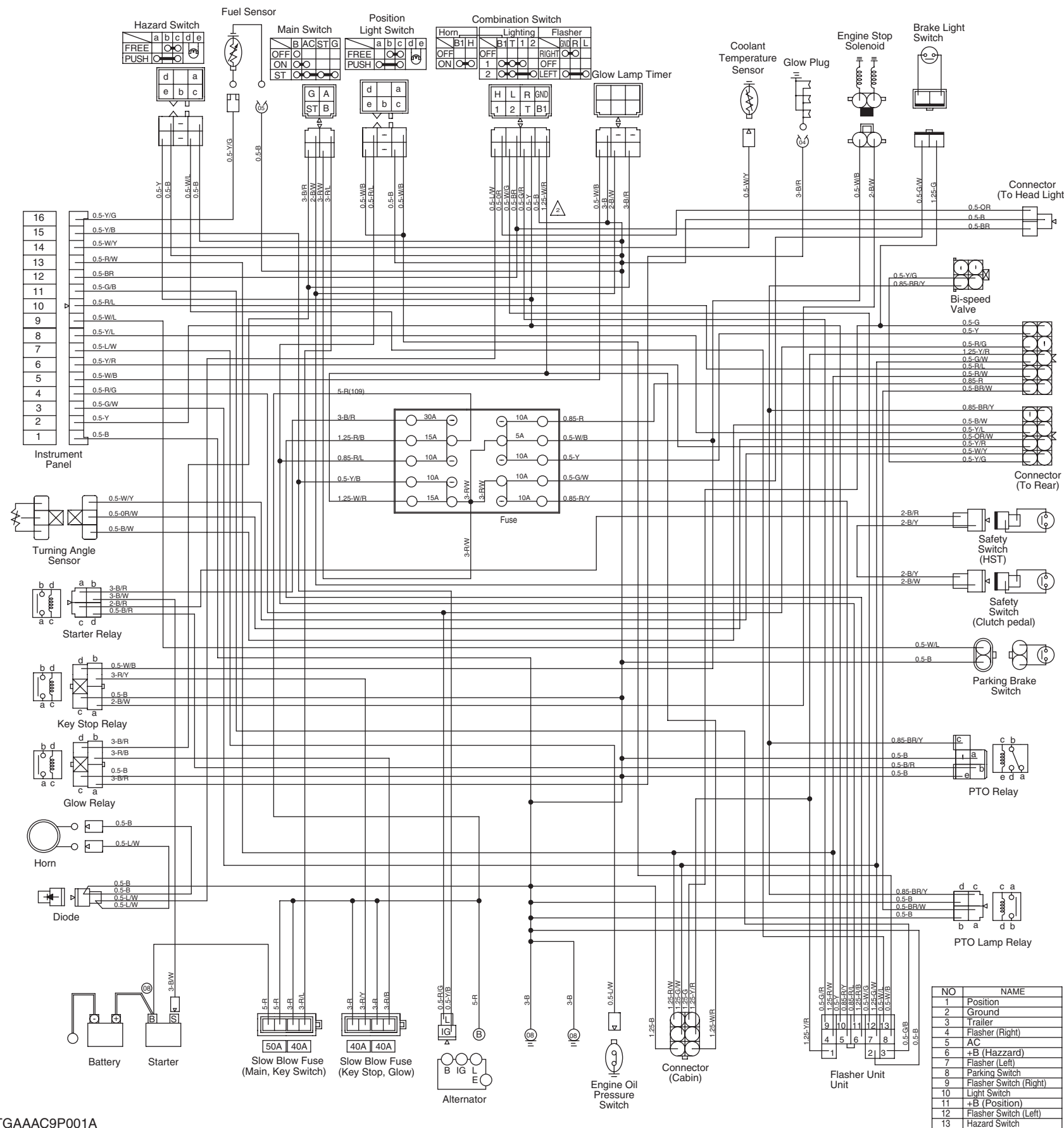
# **9 ELECTRICAL SYSTEM**

# CONTENTS

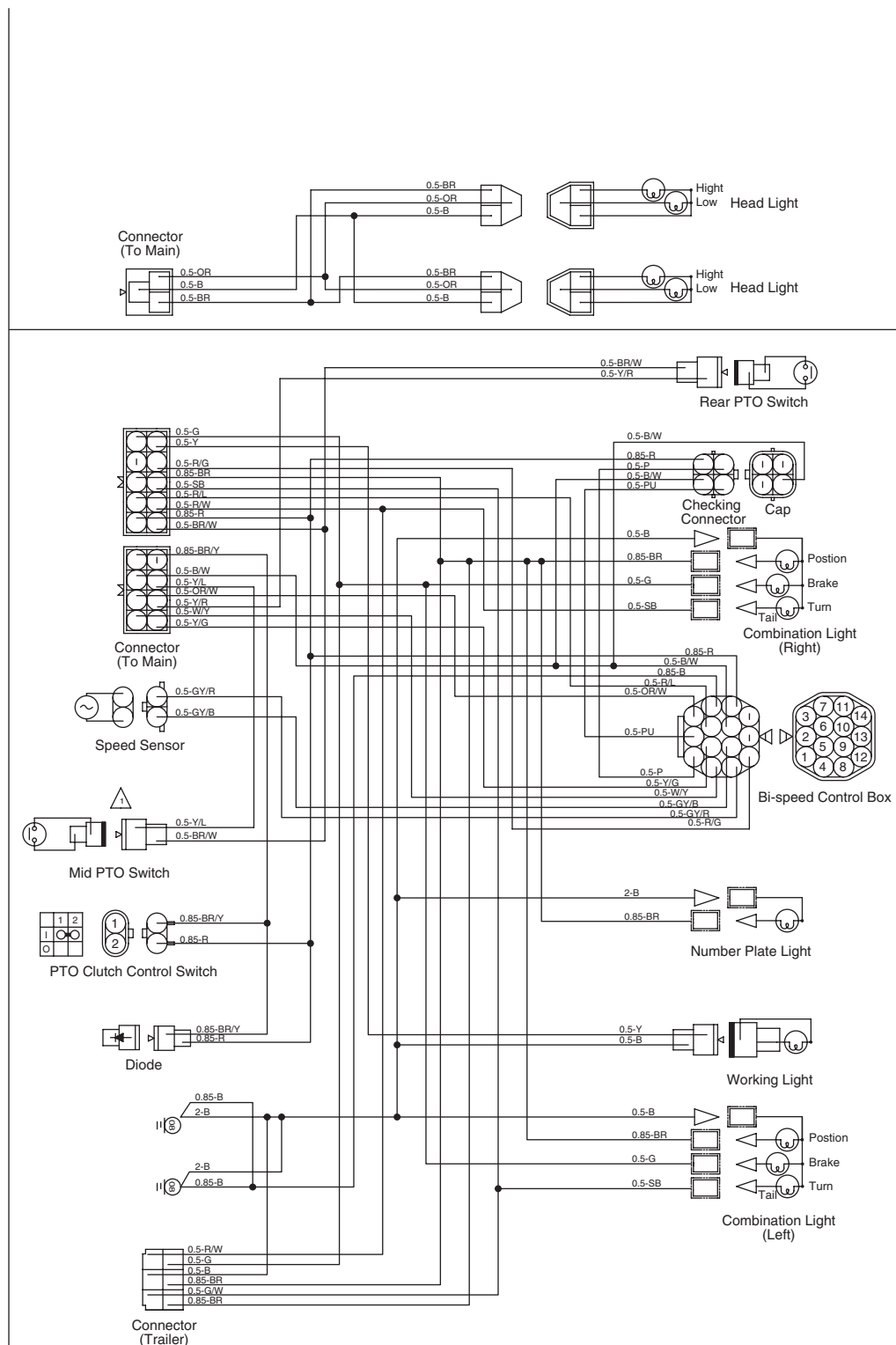
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1. WIRING DIAGRAM.....	9-M1
2. STARTING SYSTEM.....	9-M3
3. CHARGING SYSTEM.....	9-M4
4. LIGHTING SYSTEM.....	9-M5
[1] FLASHER UNIT.....	9-M6
[2] BRAKE LIGHT SWITCH.....	9-M7
5. BI-SPEED TURN SYSTEM.....	9-M8
[1] ELECTRICAL CIRCUIT.....	9-M8
6. OTHERS.....	9-M9

# 1. WIRING DIAGRAM



NO	NAME
1	Position
2	Ground
3	Trailer
4	Flasher (Right)
5	AC
6	+B (Hazzard)
7	Flasher (Left)
8	Parking Switch
9	Flasher Switch (Right)
10	Light Switch
11	+B (Position)
12	Flasher Switch (Left)
13	Hazard Switch



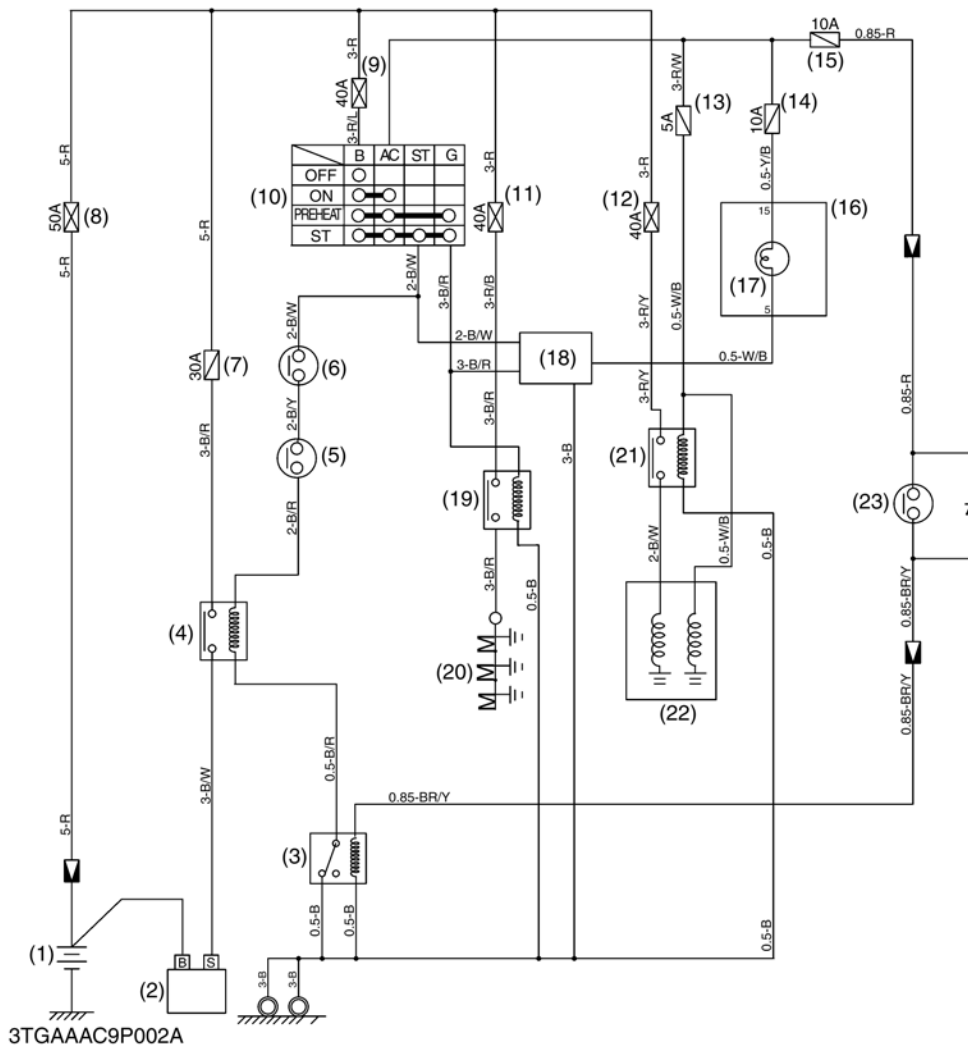
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9-M1

B ..... Black	BR/Y ..... Brown / Yellow	R/G ..... Red / Green
G ..... Green	B/R ..... Black / Red	R/L ..... Red / Blue
L ..... Blue	B/W ..... Black / White	R/W ..... Red / White
P ..... Pink	G/B ..... Green / Black	R/Y ..... Red / Yellow
R ..... Red	G/L ..... Green / Blue	W/B ..... White / Black
Y ..... Yellow	G/R ..... Green / Red	W/G ..... White / Green
BR ..... Brown	G/W ..... Green / White	W/L ..... White / Blue
OR ..... Orange	GR/B ..... Gray / Black	W/R ..... White / Red
PU ..... Purple	GR/R ..... Gray / Red	W/Y ..... White / Yellow
SB ..... Sky Blue	L/W ..... Blue / White	Y/B ..... Yellow / Black
B/Y ..... Black / Yellow	OR/W ..... Orange / White	Y/G ..... Yellow / Green
BR/W ..... Brown / White	R/B ..... Red / Black	Y/R ..... Yellow / Red
		Y/W ..... Yellow / White

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## 2. STARTING SYSTEM



- (1) Battery
- (2) Starter
- (3) PTO Relay
- (4) Starter Relay
- (5) Safety Switch (HST)
- (6) Safety Switch (Clutch Pedal)
- (7) Fuse (Starter)
- (8) Fuse (Main)
- (9) Fuse (Main Switch)
- (10) Main Switch
- (11) Fuse (Glow)
- (12) Fuse (Key Stop)
- (13) Fuse (Key Stop)
- (14) Fuse (Panel Board)
- (15) Fuse (Control Box)
- (16) Instrument Panel
- (17) Glow Indicator Lamp
- (18) Glow Lamp Timer
- (19) Glow Relay
- (20) Glow Plug
- (21) Key Stop Relay
- (22) Engine Stop Solenoid
- (23) PTO Clutch Control Switch

When the main switch is turned to the **PREHEAT** position, the terminal **B** is connected to the terminals **G** and **AC**. The glow plugs become red-hot, and at the same time, glow indicator lamp lights on by the glow lamp timer. After 5 seconds glow lamp timer cuts off the current of glow indicator lamp. Therefore the glow indicator lamp lights off but glow plugs become red hot.

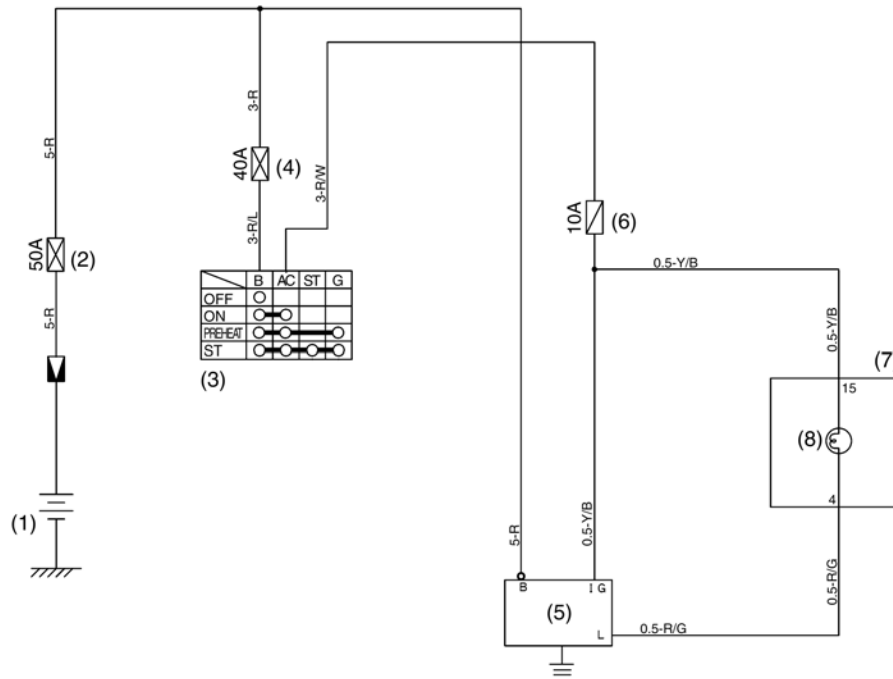
When the main switch is then turned to the **START** position with the safety switches on and the PTO clutch control switch off, the terminal **B** is connected to the terminals **G**, **ST** and **AC**. Consequently, battery current flows to the starter motor and start the engine.

The main switch automatically returns to the **ON** position, the terminal **B** 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 engine stop solenoid moves the fuel injection pump control rack to the "**No Fuel Injection**" position and stop the engine. The engine stop solenoid is a "**Energized to Run Type**"

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### 3. CHARGING SYSTEM



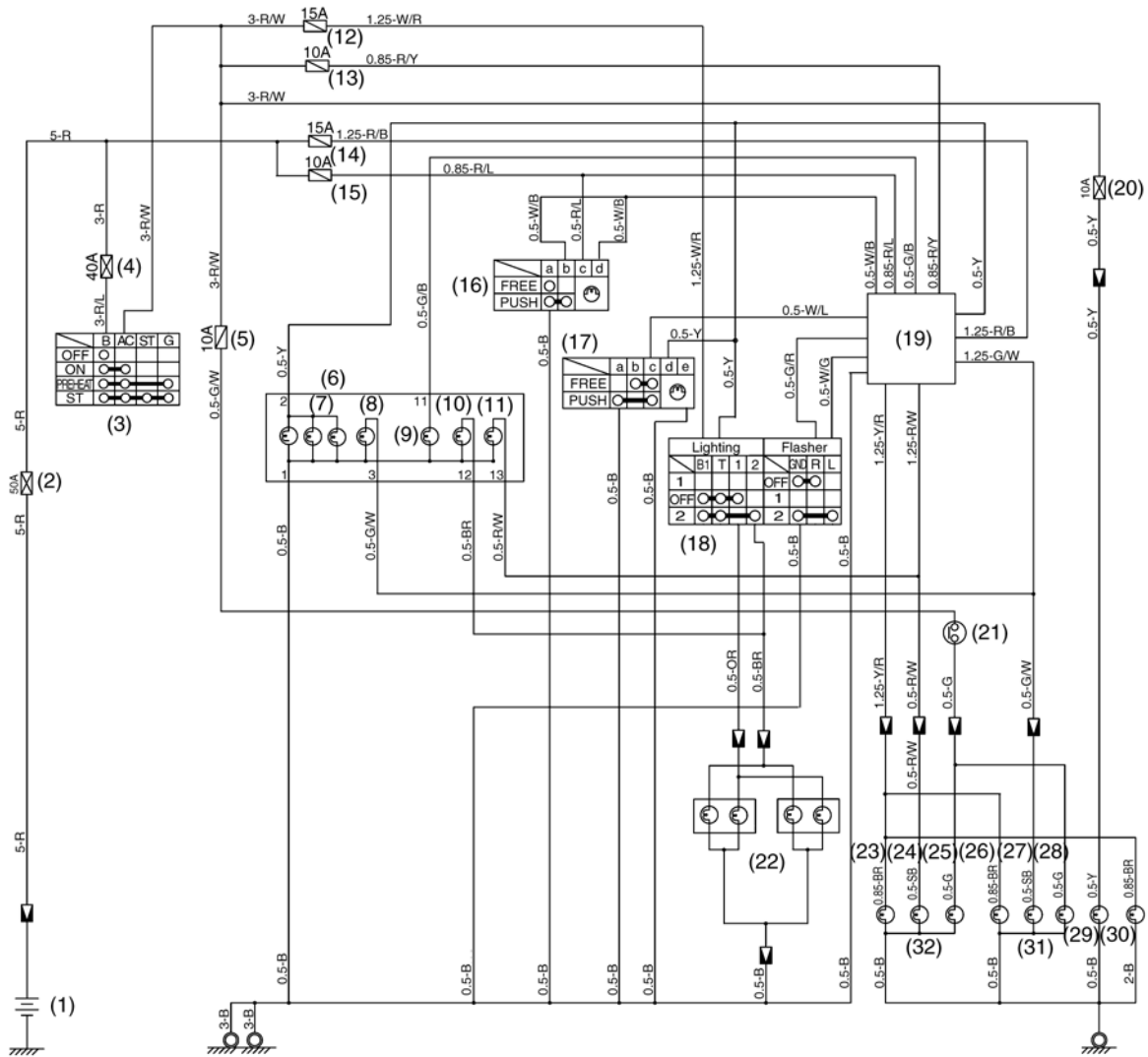
- (1) Battery
- (2) Fuse (Main)
- (3) Main Switch
- (4) Fuse (Main Switch)
- (5) Alternator
- (6) Fuse (Panel Board)
- (7) Instrument Panel
- (8) Charge Lamp

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The charging system supplies electric power for various devices and also charges the battery while the engine runs.

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# 4. LIGHTING SYSTEM



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- |                        |                            |                             |                                |
|------------------------|----------------------------|-----------------------------|--------------------------------|
| (1) Battery            | (9) Hazard                 | (17) Hazard Switch          | (25) Brake Light (Right)       |
| (2) Fuse (Main)        | (10) High Beam             | (18) Combination Switch     | (26) Position Light (Left)     |
| (3) Main Switch        | (11) Turn Signal (Right)   | (19) Flasher Unit           | (27) Turn Signal (Left)        |
| (4) Fuse (Main Switch) | (12) Fuse (Light)          | (20) Fuse (Working Light)   | (28) Brake Light (Left)        |
| (5) Fuse (Break Lamp)  | (13) Fuse (Flasher)        | (21) Brake Light Switch     | (29) Working Light             |
| (6) Instrument Panel   | (14) Fuse (Hazard)         | (22) Head Light             | (30) Number Plate Light        |
| (7) Light              | (15) Fuse (Position)       | (23) Position Light (Right) | (31) Combination Light (Left)  |
| (8) Turn Signal (Left) | (16) Position Light Switch | (24) Turn Signal (Right)    | (32) Combination Light (Right) |

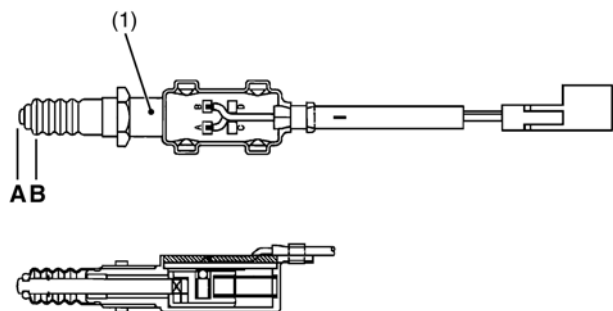
The lighting system consists of main switch, combination switch, hazard switch, position light switch, flasher unit, brake light switch, head light, combination light, brake light, etc..

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## [2] BRAKE LIGHT SWITCH



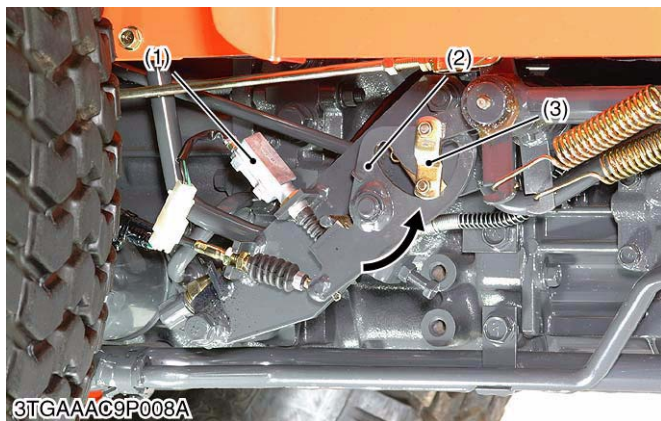
When the broke pedal is not operated, the brake switch is pushed with the lever (2), and turned off.

The lever (2) rotates counterclockwise by the brake link (3) when both brake pedals are depressed at the same time. Then, the brake light switch (1) turns on and the brake lamp lights.

- (1) Brake Light Switch      **A : ON Position**
- (2) Lever                      **B : OFF Position**
- (3) Brake Link

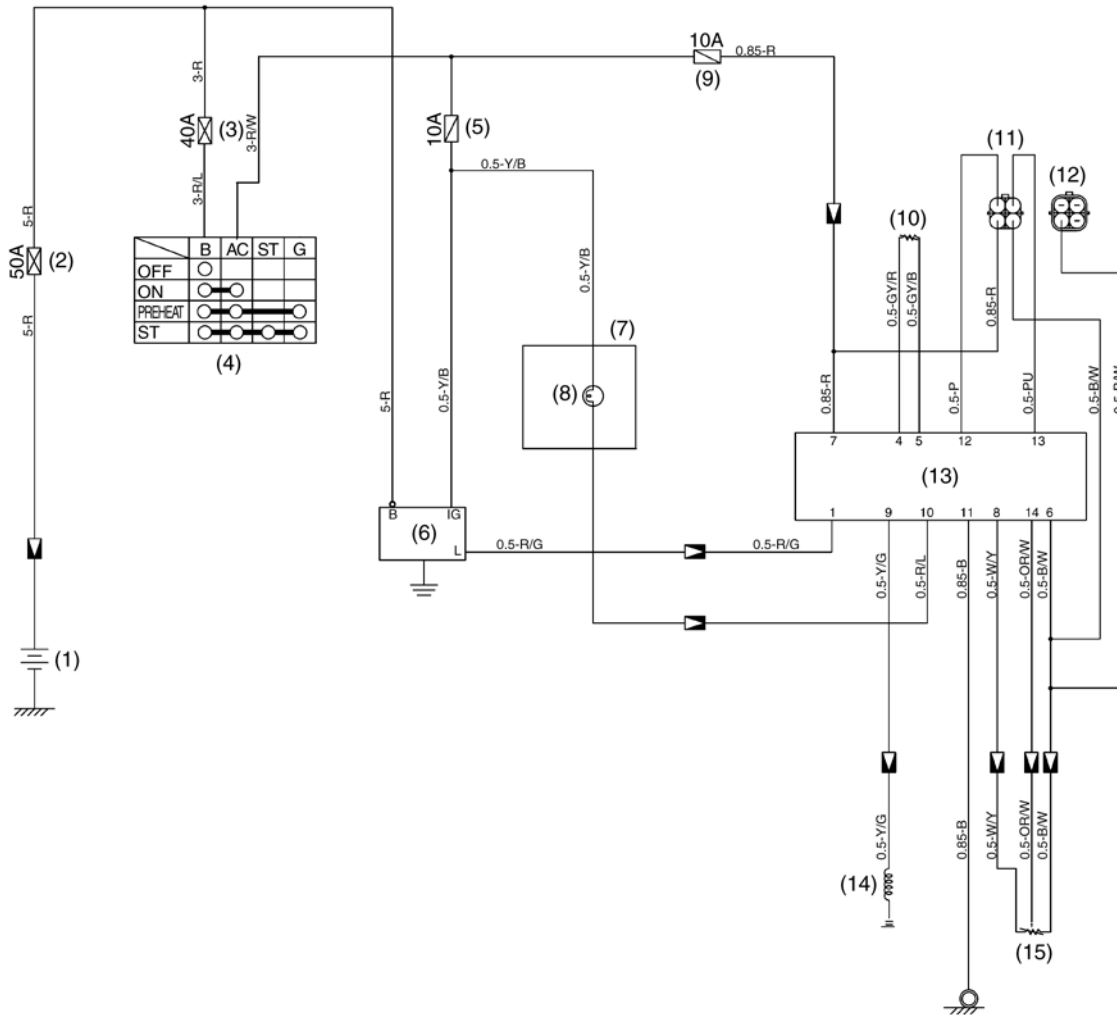
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# 5. BI-SPEED TURN SYSTEM

## [1] ELECTRICAL CIRCUIT



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- |                        |                             |                         |                           |
|------------------------|-----------------------------|-------------------------|---------------------------|
| (1) Battery            | (5) Fuse (Panel Board)      | (9) Fuse (Control Box)  | (13) Bi-speed Control Box |
| (2) Fuse (Main)        | (6) Alternator              | (10) Speed Sensor       | (14) Bi-speed Solenoid    |
| (3) Fuse (Main Switch) | (7) Instrument Panel        | (11) Checking Connector | (15) Turning Angle Sensor |
| (4) Main Switch        | (8) Bi-speed Turn Indicator | (12) Cap                |                           |

The bi-speed turn system is composed of traveling speed sensor, front wheel turning angle sensor, bi-speed switch, engine running sensor (Alternator L terminal) and bi-speed valve. Those are controlled by bi-speed controller.

This system equipped with fail safe system. If the electrical sensor (Bi-speed valve, front wheel turning angle sensor or traveling speed sensor) has failed, the bi-speed indicator lamp that located on the instrument panel will flash on to mention the system failure. (Refer to 9-S9.)

**NOTE**

- Bi-speed turn system is also explained in 3. TRANSMISSION, refer to 3-M15.

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## 6. OTHERS

Refer to Workshop Manual for Diesel Engine Mechanism (Code No. 97897-01872) and Tractor Mechanism (Code No. 97897-18200) as following terms.

### [1] STARTING SYSTEM

- (1) Main Switch : [Type 1] in Workshop Manual for Tractor Mechanism.
- (2) Starter Motor : [Gear Reduction Type] in Workshop Manual for Diesel Engine Mechanism.
- (3) Starter Relay : Workshop Manual for Tractor Mechanism.
- (4) Safety Switch (Clutch pedal) and Safety Switch (HST) : [Push Type 1] in Workshop Manual for Tractor Mechanism.
- (5) Glow Plug : [Quick Glow System] in Workshop Manual for Diesel Engine Mechanism.
- (6) Glow Relay and Key Stop Relay : Same as [Starter Relay] in Workshop Manual for Tractor Mechanism.
- (7) Key Stop Solenoid : [Energized-to-stop type] in Workshop Manual for Diesel Engine Mechanism.

### [2] CHARGING SYSTEM

- (1) Alternator : [Alternator with IC Regulator] in Workshop Manual for Diesel Engine Mechanism.

### [3] LIGHTING SYSTEM

- (1) Combination Switch : [Type 2] in Workshop Manual for Tractor Mechanism.
- (2) Hazard Switch : Workshop Manual for Tractor Mechanism.
- (3) Position Light Switch : [Position (Parking) Switch] in Workshop Manual for Tractor Mechanism.

### [4] EASY CHECKER

- (1) Engine Oil Pressure Switch : [Type 1] in Workshop Manual for Tractor Mechanism.

### [5] GAUGES

- (1) Fuel Level Sensor : [Fuel Level Sensor 1] in Workshop Manual for Tractor Mechanism.
- (2) Coolant Temperature Sensor : Workshop Manual for Tractor Mechanism.

### [5] TRAILER SOCKET

- (1) Trailer Socket : [Type A] in Workshop Manual for Tractor Mechanism.

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# 1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
<b>All Electrical Equipment Do Not Operate</b>	● Battery discharged or defective	Recharge or Replace	G-25, 26
	● Battery positive cable disconnected or improperly connected	Connect	—
	● Battery negative cable disconnected or improperly connected	Connect	—
	● Slow blow fuse (main) blown	Replace	G-34
<b>Fuse Blown Frequently</b>	● Short-circuited	Repair or replace	—

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## BATTERY

Symptom	Probable Cause	Solution	Reference Page
<b>Battery Discharges Too Quickly</b>	● Battery defective	Replace	G-25
	● Alternator defective	Repair or replace	9-S22
	● Wiring harness disconnected or improperly connected (between battery positive terminal and alternator <b>B</b> terminal)	Repair or replace	9-M4
	● Cooling fan belt slipping	Adjust tension	G-23

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**STARTING SYSTEM**

Symptom	Probable Cause	Solution	Reference Page
<b>Starter Motor Does Not Operate</b>	● Battery discharged or defective	Recharge or replace	G-25, 26
	● Slow blow fuse (main, key switch) or fuse (starter) blown	Replace	G-34
	● Safety switch improperly adjusted or defective	Repair or replace	9-S16, S17
	● PTO clutch control switch defective	Repair or replace	9-S15
	● Wiring harness disconnected or improperly connected (between main switch <b>ST</b> terminal and safety switches, between safety switches and starter relay, between battery positive terminal and starter motor)	Repair or replace	—
	● Starter motor defective	Repair or replace	9-S16
	● Main switch defective	Replace	9-S8
<b>Engine Does Not Start</b>	● Engine stop solenoid defective	Replace	9-S21
	● Slow blow fuse (key stop) or fuse (key stop) blown	Replace	G-34

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**CHARGING SYSTEM**

Symptom	Probable Cause	Solution	Reference Page
<b>Charging Lamp Does Not Light when Main Switch is Turned ON</b>	● Fuse blown (10 A)	Replace	G-34
	● Wiring harness disconnected or improperly connected (between main switch <b>AC</b> terminal and panel board, between panel board and alternator)	Repair or replace	—
	● Alternator defective	Repair or replace	9-S22
<b>Charging Lamp Does Not Go Off When Engine is Running</b>	● Wiring harness disconnected or improperly connected (between main switch <b>B</b> terminal and alternator, between panel board and alternator)	Replace Repair or replace	—
	● Alternator defective	Repair or replace	9-S22

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**LIGHTING SYSTEM**

<b>Symptom</b>	<b>Probable Cause</b>	<b>Solution</b>	<b>Reference Page</b>
<b>Head Light Does Not Light</b>	● Fuse blown (15 A)	Replace	G-34
	● Bulb blown	Replace	G-35
	● 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)	Repair or replace	—
	● Combination switch defective	Replace	9-S23
<b>Turn Signal Light Does Not Light</b>	● Fuse blown (10 A)	Replace	G-34
	● Bulb blown	Replace	G-35
	● Wiring harness disconnected (between combination switch R terminal and flasher unit, between combination switch L terminal and flasher unit, between flasher unit and turn signal light)	Repair or replace	9-S27
	● Flasher unit defective	Replace	—
	● Combination switch defective	Replace	9-S23
	● Hazard switch defective	Replace	9-S25
<b>Hazard Light Does Not Light</b>	● Fuse blown (15 A)	Replace	G-34
	● Bulb blown	Replace	G-35
	● Wiring harness disconnected or improperly connected	Repair or replace	9-S27
	● Flasher unit defective	Replace	—
	● Hazard switch defective	Replace	9-S25
<b>Position Light Does Not Light (When Position Light Switch is pushed)</b>	● Fuse blown (10 A)	Replace	G-34
	● Bulb blown	Replace	G-35
	● Position light switch defective	Repair or replace	9-S26
	● Wiring harness disconnected (between position light switch and flasher unit, between flasher unit and position light)	Repair or replace	—
	● Flasher unit defective	Replace	—

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**HORN**

<b>Symptom</b>	<b>Probable Cause</b>	<b>Solution</b>	<b>Reference Page</b>
<b>Horn Does Not Sound</b>	● Combination switch defective	Replace	9-S23
	● Horn defective	Replace	—
	● Wiring harness disconnected or improperly connected (between combination switch terminal and horn)	Replace or replace	—

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## 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 $\Omega$	—
Stop Solenoid	Pull-in Coil (Resistance)	Approx. 0.375 $\Omega$	—
	Holding Coil (Resistance)	Approx. 15.6 $\Omega$	—
Fuel Level Sensor	Float at Upper-most Position (Resistance)	1.0 to 5.0 $\Omega$	—
	Float at Lower-most Position (Resistance)	103 to 117 $\Omega$	—
Coolant Temperature Sensor	at 120 °C (266 °F) (Resistance)	Approx. 16.1 $\Omega$	—
	at 100 °C (221 °F) (Resistance)	Approx. 27.4 $\Omega$	—
	at 80 °C (176 °F) (Resistance)	Approx. 51.9 $\Omega$	—
	at 50 °C (122 °F) (Resistance)	Approx. 153.9 $\Omega$	—
Alternator	No-load voltage	More than 14 V	—
	Stator (Resistance)	Less than 1.0 $\Omega$	—
	Rotor (Resistance)	2.9 $\Omega$	—
	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.

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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.)

<b>Item</b>	<b>N·m</b>	<b>kgf·m</b>	<b>ft-lbs</b>
Alternator (Pulley nut)	58.3 to 78.9	5.95 to 8.05	43.0 to 58.2

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# 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 splattered 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.

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## [1] CHECKING AND ADJUSTING

### (1) Battery

#### Battery Condition

See page G-25 "Checking Battery Condition".

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#### 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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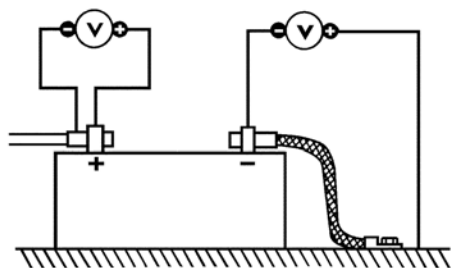
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#### Battery Terminal Connection

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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## (2) Main Switch



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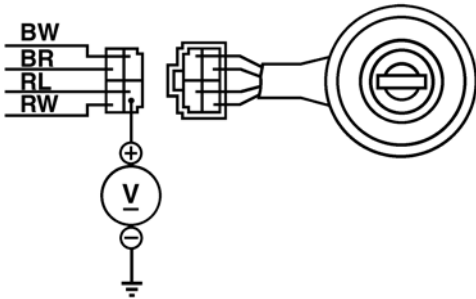
### Main Switch

1. Remove the panel board.
2. Disconnect the 4P connector and remove the main switch (1).
3. Perform the following checks.

(1) Main Switch

(2) 4P Connector

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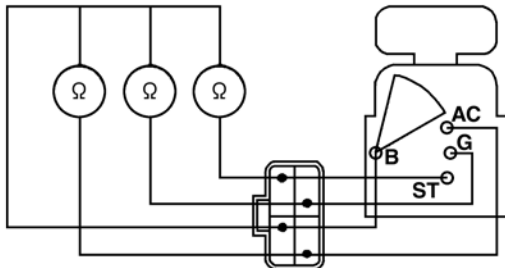
3GFABAB9P006C

### Connector Voltage

1. Measure the voltage with a voltmeter across the connector **B** terminal and chassis.
2. If the voltage differs from the battery voltage (11 to 14 V), the wiring harness is faulty.

Voltage	Connector <b>B</b> terminal - Chassis	Approx. battery voltage
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### Main Switch Continuity

#### 1) Main Switch Key at OFF Position

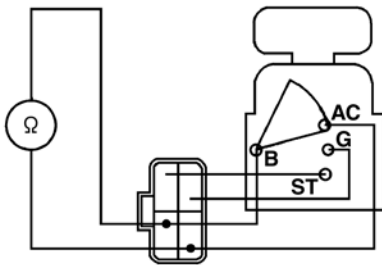
1. Set the main switch **OFF** position.
2. Measure the resistance with an ohmmeter across the **B** terminal and the **AC** terminal, **B** terminal and **ST** terminal, **B** terminal and **G** terminal.
3. If infinity is not indicated, the contacts of the main switch are faulty.

Resistance	<b>B</b> terminal - <b>AC</b> terminal	Infinity
	<b>B</b> terminal - <b>ST</b> terminal	
	<b>B</b> terminal - <b>G</b> terminal	

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#### 2) Main Switch Key at On Position

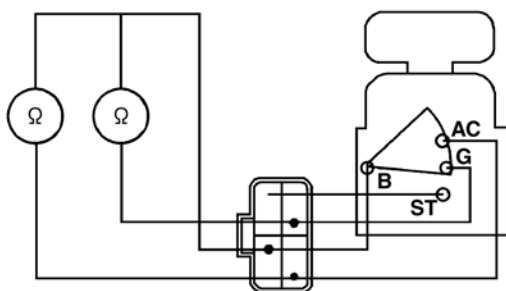
1. Set the main switch **ON** position.
2. Measure the resistance with an ohmmeter across the **B** terminal and the **AC** terminal.
3. If 0 Ω is not indicated, the **B - AC** contact of the main switch are faulty.



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Resistance	<b>B</b> terminal - <b>AC</b> terminal	0 Ω
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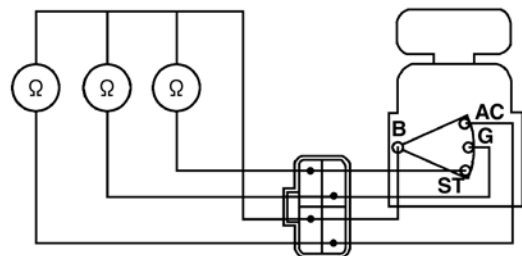
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**3) Main Switch Key at PREHEAT Position**

1. Set and hold the main switch key at the **PREHEAT** position.
2. Measure the resistance with an ohmmeter across the **B** terminal and the **G** terminal, and measure the resistance across the **B** terminal and the **AC** terminal.
3. If 0 Ω is not indicated, these contacts of the main switch are faulty.

Resistance	B terminal - G terminal	0 Ω
	B terminal - AC terminal	

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3TBAAAD9P019B

**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 **B** terminal and the **G** terminal, across the **B** terminal and the **ST** terminal, and across the **B** terminal and the **AC** terminal.
3. If 0 Ω is not indicated, these contacts of the main switch are faulty.

Resistance	B terminal - G terminal	0 Ω
	B terminal - ST terminal	
	B terminal - AC terminal	

Terminal	B	AC	G	ST
Key position				
OFF	●			
ON	●	●		
PREHEAT	●	●	●	
START	●	●	●	●

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**(3) Fail Safe System (Bi-speed Turn System)**



3TGAAAC9P011A

The fail safe system mentions to the operator for some trouble occurred while operating the tractor.

When the fail safe system is operated, the bi-speed indicator lamp (1) blinks and informs troubled parts. And the bi-speed turn system does not work.

Blinking Mode	Troubled parts
Slow (Light up: 1.0 sec. / lights off: 0.2 sec.)	Wiring harness for traveling speed sensor disconnected
Slow (same above)	Front wheel turning angle sensor
Quick (Light up: 0.2 sec. / lights off: 0.2 sec.)	Bi-speed solenoid valve

(1) Bi-speed Indicator Lamp

000007898E

#### (4) Fine Adjustment (Bi-speed Turn System)

When the front wheel turning angle sensor is replaced, the fine adjustment should be done to set the wheel angle information for the bi-speed controller.

##### Procedure 1: Making standard setting for the fine adjustment

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. Hold down the bi-speed switch and turn on the main switch (The engine does not start). Now make sure the bi-speed indicator 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 bi-speed indicator lamp light-up and saving the fine adjustment data

1. First check up the bi-speed indicator lamp.  
If any setting is wrong or a component part is defective or malpositioned, the bi-speed indicator lamp starts blinking the number of times that corresponds to a trouble spot. See the [Lamp Blinking Chart] in "(5) Self Diagnosis". The bi-speed lamp indicator 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 from the above steps 1 in Procedure 1.
2. When the data is judged correct, the bi-speed indicator lamp lights up and stays on. Then hold down the bi-speed switch for longer than 3 seconds. (The bi-speed indicator lamp goes out just when this switch is pressed down.)
3. When the fine adjustment data has been properly saved, the bi-speed indicator 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 indicator 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 indicator lamp stay on. Finally turn off the switch.

#### (Reference)

##### ■ Standard Setting for Fine Adjustment and Self Diagnosis

Description	Status	Related Sensor
Front wheel	Straight run	Front wheel turning angle sensor
Tractor body	Stop	Travelling speed sensor
Engine	Stop	—

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## (5) Self Diagnosis (Bi-speed Turn System)

The self-diagnosis mode is 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.

### Procedure 1: Making standard setting for the self-diagnosis

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 bi-speed indicator light-up and operating the self-diagnosis

1. First check up the bi-speed indicator 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 Blinking 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 indicator 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 bi-speed indicator 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 date.

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## (6) Bi-speed Restraint Check (Bi-speed Turn System)

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 indicator 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 22T gear of differential gear case.

#### (Reference)

	Approximate travelling speed with standard tire	Bi-speed indicator lamp
<b>A</b>	0 to 0.2 km/h (0 to 0.13 mph)	Turned off
<b>B</b>	0.2 to 9.0 km/h (0.13 to 5.62 mph)	Lights up
<b>C</b>	over 9.0 km/h (over 5.62 mph)	Turned off

- Checking condition A: Tractor at stop
- Checking condition B: Drive the tractor with range gear shift 1, cruise control lever at 2 notches 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 main switch
2. Switch on the 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

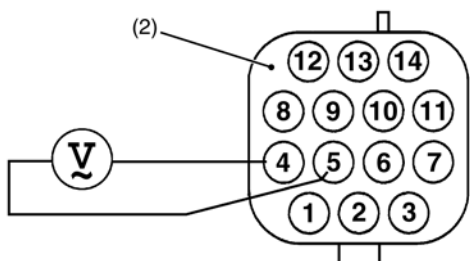
1. Turn off the main switch.
2. The bi-speed restraint mode can be accepted through the above two procedures "Checking the travelling speed sensor input" and "Checking the bi-speed control output".

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### (7) Sensors, Bi-speed and Solenoid Valve



3TGAAAC9P022A



3TGAAABIP023B

#### 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 following condition.
  - Range shift lever : 1
  - Cruise control lever : 2 notches
  - Engine speed : around 1000 rpm
4. Measure the travelling speed sensor voltage on the connector's terminal of wire harness side (5 terminal - 4 terminal)

#### ⚠ CAUTION

- Be sure to disengage the front wheel drive, when checking the travelling speed sensor with rotating 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.	5 terminal - 4 terminal	Approx.AC 1.0 V
---	---------------	-------------------------	-----------------

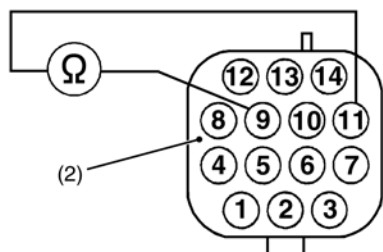
(1) Connector

(2) Connector (Wire Harness)

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3TGAAABIP024B

#### Bi-speed Solenoid Valve

##### [Solenoid]

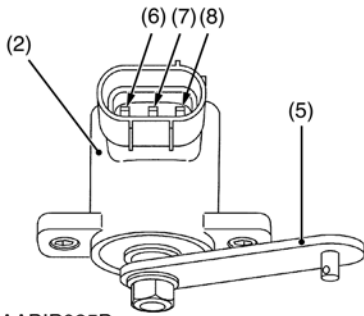
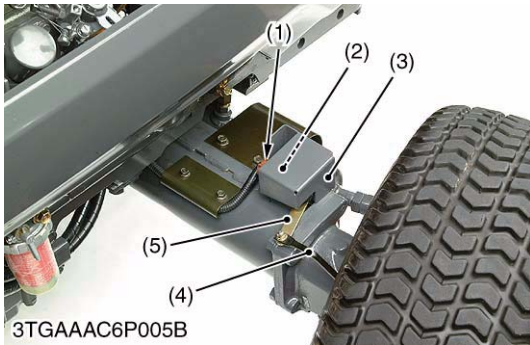
1. Disconnect the connector (1).
2. Measure the bi-speed solenoid valve resistance between 9 terminal (Ground) and 11 terminal (solenoid valve).  
If the measurement is not within the factory specifications, replace it.

Resistance between bi-speed solenoid valve and ground	Factory spec.	9 terminal - 11 terminal	11 to 15 Ω
---	---------------	--------------------------	------------

(1) Connector

(2) Connector (Wire Harness)

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Front Wheel Turning Angle Sensor

1. Separate the arm (4) from angle sensor lever (5).
2. Disconnect the connector (1).
3. Remove the sensor with sensor cover (3), then remove the sensor from sensor cover (3).
4. Measure the angle sensor resistance between the **A** terminal (6) and ground **C** terminal (8).
5. Set the test lead of tester between **B** terminal (7) and ground **C** terminal (8).  
Turn the sensor lever (5) slowly and check the changing of resistance value.
6. If measurement is not within the factory specifications, replace it.

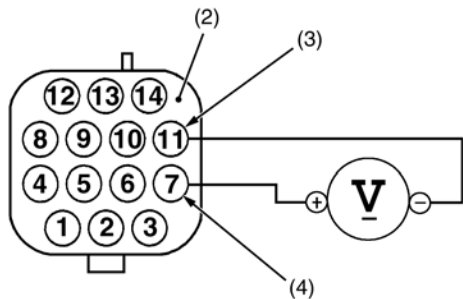
■ **IMPORTANT**

- If replaced a front wheel turning angle sensor, be sure to operate the "Fine adjustment system".

Front wheel turning angle sensor resistance	Factory spec.	<b>A</b> terminal - <b>C</b> terminal	4.32 to 6.48 kΩ
Changing of resistance value		<b>B</b> terminal - <b>C</b> terminal	Changing with smoothly

- |                                      |                                |
|--------------------------------------|--------------------------------|
| (1) Connector                        | (5) Lever                      |
| (2) Front Wheel Turning Angle Sensor | (6) <b>A</b> Terminal          |
| (3) Sensor Cover                     | (7) <b>B</b> Terminal          |
| (4) Arm                              | (8) <b>C</b> Terminal (Ground) |

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Bi-speed Controller

■ **NOTE**

- The controller used micro-computer, it is necessary a special checking instrument to inspect it.
- If the connector voltage is in good condition and the output voltage is not in good, the controller may faulty.

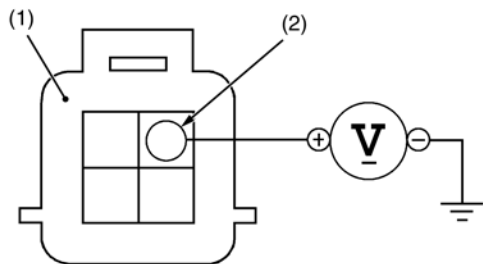
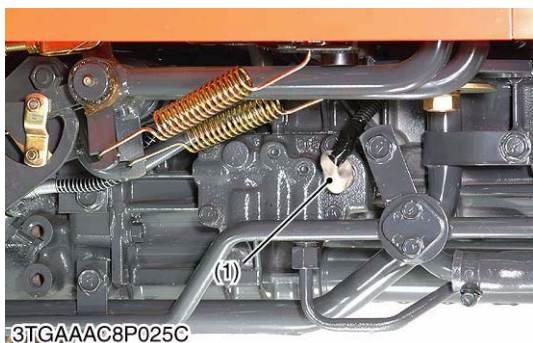
**1) Connector Voltage**

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 **7** terminal (4) and **11** terminal (3). If the voltage differs from the battery voltage, check the fuse, wiring harness or ground condition.

Voltage	<b>4</b> Terminal and <b>8</b> Terminal	Battery voltage (11 to 14 V)
---------	---	------------------------------

- |                              |                        |
|------------------------------|------------------------|
| (1) Connector                | (3) <b>11</b> Terminal |
| (2) Connector (Harness Side) | (4) <b>7</b> Terminal  |

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3TGAAABIP028B

**2)Output Voltage**

1. Remove the connector for bi-speed 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 following condition.
  - Range shift lever : 1
  - Cruise control lever : 2 notches
  - Engine speed : around 1000 rpm
4. Steer the front wheel to the left or the right 0.61 rad (35°) or more.
5. 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 between Terminal (2) and chassis	Front wheel is steered to the right or the left 0.61 rad (35°) or more	Battery Voltage
	Front wheel is straight	OV

- (1) Bi-speed Valve Connector      (2) Terminal (Y/G)

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**(8) PTO Clutch Control Switch**



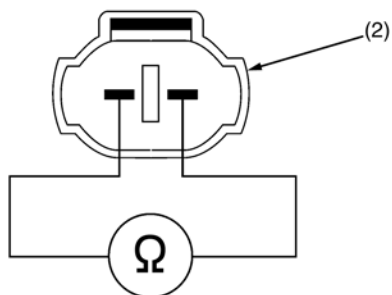
PTO Clutch Control Switch

1. Remove the auxiliary control valve cover.
2. Disconnect the **2P** connector (2) of the PTO clutch control switch (1).
3. Measure the resistance of **2P** connector (switch side).
4. If the measurement differs from the table, replace it.

Resistance	PTO clutch control switch at ON position	0 Ω
	PTO clutch control switch at OFF position	Resistance Infinity

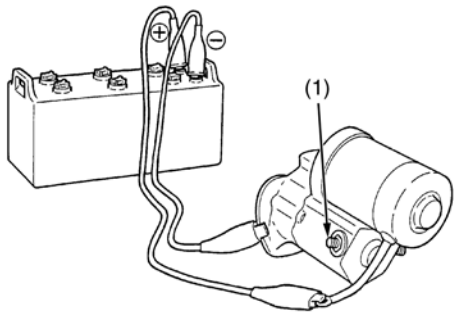
- (1) PTO Clutch Control Switch      (2) 2P Connector (Switch Side)

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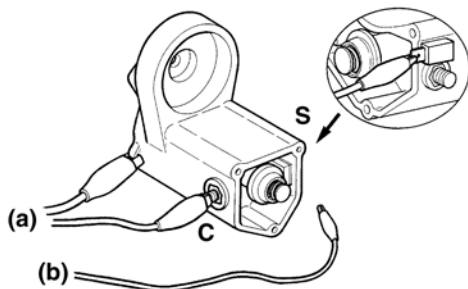


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**(9) Starter**



3TMABAB9P007B



3TMABAB9P008A

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

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Magnetic 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**

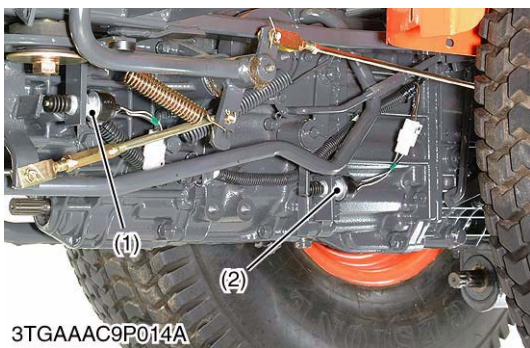
● **Testing time must be 3 to 5 sec.**

(a) **To Negative Terminal**

(b) **To Positive Terminal**

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**(10) Safety Switches**



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Safety Switch Continuity

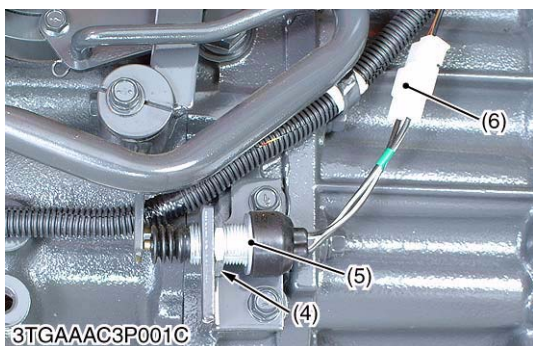
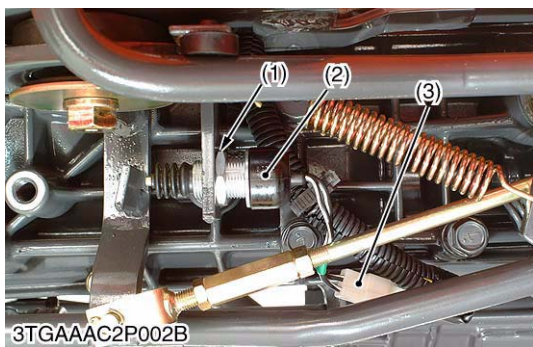
1. Remove the safety switch leads.
2. Connect the circuit tester to the safety switch leads.
3. Measure the resistance between leads.
4. If the safety switch is defective, replace it.

Resistance Across switch terminal	When switch push is pushed	0 Ω
	When switch push is released	Infinity

(1) Safety Switch for Clutch Pedal

(2) Safety Switch for HST

000007931E



Adjusting Safety Switches

**(Safety switch for clutch pedal)**

1. Disconnect the safety switch connector (3) and remove the safety switch (2) once.
2. Fully depress the clutch pedal and hold it.
3. Connect the leads of the ohmmeter to the safety switch lead terminal.
4. Screw in the safety switch (2) until the ohmmeter begins to show 0 ohm.
5. Further screw in the safety switch by 1/2 turn and tighten the lock nut (1).

**(Safety switch for HST)**

1. Disconnect the safety switch connector (6) and remove the safety switch (5) once.
2. Set the HST at neutral position.
3. Connect the leads of the ohmmeter to the safety switch lead terminal.
4. Screw in the safety switch (5) until the ohmmeter begins to show 0 ohm.
5. Further screw in the safety switch by 1/2 turn and tighten the lock nut (4).

- |                                      |                             |
|--------------------------------------|-----------------------------|
| (1) Lock Nut                         | (4) Lock Nut                |
| (2) Safety Switch (for Clutch Pedal) | (5) Safety Switch (for HST) |
| (3) Connector                        | (6) Connector               |

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**(11)Relays and Timer Relay**



Starter Relay

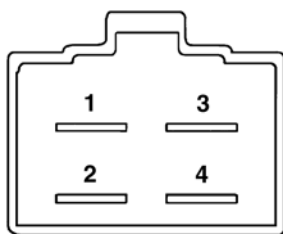
1. Turn the main switch off and remove the starter relay (1).
2. Apply battery voltage across 3 and 4 terminals, and check for continuity across 1 and 2 terminals.
3. If continuity is not established across 1 and 2 terminals, renew the starter relay.

**NOTE**

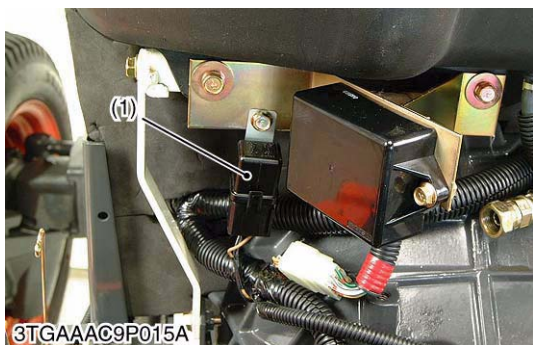
- The starter relay and the PTO lamp relay are the same parts.

- (1) Starter Relay

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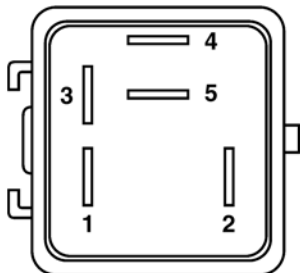
PTO Relay

1. Turn the main switch off and remove the PTO relay (1).
2. Apply battery voltage across **1** and **2** terminals, and check for continuity across **3** and **5** terminals.
3. If continuity is not established across **3** and **5** terminal, renew the PTO relay.

(1) PTO Relay

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A



3TMACAD9P021A



Glow Relay

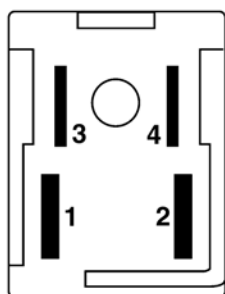
1. Turn the main switch off and remove the glow relay (1).
2. Apply battery voltage across **3** and **4** terminals, and check for continuity across **1** and **2** terminals.
3. If continuity is not established across **1** and **2** terminals, renew the glow relay.

■ **NOTE**

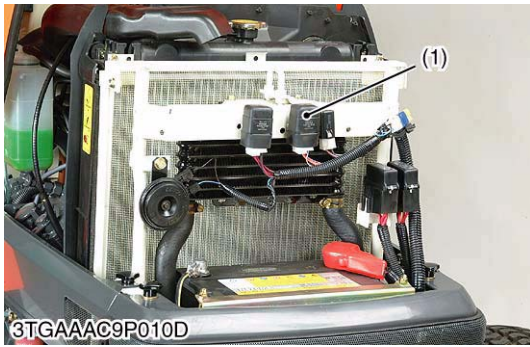
- **The glow relay and the key stop relay are the same parts.**

(1) Glow Relay

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Key Stop Relay

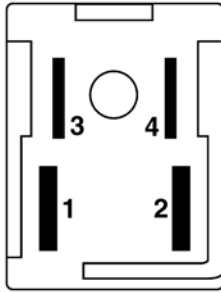
1. Turn the main switch off and remove the key stop relay (1).
2. Apply battery voltage across **3** and **4** terminals, and check for continuity across **1** and **2** terminals.
3. If continuity is not established across **1** and **2** terminals, renew the key stop relay.

■ **NOTE**

- **The glow relay and the key stop relay are the same parts.**

(1) Key Stop Relay

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3TGAAAC9P016A



PTO Lamp Relay

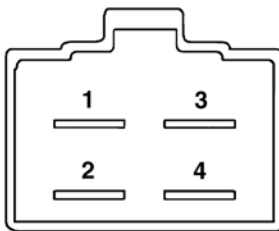
1. Turn the main switch off and remove the PTO lamp relay (1).
2. Apply battery voltage across **3** and **4** terminals, and check for continuity across **1** and **2** terminals.
3. If continuity is not established across **1** and **2** terminals, renew the PTO lamp relay.

■ **NOTE**

- **The PTO lamp relay and starter relay are the same parts.**

(1) PTO Lamp Relay

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3TMABAB9P010C



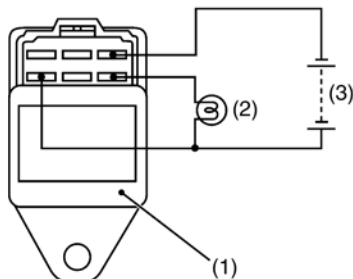


Glow Lamp Timer

1. Turn the main switch of remove the glow lamp timer (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 timer is proper.

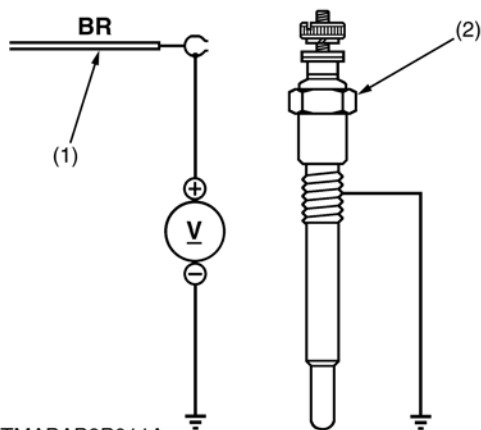
- (1) Glow Lamp Timer
- (2) Bulb
- (3) Battery (12 V)

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**(12)Glow Plug**



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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.

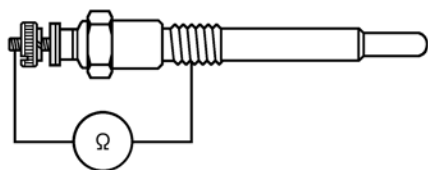
Voltage (Lead terminal - Chassis)	Main switch key at "PREHEAT"	Approx. battery voltage
	Main switch key at "START"	Approx. battery voltage

- (1) Wiring Lead
- (2) Glow Plug

000004662E

Glow Plug Continuity

1. Disconnect the leads from the glow plugs.
2. Measure the resistance with an ohmmeter between the glow plug terminal and chassis.
3. If 0 Ω 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.

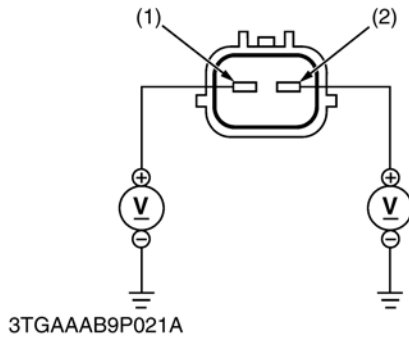


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Glow plug resistance	Factory spec.	Approx. 0.9 Ω
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### (13)Engine Stop Solenoid



#### Connector Voltage

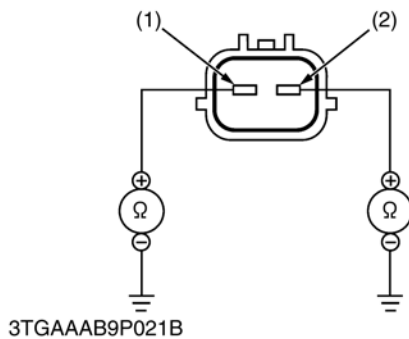
1. Disconnect the **2P** connector from engine stop solenoid.
2. Turn the main switch key to the "**ON**" position.
3. Measure the voltage with voltmeter between the terminal **1** (Black / White), terminal **2** (White / Black) and Body.
4. If the voltage differs from the battery voltage, the wiring harness or main switch is faulty.

Voltage	Terminal 1 - Body	Approx. battery voltage
	Terminal 2 - Body	

(1) Terminal 2

(2) Terminal 1

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#### 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.

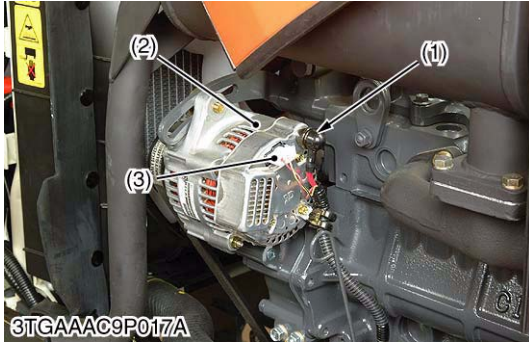
Resistance	Terminal 1 - Body (Pull-in Coil)	Approx. 0.375 Ω
	Terminal 2 - Body (Holding Coil)	Approx. 15.6 Ω

(1) Terminal 1 (Pull-in Coil)

(2) Terminal 2 (Holding Coil)

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### (14) Alternator

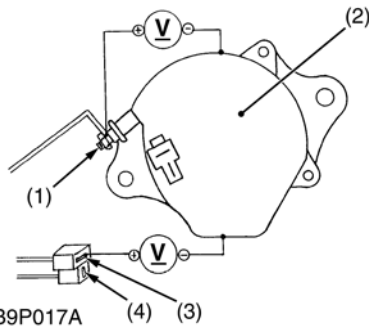


#### Alternator

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

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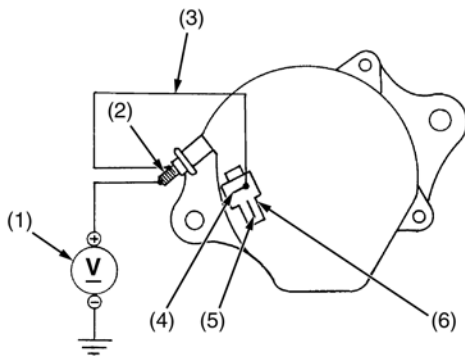
#### Connector Voltage

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 <b>OFF</b> )	<b>B</b> terminal - Chassis	Approx. battery voltage
Voltage (Main switch at <b>ON</b> )	<b>IG</b> terminal - Chassis	Approx. battery voltage

- (1) **B** Terminal
- (2) Alternator
- (3) **IG** Terminal
- (4) **L** Terminal

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#### 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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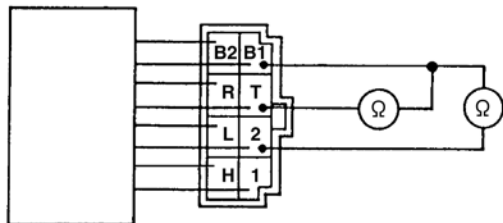
#### (Reference)

- 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** Connector

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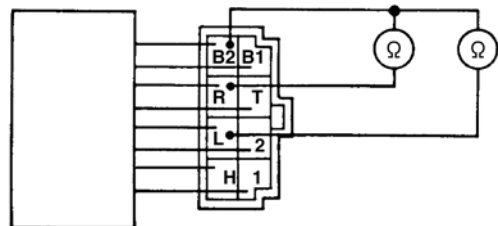
3TLABAB9P044B

**4) Light Switch Continuity when Setting Switch at LOW-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, the head light switch is faulty.

Resistance (Switch at <b>LOW-BEAM</b> position)	<b>B1</b> terminal - <b>T</b> terminal	0 Ω
	<b>B1</b> terminal - <b>2</b> terminal	

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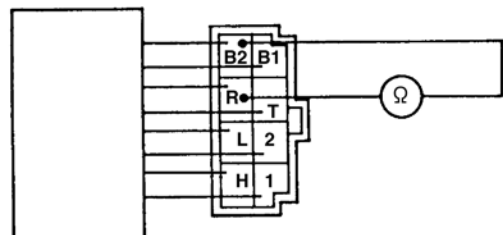
3TLABAB9P045B

**5) Turn Signal Light Switch when Setting Switch Knob at OFF Position**

1. Set the turn signal light 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 is not indicated, the turn signal light switch is faulty.

Resistance (Switch at <b>OFF</b> position)	<b>B2</b> terminal - <b>R</b> terminal	Infinity
	<b>B2</b> terminal - <b>L</b> terminal	

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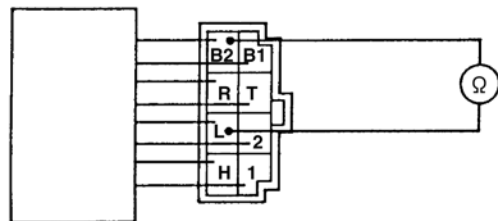
3TLABAB9P046B

**6) Turn Signal Light Switch when Setting Switch Knob at R Position**

1. Set the turn signal light 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, the turn signal light switch is faulty.

Resistance (Switch at <b>R</b> position)	<b>B2</b> terminal - <b>R</b> terminal	0 Ω
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**7) Turn Signal Light Switch when Setting Switch Knob at L Position**

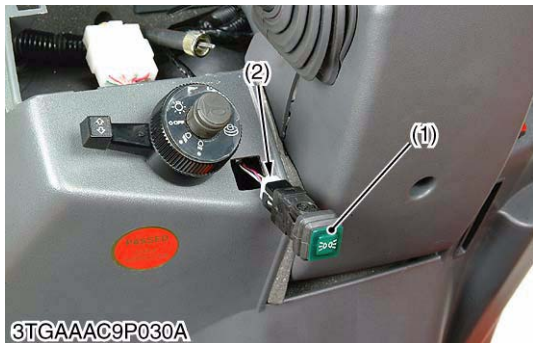
1. Set the turn signal light switch to the **L** position.
2. Measure the resistance with an ohmmeter across the **B2** terminal to the **L** terminal.
3. If 0 ohm is not indicated, the turn signal light switch is faulty.

Resistance (Switch at <b>L</b> position)	<b>B2</b> terminal - <b>L</b> terminal	0 Ω
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000001781E



### (17) Position Light Switch



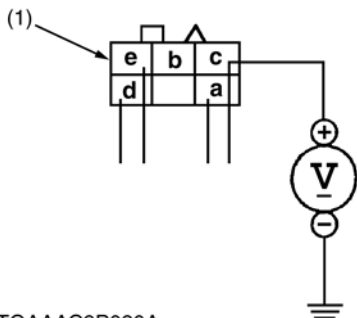
3TGAAAC9P030A

#### Position Light Switch

1. Remove the meter panel and disconnect the **6P** connector (2) from position light switch (1) after disconnect the battery negative code.
2. Remove position light switch (1).
3. Perform the following checking.

- (1) Position Light Switch                      (2) **6P** Connector

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3TGAAAC9P020A

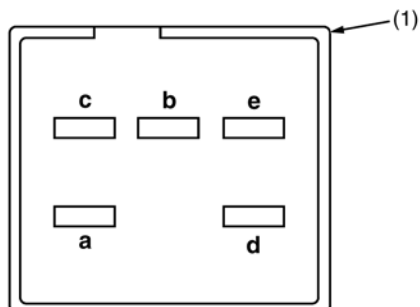
#### 1) Connector Voltage

1. Connect the battery negative code, then measure the voltage with a voltmeter across the **c** terminal and chassis.
2. If the voltage differ from the battery voltage, the wiring harness is faulty.

Voltage	<b>c</b> terminal - Chassis	Approx. battery voltage
---------	-----------------------------	-------------------------

- (1) **6P** Connector

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3TGAAAC9P019A

#### 2) Position Light Switch Continuity

1. Measure the resistance with ohmmeter across the **a** terminal and **c** terminal, and across the **d** terminal and **e** terminal.
2. If the measurement is not following below, the hazard switch or the bulb are faulty.

Resistance (Switch at <b>OFF</b> )	<b>a</b> terminal - <b>c</b> terminal	Infinity
Resistance (Switch at <b>ON</b> )	<b>a</b> terminal - <b>c</b> terminal	0 Ω
Resistance (Bulb)	<b>d</b> terminal - <b>e</b> terminal	Approx. 13 Ω

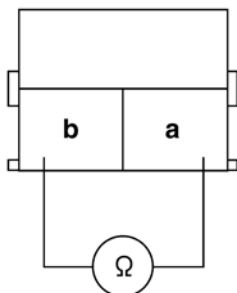
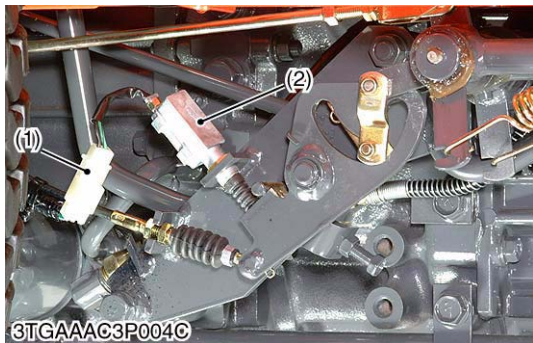
- (1) Position Light Switch

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### (19) Brake Light Switch



3TGAAAC9P023A



#### Brake Light Switch Continuity

1. Disconnect the 2P connector (1), and measure the resistance with an ohmmeter across the brake switch leads.
2. If the measurement still differs from the table, replace the brake light switch.

Resistance (When the switch push is released)	a - b	0 Ω
Resistance (When the switch push is pushed)	a - b	Infinity

#### NOTE

- Brake pedal free travel : 20 to 30 mm (0.79 to 1.18 in.).

- (1) 2P connector (2) Brake Light Switch

000007948E

#### Adjusting Brake Light Switch

1. Disconnect the connector (1) and remove the brake light switch (2) once.
2. Depress the brake within the range of free travel (20 to 30 mm (0.79 to 1.18 in.)) and hold it.
3. Connect the leads of the ohmmeter to the brake light switch lead terminal.
4. Screw in the brake light switch (2) until the ohmmeter begins to show "Infinity".
5. Further screw in the brake light switch by 1/2 turn and tighten the lock nut (3).

- (1) Connector (3) Lock Nut  
(2) Brake Light Switch

000008029E

**(20)Switches for Indicator Lamps (Rear PTO, Mid PTO, Parking Brake and Oil Pressure)**

PTO Switches

1. Disconnect the PTO switch **2P** connector.
2. Measure the resistance of **2P** connector (switch side).
3. If the measurement differs from the table, replace it.

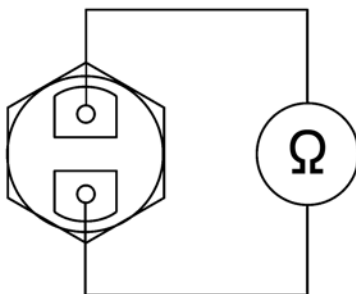
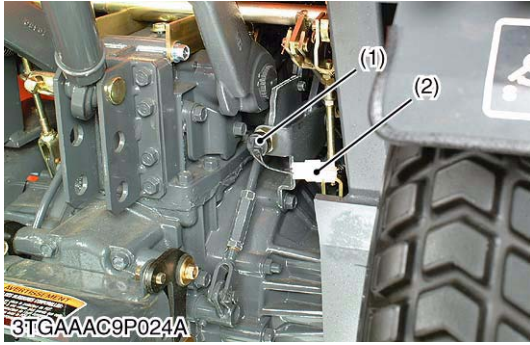
PTO Switch	State	Resistance
Rear PTO switch (1)	Rear PTO gear shift lever in neutral position	Infinity
	Rear PTO gear shift lever in 1st or 2nd speed position	0 Ω
Mid PTO switch (3)	Mid PTO gear shift lever at <b>OFF</b> position	Infinity
	PTO gear shift lever at <b>ON</b> position	0 Ω

■ **NOTE**

- **Rear PTO switch and mid PTO switch are the same parts.**

- |                     |                    |
|---------------------|--------------------|
| (1) Rear PTO Switch | (3) Mid PTO Switch |
| (2) 2P Connector    | (4) 2P Connector   |

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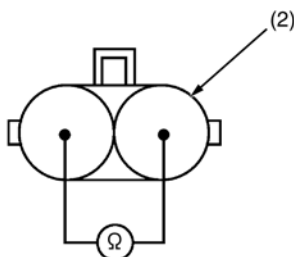
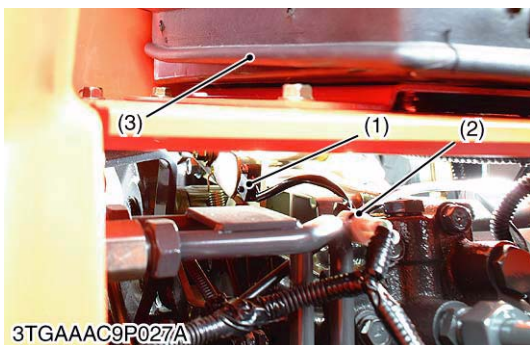
Parking Brake Switch

1. Disconnect the connector from the parking brake switch (1) after turning the main switch **OFF**.
2. Measure the resistance across the two terminals.
3. If the measurement differs from the table below, the replace the switch.

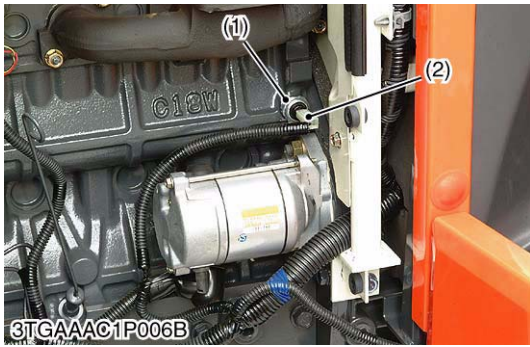
Resistance (Across switch terminals)	Parking lever at off position	Infinity
	Parking lever pulled up	0 Ω

- |                                       |          |
|---------------------------------------|----------|
| (1) Parking Brake Switch              | (3) Seat |
| (2) Connector of Parking Brake Switch |          |

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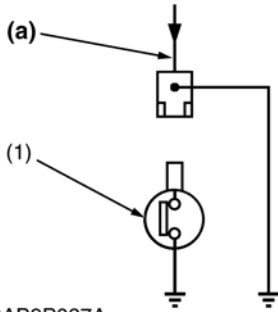


Engine Oil Pressure Switch

1. Disconnect the lead (2) from the engine oil pressure switch after turning the main switch **OFF**.
2. Turn the main switch **ON** and connect a jumper lead from the lead to the chassis.
3. If the engine oil pressure indicator lamp does not light, the panel circuit or the wiring harness is faulty.

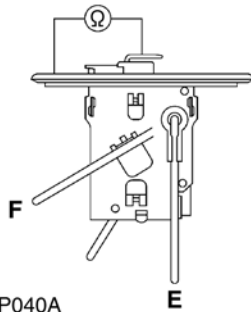
- (1) Engine Oil Pressure Switch      (a) From Oil Pressure Lamp  
 (2) Switch Lead

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**(21) Gauges**



3TMABAB9P040A

Fuel Level Sensor

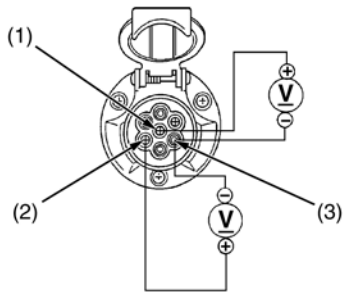
**1) Sensor Continuity**

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- moat position	1 to 5 Ω
		Float at lower- most position	103 to 117 Ω

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**2) Tail Terminals**

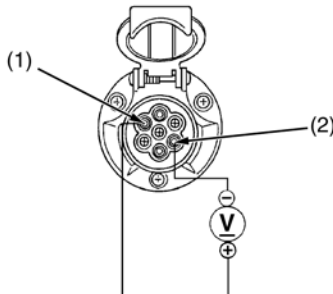
1. Turn the main switch **ON**, and measure the voltage with voltmeter across the **7** terminal (1) and **3** terminal (3), and across the **5** terminal (2) and **3** terminal (3).
2. If the voltage differs from the battery voltage, the wiring harness or switches for tail lights are faulty.

Voltage (Head light switch at <b>ON</b> , or position switch at <b>ON</b> )	<b>7</b> Terminal (Yellow / Blue) - <b>3</b> Terminal (Black)	Approx. battery voltage
Voltage (Head light switch at <b>ON</b> , or position switch at <b>ON</b> )	<b>5</b> Terminal (Blue / White) - <b>3</b> Terminal (Black)	Approx. battery voltage

- (1) **7** Terminal  
 (2) **5** Terminal

- (3) **3** Terminal

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**3) Brake Light Terminals**

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 the battery voltage, the wiring harness or switch for brake lights are faulty.

Voltage (When stepping the brake pedal)	<b>6</b> Terminal (Yellow / Black) - <b>3</b> Terminal (Black)	Approx. battery voltage
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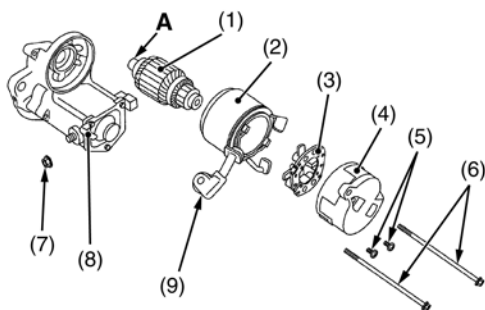
- (1) **6** Terminal

- (2) **3** Terminal

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## [2] DISASSEMBLING AND ASSEMBLING

### (1) Starter



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#### Disassembling Motor

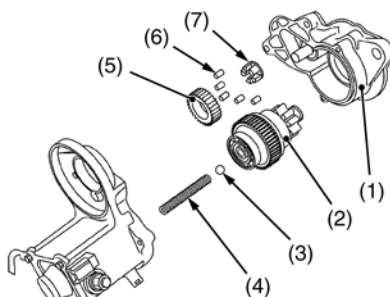
1. Disconnect the connecting lead (9) from the magnet switch (8).
2. Remove the screws (6), and then separate the end frame (4), yoke (2) and armature (1).
3. Remove the two screws (5), and then take out the brush holder (3) from the end frame (4).

#### **(When reassembling)**

- Apply grease to the spline teeth **A** of the armature (1).

- |                  |                         |
|------------------|-------------------------|
| (1) Armature     | (7) Nut                 |
| (2) Yoke         | (8) Magnet Switch       |
| (3) Brush Holder | (9) Connecting Lead     |
| (4) End Frame    |                         |
| (5) Screw        | <b>A : Spline Teeth</b> |
| (6) Screw        |                         |

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3TAAAAB9P036A

#### Disassembling Magnet Switch

1. Remove the drive end frame (1) mounting screws.
2. Take out the overrunning clutch (2), ball (3), spring (4), gears (5), rollers (6) and retainer (7).

#### **(When reassembling)**

- Apply grease to the gear teeth of the gears (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             |              |

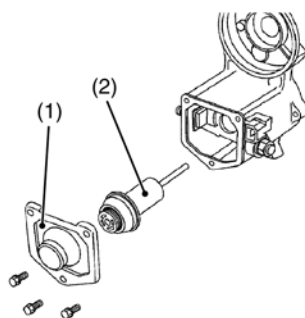
000002956E

#### Plunger

1. Remove the end cover (1).
2. Take out the plunger (2).

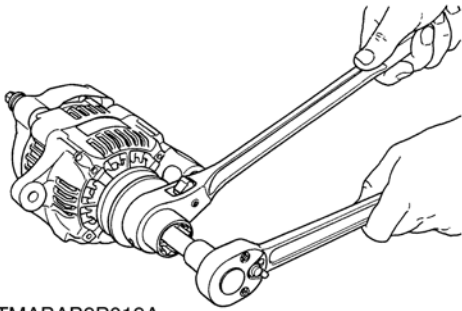
- |               |             |
|---------------|-------------|
| (1) End Cover | (2) Plunger |
|---------------|-------------|

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**(2) Alternator**



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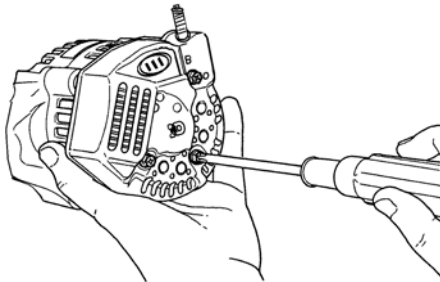
Pulley

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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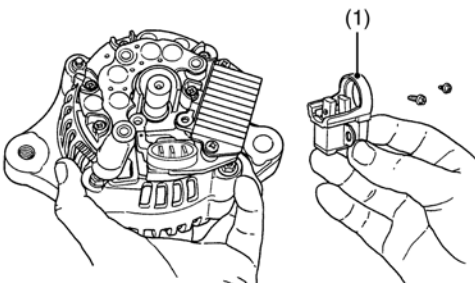


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Rear End Cover

1. Unscrew the three rear end cover screws and the **B** terminal nut, and remove the rear end cover.

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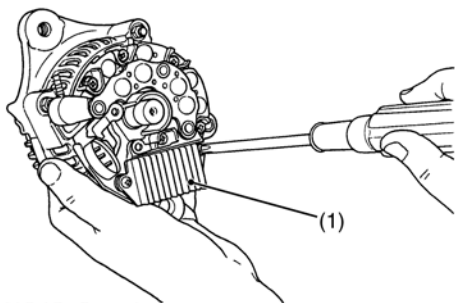
3TMABAB9P021A

Brush Holder

1. Unscrew the two screws holding the brush holder, and remove the brush holder (1).

(1) Brush Holder

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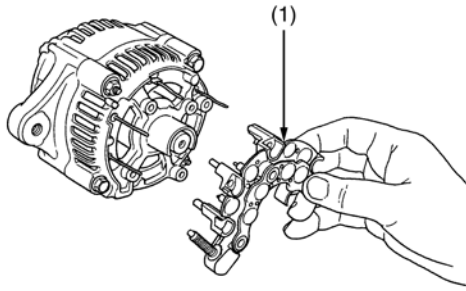
3TMABAB9P022A

IC Regulator

1. Unscrew the three screws holding the IC regulator, and remove the IC regulator (1).

(1) IC Regulator

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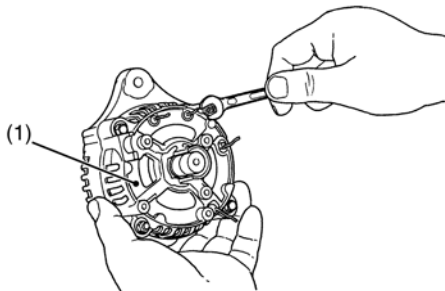
3TMABAB9P023A

Rectifier

1. Remove the four screws holding the rectifier and the stator lead wires.
2. Remove the rectifier (1).

(1) Rectifier

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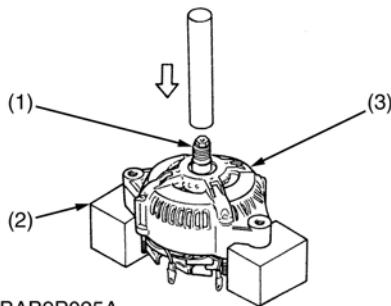
3TMABAB9P024A

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

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3TMABAB9P025A

Rotor

1. Press out the rotor (1) from drive end frame (3).

■ **IMPORTANT**

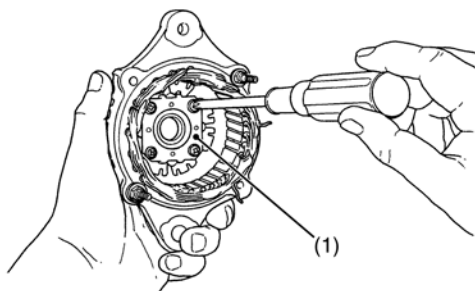
- **Take special care not to drop the rotor and damage the slip ring or fan, etc..**

(1) Rotor

(3) Drive End Frame

(2) Block

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Retainer Plate

1. Unscrew the four screws holding the retainer plate, and remove the retainer plate (1).

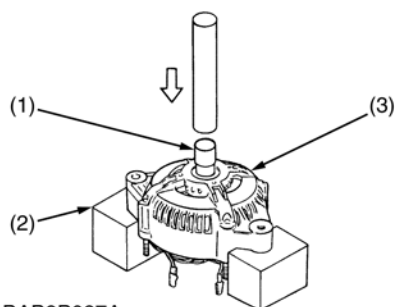
(1) Retainer Plate

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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

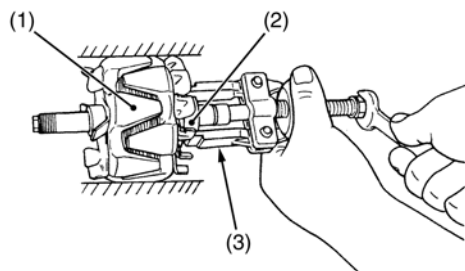
- (3) Drive End Frame

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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

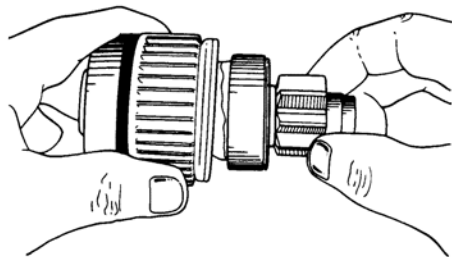
- (3) Puller

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### [3] SERVICING

#### (1) Starter

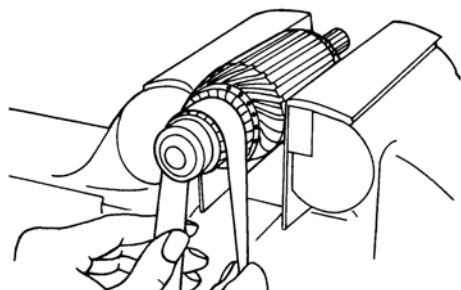


3EEABAB1P188A

#### 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.

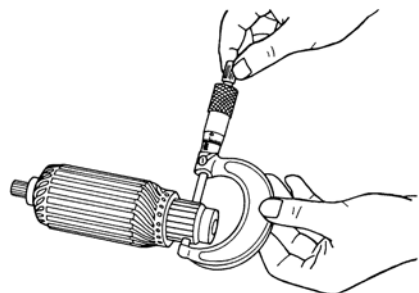
000001168E



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#### Commutator and Mica

1. Check the contact face of the commutator for wear, and grind the commutator with emery paper if it is slightly worn.
2. Measure the commutator O.D. with an outside micrometer at several points.
3. If the minimum O.D. is less than the allowable limit, replace the armature.
4. If the difference of the O.D.'s exceeds the allowable limit, correct the commutator on a lathe to the factory specification.
5. Measure the mica undercut.
6. If the undercut is less than the allowable limit, correct it with a saw blade and chamfer the segment edges.

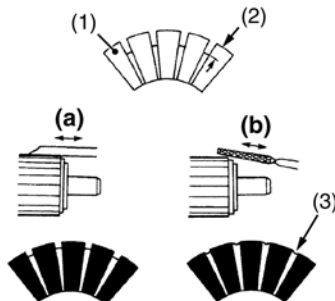


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Commutator O.D.	Factory spec.	30.0 mm 1.181 in.
	Allowable limit	29.0 mm 1.142 in.

Difference of O.D.'s	Factory spec.	Less than 0.02 mm 0.0008 in.
	Allowable limit	0.05 mm 0.0020 in.

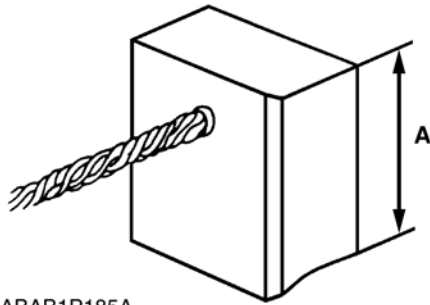
Mica undercut	Factory spec.	0.50 to 0.80 mm 0.0197 to 0.0315 in.
	Allowable limit	0.20 mm 0.0079 in.



3EEABAB1P184A

- (1) Segment
- (2) Undercut
- (3) Mica
- (a) **Correct**
- (b) **incorrect**

000001169E



3EEABAB1P185A

Brush Wear

1. If the contact face of the brush is dirty or dusty, clean it with emery paper.
2. Measure the brush length (A) with vernier calipers.
3. If the length is less than the allowable limit, replace the yoke assembly and brush holder.

Brush length (A)	Factory spec.	15.0 mm 0.591 in.
	Allowable limit	11.0 mm 0.433 in.

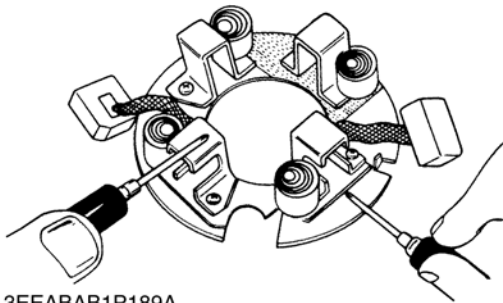
000005173E

Brush Holder

1. Check the continuity across the brush holder and the holder support with an ohmmeter.
2. If it conducts, replace the brush holder.

Resistance	Brush holder - Holder support	Infinity
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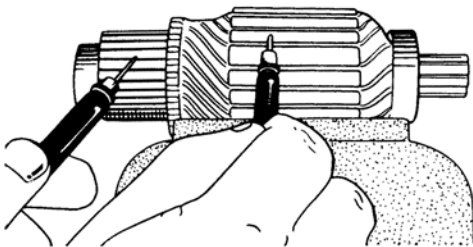


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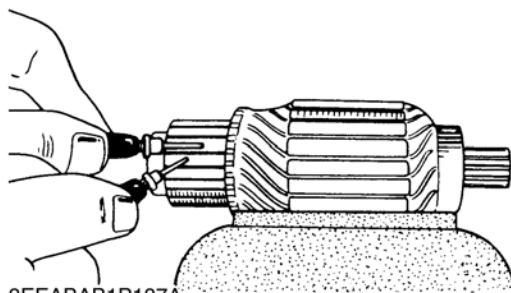
Armature Coil

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.

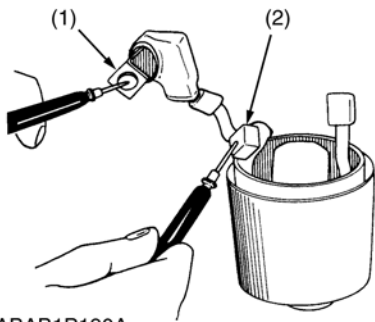
000001172E



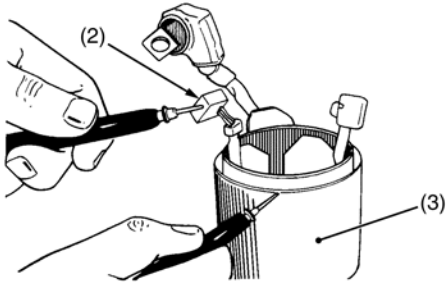
3EEABAB1P186A



3EEABAB1P187A



3EEABAB1P190A



3EEABAB1P191A

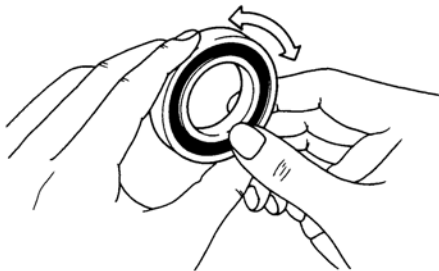
Field Coil

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

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**(2) Alternator**

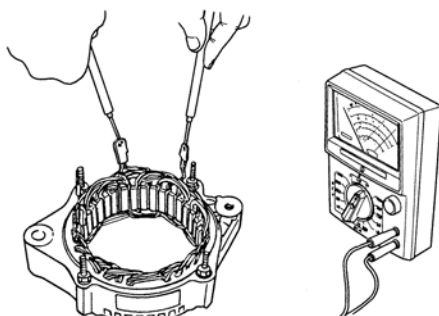


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Bearing

1. Check the bearing for smooth rotation.
2. If it does not rotate smoothly, replace it.

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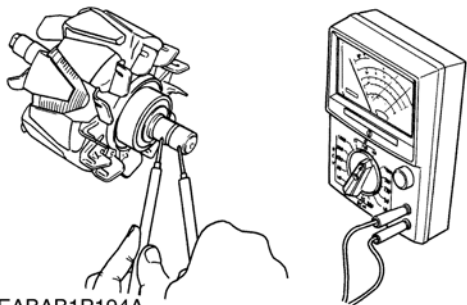
3EEABAB1P193A

Stator

1. Measure the resistance across each lead of the stator coil with an ohmmeter.
2. If the measurement is not within 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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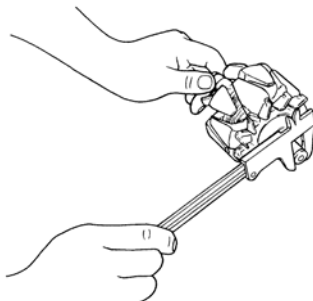
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Rotor

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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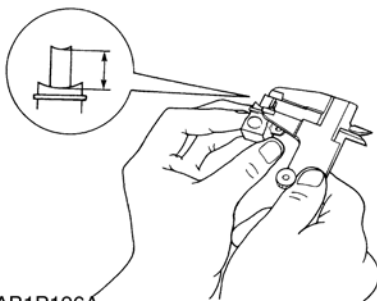
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Slip Ring

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	14.0 mm 0.551 in.

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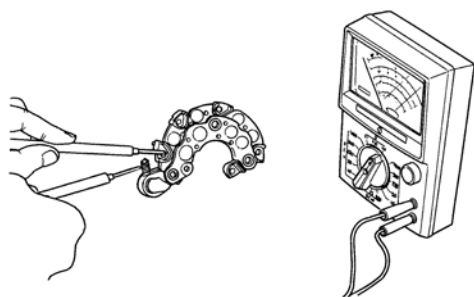
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Brush Wear

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.

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Rectifier

1. Check the continuity across each diode of rectifier with an analog ohmmeter. Conduct the test in the (R x 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.

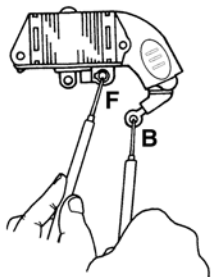
■ **IMPORTANT**

- Do not use a 500 V megger for measuring because it will destroy the rectifier.

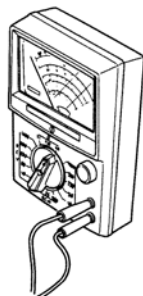
■ **NOTE**

- Do not use an auto digital multimeter. Because it's very hard to check the continuity of rectifier by using it.

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### 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 x 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.

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